
# Abstract Book

JMIH 2016

**0038 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Daniel Abel[1], Dean Grubbs[2], Bryan Keller[1], John Simcox[1], Alexandra Dowlin[1], Megan Novak[1]

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## Do Osmoregulatory Adaptations of Deep-Sea Sharks Represent a Paradigm Shift? Evidence from Rectal Glands of *Hexanchus nakamurai* and Other Species

A serendipitous observation of a smaller than expected rectal gland in a bigeye sixgill shark (*Hexanchus nakamurai*) led us to question whether smaller rectal glands were characteristic of deep-sea sharks and, if so, whether these differences were physiologically significant. We collected rectal glands from 6 shallow-water species [blacknose (*Carcharhinus acronotus*), finetooth (*C. isodon*), blacktip (*C. limbatus*), gulf smoothhound (*M. sinusmexicanus*), Atlantic sharpnose (*Rhizoprionodon terraenovae*), and bonnethead (*Sphyrna tiburo*)] and 4 mid- to deep-water species [little gulper (*C. cf. uyato*), dusky smoothhound (*Mustelus canis*), Cuban dogfish (*Squalus cubensis*), and shortspine spurdog (*S. cf. mitsukuri*)]. Mean dry rectal gland weight (x 1000)/body weight ratios ranged from 18.5 (*C. acronotus*) to > 40 (*M. canis, S. tiburo,* and *S. cf. mitsukuri*), and all were in the range of previous studies. Dry rectal gland mass/body mass ratios varied by genus and species ($F_{8,77}$ = 55.44 and $F_{4,81}$ = 40.55, respectively), but not by habitat [shallow: 28.90 ± 3.05 (μ ± SEM, N = 32); mid and deep: 31.50 ± 3.81 (N = 57)]. Although we have been unable to obtain rectal glands or blood samples from *H. nakamurai* or congeners/confamilials, these preliminary results suggest that both galeomorph and squalomorph deep-sea sharks operate by the long held osmoregulatory paradigm, and that our initial observation for *H. nakamurai* may obtain only for this species, genus, or family. Histological examination and blood chemistry are needed to understand the observed differences in the rectal glands and their physiological implications in the taxa we sampled.

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**0688 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Cory Adams[1], Daniel Saenz[1], Toby Hibbitts[2], James Childress[1]

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## Calling Phenology of Coastal Prairie Anurans

Prairies are among the most rapidly disappearing landscape types in North America. Between 1830 and 1994, the extant area of tallgrass prairie declined by as much as 99% in parts of its historic range. The prairies of Texas have suffered a decline of 90%, with most of this loss occurring on the coastal prairie. This decline is primarily attributed to

habitat loss and fragmentation which are considered major threats to biodiversity. The Attwater Prairie Chicken National Wildlife Refuge (APCNWR) is one of the largest remnants of native coastal prairie habitat in southeast Texas, thus making it an ideal place to examine prairie inhabiting anurans. We used Song Meters to record calling frogs at twelve sites (9 ephemeral and 3 permanent). Overall, 12 species of anurans were detected at the APCNWR, representing four families. Some anuran species were common on the APCNWR; crawfish frogs (*Lithobates areolatus*; a species of conservation concern), southern leopard frogs (*L. sphenocephalus*), eastern narrowmouth toads (*Gastrophryne carolinesis*), and Cajun chorus frogs (*Pseudacris fouquettei*) were detected at all ponds during our study. In contrast, Fowler's toad (*Anaxyrus fowleri*) and the bronze frog (*L. clamitans*) were only detected at one pond and two ponds, respectively. Our results suggest that numerous anuran species utilize the coastal prairie of Texas for breeding, including the crawfish frog, which has suffered declines across much of its range, primarily due to a loss of habitat.

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**0779 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016**

Ginny Adams, Reid Adams, Heather Saco

*University of Central Arkansas, Conway, AR, USA*

**Persistence and Stability of Ozark Highland Fish Assemblages in Relation to Landscape and Local Variables**

Studies examining relationships between land use, in-stream habitat, and fish assemblage persistence and stability are rare but necessary to understand fish-habitat associations at multiple temporal and spatial scales. We examined persistence and stability over 32–43 years in four streams in the Ozark Highlands by repeating surveys conducted by previous researchers. Sites located within smaller catchments (<120 $km^2$) exhibited the lowest and most variable persistence and stability suggesting smaller catchments were more vulnerable across time. Within smaller catchments, assemblage persistence was significantly correlated to both forest (rho = 0.43) and pasture (-0.47) and weakly correlated with urban (-0.41) land use within the upstream catchment; in contrast, persistence in larger catchments was only significantly correlated with urban (-0.78) land use. Stability was significantly correlated to pasture (-0.42) land use in small catchments and was not significantly correlated with land use in larger catchments. Maximum water depth, mean flow and mean stream width were correlated with catchment size, but water depth was the only in-stream variable correlated with persistence (0.47) and stability (0.52) in smaller catchments. Stream width and mean flow were correlated to persistence and stability in larger catchments. Even relatively small levels of urbanization (1.7–7.8%) were associated with declines in both persistence and stability within our watersheds. Our data suggest differential influence of both landscape and local variables on fish assemblages based on position of the site within the watershed.

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**0132 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

Ishan Agarwal[1], Praveen Karanth[2]

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### Mass Extinctions with Miocene Warming

Tropical, range-restricted ectotherms are predicted to face high extinction risk from global warming. Here, we study how past climate change impacted cool-adapted forest biota in peninsular India (PI), providing insights into potential future effects. We use niche modelling along with the most complete phylogeny to date of the cool-adapted ground-dwelling forest geckos *Geckoella*, with multi-locus sequence data from >120 individuals across >100 localities across PI. *Geckoella* has an anti-sigmoidal lineages-through-time plot, indicative of mass extinction (ME); with initial diversification 42-32 million years ago (mya), no cladogenesis between ~21-14 mya, and concurrent rapid diversification in 3 of 4 lineages into over 40 species across PI from 14-8 mya. Phylogenetic analyses and simulations suggest a ME event that overlaps with the warmest period in the last 30 million years (my), the Mid-Miocene climatic optimum (17-15 my ago, MMCO), when the earth was 2-6° C warmer. *Geckoella* niche models projected onto conditions mimicking the MMCO show severe range contractions of all three species complexes, with high suitability only at elevations >800 m. Finally, we use dated phylogenies of *Cnemaspis* and *Hemiphyllodactylus*, two distantly-related, co-distributed, cool-adapted gekkonid genera to demonstrate that this was at the very least a regional event. A flatline in diversification that overlaps with the MMCO is detected across four co-distributed clades within these genera. Warming during the MMCO is likely to have caused widespread extinctions of cool-adapted taxa in the mesic zone of PI; with suitable conditions for persistence only at high elevations.

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**0763 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Joseph Agugliaro

*Fairleigh Dickinson University, Florham Campus, Madison, NJ, USA*

### Does Circadian Variation in Metabolic Rate Persist during Artificial Hibernation in Rubber Boas (*Charina bottae*)?

One of the most elusive problems in studies of snake hibernation is identification of the factors that stimulate emergence from hibernation. Despite the popular hypothesis that increases in hibernaculum temperature may stimulate emergence from hibernation in snakes, several studies have detected little to no increase in hibernaculum or snake body temperature prior to emergence. Instead, some researchers have suggested the possibility of a free-running endogenous rhythm during hibernation in continuous

darkness in snakes, which may be used as an intrinsic timekeeping mechanism mediating spring emergence. To explore that hypothesis, I tested for the presence of circadian metabolic rhythms in Rubber Boas (*Charina bottae*) hibernating in the laboratory without photoperiodic cues. Metabolic rates ($CO_2$ production rates measured via open-flow respirometry) of seven *C. bottae* were sampled every two hours over several days at an acute temperature of 7°C and under continuous darkness during the simulated active season and during artificial hibernation. Metabolism records will be analyzed to determine the presence/absence, amplitude, and phase of circadian variation in resting metabolic rate and apparent spontaneous physical activity in each season. Data collected from this experiment will also be integrated with that obtained from a previous study of thermal acclimation of metabolism in *C. bottae*, which provided evidence for metabolic compensation in this species (i.e., elevated resting metabolic rate during artificial hibernation, relative to simulated active season). Results from this study will help improve our understanding of endogenous rhythmicity and hibernation energetics of snakes.

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**1039 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Cesar Aguilar[1], Luciano J. Avila[2], Mariana Morando[2], Ignacio De la Riva[3], Noemí Goicoechea[3], Jaime Troncoso-Palacios[4], Leigh Johnson[1], Jack W. Sites Jr.[1]

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**Low and high in the Andes: Phylogeny of the poorly known South American lizards of the *Liolaemus montanus* group**

The *Liolaemus montanus* group is distributed over a wide latitudinal and altitudinal geographic range from central Perú to central Argentina and Chile, and from sea level to more than 5000 masl. A comprehensive hypothesis of phylogenetic relationships is lacking and species in this group are arranged based on overall morphological features that preclude further evolutionary studies. We present the first comprehensive molecular phylogenetic hypothesis for this group based on a sample of 33 known species (of about 60 species assigned to this group), and four genes (two mitochondrial and two nuclear regions). Our results show that the *L. montanus* group is not monophyletic and some species that were previously included in this group, seem to be part of other species arrangements in the same subgenus. We discuss taxonomic and biogeographic implications of our results.

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**0604 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Cesar Aguilar[1], Edgar Lehr[2], Julianne Capito[1], Mikael Lundberg[3], Claudia Torres[3], Luciano J. Avila[4], Mariana Morando[4], Jack W. Sites, Jr.[1]

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**Better late than never: Reassessment of Peruvian Tachymenini (Squamata: Serpentes) after more than half a century**

Integrative taxonomy is becoming a preferred approach to delimiting species boundaries by including different empirical data sets and multiple methods. In this study we use a sequential evaluation of multiple kinds of evidence to test hypotheses of species limits in a hypothetic-deductive framework. We used morphological (meristic & morphometric) and molecular (mitochondrial & nuclear) data to reassess species boundaries in the *Tachymenis peruviana* complex, a group of species not studied since Walker's 1945 monograph. One population of *Tachymenis* Wiegmann, 1834 from central Peru differs from *T. peruviana* Wiegman, 1834 and *T. tarmensis* Walker, 1945 in color pattern, as well as ventral and subcaudal scale counts, and may represent a new species. Our phylogenetic analyses recover *T. tarmensis*, a species originally described from one specimen and only known from a single locality, external to the *T. peruviana* clade, extending southward its geographic distribution. Finally another population from central Peru and morphologically similar to *Tachymenis*, is phylogenetically nested within the genus *Thamnodynastes* Wagler, 1830 and most probably represents a new Andean linage of this genus.

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**0323 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Windsor Aguirre, Seth Contreras, Katelyn Carlson, Alex Jagla, Lissette Arellano

*DePaul University, Chicago, IL, USA*

**Evolutionary Diversification of Body Form and the Axial Skeleton in the Gasterosteoidei - The Sticklebacks and their Closest Relatives**

Elongation is one of the most common forms of body shape divergence seen in fishes. Past research has uncovered substantial variability in body form within the threespine stickleback, *Gasterosteus aculeatus*, and among its relatives in the Gasterosteoidei, including the evolution of extreme body elongation. Body elongation is likely to be associated with the evolution of the axial skeleton in this group but comparative studies across the Gasterosteoidei are lacking. We examined samples of all genera of the Gasterosteidae, Aulorhynchidae and Hypoptychidae, collected throughout their ranges. Body form variation was examined using geometric morphometric methods and the fineness ratio. Total vertebral number and the proportion of precaudal to caudal vertebrae were collected from x-rays of the same specimens. Mean total vertebral number varied from 26.8 in *Gasterosteus wheatlandi* to 54.5 in *Hypoptychus dybowskii*. Body shape was significantly related to total vertebral number across taxa with longer bodied

species having more vertebrae. *Hypoptychus dybowskii* is an outlier. The number of precaudal and caudal vertebrae generally covaried across taxa with a few exceptions (*Hypoptychus dybowskii* and *Apeltes quadracus*), and changes in the relative proportions of the body are typically accompanied by corresponding changes in vertebral number. Differences in the number of caudal vertebrae appear to be particularly important among some of the morphologically more similar genera like *Gasterosteus*, *Culaea*, and *Pungitius*. Consistent with the hypothesis of pleomerism, larger species have more vertebrae.

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**1051 NIA I, Salon E, Friday 8 July 2016**

Windsor Aguirre[1], Grace Malato[1], Ronald Navarrete[2], Jonathan Valdiviezo[3], Fredy Nugra[4], Virginia Shervette[5], Paola Calle[6]

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## Elevational Gradients and the Evolution of Biological Diversity: The Genus *Rhoadsia* as a Case Study from the Western Slope of the Andes in Ecuador

The genus *Rhoadsia* is a morphologically distinctive characid that is deep-bodied and exhibits extreme sexual dimorphism. It includes two described species, *Rhoadsia altipinna* and *Rhoadsia minor*, that differ primarily in body form and the elevations at which they occur. *Rhoadsia altipinna* is a deeper bodied species from lower elevations in southwestern Ecuador, while *R. minor* is a smaller, more streamlined species from higher elevations in northwestern Ecuador. Unfortunately, there is uncertainty about the number of species that should be recognized in the genus and the causes of the morphological differences between them. We collected specimens from throughout the known range of both species in western Ecuador. Specimens collected at the type locality of *Rhoadsia minor* in the Esmeraldas River drainage had the most streamlined bodies as expected. However, body depth decreased relatively continuously with elevation in the Esmeraldas drainage, indicating the presence of a phenotypic cline. Although not as extreme as in the Esmeraldas River drainage, body depth also declined with elevation in the Jubones River and Santa Rosa river drainages, which are located hundreds of kilometers south, suggesting that these phenotypic clines have arisen in parallel. Genetic divergence among samples based on the mitochondrial Cytochrome Oxidase I gene was very low (<1%) and seemed more consistent with geographic structuring of populations within a species. Regardless of whether the parallel phenotypic clines documented are due to parallel evolution of phenotypic plasticity, the genus *Rhoadsia* seems like a promising taxon for studying adaptation to elevational gradients in Neotropical rivers.

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**0978 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Nathaniel Akers, Thomas Lankford

*University of North Carolina Wilmington, Wilmington, North Carolina, USA*

**Scale Morphology in the White Shark (*Carcharodon carcharias*)**

The white shark, *Carcharodon carcharias*, is a wide-ranging apex predator and the largest member of the mackerel sharks (*Lamnidae*). Considerable data has been collected on the structure and function of placoid scales, and it is believed that the scales play a major role in hydrodynamic drag reduction. Previous studies examined deviations in scale morphology across different regions of the body, but little, if any, work has been done to examine scale morphology specifically in white sharks. In order to examine scale morphology as it relates to hydrodynamic drag reduction across different regions of the body, we have prepared samples of scales from a recently stranded white shark, and we utilized scanning electron microscopy coupled with analysis software to assess variations in crown height and shape and overall spacing of scales. Here, we present the results of our analysis.

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**0673 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

K.V Akhilesh, K.K Bineesh, P.U. Zacharia, A Gopalakrishnan

*ICAR-Central Marine Fisheries Research Institute, Kochi, Kerala, India*

**Records of sawfishes (Chondrichthyes: Pristidae) in Indian waters: A historical review and survey results**

Sawfishes (Pristidae) are highly vulnerable to exploitation and habitat destruction; as a result, there is an increased concern about the declining population of sawfishes in its wide distribution range. Indian Ocean is considered as a major habitat of sawfishes and most of the earlier studies in the region have stated declining populations, however most of them are without reliable assessments of their status and data deficient reports except few. India is one of the major fishing nations in the Indian Ocean region and sawfishes were common until the past three-four decades. Arabian Sea was a major habitat of the species with more fishery landing and observations. However presently they are rarely observed in the fishery landings, along the entire coast. The increased fishing fleet/pressure in the coastal waters, sandmining, and habitat destruction are the major reasons for their observable reduction in fishery. In view of the absence of a reliable status-assessment of sawfishes from the major elasmobranch fishing nation in the region, their conservation and management efforts will be futile so the study was under taken. Here we provides preliminary results of an ongoing study, on their present and past distribution range, comparative morphology of saw fish rostrums observed along the Indian coast, threats and their cultural significance.

**0929 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jonathan Akin

*Northwestern State University of Louisiana, Natchitoches, LA, USA*

**Characterization of *Ambystoma* Salamander Secretions**

Ambystomatid salamanders produce toxic secretions as an anti-predator defense and many species are associated with conspicuous aposematic warning colorations. While the toxicity of these secretions has been demonstrated for some *Ambystoma* species, little is known about the chemical composition of these secretions. In this study, secretions from individuals of two species of *Ambystoma: A. maculatum* and *A. opacum* were obtained using both transcutaneous electrical and mechanical stimulation and subjected to chemical separation methods for characterization and comparison.

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**0708 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Maria Akopyan, Jeanne Robertson

*California State University, Northridge, Northridge, CA, USA*

**Characterizing Reproductive Isolation Across Clinal Populations of Red-eyed Treefrogs Using Population Genomics**

Studies of geographic patterns of genetic diversity have provided countless insights into the evolutionary mechanisms underlying biological diversity. Here, we conduct a study of genomic and phenotypic clinal variation across red-eyed treefrog populations from Costa Rica and Panama. This study examines 15 populations sampled along a phenotypic gradient (leg color), including a central contact zone that contains multiple phenotypes. Examining population genomic structure along the cline and genetic admixture at a contact zone permits a fine-scale mapping of reproductive isolation, and provides insights into the strength of selection that prevents or facilitates hybridization. We will use outlier analyses to provide insight into genomic regions that contribute either to reproductive isolation (markers with reduced introgression) or hybrid vigor (markers with increased introgression). This is a first step in determining the prevalence and distribution of the genomic regions associated with reproductive isolation, enhancing our knowledge of how genomes evolve during diversification.

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**0353 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

James S. Albert[1], Victor A. Tagliacollo[2], Scott M. Duke-Sylvester[3]

*[1]University of Louisiana at Lafayette, Lafayette, LA, USA, [2]Universidade Estadual Paulista, Botucatu, SP, Brazil, [3]University of Louisiana at Lafayette, Lafayette, LA, USA*

## Barrier displacement on a neutral landscape: Towards a theory of continental biogeography

Five broad regularities of biogeography and biodiversity are observed in many taxa with continental distributions: 1, power function-like species-area relationships; 2, log-normal distribution of species geographic range sizes, 3, mid-domain effects with more species towards the geographic center, and more early-branching, species-poor clades (i.e. living fossils) towards the geographic periphery; 4, exponential diversification with log-linear accumulation of lineages through geological time; and 5, power function-like relationships between species-richness and cladal-diversity, where most clades are species-poor and few clades are species-rich. However, current theory does not provide a robust mechanistic framework to connect these seemingly disparate patterns. Here we present SEAMLESS (Spatially-Explicit Area Model of Landscape Evolution by SimulationS) that generates clade diversification by moving geographic barriers on a continuous, neutral landscape. SEAMLESS differs from other biogeographic methods by studying the evolution of trees on a continuous landscape, rather than treating species geographic ranges as traits changing along branches of a phylogeny. SEAMLESS contributes to a theory of continental biogeography by modeling the effects of barrier-displacement on all three terms of macroevolutionary diversification: dispersal, speciation, and extinction. Barrier-displacement events merge adjacent areas allowing dispersal and larger geographic ranges, separate adjacent areas resulting in vicariant speciation and smaller geographic ranges, and subdivide areas below a minimum threshold for species persistence resulting in extinction. SEAMLESS shows how dispersal is required to maintain species richness and avoid clade-wide extinction, demonstrates that ancestral range size does not predict species richness, and provides a unified explanation for the five biogeographic and phylogenetic patterns described above.

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**0223 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

Fernando Alda[1], Caleb D. McMahan[3], Victor A. Tagliacollo[2], Maxwell J. Bernt[2], Brandon T. Waltz[2], William B. Ludt[2], James S. Albert[1], Prosanta Chakrabarty[2]

*[1]LSU Museum of Natural Science, Baton Rouge, LA, USA, [2]University Louisiana Lafayette, Lafayette, LA, USA, [3]Field Museum, Chicago, IL, USA*

## Phylogenomic analyses of two major Neotropical freshwater fish radiations

Phylogenomic analyses can overcome traditional phylogenetic limitations by incorporating data from hundreds to thousands of unlinked loci. Here, we attempt to resolve phylogenetic relationships in two highly diverse Neotropical freshwater fish

groups: Central American cichlids (mostly in Heroini) and gymnotiforms (Gymnotiformes). Neotropical cichlids are particularly diverse in Central America, but the roots and timing of this diversification from South America remains poorly understood. The greatest diversity of Gymnotiformes occurs in South America, with few species having colonized the Central American landbridge. We use these examples to compare phylogenetic and biogeographic hypotheses obtained with concatenated and multispecies coalescent data analyses using traditional multilocus and next-generation sequence data. We obtained 500-2000 loci using targeted sequencing of ultraconserved elements, from all the major lineages of Central American cichlids and Neotropical Gymnotiformes. We assess the performance of both traditional and next-generation sequence data in resolving radiations at different temporal, biogeographic, and taxonomical scales.

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**0900 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Landon Allen, Jennifer Deitloff

*Lock Haven University, Lock Haven, PA, USA*

## Comparing population and sex differences in head shape for two populations of *Plethodon cinereus* in central Pennsylvania

Many different ecological processes influence the characteristics of a species, and these processes can vary between geographic locations. Consequently, characteristics that are influenced by ecological factors can differ among locations. *Plethodon cinereus* has a broad geographic range and is known to exhibit geographic variation in many characteristics, such as morphology. Variation in morphology can be due to differences in environmental conditions, to intensity of competition, or to other ecological factors. Furthermore, sexual dimorphism can result from various ecological pressures experienced by males and females. In this study, we examined the head shape morphology of *Plethodon cinereus* from two populations in central Pennsylvania. In addition to population variation, we examined differences among males, non-gravid females, and females. We tested the hypotheses that (1) populations and (2) sexes differed in head morphology. However, we did not find support for these hypotheses. Because populations did not differ and since these populations occur relatively close together, we conclude that morphology may be similar due to similar ecological characteristics in both locations. Similarly, sexes may experience similar ecological pressures that may influence the morphology characteristics studied here, and, thus, are not different in these characteristics.

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**0459 Fish Ecology I, Salon A-C, Saturday 9 July 2016**

Karen Alofs, Donald Jackson

*University of Toronto, Toronto, Ontario, Canada*

**Is Fish Body Size a Reliable Trait for Ecological Inference?**

Species-level trait data is often used in community ecology under the assumption that intraspecific variation in traits is small in comparison to interspecific variation. However, intraspecific variation across species ranges or within populations can cause variability in trait data from different sources. Body size is one of the most frequently measured traits. We collected measures of fish species length from literature, online databases, museum collections and field data. Using this data we tested whether different measures of length could consistently predict observed species range boundary shifts and the impacts of an introduced predator. We also investigated whether phylogenetic signal, an indicator of niche-conservativism, changed among measures. We found strong correlations between measures and limited variation across measures. Length data was a consistently significant predictor of the response of fish communities to environmental change. There was also significant evidence of phylogenetic signal in fish length across measures.

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**0376 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

S. Elizabeth Alter[1], Jason Munshi-South[2], Melanie Stiassny[3]

*[1]CUNY (York College and the Graduate Center), New York, NY, USA, [2]Fordham University, Bronx, NY, USA, [3]American Museum of Natural History, New York, NY, USA*

**Genome-wide SNP data reveal cryptic phylogenetic structure and history of hybridization in a rapids-adapted clade of cichlids from the Congo River**

Cichlids represent a classic case study of evolutionary radiation, but most attention has focused on cichlids in the African Great Lakes. Understanding the processes driving diversification in alternate environments, such as African rivers, can shed light on the underlying mechanisms of high speciation rates in this group. We investigated phylogenetic and population genetic relationships in the cichlid genus *Teleogramma*, a small clade of rock-dwelling chromidotilapiines. Several species of *Teleogramma* are endemic to the lower Congo River (LCR), a region characterized by some of the world's largest rapids. Previous morphological studies have been unable to resolve phylogenetic relationships within *Teleogramma*. We analyzed restriction-associated sequencing (RAD) data from 56 individuals across all five described species in the genus, as well as morphological and mitochondrial variation within and between taxa. Phylogenetic analyses reveal several cryptic clades. Results indicate the topography and complex hydrological regime of the LCR are likely important drivers of diversification, but do not support the hypothesis of sequential downstream colonization. Discordance between mitochondrial and nuclear trees demonstrate several hybridization/introgression

events, but admixture tests indicate these events were ancient and that no current gene flow is occurring between species. A survey of female caudal and dorsal fin patterning across taxa suggests that sexual selection is also likely acting to reinforce species cohesion, a phenomenon that has been well-studied in lake cichlids but has not previously been investigated in riverine cichlids. These analyses highlight the utility of RAD-seq data in understanding diversification processes operating both below and above the species level.

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**0689 HL: Social Behavior in Reptiles Symposium, Salon E, Saturday 9 July 2016**

Melissa Amarello, Jeffrey J. Smith

*Advocates for Snake Preservation, Tucson, AZ, USA*

**The Secret Social Lives of Snakes and Why They Matter**

Social structure affects many aspects of ecology including reproductive success, gene flow, and space use. Here we describe the social structure of two communities within a population of Arizona black rattlesnakes (*Crotalus cerberus*) using association indices and social network analysis. We used remote timelapse cameras and opportunistic observations to semi-continuously sample rattlesnake behavior at communal basking sites during early April through mid-May in 2011 and 2012. We calculated an association index (proportion of time snakes spent together) for each pair of rattlesnakes, which we used to construct a weighted, undirected social network for each community. We found that individual *C. cerberus* are selective about with whom they associate. Females and juveniles formed preferred associations with each other and with males, but males did not form preferred associations with each other. Our study is the first to show preferred associations among individual snakes, but to our knowledge it is also the first to use association indices and social network analysis to examine association patterns among snakes. This information has some surprising applications to the conservation of all snakes.

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**0701 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Kayla Anatone[1], Barry Chernoff[1], Michelle Kraczkowski[2], Abrial Meyer[1], Nicole Roman-Johnston[1], Chloe Nash[1], Julio Angel[1], Alexandra Fireman[1], Laura Bither[1], Cindy Flores[1]

*[1]Wesleyan University, Middletown, CT, USA, [2]Middlesex Community College, Middletown, CT, USA*

**The Genetic Structure of Longnose Dace, *Rhinichthys cataractae*, from two Waterfalls in Connecticut**

Understanding the nature of barriers to gene flow is critical for understanding the evolutionary potential and the nature of species. Waterfalls isolate populations of fishes above the falls but other barriers exist within rivers due to the patchy nature of habitats. We studied Longnose Dace, *Rhinichthys cataractae*, a common riffle dweller in two tributaries of the Connecticut River using microsatellites and *nd2*. From the literature, we tested four hypotheses: (i) waterfalls act as barriers to gene flow; (ii) populations below falls have higher genetic diversity than populations above falls; (iii) genetic differences follow the isolation by distance model; and (iv) populations lacking obvious barriers to gene flow are most similar to one another. Results from Analysis of Molecular Variance, pairwise genetic distances ($\Delta\mu^2$), haplotype networks, and patterns of unique alleles and haplotypes lead us to conclude that: (i) waterfalls are acting as barriers to gene flow; (ii) there is only weak evidence to support that below falls populations have a higher genetic diversity; (iii) although there are no shared haplotypes in the two rivers, the isolation by distance model does not describe the pattern of genetic signatures; and (iv) while populations that lack barriers to gene flow have the lowest inter-population genetic distance, there is important evidence that gene flow is nonetheless minimal between these populations. In summary, the apparent gene flow among populations is low whether they are separated by waterfalls, by tributaries or even by unimpeded stretches of river.

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**0669 Turtle Ecology, Salon A-C, Sunday 10 July 2016**

Corey Devin Anderson[1], Brittany A. Mixon[1], Colleen M. McDonough[1], Gregory W. Lee[2], J. Mitchell Lockhart[1]

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**Burrowing by the Nine-Banded Armadillo (*Dasypus novemcinctus*) Does Not Affect the Spatial Distribution of Gopher Tortoise (*Gopherus polyphemus*) Burrows**

Competition between burrowing species may restrict distributions locally and result in spatial segregation. Two burrowing species, the gopher tortoise (*Gopherus polyphemus*) and the nine-banded armadillo (*Dasypus novemcinctus*) cohabit pine forests of the

southeastern United States; however, it is not clear how burrows associated with each species are codistributed within a forest stand. We sampled 190 armadillo burrow locations and 76 gopher tortoise burrow locations within a 13.35 ha plot on Moody Air Force Base (near Valdosta, GA, USA) and used point pattern analysis and marked point pattern analysis to characterize the spatial distribution and co-distribution of each species' burrows (respectively). The spatial distribution of gopher tortoise burrows showed a close fit to a homogeneous Poisson process, while the intensity of armadillo burrows was inhomogeneous due to higher intensity of burrowing activity on man-made berms. When corrected for spatial inhomogeneity and the fact that some burrows excavated by gopher tortoises are coopted by armadillos, the cross *L*-function was consistent with the null hypothesis that the processes driving the distribution of armadillo and gopher tortoise burrows are independent. Our results suggest that burrowing by armadillos does not affect the spatial distribution gopher tortoise burrows in our study area.

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**0449 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Kenneth Anderson, Jarrett Johnson

*Western Kentucky University, Bowling Green, KY, USA*

## Growth of the Marbled Salamander (*Ambystoma opacum*) on substrates of varying acidity

In terrestrial habitats with a history of mining activity and previous or ongoing reclamation efforts, understanding the effects of soil acidification on the ecology of amphibians is an important part of the restoration process and the conservation of local amphibian populations. Pond-breeding amphibians spend much of their post metamorphic life history in direct contact with the soil in upland habitat adjacent to aquatic breeding sites. Given the thin, permeable skin of amphibians, soil characteristics are likely to influence patterns of growth and survival. To evaluate the role of pH on these determinants of fitness, we reared recently metamorphosed marbled salamanders (*Ambystoma opacum*) at pH 4, 5, 6 and 7. Size was recorded every two weeks for eight months at which point the study was terminated. Our results indicate that a substrate pH of 4 was found to be lethal to recent metamorphs, while at pH 5 individuals showed a reduction in total length and snout vent length. These results suggest that substrate acidity can decrease the initial growth of salamanders even after metamorphosis. In this case even populations that metamorphosed early to escape acidic ponds would still be subject to stressful conditions in areas with acidic substrates.

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**0887 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Michael Andres[1], Jennifer Frey[2], Thomas Mann[3], Debora Mann[4]

*[1]University of Southern Mississippi, Department of Coastal Sciences, Ocean Springs, MS, USA, [2]Mississippi Department of Marine Resources, Biloxi, MS, USA, [3]Mississippi Natural Heritage Program, Mississippi Museum of Natural Science, Jackson, MS, USA, [4]Millsaps College, Department of Biology, Jackson, MS, USA*

## The Salamanders that Didn't Make it Across the Road: Helminth Fauna of Two Salamander Species from Mississippi

Road mortality among salamanders during seasonal breeding migrations and other movements is a problem for many populations in an increasingly fragmented landscape. Since 2006, resource managers of the Natchez Trace Parkway have permitted volunteers to operate bucket brigades to help salamanders cross the parkway (near Clinton, Mississippi) to reduce such traffic mortality. Wildlife crossing signs (these flash on wet nights) were installed, bracketing the stretch commonly used by populations of marbled salamanders, *Ambystoma opacum* (Ao); spotted salamanders, *Ambystoma maculatum*; and state-imperiled, Webster's salamanders, *Plethodon websteri* (Pw). However, some mortality still occurs. We examined salamanders that suffered road mortality in November-December 2014, and March 2015, to acquire data on the helminth community and diet of these two species. Ten specimens each of Ao and Pw ranging in size from 47–69 mm and 35–47 mm snout-to-vent length, respectively, were examined for helminths. Four trematode (two adult and two metacercarial), two nematode, and one juvenile cestode species were recovered from Ao whereas only one trematode and one nematode species were recovered from Pw. The trematode *Brachycoelium salamandrae* was the only parasite species shared by both salamanders, but was more prevalent in Ao (90%) than Pw (10%). The diets of both species were comprised of ants, centipedes, small beetles, weevils, and woodlice. The greater helminth richness observed in Ao likely reflects the hosts' life-history differences; Ao have an aquatic stage whereas Pw have direct-development. This study represents the first report of helminths from Pw and demonstrates the potential use of road mortalities.

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**0484 Fish Ecology II, Salon A-C, Saturday 9 July 2016**

Michael Andres[1], Mark Peterson[1], William Slack[2], Kayla Kimmel[3], Paul Grammer[1], Jeanne-Marie Havrylkoff[4], Bradley Lewis[2], Page Vick[1]

*[1]University of Southern Mississippi, Department of Coastal Sciences, Ocean Springs, MS, USA, [2]U.S. Army Engineer Research and Development Center, Vicksburg, MS, USA, [3]US Fish and Wildlife Service, Baton Rouge, LA, USA, [4]Florida Fish & Wildlife Conservation Commission, Tallahassee, FL, USA*

### Estimation of Length-at-Age, Growth, and Condition of Gulf Sturgeon, *Acipenser oxyrinchus desotoi*, from the Pearl and Pascagoula Rivers

Gulf Sturgeon is a federally threatened and Mississippi endangered anadromous species. Natal fish from drainages west of Mobile Bay comprise the western population segment (WPS), which appear to be recovering at a slower rate than the eastern population segment (EPS). Current stock assessment (SA) models are based mainly on EPS data; therefore, WPS age-growth relationships are necessary to generate precise SA models. Fish were gillnetted from the Pascagoula (1998-2004; 2008-2015) and the Pearl rivers (2010-2015); field measurements were taken and ages were based on pectoral spine sections (n=60). All length-weight-age relationships and Fulton's condition factor (K) were compared by river and month. We calculated 2- and 3-parameter Von Bertalanffy growth models (VBGM) and power model to compare with published data. Akaike information criterion (AICc) selected the 3-parameter VBGM as the "best", followed by the power model, and the 2-parameter VBGM. The previously published 2-parameter VBGM and power model (EPS) fell within our 95% bootstrap bounds; however, the published 3-parameter VBGM (WPS/EPS) was outside the upper 95% bootstrap bound. Differences among models is likely related to our underrepresentation of fish older than 10 and lack of age 12-17 fish. Mean K was highest in March-April and lowest in October-November; these differences reflect the fasting period of Gulf Sturgeon in freshwater. All actively spawning males and suspected females collected during spawning months (March-April) had K's ≥0.75 whereas all but two fish collected in fall months had K's <0.75, suggesting condition may help identify fall spawning Gulf Sturgeon.

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**0950 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Kimberly Andrews[1], Katie Parson[2]

*[1]University of Georgia and Jekyll Island, Jekyll Island, GA, USA, [2]AmeriCorps and Jekyll Island, Jekyll Island, GA, USA*

### The Influence of Temperature on Activity Patterns and Surfacing Behavior of Coastal Rattlesnakes

Rattlesnakes are reportedly declining throughout their range due to habitat loss, habitat degradation, and human persecution. Coastal rattlesnakes experience these threats to an accelerating degree - as inhabitants of beachfront sand dunes and salt marsh edges,

these snakes are particularly susceptible to progressing rates of climate change and erratic temperature and precipitation patterns. As ectothermic ambush predators, snake activity is driven by temperature and the frequency of their activity then influences their energetic consumption and body condition (fat storage available for reproduction). Modern-day changes in environmental conditions and shoreline movement can influence activity patterns and surfacing behaviors, prey abundance and distribution and foraging success, and energetic availability and reproductive frequency. In Georgia and South Carolina, on-going research is investigating the influence of temperature and habitat on activity patterns of eastern diamondback rattlesnakes (*Crotalus adamanteus*) and canebrake rattlesnakes (*Crotalus horridus*). We focus here on phenological trends observed with *C. adamanteus* on Jekyll Island, Georgia, including inter-annual and individual variation in the extent of their active season and the influence of temperature (body, air, and surface) on surfacing behavior and thermoregulation. These patterns will be compared to current findings from *C. horridus* in coastal SC. Lastly, we will include our observations regarding the timing of breeding and reproduction on barrier islands and coastal habitats.

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**0961 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Kimberly Andrews[1], Gregory Skupien[2], Richard Bauer[3]

*[1]University of Georgia and Jekyll Island, Jekyll Island, GA, USA, [2]University of Georgia, Athens, GA, USA, [3]Jekyll Island State Park Authority, Jekyll Island, GA, USA*

## Spatial Ecology of American Alligators (*Alligator mississippiensis*) on a Developed Barrier Island

American alligators (*Alligator mississippiensis*) historically occupy freshwater habitats such as wetlands, lakes, rivers, and reservoirs. However, due to the loss of many coastal aquatic habitats, alligators have resorted to inhabiting human-made lagoons in close proximity to developed areas. Alligators inhabiting these systems exhibit novel behaviors and have been documented using human-made habitats such as culverts and storm drains to move across the landscape. Additionally, human-wildlife conflicts are more likely to occur in developed areas where alligators are present. As such, a more detailed understanding of the spatial ecology of the alligator in human-dominated landscapes is needed in order to reduce the risk to humans while maintaining population viability of alligators. Our objective was to determine home range size and habitat use of adult alligators inhabiting Jekyll Island, a developed barrier island off the coast of Georgia. Here, we present findings from a radio telemetry study of twelve adult alligators tracked between June 2012 and October 2015. Home ranges were calculated using minimum convex polygons (MCPs) and adaptive localized convex hulls (*a*-LoCoH). We observed a high degree of variability in home range size amongst individuals and sexes. Additionally, alligators were observed using human-made habitat types, such as golf course lagoons and culverts, during >90% of all successful relocations. These data provide information on how this ecologically important predator is adapting to development along the coast. Further, these data will be used to make

data-based decisions concerning the conservation and management of the alligator on Jekyll Island and throughout the species range.

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**0106 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Nicole Angeli, Lee Fitzgerald

*Texas A&M University, College Station, TX, USA*

### Prioritizing island landscapes for the repatriation of offshore populations with spatial and mechanistic modeling

Persistence of species is determined by factors that work synergistically, including life history of species, land use, and patterns of predation. In the Caribbean, a conservation challenge is to repatriate species to historic ranges where the cause of extirpation still exists. For example, invasive mongoose and cats (*Herpestes auropunctatus* and *Felis catus*) caused the extinction of reptiles from Caribbean islands but these predatory mammals are not likely to be eliminated. The critically endangered St. Croix Ground Lizard (*Ameiva polops*) was extirpated from the main island of St. Croix, U.S. Virgin Islands and is restricted to four offshore islands. We suggest that current patterns of land use and localized control of mongoose populations on St. Croix could allow source populations of *A. polops* to persist locally. We collected life history, physiological, and abundance data of the St. Croix Ground Lizard where it still occurs on the offshore islands of St. Croix. To identify suitable repatriation sites to the main island, we projected mechanistic binomial models onto St. Croix using fine-scale remotely sensed data. We prioritized local land tracts by governance and capacity for trapping and monitoring mongoose locally. We integrated the biological and social data using a weighted regression scheme which systematically chose repatriation sites for assisted translocation of the lizard. If self-sustaining populations could be established on St. Croix, our approach could be replicated as a management approach for island endemics similarly in danger of extinction around the globe.

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**0178 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Whitney Anthonysamy, Marlis Douglas, Michael Douglas

*University of Arkansas, Fayetteville, AR, USA*

### Phylogeography of the Western Rattlesnake Complex (*Crotalus viridis* spp.): A Genomic Perspective

The Western Rattlesnake complex (*Crotalus viridis* spp.) is the most widespread and phenotypically variable rattlesnake in North America. As many as nine subspecies have been described based on previous morphological and genetic studies, however additional work is needed to substantiate and resolve clades. Here, we use genomic (ddRAD; double-digest restriction associated DNA) and bioinformatic methods to

reconstruct evolutionary history and clarify taxonomic status within this species complex. This approach promotes a genome-wide assessment that produces thousands of independent DNA markers (SNPs), compared to more traditional genetic approaches (e.g., mitochondrial DNA) that employ only a handful of markers. This work will result in a much more informative phylogenetic tree, reveal significant lineages, and provide valuable insights into the historical processes that shaped the current genetic patterns.

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**0511 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Triana Arguedas, Jim Gelsleichter

*University of North Florida, 1 UNF Drive, Jacksonville FL 32224, USA*

**Trends in Abundance of Sharks in Northeast Florida Estuaries**

Sharks are important components of many marine ecosystems, and play an important role in structuring community ecology. Because of this, it is important to examine their distribution and abundance, along with factors that influence their population dynamics. In 2012, we reported the results of the first 3 years (2009-2011) of a new, long-term survey of sharks in northeast Florida estuaries and bays, focusing on the species composition of sharks that use these areas as well as the abiotic factors that influence their habitat use patterns. These data indicated that inshore locations on northeast Florida provide critical habitat to up to 11 shark species, especially the Atlantic sharpnose (*Rhizoprionodon terraenovae*), blacktip (*Carcharhinus limbatus*), bonnethead (*Sphyrna tiburo*), and sandbar (*Carcharhinus plumbeus*) sharks, and that habitat use is significantly influenced by environmental factors, particularly temperature. In this presentation, we provide updated data on shark habitat use patterns in northeast Florida estuaries, along with the results of a now 7-year time-series on shark abundance in these locations. The overall goal of this research was to use time-series data to characterize trends in local shark populations for management purposes.

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**0979 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Rachel Arnold

*Northwest Indian College, Bellingham, WA, USA*

**Hooligans: Assessing Population Size and Structure of the Longfin Smelt (*Spirinchus thaleichthys*) in the Nooksack River**

Longfin Smelt (*Spirinchus thaleichthys*), or "Hooligans" as they are known by Indigenous Peoples of the Salish Sea, are an indigenous food source within a data-poor commercial, recreational, and tribal fishery. While interest and research funds for obtaining biological information on forage fishes of the Salish Sea has increased dramatically in recent years, little or no funding has gone to studying populations of Longfin Smelt, especially anadromous populations that reside within estuarine areas of Washington

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State. The largest spawning run of anadromous Longfin Smelt occurs within the Nooksack River and provides a sustainable food source to the Lummi People. The goals of this study are to assess the effective population size (FST) of Longfin Smelt within the Nooksack River system and identify any genetic structure within the population. The results of this study will add to the basic biological information for Longfin Smelt and provide population data for management decisions. In addition, this project will provide opportunities for undergraduate students at Northwest Indian College to learn and conduct place-based research using molecular methods.

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**0918 NIA I, Salon E, Friday 8 July 2016**

Jairo Arroyave[1], Mark Sabaj[2]

*[1]Universidad Nacional Autónoma de México, Mexico City, Mexico, [2]Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA*

## Systematics of the Loricariinae (Siluriformes: Loricariidae): comparison between independent molecular datasets and inferences from the largest matrix to date

With almost 240 species arrayed in 32 genera, suckermouth armoured catfishes of the subfamily Loricariinae constitute the second-most speciose subfamilial clade within the family Loricariidae. Such tremendous diversity has certainly hampered efforts to propose a natural classification of the group, one that follows a robust and comprehensive hypothesis of phylogenetic relationships. Furthermore, most phylogenetic studies of this hyperdiverse clade of catfishes have suffered, to a greater or lesser extent, from limited taxon sampling, which inevitably undermines their conclusions. In the most recent phylogenetic study of Loricariinae, Covain et al. (2015) presented the most densely sampled molecular phylogeny of the group at the time. Their taxon sampling included all recognized genera except for *Dentectus*, *Furcodontichthys*, *Pyxiloricaria*, *Reganella*, and *Ricola*. To further investigate loricariin interrelationships we inferred a phylogeny based on independent and non-overlapping comparative DNA sequence data (5 markers from both nc- and mtDNA, totaling ca. 4,500 bp) derived from a comparably comprehensive taxon sampling to that of Covain et al. (2015). Since our sampling does include *Dentectus* and *Reganella*, genera missing from the study of Covain et al. (2015), by combining data from both studies in the form of a supermatrix we also present the effectively most comprehensive systematic treatment and hypothesis of intergeneric relationships of Loricariinae to date. Whereas the results presented herein offer the fundamental phylogenetic framework for testing previous hypotheses of relationships and assessing the adequacy of current classifications, expanded taxonomic coverage is necessary to provide a perfectly complete and accurate picture of loricariin diversification.

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**0149 Fish Conservation, Galerie 3, Sunday 10 July 2016**

Rebecca Asch[1], Brad Erisman[2]

*[1]Princeton University, Princeton, NJ, USA, [2]University of Texas at Austin, Austin, TX, USA*

### Effects of Climate Change on the Distribution and Phenology of Nassau Grouper (*Epinephelus striatus*) Spawning Aggregations

Spawning fishes often have narrower thermal tolerances than other life stages. Consequently, spawning has been hypothesized to constrain how species will respond to climate change. We evaluate this hypothesis by combining a global database of fish spawning aggregations with earth system and ecological niche models to project shifts in the spawning distribution and phenology of Nassau grouper (*Epinephelus striatus*) under the RCP 8.5 climate change scenario. This species is a top predator on Caribbean coral reefs and is listed as endangered due to overfishing of its spawning grounds. The highest probability of encountering *E. striatus* aggregations occurred at sea surface temperatures (SSTs) of 24.5-26.5° C and seasonal SST gradients of 0 to -1° C. Based on a historical climatology, our model projected that the highest probability of spawning occurs around Cuba, the Mesoamerican barrier reef, the Bahamas, and other areas of the Caribbean. This coincides with the observed distribution of grouper aggregations. By 2081-2100, a 50% decline is projected in the number of months and locations with adequate conditions for spawning. Potential *E. striatus* spawning habitat shifts northward and eastward, with slight increases in the probability of spawning around Aruba, Curacao, and Bonaire. The *E. striatus* spawning season is projected to contract and occur later in the year. Two-month delays in phenology are projected at 78% of sites where *E. striatus* is managed through spawning season sales bans and fishing closures. This implies that adaptive management in response to climate change will be needed for management measures to remain effective.

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**0865 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Jonathon Ashley, Eric Nordberg, Alyssa Hoekstra, Sarah Kirkpatrick, Vincent Cobb

*Middle Tennessee State University, Murfreesboro, Tennessee, USA*

### Home range and movement analysis of the timber rattlesnake (*Crotalus horridus*) in fragmented habitat in Tennessee

Movement patterns of reptiles and amphibians have been shown to be greatly influenced by habitat destruction and fragmentation from human development. The timber rattlesnake (*C. horridus*), a wide-ranging viperid snake in the eastern United States, has been extirpated or listed as threatened or endangered in many parts of its range and suffers from both habitat loss and fragmentation. Because many *C. horridus* populations near human development are being exposed to smaller divisions of

undisturbed habitat, understanding the movement patterns of the timber rattlesnake across a fragmented landscape can only aid in management and conservation for the species. Using radio-telemetry timber rattlesnakes were tracked and habitat information was documented from 2012-2015 at a state natural area in central Tennessee. This site has varied habitats and is fragmented by adjacent farmland. Home range size and other movement parameters were compared among male (n=10), female (n=13), and gravid (n=3) snakes. Interestingly, daily movement rate, cumulative distance moved, maximum length of home range, and the home range size via minimum convex polygon revealed no significant differences. There was a weak positive relationship between snake body size and home range size. We hypothesize that the large degree of habitat fragmentation and possibly patterns of temperature availability may provide some explanation for these lack of differences that are contrary to other prior studies of this species.

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**0938 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Sydney Ashton-Cromwell, M. Rockwell Parker

*James Madison University, Harrisonburg, VA, USA*

**Searching for sex differences in snake skin**

Vertebrates display myriad sexually dimorphic traits including size, coloration, and behavior to communicate information, such as sex and/or condition, to conspecifics. These signals, including pheromones, are typically regulated by sex steroid hormones. The red-sided garter snake (*Thamnophis sirtalis parietalis*) is an ideal model organism for studies linking steroid hormones with sexual signals. Males and females produce difference scents, and pheromone expression can be directly augmented by treatment with sex steroids, as evidenced by male expression of female pheromones under the influence of estrogen. Steroid hormone receptors are the molecular links between hormones and sexually dimorphic signals, but it is unknown where and to what degree these proteins are involved in the pheromone production mechanism of snakes. The most active primary sex steroids in garter snakes are 17β-estradiol, which acts via estrogen receptor α (ESR1) and estrogen receptor β (ESR2), and testosterone, which acts via androgen receptor (AR). Our study seeks to determine the presence and expression levels of ESR1, ESR2 and AR in the skin of both male and female garter snakes. We are extracting and purifying mRNA from the skin to create cDNA for use in real-time PCR reactions. Next, we will quantify mRNA expression levels of the target genes to determine the degree of sexually dimorphic expression in skin. The results of this study are significant in that they will further our understanding of sexual dimorphism in reptiles at a molecular level in addition to quantifying the connection between sex steroid hormones and pheromone expression.

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**0180 General Ichthyology II, Balconies J & K, Sunday 10 July 2016**

Viviana Astudillo-Clavijo[1], Katriina, L. Ilves[2], Walter Salzburger[3], Melanie, L.J. Stiassny[4], Hernán López-Fernández[5]

*[1]University of Toronto, Toronto, Ontario, Canada, [2]Pace University, New York, New York, USA, [3]Universität Basel, Basel, Switzerland, [4]American Museum of Natural History, New York, New York, USA, [5]Royal Ontario Museum, Toronto, Ontario, Canada*

## A Phylogenomic Tree for African non-Rift-Lake Cichlids

Cichlidae is amongst the most diverse and ubiquitous freshwater fish family in the tropics, which has made it a model system for investigating historical evolutionary processes in tropical ecosystems. Cichlids are distributed throughout rivers and lakes of Central America, South America, Africa, Madagascar, Sri Lanka and southern India. Considerable efforts have been made to resolve family-level, Neotropical, and rift-lake cichlid relationships. In contrast, non-rift lake African cichlids relationships remain poorly explored, as most studies have either focused on specific lineages or included only a few species with the aim of inferring family, Neotropical, and rift-lake relationships. We present a phylogenomic tree with comprehensive sampling of non-rift lake African cichlid genera. Hundreds of single-copy exons were captured for 161 cichlid and 15 outgroup species. Exons were captured using next-generation target sequencing with 923 probes designed using an annotated tilapia (*Oreochromis niloticus*) genome. Cichlid sampling includes most known African riverine genera and a few Neotropical, Madagascan, crater lake, and rift-lake species. Several outgroups were used, including *Pholidicthys*, the proposed sister of Cichlidae. This work investigates the evolutionary relationships of the most comprehensive sample of non-rift-lake species, with the inclusion of some rift-lake taxa, and thereby sheds light on the continental context of the African cichlid radiation. Moreover, the availability of a non-rift lake cichlid phylogeny provides the necessary foundation for comparative investigations of the evolutionary and biogeographic processes that have contributed to the exceptional diversity of riverine cichlid fishes.

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**0245 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Matthew Atkinson[1], Joseph Pechmann[1], Robin Overstreet[2], John Tupy[1]

*[1]Western Carolina University, Cullowhee, NC, USA, [2]Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS, USA*

## Gosner stage may influence survival of the Southern Leopard Frog (*Rana sphenocephala*) exposed to the protist parasite *Dermomycoides* sp.

The developmental stage of a host organism may influence how a disease affects the host. Stage becomes especially important in amphibian systems given the number of changes that occur between hatching and adulthood. We examined the influence of Gosner stage at exposure to *Dermomycoides* sp. on mortality and length of larval period

in Southern Leopard Frog tadpoles (*Rana sphenocephala*). Gravid frogs were allowed to breed within cattle tanks to avoid unintentional exposure to *Dermomycoides* sp. The resulting eggs were reared in the laboratory until they hatched, and five tadpoles were then placed into each of 30 aquaria. These aquaria were divided into five treatment groups: exposures conducted at Gosner stages 25, 30, 35, and 40 as well as a control group that was never exposed, with six replicate aquaria per treatment. Survival to metamorphosis was 63% for exposure at Gosner Stage 25, 61% for stage 30, 71% for stage 35, 84% for stage 40, and 80% for the control. Mortality in non-control treatments was a direct result of *Dermomycoides* infection. A non-parametric Kaplan-Meir model found no significant differences among treatments in either time or survival to metamorphosis ($p = 0.19$). However, there was higher mortality of tadpoles exposed at early in development than those exposed late in development. This trend suggests that release of tadpoles headstarted for longer periods of time may help avoid mortality associated with *Dermomycoides* sp.

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**1077 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Catherine Aubee

*US Environmental Protection Agency, Washington, DC, USA*

**Measurements Matter: The Power of Simple Data in a Conservation Context**

The conservation needs of reptiles and amphibians are more visible in the 21st century, but data needs remain less prominently portrayed. Social networks and mainstream media have raised awareness of disease pressures, habitat loss, illegal harvest, invasive species, and contaminants. Accurate life history data are crucial to understanding, predicting, and ideally preventing such stressor effects on reptiles and amphibians. Although interest and research in these areas are expanding, it remains difficult to locate primary observational data on species of conservation concern. Data-sharing initiatives are promising and could be enhanced if the data needs of conservation officials are clearly communicated. In the United States, data on reptiles and amphibians are especially valuable for pesticide risk assessments since these species are typically represented by surrogates (birds and fish). From this perspective, I discuss simple considerations for data reporting, for species underrepresented in ecotoxicology, that may be useful in an applied context (e.g., for ecological risk assessment and regulatory decision making).

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**0082 Squamate Biology, Balconies L & M, Sunday 10 July 2016**

Kevin Avilés-Rodríguez[1], Andrew Battles[2], Jason Kolbe[2]

*[1]University of Massachusetts of Boston, Boston, Massachusetts, USA, [2]University of Rhode Island, South Kingston, Rhode Island, USA*

### Structural habitat alterations caused by urbanization influence escape behavior of a common lizard

Urbanization has drastically altered large portions of the environment for lizards. For example, urban parks and yards typically consist of widely spaced trees on mowed lawns. Furthermore, urban habitats include a variety of artificial substrates, such as cement walls, metal fences, and light posts, which may be used by lizards. We characterized the availability of substrates and its use by lizards in urban and forest habitats to better understand how these factors influence escape behavior. Forest habitats had more perches available (denser vegetation), but fewer large diameter trees. Lizards used larger diameter perches more often given their availability in both habitats, which suggests that larger perches might be preferable. Urban lizards escaped more frequently by sprinting and used jumping less, in contrast to forest lizards, which utilized jumping just as much as the other escapes. An increase in sprinting at the expense of jumping in urban lizards was consistent with the greater availability of larger diameter substrates and fewer nearby perches for lizards to jump to in urban habitats. We found that flight initiation distance, the distance at which a lizard flees when approached by a simulated threat, was significantly shorter in the urban environment compared to the forest habitat. Our results suggest that urban lizards have adjusted their escape response to altered urban environments, likely due to a combination of factors including changes in the structural habitat, habituation to the presence of humans, and possibly lower predation risk.

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**1049 General Herpetology, Galerie 2, Thursday 7 July 2016**

Joseph Baecher[2], Phillip Vogrinc[1], John Willson[1]

*[1]University of Arkansas, Fayetteville, AR, USA, [2]Eastern Kentucky University, Richmond, KY, USA*

### Comparison of Herpetofaunal Communities in Degraded and Restored Remnant Tallgrass Prairie

Prairie ecosystems support a vast diversity of taxa, including many specialists, and often contain high degrees of endemism. Rates of North American tallgrass prairie loss prior to European colonization, range from 82.6-99.9%. While some studies have examined herpetofauna in fire-maintained wood and grasslands, limited data documenting responses of herpetofaunal communities to prairie ecosystem restoration (i.e. landscape recontouring, hydrologic modifications, prescribed burning, reseeding, etc.) exist. Woolsey Wet Prairie Sanctuary is a restored remnant tallgrass prairie, constructed to mitigate wetland loss owing to construction of a wastewater treatment facility in

Northwest Arkansas, USA. This study compares species richness and abundance of herpetofaunal communities in recently (2006) restored remnant wet prairie in Northwest Arkansas, to that of neighboring degraded habitat. Using aquatic and terrestrial sampling techniques (visual encounter, coverboards, minnow-trapping, Anuran call monitoring), we assessed reptile and amphibian communities from February-November, 2014. Prairie specialists, like *Regina grahamii* (Graham's Crayfish Snake) and *Lithobates aerolatus* (Crawfish Frog), were found to have greater abundance in restored prairie habitat. These results provide evidence that prairie and wetland restoration can benefit rare and sensitive reptiles and amphibians that inhabit endangered tallgrass prairie ecosystems.

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## 0072 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016

Christina Baggett[1], Carl Anthony[1], Cari-Ann Hickerson[1], Richard Feldhoff[2]

[1]*John Carroll University, University Heights, OH, USA,* [2]*University of Louisville, Louisville, KY, USA*

### Population-level Variation in a Pheromone Complex Across Species' Geographic Range

Protein pheromones are undergoing rapid directional selection in salamanders of the genus *Plethodon*. Variation in mate recognition components, such as the sex-specific pheromones used by plethodontid salamanders, may play a role in sexual incompatibility and therefore provide a mechanism in the maintenance of discrete, isolated populations. Recent studies suggest that multiple, genetically distinct lineages of *Plethodon cinereus* are present throughout their broad range. Two of these lineages, referred to here as the Ohio (OH) and Pennsylvania (PA) clades, are represented in northern Ohio, spanning the state along the southern shore of Lake Erie. This pattern of distribution creates a unique opportunity to study differences across populations within a single species. The objectives of this study were to (1) characterize the pheromone profiles of male *P. cinereus* and (2) make a between-population comparison among the two distinct lineages present in Ohio. Fifteen reproductive male *P. cinereus* were collected from 9 populations across northern Ohio. Five populations belonged to the OH clade and 4 belong to the PA clade. Mental glands were surgically removed and glands from 5 males were pooled into 3 samples from each population. Proteinaceous pheromones were then extracted from glandular tissue and were biochemically characterized using RP-HPLC. Regions of proteins known to be associated with courtship pheromones were used in an analysis of similarity (ANOSIM) in order to make comparisons within and across-lineages of *P. cinereus*.

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**1024 AES GRUBER AWARD, Balconies J & K, Thursday 7 July 2016**

Danielle Bailey[1], Jill Hendon[2], Andrew Evans[1]

*[1]Department of Coastal Sciences, The University of Southern Mississippi, Ocean Springs, MS 39564, USA, [2]Center for Fisheries Research and Development, The University of Southern Mississippi, Ocean Springs, MS 39564, USA*

## Species-specific Variation in Elasmobranch Interrenal Morphology, Histology, and Steroid Synthesis

Interrenal tissue in fish is homologous to the mammalian adrenal cortex, and is therefore composed of steroidogenic cells that secrete corticosteroids involved in critical physiological systems such as the stress response and hydromineral balance. In elasmobranchs, previous studies indicated that interrenal tissue is organized into discrete bodies that produce the dominant corticosteroid 1α-hydroxycorticosterone (1α-B). However, studies in our laboratory revealed distinct differences in the size, abundance, color and distribution of putative interrenal bodies among several shark species including Finetooth (*Carcharhinus isodon*), Blacktip (*Carcharhinus limbatus*), Atlantic Sharpnose (*Rhizoprionodon terraenovae*), and Bonnethead (*Sphyrna tiburo*). In particular, the morphology of putative interrenal tissue in *R. terraenovae* and *S. tiburo* is distinct from the classic elasmobranch model, with a single pigmented body in *R. terraenovae* and a strip of interrenal tissue along the entire length of the kidney in *S. tiburo*. To validate the classification of interrenal tissue across these species, tissue was collected for histological examination and ex vivo incubations to verify corticosteroid production. Histological analysis revealed similarity in cell structure and organization across all species, and thin-layer chromatography demonstrated that 1α-B was the dominant corticosteroid produced by all putative interrenal tissues. Finally, morphometric analyses revealed differences in interrenal mass that may be related to corticosteorid output and therefore provide insight regarding species-specific differences in susceptibility to stress-induced mortality or reduced fitness.

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**0367 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Sarah Baker[1], Michael Dreslik[1], Christopher Phillips[1], Matthew Allender[2]

*[1]Illinois Natural History Survey, Champaign, IL, USA, [2]University of Illinois, Urbana, IL, USA*

## Hematology and Emergence of Snake Fungal Disease in Illinois Eastern Massasaugas (*Sistrurus catenatus*)

Disease events are threatening wildlife populations across North America. Specifically, mortality events due to ranavirus and Ophidiomyces (Snake Fungal Disease; SFD) have been observed recently in Illinois reptiles. Of particular concern is the endangered Eastern Massasauga (*Sistrurus catenatus*) which appears to experience high mortality associated with SFD infection. The health of a population of Eastern Massasaugas in south-central Illinois was investigated using a meta-analysis of four years of

hematologic data, determination of the prevalence of SFD in the population, and the examination of 184 museum specimens for signs and presence of SFD. The prevalence of SFD ranged from 14.3% to 22.0%, but no hematologic variables were associated with SFD presence. In museum specimens, Ophidiomyces DNA was first detected from an individual collected in 2000, eight years earlier than the first field observation. Studies integrating multiple modalities of health, such as these, can elucidate the epidemiology of diseases that may pose conservation threats.

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**0538 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Brandon Ballengée, Prosanta Chakrabarty

*Louisiana State University, Baton Rouge, Louisiana, USA*

## Combining Art and Science for Conservation Outreach of Ectothermic Vertebrates (Amphibians and Fishes)

Although artists and biologists tend to stay confined to their professional boundaries, and their discourses largely remain inaccessible to larger audiences, evidence is presented here for a combined approach, which may effectively disseminate knowledge about amphibians and fishes to non-specialists through novel art-science participatory research and exhibitions. In this study evidence is presented that suggests combining art with biology may successfully increase public understanding of the international decline of amphibian and fish populations, as members of the public achieved increased understanding of ectothermic vertebrate conservation issues through direct participation (citizen science) in primary scientific studies. Likewise, art inspired from these research experiences was exhibited internationally with the intention of furthering a conservation message and results from questionnaires suggests visitors gained an increased awareness of the threats many species of amphibians and fishes currently face. Historically many scientists utilized varied creative art forms to disseminate scientific insights to a larger populace of non-specialists, such strategies as visually provocative artworks may still be effective to captivate contemporary audiences. As today's environmental issues are often complex and large-scale, finding effective strategies that encourage public awareness and stewardship may be paramount for long-term conservation of species and ecosystems.

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**0942 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Charles Bangley, Roger Rulifson

*East Carolina University, Greenville, NC, USA*

### The Importance of Raleigh Bay as Overwintering Habitat for Juvenile Sandbar Sharks (*Carcharhinus plumbeus*)

Raleigh Bay, an area of the North Carolina coast between Cape Hatteras and Cape Lookout, has long been considered an important winter habitat for juvenile sandbar sharks, but this has largely been based on recaptures of tagged sharks originating from summer nurseries. In order to assess the importance of Raleigh Bay, juvenile sandbar sharks were tagged with acoustic transmitters and tracked using a stationary array deployed off of Cape Hatteras and other arrays along the U.S. east coast through the Atlantic Cooperative Telemetry Network from February 2013-October 2014. To delineate the spatial extent of potential sandbar shark habitat, daily sea surface temperature and chlorophyll-a concentration data recorded by the MODIS satellite were used to identify relationships between these environmental factors and shark presence at receiver locations. Boosted regression trees were used to identify environmental cut points between high and low likelihood of shark presence by season, which were then used to map areas of potential seasonal habitat. Projected juvenile sandbar shark habitat was more spatially restricted during winter than other seasons, and was focused in the area of Raleigh Bay and the Hatteras Bight. The unique geography of Cape Hatteras created an area where sharks could mitigate trade-offs between warmer temperatures and higher productivity. This may cause juvenile sharks from multiple primary nurseries to concentrate in Raleigh Bay, making this area critical habitat for the species.

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**0784 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon F-H, Friday 8 July 2016**

Max Bangs, Marlis Douglas, Michael Douglas, Tyler Chafin

*University of Arkansas, Fayetteville, AR, USA*

### Comparative phylogeography and introgression of catostomids in the Little Colorado River using ddRAD

Disciplines focusing on biodiversity assessment and applied conservation have greatly benefited from recent advancements in Next-Generation-Sequencing (NGS) approaches. For example, reduced representation library methods (i.e. RAD-seq, GBS, ddRAD) coupled with NGS facilitate generation of genotypes across thousands of loci in non-model organisms at relatively low costs. This allows for fine-scale examination of phylogeographic patterns and disentanglement of complex histories of isolation and secondary contact, as exemplified in Southwestern fishes. Recent phylogenomics studies in suckers revealed unique clades in the upper Little Colorado River for two species of catostomids (Bluehead Sucker, *Catostomus* (*Pantosteus*) *discobolus*) and (Flannelmouth

Sucker, *C. latipinnis*). The Little Colorado River is one of the largest tributaries of the Colorado River in Arizona, but its upper drainage is isolated by Grand Falls. The unique lineages found in this area might represent a distinct species (Little Colorado River Sucker, *C. crassicauda*) and subspecies (Zuni Bluehead Sucker, *C.* (*P.*) *d. yarrowi*). We used double digest restriction-site associated DNA sequencing (ddRAD) to examine phylogeographic patterns in and around the Little Colorado River in both species and evaluate proposed taxonomic revisions. Comparative results derived with Bayesian clustering analyses, various phylogenetic methods, and species delimitation approaches reveal similar patterns in both species, reflecting isolation and introgression from other catostomids. Variation in divergence levels may be driven by life history attributes characteristic to the different subgenera of *Pantosteus* and *Catostomus*.

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**0635 Snake Ecology, Galerie 3, Sunday 10 July 2016**

Mitchell Barazowski[1], Neil Ford[1], John Placyk[1], Joshua Banta[1], Richard Seigel[2]

[1]*University of Texas at Tyler, Tyler, TX, USA,* [2]*Towson University, Towson, MD, USA*

**Testing the Ability of Ecological Niche Modeling to Identify Habitat Needs of the Western Massasauga (*Sistrurus tergeminus*) Using Radio Telemetry**

Data on the habitat use of Western Massasaugas (*Sistrurus tergeminus*) is deficient in Texas. Due to their low detection probability, it is problematic to assume that the places and times where snakes are most frequently encountered are their preferred habitats over the course of the year. It has been observed that Massasaugas in other regions overwinter in areas that are environmentally distinct from their summer ranges. The goal of our study was to identify the habitat use of Western Massasaugas using a combination of radio telemetry and environmental niche modelling (ENM) at the Matador Wildlife Management Area in the rolling plains ecoregion of north Texas. In this study we built an ENM using MaxEnt based on captures from the areas of high detection probability (roads) during the seasons of high detection probability (Spring, Summer and Fall). The ability of this model to accurately identify massasauga habitat was tested by radio tracking a subset of the captured animals through the active season to their overwintering sites. A second ENM was built using the radio tracking data. The overlap between the two models was measured to determine the validity of using models based on road surveys to identify year round habitat use.

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**0021 General Ichthyology I, Balconies J & K, Sunday 10 July 2016**

Ruthie Barbas, Matthew Gilg

*University of North Florida, Jacksonville, FL, USA*

### Tests of Reproductive Isolation Between the Killifishes *Fundulus heteroclitus* and *F. grandis*

The closely related killifishes *Fundulus heteroclitus* and *F. grandis* hybridize in a small region where their ranges overlap in coastal northeastern Florida. Hybrids of these species are rare in frequency within the contact zone, suggesting the presence of relatively strong reproductive isolation between these species. The objective of this study was to elucidate barriers to reproduction between *F. heteroclitus* and *F. grandis* in the lab, as well as to quantify the relative strengths and contributions of various isolating barriers. Pre-zygotic (mating and fertilization) and post-zygotic (hatching) barriers were investigated by performing a variety of choice and no-choice laboratory mating experiments. Our results revealed that under no-choice conditions, barriers to mating had the biggest influence on hybrid production in *F. grandis*, whereas hatching barriers contributed to the majority of reproductive isolation in *F. heteroclitus*. However, under choice conditions pre-zygotic barriers had the greatest influence on both species' ability to produce hybrids. The total relative reproductive isolation that was observed in females of each species was stronger in *F. heteroclitus* than in *F. grandis* overall, and was nearly complete in *F. heteroclitus* females under choice conditions while moderate in *F. grandis* females. These results reveal an asymmetry in the potential gene flow between these two species, with *F. grandis* being more likely to hybridize than *F. heteroclitus* in the absence of environmental influences.

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**0239 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Charles Barden, Peter Berendzen

*University of Northern Iowa, Cedar Falls, IA, USA*

### Genomic Evolution in a Tetraploid Family of Fishes (Cypriniformes: Catostomidae)

Whole genome duplication (WGD) events result in the addition of thousands of duplicate genes and regulatory elements to the genome, which are subjected to a variety of evolutionary forces. Duplicates can experience a number of evolutionary fates including retention, loss of function by deleterious mutation resulting in pseudogenes, mutation resulting in novel function or partitioning of function between copies. In the evolutionary history of animals, WGD events have occurred at several key points including a fish specific genome duplication event within Actinopterygii. Within the teleost fishes several additional groups have experienced further WGD events. Many of these have occurred within the order Cypriniformes including the family Catostomidae.

The objective of this study is to examine the impact of WGD and subsequent genomic evolution on shaping the architecture of the tetraploid catostomid genome. Targeted enrichment techniques and high-throughput sequencing were used to selectively sequence the exome of eight species in the Catostomidae. Sequencing reads were aligned and annotated to the zebrafish reference genome GRCz10. The exomes were characterized in reference to the zebrafish by determining the number of single nucleotide changes, structural variations, copy number variants, presence of pseudogenes, and evidence of retained function. Patterns observed in these data were used to determine the amount of genome variation following WGD.

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**0935 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Ivy Baremore[1], Rachel Graham[1], Gaby Ochoa[1], Francisco Polanco[2]

[1]*MarAlliance, San Pedro, Belize,* [2]*Fundacion Mundo Azul, Guatemala City, Guatemala*

**Emerging deep-water fisheries of the Mesoamerican Barrier Reef**

Coastal fisheries along Mesoamerican Reef (MAR) countries are generally overfished and under-managed. As coastal fish stocks decline, select fishers are expanding into deep sea-fisheries. The topography of the MAR enables deep-sea fishing (>150 m) very close to shore, easily attainable in small vessels. Fishing effort in the deep-waters varies substantially among countries, with exploitation based on the use of both vertical and horizontal bottom-set longline gear. Captured shark species include gulper sharks (*Centrophorus* sp.), sixgills (*Hexanchus nakamurai*), smoothhounds (*Mustelus* sp.), and occasionally chimaeras. Although deep longline fishing targets sharks in Guatemala and Honduras, most fishers in Belize target snappers, and deep-water sharks are landed infrequently. Fisheries-independent sampling in Belize and Honduras has been undertaken to develop species diversity and abundance trends for deep-water sharks and teleosts. Fisher surveys from Belize have also exposed a fishery on the brink of expansion. Results from fishery-independent monitoring, fishery-dependent landings data, and fisher questionnaire surveys will be presented.

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**0416 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Micah Barkenhaster[1], Lauren Partridge[1], Rachel Scharer[2], Gregg Poulakis[2]

*[1]Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, St. Petersburg, FL, USA, [2]Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, Charlotte Harbor Field Laboratory, Port Charlotte, FL, USA*

## Parasites as Indicators of Sawfish and Ecosystem Health: How "bad guys" can be Good News

Among parasites of fishes are those with inflexible fidelity to a single host species with which their fates are inherently entwined. Such is the case for some of the diminutive passengers of Smalltooth Sawfish, *Pristis pectinata*, co-evolved parasites that are almost certainly at *greater* risk of extinction than their host. In addition to their contribution to biological diversity, these organisms could serve as indicators of environmental and host population health. To evaluate the status of the *P. pectinata* parasite community in the Charlotte Harbor estuary, in 2005 we began to conduct routine screenings for ecto parasites during our routine sampling efforts for population monitoring and tagging. Also, to the greatest practical extent, we have opportunely conducted parasitological evaluations on recovered carcasses of freshly dead specimens. External parasites have included monogeneans, isopods, copepods, and leeches. Internal parasites have included digeneans and cestodes. These species include sawfish-specific parasites that have not been reported for decades and very likely undescribed species. One species of external monogenean, *Dermophtherioides pristidis*, is particularly common in our samples and may serve as a good biological indicator species.

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**0866 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Amanda Barker[1], Bryan Frazier[2], Douglas Adams[3], Jim Gelsleichter[4], David Portnoy[1]

*[1]Texas A&M University Corpus Christi, Corpus Christi, TX, USA, [2]South Carolina Department of Natural Resources, Charleston, SC, USA, [3]Florida Fish and Wildlife Conservation Commission, Melbourne, FL, USA, [4]University of North Florida, Jacksonville, FL, USA*

## Identification and Relative Abundance of Cryptic Hammerhead Sharks

Scalloped hammerheads (*Sphyrna lewini*) and Carolina hammerheads (*Sphyrna gilberti*) are cryptic species that are sympatrically distributed in the southeastern United States. The scalloped hammerhead employs a reproductive strategy in which parturition occurs in discrete coastal nursery habitats. Several nursery areas have been identified on the east coast of the United States, yet the extent to which Carolina hammerheads utilize the same nursery habitats is unknown. Because nursery utilization may not be equivalent between the species, one or more nurseries may be critical to the persistence of one or both species. In this study, we used double digest restriction-site associated DNA

(ddRAD) sequencing to identify a panel of single nucleotide polymorphisms (SNPs) that can be used to reliably differentiate between the species of young-of-the-year sharks sampled in four locations (Bulls Bay, SC, Cape Canaveral, FL, Panama City, FL, and Corpus Christi, TX). Sixty-one out of 34,282 SNPs have been identified as diagnostic through preliminary analysis. Screening of 141 young of the year hammerhead sharks caught between 2012-2014 revealed a mix of scalloped, Carolina and great hammerhead sharks (101 *S. lewini*, 29 *S. gilberti, 2 S. mokarran,* 11 unidentified). Scalloped hammerheads were the most abundant hammerhead shark in all nurseries except Bulls Bay, SC where Carolina hammerheads comprised 61% of identified individuals.

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**0420 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Helena de Souza Brasil Barreto, Kathleen Cole, Jessica Maxfield

*University of Hawaii at Manoa, Honolulu, Hawaii, USA*

**Patterns of oogonia and spermatogonia distribution in the non-partitioned ovotestis of the Hawaiian endemic goby species, *Eviota epiphanes***

Teleost fishes exhibit a dynamic range of sex determining systems and reproductive strategies. This diversity has been extensively explored in the literature, however, the vast majority of studies have focused on gonochoristic fishes (i.e. those with separate sexes). The precise mechanisms for sexual differentiation and maintenance remains poorly understood in hermaphroditic species. The aim of this research project is to identify the distributional pattern of gonial cells (oogonia and spermatogonia) in the ovotestis of the Hawaiian endemic hermaphroditic goby, *Eviota epiphanes*. In order to accomplish this goal, we propose to look at the expression patterns of *vasa, dmrt1,* and *cyp19* genes by immunohistochemistry (IHC) analysis. These three genes are directly implicated in sexual determination and differentiation in many vertebrate taxa. We will be testing three competing hypothesis concerning the differentiation process of gonial cell types during transition from one gamete type to the other. We hypothesize that the number of appropriate gonadal cell increases through cell division during transition of gamete type. Alternatively, gonial cells may re-differentiate (i.e. oogonia become spermatogonia and spermatogonia become oogonia) and/or PGCs are maintained in the ovotestis of hermaphroditic fishes and undergo differentiation during transition. The results of this study will provide us with a clear understanding of how sexual differentiation, specifically the generation of new and different gametes, is regulated in hermaphroditic fishes.

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**0724 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Kyle Barrett[1], Craig Guyer[2], Stephen Samoray[3], Yoichiro Kanno[1]

*[1]Clemson University, Clemson, SC, USA, [2]Auburn University, Auburn, AL, USA, [3]Copperhead Consulting, Paint Lick, KY, USA*

### Species Richness and Occupancy Patterns for Anurans Along a Forested Gradient in Western Georgia, USA

Urban development is known to alter the structure, chemistry, and biota associated with stream systems; however, little is known about the dynamics of anurans that breed in and around streams. We used automated devices to record breeding anurans for one year across a forested gradient in an effort to identify species-specific sensitivities to urbanization. Six of 13 total species found during the study were present in surveyed streams that were representative of a gradient ranging from heavily urbanized to largely forested, and maximum species richness occurred in watersheds with rapid urban development but low values of impervious surfaces such as pavement and roof tops. The best landscape-scale predictor of assemblage metrics such as species richness, total species activity, and species diversity was generally percent forest cover at the watershed scale (or in very large buffers around the sample point). We used Bayesian inference to estimate detection probability and occupancy for 11 species. While detection probability varied across sampling occasions, there was no evidence that occupancy was a function of forest loss for any species. Urban streams and riparian areas are often severely altered when compared to similar habitats in forested areas. Anuran richness and diversity from urban areas was not altered to the same extent as caudates, which have been sampled from these same streams in previous studies. Increased vagility of anurans, coupled with different breeding strategies, may help to explain this discrepancy.

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**0085 HL, ASIH, SSAR: Eco-Evolutionary Dynamics Symposium, Salon D, Friday 8 July 2016**

Marissa Baskett

*University of California, Davis, Davis, CA, USA*

### Accounting for eco-evolutionary dynamics in management decision-making

Human-driven environmental change can be a source of contemporary evolution with eco-evolutionary feedbacks. Subsequent demographic changes can, in turn, affect management decision-making for biodiversity conservation and natural resource management. The challenge for management in such cases is then how to account for eco-evolutionary dynamics. I will illustrate how management might account for eco-evolutionary dynamics using a series of models of coupled genetic-demographic dynamics applied to fish systems. Models of fisheries-induced evolution demonstrate the potential for eco-evolutionary feedbacks to change optimal management decisions such as harvest rate. Models of spillover from domesticated hatchery and aquaculture

populations to the wild demonstrate how a basic science understanding of eco-evolutionary dynamics can inform management approaches to mitigating unintended fitness consequences on wild populations. Models of hatchery effects on straying rates across locally adapted salmon populations show how ignoring eco-evolutionary dynamics can lead to unanticipated negative consequences for both wild populations and fisheries sustainability. Therefore, an increasing understanding of eco-evolutionary dynamics can help to reduce the likelihood of unintended consequences in natural resource management.

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**0617 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Michael F. Bates[1], Donald G. Broadley[2], Luis M.P. Ceriaco[3], William R. Branch[4]

*[1]National Museum, Bloemfontein, Free State, South Africa, [2]Natural History Museum of Zimbabwe, Bulawayo, Zimbabwe, [3]National Museum of Natural History and Science, Lisbon, Portugal, [4]Port Elizabeth Museum, Port Elizabeth, Eastern Cape, South Africa*

**A Review of the *Gerrhosaurus nigrolineatus* Species Complex (Sauria: Gerrhosauridae) in sub-Saharan Africa**

The *Gerrhosaurus nigrolineatus* species complex is a clade of four species of medium-sized, heavily-armoured lizards widely distributed in sub-Saharan Africa. A molecular phylogeny indicates that within this complex *G. multilineatus* is sister species to a subclade containing *G. nigrolineatus*, *G. auritus* and *G. intermedius*. West-Central African *G. nigrolineatus* is most closely related to *G. auritus* rather than to populations previously referred to as '*G. nigrolineatus*' from East and southern Africa, and the latter populations therefore represent a separate species for which the name *G. intermedius* is applicable. A morphological analysis indicated considerable overlap in scale counts, but the various species differ regarding dorsal colour pattern. *Gerrhosaurus multilineatus* (Angola, Zambia, adjacent D.R.C.) also has strongly armoured and spinose scales at the base of the tail. *Gerrhosaurus nigrolineatus* (Gabon, Congo, western D.R.C., northern Angola) and *G. intermedius* (East and southern Africa, Angola, southern D.R.C.) are similar but differ with regard to colour pattern, keeling on the soles, and numbers of longitudinal dorsal scale rows. *Gerrhosaurus auritus* (mainly Botswana, NE Namibia, SW Zambia) is unique in having a large lobe on the anterior border of the tympanum. The status of *G. multilineatus* was particularly problematic as its vague description was based on a few subadults only, all destroyed in a fire at the Museu Bocage. However, examination of Angolan *Gerrhosaurus* at the American Museum of Natural History provided insight into variation in tail spinosity and dorsal colour pattern, indicating that *G. bulsi* is in fact a junior synonym of *G. multilineatus*.

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**0378 SSAR SEIBERT AWARD ECOLOGY, Galerie 3, Thursday 7 July 2016**

Andrew Battles, Jason Kolbe

*University of Rhode Island, Kingston, RI, USA*

**Urban habitats influence the spread of introduced *Anolis cristatellus* in Miami, FL**

The success of an introduced organism depends on both the species' biology and environmental factors, but in urban areas, the processes shaping environmental conditions are often novel and influenced by human activities. For ectotherms in cities, both increased ambient temperatures (the urban heat island effect) and greater thermal heterogeneity may alter costs and benefits of thermoregulation. We examined how structural habitat and thermal microclimates affect the distribution of a recently introduced lizard, *Anolis cristatellus*, in South Miami, Florida (USA). Roadside transects through the city and GIS-based analyses revealed that *A. cristatellus* is most commonly found in areas with high canopy cover, dense vegetation, and low levels of impervious surface. These habitats have lower operative temperatures, the body temperature of a non-thermoregulating lizard, than more open and less vegetated urban areas. Body temperatures of lizards from urban populations are higher than those in natural areas, but this species is not found in urban areas with the highest operative temperatures. Increased exposure to upper thermal limits and high costs of thermoregulation may prevent *A. cristatellus* from occupying these urban areas. Heavily shaded, relatively cool urban habitats suitable for *A. cristatellus* are fragmented in Miami, which constrains the ability of *A. cristatellus* to spread by diffusion. While human activity may increase rates of species introductions, heterogeneity in urban development complicates predictions for their establishment and spread.

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**0283 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Sudesh Batuwita[1], Udeni Edirisinghe[2]

*[1]The Society for the Biodiversity Conservation, Kandy, Sri Lanka, [2]Postgraduate Institute of Agriculture, University of Peradeniya, Peradeniya, Kandy, Sri Lanka*

**Chin and gular scale arrangement: a phylogenetic subdivision to Sri Lankan Scincidae**

Scincid fauna of Sri Lanka is not well studied since 1950s (after Taylor's and Deraniyagala's classic works). Eight genera are currently recognized from the Family Scincidae of Sri Lanka, i.e., *Dasia* (after Taylor's and Deraniyagala's classic works). Eight genera are currently recognized from the Family Scincidae of Sri Lanka, i.e., *Dasia* Gray, *Eutropis* Fitzinger, *Lankascincus* Greer, *Nygosoma* Hardwicke and Gray, *Nessia* Gray, *Chalcidoseps* Boulenger, *Chalcides* Laurenti, and *Sphenomorphus* Fitzinger, of which the record of *Chalcides* ~~(*C. ocellatus*) presumed to be due to pet trade~~ and the '*Sphenomorphus*'

CANCELED

*megalops* is incertae sedis within Lygosominae. Here, we describe following important characters in chin and gular scale arrangement, which are useful to diagnose all Sri Lankan genera: postmental scale; first, second, and third pairs of chin shields (Batuwita, in press); and sublabials. In Sri Lankan genera, the third pair of chin shields are separated from infralabial row by elongate shaped sublabials or sublabials (similar to ventral scales). With regard to the phylogenetic relationships of these Sri Lankan genera, the third pair of chin shields separated by three scales appears to be in synapomorphy (found in all Sri Lankan genera and also found in the type species of *Sphenomorphus*, *S. melanopogon*. *Chalcidoseps* together with *Nessia*, and *Lankascincus*, showed an autapomorphy, respectively for chin and gular scale arrangement, whereas pleisiomorphic character states were in *Eutropis*, *Dasia*, and *Lygosoma*. Latter two genera showed synapomorphy based on the sublabial shape (similar to ventral scales).

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**0120 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Aaron Bauer

*Villanova University, Villanova, Pennsylvania, USA*

## The American Society of Ichthyologists and Herpetologists on the Global Stage of Herpetology

ASIH is a global society with its roots in the United States. Although the early Society was exclusively American, its attraction as a professional "home" and the availability of *Copeia* as a taxon-specific publication outlet soon attracted the attention of ichthyologists and herpetologists from around the world. By the 1920s members had been elected from elsewhere in the Americas and papers were being published by authors from Russia and Japan. By the early 1930s prominent herpetologists from across Europe were paying $2.00 yearly for the privilege of membership and the opportunity to receive *Copeia*, which had become especially popular after it became a larger format quarterly in 1930. In these early years, membership in ASIH was sometimes regarded as a mark of distinction, akin to "corresponding member" status in the national and regional scientific academies and societies of the 19th century. Honorary Foreign Membership, established in 1935, became recognized as the highest honor a herpetologist could receive from his or her colleagues. In the post-war years, the growth of English as the language of science promoted ever more manuscript submissions from abroad and in the jet-age, ASIH meetings began, for the first time, to be widely attended by foreign scientists. Although American "by birth", ASIH has grown to be truly cosmopolitan.

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**1065 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jennifer Beals, Matthew Julius

*St Cloud State University, St. Cloud, MN, USA*

**Dietary Analysis of Algae Eating Fishes from the Xingu River, Brazil**

The gut contents of algiverous fish collected from the Xingu River, a tributary to the Amazon in northern Brazil, were examined to identify the feeding habitat and preferences of various fish. A large hydroelectric dam is scheduled to be constructed in the lower Xingu River, making studies on fish from this threatened environment especially important. Samples were collected in 2009 and preserved in ethanol, and the gut contents were extracted in 2015 for analysis; preservation of diatoms for both morphological and molecular analysis was maintained. Diatom specimens obtained from the guts were quantified to generate species diversity estimates and the ratios of rare and common diatoms from stomach contents were compared statistically. Several fish species were identified as dietary generalists feeding on common diatoms with varied growth microhabitats; and others were extreme specialists, feeding selectively on only a few uncommon diatom genera with specific microhabitats. A final comparison was made correlating the geographic distribution of individual fish species with their degree of dietary specialty.

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**0128 HL GRADUATE RESEARCH AWARD, Galerie 2, Thursday 7 July 2016**

Alicia Beattie[1], Matt Whiles[1], Phillip Willink[2]

*[1]Southern Illinois University, Carbondale, Department of Zoology, Carbondale, IL, USA, [2]Shedd Aquarium, Department of Conservation and Research, Chicago, IL, USA*

**Seasonality, Population Demographics, and Ontogenetic Diet Shifts of Mudpuppies (*Necturus maculosus*) in Near-shore Habitats of a Chicago lake**

Mudpuppy (*Necturus maculosus*) populations appear to be declining throughout the Great Lakes region, yet little is known about their natural history. We captured 120 individual mudpuppies in Wolf Lake, Chicago, IL during ten trapping events of ≥ 3 consecutive nights from January to May 2015 and October 2015 to January 2016, with 19 additional mudpuppies caught with hand nets, yielding 145 total captures. Capture success was highest during February-early March, March-early April, November, and December. Trapping success in December and February-March was higher than in May, when no mudpuppies were caught. Analyses of size classes indicated potential gear and seasonal biases, with mudpuppies in traps (mean=27.1 ± 0.6 cm) larger than those caught using hand nets (mean=15.8 ± 1.10 cm) and mudpuppies trapped in fall (24.5 ± 1.0 cm) smaller than those trapped in winter (28.4 ± 0.6 cm). Stomach contents obtained through gastric lavage included mollusks, leeches, insects, malacostracans, fish, a frog, and a juvenile mudpuppy. Smaller juveniles (<20.0 cm) consumed fewer fish and no crayfish, but more leeches and amphipods, than larger adult size classes. Mean percent

volume of crayfish in guts was higher only for the largest size class. Nonmetric multidimensional scaling ordinations showed different communities of prey among size classes. ANOSIM results confirmed observed differences in composition among size classes (Global R = 0.253 for abundance, 0.258 for volume, and 0.267 for % volume, p = 0.001). Results suggest mudpuppies in lake ecosystems occupy a broad niche that changes over their development.

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**0653 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Justine Becker, R. Brent Thomas

*Emporia State University, Emporia, KS, USA*

## Male Response to Female Chemical Signals in Painted Turtles (*Chrysemys picta*)

Many reptiles use chemical signals to communicate information regarding sender identity, receptivity to mating, and other information that may benefit both sender and receiver. Although the use of chemical signals seems probable for chelonians, few studies have focused on this form of communication, and only in a limited number of species. I studied male Painted Turtles (*Chrysemys picta*) and their response to chemical signals exuded by conspecifics. I tested whether male Painted Turtles spent more time in close proximity to males, females, or a control (empty) section of a pool, based only on chemical signals exuded by the stimulus animals. I completed 27 trials and recorded the time male turtles spent in each section of the pool. Male Painted Turtles spent the most time in the female section, followed by the male section and spent the least amount of time in the empty section of the pool. A one-way ANOVA test and Tukey's test revealed a significant difference in time spent in the female and empty sections of the pool. The female and male sections did not differ significantly in the amount of time males spent in each. Additionally, no significant difference was found in the time a male Painted Turtle spent in the male section of the pool or the control section. With few studies focusing on turtle chemical signals and many turtle populations declining, it is important to study aspects of their reproduction, including communication.

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**0271 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Brooke Bedal, Andy Mueller, Cole Spicer, Mattie Lewis, Kristoffer Wild, Mollie Cashner

*Austin Peay State University, Clarksville, TN, USA*

**mtDNA Analysis of Population Structure among Blackside Dace (*Chrosomus cumberlandensis*) populations**

*Chrosomus cumberlandensis* (Blackside Dace) is a federally threatened cyprinid that is endemic to the upper Cumberland River system in northeastern Tennessee and southeastern Kentucky. Populations are found in tributaries throughout the range, and are comprised of "residents" and "roamers", which are essential for gene flow. Disconnections between populations due to anthropogenic factors; such as coal mining and logging, suggest heightened risk of increased fragmentation and decreased genetic variability among populations. Through preliminary examinations of the mtDNA ND2 gene, the genetic structure among five populations located throughout the historic range with variable spatial differences was investigated to further understand genetic diversity, historic gene flow patterns, and potential threats to the genetic health of this rare cyprinid species. Future population genetics analyses will include finer-scale markers (species-specific microsatellites), in order to identify the degree of isolation or genetic mixing within the current time frame, all of which are crucial components of an effective and biologically meaningful conservation plan.

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**0842 AES Physiology, Paleontology, & Collections, Balconies L & M, Friday 8 July 2016**

Christine Bedore

*Georgia Southern University, Statesboro, GA, USA*

**Evaluation of propofol immersion anesthesia in stingrays**

Previous work has shown suppression of fish physiological responses to experimental stimuli while immobilized with the anesthetic tricaine. For example, temporal resolution (a measure of retinal integration speed) may be reduced by 50% in stingrays anesthetized with tricaine. Alternative anesthetic protocols have been evaluated for some fishes that may provide an adequate surgical plane of anesthesia, but yield accurate physiological data. Propofol is a dissociative-type anesthetic that produces rapid induction and recovery when administered intravenously in bamboo sharks. Propofol may provide more long-term immobilization for elasmobranchs when administered as an immersion anesthetic as in some teleosts. Immersion in propofol (1.25mg/L) induced a surgical plane of anesthesia in round stingrays (*Urobatis halleri*) slower than tricaine (100mg/L). Recovery from tricaine occurred within 30 minutes, whereas recovery from propofol took up to 3 hours. All stingrays recovered completely from both anesthetic regimens. These results suggest that propofol acts as an effective

immersion anesthetic for stingrays and the effects of immersion in propofol are substantially longer lasting than tricaine (hours v. minutes). The long-lasting effects of propofol may warrant selection of propofol as an alternative anesthetic to tricaine when longer anesthetic periods are needed.

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## 0045 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016

Anat Belasen[1], Felipe Toledo[2], Tim James[2]

*[1]University of Michigan, Ann Arbor, MI, USA, [2]Universidade Estadual de Campinas, Campinas, SP, Brazil*

### How does habitat fragmentation affect disease susceptibility? Examining the relationship between land-use and amphibian resilience in Brazilian forests

Human impacts on natural systems often promote disease emergence, but the ecological and evolutionary mechanisms by which this occurs are poorly understood. When humans divide and reduce natural areas (e.g., clearing sections of forest for roads or agriculture), a process known as habitat fragmentation, the disjunct patches of forest that remain contain small, isolated wildlife populations. Inbreeding in fragmented populations leads to genetic impoverishment that may in turn increase disease susceptibility, though empirical tests of this phenomenon are lacking. Land-bridge islands offer a useful model system of fragmentation, as they were divided from the mainland by rising sea levels due to glacial melting in the last 12-20,000 years. Terrestrial island biota represent relicts of once-contiguous populations, and thus provide insights into the long-term effects of contemporary fragmentation. In this study, we examine whether disease susceptibility is affected by fragmentation in amphibians, which are particularly vulnerable to both stressors. This is performed in the Brazilian Atlantic Forest, which is extensively fragmented, heavily invaded by disease agents, and contains hundreds of land-bridge islands. To examine the effects of recent and long-term fragmentation, we analyze genetic and immunogenetic diversity in amphibians found in contiguous forest (baseline), human-created habitat fragments (recent), and land-bridge islands (long-term). Pathogen prevalence and load are quantified using molecular techniques. Our preliminary results suggest that fragmentation may affect immunity more significantly than previously thought, with potential mechanisms being a lack of selective pressure due to reduced disease transmission, and/or a reduction in immunogenetic diversity due to inbreeding and genetic drift.

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**0719 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

Katherine Bemis, Samantha Burke, Taylor Hughes, Carl St. John, William Bemis

*Cornell University, Ithaca, NY, USA*

### Tooth development, attachment, and replacement in Atlantic Cutlassfish, *Trichiurus lepturus*

The Atlantic Cutlassfish, *Trichiurus lepturus*, has a characteristic oral dentition suited for stabbing and cutting fishes and squids. We studied tooth structure, development, and replacement in 80 specimens from the western North Atlantic ranging from larvae and small juveniles to adults using dissection, osteology, histology, SEM, and micro-CT. Barbed premaxillary fangs are flanked by small dagger-like teeth. Posteriorly along the crest of the premaxilla is a single row of larger dagger-like teeth. Each dentary bears a single barbed fang. A diastema separates the fang from a single row of larger teeth along the dentary crest. The largest teeth in the dentary occur in the middle of that row, and are barbed. We scored each tooth locus for condition of the teeth, using categories incoming, functional, eroding, or absent following a system used in a study of tooth replacement in Bluefish (*Pomatomus saltatrix*). Tooth development is intraosseous, and all functional teeth are ankylosed to their bone of attachment. Teeth along the premaxillary and dentary crests show alternate tooth replacement, with teeth developing immediately beneath the locus into which they will erupt. Premaxillary fang replacement differs: developing teeth form perpendicular to their ultimate positions and rotate into place before ankyloses. Tooth replacement in Atlantic Cutlassfish resembles that of Bluefish, another piscivorous teleost that bites its prey and has intraosseus tooth replacement. Unlike Bluefish, Atlantic Cutlassfish lack tooth replacement pores in the bone of attachment. Snake Mackerels (Gempylidae) show a similar pattern of tooth replacement, which may be synapomorphic for Trichiuridae + Gempylidae.

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**0518 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Michael Benard, Hilary Rollins

*Case Western Reserve University, Cleveland, OH, USA*

### Combined Effects of Variable Snow Cover and Shifting Phenology on Wood Frogs

Climate change is likely to affect amphibians both through altered phenology (i.e., the timing of life history events) and shifts in the temperatures and precipitation experienced by individuals. However, few studies simultaneously examine both factors. We investigated this issue in wood frogs (*Rana sylvatica*) which are expected to experience more variable winter snow cover and breed earlier in the spring as climate change continues. We experimentally manipulated the timing of wood frog metamorphosis, and the amount of snow cover during wood frog hibernation, then measured how these factors affected wood frog survival and growth. To generate early-metamorphosing and late-metamorphosing wood frogs, we raised woodfrog larvae in

outdoor mesocosms at two different temperatures. We then placed metamorphosed wood frogs in outdoor terrestrial pens and monitored their growth and survival through the end of the active period. Although there was no initial mass difference between early- and late-metamorphosing wood frogs, by November the early-metamorphosing wood frogs were 60% larger (3.2 g) than the late-metamorphosing wood frogs (2.0 g). Throughout the winter we applied snow removal treatments to half of the terrestrial pens, and allowed the other half of the pens to experience ambient snow conditions. Temperature dataloggers quantified the effects of snow removal on the freeze-thaw cycle of the soil where wood frogs hibernated. At the end of the experiment in March, we assessed the combined effects of metamorphic timing and snow cover. Our results demonstrated the importance of testing for interactions between multiple pathways through which climate change may affect amphibians.

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**0307 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Amanda Bennett[1], Matthew Keevil[2], Jessica Steiner[3]

*[1]Trent University, Peterborough, Ontario, Canada, [2]Laurentian University, Sudbury, Ontario, Canada, [3]Wildlife Preservation Canada, Guelph, Ontario, Canada*

## A Systematic Review of Headstarting Programs for Freshwater Turtle Populations

Freshwater turtles are declining globally, facing numerous threats from habitat loss to subsidized predation to poaching and disease. Turtles rely on a long life coupled with many reproductive events to maximized fitness as survivorship of turtle nests is naturally low. One conservation intervention used to offset population declines is headstarting: the removal of eggs or hatchlings from the wild and then rearing of those young in captivity until they reach a larger, less vulnerable, body size. The effectiveness of headstarting for increasing populations had long been debated in the literature, and modelling exercises have largely decried the intervention as an ineffective tool for halting or reversing population declines. However, population models evaluating headstarting effectiveness have relied on limited data for wild hatchling and juvenile survivorship, as well as little-to-no information on the size or age at maturity of headstarts. Thus, population models evaluating headstarting may have historically underestimated growth rates under the intervention. While headstarting is a widely used intervention, information regarding the outcomes from headstarting projects is sparse and scattered among personal expertise, technical reports, and the primary literature. In 2015, along with a systematic literature review, we initiated an online survey to gather data on headstarting projects worldwide, soliciting information from headstarting projects on husbandry, wild population status, and pre- and post-release outcomes. Compilation of this data is ongoing, however, preliminary analyses suggest that headstarting has been effective at stopping population declines, with documented cases of headstarted individuals reaching sexual maturity and expanding documented species ranges.

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**0303 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Amanda Bennett, Dennis Murray

*Trent University, Peterborough, Ontario, Canada*

### Development of Risk Maps for Chytrid and Ranavirus Infection and Disease in Ontario, Canada

Declines in amphibian populations are occurring on a global scale; causes of declines include pathogens, contaminants, habitat loss, fragmentation, and degradation. Climate change may exacerbate declines via interactions between changes in environmental conditions, such as temperature or precipitation, and the causal agents of declines, such as disease or habitat degradation. Emergence of both chytrid disease, caused by the fungus *Batrachochytrium dendrobatidis*, and ranaviral disease, caused by viruses in the genus *Ranavirus*, have resulted in amphibian mortality events worldwide. In Canada, there is no national program for monitoring amphibians; within provinces, amphibian monitoring is largely under the purview of citizen science programs. Consequently, data on amphibian population sizes, distributions, and mortality events is limited. We have compiled all available data on pathogen and disease occurrence in Canada, from published literature, personal communications with collaborating researchers, and from amphibian necropsy data shared by the Canadian Wildlife Health Cooperative (CWHC). We have developed preliminary pathogen distribution models for Ontario, using presence data for both pathogens, as well as occurrences of either chytrid or ranaviral disease (i.e., mortality events). These models will be used to assess the relationships between pathogen or disease occurrence and a suite of relevant land cover and environmental variables. Ultimately, we will develop a predictive model for the occurrence of pathogens and die-off events in Ontario, creating risk maps to highlight areas of present and future (using anticipated climate change scenarios) concern for the province.

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**0187 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Stephanie Benseman, Larry Allen

*California State University, Northridge, Northridge, California, USA*

### The Secret Life of Baby Giants: The Recruitment of the Endangered Giant Sea Bass

Little is known about the complete life history of giant sea bass (*Stereolepis gigas*) due to the over exploitation of their fishery in the early 1900's, and depressed populations have prevented much detailed research. This study finally fills in gaps in the early life history of the juvenile giant sea bass by 1) determining distribution and general ecology for the young-of-the-year of *S. gigas* in the wild, 2) estimating growth rates, based on site

aggregations in the wild, and otoliths analysis in the lab, and 3) finally determining pelagic larval duration and general temporal scale of their spawning period. The use of SCUBA transects, video, and lasers allows us to estimate cohort populations, individual sizes, and ecosystem quantifications while in the field, and collecting individuals for otolith analysis helps determine growth rates and planktonic larval duration. These observations have already discovered several previously unknown behaviors, including the "kelping" mimicking behavior, distinct distribution patterns across southern California primarily near underwater canyons, and their annual and daily temporal distribution. These early developmental process are crucial for completing the life history for any species, and this study is the only one of its kind to do so for this endangered species making it a key component to their life history, as well as a baseline for future work on not only *S. gigas*, but also similar species. Increasing knowledge about current and future populations, will allow us to make increasingly intelligent decisions about current fisheries management policies as well as future conservation efforts.

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**0650 Herp Morphology & Genetics, Galerie 3, Sunday 10 July 2016**

Abigail Berkey[1], Marlis Douglas[2], Christopher Phillips[3]

*[1]Eastern Mennonite University, Harrisonburg, VA, USA, [2]University of Arkansas, Fayetteville, AR, USA, [3]University of Illinois, Champaign, IL, USA*

## Population genetics of the Four-Toed Salamander, *Hemidactylium scutatum*, at local and regional scales

Amphibians are among the biota most impacted by global declines in biodiversity. Many salamander species, especially the small-bodied members of the family Plethodontidae, are at risk because they persist in small, isolated populations due to specialized habitat requirements and/or limited dispersal ability. To effectively conserve and manage such species, factors influencing population connectivity and dynamics must be understood across various spatial scales. The Four-Toed Salamander, *Hemidactylium scutatum*, is a plethodontid species of conservation concern throughout much of its range in eastern North America. This study used microsatellite analysis to estimate genetic variation and gene flow within and among populations (N=14) of *H. scutatum* and explored the data for signs of population bottlenecks on both local and regional scales. While *H. scutatum* follows a pattern of genetic structuring similar to that of other plethodontid salamanders on the regional scale, very little genetic differentiation was observed between sites on a local scale. This may be a result of high levels of gene flow and dispersal, reduced genetic variation between populations due to post-glacial recolonization from a common source, and/or a reduction in genetic drift due to specific life history characteristics.

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**0194 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Salon A-C, Friday 8 July 2016**

Justin Bernstein[1], Aaron Bauer[1], Todd Jackman[1], Yunyu Wang[2]

*[1]Villanova University, Villanova, PA, USA, [2]Kunming Institute of Zoology, Kunming, Yunnan, China*

### Phylogenetic Analysis, Species Identification and Delimitation of New Caledonian Geckos and Skinks using DNA Barcoding

Due to its unique geological history, New Caledonia has an extraordinary level of endemism. However, many species, including scincid and gekkotan lizards, are still being discovered and are in danger of extinction due to anthropogenic activity. The CO1 gene is being used to barcode the most speciose genera of endemic New Caledonian geckos and skinks. The utility of CO1 for distinguishing undescribed species identified by other means and its phylogenetic informativeness within the target genera are assessed. Over 620 New Caledonian lizards have been sequenced, many of which have been used to create CO1 phylogenies for 6 endemic genera of New Caledonian lizards. These trees were compared to highly-supported trees based on the mitochondrial ND2 gene. Barcode trees recovered all described and putative new species from the ND2 tree. Both the basalmost and distalmost branching patterns of the CO1 trees are moderately to well supported and similar to the ND2 trees. However, intermediate branching patterns are unsupported and/or conflict with the ND2 trees. All described and putative species identified using ND2 exceed the 2% threshold for interspecific separation (excluding problematic clades in the ND2 tree), generally recommended for CO1 use. Additionally, barcodes have been obtained for 103 of the 107 lizard species found on New Caledonia. CO1 barcoding may be of particular conservation value in New Caledonia where fragmentary lizard skeletal remains and scales are recovered from the scats of feral cats.

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**0831 NIA BEST STUDENT PAPER, Salon A-C, Friday 8 July 2016**

Maxwell Bernt

*University of Louisiana at Lafayette, Lafayette, LA, USA*

### Diversification in the Deep Channels: Molecular Phylogeny of the Ghost Knifefishes (Gymnotiformes: Apteronotidae)

The Apteronotidae is the most species-rich family-level clade of Neotropical electric knifefishes (Gymnotiformes), with 96 currently valid species in 15 genera. Apteronotids are widespread across northern South America, and are most diverse and abundant in the deep channels of large lowland rivers. A noteworthy observation is that the majority of apteronotid species richness and morphological disparity exists in sympatry and syntopy in the Amazon basin, giving this clade the appearance of a riverine species flock. Previous morphological and molecular phylogenies for Gymnotiformes had insufficient taxon sampling across Apteronotidae to draw major conclusions regarding the origins and diversification of this unique fauna. The present study is the first

molecular phylogenetic analysis designed to resolve species-level relationships across the whole family. We analyze 5,400 bp of DNA from nuclear and mitochondrial markers for 45 species in 14 genera. In order to understand evolutionary patterns among geographically disparate faunas, samples were included from the western and eastern Amazon, Orinoco, Upper Madeira, Essequibo, Magdalena, Maracaibo, and La Plata basins. Our Bayesian and Maximum Likelihood topologies corroborate previous findings of Sternarchorhamphinae as the sister to all other apteronotids and indicate novel positions for the Amazonian endemic genera *Magosternarchus* and *Pariosternarchus*, and find that the poorly-defined *Porotergus* is monophyletic. Our results further show short branch lengths in the clade of the morphologically diverse deep-channel specialists consisting of *Sternarchorhynchus* + Navajini, suggesting rapid evolution associated with this habitat.

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**0017 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

Tim Berra[1], You He[2], Dion Wedd[3]

*[1]The Ohio State University, Dept. of Evolution, Ecology & Organismal Biology, Mansfield, OH, USA, [2]Shanghai Synchrotron Radiation Facility, Shanghai Institute of Applied Physics, Chinese Academy of Sciences, Shanghai, China, [3]Territory Wildlife Park, Parks and Wildlife Commission of the Northern Territory, Palmerston, Northern Territory, Australia*

## A Microtomographic Osteology of the Forehead Hook of Nurseryfish, *Kurtus gulliveri* (Perciformes: Kurtidae)

The nurseryfish, *Kurtus gulliveri*, is known for "forehead brooding" parental care behavior in which the adult male carries the egg mass on a hook that overhangs the "forehead". We employed X-ray microtomography to investigate the neurocranium with focus on the supraoccipital bone in a series of specimens from postflexion larva to adult male and female (10-200 mm SL). A slit-like cavity appeared in the SOC in the late postflexion-stage. The SOC can be divided into three parts anteroposteriorly in juveniles and adult females by reference to the cavity. 1. The crest rostrum is the most anterior end of the supraoccipital. 2. The intermediate segment contains a slit-like cavity filled with soft tissue. 3. The crest tail expands posteroventraly. The hook in adult males is derived from this basic configuration by resorption of the crest rostrum and forward growth of the anterior part of the intermediate segment. The cavity within the intermediate segment extends into the hook's protruding termination. This cavity may accommodate vessels nourishing the SOC. By comparison, in apogonid fishes, putative sister group of the Kurtidae, the SOC is a simple laminar structure without any cavity. Based on the above findings, we suggest that the cavity within the SOC is a unique osteological feature and may represent an anatomical pre-adaption for *K. gulliveri* that allowed the peculiar supraoccpital hook to evolve and constitute the osteological basis of forehead brooding parental care.

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**0974 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Dana Bethea[1], John Carlson[1], R. Dean Grubbs[2], Gregg Poulakis[3]

*[1]NOAA Fisheries Southeast Fisheries Science Center Panama City Laboratory, Panama City, FL, USA, [2]Florida State University Coastal and Marine Laboratory, St. Teresa, FL, USA, [3]Florida Fish and Wildlife Conservation Commission Port Charlotte Field Laboratory, Port Charlotte, FL, USA*

## Growth Rates of Smalltooth Sawfish, *Pristis pectinata*, Using Length-frequency and Tag-recapture Data

Predicting the recovery of an endangered species requires a clear understanding of its life history, including species-specific growth rates. To examine the growth rates of smalltooth sawfish, *Pristis pectinata*, we used length-frequency and tag-recapture data of animals collected 2009 to 2015 in southwest Florida USA. Stretched total length (STL) data from 621 captures (64 - 455 cm) and 137 recaptures (69 - 417 cm) were used for analyses. Length-frequency data showed modes at 80 - 85, 155 - 175, and 405 cm STL; however majority of the data were from animals less than 220 cm STL (n=580 captures, 134 recaptures). Animals were collected in all months, with 72% captured March to July. Data were analyzed using the ELEFAN II and PROJMAT methods to fit seasonal and non-seasonal von Bertalanffy growth functions. Growth parameters estimated from length-frequency data were Linf = 501 - 572 cm STL, k = 0.19 - 0.26 year-1, and t0 = -0.93 - -0.70 years, depending on the model used. Growth parameters for tag-recapture data were analyzed using the GROTAG method and were similar to that from length-frequency data (Linf = 424 cm STL, k = 0.23 year-1). This study supports published information for smalltooth sawfish and suggests this species has more rapid growth, especially during the first year, than has previously been reported.

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**0665 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Alannah Biega[1], Dan Greenberg[1], Arne Mooers[1], Owen Jones[2], Tom Martin[3]

*[1]Simon Fraser University, Burnaby, Canada, [2]Max-Planck Odense Center, Odense, Denmark, [3]Operation Wallacea, Lincolnshire, UK*

## Assessing Amphibians held *Ex Situ* for Current and Future Conservation Concern

Ambitious global conservation targets have been set to manage increasing threats to amphibians. Ex-situ institutions are playing an expanding role in meeting these targets. Here, we examine the extent to which zoos house species representing the greatest overall conservation priority by testing how eight variables relating to extinction risk - IUCN status, habitat specialization, obligate stream-breeding, geographic range size, body size, and island, high-altitude and tropical endemism - vary between amphibian species held in zoos and their close relatives not held in zoos. Based on 253 species found in zoos that could be confidently paired with close relatives not in zoos, and in contrast to reported patterns for birds and mammals, we find that amphibians currently

held in zoos are equally as threatened as their close relatives not found in zoos. This is due entirely to the inclusion of data on species holdings from Amphibian Ark, an organization that helps to coordinate conservation activities in many 'non-traditional' institutions. Such networks of small non-traditional zoos are making meaningful contributions to ex-situ conservation, and the establishment of other taxa-specific organisations modelled on Amphibian Ark might be considered. That said, our results indicate that the ex-situ network is still not prioritizing range-restricted habitat specialists, species that possess greater overall extinction risk in the near future. We strongly encourage all zoos to continue increasing their holdings of amphibian species, but to pay greater attention to these species of particular conservation concern.

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**0110 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Jennifer S. Bigman, Nicholas K. Dulvy

*Simon Fraser University, Burnaby, BC, Canada*

**Body size and the speed of life**

Elasmobranchs are among the most threatened groups of marine life and conservation efforts are lacking, likely due to the data-poor nature of this group (Dulvy et al. 2014). Understanding the intrinsic sensitivity to decline for threatened species and predicting the same for data-poor species is needed to prioritize management. As life history traits relate to intrinsic sensitivity to decline, they can be used to understand which species should be prioritized (Dulvy and Reynolds 2003, Hutchings et al. 2012). Many life history traits have been used as correlates of decline sensitivity, with population growth rate having one of the strongest relationships (Dulvy et al. 2004, Hutchings et al. 2012). Unfortunately, estimating population growth rates requires large, detailed demographic data sets resulting from many specimens, time, and funding. As population growth rates are constrained by metabolic function, measuring metabolic rate could be a possible tool for estimating the relative sensitivity to decline of an organism (Hennemann 1983). For elasmobranchs, measuring metabolic rate is often not feasible due to their large size, and some other trait that is easier to measure is needed. Here, we analyze the utility of a morphological trait, gill surface area, as a proxy for relative metabolic rate. Specifically, the relationship of metabolic rate, gill surface area, body size, and temperature will be explored for both elasmobranch and teleost fishes, as there is sparse data existing for elasmobranch metabolic rate and gill surface area. Results of this analysis will be presented along with the implications of this study.

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**0196 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Corinthia Black[2], Peter Berendzen[1]

*[1]University of Northern Iowa, Cedar Falls, IA, USA, [2]Clarke University, Dubuque, IA, USA*

## The Effect of Phylogeny on Morphological Characteristics of the Skeleton in Pleuronectiformes

Pleuronectiformes is a unique order of fishes that display asymmetrical characteristics related to eye migration. Despite sharing characteristics related to sidedness, Pleuronectiformes have a diverse array of body shapes and habitats. The goal of this study was to analyze body shape and habitat type in relation to the most recent phylogeny. Body shape was quantified through geometric morphometric analysis on radiographic images. Radiographs were chosen over photographs to insure ossification of the frontal bone was complete, which indicates the end of eye migration. Thirteen landmarks and 25 semilandmarks outlining the body and spinal column were digitized on 392 specimens, representing 10 families in the order. Shape variation was summarized through principal component analyses. Some families within Pleuronectiformes revealed tight clustering and clear separation within the morphospace, whereas others showed extensive overlapping with other families. Psettodidae, Cynoglossidae, Samaridae, Citharidae, and Achiropsettidae clustered more tightly in the morphospace, implying more conservative body shapes. Pleuronectidae, Scophthalmidae, Soleidae, Bothidae, and Achiridae displayed broad scattering and overlap in the morphospace indicating greater diversity in body shape. Life history traits were mapped onto the morphospace to determine if clustering was based on habitat. Individuals tend to cluster based on fresh, brackish, and marine water environments, suggesting water type may attribute to convergence of body shape.

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**0828 HL GRADUATE RESEARCH AWARD, Galerie 2, Friday 8 July 2016**

Jenell Black[1], Frank V. Paladino[1], Nathan J. Robinson[1], Laurie Mauger[2]

*[1]Indiana University Purdue University Fort Wayne, Fort Wayne, IN, USA, [2]Southern Utah University, Cedar City, UT, USA*

## Size class distribution of the American crocodile (*Crocodylus acutus*) in a mangrove estuary on the Pacific coast of Costa Rica

The purpose of this study was to determine the size-class distribution of American crocodiles (*Crocodylus acutus*) within a mangrove estuary on the Pacific coast of Costa Rica. Furthermore, this study was conducted during the local dry season. It is hypothesized that in periods of drought, a size class arrangement arises along the estuary with smaller crocodiles found in areas of lowest salinity. To obtain baseline data on water chemistry, salinity measurements were obtained every 200m along the length of the Tamarindo estuary using a YSI Model 30. The estuary was toured opportunistically with a local guided tour, or monthly via canoe. The GPS location,

salinity, temperature, and estimated size class was recorded for every crocodile encountered. Total length determined size class categories; hatchlings are classified under 0.5m, juveniles 0.5m – 1.25m, subadults 1.25m – 2.25m, and adults above 2.25m. The results of this study show that during the dry season juveniles occupy the areas of the estuary that are further from the mouth, while adults occupy the mouth of the estuary. The highest salinity recorded was 36 ppt, in the furthest accessible reaches of the estuary. Hatchlings observed during the spring of the 2015-2016 wet season were not found during the dry season, possibly due to strong El Niño effects which induced a harsh drought locally. It is possible that larger crocodiles outcompete their smaller counterparts for the lower salinity areas of the estuary. This area is also proximal to the ocean, which adult crocodiles use often to travel.

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## 0235 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Jenell Black[1], Frank Paladino[1], Nathan Robinson[1], Pilar Santidrian Tomillo[2], Elizabeth Vélez[3]

*[1]Indiana University Purdue University Fort Wayne, Fort Wayne, IN, USA, [2]Mediterranean Institute for Advanced Studies, Illes Balears, Spain, [3]Kelonian Conservation Society, Heredia, Costa Rica*

### Efficacy of drones for studying habitat use of American crocodiles (*Crocodylus acutus*)

The purpose of this study was to determine the efficacy of using Unmanned Aerial Vehicles (hereafter called drones), for studying habitat use of American crocodiles (*Crocodylus acutus*). Drones are less expensive than conventional visual surveys conducted by boat or helicopter and do not require the same manpower or time. All drone flights were performed within a 24-hour period of a diurnal boat survey and nocturnal boat survey. Video was recorded continuously in linear sections along a mangrove-lined estuary, to prevent loss from the remote control (RC). This type of drone allows researchers to better visualize submerged crocodiles, and has similar efficacy to diurnal surveys in the open water. This method also allows researchers to explore habitats that are inaccessible by boat, and facilitates the discovery of hard to find nests. Surveys performed by drones allow for a larger number of submerged crocodiles to be seen, while a diminished number of basking crocodiles in the vegetation are seen. Surveys done by drone also have no effect on crocodiles in their habitat, and allow for a more unobtrusive study of the animal. Limitations of this equipment are habitat, such as estuaries lined with red mangrove species where crocodiles can bask. Weather is a strong limiter of drones, where drones cannot be flown in excessive wind speeds. The limited range of the drone from the remote control does not allow for a continuous sweeping of the estuary, but with time and rapid innovations, this should be a negligible factor.

**0425 General Ichthyology II, Balconies J & K, Sunday 10 July 2016**

Devin Bloom[1], Haley Ohms[2]

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## On the Origins of Diadromy: A Conceptual and Empirical Evaluation of the Productivity Hypothesis

Diadromous fishes migrate between oceans and rivers at predictable life stages for feeding and reproduction. Diadromous fishes include iconic species such as salmon, eels, shad, lamprey and sturgeon, yet explanations for the evolutionary origins of diadromy remain elusive. Two of the major modes of diadromy, catadromy and anadromy, have mirror opposite migratory loops. Catadromous species feed in freshwater and reproduce in oceans, while anadromous fishes feed in oceans and reproduce in freshwater. The opposing directionality of diadromous migration patterns remains enigmatic. The productivity hypothesis is the most widely accepted explanation for the evolution of diadromy, which suggests that individuals capitalize on productivity gains by feeding in oceans in temperate regions and freshwaters in tropical regions. Alternatively, the safe-site hypothesis suggests diadromy evolved in response to differences in predation pressure across marine and freshwater environments. Here we evaluate empirical evidence for these hypotheses in several groups of fishes, including shad, herring, anchovies, salmonids, eels, tetraponids, and lamprey. We find little biogeographic and phylogenetic evidence supporting the productivity hypothesis. In light of our data, we reconsider the conceptual basis for these hypotheses and suggest the premise for the productivity hypothesis ignores phylogenetic history. We propose integrating phylogenetic history, comparative methods and mathematical modeling offer fruitful pathways to understanding the evolutionary mechanisms that explain the origins of diadromy.

**0790 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Tara Boag[1], Angela Cicia[1], William Driggers III[2], David Kulka[3], Mark Simpson[3], Carolyn Miri[3], David Koester[1], James Sulikowski[1]

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## Utilizing histologically processed vertebrae to estimate age and size at sexual maturity of black dogfish (*Centroscyllium fabricii*) from the western north Atlantic

Aging deepwater elasmobranchs is challenging not only because they are difficult to capture, but also reduced calcification rates make discerning vertebral banding patterns problematic. As such, there is a need to modify traditional aging methodologies in order to help distinguish vertebral banding patterns in this group of fish. Previous work in skates suggests histological processing of vertebral cross-sections may help elucidate banding patterns in species that possess less-calcified skeletons. Building off this premise, the objective of this study was to modify and apply this technique to estimate age and size at sexual maturity of the black dogfish (males=266; females=211), a small, deepwater shark that is commonly caught as bycatch in Canadian trawl fishery. Maturity ogives suggest that 50% maturity in females occur at 6 years and 561mm total length (TL), whereas 50% maturity in males occurs at a younger age of 5.3 years and smaller size of 460mm TL. Age estimates were made from a subsample 186 dogfish (males=94; females=92) ranging in size from 170-720mm TL. The index of average percent error and age-bias plot indicate that the ageing method was precise and non-biases. Additionally, marginal increment analysis, although incomplete, suggests seasonal growth and band disposition potentially occurs in winter or early spring. In conclusion, the present study indicates black dogfish exhibit characteristics that make other elasmobranchs population highly susceptible to overexploitation. Furthermore, our results suggest histological processing of vertebrae may be a useful technique in elucidating annual banding patterns, not only in black dogfish but other deepwater elasmobranchs.

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**1059 Amphibian Reproduction & Herp Conservation, Galerie 3, Saturday 9 July 2016**

Scott Boback[1], Robert Reed[2], Alberto Puente-Rolón[3], Graham Reynolds[4]

*[1]Dickinson College, Carlisle, PA, USA, [2]United States Geological Society, Fort Collins, CO, USA, [3]Inter American University of Puerto Rico, Puerto Rico, USA, [4]Harvard University, Cambridge, MA, USA*

## Body size, reproduction, and diet characteristics of an expanding population of exotic boa constrictors (*Boa constrictor*) in Puerto Rico, U.S.A.

A population of exotic boa constrictors (*Boa constrictor constrictor*) is present and expanding in western Puerto Rico, U.S.A. Previous work reported that boas collected from the Mayaguez region shared a haplotype corresponding to a northern South American clade of Boa constrictor, suggesting a single introduction. In this study we examined the morphology and diet of 371 exotic boas collected from the vicinity of Mayagüez and compared these data to other island populations. The introduced population of boas was sexually dimorphic in size with females being larger than males ($T_{SVL}$= 6.81, $P$ <0.0001; $T_{mass}$ = 5.17, $P$ <0.0001). Males averaged 1476 mm in length and 2920 g in mass whereas females averaged 1653 mm in length and 4183 g in mass. Remarkably, greater than 70% of necropsied individuals contained prey remains (72.5% of 200 females, 70.7% of 171 males) and the proportion with prey did not differ between sexes (chi-square = 0.07; $P$ = 0.79; df = 1, $n$ = 371). Boas in Puerto Rico consumed a variety of native and exotic vertebrate prey, especially rodents. Diet of exotic boas overlaps with that of the endangered Puerto Rican boa however direct evidence of the impact of this non-native boa on the Puerto Rican boa is not yet available. Given a lack of proven control tools to prevent spread of the population, it is probable that introduced boa constrictors could spread across most or all of Puerto Rico, thereby increasing the likelihood of accidental or intentional establishment elsewhere in the Caribbean.

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**1009 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Juan D. Bogotá Gregory[1], Flávio T. Lima[2], Sandra B. Correa[3], Joseph C. Waddell[1], William G.R. Crampton[1]

*[1]University of Central Florida, Orlando, Florida, USA, [2]Universidade Estadual de Campinas, São Paulo, Brazil, [3]University of South Carolina, South Carolina, USA*

## Diversity of Amazon river-floodplain fish communities: a comparison of whitewater, blackwater, and clearwater systems

We compared community diversity of riverine and floodplain fishes between whitewater systems (rio Amazonas), blackwater systems (rio Arapiuns) and clearwater systems (rio Tapajós) in the vicinity of Santarém, Pará, Brazil. Collections were

performed bimonthly over one year at two river-margin sites and two floodplain lake sites for each of the three water types. Fish were captured using beach seines (30 m x 3 m, 7 mm mesh) and gill net batteries (four 25 m x 3 m of 15 mm, 30 mm, 50 mm and 60 mm mesh). 23,335 fish representing 345 species were collected. The pooled species abundance matrix was subjected to a non-metric multidimensional scaling (NMDS) analysis. NMDS data were plotted according to two different treatments: the first corresponding to water type (white, clear, black), and the second to habitat category (river margin or floodplain lake). An Analysis of Similarity (ANOSIM) was performed to test for significance of differences observed among treatments. We documented a clear differentiation of fish communities between all three water types, but blackwater and clearwater systems were the most similar. We also documented consistent differentiation of floodplain lake and river margin communities, across all water types. Our study is the first to perform a quantitative comparison of the community diversity of all three of the Amazon's major water types within a single biogeographical region.

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**0823 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday 7 July 2016**

Jason R. Bohenek, William J. Resetarits Jr.

*The University of Mississippi, Oxford, MS, USA*

### Density-dependent polyphenisms are mediated by chemical cues in *Notophthalmus viridescens louisianensis*

Polyphenisms are life-history strategies where multiple, environmentally-cued phenotypes can arise from a single genotype. Facultative paedomorphosis is a polyphenism exhibited by many salamanders whereby individuals delay metamorphosis and reproduce in an aquatic form. It is a density-dependent response in that metamorphic phenotypes are elicited in high larval densities and paedomorphic phenotypes occur under low larval densities. Our study with *Notophthalmus viridescens louisianensis* investigated the cues involved in the density-dependent response to understand how larval salamanders assess conspecific density in their environments. We utilized a 2 × 2 factorial mesocosm design in which subsets of larval salamanders were caged, and we independently manipulated both background densities (high or low) and food levels (ambient or supplemented). In treatments with supplemented food, caged larvae in high density environments grew rapidly, but forewent additional growth in order to metamorphose early whereas caged larvae in low density environments took advantage of those growth opportunities. Larvae in low density environments had much longer larval periods and higher masses at metamorphosis. High density treatments produced a higher proportion of efts than low density treatments. Though food levels played a role in the rate of the response, overall metamorphic timing and phenotype appear to be primarily influenced by density. Since our design utilized caged individuals, our study shows that larval salamanders likely utilize chemical cues in assessment of aquatic habitat conditions in order to inform metamorphic trajectories, timing and phenotypes.

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**1052 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

Sarah Bolton[1], Kelsie Dickerson[2], Ralph Saporito[1]

*[1]John Carroll University, University Heights, OH, USA, [2]University of California, Berkeley, Berkeley, CA, USA*

### Variation in Alkaloid Defenses of the Dendrobatid Poison Frog *Oophaga pumilio* Lead to Differences in Avoidance by the Neotropical Ant *Ectatomma ruidum*

Conspicuously colored dendrobatid frogs sequester alkaloid-based defenses from dietary arthropods, resulting in considerable alkaloid variation among populations. Although alkaloids act as a defense against predation, relatively little is known about how alkaloid variation is perceived and functions as a defense against predators. Previous studies have found the dendrobatid frog *Oophaga pumilio* to have particularly variable alkaloids throughout its geographic range, and that differences in these alkaloids are related to differences in toxicity to laboratory mice. Although toxicity is one measure of alkaloid variation, predator avoidance of dendrobatids might simply be due to the bitter or unpalatable nature of alkaloid defenses. Arthropods are natural predators that use primarily chemoreception to detect prey such as frogs, and may therefore perceive different alkaloid profiles as differences in palatability. Herein, we report the results of a study aimed at understanding how ants respond to variation in alkaloid defenses of *O. pumilio*. We sampled alkaloids from individual frogs from five geographic locations throughout Costa Rica. These alkaloids were then used in feeding bioassays with the omnivorous ant *Ectatomma ruidum* to investigate how an arthropod responds to different suites of frog alkaloids. Our results demonstrate that *E. ruidum* feed less on frog alkaloid solutions when compared to controls, and that variation in alkaloid profiles among populations result in differences in palatability. The current study contributes to our understanding of how variable alkaloid-based chemical defenses in dendrobatid frogs are perceived by ants, and provides insight into how arthropod predators may respond to variable defenses in nature.

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**1050 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Sarah Bolton, Ralph Saporito

*John Carroll University, University Heights, Ohio, USA*

### Dietary Alkaloid Uptake and Modification of Pumiliotoxin 251D in Dendrobatid Poison Frogs

Poison frogs have alkaloid-based chemical defenses that are aimed at deterring pathogenic microbes and natural predators. Unlike most defended organisms that synthesize defensive chemicals, poison frogs sequester their defenses from a diet largely

consisting of mites and ants. In most cases, alkaloids appear to be sequestered from dietary arthropods unmodified; however, certain dendrobatids in the genera *Dendrobates* and *Adelphobates* can stereoselectively hydroxylate the dietary pumiliotoxin (+)-**251D** to allopumiliotoxin (+)-**267A**, whereas members of *Phyllobates* and *Epipedobates* do not modify this pumiliotoxin. Although the biological function of this modification is not understood, allopumiliotoxin (+)-**267A** is approximately five times more toxic to laboratory mice than pumiliotoxin (+)-**251D**, suggesting the possibility that hydroxylation increases the effectiveness of this alkaloid as a defense. The ability to hydroxylate pumiliotoxin (+)-**251D** has not been examined in all lineages of dendrobatids that sequester alkaloids, and therefore the phylogenetic distribution of this character is not well resolved. Members of the genus *Ranitomeya* represent one lineage of dendrobatids that has not been examined for its ability to hydroxylate pumiliotoxin (+)-**251D**. Herein, we will report the findings of an alkaloid feeding experiment to determine whether or not *Ranitomeya ventrimaculata* possess the ability to uptake and modify dietary pumiliotoxin (+)-**251D** to allopumiliotoxin (+)-**267A**. Furthermore, we will compare this dietary uptake and potential modification of pumiliotoxin (+)-**251D** with that of *Dendrobates auratus*, a dendrobatid known to efficiently uptake and hydroxylate pumiliotoxin (+)-**251D**. The findings of this study will provide important insight into the evolution of alkaloid sequestration and modification in dendrobatid poison frogs.

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**0047 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Ramón Bonfil[1], Melina Ricaño-Soriano[1], Oscar Uriel Mendoza-Vargas[2], Nataly Bolaño-Martínez[3], Paola Yanira Palacios-Barreto[3]

*[1]Océanos Vivientes AC, Mexico DF, Mexico, [2]Posgrado en Ciencias Biologicas, UNAM, Mexico DF, Mexico, [3]Posgrado en Ciencias del Mar y Limnología, UNAM, Mexico DF, Mexico*

## Gone right under our noses? - Conservation Status of 'El Tiburón Sierra' (*Pristis* ssp.) in México

Occurrence and abundance information of Critically Endangered smalltooth (*Pristis pectinata*) and largetooth (*P. pristis*) sawfishes across most of their former range is sorely needed for a comprehensive global conservation status assessment. The current presence of both species in Mexico and Latin America remains largely uncertain due to a void of reliable information based on focused studies. During August-November 2015, we performed the first-ever nation-wide study of sawfishes in Mexico. We developed specific materials to survey fishers, raise community awareness, and publicize sawfish conservation needs. We interviewed over 800 fishermen in 71 coastal towns along the entire Mexican coast of the Gulf of Mexico/Caribbean, and from the mouth of the Gulf of California to the southernmost State. Results indicate that both sawfish species are nearly extirpated from Mexico, but not quite so. Interviewees reported mean decadal dates of last sighting, as the 1980s for *P. pectinata* and *P. pristis* in the Gulf of Mexico/Caribbean coast, and as the 1970s for *P. pristis* in the Pacific coast. No confirmed reports of recent (<5 years) presence of either species were obtained during the survey

anywhere in Mexico. However, a live juvenile smalltooth sawfish was caught and kept alive in the state of Veracruz just last January. Results also include the first historical relative abundance maps, records of former directed fisheries, former utilization, and main threats, among others. Both species must be re-categorized in conservation status in Mexican legislation. Our approach should be replicated along Central American countries and other parts of the world.

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**0250 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Sophia Bonjour[1], Matt Whiles[2], Keith Gido[3]

*[1]Southern Illinois University, Carbondale, IL, USA, [2]Southern Illinois University, Carbondale, IL, USA, [3]Kansas State University, Manhattan, KS, USA*

**Influences of Fishes on Insect Colonization of Prairie Stream Pools**

Physical factors, such as hydrologic variability, are major structuring forces of prairie stream communities. Macroinvertebrate and algae densities can both decrease sharply in response to floods and drying events. Less is known about the influences of biological factors such as fishes, and potential interactions between hydrology and fishes. We examined macroinvertebrate and algal colonization across varying densities of fishes in prairie stream pool mesocosms at the Konza Prairie Biological Station in northeastern Kansas. Mesocosms were stocked with low (7.1±0.4 g/m$^2$) or high (18.1±0.6 g/m$^2$) densities of a combination of three common prairie fishes: southern redbelly dace (*Chrosomus erythrogaster*), central stoneroller (*Campostoma anomalum*), and orangethroat darter (*Etheostoma spectabile*). Six additional pools contained no fishes. During the six-week experiment, each pool was sampled three times for macroinvertebrates and twice for chlorophyll-a. Fish presence significantly reduced abundance of colonizing insects ($p<0.001$) and total invertebrate biomass ($p=0.001$). Insect communities differed with treatment and were characterized by more Chironomidae, Culicidae, and Corduliidae in fishless pools ($p<0.001$ for all). Chlorophyll-a increased between sampling dates but did not differ among treatments. Results suggest fishes can influence colonization and community structure in prairie stream pools, which serve as important refugia during hydrologic disturbance.

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**0471 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Michelle Boone, Samantha Rumschlag, Melissa Youngquist

*Miami University, Oxford, OH, USA*

### Evaluating the Impact of Land Use on Amphibian Presence in Human-Dominated Systems: Does Increasing Cultivation Reduce Amphibian Presence on the Landscape?

Changes in land use that result in habitat conversion and degradation can alter the abiotic environment and the biotic interactions within the community, which determines the composition of a local community. The objectives of our study were to examine if percent cultivation or other land cover (including forest, open [non-cultivated] canopy, and development) surrounding ponds influenced the likelihood of presence of four summer breeding anurans (cricket frogs [*Acris blanchardi*], gray treefrogs [*Hyla chrysoscelis/versicolor*], bullfrogs [*Lithobates catesbeianus*], and green frogs [*Lithobates clamitans*]). We examined the relative importance of upwind land use (aerial deposition hypothesis) and land use in a circular buffer (runoff hypothesis), as well as the importance of land use and pesticide use in the county, in predicting amphibian presence or absence at a pond. Our central prediction was that increasing cultivation and associate pesticide use would reduce the likelihood of amphibian presence, while increasing amounts of uncultivated habitat (including forest and open canopy habitats) would be positively associated with amphibian presence. To test this prediction, we used data from a field call survey conducted at 191 randomly selected ponds across three north-south transects and one west-east transect in western Ohio, and examined the relationship between these variables and land use from National Land Cover Data. Our results partially support these predictions, suggesting that cultivation (at the county-level) can reduce the likelihood of presence for some amphibians and that forests-the native habitat of most of Ohio-increased amphibian species diversity of summer breeding amphibians on the landscape.

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**0513 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Timothy Borgardt

*Southeastern Louisiana University, Hammond, Louisiana, USA*

### Habitat Preference, Movement Patterns, and Behavior of the Timber Rattlesnake (*Crotalus horridus*) in southeastern Louisiana

*Crotalus horridus* has one of the largest distributions of any of the North American rattlesnakes. It is considered vulnerable, imperiled, or critically imperiled in 20 of the 30 states that it occurs in, mostly because of anthropogenic factors. The movement patterns and foraging behaviors of this species have been extensively studied throughout much of its northern range. It has been shown that sex, reproductive status, temperature, prey

availability, and habitat type all influence snake behavior. Understanding the behavior of the Timber Rattlesnake and how these factors affect it can have a large impact on the conservation of the species. Utilizing the knowledge gained from research like this can shed light on what the best management strategies might be. Since there has been no prior research of this kind on *C. horridus* in Louisiana, this study will be important in understanding a species whose habitat is becoming more fragmented due to urbanization. Using radio telemetry, this study will attempt to compare the movement patterns, habitat usage, body temperature, and foraging behaviors of a population of *C. horridus* in Orleans Parish, a relic bottomland hardwood habitat, to that of populations in the northern part of its range. It will also determine if movement patterns, body temperatures, and foraging behaviors differ between sexes and reproductive condition, and if habitat usage changes across behaviorally-based seasons (foraging, breeding, hibernation).

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**0893 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Sarah C Bornhoeft, Joel C Trexler

*Florida International University, Miami, FL, USA*

## Influence of an Experimental Sheet Flow Regime on Aquatic Food Webs of the Central Everglades

Restoration of the Florida Everglades seeks to re-create historical quality, quantity, timing, and flow of water, which may influence energy flow and food web function. We hypothesized that fatty acids (FA) can be used as dietary tracers to document how changes in environmental conditions alter the relative detrital and autotrophic contribution of energy to select primary and secondary aquatic consumers and that water flow velocity can indirectly impact the origins of organic matter by nutrient loading to biofilms, changing their quality as food (stoichiometry, species composition, and edibility), and cascading up to consumers through dietary impacts on body condition. We tested our hypothesis in a field experiment in an Everglades marsh with the introduction of flowing water in November, 2014. In the laboratory, FAs were reflective of changing diets in common Everglades consumers, the sailfin molly (*Poecilia latipinna*), eastern mosquitofish (*Gambusia holbrooki*), and riverine grass shrimp (*Palaemonetes paludosus*) in less than 3 weeks, making FAs a sensitive dietary tracer, especially for higher quality diets. In the field study, periphyton and biofilm taxonomic composition were different for pre-flow and flow sampling, most marked by increases in the nutrient exploiting *Mougeotia* sp. (green algae) during flow sampling. Dietary tracer FAs changed in consumers, which reflected the changes in the basal resources, including an increase in green algae and a decrease in bacteria derived FAs. These food web responses indicate that elevated water flow velocity shifts the food web from a more detrital (brown) to more algal (green) dominated web.

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**0520 HL GRADUATE RESEARCH AWARD, Galerie 2, Friday 8 July 2016**

Nassima M. Bouzid[1], James W. Archie[2], Roger A. Anderson[3], Jared A. Grummer[1], Joshua G. Schraiber[4], Adam D. Leaché[1]

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## Inferring demographic history and adaptive potential of *Sceloporus occidentalis* using genome-wide SNP data

The tight linkage between environment and organismal fitness in ectotherms suggests that demographic processes have been most proximately impacted by past climate change. Effective population sizes ($N_e$) of species with environmentally heterogeneous ranges, like the western fence lizard (*Sceloporus occidentalis*), provide an estimate of adaptive potential because selection is more effective in populations with larger Ne. We use double digest restriction associated DNA sequencing (ddRADseq) to collect single nucleotide polymorphism (SNP) data for 100+ individuals from across the range. We infer population structure, measure standing genetic diversity, and elucidate demographic history. SNP-based ancestry analyses support four major populations: (1) a clade along the west coast north of the San Francisco Bay Area in Washington, Oregon, and California; (2) a clade in the Great Basin (western Oregon, Nevada, Idaho); (3) a paraphyletic group in southern California; and (4) a paraphyletic group in central California bounded by the remaining three populations. Allele frequency-based methods indicate high diversity in the Central population due to ongoing gene flow between adjacent populations. Great Basin and Coastal populations have recently expanded, putatively as a result of increased ecological opportunity following Quaternary climate change. The Southern population has the smallest $N_e$, potentially due to a recent bottleneck. Regions occupied by the Central and Southern populations are projected to experience the most climate change in the immediate future, however, differences in standing genetic variation, and hence adaptive potential, suggest that the Central population will be capable of adaptation, while the Southern population will be at risk of extinction.

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**1023 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Luke Bower, Kirk Winemiller

*Texas A&M University, College Station, TX, USA*

### Global Patterns of Fish Functional Diversity and Trait Convergence along Species Richness and Environmental Gradients

Community assembly processes (CAP), such as environmental filtering, limiting similarity, and neutral processes, explain species coexistence and community composition. Environmental filtering posits that environmental conditions allow species with certain traits to establish and persist, causing species traits to cluster. Alternatively, limiting similarity is the idea that species with similar traits will competitively exclude each other, producing an assemblage with an overdispersion of traits. Trait dispersion patterns are used to determine the importance of these scale-dependent, niche-based processes in structuring assemblages relative to neutral processes. A major challenge for ecology is to understand how assemblages are functionally structured and how CAP, at varying spatial scales, influence biodiversity patterns. This project has three aims that address these issues: (1) examine knowledge gaps regarding functional diversity of fish assemblages at a global scale; (2) determine relative contribution of limiting similarity and environmental filtering to neutral processes at three scales; and (3) assess changes in functional diversity and CAP across environment and species richness gradients.
To address these aims, fish assemblages will be sampled in 40 wadeable streams in five different zoogeographic regions of varying species richness. Traits with well-known relationships to trophic ecology, habitat use, and life history will be measured for each assemblage. The relative contribution of CAP will be tested at three spatial scales using functional trait dispersion. Functional diversity indices will be compared across gradients of stream size and species richness. Lastly, patterns of CAP in different zoogeographic systems will be analyzed using multivariate statistical methods.

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**0531 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday 7 July 2016**

Beth Bowers, Stephen Kajiura

*Florida Atlantic University, Boca Raton, FL, USA*

### Migratory Behavior of the Blacktip Shark, *Carcharhinus limbatus*

The migratory behavior of the blacktip shark, *Carcharhinus limbatus,* in the Western Atlantic has been anecdotally described but not empirically studied. The sharks are thought to migrate from nursery areas along the southeastern coast of the United States in the summer, to South Florida, where they overwinter in large aggregations (up to 800 sharks $km^{-2}$) from January to April before returning northward. The first recorded description of the blacktip shark migration states that they occur north of Cape Hatteras, NC "only as a rare stray." Given that this description was published over 70 years ago,

their range might have shifted poleward in response to warming ocean temperatures, as has been demonstrated in many other marine species. To investigate the current migratory pattern of this population, 26 blacktip sharks were instrumented with acoustic transmitters, while they overwintered in South Florida, and passively tracked along the eastern seaboard in cooperation with the Florida Atlantic Coast Telemetry (FACT) and the Atlantic Cooperative Telemetry (ACT) networks. 18 of the 26 individuals (69%) were detected after instrumentation. Three of those 18 individuals (17%) were detected far north of the previously reported NC limit, off Delaware Bay, NJ (1) and Long Island, NY (2). Nine individuals (50%) were detected at the original capture location in South Florida the following season, including two sharks that were detected in Delaware Bay and Long Island. This study provides the first empirical evidence of blacktip sharks completing a full migration cycle and suggests that their northern limit has expanded poleward.

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**0284 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

David Boyd, Lawrence Page

*Florida Museum of Natural History, Gainesville, FL, USA*

### Systematics of Horseface Loaches *Acantopsis* (Teleostei: Cobitidae) with Descriptions of Three New Species

Horseface loaches of the genus *Acantopsis* (Cobitidae) are distributed in freshwaters from India east to Laos and Vietnam, and south to Borneo and Java. They show considerable morphological variation in color pattern, development of labial barbels, and body shape but have received surprisingly little attention by systematists and only six scientific names are available. Fisheries biologists estimate that as many as six species occur in the Lower Mekong Basin alone, yet preliminary data suggest none of the described species are known from its waters. The poor condition of types and the scarcity of other specimens of recognized species in institutional collections have impeded comparative morphological study in recent decades. This hindrance to systematic work, in turn, continues to stall conservation efforts toward and ecological understanding of these economically important fishes. We review the taxonomic history of *Acantopsis*; clarify the recognized species, their diagnoses and geographic ranges; and describe three new species based on morphological and phylogenetic evidence. Morphological study is focused on mouth and body structure with comments on superficial pigmentation patterning. Mitochondrial (COI) and nuclear (RAG1) phylogenetic analysis supports new and previously recognized species boundaries and evolutionary relationships to inform future research on *Acantopsis* biodiversity.

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**1070 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Braimah Boyd-Lecky, Monet Brown, Matthew Julius

*St. Cloud State University, St. Cloud, MN, USA*

**Are Wood Eating Catfish a Myth?**

The armored, wood-eating *Panaque maccus* is a member of the Loricarridae family of catfish. Some believe that their disc-shaped mouths and horizontal teeth they are able to grasp onto wood surfaces and feed solely for fiber. A series of experiments were conducted to test this hypothesis. Whole DNA was extracted and amplified from the stomachs of museum preserved specimens, in an attempt to detect Embryophyte (land plant) species. Additionally feeding trials were conducted to assess the scraping ability and food preferences of the fish. Biomechanic models for optimal feeding strategies were also developed using high speed video acquired during feeding experiments. Each of these experiments refuted the idea that *P. maccus* has a diet sustained by wood.

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**0632 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Sean Boyle, Chantal Barriault, Jacqueline Litzgus, David Lesbarreres

*Laurentian University, Sudbury, Ontario, Canada*

**The Quantifiable Value of Outreach to Herpetofaunal Conservation**

Citizen science has proven its ability to produce enormous data sets that can guide policy and conservation. Outreach programs are often considered valuable tools for attracting citizen scientists, but also for engaging a general interest in conservation. A mixed-methods approach was used to evaluate the success of outreach programs to youths and to identify specific cues that elicited positive responses from participants. Grade nine students (n = 175) were asked to self-evaluate their likelihood of participating in conservation directly (i.e. helping a turtle across the road) and indirectly (i.e. participation in herp citizen science programs) before and after outreach presentations. Next, for students that admitted to a change in behaviour as a result of outreach, we asked if there was a certain part of the presentation which most affected their decision to change their self-evaluation. Outreach was successful as students were significantly more likely to consider contributing directly and indirectly to herpetofauna conservation after, than before the program. Students identified specific cues that influenced their willingness to participate in conservation activities and these cues were grouped into core themes. Integration of these core themes and specific cues into future outreach presentations optimize outreach effectiveness. Effective outreach plays a vital role in engagement and advocacy for conservation action. This is particularly significant because the perceived importance of conservation action plays a critical role in the creation and execution of conservation policy.

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**0637 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT**

Sean Boyle[1], Chad Chordes[2], Jacqueline Litzgus[1], David Lesbarreres[1]

*[1]Laurentian University, Sudbury, Ontario, Canada, [2]Ontario MNRF, Peterborough, Ontario, Canada*

### Now Where Can I Put This? Comparing Two Methods of Identifying Ideal Locations for Road-Effect Mitigation

Road mortality is globally recognized as a significant driver of local and broad landscape scale extinctions of herpetofauna. Systems of mitigating road mortality for herpetofauna have varied greatly with regards to approach, scale, and design. This lack of consistency can hinder conservation of species at risk, as well as the progress of road ecology in general. We propose that in order to advance our ability to mitigate successfully, projects require comprehensive mitigation strategies that incorporate several layers of baseline data. Using two methods of identifying road mortality hotspots, we demonstrate that relying on limited data can prevent effective application of mitigation infrastructure. Using daily road surveys, we pinpointed road mortality hotspots via comparison of the spatial distribution of road survey data points to a random distribution. Additionally, we identified road mortality hotspots using Circuitscape, a program that simulates animal movement through a landscape using aerial imagery and expert knowledge of animal habitat use. Road survey hotspots can be determined on a species-specific basis, while maintaining precision; their accuracy, however, relies on rigorous data collection. Circuitscape analysis requires little data collection; however, although the results are useful as preliminary guidance or in situations where no baseline data are available, they lack precision compared to standardized road surveys. Our study provides a critical examination of tools available to wildlife managers responsible for planning road mortality mitigation projects. Further, we demonstrate that when used in conjunction, road surveys and Circuitscape provide complementary results that aid in the optimization of mitigation effectiveness.

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**0454 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: EVOLUTION, GENETICS, & SYSTEMATICS**

Danielle Bradke, Joseph Altobelli, Susan Munster, Amy Russell, Jennifer Moore

*Grand Valley State University, Allendale, Michigan, USA*

### Are Standard Genetic Tests Effective for Detecting Bottlenecks in Long-Lived Reptiles? A Case Study of Tuatara and Eastern Massasauga Rattlesnakes

Population bottlenecks can cause severe declines in genetic diversity and may lead to inbreeding depression. However, some studies have provided evidence that long lifespans can buffer the negative genetic effects typically imposed by bottlenecks. Others

have cautioned that longevity might merely mask the effects of genetic drift, which will still affect long-term population viability. We used microsatellite data from tuatara (*Sphenodon punctatus*) and eastern massasaugas (*Sistrurus catenatus*) to analyze the effects of longevity on bottleneck detection and to determine whether commonly used tests can detect known population bottlenecks in these organisms. We simulated bottlenecks of varying severity based on actual allele frequencies from one population of each species. Then we evaluated whether the simulated bottlenecks could be identified by M-ratio, heterozygosity excess, and mode-shift tests. Our results question the ability of these tests to reliably detect bottlenecks for moderate- to long-lived species, even when a substantial loss in genetic diversity has occurred. Therefore, commonly employed genetic bottleneck detection methods may be ineffective for long-lived species of conservation concern, like many reptiles.

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**0214 Fish Behavior & Development, Salon A-C, Sunday 10 July 2016**

Darcy Bradley[1], Yannis P. Papastamatiou[2], Steven D. Gaines[1], Jennifer E. Caselle[1]

*[1]University of California, Santa Barbara, Santa Barbara, CA, USA, [2]Florida International University, North Miami, FL, USA*

**Do SCUBA divers affect the long-term spatial behavior of reef sharks?**

Humans play a significant predatory role in terrestrial and marine ecosystems and anthropogenic fear effects have been recorded in a suite of systems across the globe. An open question is whether the mere presence of SCUBA divers can have long-term effects on animal behavior in the marine environment. Using baited remote underwater video surveys (BRUVs), we examined the spatial distribution and abundance of reef sharks at heavily dived and undived sites at Palmyra atoll, a U.S. Wildlife Refuge that has a ban on extractive fishing. In recent years, researchers have reported seeing fewer and fewer reef sharks at Palmyra, and data from multiple SCUBA surveys resulted in contradictory trends in reported shark population abundance through time. However, a capture-recapture population study revealed that Palmyra's reef shark population is stable. Failing to account for behavioral effects in monitoring studies may be problematic as in most places it is impossible to differentiate changes in estimated population abundance due to behavioral modifications and those resulting from fishing. In Palmyra, we can isolate and quantify the behavioral response of reef sharks to human activities in the absence of fishing. We hypothesized that sharks may be actively avoiding sites with substantial human activity. However, contrary to our prediction, we found no evidence that SCUBA divers affect the long-term spatial distribution of reef sharks at Palmyra. Therefore, the observation that sharks appear to be declining may be the result of habituation to human presence or short-term avoidance behavior.

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**0562 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Emily Bradley, Jim Gelsleichter

*University of North Florida, Jacksonville, Florida, USA*

### Variations in thyroid activity in Atlantic stingrays (*Dasyatis sabina)* with respect to reproductive cycle

Thyroid activity variations have been observed over many taxa. Previous studies have shown that thyroid activity can vary with respect to the reproductive cycle. However, very little published research to date has been focused thyroid activity and reproduction in elasmobranchs. Therefore, the purpose of this study was to examine the relationship between thyroid activity and reproduction in the Atlantic stingray, *Dasyatis sabina,* an animal for which reproductive biology has been well characterized. To address this goal, the histomorphology of the thyroid gland in both males and female *Dasyatis sabina* was examined. One measurement of thyroid activity, the height of epithelial cells (EH), displayed seasonal variations in both males and females. In males, EH was greatest in winter (Jan). During this time, after sperm storage has occurred, testes begin to regress and mating begins. In females, EH increased from early to late spring (Mar-May), the time of ovulation and early gestation. Female EH declined in June when yolk dependent embryos were present. These data were consistent with previous studies on females of the same species and with other vertebrates. This suggests a potential role for thyroid hormones during early gestation. The data for male stingrays is one of the first examinations of thyroid activity in relation to reproduction in male elasmobranchs. Other indicators of thyroid activity such as follicle diameter and histochemistry are discussed.

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**0273 HL, ASIH, SSAR: Eco-Evolutionary Dynamics Symposium, Salon D, Friday 8 July 2016**

Steven Brady

*Dartmouth College, Hanover, NH, USA*

### Adaptation and Maladaptation in Roadside Amphibians

The global road network is said to be the largest human artifact on the planet and is projected to increase 60% in length by 2050. The suite of negative ecological effects exerted by roads is far-reaching, influencing 20% of the landscape. Roadkill, contamination from runoff, and fragmentation effects all challenge the success of populations in road-adjacent habits. Though seldom considered, these forces can also act as agents of natural selection, driving evolutionary change. Based on a series of field transplant and laboratory exposure experiments, I report on the adaptive and maladaptive outcomes in populations of two species of amphibians: the spotted salamander (*Ambystoma maculatum*) and the wood frog (*Rana sylvatica*). Whereas the former shows evidence for local adaptation to road-adjacency, evidence for the latter is mixed. Embryonic and larval stage wood frogs consistently perform maladaptively.

Compared to populations located away from roads, roadside populations maintain relative survival disadvantages, decreased growth and developmental rates, and increased frequency of malformations. In contrast to these results from aquatic life history stages, terrestrial stage adults show evidence for adaptation. This includes longer leg length and increased locomotor performance as well as increased fecundity. These results suggest that maladaptation patterns detected in aquatic life history stages may be linked to adaptive outcomes in terrestrial stages, potentially representing a suite of tradeoff. That these outcomes differ dramatically between two amphibian species—breeding and dwelling in identical habitats—highlights the complexity of responses to a component of global environmental change as revealed through the lens of evolution.

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**0598 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Salon A-C, Friday 8 July 2016**

Ian Brennan, Paul Oliver

*Australian National University, Canberra, ACT, Australia*

**Postextinction diversification of an adaptive Australian reptile radiation**

Increasingly large and taxonomically complete phylogenies, and new analytical methods are currently allowing us to identify and test mechanisms that explain macroevolutionary change across deep temporal timescales. Of Australia's >1,000 recognized squamate species, we focus on pygopodoidean geckos, a pre-Gondwanan clade, comprising a suprafamily of morphologically and ecologically diverse endemic lizards. Experimentally, the Pygopodoidea are an ideal opportunity to study patterns and asymmetries in diversification on a continental scale: they are an old (50–70 Mya), species rich (>150 Australian spp.) clade, which have diversified in-situ alongside Australia's latitudinal and climatic wanderings. Recent analysis of Australian flora and fauna suggest the dramatic influence of Oligocene mass turnover, perhaps associated with the isolation of the Australian continent ~35 mya. Using the largest fossil-calibrated phylogeny of the Pygopodoidea yet, we find the rate and shape of species accumulation in the Pygopodoidea support a mass extinction event approximately 30 Mya, which dramatically influenced the composition of this group. Despite a phylogenetic "reset" in the Oligocene, these geckos have diverged on disparate morphological, ecological, and distributional paths. We reconstruct ancestral biome distributions, and quantify within-biome speciation rates to determine how richness within this group has developed across the continent. Additionally, we use snout-vent-length (SVL) as a proxy for body size and general ecology, to determine how variation in size has accumulated and been partitioned. We suggest an early bout of morphological and ecological partitioning was maintained until a second, more widely recognized adaptive radiation occurred in the pygopodids.

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**0266 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Casey Brewster

*University of Arkansas, Fayetteville, AR, USA*

## The impact of woody vegetation density in Ozark cedar-glades on operative temperature and activity time of the Eastern Collared Lizard (*Crotaphytus collaris*)

Preliminary data suggest that *Crotaphytus collaris* populations restricted to cedar-glade habitats with high-levels of dense woody vegetation (degraded glades) exhibit reduced daily activity time compared to populations with low woody vegetation density (intact glades). Increased shading from woody vegetation may reduce availability of suitable operative temperature (Te), and thus restrict activity. To address this explanatory mechanism I tested two iterative hypotheses: 1) Is *C. collaris* hourly activity time closely related to availability of suitable Te, and 2) do degraded glades have fewer hours a day with suitable Te availability than intact glades? Results suggest that *C. collaris* activity time is closely tied to availability of suitable Te in a degraded ($r^2 = 0.746$, $p<0.05$) and an intact glade ($r^2 = 0.605$, $p<0.05$). Furthermore, degraded habitats (n=4) have significantly fewer hours a day with suitable Te (9.6, 11.2 and 11.4 hrs for May, June and July) compared to intact glades (n = 4; 12.2, 14.0, and 14.0 hrs for May, June and July). These findings are consistent with the explanatory mechanism that *C. collaris* in degraded habitats have decreased activity-time budgets as a result of reduced availability of suitable Te associated with increased shading.

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**0315 AES Physiology, Paleontology, & Collections, Balconies L & M, Friday 8 July 2016**

Lauran Brewster[1], Nicholas Whitney[2], Samuel Gruber[3], Tristan Guttridge[3], Mike Elliott[1], Ian Cowx[1], Karissa Lear[2], Adrian Gleiss[5]

*[1]University of Hull, Hull, UK, [2]Mote Marine Laboratory, Sarasota, Florida, USA, [3]Bimini Biological Field Station Foundation, Bimini, Bahamas, [4]Rosenstiel School of Marine and Atmospheric Science, Miami, Florida, USA, [5]Murdoch University, Murdoch, Western Australia, Australia*

## Accelerating Understanding of Field Metabolic Rates in Elasmobranchs

Metabolism governs the rate at which organisms transform and use energy and consequently is often considered the most fundamental rate in biology. Ascertaining field metabolic rate (FMR) is essential for quantifying the impact of a species on its ecosystem and producing reliable bioenergetics models for use in fisheries management and ecosystem modelling. However, the validity of the model is dependent on its parameterization and the accuracy of its components, including metabolism. Determining FMR of free-swimming elasmobranchs has logistical constraints and difficulties, especially in reconciling laboratory-based studies with field studies.

Activity-based energy expenditure is likely to be the largest and most variable component of metabolism in many species of sharks and so their fine-scale activity levels may be used as a proxy for metabolic rate. Here, we demonstrate the use of animal borne accelerometers for elucidating the activity and concurrent metabolic demands of the lemon shark, *Negaprion brevirostris*. The relationship between overall dynamic body acceleration (ODBA) and mass-specific oxygen consumption ($MO_2$) was derived from lemon sharks exercised in a swim-tunnel respirometer. Trials were conducted over a range of temperatures to investigate the effect of temperature on the ODBA-$MO_2$ relationship for consideration when determining FMR values, particularly between seasons. FMR was determined from free-living lemon sharks tagged at Bimini, Bahamas (n=10 during wet season, n=10 during dry season), where acceleration data was recorded at 30 Hz for 120 hours per individual.

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**0143 AES Conservation & Management I, Balconies L & M, Friday 8 July 2016**

Karyl Brewster-Geisz

*NOAA Fisheries, Silver Spring, MD, USA*

**Recent changes in Atlantic Shark Management in the United States**

The Highly Migratory Species Management Division of the National Marine Fisheries Service (NMFS) is responsible for the management of the U.S. federal shark fisheries in the Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea. When federal management of sharks began in 1993, management was relatively simple, and included establishing three management groups for 39 species of sharks and requiring fishermen and dealers to follow certain regulations such as permitting and reporting. Over time, as shark science has improved and the public knowledge about the importance of sharks has increased, the regulations have become much more species- and regionally-based than the original regulations. In 2015, NMFS implemented several changes to federal shark management including the addition of three shark species to the management unit and the implementation of regulations that increase flexibility for commercial fishermen while continuing to rebuild overfished sharks. Potential changes coming in 2016 and beyond will continue to need strong scientific research and support.

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**0566 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Ananda Brito de Assis[1], Beatriz Simas Magalhães[2], Cristine Chaves Barreto[2], Catherine R. Bevier[3], Carlos Arturo Navas[1]

*[1]University of São Paulo, São Paulo, SP, Brazil, [2]Catholic University of Brasília, Brasília, DF, Brazil, [3]Colby College, Waterville, ME, USA*

**Assessing Defense Mechanisms of Frogs Against Microbial Pathogens**

Antimicrobial peptides (AMPs) and bacterial metabolites from amphibian skin offer protection against pathogens. The effectiveness of both systems is crucial for sustaining populations, especially in areas where amphibians are more exposed to emerging infectious diseases. In this experiment we used the terrestrial frog, *Proceratophrys boiei*, as a model to determine the percentage of epibiotic bacteria that effectively inhibit growth of pathogens, to identify these bacteria, and to explore antimicrobial capacity of skin secretions. Frogs from populations inhabiting different geographical areas of the Atlantic Forest were sampled. Of the 517 bacteria morphotypes isolated from the skin microbiome, 84 exhibited antimicrobial activity against common bacteria pathogens such as *E. coli* and *Aeromonas hydrophila*. The percentage of bacteria with antimicrobial activity varied from 5.6% to 64% of those tested among the populations. Eighteen genera of skin bacteria exhibited antimicrobial activity against the pathogenic chytrid fungus, *Batrachochytrium dendrobatidis* (*Bd*). The most frequent antimicrobial genera were *Pseudomonas*, *Stenotrophomonas*, *Chryseobacterium* and *Pedobacte*r and their abundances varied among frog populations. Skin secretion profiles were similar between populations, protein concentration varied greatly among individuals, and 60% of the 65 frogs sampled produced secretions with high levels of antifungal activity against three different strains of *Bd*. However, these skin secretions were less effective against the pathogenic bacteria tested. These results suggest that bacterial metabolites and skin secretions should work together and complement each other in fighting infections in amphibians, but potential differences between populations likely exist and may have implications for susceptibility to infectious diseases.

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**0137 ASIH STOYE GENERAL ICHTHYOLOGY AWARD, Galerie 2, Friday 8 July 2016**

Allison Bronson[2], John Maisey[1]

*[1]American Museum of Natural History, New York City, NY, USA, [2]Richard Gilder Graduate School, New York City, NY, USA*

**The first described cranium of *Carcharopsis wortheni*, from the Fayetteville Formation of Arkansas**

The Late Mississippian Fayetteville Shale of Arkansas has yielded exceptional invertebrate and plant fossils for more than 50 years, but recent work on the formation's vertebrate fauna has provided new insights into shark evolution. We describe the first known cranium of *Carcharopsis*, a taxon described originally from isolated, serrated

teeth. Computed tomographic scanning reveals the posterior (parachordal, occipital) region of the braincase, plus portions of the skeletal labyrinth of the inner ear. Several plesiomorphic features of the *Carcharopsis* cranium suggest a phylogenetic position on the chondrichthyan stem, outside the crown group. The ctenacanth group is likely paraphyletic, and the cranial anatomy of *Carcharopsis* may provide new anatomical features for phylogenetic analysis, resulting in better resolution of ctenacanth systematics.

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**0343 Fish Ecology II, Salon A-C, Saturday 9 July 2016**

Nathania Brooke[1], Phil Ross[1], Tom Trnski[3], Chris Battershill[1], Keith Gregor[2]

*[1]University of Waikato, Hamilton, Waikato, New Zealand, [2]Bay of Plenty Polytechnic, Tauranga, Bay of Plenty, New Zealand, [3]Auckland Museum, Auckland, Auckland, New Zealand*

**Larval fish of Tauranga Harbour, New Zealand**

Estuaries are important nursery habitats for many fish species on account of their high primary production and shallow warm waters. While the value of estuaries as a nursery habitat for juvenile fish is well demonstrated in New Zealand and worldwide, the importance of estuaries for larval life stages is less certain. Here we conducted a series of investigations to better understand the significance of estuaries as nursery habitats, migrational routes and feeding grounds for larval fish. Larval fish community composition, and tidal and diel distribution patterns were assessed in Tauranga Harbour. Intensive sampling was conducted over the summer period and a reduced level of sampling conducted over a 12 month period. Nineteen species were recorded, with the anchovy *Engraulis australis, triplefins* and gobies as the most dominant taxa found. The diel phase was the most important variable, followed by the tidal phase. Very low recruitment was recorded in the second summer of sampling. A choice chamber experiment was also conducted to assess whether fish larvae would distinguish between water of oceanic and estuarine origins and whether this might influence species found in estuaries.

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**0434 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Alan Brooks[1], Katie Vaccaro[1], Dean Grubbs[2], Toby Daly-Engel[1]

*[1]University of West Florida, Pensacola, FL, USA, [2]Florida State University, Tallahassee, FL, USA*

## Polyandry and Multiple Paternity in the Gulf Spurdog Shark, *Squalus* cf *mitsukurii*

Polyandry, a mating system where a female mates with multiple males during a single breeding season, is a common reproductive strategy among many species. It is suggested that polyandry may increase the genetic diversity of a population, increase fitness of offspring, and possibly increase reproductive output. As a result of polyandry, a litter of pups in a female can be sired by multiple males, which is a widespread phenomenon called multiple paternity. Multiple paternity has been shown to be common in sharks, with every species that has been studied using more than a single brood showing some evidence of multiple mating. Here we examine the frequency of multiple paternity in a newly-described species of dogfish shark, the Gulf spurdog *Squalus* cf *mitsukurii* (*Squalus clarkae*), using microsatellite fragment analysis. Microsatellites are short tandem repeats in DNA which are notable for a high rate of mutation, allowing for individuals in a population to be identified with a high degree of accuracy. In order to estimate the extent of multiple paternity in *S. mitsukurii*, 13 separate litters with mothers were analyzed, along with 50 unrelated individuals, using 12 previously-developed microsatellite loci. Initial results suggest that *S. mitsukurii* may be the first shark species to date that shows no evidence of multiple paternity, instead showing a predominance of genetic monogamy. Even though rates of multiple paternity are highly variable between species, this result is surprising and may have future implications on the diversity and extinction risk for deep-water sharks in the Gulf of Mexico.

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**0881 Fish Behavior & Development, Salon A-C, Sunday 10 July 2016**

Christopher Brooks[1], Jennifer Gumm[2]

*[1]Southern Illinois University, Carbondale, IL, USA, [2]Stephen F. Austin State University, Nacogdoches, TX, USA*

## Territoriality and heterospecific 'dear enemy' recognition in two freshwater fishes (genus *Cyprinodon*)

Territorial aggression can vary based on species or the identity of the competitor. Some species exhibit ‘dear enemy' recognition; where lower levels of aggression are directed toward neighboring, territorial individuals. *Cyprinodon variegatus* has been shown to outcompete closely related species due to high levels of aggression and territorial males exhibit dear enemy recognition. Recently, *C. variegatus* has been introduced into the home range of *Cyprinodon rubrofluviatilis*, leading to hybridization. We examined

territorial establishment and maintenance between heterospecific neighbors and evaluated if heterospecific neighbors express dear enemy recognition. We also tested the hypothesis that territorial males of each species differ in their expression of dear enemy recognition. We found that territorial male *C. rubrofluviatilis* and *C. variegatus* in conspecific and heterospecific groups do show more aggression towards non-territorial males. Change in aggressive behaviors over time depends upon the behavior, the identity of the individual, and community structure. Energetically expensive aggressive acts towards territorial neighbors decreased after territory establishment while aggression towards non-territorials did not change. Less energetically expensive behaviors increased towards territorial males while no displays were directed towards non-territorials. *C. rubrofluviatilis* established territories faster, more often and reduced aggression more over time when compared to *C. variegatus.* When aggression is decreased towards invasive species, hybridization may increase, leading to introgression. This is the first study to show heterospecific dear enemy recognition between vertebrate species and to compare the expression of dear enemy recognition between closely related species.

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## 0028 Fish Reproduction, Physiology, & Conservation, Balconies J & K, Sunday 10 July 2016

Nancy J. Brown-Peterson[1], Alexander Q. Fogg[2], Mark S. Peterson[3]

*[1]EcoFish Consulting, LLC, Ocean Springs, MS, USA, [2]Florida Fish and Wildlife Conservation Commission, Tallahassee, FL, USA, [3]University of Southern Mississippi, Ocean Springs, MS, USA*

### Reproductive Biology of Invasive Lionfish, *Pterois* spp., in the northern Gulf of Mexico

With invasive lionfish (*Pterois* sp.) increasing throughout the western North Atlantic and Gulf of Mexico (GOM), it is important to define life history characteristics so that management practices can mitigate potential effects on native ecosystems. Although some aspects of reproduction are known elsewhere in the invaded range, little is known in the northern GOM (nGOM; Florida Keys (24.66°N) to South Texas (26.00°N)). Based on 4,527 specimens (April 2012-March 2015), the male and female gonadosomatic index peaked from May to October, corresponding with macroscopic gonadal assessments of reproductively active females. Histological examination of 265 females from the northeast GOM ecoregion found they were spawning capable during all months; males (N = 158) were spawning capable in all months except March. A significantly higher percentage of reproductively active females was found in the western GOM ecoregion from February-October, and actively spawning females were present monthly except March. Lionfish reached 50% maturity at a small size (166.6mm TL, females; 145.2mm TL, males). Mean relative batch fecundity (N = 71) was 92 eggs/g gonad-free body weight (GFBW) and was highest in August (207 eggs/g GFBW). Spawning frequency was estimated to be every 2.5 days over 11 months, corresponding to a potential annual output of 2,332,490 eggs for a 188.6 g female. These reproductive characteristics differ

little among nGOM ecoregions and are similar to tropical-climate lionfish, although nGOM reproductive output is higher. These results represent the most comprehensive reproductive data on lionfish throughout their invaded range, and provide a baseline for management in the nGOM.

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**0056 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Lindsey Bruckerhoff[1], Doug Leasure[2], Daniel Magoulick[1]

*[1]University of Arkansas Cooperative Fish and Wildlife Research Unit, Fayetteville, AR, USA, [2]University of Georgia, Athens, GA, USA*

### Spatial Auto-correlation of Fish Traits across Hydrologic Regimes and Implications for Developing Ecological-flow Relationships

Establishing ecological-flow relationships is a crucial component of managing lotic systems within an environmental flow framework. Species traits may be useful for developing ecological-flow relationships because they can be used to make comparisons across biogeographical boundaries. Fish traits, such as life history strategies and spawning characteristics, have been linked to hydrologic metrics and classified flow regimes at relatively large spatial scales, but not smaller, management level scales, and the role of spatial autocorrelation in driving trait distributions in stream networks has not been assessed. We used mixed moving average spatial stream network models to (1) determine the relationship between fish traits and hydrologic metrics within classified flow regimes at a management (state) level spatial scale, (2) determine how traits are spatially auto-correlated within a stream network, and (3) compare the degree of spatial autocorrelation between flow regimes. We observed weak relationships between fish traits and hydrologic metrics, and these relationships were different between flow regimes. Spatial factors described more variability in the distribution of fish traits than hydrologic metrics within and between flow regimes and different types of spatial auto-correlation structured trait patterns across flow regimes. This study highlights the importance of considering spatial patterns when developing ecological-flow relationships.

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**0885 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jacob Brumley, Philip Lienesch

*Western Kentucky University, Bowling Green, KY, USA*

### Changes to the fish assemblage of the Middle Fork of Drakes Creek in south-central Kentucky over 40 years

Within the Middle Fork of Drake's Creek in south-central Kentucky, humans have been settling and manipulating the landscape for centuries. The manipulation of the lands

within watersheds of rivers and streams is an enormous issue for conservation biologists, who are interested in the impact on aquatic diversity. This study is an extension of a survey done in the Middle Fork of Drakes Creek in 1972 by David Bell and Robert Hoyt. We resampled the same reach of river examined by Bell and Hoyt to determine if there has been any change to the species diversity of fishes over the past four decades. Fish samples were taken at three stations: upstream, midstream, and downstream. The sampling was conducted seasonally, which differs from the original survey where fish were sampled every month. The fish were identified to species and the relative abundance calculated. Species of the family Cyprinidae remained the most abundant, as seen in the prior study, composing approximately 80% of the collection. Most of the species not collected in the later sampling had been rare (<1% relative abundance) in 1972. The loss of rare species will be discussed in relation to general trends in fish diversity.

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**0251 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Scott Buchanan, Nancy Karraker, Bill Buffum

*University of Rhode Island, Kingston, RI, USA*

### Understanding the Influence of Altered Habitat: Modeling Occupancy of Aquatic Turtles in Rhode Island along a Gradient of Forest Cover

Habitat loss and degradation, unsustainable human use, and climate change, have made freshwater aquatic turtles a taxa of particular conservation concern. The five aquatic turtle species native to Rhode Island use an array of upland habitats adjacent to wetlands, making a landscape-level understanding of what is driving distribution and occupancy an important component of effective management. In Rhode Island, deforestation associated with development is the leading cause of habitat loss and fragmentation, but we know little about how aquatic turtle populations respond to this landscape-level alteration. An investigation was initiated in 2013 to study the effects of landscape composition and configuration on the distribution, abundance, demography, and genetic diversity of aquatic turtles in Rhode Island. We trapped turtles in 88 isolated, non-riparian wetlands across a gradient of forest cover throughout Rhode Island and used mark-recapture methods to assess populations. Results focus on three native species, *Chelydra serpentina, Chrysemys picta*, and *Clemmys guttata*, and one invasive species, *Trachemys scripta*. *C. guttata* occurred in fewer wetlands (~8%) than *C. serpentina* (~63%), *C. picta* (~84%) and *T. scripta* (~10%). Occupancy was modeled for each species using a suite of landscape and within-wetland variables, and top models are presented in an information criterion framework. An improved understanding of what is driving the presence or absence of a species of conservation importance will improve management practices for the persistence (or removal) of that species.

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**0825 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Phillip Bumpers[1], John Maerz[1], Amy Rosemond[1], Jonathan Benstead[2], Mick Lemi[2]

*[1]University of Georgia, Athens, GA, USA, [2]University of Alabama, Tuscaloosa, AL, USA*

## Effects of Nutrient Enrichment and Stoichiometry on Larval Salamander Growth

Nutrient-driven perturbations to basal resources are predicted to attenuate with trophic distance, so it is unclear whether higher-level consumers will respond to natural or anthropogenic increases in nutrient availability. We continuously enriched five streams for two years with different concentrations of dissolved nitrogen and phosphorus, creating a gradient of stream water nitrogen:phosphorus ratio (2:1-128:1), to determine whether nutrient enrichment effects growth rates and diets of caged and free-roaming larval *Desmognathus quadramaculatus (Dq)* and *Eurycea wilderae (Ew)*. Growth rates of *Desmognathus* and *Eurycea* increased by 40% and 60%, respectively, with P concentration. Nitrogen enrichment had only a small effect on salamander growth. Nutrient addition resulted in greater *Desmognathus* prey biomass and diet shifts that tracked changes in basal resource stoichiometry and insect production. In particular, enrichment increased *Desmognathus* consumption of algal biofilm consumers and decreased consumption of detritivores. In contrast, there were no clear changes in *Eurycea* prey size or composition. Our findings show salamander growth responds to the relaxation of ecosystem-level P limitation and that moderate increases in P availability can have relatively large effects on larval salamander life history traits. Our results suggest that nutrient enrichment effects on larval salamander diet and growth occurred via effects on "green" food web pathways, despite the dominance of detrital resources in the streams. Biofilm consumers are generally higher in nutrient content than detritivores, and their increase potentially alters energy flow and trophic efficiency of predators. We hypothesize that microhabitat or size differences partially explain the different dietary responses of salamander species.

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**0843 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Frank Burbrink

*The American Museum of Natural History, New York, NY, USA*

## Modeling the effects of ecology on the mtDNA genome in ratsnakes

Selection in different ecological backgrounds shapes traits among closely related species. The effect of selection can also be examined at the genomic level, though understanding the interplay among ecology, the genome and traits has typically been examined in model taxa only. It has widely been considered that different habitats, particularly temperate and tropical environments, have had profound effects shaping the

mitochondrial (mt) genome. Using the globally distributed ratsnakes, which have radiated in both temperate and tropical regions of the world, I ask are the processes of substitution among all mtDNA proteins governed by diversification in distinctly different environments? Here using genomic-scale data, I produce a mtDNA-free species tree of ratsnakes while also generating the full mtDNA genome from non-target regions. With these mtDNA genomes I test for significant nonsynonymous (ns) changes at each site in all of the mitochondrial protein complexes. With these sites identified, I then determine mutational sensitivity on protein phenotype. Finally, I examine for correlation between the rates of ns change for each significant site and environment using a phylogenetic threshold model and mtDNA-free tree.

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**0218 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Aaron Burgad, Ginny Adams, Reid Adams

*University of Central Arkansas, Conway, AR, USA*

**Historical Perspective on Darter Assemblage Structure in the Saline River, Arkansas**

Long-term data provide critical insight into the stability and persistence of fish assemblages across temporal and spatial scales. The Saline River, a tributary of the Ouachita River, historically supported a high diversity of darters (n = 23) and had minimal anthropogenic disturbance. We used darter collections from the Saline River during 1969-1971 (16,980 specimens) and 1981-1982 (10,702 specimens) at 20 sites to assess changes in darter assemblage structure. For both periods, *Percina vigil* had the highest relative abundance (> 40%), and *Etheostoma artesiae* had the highest frequency of occurrence (≥ 75%). Results showed three lowland species (*Etheostoma asprigene*, *Etheostoma chlorosoma,* and *Etheostoma gracile*) increased in site frequency, whereas upland species were found at fewer sites over the 11-year period. Lowland species were found at sites further upstream, perhaps in response to changing environmental conditions. It is unclear whether dispersal mechanisms were longitudinal or lateral. Changes in current land use have increased dramatically, with nine sites having > 10% urbanization within the upstream catchment compared to two sites in 1982. It is well known that land use and stream integrity are linked, and urbanization has the strongest influence. We will repeat sampling in 2016-2017 using similar methods to assess similarity among fish assemblages after three decades. These results will provide insight into the persistence of darter assemblages, which are highly vulnerable to habitat alteration.

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**0686 HL: Social Behavior in Reptiles Symposium, Salon E, Saturday 9 July 2016**

Gordon Burghardt

*University of Tennessee, Knoxville, TN, USA*

**Reptile Sociality: Ignored, Mischaracterized, and Still Misunderstood**

Extant nonavian reptiles are a diverse paraphyletic assemblage consisting of the Crocodylia, Testudines, Squamata, and Rhynchocephalia. The behavior of these groups is extremely diverse as are their habitats, physiology, and reproductive modes. What is not diverse is the historical denigration of these animals as largely socially uninteresting and unimportant in understanding social behavior and its evolution. Although data questioning this view was provided by early naturalists and studies in the 1930s by G. K. Noble and L. T. Evans, it was C. C. Carpenter and A. S. Rand who, beginning in the 1960s, were especially significant in bringing evidence of complex social communication and sociality to the emerging field of comparative ethology that had largely focused on birds, mammals, fishes, and insects. This presentation will provide some background to the presentations in this symposium, presentations that represent exciting new data, new methods, and new conceptions of our emerging view of reptile sociality, the problems these pose for endothermic chauvinists, and the challenges that still endure.

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**0118 AES Conservation & Management III, Balconies L & M, Saturday 9 July 2016**

Patrick Burke[1], Maurits van Zinnicq Bergmann[2], Mark Bond[2], Samuel Gruber[2], Simon Dedman[2], Yannis Papastamatiou[2], Tristan Guttridge[2]

*[1]EMBC+, Ghent, Belgium, [2]Bimini Biological Field Station, Bimini, Bahamas*

**Use of Baited Remote Underwater Video Surveys to Assess the Diversity and Distribution of Elasmobranchs and their Prey Species in Bimini, Bahamas**

Establishing effective management and conservation policies for marine systems requires an understanding of the dynamic relationship between predators and their environment. There is currently a lack of understanding of how this relationship shapes natural communities and influences population dynamics. This study used baited remote underwater video surveys (BRUV) to investigate the influence of abiotic and biotic factors on elasmobranch distribution, relative abundance, and species-specific habitat associations around Bimini, Bahamas. To date, 31 BRUVs have been deployed during February with an additional 120 envisaged before June. BRUVs were deployed in multiple locations and habitat types around the island, with habitat categorized as sand flats, seagrass beds, coral reefs, and mangrove edge. These locations serve as representative habitat types for the greater Bimini ecosystem. Current assemblage observed 6 species of chondrichthyans, 19 families of osteichthyes, 1 species of marine reptile, and 4 species of invertebrates. Preliminary results suggest elasmobranch abundance and distribution is influenced by water depth, heterogeneous substrate, and

high relative abundance of teleosts. The identification of significant factors influencing elasmobranch assemblage structure provides further insight into community dynamics that can contribute to effective management and conservation policies.

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**0383 SSAR SEIBERT ECOLOGY AWARD, Galerie 2, Friday 8 July 2016**

Jacob Burkhart, Chelsey Kroese, Raymond Semlitsch, Lori Eggert

*University of Missouri, Columbia, Missouri, USA*

**Range Wide Genetic Diversity of the Ringed Salamander**

Range wide studies are important for understanding species distributions. Such studies not only provide a basic understanding of habitats utilized, range of climatic conditions tolerated (e.g., temperature, elevation, humidity), species interactions, and resources utilized but they also inform questions that necessitate further study. Our study uses contemporary genetic techniques to investigate the range-wide genetic diversity in the Ozark and Ouachita Mountain endemic ringed salamander (*Ambystoma annulatum*), a species of conservation concern across all portions of its range. We tested the patterns of genetic diversity and structure across the species range to assess areas of greatest genetic diversity and to infer putative refugial areas in this species. Using microsatellite genotypes of 498 individuals from 20 localities across the ringed salamander's distribution, we observed significant differentiation between the Ozark and Ouachita Mountains with substructure within the Ozark Mountains. Given the low mitochondrial DNA diversity observed in previous studies, our results suggest that contemporary landscape alterations are influencing observed ringed salamander genetic diversity. Future studies will investigate this result by using genomic techniques to infer patterns of range expansion in this species.

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**0437 NIA BEST STUDENT PAPER, Salon A-C, Friday 8 July 2016**

Michael Burns

*Oregon State University, Corvallis, OR, USA*

**Body Shape Convergence and Rates of Morphological Diversification in the Order Characiformes**

The order Characiformes is a hyperdiverse group of South American and African fishes that exhibits an unparalleled amount of variation in body shape, trophic ecology, and habitat. I sought to analyze body shape diversification of this order to characterize and quantify morphological variation and test hypotheses about the origin of the variation. I tested macroevolutionary hypotheses through comparative phylogenetic methods, specifically tests of convergence and analyses of morphological rate evolution. I quantified body shape through geometric morphometric analysis of radiographed specimens. I digitized 24 landmarks from the head and body of 10 adult individuals per

species for 134 genera, with at least two genera from each family, and summarized variation through a principal components analysis. I also constructed a multi locus phylogeny of 104 taxa. Most of the variation was between families and indicates that body shape evolution occurred early in cladogenesis. Phylogenetic comparative analysis supported a relationship between body shape and trophic ecology, with multiple instances of convergence across the order. I compared rates of morphological evolution between families and trophic groups. I found that rates of morphological evolution varied across the order and between groups. These results are consistent with the hypothesis that trophic ecology was a key factor promoting morphological differentiation in characiform fishes.

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**0588 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Edward Burress[1], Fernando Alda[2], Prosanta Chakrabarty[2], Jonathan Armbruster[1]

*[1]Auburn University, Auburn, AL, USA, [2]Louisiana State University, Baton Rouge, LA, USA*

## Phylogenomics of the Pike Cichlids (Cichliformes: Cichlidae: *Crenicichla*)

The pike cichlids (*Crenicichla*) are a diverse (>100 species) and widespread group of riverine Neotropical cichlids. Pike cichlids are particularly unique among cichlids in that they are highly diverse within both the Amazon basin as well as the subtropical La Plata basin, with particularly high diversity in Argentina, Southern Brazil, and Uruguay. The evolutionary relationships among major species groups is poorly resolved and currently without a robust phylogenomic hypothesis. Here, we estimate the *Crenicichla* phylogeny using ultraconserved elements (UCE), with particular focus on resolving the relationships among major species groups as well as a problematic group of closely-related species from Uruguay and Southern Brazil. Based on analysis of 34 species representing all major species groups and >400 loci, we find unique relationships among the species groups and a novel placement of the type species (*C. macrophthalma*). *Crenicichla* consists of two major clades. The first consists of the *C. reticulata*-group, which is sister to the *C. lacustris*-group, which includes most of the subtropical species. The second clade consists of the *C. lugubris*-group, which is sister to the *C. lepidota*-group. The *C. wallacii*-group has a basal relationship to the *C. lugubris*-group + *C. lepidota*-group clade. Lastly, *Teleocichla* have a basal relationship with the clade containing the *C. lugubris*-, *C. lepidota*, and *C. wallacii*-groups. Therefore, *Teleocichla* is nested firmly within *Crenicichla*, which is consistent with previous work. The type species, *C. macrophthalma*, is placed within the *C. reticulata*-group. These relationships have several implications for the evolution and historical biogeography of *Crenicichla*.

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**0586 ASIH STOYE GENERAL ICHTHYOLOGY AWARD, Galerie 2, Friday 8 July 2016**

Edward Burress[1], Jorge Casciotta[2], Oldrich Rican[3], Lubomír Piálek[3], Milton Tan[1], Jonathan Armbruster[1]

*[1]Auburn University, Auburn, AL, USA, [2]Universidad Nacional de La Plata, Buenos Aires, Argentina, [3]University of South Bohemia, Ceske Budejovice, Czech Republic*

## Parallel Phenotypic Diversification and Rapid Speciation of *Crenicichla* Species Flocks: Riverine Analogs to the East African Great Lake Cichlids

Adaptive radiation is the source of much of the functional, morphological, and molecular diversity on Earth and is a fundamental process linking ecology and evolution. Adaptive radiation is the genesis of corresponding ecological and trait diversity within a lineage. Cichlid fishes of the East African Great Lakes, particularly Lakes Malawi and Victoria, as well as Nicaraguan crater lakes, serve as textbook examples of metazoan adaptive radiation. Here, we present evidence of novel adaptive radiations of riverine Neotropical cichlid fishes. We quantified body and lower pharyngeal jaw shape among 66 *Crenicichla* species using geometric morphometrics and generated phylogeny- and size-corrected principal components. Secondly, we accessed rates of speciation and phenotypic diversification, phenotypic convergence, and evolutionary regime shifts across the phylogeny and through time. The *Crenicichla* species flocks of the Parana and Uruguay rivers exhibit rapid parallel phenotypic diversification associated with trophic specializations, particularly the evolution of 1) specialist piscivores that have large mouths and atrophied pharyngeal jaws, 2) molluskivores that have short snouts and hypertrophied pharyngeal jaws, and 3) crevice-feeding invertivores that have long snouts and hypertrophied lips. These phenotypes and their corresponding trophic roles, particularly the molluskivory and crevice-feeding, are dramatic deviations from the generalist carnivore ancestral state. These evolutionary patterns share many similarities with trophic-based diversification by cichlid fishes in rift valley and crater lakes.

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**0382 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Cecily Burton[1], Rachel Scharer[1], Philip Stevens[2], Gregg Poulakis[1]

*[1]Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, Charlotte Harbor Field Laboratory, Port Charlotte, FL, USA, [2]Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, St. Petersburg, FL, USA*

## Diel Movements and Habitat Use of the Smalltooth Sawfish, *Pristis pectinata*, in the Peace River: Implications for Defining the Boundaries of a Nursery Hotspot

Movements and habitat use of endangered juvenile (<3 yr old) Smalltooth Sawfish (*Pristis pectinata*) were studied in the Peace River, Florida during 2014 using active manual tracking and passive acoustic monitoring to (1) document fine-scale habitat associations and (2) estimate the boundaries of the only known nursery hotspot in the river. A total of 23 sawfish were acoustically tagged on the north side of the river during the peak recruitment period in April and May. Subsequently, rather than following individuals for long periods of time, manual tracking was conducted during June and July using kayaks (day) and small boats (night) to determine position estimates of individuals relative to the shoreline and major habitat types (e.g., red mangroves, oyster reefs, canals) throughout the study area. During the day, juveniles remained along the northern shoreline and tended to be close (< 25 m) to red mangrove-dominated shorelines. At night, juveniles moved away from the northern shore, and made excursions to the south side of the river. These data suggest that the boundaries of the hotspot include both shorelines of a six river kilometer portion of the Peace River between the US 41 and I-75 bridges.

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**0043 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Thaddaeus Buser[1], Adam Summers[2]

*[1]Oregon State University, Corvallis, Oregon, USA, [2]University of Washington, Seattle, Washington, USA*

## Body Shape vs. Osteology in the Fish Superfamily Cottoidea

Sculpins are a speciose and morphologically diverse group of fishes found in diverse habitats across the northern hemisphere. The morphological diversity of sculpins, especially of the North American species of the genus *Cottus*, is broad and has led to confusion. Within this widespread genus, there can be a confounding overlap in many commonly used morphological characters (i.e., fin rays, mandibular pores, etc.), and substantial morphological phenotypic plasticity within a given species. We are using X-ray micro-tomography (mCT) to determine the extent to which changes in the morphology of specific bones correlate with changes in aspects of body shape across the diversity of sculpin species. We are finding differences in osteology that ultimately

result in a superficially indistinguishable phenotype. This could lay the framework for a better understanding of not only the evolution and radiation of sculpins, but perhaps more practically, more concrete and precise delimitation of some of the sculpin species, particularly in the genus *Cottus*. The use of mCT in this study allows us to reconstruct and quantitatively compare minute structures in three dimensions across large numbers of individuals with high precision. As we catalog morphological diversity and generate hypotheses of the evolutionary history of sculpins, we are making the mCT data available as an open resource freely available via the Open Science Framework website (https://osf.io/) so any researcher can download and analyze scans as they are completed.

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**0463 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Julie Butler, Anwei Gwan, Prosanta Chakrabarty, Karen Maruska

*Louisiana State University, Baton Rouge, LA, USA*

**Swim Bladder Morphology Changes with Reproductive and Social Status in the Mouthbrooding African Cichlid *Astatotilapia burtoni***

Fishes use a variety of reproductive tactics ranging from broadcast spawning, to nest building, to oral incubation of developing larvae. In mouthbrooding fishes, the brooding parent undergoes several behavioral and physiological changes as the fry develop in their buccal cavity. To accommodate the increasing weight of the developing fry in the mouth, fishes must adjust their buoyancy to maintain normal swimming posture. Increasing gas exchange at the gills can increase gas secretion into the swim bladder to partially control buoyancy. For fishes with swim bladders containing a transverse diaphragm, it is possible that changes in the relative size of the anterior and posterior compartment may also aid in regulating buoyancy during mouthbrooding. To test this hypothesis, we compared radiographs of specimens of mouthbrooding *Astatotilapia burtoni* (Cichlidae: Haplochromini) to examine swim bladder morphology across the reproductive cycle. In gravid females, the swim bladder has a long, cylindrical shape. Following spawning, females carry developing fry for ~2 weeks, and consequently, the relative size and shape of the swim bladder changes throughout this brood cycle. Specifically, the anterior compartment increases in size and becomes rounder as brooding progresses, presumably to compensate for increasing fry weight in the mouth. The diaphragm separating the anterior and posterior compartment may allow *A. burtoni* to control relative size/shape of the two compartments to regulate buoyancy during mouthbrooding. To our knowledge, this is the first record of swim bladder morphology changing during the reproductive cycle.

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**0409 AES Conservation & Management III, Balconies L & M, Saturday 9 July 2016**

Michael Byrne[1], Jeremy Vaudo[1], Guy Harvey[1], Bradley Wetherbee[2], Mahmood Shivji[1,3]

*[1]Guy Harvey Research Institute, Dania Beach, FL, USA, [2]University of Rhode Island, Kingston, RI, USA, [3]Save Our Seas Shark Research Center, Dania Beach, FL, USA*

### Using Satellite Telemetry to Quantify Fisheries Interactions and Survival of Shortfin Mako Sharks

Accurate measures of annual survival and fishing mortality are vital to successful fisheries management and conservation, however such parameters are notoriously difficult to measure for highly mobile pelagic species. Fin-mounted Argos transmitters (SPOT tags) may prove to be a valuable tool to gather information on survival and fisheries interactions. We tagged 42 shortfin mako sharks (*Isurus oxyrinchus*) off the U.S. east coast (EC; 27), and the Yucatan Peninsula (YP; 15) with SPOT tags which reported near daily location data for up to 628 days. We were able to identify fishing mortality events, capture locations, the fisher's port of origin, and the fishery (i.e. commercial/recreational). Eight sharks tagged off the EC (29.6%), and four from the YP (26.7%) were confirmed harvested by fishers. This level of fishing mortality is above estimates derived from conventional tag data, and represents minimal estimates as additional transmitters may have been destroyed by fishers at sea. Makos were harvested by fishers from 5 countries: Canada (4), Mexico (3), U.S. (3), Cuba (1), and Spain (1), highlighting the need for international management. The majority of makos were captured by pelagic long-liners (83%). We used known-fate models for telemetry data to estimate an annual survival rate of 0.69 (0.54 – 0.81). This is best interpreted as a "maximum fishery survival" rate as it was not possible to detect natural mortality events. Our data suggests very high fishing pressure on makos in the western North Atlantic. Such estimates should prove valuable for incorporation into population models and stock assessments.

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**1084 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Rita I Cáceres-Charneco, Jorge Ortiz-Zayas

*University of Puerto Rico-Río Piedras Campus, San Juan, Puerto Rico, USA*

### Conservation and Management of the Puerto Rican Crested Toad (*Peltophryne lemur*): Pond Conditions and Tadpole Growth

The Puerto Rican Crested Toad (*Peltophryne lemur*) is the only endemic toad in the Caribbean island of Puerto Rico. Currently listed as threatened, the goals for the conservation of the natural population include monitoring the breeding site and the success of the breeding events. The main natural breeding population of *P. lemur* is located in the Guánica Commonwealth Forest (GCF), a subtropical-dry forest in the south-west side of the island. Adults breed in three temporary coastal ponds, Aroma,

Atolladora and Tamarindo. Pond abiotic conditions have been known to affect tadpole time to metamorphosis and tadpole size. In 2013, we monitored pond characteristics and we placed tadpole enclosures in each pond in order to measure tadpole length and time to metamorphosis. A principal component analysis showed that all ponds were different. Tadpoles metamorphosed between 23 and 26 days and Aroma and Atolladora had longer tadpoles than Tamarindo pond. Although tadpole growth was not measured directly in 2014, pond conditions were very different from those measured in 2013. This reflects the importance of treating each breeding event as a unique event and that monitoring should be continuous during the breeding season. No breeding events were recorded in 2015 due to the reduction in precipitation during the strong El Niño year. The persistence of this population in the GCF will require more coordination between the agencies that protect this species and will require active management practices in order to adjust to the given conditions of each event.

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**0468 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016**

Joshua Cahal

*Southeastern Louisiana University, Hammond, Louisiana, USA*

**Cladistic Biogeography of North American Dinosaurs**

The Mesozoic had a rich diversity of animals that included some of the largest megafauna in Earth's history. Virtually all megafauna and much of the diversity of smaller terrestrial vertebrates from this era come from a single clade, the Dinosauria. The Mesozoic dinosaurs are one of the most heavily studied extinct organisms and persisted through a geologically dynamic part of Earth's history (the breakup of Pangea, development of the Western Interior Seaway, etc.). These three factors (rich diversity, substantial amount of research, geologically dynamic history) make dinosaurs a model organism for biogeographical studies of fossil organisms. Despite this, no study has attempted to discover areas of endemism for dinosaurs, the operational taxonomic unit for biogeographical studies, using analytical means. On top of this, most studies have relied on direct interpretation of fossil distribution to test biogeographic hypotheses and very few have employed cladistic biogeography as a method to test and develop biogeographic hypotheses. The studies that use cladistic biogeography tend to focus on large spatial and temporal scales (i.e. continents and epochs). Presented here is the first study to use cladistic biogeography to study dinosaur distributions on the smallest possible temporal and spatial scales, focusing primarily on Late Cretaceous North American biotas. Results yielded well resolved general area cladograms that can be used not only to test hypotheses about the spatial distribution of these animals but the temporal distributions as well.

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**0631 NIA BEST STUDENT PAPER, Salon A-C, Friday 8 July 2016**

Bárbara Calegari[1], Richard Vari[2], Roberto Reis[1]

*[1]Museu de Ciências e Tecnologia, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil, [2]National Museum of Natural History, Smithsonian Institution, Washington, District of Columbia, USA*

## Phylogenetic Systematics of the Driftwood Catfishes (Siluriformes: Auchenipteridae): A Combined Morphological and Molecular Analysis.

The Auchenipteridae, a Neotropical family of inseminating catfishes, have an extensive and confusing taxonomic history with divergent proposed phylogenetic hypothesis. Several studies developed since 1766 involving descriptions of species generated controversial results about the composition of the family and their interrelationships. A comprehensive, densely sampled phylogenetic study of the species relationships of the Auchenipteridae is herein proposed based on combined, morphological and molecular datasets. The present study aimed to include most species of Auchenipteridae (109 species), as well as multiple members of siluriform families outgroup (28 species, the Ariidae, Aspredinidae, Cetopsidae, Diplomystidae, Doradidae, Mochokidae, and Pimelodidae) to embrace the diversity of forms within Siluriformes. Thus, provided a robust comparison between the taxa and utilizes information from both, morphology (261 characters) and molecular data (2814 characters based on four genes: *COI*, 16S, *RAG2*, and *MyH6*). The strict consensus of parsimony analysis based on combined data corroborated the monophyly of the superfamily Doradoidea, the family Auchenipteridae and its two subfamilies, Centromochlinae and Auchenipterinae. The new classificatory proposal increases the number of tribes in Auchenipteridae from two to nine, based on evidence of major groups within Auchenipterinae: Liosomadoradini, Trachelyopterini, Asterophysini, Auchenipterini, and Ageneiosini; and in Centromochlinae: Gelanoglanini, Gephyromochlini, Centromochlini, and Glanidini. All auchenipterid genera were recovered as monophyletic except for *Centromochlus*, *Glanidium*, *Tatia* and *Trachycorystes*. To address these issues, new genera are being proposed with a nomenclatural reorganization of the species of *Tatia* and *Centromochlus*.

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**0743 AES GRUBER AWARD, Balconies J & K, Thursday 7 July 2016**

Hannah Calich, Neil Hammerschlag

*University of Miami, Miami, Florida, USA*

## Quantifying Distribution and Environmental Preferences of Apex Predatory Sharks in the Western Atlantic Ocean

Great hammerhead, tiger, and bull sharks are either threatened with extinction or vulnerable to exploitation throughout their range due to interactions with commercial fisheries. Identifying critical habitats and environmental preferences of these species can provide important information for wildlife managers to implement regulations to reduce shark interactions with fishing gear. In the present study, we used spatial

analysis to analyze data from over 100 great hammerhead, tiger, and bull sharks instrumented with satellite tags in the Western Atlantic Ocean and Gulf of Mexico. Using these data, we identified shark distribution patterns and correlated them with environmental data obtained through remote sensing. Habitat preferences were then overlapped with data on regional fishing intensity. This permitted us to identify areas and times where these sharks were vulnerable to fisheries interactions.

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**0156 ASIH STOYE AWARD CONSERVATION, Salon F-H, Friday 8 July 2016**

Alex Cameron[1], Carl Anthony[1], Cari Hickerson[1], Robert Page[2]

*[1]John Carroll University, University Heights, Ohio, USA, [2]Saint Benedict Saint John's University, Collegeville, Minnesota, USA*

**Effects of Habitat Fragmentation on the Spatiotemporal Genetic Structure of the Eastern Red-backed Salamander (*Plethodon cinereus*)**

Dispersal is a fundamental evolutionary process that serves as a mechanism by which local populations remain connected through space. As habitat loss and fragmentation continues to remain as one of the most widespread threats to biodiversity, it is imperative to understand how dispersal patterns are affected as a result of anthropogenic modification of the environment. Using a panel of 10 novel microsatellite loci, we estimated gene flow patterns among populations (n = 8) of Eastern Red-backed Salamanders (*Plethodon cinereus*) in a previously unstudied portion of the species range. Four focal populations reside in a highly populated urban center (Cuyahoga Co., OH) while the remaining four focal populations persist in relatively undisturbed habitat within the Allegheny National Forest (Elk, Forest, McKean, and Warren Cos., PA). Results of this study indicate how genetic diversity within populations, as well as genetic structuring among populations, is influenced by habitat matrix quality. Additionally, we investigated gene flow on two different evolutionary time scales among each set of populations respectively, in order to investigate the idea that contemporary genetic structuring may be a result of historical processes rather than due to recent habitat fragmentation.

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**0160 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT**

Alex Cameron, James Watling

*John Carroll University, University Heights, Ohio, USA*

**Can Species Distribution Models Predict Abundance?**

Species distribution modeling has emerged as a powerful tool in conservation biology because the models can be applied to questions regarding forecasting range shifts due to

climate change, the identification of conservation gaps across geographic ranges, and guiding field surveys. Although some work has focused on the ability of species distribution models (SDMs) to predict organism abundance, this application remains relatively unexplored. In this study, we developed ensemble SDMs for the Eastern Red-backed Salamander (*Plethodon cinereus*) spanning the entire geographic range as well as a subset of the range located in the Allegheny National Forest (ANF, Pennsylvania, USA). Predictions of the SDMs generated at both scales were evaluated using both traditional cross-validation methods, and a set of 59 independent occurrence points collected within the ANF. Each point in the validation dataset represents a 5x5m plot that was systematically sampled to estimate local abundance. The use of the independent data set was twofold: 1) generate robust estimates of model accuracy, and 2) evaluate whether estimates of environmental suitability from SDMs correlated with abundance. We tested for differences in SDM performance for local versus range-wide models to identify the model that best predicted local abundance.

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**0396 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H, Thursday 7 July 2016**

D. Cooper Campbell, Kyle R. Piller

*Southeastern Louisiana University, Hammond, Louisiana, USA*

## Let's Jump In: A Phylogeographic Study of the Great Basin Springfishes and Poolfishes, *Crenichthys* and *Empetrichthys* (Cyprinodontiformes: Goodeidae)

*Crenichthys* and *Empetrichthys* are two genera of goodeid fishes that are poorly studied and lack clear taxonomic distinction in terms of their species and subspecies status. Many of the members of these two genera are federally listed as endangered due to anthropogenic impacts and their disjunct distribution across the Great Basin. As a result, clarification of the taxonomy of these populations has been limited by the constraints on specimen acquisition due to conservation concerns. Most recently, with the cooperation of natural resources agencies, we obtained tissue samples for 18 different populations inclusive of nearly all species and subspecies. The objective of this study was to examine the phylogenetic relationships of the populations, subspecies, and species of *Crenichthys* and *Empetrichthys* using both mitochondrial and nuclear markers analyzed using Bayesian and Maximum Likelihood inferences. We also examined genetic variation within and between populations, estimated divergence times, and generated haplotype networks. The results of this study represent a first step towards understanding the evolutionary history and taxonomic diversity of this understudied group of fishes.

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**0552 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Sean Canfield, Brian Bowen

*University of Hawaii at Manoa, Honolulu, HI, USA*

### Population Genetic Structure and Connectivity in the California Horn Shark (*Heterodontus francisci*)

The California horn shark (*Heterodontus francisci*) is a small, benthic shark inhabiting the East-Pacific coastline from California to Mexico. This species is known to maintain small home-ranges of approximately 1,000 square meters as adults and exhibit extremely high levels of site-fidelity. How these behaviors influence population-genetic structure is unknown, although there is some morphological evidence to indicate that the cohorts on the California mainland may be reproductively isolated from the Santa Catalina Island (CA) population - separated by only 20 kilometers of deep water. To assess population connectivity in this species, samples were collected from near-shore locations along the California mainland and from Santa Catalina Island. Using a genomic sampling technique called double-digest RADseq (ddRAD), hundreds of single-nucleotide polymorphisms from across the genome were identified and used to estimate connectivity and population structure between putative populations.

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**0578 SSAR SEIBERT AWARD ECOLOGY, Galerie 3, Thursday 7 July 2016**

Stefani Cannon, Thomas C. LaDuke

*East Stroudsburg University, East Stroudsburg, PA, USA*

### Niche Partitioning by Shelter Site Selection in Lowland Tropical Tree Frogs of Northeastern Costa Rica

Few studies have considered the need of arboreal frogs to avoid predators while "sleeping". Here, we examine the ways that arboreal frogs (Hylidae, Eleutherodactylidae) in the lowlands of Costa Rica specialize in particular daytime shelter microhabitats. Some species shelter in unfurling leaves of large-leafed tropical plants; others have been observed "sleeping" on the surfaces of the leaves of large-leafed plants. In this study, we assess the positions of eight species of arboreal frogs with reference to shelter habitat and microhabitat. We identify two fundamental positions: 1) ectophyllic- "sleeping" attached to the flat surface of a mature leaf, and 2) endophyllic- "sleeping" within the confines of an unfurling leaf. Ectophyllic individuals were found either on the underside of the mature leaf, or on top of the mature leaf. There were more endophyllic individuals (104 frogs) found compared to ectophyllic individuals (90 frogs) and some species showed a strong preference for a specific sleeping position. There were other distinctions in sleeping microhabitat selection based on species, including a difference in the height of the frogs above the ground ($p<0.001$), as well as differences in the leaf shape of the leaves used as shelter sites. Shelter sites were checked for returning individuals and it was found that these frogs use a shelter shifting strategy, changing

sites from one day to the next. While these frogs spend their daytime sheltering, various predators seek them out. We hypothesize that these predators heavily influence microhabitat selection and the use of a shelter shifting strategy by frogs.

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**0573 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Diego Cardeñosa[1], Andrew Fields[1], Stan Shea[2], Maxwell Marsh[1], Jessica Quinlan[1], Elizabeth Babcock[3], Kevin Feldheim[4], Demian Chapman[1]

*[1]Stony Brook University, Stony Brook, NY, USA, [2]Bloom Association, Hong Kong, Hong Kong, [3]University of Miami, Miami, FL, USA, [4]Field Museum of Natural History, Chicago, IL, USA*

## Shark Species Composition and Proportion in the Guangzhou Dried-Seafood Market

Shark populations around the world are threatened by the high demand for their fins in Asian countries. The molecular identification of processed shark products has proven to be challenging, due to the level of degradation of the DNA. This lack of detailed species-specific data has hindered the adoption of management regulations of the shark trade on a global scale. Here, we describe the species composition and proportion of shark species in the Guangzhou dried-seafood market by using a novel multiplex PCR mini-barcode assay and a Bayesian statistical model. The analyzed samples (n= 392) comprised 24 different chondrichthyan species with blue sharks (*Prionace glauca*; 36.22%), silky sharks (*Carcharhinus falciformis*; 11.73%), smooth hammerheads (*Sphyrna zygaena*; 9.44%) and scalloped hammerheads (*S. lewini*; 5.36%) being the most common species, representing 63% of the market. These results highlight the need of species-specific based regulation since the market is focused on a small subset of vulnerable species. As these highly vulnerable species become less abundant and more regulated, the market will likely keep shifting towards more productive and less regulated species such as blue sharks.

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**0287 General Herpetology, Galerie 3, Thursday 7 July 2016**

Michael Cardwell

*California State University, Sacramento, CA, USA*

## Does drought drive rattlesnakes into yards looking for water? Not in these populations.

Multi-year radiotelemetry studies were carried out at three California sites involving two species of *Crotalus* and behavior was correlated with meteorological data to assess the effect of drought on behavior. *Crotalus scutulatus* behavior in the Mohave Desert during a rainless year was compared to two years with precipitation at or above mean. *Crotalus oreganus* behavior was assessed at two locations during a long-term regional

drought. Data suggest that rainfall deficits do not affect behavior until local conditions reduce prey availability. Despite regional conditions, when local rainfall allowed primary producers to flourish, prey species reproduced in abundance and rattlesnakes reproduced as well, often annually by *C. oreganus*. During extended hot dry weather, *C. oreganus* in foothill habitat reduced movement and remained coiled on the surface in dense vegetation on north-facing slopes. During severe local drought that dramatically reduced prey availability, daily movement of *C. scutulatus* was reduced and courtship was eliminated while animals remained coiled on the surface away from wind and sun. Previous studies identify the mechanism of greatest water loss by snakes in arid climates as cutaneous evaporation and indicate that most of the snakes' water requirement is satisfied by the water content of their prey. Contrary to the popular belief that drought drives rattlesnakes into yards looking for water, these observations suggest that water-stressed rattlesnakes remain in their home ranges and move less, not more, minimizing exposed skin by remaining tightly coiled and even partly buried (*C. scutulatus*) on the surface, where they may still ambush scarce prey.

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**0621 Turtle Ecology, Salon A-C, Sunday 10 July 2016**

Matthew Carey, David Rostal

*Georgia Southern University, Statesboro, GA, USA*

### Clutch Effects on Growth Rates in Gopher tortoise, *Gopherus polyphemus*, Hatchlings

Incubation temperatures have an effect on the sex and size of hatchling turtles, tortoises and other reptiles. They have also shown to have an effect on hatchling survival and size after 120 days of hatching as well as post hatching performance. This study is being conducted to look at gopher tortoise hatchling metabolic and growth rates within and among different clutches. Nests and hatchlings were collected from at George L. Smith State Park and Fort Stewart Army Reserve in southeast Georgia during August of 2015. Nest temperatures were recorded throughout incubation in the field. The hatchlings were incubated under natural conditions, so this study can serve as a baseline to gather information on clutch effect on growth in the lab. Growth and metabolic rates will be reported. The interaction between nest temperature, clutch effect and hatchling growth rate will be analyzed. I will analyze the growth and metabolic rates between and within clutches to test for differences in these aspects. I will also analyze the effect nest temperature has on the selected temperature in a laboratory thermal gradient. Having this data will give us insight to future problems as climate change can affect future nests temperatures. This can also give us insight on how to improve management for this species as it is a keystone species in its habitat.

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**0755 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Aaron Carlisle[1], Wade Smith[2], Salvador Jorgenson[3]

*[1]Stanford University, Pacific Grove, California, USA, [2]University of British Columbia, Vancouver, British Columbia, Canada, [3]Monterey Bay Aquarium, Monterey, California, USA*

### Insights into the natal origin and early life history of sharks from intrinsic chemical markers within vertebrae

Sharks, skates, and rays (elasmobranchs) exhibit complex patterns of movement and habitat use which often vary by sex, season and ontogenetic stage. As a result, there remain large gaps in our understanding of the life history of most species, particularly among more mobile and pelagic species. Migratory pathways, environmental history, and source populations have been successfully reconstructed from chemical markers in the otoliths of teleost fishes, but this approach has only recently been applied to studies of elasmobranchs. Electronic tagging has demonstrated that elasmobranchs often exhibit a high degree of site fidelity to feeding, breeding or nursery areas. Differences in environmental conditions and feeding among these areas can be reflected in the chemical composition of elasmobranch vertebrae, providing valuable markers of individual, age- and sex-specific differences in geographic origins and habitat use. Here, we discuss the utility of intrinsic chemical markers deposited in elasmobranch vertebrae and apply vertebral elemental and isotopic composition to infer patterns of maternal and juvenile habitat use in white sharks (*Carcharodon carcharias*). Analyses of vertebral chemistry offer a promising tool for the study and conservation of highly mobile shark and ray populations.

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**0042 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

John Carlson, Enric Cortés

*National Marine Fisheries Service, Panama City, FL, USA*

### Estimates of Maximum Rate of Population Increase for Sawfish: Do Sawfish have the Highest Risk of Extinction?

Sawfish are recognized as one of the world's most endangered marine fish. All species are classified as highly threatened with extinction based on IUCN criteria. Sawfishes are captured as a target species and bycatch in a variety of fishing gears primarily due to their toothed rostra being easily entangled. In addition, they occur in shallow coastal waters associated with threatened mangrove habitats. Sawfish are currently considered to have low productivity and limited ability to rebound from exploitation. While productivity has been compared to exploited shark species, no comparison of extinction risk has been made among sympatric batoids. Acknowledging that many species of tropical and subtropical batoids are data poor, we estimated the extinction risk by calculating the maximum rate of population increase (rmax) using several variants of the Euler–Lotka model with different data requirements. Our results suggest sawfish have

moderate levels of productivity, with one species, narrow sawfish, among the most productive batoids. Species with higher risks of extinction include pelagic batoids such as manta, mobulid and cownose ray. Larger dasayatid rays with low fecundity also exhibited low productivity. Sawfish have the ability to recover providing the availability of habitat and fishing-related mortality is low.

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**0059 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Malle Carrasco-Harris[1], Judith Cole[1], Steve Reichling[2]

[1]*University of Memphis, Memphis, TN, USA,* [2]*The Memphis Zoo, Memphis, TN, USA*

**The Spatial Ecology of Urban Copperheads (*Agkistrodon contortrix)***

As urbanization continues, it becomes increasingly important to understand the effects of changing and fragmenting environments on limited mobility organisms. Although the home range and activity of *Agkistrodon contortrix* has been characterized in natural areas, little is known regarding the species' adaptations to urban forest fragments. This study examines the spatial ecology of *A. contortrix* in urban environments by conducting radio telemetric research in a historically isolated urban park. Captured adult snakes from Overton Park, Memphis, Tennessee, were implanted with radiotransmitters and tracked periodically to collect location coordinates, environmental and behavioral data. Spatial data was analyzed using Minimum Convex Polygon (MCP), Kernel Density Estimators (KDE), and Local Convex Hull (LoCoH) methods to provide home range and core area usage estimation. Average home ranges (MCP) for males (0.79 hectares) and females (0.66), and core area usage estimates (95% /50% KDE) for males (1.02/0.30) and females (0.93/0.28) were less than previously reported. Local convex hull also suggested extremely small home ranges for males (0.40) and females (0.39) excluding much geographic area not used by the snakes. Preliminary analysis and comparison of spatial data suggests urban snakes have smaller home ranges than rural conspecifics in previous radio telemetric studies. The addition of a rural site and year long tracking of animals will provide further insight into the spatial ecology and habitat usage of *A. contortrix*.

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**0035 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Jeffrey Carrier[1], Jillian Morris[3], Derek Burkholder[4], Judith Gregoire[5], Alena Ellerbee[2], Sarah Maschal[2]

*[1]Albion College, Albion, MI, USA, [2]Monroe County Schools, Monroe County, FL, USA, [3]Sharks4Kids, Ft. Lauderdale, FL, USA, [4]Nova Southeastern University, Halmos College of Natural Sciences, Guy Harvey Research Inst., Dania Beach, FL, USA, [5]Seacamp Association, Inc., Big Pine Key, FL, USA*

## Expanding Opportunities for Young Women in Shark Research: A STEM Initiative in the Florida Keys

Twelve sixth and seventh grade women from Monroe County Public Schools in the Florida Keys competed to participate in an on-going research project studying age, growth, and movement of nurse sharks (*Ginglymostoma cirratum*). Participants were selected by their teachers on the basis of an essay detailing their interest in shark biology and the role of such an experience in their perception of their eventual career goals. The program was developed to address the continuing need to attract women at an early age to the marine sciences by demonstrating the fundamental techniques for conducting basic research and familiarizing them with the capture, management, and release of large sharks. Five of the facilitators were men, and five, including the boat captains, were women, deliberately selected to demonstrate that the necessary skill sets were independent of sex. Following a lecture describing basic shark biology, tagging demonstrations were performed. Participants were then each given their own small nurse shark for tagging and release. The remaining days were spent capturing and tagging sharks from the Big Pine Key area. Twenty-four nurse sharks, four blacktips, two lemons, and one bull were captured. All were measured, tagged and were released. All work was done by participants. Immobilization was tasked to facilitators. A pre-test and post-test evaluation measured both learning and attitude changes during the experience and were overwhelmingly favorable: "This experience showed hands-on application to marine science (and) made me think of reasons why sharks are not scary and why there are so many misconceptions."

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**0998 HL GRADUATE RESEARCH AWARD, Galerie 2, Thursday 7 July 2016**

Nicholas Caruso[1], Jeremy Jacobs[2], Leslie Rissler[3]

*[1]University of Alabama, Tuscaloosa, AL, USA, [2]Smithsonian National Museum of Natural History, Washington, DC, USA, [3]National Science Foundation, Washington, DC, USA*

## Using a Reciprocal Transplant Experiment to Quantify the Effects of the Abiotic Environment on Montane Salamander Life History

The rates of individuals entering (births, immigration), leaving (deaths, emigration), and transitioning (e.g., from immature to mature) are the core measureable units for understanding changes in population dynamics. However, these values are not static and depend on abiotic and biotic factors that vary both spatially and temporally. To determine how the abiotic environment influences survival, growth, maturation, and reproductive condition of a montane endemic salamander (*Plethodon montanus*), we used a reciprocal transplant experiment along an elevational gradient. We found that the probability of survival was greatest for animals that started with a higher body condition, those that originated from low elevations, and, those that were transplanted to mid or high elevations. Animals that started off with a lower body condition had a more positive growth rate and this relationship was greatest for animals transplanted to mid elevations compared to the elevational extremes. Likewise, individuals that began the experiment with a lower body condition and those animals that originated from mid and low elevations had a more positive rate of body condition change. Lastly, males that had a more positive body condition had greater reproductive condition. Though it has been posited that abiotic conditions generally determine a species' pole-ward (and therefore upper-elevational) range limit, our results support the opposite trend in which abiotic factors are a greater constraint at the southern or lower-elevational range edge. These results provide quantifiable estimates of abiotic constraints in montane salamanders and can inform predictions about how future climate changes may affect life history and distributions.

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**0094 NIA II, Galerie 3, Sunday 10 July 2016**

Tiago Carvalho[5], Roberto Reis[3], John Friel[2], Jonathan Baskin[4], John Lundberg[1]

*[1]Academy of Natural Sciences, Philadelphia, PA, USA, [2]University of Alabama, Tuscaloosa, AL, USA, [3]Pontificia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil, [4]California State Polytechnic University, Pomona, CA, USA, [5]Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil*

## High-Resolution Computed Microtomography of Two New and Rare Species of Banjo Catfishes from Venezuela (Siluriformes: Aspredinidae: Hoplomyzontini)

The Hoplomyzontini is a group of banjo catfishes inhabiting mostly river channels. The group has eight described and several undescribed species. Some hoplomyzontines are miniaturized (e.g., *Micromyzon akamai*) and have features associated with size reduction. Here we describe two new miniature species of Hoplomyzontini from Venezuela, putatively included within *Hoplomyzon* and *Micromyzon*. The new species of *Hoplomyzon* is known by three specimens (18.5 mm maximum SL) from tributaries to Lake Maracaibo, and the new *Micromyzon* by two specimens (15.6 maximum SL) from the lower Orinoco River. Due to their rarity, non-invasive High-Resolution X-Ray Computed Tomography (HRXCT) was used to study their osteology and provide evidence for inclusion in a phylogeny of the Aspredinidae. The new *Hoplomyzon* differs from all congeners by the absence of bony knobs on the ventral surface of the premaxilla, and by several features of its soft anatomy. The new *Micromyzon* differs from its only congener by an open posterior cranial fontanel, the absence of lateral plates on the anterior portion of the body, and the larger posterior process of the cleithrum. We included both new species and all remaining described hoplomyzontines in a phylogenetic framework using a combined dataset (morphology+molecules) and recovered a (*Hoplomyzon* (*Micromyzon* (*Dupouyichthys*, *Ernstichthys*))) relationship. Some putatively plesiomorphic character states observed in *Micromyzon* are homoplastic and appear to be heterochronic features. We demonstrate that HRXCT is an important tool for the discovery of novel phylogenetic information from rarely sampled specimens, and for documenting osteological details on extremely size-reduced taxa such as hoplomyzontines.

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**0157 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Mollie Cashner

*Austin Peay State University, Clarksville, TN, USA*

## Lineage sorting and ontogeny in the ASIH - impacts of the society on professional development

As part of the early-childhood-development membership in ASIH, I was brought along to meetings nearly every year from ages 2 - 14. Although not what my peers were doing on their summer vacations, those meetings were formative experiences and contributed

strongly to my understanding of: (1) careers studying the "lower vertebrates"; (2) professional attire (beards were as important then as they are today); (3) family (I thought all men studied fish); and (4) friendship. Despite a strong familial connection to the society, I never thought I'd become a professional member. However, the lessons learned and the insight gained during my early exposure have certainly contributed to my professional development and career path. Just as when I was a small child, the annual meeting feels more like a family reunion and it is exciting to meet the new additions each year.

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**0398 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Gary Casper[1], Stefanie Nadeau[2], Ulf Gafvert[3], John Peterson[4]

*[1]UWM Field Station, Saukville, Wisconsin, USA, [2]Great Lakes Ecological Services, Slinger, Wisconsin, USA, [3]National Park Service, Great Lakes Network, Ashland, Wisconsin, USA, [4]University of Wisconsin, Platteville, Wisconsin, USA*

## An Improved Method for Detecting Blanchard's Cricket Frog, *Acris blanchardi*, in the Upper Midwest

Blanchard's Cricket Frog, *Acris blanchardi*, is at the northern limit of its range in Minnesota and Wisconsin, where it is listed as an Endangered Species. It appears to have retracted its range southward, a decline attributed to climate change, possibly exacerbated by habitat loss and alterations, including chemical contaminants. To date, surveys for this small, cryptic, species have relied mostly on call survey methodology such as that used by state frog monitoring programs. These programs typically require 3 surveys be run across the season, with only 2 falling within the calling period for *A. blanchardi*. This low sample size coupled with low detectability by this method results in many false absences being reported (the species is missed half the time on average), low confidence in survey results, and an inability to model occupancy trends with good confidence. Our results indicate that to meet 95% confidence in detecting the species by call surveys at least 9 visits are required. Regulatory guidance for proving absence currently requires only 5 visits. We therefore developed a semi-automated method to overcome low sample sizes using automated recording systems, and further developed a protocol using automated call recognition with a proofing step that allows for >95% confidence in detecting the species if present. We discuss how this methodology can be, a) applied to other species, b) applied in remote locations where site visits are expensive, b) used to improve inventory and monitoring programs, and d) used to better assess regulatory requirements where this species is protected.

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**0068 Fish Ecology II, Salon A-C, Saturday 9 July 2016**

Fabio Castagnino[1], Ana Alegre[2], John G. Ramirez[3], Alfonso Alonso[4], Ximena Velez-Zuazo[1]

*[1]Center for Conservation Education and Sustainability, Smithsonian Conservation Biology Institute, Lima, Peru, [2]Instituto del Mar del Perú, Lima, Peru, [3]Instituto de Ciencias del Mar de Barcelona, Barcelona, Spain, [4]Center for Conservation Education and Sustainability, Smithsonian Conservation Biology Institute, Washington, DC, USA*

**Individual-based analysis evidences dynamic functional roles of marine fishes**

Organisms influence the structure, dynamics and trajectory of natural systems. These functional roles are the evolutionary result of complex interactions between individual traits and the characteristics of the environment. A better understanding of how these roles are determined and distributed in a community could enhance our capabilities to make good conservation decisions. Previous studies assess functionality using diversity indexes with the species identity as the fundamental unit of analysis, potentially masking the influence of community-level traits and environmental parameters over the function of individuals. Here, we propose an individual-based approach to investigate the roles that organisms play in a marine community, focused in their trophic function, and apply it to a fish assemblage established on an artificial reef in the southeastern Pacific. We analyzed the stomach contents and morphometrics of 199 individuals from 18 species. Through multivariate regression and ordination analysis, we used the diet as a proxy of the trophic function and (i) explored its relation with functional traits and spatial-temporal environmental characteristics and (ii) analyzed the distribution of the functions within the assemblage. We found that the function of an individual is not only determined by its species identity but also by community-level traits and environmental parameters. The distribution of functions evidenced a fish community with high redundancy and, likely, adaptability. Inter-annual environmental changes are suggested to play a main role in the dynamics of the marine community. Our approach offers fine-scale insights of the roles of individuals with potential implications on regulation and management of artisanal fisheries.

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**0555 AES Morphology & Reproduction, Balconies L & M, Friday 8 July 2016**

Jose I. Castro[2], Keiichi Sato[2], Ashby B. Bodine[2]

*[1]NOAA/NMFS, St. Petersburg, Florida, USA, [2]Okinawa Churashima Research Center, Okinawa, Japan*

**A Novel Mode of Embryonic Nutrition in the Tiger Shark, *Galeocerdo cuvier***

How are tiger shark embryos nourished to large size without a placental connection? Tiger sharks belong to the family Carcharhinidae, and all carcharhinid sharks are placental with the exception of the tiger shark. The aim of this study was to test the hypothesis that tiger shark embryos are nourished to large size by imbibing a clear uterine fluid found in their egg cases. Based on weights of fertilized eggs and of term

embryos, the tiger shark is a matrotrophic species, and its embryos can reach gains of 2119% in wet weight and 1092% in dry weight during gestation. By measuring the total energy content of the fluid in the egg case by chemical oxygen demand (COD), the authors demonstrate that clear liquid in the tiger shark egg case is an energy-rich embryotrophe that nourishes the embryos to large size. The term embryotrophy is suggested for this process. The process appears to be an adaptation for producing large broods of up to 70 young of relatively large size.

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**0282 Amphibian Reproduction & Herp Conservation, Galerie 3, Saturday 9 July 2016**

Alessandro Catenazzi, Robin W. Warne

*Southern Illinois University Carbondale, Carbondale, IL, USA*

**Secrets of the marsupial frogs: maternal nutrient transfer in a direct developing species**

Amphibians exhibit a stunning diversity of reproductive modes ranging from aquatic larvae to terrestrial, direct developing offspring. Marsupial frogs display one intriguing reproductive mode in which females carry eggs adhered to their dorsum or enclosed in a well-vascularized, sealed dorsal brooding pouch. In some species the eggs hatch as tadpoles, but in most species they undergo direct development and emerge as froglets. While anurans are generally considered to be oviparous with lecithotrophic eggs (i.e., the embryo receives no nutrition from the mother other than yolk), the extensively vascularized membrane of the brood pouch in some direct developing marsupial frogs suggests that there may be opportunities for nutrient transfer. We explored the hypothesis that females of the direct developing *Gastrotheca excubitor* from southern Peru provide nutrition to developing embryos. We used carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotopes to track nutrient allocation in gravid females, and to test if there is maternal nutrient transfer to developing embryos. Through feeding gravid marsupial frogs insects labeled with a $^{13}C$ labeled fatty acid and a $^{15}N$ labeled amino acid, we found that embryos and maternal tissues all exhibited significant increases in $\delta^{13}C$ and $\delta^{15}N$ values. Embryo mass increased with developmental stage, providing further support for the hypothesis of maternal nutrient transfer. These results suggest that in addition to gas exchange, the vascularized membrane of the brood pouch also provides a means for maternal nutrient transfer, in contrast to previous work that had found no evidence for transfer in *Gastrotheca* species that lay feeding tadpoles.

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**0966 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Galerie 3, Friday 8 July 2016**

Corey Cates, Daniel Warner

*Auburn University, Auburn, AL, USA*

### Long Term Effects of Incubation Moisture on Desiccation Rate in the Brown Anole Lizard (*Anolis sagrei*)

Interactions between a developing embryo and its environment can have significant effects on an individual's phenotypes. Developmental plasticity is considered adaptive when the environment induces phenotypes beneficial in that environment. However, because the environment can change throughout an individual's lifespan, understanding long-term effects of plastic responses during development is important. In this study, we use lab and field experiments to quantify the long-term effects of incubation moisture on desiccation rate in lizards (brown anole, *Anolis sagrei*). We have shown previously that incubation moisture has dramatic effects on desiccation rate of hatchling lizards, which in turn influences offspring survival in the field depending upon their post-hatching moisture environment. For example, egg incubation under dry conditions (-600 kPa) produces offspring with significantly lower rates of desiccation than does incubation under wet conditions (-30 kPa). Offspring from dry incubation conditions also have greater survival in dry post-hatching environments than do those from wet incubation conditions. Monitoring lizards via a mark-recapture study in the field, we continued to measure their desiccation rate up to about 1.5 years of age (well into adulthood). Data suggests that lizards lose less overall body mass due to desiccation as they age. Analysis of the survival and desiccation data (both as hatchlings and as adults) allowed us to assess selection on desiccation rates in the wild and assess the long term effects that incubation moisture has on desiccation rate.

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**0140 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Kristen Cecala[1], Lindsey Liles[1], Mary Lou Hoffacker[1], Joshua Ennen[2], Jon Davenport[3], Shawna Mitchell[2]

*[1]University of the South, Sewanee, TN, USA, [2]Tennessee Aquarium Conservation Institute, Chattanooga, TN, USA, [3]Southeast Missouri State University, Cape Girardeau, MO, USA*

### Effect of elevated temperatures on competitive outcomes in desmognathine salamanders

Changing climates have been documented and projected to change the distributions and success of amphibians. Behavior and activity of plethodontid salamanders are closely tied to climate, and desmognathine salamander communities are structured spatially by size and distance to permanent moisture. It is therefore possible that changing climates may also alter ways that individuals within streamside guilds interact. The objective of this project was to assess competitive interactions and outcomes among coexisting

species at ambient and elevated temperatures. We used stream mesocosms to implement a factorial design of conspecific or heterospecific interactions at ambient temperatures or elevated temperatures. Elevated temperature enclosures were warmed 2C with aquarium heaters. At ambient temperatures, we found that smaller community members performed poorly in the presence of a larger congener, but at elevated temperatures, all individuals performed similarly. We also noted that at ambient temperatures, individuals tended to increase in length whereas individuals at elevated temperatures tended to increase in mass while maintaining similar body conditions. Overall, we found that elevated temperatures predicted by climate change may increase animal stress resulting in morphological changes that could have population-level consequences. Changing temperatures minimized the negative effect of a larger congener suggesting that climate change is altering not only individual performance but also the ways that species interact.

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**0940 General Herpetology, Galerie 2, Saturday 9 July 2016**

Luis Ceríaco, Mariana Marques

*Museu Nacional de História Natural e da Ciência, Lisboa, Portugal*

### 170 years of herpetological studies on Gulf of Guinea: a review of the current knowledge on the amphibians and reptiles of the São Tomé & Príncipe islands

The Gulf of Guinea oceanic islands are a remarkable hotspot for vertebrate diversity, with high levels of endemism. The herpetofauna of these islands is an interesting example of this biodiversity. However, our current knowledge on the diversity of amphibians and reptiles of these islands are far to be complete. Several species belong to widely-distributed species-complex, and the cryptic diversity within the islands populations only recently began to be addressed. Due to this several new species have been described in the recent years, while others are currently on the process of being described. This "Linnean shortfall" has several implications on our knowledge on the diversity, ecology and evolutionary patterns of these islands, as well as it undermines any effort to apply successful and appropriated conservation strategies. Herpetological studies on these islands have started in the first half of the nineteenth century. Several important expeditions were made upon the biodiversity of these islands, amphibians and reptiles included. These expeditions resulted in collections that were used by naturalists to study the fauna of the islands. Among these studies, several new amphibians and reptile taxa were described, and while the majority is currently considered as valid, some other have been sunk in synonymy or simply forgotten. However, some of these names are nomenclaturally available and may in fact represent some of the cryptic taxa currently under review. This talk will provide an historical overview of the herpetological studies of the Gulf of Guinea Oceanic islands and address the current situation of our knowledge.

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**0185 Turtle Ecology, Salon A-C, Sunday 10 July 2016**

Ryan Chabot, Katherine Mansfield

*University of Central Florida, Orlando, FL, USA*

### Migratory Ecology and Reproduction in the Florida Green Turtle (*Chelonia mydas*)

The green turtle (*Chelonia mydas*) is a long-lived, highly migratory species that habitually exhibits nest and adult foraging site fidelity. Migration patterns and habitat selection are important factors influencing female condition and reproductive potential. Females utilizing the same nesting beach may differ in fecundity, depending on the foraging aggregation to which they belong. We investigated the relationship between foraging ecology and reproductive investment and output in the Archie Carr National Wildlife Refuge green turtle rookery, which contains, on average, 35% of the green turtle nests laid within the United States each year. We used stable isotope analysis to identify distinct foraging aggregations of females on the shared nesting beach. Skin samples were collected from fifty untracked nesting female green turtles during both the 2013 and 2014 nesting seasons (n=100 total females) and 15 satellite-tracked individuals (2013-2015). We divided individual females into related foraging groups, or clusters, using a Gaussian finite mixture model in R based on stable isotope values of δ13C, δ15N, and δ34S derived from skin samples. Clutch size, egg mass and diameter (2014 only), hatching success, and emerging success were compared across these adult female groupings to evaluate potential differences in reproductive investment and output among foraging aggregations. This study provides insight into the efficacy of using green turtle fecundity as a proxy to assess resource limitations and impacts at distant feeding locations. By evaluating the impact of foraging habitats on productivity, we can identify conservation priority regions which are crucial for effective management of the species.

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**0074 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon F-H, Friday 8 July 2016**

Tyler Chafin, Marlis Douglas, Michael Douglas

*University of Arkansas, Fayetteville, AR, USA*

### Reduced-representation genomics reveals reticulate evolutionary history and species boundaries in *Gila* spp. of Colorado River

The Colorado River Basin (CRB) is the most threatened riverine system in North America, due largely to persistent drought and anthropogenic modifications. Historically, its isolation and harsh environment have provided a theater for diversification for several unique groups of fishes, such that distinctive local adaptations arose over time to cope with these demanding and stochastic conditions. However, the effectiveness of these adaptations has been truncated by human habitat modifications, and by a prolific introduction of non-native competitors to a system with already

depauperate levels of intraspecific competition. Unique adaptations are most apparent within the *Gila* spp. (Cyprinidae) assemblage, manifested as multiple ecologically and morphologically distinct species, yet phylogenetic discordance and reticulation suggests a history of gene flow and blurred species boundaries. Here, using next-generation sequencing of reduced genomic samples (ddRAD), we present a phylogeny of Colorado River *Gila* informed by genomic insights, investigate historical interspecific introgression, and apply the multispecies coalescent to facilitate species-delimitation within the *Gila robusta* complex of the lower Colorado River Basin.

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**0075 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Tyler Chafin, Bradley Martin, Steven Mussmann, Marlis Douglas, Michael Douglas

*University of Arkansas, Fayetteville, AR, USA*

**FRAGMATIC: *In silico* locus prediction and its utility for RADseq project design and optimization**

Design of ddRAD projects is hindered by the difficulty to probabilistically predict locus recovery and degree of wasted sequencing effort on overly -redundant regions. Additionally, the recognition motif of selected enzymes may bias library composition by enriching for repetitive elements- detrimentally affecting cost-efficiency. Enzyme choice, together with size-selection range, determine the numbers of recovered fragments, level of multiplexing that can be achieved, and sequence depth across loci. Simulation provides a solution for locus prediction in RAD methods involving complicated library preparation. Here we present an easy to use method written in the Perl programming language that simulates restriction digestion by an arbitrary number of endonucleases on a genome assembly, and compare the accuracy of these predictions across a broad array of organisms.

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**0101 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Prosanta Chakrabarty

*Museum of Natural Science, LSU, Baton Rouge, Louisiana, USA*

**Looking Back to the Future: ASIH at 200, The 2116 Perspective for the next 100 years**

The American Society of Ichthyologists and Herpetologists will be celebrating its 200th anniversary in the year 2116. This futuristic talk will look back over the next 100 years from the perspective of an ASIH member in 2116. These 200th anniversary meetings will be held in the underwater city of New-New Orleans. One may ask: How will ichthyologists and herpetologists study fishes, reptiles, and amphibians over the next

100 years. What will remain of our environment? How will the innovation of a CRISPR/Cas9 gene editing home typewriter (with optional gene drive USB port) in 2020 influence Donald Trump's attempts at winning a second term as president of the United States of North America? How will we study non-GMO gluten free taxa relative to "natural" taxa? Will the study of morphology rise again? Will the ASIH still have the gender and ethnic diversity of a Finnish sauna? All these questions and more will be answered.

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**0794 Fish Ecology I, Salon A-C, Saturday 9 July 2016**

Barry Chernoff, Helen Poulos

*Wesleyan University, Middletown, CT, USA*

### Community Dynamics of Fishes and Aquatic Invertebrates in the Eightmile River, Connecticut

Understanding the dynamical nature of ecological communities is critical for management and conservation. We have been investigating the changes in fish and invertebrate community structure of the Eightmile River in relation to dam removal since 2004. Using multivariate autoregressive model 1 and random forest approaches, we demonstrated that the fish communities above and below the former dam site are in the process of ecological regime shift. In this presentation we show the co-relationship of the fishes and the aquatic invertebrates over time. We use metrics developed by Ives to measure resilience and reactivity. To these metrics we introduce a new metric that measures the ability of a community to return to former conditions following a perturbation of sufficient magnitude to disrupt covariance relationships among members of the community. The new metric partitions species' variance into the portion that is tied up in covariance relationships and the portion that is independent. We show that the ability to of a community to respond to perturbation and remain within the same ecological domain requires sufficient idiosyncratic variance from which to re-establish interspecific ecological linkages.

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**0158 Turtle Ecology, Salon A-C, Sunday 10 July 2016**

Ylenia Chiari[1], Arie van der Meijden[2], Julien Claude[3], Benjamin Gilles[4]

*[1]University of South Alabama, Mobile, AL, USA, [2]CIBIO Research Institute, Vairão, Portugal, [3]University of Montpellier II, Montpellier, France, [4]LIRMM, Montpellier, France*

### Self-Righting Performance and Shell Evolution in Galápagos Tortoises

The giant tortoises inhabiting the Galápagos archipelago represent one of only two surviving lineages of once widespread giant tortoises. Galápagos tortoises have two very distinct shell shapes: either domed, with a rounded carapace, or saddleback, with a

higher anterior opening of the carapace and a more compressed shape on the sides. The extension of the neck is different in the two morphotypes due to the distinct anterior opening of the shell: saddleback tortoises can extend their necks more than domed ones. It is currently not clear if these different morphologies are adaptive and for which function(s). One of the hypotheses that have been proposed and never tested so far is that shell shapes correlate with different performances in self-righting: saddlebacks generally occur in drier environments with more impervious ground than domed tortoises. Improved self-righting capacity in saddlebacks would prevent animals from dying due to lying on their back for long periods of time at high temperatures. To address this question, we reconstructed the 3D shell shape for 89 individuals belonging to three domed and two saddleback lineages. Center of mass was estimated on a living tortoise and used to simulate differences in self-righting performance between saddleback and domed tortoises on the basis only of their shell shapes. Our results indicate that saddleback tortoises have a higher energetic deficit in self-righting due their less spherical shell morphology. Therefore, if self-righting performance between the two morphotypes is similar, saddlebacks have to achieve this through other morphological adaptations (e.g., longer neck extension).

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## 0455 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016

William Childress, Terrence Tiersch

*Aquatic Germplasm and Genetic Resources Center, Louisiana State University Agricultural Center, Baton Rouge, LA, USA*

### Conservation of Aquatic Species: On-site Cryopreservation from a Mobile Laboratory

Habitat destruction, pollution, and overexploitation are often causes of decline in wild populations. Cryopreservation offers the ability to protect the genetic diversity of wild populations and store genetics for recovery programs. On-site cryopreservation of aquatic species sperm (in nitrogen-vapor shipping dewars) for conservation has been used for more than 30 years. But, due to the size of shipping dewars, most efforts are small scale and can only produce tens of samples. The goal of this project was to create a self-contained mobile cryopreservation laboratory that provides on-site cryopreservation comparable to specialized laboratory facilities. We applied three operational designs in different scenarios: 1) self-contained, working inside the mobile laboratory using generator power; 2) working inside the mobile laboratory using external facilities power; 3) setting up the equipment inside a host facility. Having the capability of using a generator or existing on-site facility power provides the ability to adapt to different working locations. The mobile laboratory can provide on-site cryopreservation comparable to our central laboratory facility. Since May 2015, we traveled more than a combined 2,000 miles collecting fish germplasm from more than 500 males. These included freshwater and saltwater species, and from these males we froze more than 4,000 straws. These trips allowed us to test the operational design and

refine the overall structure of the laboratory. We are currently working with user groups in Arkansas, Louisiana, Texas, and Mississippi, and looking for additional collaborations for future work.

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**0337 AES Conservation & Management I, Balconies L & M, Friday 8 July 2016**

Andrew Chin[2], Michelle Heupel[2], Colin Simpfendorfer[1], William White[3]

*[1]James Cook University, Townsville, QLD, Australia, [2]Australian Institute of Marine Science, Townsville, QLD, Australia, [3]CSIRO, Hobart, TAS, Australia*

## Crossing lines: a Multidisciplinary Framework for Migratory Hammerhead Sharks across Jurisdictional Boundaries

The conservation and management of migratory species is complex and challenging. International agreements such as CITES and CMS provide frameworks to manage highly migratory species, but management can be compromised by lack of data and tractable mechanisms to integrate disparate datasets. Hammerhead sharks (*Sphyrna* spp.) are highly migratory species taken in coastal and oceanic fisheries around the world and are listed in CITES and CMS. A large scale assessment of scalloped hammerhead (*S. lewini*) and great hammerhead (*S. mokarran*) populations across northern Australia, Indonesia and Papua New Guinea was conducted to inform management responses to CITES and CMS. A simple Integrative Assessment Framework for Migratory Species (IAFMS) was devised to systematically incorporate disparate data types across jurisdictions and create a regional synopsis. The IAF amalgamated data from fisheries catch records, fishery independent research, shark control programs, market surveys, BRUVS and citizen science data. Hammerhead populations are segregated by sex and size across the assessment area, with Australian populations dominated by juveniles and small sized adult males, while Indonesian and Papua New Guinean populations contained large adult females. The final IAF assessment stage introduced genetic and tagging data to produce conceptual models of regional hammerhead movement and stock structure. Several viable hypotheses for regional stock structure and movement patterns were produced, but more data are needed to identify the most plausible hypothesis. This work demonstrates a simple conceptual framework for assessing migratory species, and highlights priority areas for management and research of hammerheads in the Australasian region.

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**0036 General Herpetology, Galerie 2, Saturday 9 July 2016**

James L. Christiansen[1], Elliott Jacobson[2], Travis LaDuc[1]

*[1]University of Texas, Biodiversity Collections, Austin, TX, USA, [2]University of Florida, College of Veterinary Medicine, Gainesville, FL, USA*

## An Algae Mediated Shell Disease of Yellow Mud Turtles, *Kinosternon flavescens*, confirmed

Recent histological work and ongoing longitudinal studies of a population of *Kinosternon flavescens* in Presidio and Jeff Davis counties in West Texas has confirmed algae associated shell lesions. While we can not be certain of all aspects of the cause, light microscopy showed that the common filamentous algae *Basicladia chelonium* was present in all stages of the shell lesions. The algae had invaded and disrupted the lamellae of the keratinized portion of the shell with erosion leading to complete loss of the epidermis of the scute and exposure of underlying bone. Four stages of progression of the shell lesion were identified and are easily recognized in the field. We provide data on prevalence of this shell disease among the marked population, association of the algal infection with aquatic tendency of individual turtles, progression of the disease in individual turtles, and typical ages of turtles with onset of the disease and more advanced stages. Our data are consistent with the concept that the most arid-adapted populations of this species may have lost defenses against this common turtle epiphyte. We are examining other populations to determine the distribution of the disease over the range of *K. flavescens*.

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**0166 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Kristina Chyn[1], James Tracy[1], Te-En Lin[2], Lee Fitzgerald[1]

*[1]Texas A&M University, College Station, TX, USA, [2]Taiwan Endemic Species Research Institute, Chichi, Nantou, Taiwan*

## Using Ecological Niche Modeling with Citizen Science Roadkill Data to Project Herpetofaunal Road Mortality Hotspots in Taiwan

The expansion of urban infrastructure, especially roads, bears profound ecological consequences to biodiversity. These consequences on populations, species, and communities can be both direct (wildlife-vehicle collisions) and indirect (habitat change, edge effects, genetic barriers). Roads impact all terrestrial animals, but herpetofauna are known to have the highest levels of road mortality. Ecological impacts of roads are expected to be especially dramatic in island ecosystems due to the high density of roads and vulnerability of endemic species. Surprisingly, little research on the ecological effects of roads has been conducted on islands even though some islands have extremely high densities of roads. Taiwan, for example has about twice the density of roads as USA. Most roadkill studies have focused on direct effects of roads, and relatively few address indirect effects at the landscape scale. To help fill this gap, we created a

predictive roadkill hotspot map for the entire island of Taiwan to elucidate regional landscape effects of roads on wildlife mortality. We analyzed the influence of environmental variables (land cover, roads, waterways) on 8,994 herpetofaunal roadkill presence points from 2004-2015 collected by the Taiwan Road Observation Network citizen science group. We employed the following models to identify roadkill hotspots in association with environmental input variables: Malo's regression method, Ecological Niche Factor Analysis (ENFA), and Maxent. To the best of our knowledge this is the first application of Maxent algorithms to roadkill data. This study elucidates regional and local effects of roads on highly endemic wildlife restricted to an urban island ecosystem.

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**0108 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Galerie 3, Friday 8 July 2016**

Francois Clarac[1], Vivian de Buffrénil[2], Christopher Brochu[3], Jorge Cubo[1]

*[1]UPMC, Paris, France, [2]MNHN, Paris, France, [3]University of Iowa, Iowa, USA*

**Bone ornamentation: An ecological adaption in the history of the crocodylian lineage?**

Though present in “reptiles”, “fishes” and lissamphibians, bone ornamentation, i.e. the honeycomb-like pattern of pits and ridges that occurs on the surface of dermal bones, remains poorly understood. As pseudosuchians (crocodiles and their extinct close allies) both show a large pattern of different lifestyles (terrestrial, amphibious, pelagic) and a high variability in ornamentation development, they consist therefore of an ideal taxa to assess if ornamentation may be involved in an ecological adaptive role. Thus, ornamentation development was quantified in 69 extant and extinct pseudosuchian taxa to their dominant habitat within a phylogenetic framework over 250 Ma of evolution. The phylogenetic analyses reveal a significant correlation between the development of bone ornamentation on the skull roof with both the lifestyle (terrestrial, amphibious, off-shore) and the salinity in which the amphibious and the off-shore forms live(d). A straightforward adaptive interpretation of these results is to be avoided because skull morphology was recently shown, to strongly influence local development of bone ornamentation. Indeed, ornamentation in long-snouted amphibious forms scores low or nil values on the skull roof while scoring very high values on osteoderms. Our results also show that amphibious forms, whether marine or fluvial have a high degree of ornamentation whereas both terrestrial and pelagic forms are not ornamented or have a low level of ornamentation. Therefore, it is probable that the high degree of ornamentation among semi-aquatic pseudosuchians has been positively selected since the Triassic-Jurassic transition because it would help in facilitate heat-capture for semi-aquatic ambush predators.

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**0973 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Brian Clark, Larry Allen

*California State University, Northridge, Northridge, California, USA*

**Courting Behavior of Giant Sea Bass, *Stereolepis gigas***

The Critically Endangered (IUCN) giant sea bass, *Stereolepis gigas,* has a long history of overexploitation resulting in a population collapse. Giant sea bass are members of the wreckfish family, *Polyprionidae*, whose species are long-lived, late to mature and their reproductive behaviors are relatively unknown. Understanding giant sea bass reproductive behavior can serve as a baseline for the wreckfish family and be applied to their management and conservation strategies. Based on this, the objective of this study was to investigate giant sea bass reproductive behavior at Santa Catalina Island. Transects were done to identify when abundances were highest throughout the day (morning, afternoon and evening) and observations of reproductive behaviors were recorded. In 2014 we saw significantly more giant sea bass during the afternoons, but in 2015 there was no difference. Observations were made of presumed sexual dimorphism and courtship behaviors, although no spawning was observed.

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**0607 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Geneva Clark, Juan Daza, Patrick Lewis

*Sam Houston State University, Huntsville, Texas, USA*

**The Ear Apparatus of Subterranean Worm Lizards**

Amphisbaenians are specialized squamates with a worm-like morphology. Their specialized subterranean lifestyle exposes these organisms to a totally different microhabitat than lizards and snakes dwelling on the surface. Underground dwellers specialize on low frequency hearing, which requires them to develop a specialized ear apparatus. We review this apparatus in 7 genera, including 15 species, using HRCT data. We sampled all species within the genus *Zygaspis*, which is our focal taxon. HRCT allows us to look into hearing apparatus organization in detail. We used the computer program Avizo Lite 9.0.0 to obtain volumetric data from the inner ear endocast, and linear measurements from the skull, extracolumella, and stapes. We found a proportionally small extracolumella in the most basal genus *Rhineura*, while this structure is completely absent in *Bipes*. Within the genus *Zygaspis*, skull length fluctuates from 5.96 mm (*Z. quadrifrons*) to 10.4 mm (*Z. nigra*). We found an isometric relationship between the skull length and inner ear volume, showing a well-fit exponential curve when graphed together. The stapes also presents an isometric relationship with the skull length while the size of the extracolumella becomes proportionally smaller and more robust as the specimens increase in size. We observed remarkable variation in ear

structure across amphisbaenians, suggesting that size, mode of burrowing, and dwelling substrate might affect how these organisms hear.

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**0830 HL: Social Behavior in Reptiles Symposium, Salon E, Saturday 9 July 2016**

Rulon Clark, Shannon Hoss

*San Diego State University, San Diego, CA, USA*

**The role of maternal care in the development of social behaviors of pitvipers**

Most snakes spend a majority of their life as solitary individuals, rather than living in the complex, cooperatively breeding social groups that characterize some birds, mammals, and eusocial insects. This lack of obvious complex sociality has led to a general assumption that social interactions with conspecifics are not as important in reptiles and amphibians as they are in other taxa. However, as with other aspects of their natural history, this assumption may stem more from a lack of detailed studies carried out at appropriate spatial and temporal scales, rather than a true lack of important social interactions. As one example, many pitviper species exhibit a short period of post-birth association between litters of neonates and their mother. Findings from both laboratory and field studies suggest that this association may be a critical component of development, and could be involved in recognition of kin or identification of key resources in natural habitats. However, there is still much that we do not know regarding the potential benefits of this period of association, and different species appear to behave disparately during this phase of reproduction. Broader comparative work and a stronger focus on field studies are necessary to further characterize the importance of maternal care behavior in snakes.

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**0119 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Callahan Clarke, Paul Hampton

*Colorado Mesa University, Grand Junction, CO, USA*

**Comparative Trophic Morphology of Sea Snakes in Relation to Feeding Ecology**

Sea snakes represent a polyphyletic clade that have inhabited marine environments at least twice. Sea snakes consume a diversity of prey types including fish eggs, and a variety of fish shapes ranging from elongate to spinous to laterally compressed fish. Sea snakes search for and capture prey in open water, burrows, and within benthic regions. There are conspicuous disparities in head morphology among sea snake species that

may be associated with their feeding ecology. We hypothesize that sea snakes that eat relatively wide or spinous prey will have longer quadrates because quadrate length is correlated with maximum gape size. Piscivores tend to have elongate jaw components to overcome hydrodynamics, thus we hypothesize that sea snakes that are eating open water fish will have relatively long narrow heads. Finally, we predict that there will be convergence in trophic morphology among species with similar feeding ecologies. Using persevered specimens, we are collecting morphometrics from at least 20 species of sea snake. Specifically, we are measuring snout-vent length, head length, jaw length, and quadrate length. Diet data will be gleaned from literature including relative prey size and frequency that different prey types are consumed. The correlation between morphology and ecology will be determined using both conventional and phylogenetic independent contrasts (PIC) analysis. Results will be discussed at the conference.

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## 0475 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, Salon A-C, Thursday 7 July 2016

Pam Clarkson[1], Cody Mott[2], Eric Pulis[3], Roldán Valverde[1]

*[1]Southeastern Louisiana University, Hammond, LA, USA, [2]Inwater Research Group, Jensen Beach, FL, USA, [3]Institute for Marine Mammal Studies, Gulfport, MS, USA*

### Steroid Hormones of Incidentally Hooked Kemp's Ridley Sea Turtles, *Lepidochelys kempii*

The hypothalamic-pituitary-adrenal axis is activated during stressful events, and the end product of this hormonal cascade is either cortisol or corticosterone. Corticosterone, the stress hormone in sea turtles, was measured in juvenile Kemp's ridley sea turtles, *Lepidochelys kempii,* incidentally hooked off the coast of Mississippi, to determine their stress response to hooking, handling, and rehabilitation. Turtles were bled four times from the dorsal cervical sinus: immediately after hooking, after hook removal, after several days in rehabilitation, and thirty minutes after tagging prior to release. Hormone concentrations were analyzed with enzyme-linked immunosorbent assays. Turtles captured off the coast of Florida and bled within 10 minutes of sighting were used for baseline comparisons. Initial corticosterone concentrations increased in response to hooking and handling compared to baseline concentrations. Corticosterone concentrations remained elevated throughout rehabilitation and turtles remained adrenally responsive throughout rehabilitation. These data show that hooking is a stressor but handling is a greater stressor. Ongoing work includes analyzing testosterone concentrations to determine sex and to determine if stress alters testosterone concentrations.

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**0055 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, Salon A-C, Thursday 7 July 2016**

Natalie Claunch[1], Matthew Holding[2], Julius A. Frazier[1], Ignacio Moore[3], Emily Taylor[1]

*[1]California Polytechnic State University, San Luis Obispo, CA, USA, [2]The Ohio State University, Columbus, OH, USA, [3]Virginia Tech, Blacksburg, VA, USA*

### Stress Ecology of the Southern Pacific Rattlesnake, *Crotalus oreganus helleri*

Stressors can have various impacts on vertebrates' life history, and may affect survival. The glucocorticoid hormone corticosterone (CORT) modulates stress responses in reptiles and amphibians, but little is known about its chronic effects in free-ranging reptiles. Our study aimed to investigate the various effects of chronically elevated CORT in a wild population of southern Pacific rattlesnakes (*Crotalus oreganus helleri*). We experimentally investigated these effects in twenty-eight radio-telemetered wild rattlesnakes that were implanted intra-coelomically with either crystalline CORT or sham implants. Thermal data logger implants recorded snake body temperature each hour. Snakes were tracked daily for one month. Detectability, defensive behavior, movement, and home range size was calculated for each group. Every two weeks, blood was sampled to confirm experimental elevation of plasma CORT, and to track decline in CORT release from implants. Stress reactivity was assessed via change in CORT from baseline after one hour of acute confinement stress. To investigate potential effects of CORT on venom composition and synthesis, venom was depleted from snakes every two weeks. We tested activity of phospholipase A2 (PLA2) and snake venom metalloproteinase (SVMP) toxins isolated from individual venoms before and after treatment. Snakes were tracked from May 2015-October 2015 to assess possible long-term effects of chronically-elevated corticosterone. We report our findings relating detectability, defensive behavior, movement, home range size, thermoregulation, stress reactivity, and venom activity to exogenous administration of CORT and baseline CORT levels in rattlesnakes.

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**0839 HL GRADUATE RESEARCH AWARD, Galerie 2, Friday 8 July 2016**

Chelsea E. Clyde-Brockway[1], Nathan J. Robinson[2], Gabriela S. Blanco[3], Stephen J. Morreale[4], James R. Spotila[5], Pilar Santidrián Tomillo[6], Frank V. Paladino[1]

*[1]Indiana-Purdue University, Fort Wayne, IN, USA, [2]The Leatherback Trust, Playa Grande, Santa Cruz, Costa Rica, [3]Laboratorio de Ecologia de Predadores Tope Marinos, Puerto Madryn, Argentina, [4]Cornel University, Ithaca, NY, USA, [5]Drexel University, Philadelphia, PA, USA, [6]Institut Mediterrani d'Estudis Avançats, Esporles, Spain*

### Comparing the Behavior of East Pacific Green Turtles from Two Neighboring Beaches in Pacific Costa Rica

To maximize the effectiveness of Marine Protected Areas, conservation efforts should be focused on critical habitats for endangered species. We used satellite transmitters to

examine the inter-nesting movements and dive behavior of East Pacific green turtles from Playa Cabuyal (CAB) and Nombre de Jesús (NDJ) located 50 km apart on the Pacific coast of Costa Rica. By comparing the inter-nesting behavior we aimed to describe general patterns of habitat use for East Pacific green turtles. We successfully recorded inter-nesting intervals for 22 turtles, nine from NDJ and 13 from CAB. Inter-nesting intervals were similar among years and beaches (15 d for CAB and 12 d for NDJ), and the turtles in this study were of a comparable size. Turtles nesting on CAB dispersed throughout the Gulf of Papagayo remaining within 10 m of the beach, while turtles nesting on NDJ dispersed short distances from the shore (< 4 km). Dive behavior from four turtles nesting on CAB and five turtles nesting on NDJ indicated that turtles spend a majority of the inter-nesting interval at the surface, in the top 5 – 10 m of the water column, in water temperature that was greater than 23°C. Depth and area use of inter-nesting East Pacific green turtles was influenced by the temperature, bathymetry, and available area protected from high-energy water movement. Applying this knowledge to comparable beaches in Pacific Costa Rica, scientists can estimate green turtle behavior without the need for expensive telemetry equipment; however, where possible individual beach assessment is irreplaceable.

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**0237 NIA BEST STUDENT PAPER, Salon A-C, Friday 8 July 2016**

Bethany N. Coffey, Timothy C. Tricas

*University of Hawaii at Manoa, Honolulu, HI, USA*

### Context Clues: changes in vocal behaviors of triggerfish between interactions with conspecifics and predators

Sound production is common in reef fishes but little is known about the differential use of sounds in social and predator-threat contexts. The wedge triggerfish, *Rhinecanthus rectangulus*, produces vocalizations via stridulatory movements of bony elements in the jaws and drumming movements of the pectoral fins against a sonic membrane. In laboratory tests, fish exhibit five acoustic behaviors: the pectoral fin drum, snap, drum-snap combination, substrate bite, and grind. Comparisons of pulsed sounds indicate the grind pulse train contains the highest average number of pulses (13); the grind and substrate bite had the shortest pulse duration (mean=31 ms each); and the grind and drum showed the lowest peak frequencies (732, 845 Hz, respectively). The snap, substrate bite, and drum-snap sounds had higher upper bandwidths that ranged up to 22 kHz. Solitary individuals in control environments primarily produced grinds (0.23±0.18 SE sounds/min), substrate bites (0.12±0.07 SE sounds/min), and snaps (0.28±0.18 SE sounds/min). No drum sounds were produced by solitary fish. During social interactions with conspecifics, snaps were produced most frequently (1.20±0.59 SE sounds/min) followed by drums (0.44±0.24 SE sounds/min) and grinds (0.29±0.16 SE sounds/min). During interactions with a moray predator, drums were produced most frequently (0.24±0.11 SE sounds/min) followed by snaps (0.12±0.08 SE sounds/min). While sound production rates were lower during predator versus conspecific interactions, changes in the primary vocalizations indicate triggerfish sounds are

produced in context-specific ways that may provide different acoustic information to a conspecific or predator receiver fish.

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**0320 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Kathleen Cole

*University of Hawaii at Manoa, Honolulu, HI, USA*

**Thirty Years of ASIH: a View from the Outer Ring (Galaxy)**

The American Society of Ichthyologists and Herpetologists (ASIH) has been central to the development of my professional career. It has been through the people I have met in this Society and their respective roles in my growth as an ichthyologist that I have achieved whatever small measure of success that I enjoy today. In this talk I will focus on the how the Society has shaped the direction of my professional career through interactions with some of its members, and demonstrate how a society such as ASIH can build strong scientific communities that transcend geographic, generational, and disciplinary boundaries.

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**0620 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Andrew Coleman, Lynnette Sievert

*Emporia State University, Emporia, KS, USA*

**Sound Production in the Small-mouthed Salamander (*Ambystoma texanum*)**

Auditory communication is common in vertebrates, forming an integral part of such crucial behaviors as defense, courtship, and social cohesion in several taxa. Among the amphibians, frogs are well known for their vocalizations, many of which are used by males to attract females at breeding pools. The other extant amphibians (salamanders and caecilians) are generally regarded as mute. Despite this widespread assumption, there are numerous anecdotal reports of both aquatic and terrestrial salamanders vocalizing. Very few studies have attempted to put these sounds into any sort of context, despite the potential utility (e.g., mate attraction) such sounds may have. While salamanders are extremely limited in their ability to detect sounds transmitted through air, they are able to detect water-borne sounds fairly easily. I placed Small-mouthed Salamanders (*Ambystoma texanum*) into 19L plastic tanks containing aged tap water, and used hydrophones in an attempt to document and explain underwater sound production in this species. Although sound production was rare, it was recorded in about half of all tanks. No social context for sound production could be isolated in this

experiment, but verifying that sound production occurs in this species at all is an important step in studying this behavior.

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**0150 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Bruce Collette

*NMFS Systematics Laboratory, Washington, DC, USA*

**My 60 Years with ASIH**

ASIH has been the center of my professional life since I joined as an undergraduate in April 1955. I will reflect on the value ASIH has had in the success of my career. My 1st ASIH meeting (and my honeymoon) was in June 1956 at Higgins Lake, MI. My 1st paper, on *Anolis,* won 1st prize, Stoye Award, herpetology. $25. 1958: Bloomington, IN. 2nd paper, Variation in *Etheostoma fusiforme* won 1st prize, Stoye award, ichthyology. 1959: San Diego, CA. 3rd paper, variation in *Hololepis* won 2nd prize, Stoye Award, ichthyology. Since 1956, I missed 2 meetings, one while I was in the Army in 1960, the second while I was in Australia in 1970. I presented 48 papers or posters at ASIH over the last 60 years. 1962:. Elected to Board of Governors and re-elected for 54 years of continuous membership. 1964-68: Ichthyological Editor, Copeia. 1965: Initiated billing for page costs for publication in Copeia. 1965: Led the move with Fred Berry to get all back issues of Copeia in print. 1967-1973: Formed ASIH Nomenclature Committee with Jim Peters. 1973-1976: NSF grant to ASIH to assess the future of ichthyology in the US. 1974-1978: Secretary, encouraged 1st meeting of ASIH with SSAR and HL. 1981: President, ASIH. Published 45 papers in Copeia, 1962-2013. Served on 10 different committees. 1967-2016. 1989: 1st Robert H. Gibbs Jr. Award for outstanding publications in systematic ichthyology. 2004: 70th birthday symposium. 2014: 2nd Joseph S. Nelson Lifetime Achievement Award in Ichthyology.

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**0762 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Michelle Collier[1], Emma Hanslowe[1], Frank Ridgley[2], Bryan Falk[1], Amy Yackel Adams[1], Robert Reed[1]

*[1]U.S. Geological Survey, Ft. Collins, Colorado, USA, [2]Zoo Miami, Miami, Florida, USA*

**Do Invasive, Free-ranging Black and White Tegus (*Tupinambis merianae*) Exhibit Facultative Endothermy During Brumation?**

Black and white tegus (*Tupinambis merianae*) were recently shown to exhibit seasonal reproductive endothermy. If they have a similar ability of facultative endothermy during brumation, then it could have profound implications for their ability to cope with thermal extremes in geographical ranges susceptible to tegu invasion. We used thermal loggers to monitor ambient and shaded and exposed substrate temperatures, tegu

thermal refugium temperatures, and internal body temperature of free-ranging black and white tegus in Florida during the winter. Here we present analyses addressing two questions: (1) if tegus employ behavioral thermoregulation during brumation through behaviors such as basking, and (2) if tegus employ facultative endothermy to cope with cold periods by raising their body temperature above that of thermal refugia through physiological means alone.

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**0611 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Timothy J. Colston, Brice P. Noonan, Colin R. Jackson

*University of Mississippi, University, MS, USA*

**The Evolution of Squamate Reptile Gut Microbiomes**

Vertebrates are metagenomic organisms; they are composed not only of their own genetic material, but also that of their associated microbial communities. The majority of these microorganisms are found in the host's intestinal tract and presumably assist in essential processes of energy and nutrient acquisition. The ecological and evolutionary forces that act on both the host and its trillions of resident microorganisms sculpt the endogenic microbiome. With the advent of next generation sequencing technologies we are now better able to characterize and explore factors that gave rise to this observed microbial diversity. Most studies investigating evolutionary patterns in non-human vertebrate endogenic microbiomes have focused on captive animals from zoos rather than wild populations. Very few studies have examined the endogenic microbiome of squamate reptiles (snakes, lizards), despite this being one of the most diverse and successful vertebrate clades. Here we explore and characterize the gut microbial communities across Squamata, with dense sampling of the squamate clade Toxicofera - a clade of reptiles which encompasses nearly all life history traits and ecologies found within Squamata. Using metagenomic scans of the 16S rRNA gene and next generation sequencing we collect one of the most taxonomically broad datasets to date on wild vertebrate gut microbiomes.

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**0969 AES Genetics, Genomics, Biogeography, & Systematics, Balconies J & K, Saturday 9 July 2016**

Francisco Concha[1], Janine Caira[1], Dave Ebert[2]

*[1]University of Connecticut, Storrs, Connecticut, USA, [2]Pacific Shark Research Center, Moss Landing, California, USA*

**On the identities and affinities of South American skates: Two case studies**

Elasmobranch taxonomy has undergone remarkable transformations over the past several decades as a result of the identification and description of hundreds of new species-many from the waters of the Indo-Pacific region. Inspired by that earlier work,

this study aimed to take a closer look at the identities of two intriguing South American batoids. The first was a small, deep-sea skate originally collected off Ecuador. Morphological and molecular investigations confirmed it represented a novel species of *Notoraja*, thereby extending the distribution of this genus across the Pacific Ocean to South America. The second case involved the commercially important skate *Dipturus chilensis*, which has traditionally been considered to occur throughout the coast of South America from Chile to the Falkland Islands. Preliminary molecular analyses called in to question the conspecificity of specimens from these disparate regions, in fact suggesting that *D. chilensis* from Chile was sister to *D. nasutus* from New Zealand, and that the taxon from the Falklands was the sister taxon to that clade. Additional morphological and molecular investigation confirmed the Falkland species to represent a distinct, and in fact, novel species of *Dipturus*; simultaneously that work also indicates that *D. chilensis* is endemic to Chile. These results have important conservation and management implications for they require that the species on the eastern and western coasts of South America be treated separately rather than as a single broadly distributed species. In combination, these results provide evidence of intriguing affinities between the elasmobranch faunas of the Western and Eastern Pacific Oceans.

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**0786 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Courtney Connolly

[1]*California Polytechnic State University, San Luis Obispo, CA, USA, Humboldt State University, Arcata, CA, USA*

## Changes in Defensive Behavior of *Crotalus oreganus* in Response to Corticosterone

The effects of corticosterone on behavior were observed in a population of Northern Pacific Rattlesnakes (*Crotalus oreganus)* located in the Santa Ynez Valley. Corticosterone (CORT) is a hormone that plays a primary role in reptilian stress physiology and can affect essential processes such as thermoregulation, reproduction, and movement. The impacts of CORT were studied through sight observation during tracking and sampling periods of experimental collections where hormone levels were artificially increased to simulate long-term stressors, such as drought. A variety of behaviors including tongue flicking, retreating, rattling, striking, and head hiding were detected. No significant differences in defensive behavior were observed between the control snakes implanted with a blank and the experimental snakes implanted with CORT. These findings could be the result of *Crotalus oreganus* adaptive nature to protect themselves from changes in their external environment. Further studies must be conducted in order to investigate the relationship between high corticosterone levels and the presence of defensive behaviors.

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**1115 Fish Systematics II, Salon F-H, Saturday 9 July 2016**

Kevin W. Conway[1], Cragen King[1], Adam Summers[3], Philip Hastings[2]

*[1]Texas A&M University, College Station, Texas, USA, [2]Scripps Institution of Oceanography, La Jolla, California, USA, [3]University of Washington, Friday Harbor, Washington, USA*

### Clingfish classification: problems and progress

The roughly 160 species and 48 genera of clingfishes (family Gobiesocidae) are currently divided between nine subfamilies in a "phenetic" classification scheme proposed over 60 years ago. Though heavily criticized, this classification is still widely utilized and reflects the paucity of phylogenetic studies conducted on these small and cryptic marine fishes. Using a combination of mitochondrial (CO1, 12S) and nuclear (zic1, myh6, ENC1, Gylt & SH3PX3) sequence data and a rapidly expanding morphological data set (derived largely from osteology) we assess the phylogenetic relationships of 71 species of gobiesocid, representing 31 genera and all subfamilies. Our preliminary results indicate problems with the current classification at both the generic and subfamily level. For example, only three subfamilies (Cheilobranchinae, Gobiesocinae and Diademichthyinae) out of seven that contain more than one species are obtained as monophyletic. *Gobiesox* (currently the largest genus of the Gobiesocidae) is paraphyletic and *Lepadichthys* (the largest assemblage of Indo-Pacific clingfishes) is polyphyletic. Based on these results we tentatively propose changes to the current clingfish classification to recognize monophyletic groups that are obtained in analyses of both molecular and morphological data sets.

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**0772 Fish Ecology I, Salon A-C, Saturday 9 July 2016**

April Cook

*Nova Southeastern University, Dania Beach, FL, USA*

### Historic undersampling of deep-pelagic top predators: a case study of the Chiasmodontidae of the Gulf of Mexico using multiple sampling gears

The deep-pelagic (incl. meso- and bathypelagic) domain has been historically sampled using relatively small research trawls (ring nets, modified otter trawls, rectangular trawls, International Young Gadoid Trawls, and MOCNESS trawls), which have shaped what we know about midwater taxa. The towing speed, effective mouth area, and mesh sizes of the gears mentioned mainly select for macroplankton and micronekton, as larger nekton can outswim or outmaneuver these nets. Researchers are increasingly using larger, commercial-sized high speed rope trawls to sample the deep-pelagial. An example is the Offshore Nekton Sampling and Analysis Program (ONSAP), a component of NOAA's Natural Resource Damage Assessment following the *Deepwater Horizon* oil spill. The ONSAP employed two types of midwater trawls to collect deep-pelagic fauna in the northern Gulf of Mexico between 0-1500 meters depth; a 10-$m^2$

MOCNESS (MOC10) and a commercial-sized, high-speed Irish Herring Trawl (IHT). Data will be presented comparing the catches of the Chiasmodontidae, a top meso/bathypelagic predator family, from the two gear types. The IHT collected 1,060 specimens in 146 of 167 trawls (87% frequency), compared to only 87 specimens collected by the MOC10 in 68 of 241 trawls (28% frequency). A minimum of 15 species of chiasmodontids were collected with the IHT (currently all *Chiasmodon* identifications are *C. niger* complex, pending revision), while eight were collected with the MOC10. Comparisons of standardized abundance and length frequencies will be presented as evidence and incentive for employing multiple trawl types to gain a more comprehensive understanding of the deep-pelagial, earth's largest biome.

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**0326 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Pearce Cooper[1], David Portnoy[2], Sean Powers[1]

*[1]University of South Alabama, Mobile, Alabama, USA, [2]Texas A and M University Corpus Christi, Corpus Christi, Texas, USA*

## Examining Population Structure and Disruptive Selection in Morphologically Divergent Groups of Sheepshead, *Archosargus probatocephalus:* a Genomic Approach

Sheepshead are large euryhaline sparid fish that are recreationally and commercially exploited in the coastal Southeastern United States. Morphologically divergent groups of sheepshead are described as subspecies. *Archosargus probatocephalus oviceps* is reported from the Florida panhandle to the Western Gulf of Campeche, Mexico, while *A.p. probatocephalus* is reported from Florida panhandle to Nova Scotia, Canada. These groups are distinguished primarily by the number of black vertical bars on the flank of the fish. This character is remarkably consistent among groups outside a small area of range overlap along the Florida panhandle where both morphotypes and intermediate types are found, suggesting gene flow. This area coincides with the previously described Gulf of Mexico Suture Zone, where multiple sister taxa meet and divergence has been attributed to a number of potential historical vicariance events. A previous study had shown no significant differentiation between morphologic groups in term of microsatellite variation and weak heterogeneity in mitochondrial control region haplotype distributions. To assess the level of genomic divergence between these groups, we will use double digest Restriction-site Associated DNA (ddRAD) sequencing. Genome scans will be used to identify both putatively neutral single nucleotide polymorphisms (SNPs) and SNPs putatively under selection. Comparison of patterns of variation within and between morphotypes allows for inference pertaining to the forces that maintain morphological differences. The results of this study will increase the understanding of micro-evolutionary processes associated with marine subspecies boundaries and allow for more successful management of this important fishery species.

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**1040 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon A-C, Friday 8 July 2016**

Robert D. Cooper, H. Bradley Shaffer

*University of California, Los Angeles, Los Angeles, CA, USA*

### Connecting Heat Stress and Gene Expression to Explain Pervasive Hybridization of California Tiger Salamanders

Hybridization is becoming one of the most prominent forces leading to erosion of biodiversity worldwide. California tiger salamanders, *Ambystoma californiense,* are threatened throughout their range mostly due to rapid introgression of invasive genes from an intentional introduction of barred tiger salamanders, *Ambystoma mavortium*. In order to determine a potential mechanism driving this expanding hybrid zone, we investigate heat shock tolerance and the resulting genetic expression. We measured critical thermal maximum (CTmax) by heating individuals and conducting loss of righting response experiments. Although native, invasive and hybrid salamanders do not differ in their mean CTmax, we found that hybrids have greater variability in CTmax, which may allow selection for greater thermal tolerance in subsequent generations. This may be the result of non-additive genetic variation. We uncovered several genes that are differentially expressed in response to temperature stress, which may depict the genetic pathways that tiger salamanders use to tolerate heat. This may shed light on the patterns of hybrid zone movement, in the context of heat stress in a changing landscape.

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**0857 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Samantha Cordova, Megan Osborne, Thomas Turner

*University of New Mexico, Albuquerque, New Mexico, USA*

### Environmental DNA Methodology for Endemic Plethodontid Salamanders of New Mexico

Our research aims to inform conservation of endemic New Mexico salamanders, the federally protected Jemez Mountains Salamander (*Plethodon neomexicanus*) and state protected Sacramento Mountain Salamander (*Aneides hardii*), using genetic tools. Because these salamanders live in arid lands, they have strict physiological constraints because they are lungless, require moisture for respiration and desiccate easily. Physiological reliance on moisture is concerning because the Jemez Mountains Salamander and Sacramento Mountain Salamander are increasingly hard to find due to change in habitat, drought, and fire. We have developed environmental DNA (eDNA) methods to indicate presence of salamanders. This project is coordinated with other efforts that rely on dogs to detect the Jemez Mountains Salamander and Sacramento Mountain Salamander. Dogs are trained to detect scat and odor of Jemez Mountains

Salamander and Sacramento Mountain Salamander, but frequently have "positive hits" that cannot be verified by the handler. E-DNA is employed to further test unverified positive encounters by taking soil samples and isolating salamander DNA from soil. We characterized mitochondrial ND4 genes to develop species-specific DNA primers. Sacramento Mountain Salamanders at the Albuquerque BioPark were used as a captive surrogate to isolate DNA from soil. Soil samples were genetically tested using species-specific primers to indicate presence or absence of salamander mitochondrial DNA.

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**0079 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Morgan Corey[1], Nancy Brown-Peterson[2], Robert Leaf[1], Samuel Clardy[3], Mark Peterson[1]

*[1]The University of Southern Mississippi Department of Coastal Sciences, Ocean Springs, MS, USA, [2]The University of Southern Mississippi Center for Fisheries Research and Development, Ocean Springs, MS, USA, [3]The University of Southern Mississippi Marine Education Center, Ocean Springs, MS, USA*

## Ovarian Development and Maturity of Southern Flounder in the North-Central Gulf of Mexico

Southern Flounder, *Paralichthys lethostigma*, is the most commonly harvested flatfish in the north-central Gulf of Mexico (GOM), yet knowledge of the species' reproductive biology is limited. Our objectives were to estimate length- and age-at-maturity, and to describe reproductive seasonality of female Southern Flounder. We collected fish from September 2014 through March 2016 using various sampling techniques, including hook and line and gigging. We classified maturity histologically for each individual ($n$ = 221) and fit a logistic model to binomial maturity data. The estimate for mean length-at-50%-maturity is 308 mm and mean age-at-50%-maturity is 1 y. We assessed spawning seasonality using both the mean monthly Gonadosomatic Index (GSI) and histological indicators. Mean GSI values were elevated in October and November. Offshore females were in the spawning capable reproductive phase in early November and in the regenerating phase in early February. These results suggest that the Southern Flounder spawning season occurs from November through January in the north-central GOM, although reproductively inactive females were found inshore in January. Histological analysis shows that Southern Flounder exhibits asynchronous oocyte development and is a batch spawner. The results of this research provide an improved examination of Southern Flounder reproduction, which will inform future stock assessment.

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**0255 AES Genetics, Genomics, Biogeography, & Systematics, Balconies J & K, Saturday 9 July 2016**

Shannon Corrigan[1], William White[2], Lei Yang[1], Aaron Henderson[3], Gavin Naylor[1]

*[1]Hollings Marine Laboratory, College of Charleston, Charleston, SC, USA, [2]CSIRO Marine and Atmospheric Research, Hobart, TAS, Australia, [3]The School for Field Studies, Center for Marine Resource Studies, South Caicos, Turks and Caicos Islands*

## Phylogeny of the manta and devilrays (Chondrichthyes: Mobulidae), with an updated taxonomic arrangement for the family

The manta and devilrays of the family Mobulidae are arguably the most charismatic ray group. They occur worldwide in tropical and temperate waters where they are also exploited to such an extent that there is now considerable concern regarding the conservation status of mobulid rays globally. Accurate taxonomy is recognised as the foundation of all other biological sciences and is crucially important for setting appropriate conservation management priorities. There has been progress toward characterizing the diversity and phylogeny of mobulid rays however, mobulid taxonomy remains largely unresolved due to a complex nomenclatural history and to poor representation of mobulids in biological collections. The Mobulidae is currently considered to comprise two genera, *Manta* and *Mobula*, encompassing two and nine nominal species respectively. Notable longstanding taxonomic uncertainties include the validity of the genus *Manta*, as well as distinguishing species boundaries from intraspecific variation within multiple lineages of *Mobula*. We provide an estimate of Mobulid phylogeny and present a revised taxonomy for the group based on analysis of DNA sequence data from whole mitochondrial genomes and more than 1000 protein coding, nuclear exons for a complete taxon sampling of mobulid rays. Any discordance between our molecular phylogenetic inferences and the previously recognised taxonomy were resolved by undertaking a detailed examination of morphological data and the nomenclatural history for the relevant taxa. We demonstrate that *Manta* is an invalid genus designation, provide evidence for multiple species level synonymies, and forward a new phylogeny for the group.

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**0184 AES Conservation & Management I, Balconies L & M, Friday 8 July 2016**

Enric Cortes[1], Elizabeth Brooks[2]

*[1]NOAA-NMFS-SEFSC, Panama City, FL, USA, [2]NOAA-NMFS-NEFSC, Wood Hole, MA, USA*

## Predicting overfished and overfishing reference points with data-limited stock assessment methods and life history: application to shark stocks worldwide

We investigated whether reference points obtained from stock assessments could be replicated with simpler methods by comparing the overfished reference point obtained in stock assessments of a suite of shark stocks worldwide with predictions from a data-

limited method that calculates biological reference points analytically based on life history data and an index of relative abundance. Predictions from this method agreed very well with those from the existing stock assessment models. We further tested the robustness of the method to assumptions about initial depletion of the population by identifying how much it would have to change to reverse the prediction on the state of the stock and assessed the plausability of that change. We found that the method was robust in 76% of the cases examined. We also compared the overfishing reference point from stock assessments to predictions based on two published relationships between $F_{MSY}$ and $M$ for chondrichthyans. Additionally, we conducted a review of shark stock assessments to develop another benchmark of $F_{MSY}$ based on $M$ against which we also compared results from stock assessments. Finally, we used simulation to generate ratios of $F_{MSY}/M$ for a range of $M$ and steepness values for different relationships between median selectivity and age at maturity under different slopes of the selectivity and maturity curves. We found that $F_{MSY}<0.5M$ for low productivity stocks, and even lower values if immature individuals are harvested. Empirical evidence also suggests that for many shark species with comparatively low productivity, $F_{MSY}\approx 0.25M$.

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**0069 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Cristina Cox Fernandes[1], Andrew Williston[2]

*[1]Biology Dep., University of Massachusetts, Amherst, MA, USA, [2]Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA*

## Characterization of and morphological variation within the inconspicuous electric fish *Microsternarchus bilineatus* (Gymnotiformes: Hypopomidae, Microsternarchini)

*Microsternarchus bilineatus* Fernández Yépez, 1968 is a small, inconspicuous electric fish that is distributed in the Orinoco, Amazon and Tocantins basins (Sullivan, 1997). Its holotype and paratypes from Río San José, a tributary of Río Guariquito, Orinoco basin, have been lost (Francisco Provenzano and Carlos Nascimento, pers. comm.). Mago-Leccia (1994) noted that *M. bilineatus* was not well defined by Fernández Yépez. Recently, we examined a sample of 14 specimens collected in Río San Bartolo, 129 km by river from the type locality. Because of its proximity to the type locality and apparent conformity to the original description, we used these newly collected specimens to characterize *M. bilineatus* using cranial high-resolution X-ray computed tomography, morphometrics, meristics and osteology. We compared these fish from Río San Bartolo to fishes from the confluence of Casiquiare and Orinoco rivers. The two samples differ slightly in body measurements, and anal fin ray counts, and cranial facial skeleton features. It is unclear whether these differences reflect population- or species level divergence.

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**0428 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H, Thursday 7 July 2016**

Jack Craig[1], Lesley Kim[1], Jorge Casciotta[2], William Crampton[3], James Albert[1]

*[1]University of Louisiana at Lafayette, Louisiana, USA, [2]National University of La Plata, Provincia de Buenos Aires, Argentina, [3]University of Central Florida, Florida, USA*

## Further Deconstruction of *Gymnotus carapo* (Gymnotiformes, Teleostei): Delimiting Clades, Species and Subspecies of a Neotropical Electric Fish

The number of species in a geographically widespread and phenotypically variable taxon is sensitive to species concept. The *Gymnotus carapo* group is distributed throughout most of the humid Neotropics, from the Choco of Colombia to the northern Pampas of Argentina, and is currently known from 12 described and several additional undescribed species. *Gymnotus carapo* sensu stricto is one of the most widely distributed and geographically variable gymnotiform species, occupying a range close to that of the *G. carapo* group as a whole. Here we use morphological and molecular datasets to delimit clades, species and subspecies of the *G. carapo* group, including characters of traditional morphology (pigmentation, meristics, osteology), and 5,277 bp of sequence data from three nuclear genes (RAG, RAG2, ZIC) and three mitochondrial genes (cytB, COI, 16S). We used principal components analyses on both caliper-based and geometric morphometric datasets to quantify variances within and between taxa. We found populations of *G. carapo* s.s. from the La Plata (Paraná + Paraguay) basin differ diagnostically in PC space from all five species of sympatric congeners, and significantly but not diagnostically, from allopatrically distributed conspecific in the Amazon and Guianas regions. These differences include aspects of head and body shape. Under an evolutionary species concept we recognize *G. carapo* from the La Plata, Amazon and Guianas regions as subspecies, a widely used category in animal taxonomy to name geographic variants of widespread species. Under ICZN rules the subspecies rank is the only available taxonomic category for naming recognizing distinct geographic variants.

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**0760 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Amanda Cramer, Devon Donahue, Mariangeles Arce, Mark Sabaj

*The Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA*

## Molecular Phylogenetic Analysis of Neotropical Catfishes in the genera *Ageneiosus* and *Tympanopleura* (Auchenipteridae)

*Ageneiosus* is a genus of catfishes in the Neotropical family Auchenipteridae with 13 valid species based on a revision in press. Species are distributed from Panama to the Río de la Plata in Argentina, and occur in the channels of medium to large rivers primarily at lower elevations (e.g., less than 200 m a.s.l.). A second closely related genus *Tympanopleura* (six valid species) is currently treated as valid although previous studies included it within *Ageneiosus*. Collections of *Ageneiosus* were recently made in the lower Xingu River Basin, Brazil, by the iXingu Project (NSF DEB-1257813) and compared to

congeners and *Tympanopleura* from systems throughout South America using recent taxonomic revisions to accurately identify specimens to species. Preliminary analysis of molecular sequence data (16s, rag1) identified three lineages: *A. ucayalensis* group, *Tympanopleura* group and *A. inermis* group. The *Tympanopleura* group was sister to the *A. inermis group* and thereby questions the monophyly of *Ageneiosus* as currently recognized.

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**0683 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Lydia Crawford[1], Ian Davenport[2], Henry Bart[1]

[1]*Tulane University, New Orleans, LA, USA,* [2]*Xavier University, New Orleans, LA, USA*

## Association between Novel Ova Morphology and Chondrichthyan Reproduction

The reproductive biology of Chondrichthyan fishes evolved to produce larger, more precocious young with higher survival chances. To produce larger young, chondrichthyans must provide more nutrients to developing embryos. This can be performed through multiple methods, including larger oocytes, longer gestation, and uterogestation (consumption of nutrients within the uterus). Most chondrichthyans reproduce through vivipary (up to 65%). The first step in creating more developed young was an increase in egg size, accompanied by increasing the zona pellucida thickness. Typically nutrients enter the oocyte via diffusion from the follicle cell layer, which is important for transferring nourishment into the developing oocyte for storage, through the zona pellucida. However, diffusion is unlikely in chondrichthyans. It was unclear how oocytes in chondrichthyans receive nutrients and maintain integrity during transport within the female reproductive tract. Current work regarding Follicle Cell Processes (FCP) seeks to answer both these questions. FCP, first described in sharks in 2011, are unique structures that may transfer nutrients across the zona pellucida and provide structural support to developing oocytes. They are a series of tube-like structures that cross the zona pellucida, connecting the oocyte to the follicle cells. This direct connection suggests a role in nutrient transport. They also contain the cytoskeletal protein actin, which may play a role in structural support. FCP have been found in both carcharhiniform and saqualiform sharks, though recent work indicates they are not present in skates. I am studying follicles of modern chondrichthyans to understand the distribution, variation, and possible origin of these structures.

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**0679 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Lydia Crawford[2], Faith Stone[1], Ian Davenport[1]

*[1]Xavier University of Louisiana, New Orleans, LA, USA, [2]Tulane University, New Orleans, LA, USA*

**Follicle Cell Process, a shark thing?**

Like many apex predators, chondrichthyan fishes tend to produce few offspring. To compensate for low fecundity their young are large and precocial at birth or hatching. Producing larger young requires more maternal investment to the embryo, either by producing larger eggs or by supplying nutrients to the developing embryo. The selective pressure to produce larger young has resulted in the transition from egg laying (oviparity) to live bearing (viviparity). Approximately 65% of chondrichthayns are viviparous. An early step in this transition was to increase egg size and keep them within the body cavity, ultimately until term. In some chondrichthyans, eggs can reach extreme sizes, i.e. greater that 10 cm in *Centrophorus* sp. This evokes several questions, how do enough nutrients get to the eggs and how do they maintain the integrity during ovulation and passage through the reproductive tract. Follicle cell processes (FCP) appear to answer to both questions. The FCP are a set of large tube-like structures that connect the follicle cells directly to the oocyte, thus facilitating the uptake of metabolites. They also contain the contractile, cytoskeletal protein actin, this combined with a change in orientation throughout oogenesis infers a supportive role. The FCP were first described in 2011 and associated with elasmobranchs, but recent data implies that they may be strictly a Selachian novelty; as they appear absent in the little skate *Leucoraja erinacea* (Batoids). This now raises the question, are FCP a chondrichthyan innovation which were lost in the Batoids, or exclusive to the Selachians.

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**0492 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Shelby Creager, Leif Carlsson, Erik Noonburg, Marianne Porter

*Florida Atlantic University, Boca Raton, FL, USA*

**A Comparative Study on the Tensile Properties of Elasmobranch Skin**

In sharks, the skin stiffens and acts as an exotendon modulated by changes in internal muscular pressures generated during swimming. Shark skin is embedded with dermal denticles which vary in morphology regionally along the body and among species. Denticles function to reduce drag, increase swimming performance, and may impact the mechanical properties of the skin. Our goals are to assess denticle density and differences in skin tensile properties regionally across three shark species (*Carcharhinus limbatus*, *Sphyrna lewini*, and *Isurus oxyrinchus*). We expected to see increased denticle density (denticles / mm2) in the dorsal and ventral regions and fewer denticles on lateral surfaces. We hypothesized that strength (maximum stress before failure), stiffness (resistance to tension), and toughness (ability to absorb energy without failing) will correlate with denticle density, and these properties will be greater on dorsal and

ventral surfaces compared to lateral surfaces. The skin from juvenile sharks were dissected from the underlying fascia and muscle at twelve anatomical landmarks. A dogbone-shaped steel punch was used to extract the skin samples for mechanical testing. Skin samples were oriented longitudinally (cranial to caudal) and stretched at a strain rate of 2 mm/s until failure. A stress-strain curve was generated for each sample and maximum strength, stiffness, and toughness were calculated. Comparing the exotendon function among species will help us to better understand the extent to which sharks are conserving energy during swimming.

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**0675 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Dan Crear[1], Jill Hendon[2], Eric Hoffmayer[3]

*[1]Virginia Institute of Marine Science, Gloucester Point, VA, USA, [2]Center for Fisheries Research and Development, Gulf Coast Research Laboratory, Ocean Springs, MS, USA, [3]National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, Pascagoula, MS, USA*

## Identifying the drivers of juvenile shark abundance and distribution within the Mississippi Sound

Shark nursery grounds are an important habitat that promotes young-of-year (YOY) and juvenile shark survivorship. Both abiotic and biotic variables play key roles in the abundance and distribution of individuals within these nursery grounds. From 2004 to 2014, 1,005 sampling sets using a 183-m gillnet (stretched mesh panels of 8.9 to 20.2 cm), a 152-m bottom longline (12/0 circle hook), or 1.85-km bottom longline (15/0 circle hook), were conducted in the Mississippi Sound by the Gulf Coast Research Laboratory's Shark Research Program. The use of multiple gear types allowed for a more comprehensive look into the dominant species composition, including all developmental stages (i.e. YOY, juvenile, and adults). A two-step hurdle model was used to determine the effect the biotic and abiotic variables had on the distribution of multiple shark species caught in the Mississippi Sound. A multi-model inference approach was ultimately used for each step to determine the variables that strongly influenced the presence and abundance of each shark species. Atlantic sharpnose, blacktip, and finetooth sharks represented the three most abundant shark species encountered. In general, YOY and juvenile sharks were often present in more turbid, warmer waters. Interestingly, the presence of juvenile Atlantic sharpnose and blacktip sharks increased with increasing predator presence. Habitat suitability maps were created for each species by season within the Mississippi Sound to indicate areas of critical habitat.

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**0411 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Kristine Crippen, Kristina Morben, Eriek Hansen

*Colorado Mesa University, Grand Junction, Colorado, USA*

## Quantifying Proximate Body Composition in Catostomids Using Bioelectrical Impedance Analysis

Measurements of proximate body composition (PMC; water, lipid, and lean masses) are used as indices of fish health or condition. Proximate body composition measurements are more sensitive to changes than traditional length-weight measurements. However, standard methods for quantifying PMC are lethal. Bioelectrical impedance analysis (BIA) can be used as nonlethal method to quantify PMC. Bioelectrical impedance analysis measures the resistance and reactance of tissues, and has been used to quantify human PMC. Our goal was to develop BIA techniques for studying sensitive and endangered fishes. Our objectives were 1) compare effects of invasive needle electrodes (traditional method) versus noninvasive surface electrodes, 2) compare electrode positions using landmarks that vary with fish length versus a fixed electrode distance, and 3) develop multiple regression models for predicting the PMC of White Sucker (*Catostomus commersonii*; a representative for native Catostomids). For objectives 1 and 2, the invasive needle electrodes, variable distance surface electrodes, and fixed distance surface electrodes were comparable. For objective 3, multiple regression models which used BIA metrics improved the prediction of the three components of PMC compared to length-weight indices. Multiple regression models accounted for most of the variation in the data ($R^2$=0.99) for both water and lean masses. Lipid mass was more variable and the best model only accounted for 54% of the variation. Using fixed distance surface electrodes allowed for a less invasive and simpler measurement approach than the other methods compared. Future work is necessary to improve lipid mass predictions and to validate models.

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**0559 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, SALON A-C, Thursday 7 July 2016**

Jenna Crovo[1], Carol Johnston[2]

*[1]Auburn University, Auburn, AL, USA, [2]Auburn University, Auburn, AL, USA*

## Acoustic Modulation of Gonadal Hormones in a Cyprinid Fish

Acoustic signaling is a vital component of courtship and agonistic behaviors. In fishes, these signals advertise important characteristics, such as mate quality and sexual receptivity. These signals also have the capacity to modulate the endocrine response of the target individual. We used the Blacktail Shiner (*Cyprinella venusta*), a soniferous cyprinid, as a model to investigate the acoustic modulation of gonadal hormones. Male and female *C. venusta* were exposed to two conspecific call types: growls and knocks. We used enzyme immunoassay (EIA) to measure changes in waterborne levels of estradiol, testosterone, and 11-ketotestosterone (11KT) during exposure to acoustic

signals. Males exposed to knocks exhibited a significant elevation in 11-ketotestosterone and testosterone; knocks are frequently produced during aggressive interactions. Females exhibited an elevation in estradiol after exposure to growls; a signal produced during courtship – suggesting that acoustic cues facilitate spawning by synchronizing gamete release. Future work aims to investigate the modulation of hormone levels while presenting an acoustic and visual cue simultaneously.

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**0096 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Martha L. Crump

*Utah State University, Logan, UT, USA*

**ASIH, Conservation, and the Future**

If we could see ahead to 2116, what will our ichthyological and herpetological world look like? Another century of climate change and habitat loss will further alter species distributions and interactions. Many of our favorite study animals will be gone. What will be the role of ASIH in 2116 in addressing the effect of these environmental issues on fishes, amphibians, and reptiles? ASIH is the unique taxon-based society it is because of the ideas and goals of its past and present members. Today, students represent about half of the membership. ASIH-member students are increasingly focusing on conservation issues, and ASIH as a society is becoming more involved in conservation (as reflected by the number of papers published in *Copeia* and the number of students competing for the Stoye Conservation Award). One hundred years from now, ASIH will reflect the conservation-oriented ideas and efforts of our current student members and of their students.

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**1074 General Herpetology, Galerie 2, Saturday 9 July 2016**

David Cundall[1], Edward Fernandez[2], Frances Irish[3]

*[1]Lehigh University, Bethlehem, PA, USA, [2]Cooper Medical School of Rowan University, Camden, NJ, USA, [3]Moravian College, Bethlehem, PA, USA*

***Pipa pipa:* Evolutionary Innovation in a Suction Mechanism**

Most suction-feeding aquatic vertebrates create suction by rapidly enlarging the oral cavity and pharynx. The pharynx is enlarged primarily by longitudinal hypaxial muscles that retract the hyoid and branchial arches lying between the jaws and pectoral girdle. This arrangement, thought to characterize most suction-feeding vertebrates, does not exist in *Pipa pipa*, a permanently aquatic, tongueless frog from Amazonian South America that can catch fish. Correlating high-speed video (250 and 500 fps) records with anatomical analysis and functional tests suggest that the suction mechanism in *Pipa pipa*, and possibly other pipids, is unlike that of any other suction-feeding vertebrate. In *P. pipa*, the hyoid apparatus is enclosed by the pectoral girdle. The major retractor of the

hyoid apparatus arises not from the pectoral girdle but from the femur. Retraction of the hyoid follows mouth opening and finger sweeping, and is coupled with expansion of the anterior trunk by depression of the greatly enlarged pectoral girdle and retraction of the sliding pelvic girdle, which elongates the entire trunk. We suggest that the ventral pectoral elements are forcefully depressed by pulling the scapula medially. Combined hyoid and pelvic retraction and pectoral depression expand the buccopharyngeal cavity to a volume equal to that of the entire resting body of the frog. *Pipa* is able to modulate all parts of its behavior for catching elusive prey, suggesting complex, rapid integration of sensory-motor control over its extraordinary musculoskeletal system.

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**0849 Fish Systematics II, Salon F-H, Saturday 9 July 2016**

Kendall Cupp, Benjamin Keck

*University of Tennessee, Knoxville, TN, USA*

### Genetic and Morphological Characterization of Highly Disjunct Populations of the Greenfin Darter, *Nothonotus chlorobranchius*

*Nothonotus chlorobranchius*, Greenfin Darter, inhabit the Tennessee River drainage tributaries flowing over the Blue Ridge physiographic region, resulting in highly disjunct populations. Previous molecular and morphological studies have identified geographic structure, but because phylogenetic relationships were not clearly resolved it was difficult to delimit evolutionary groups. We increased the number of individuals and loci, and inferred phylogenies that are better resolved. We also collected morphological data from over 500 individuals. We used the new phylogenies to guide group assignment of individuals in six delimitation scenarios and tested these groupings using Cross Validation Linear Discriminant Analysis. Our results support the recognition of multiple species, and highlight the benefits of using phylogenies to guide morphological comparisons.

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**0764 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Paul Cupp, Jr.

*Eastern Kentucky University, Richmond, KY, USA*

### Variability of Brooding Crevices in Green Salamanders, *Aneides aeneus*

Over 38 years the crevices of specific rock outcrops were monitored for variation in types of crevices used by females for brooding egg clutches during the summer breeding period in SE KY. Of visible rock crevices with *A. aeneus* present, only some had females brooding eggs. These crevices were often used every year or in alternate years over several years to brood eggs and young. The shapes and sizes of these crevices were quite varied. Horizontal Small brooding crevices (< 4 cm diam.) were used significantly more (60.5%) than other types of crevices. Horizontal Narrow Deep crevices and Horizontal

Wide crevices (> 4 cm diam.) made up 11.6% each of the crevices used. Those breeding crevices that were vertical or near a 45 degree angle were combined and made up 16% of crevices used. Females had high success rates in most of the types of crevices except for the Horizontal Wide crevices which had a lower success rate in rearing young. This may be due to the crevices being more open with fewer walls to protect against predators. All other crevice types were small and shallow, which may have provided greater protection. Females in previously used crevices had a higher rate of success in rearing young compared to those females in newly initiated brooding crevices or in sporadically used crevices. Nest site fidelity has some influence on the continued use of these crevices. These crevices must have properties that result in their selection by females (or males) as breeding sites.

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**0850 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Leanne Currey, Michelle Heupel

*Australian Institute of Marine Science, Townsville, Queensland, Australia*

**Northern Great Barrier Reef: a Haven of Shark Diversity and Abundance**

Australia's Great Barrier Reef (GBR) is world renowned for its diversity of marine life. Across a variety of habitats, 134 elasmobranch species occur in the GBR Marine Park (GBRMP), and likely fulfil a key role in ecosystem function. Baited Remote Underwater Video System (BRUVS) data collected along the entire GBR has revealed that shark abundance and species richness are most influenced by relative distance along and across the reef shelf and hard coral cover. Evidence suggests shark occurrence and species richness is higher in the Northern and Southern regions of the GBR compared to the Central GBR, while non-fished reefs support higher shark abundance. With a focus on coral reefs, the aim of this study was to assess the species composition and relative abundance of elasmobranchs sampled in the Northern GBR, and compare among management zones and with existing data. As part of the Global FinPrint Project, an initiative to assess shark and ray diversity and abundance in coral reef environments worldwide, BRUVS were deployed at two locations ($n$ = 154), in no-take and fished reefs. Eighteen elasmobranch species were observed, with grey reef sharks *Carcharhinus amblyrhynchos* sighted on the majority of BRUVS. Abundance of elasmobranchs was high across the sites with similar numbers across zones, indicating a low influence of fishing pressure. This research highlights the exceptional diversity and abundance of species occurring in remote areas of the GBR, and contributes to our understanding of their distribution patterns and marine reserve use, which is essential for effective shark conservation.

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**0457 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Michael Cyrana

*Tulane University, New Orleans, LA, USA*

### The Impact of Seasonal Hypoxia on the Abundance and Species Composition of Northern Gulf of Mexico Fish Communities

During the summer the northern Gulf of Mexico (NGOMEX) typically develops one of the largest hypoxic zones in the world. There is a critical need to investigate how hypoxia impacts biological communities in the NGOMEX. Using SEAMAP summer and fall groundfish survey data, I was able to investigate how seasonal hypoxia impacts fish communities in NGOMEX. My results suggest that hypoxia has a negative impact on the abundance of most fish species and that hypoxia alters fish community composition. My results also imply that the community level effects of summer hypoxia persist into the fall after the breakup of the hypoxic zone. While the finding that hypoxia impacts both the abundance and community composition of fish communities in the NGOMEX is not surprising, it is important to quantify what the exact impacts are in terms of species affected and likely mechanisms. With improved knowledge on how hypoxia affects fish communities one can better understand what part summer hypoxia plays in the overall ecology of the NGOMEX.

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**1030 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, Salon D, Thursday 7 July 2016**

Kristen Dahl[1], William Patterson III[1], Richard Snyder[2]

[1]*University of South Alabama Dauphin Island Sea Lab, Dauphin Island, AL, USA,* [2]*Virginia Institute of Marine Science Eastern Shore Laboratory, Wachapreague, VA, USA*

### Experimental assessment of lionfish removals to mitigate reef fish community shifts on northern Gulf of Mexico artificial reefs

Substantial declines in reef fishes were observed on northern Gulf of Mexico reefs between 2009-10 and 2011-12, a time period that brackets the appearance of invasive lionfish. However, a confounding factor during these declines was the Deepwater Horizon Oil Spill (DWH). The extent to which the DWH versus lionfish contributed to initial reef fish declines is unclear, but taxa that experienced the greatest declines are the preferred prey of lionfish in other systems. Targeted lionfish removals have been demonstrated to mitigate or reverse negative impacts on native fishes elsewhere. Therefore, we conducted a two-year experiment to examine the effectiveness and ecological benefits of lionfish removals at artificial reefs (n=27) off northwest Florida, where lionfish densities reached the highest recorded in the western Atlantic by 2013. All lionfish were removed via spearfishing from 17 reefs in December 2013, nine of which were periodically re-cleared of lionfish through May 2015. Remaining sites served

as uncleared controls. Both juvenile and adult lionfish quickly recruited to cleared reefs, with lionfish reaching pre-clearance densities in less than a year on reefs cleared once. Removal treatment significantly affected reef fish community structure, but removal effort was insufficient to achieve substantial gains for most taxa, and declines in several taxa were observed throughout the study regardless of treatment. It is unclear whether chronic effects of the DWH or regionally high lionfish densities were more important factors in explaining trends in community structure, but removals had few positive impacts overall on native reef fish communities in this study.

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**0943 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016**

Hollis Dahn, Alejandra Osorio, Jason Strickland, Christopher Parkinson

*University of Central Florida, Orlando, FL, USA*

**Comparative Phylogeography of *Arizona elegans* and *Rhinocheilus lecontei*: Two Perspectives on North American Desert Biogeography**

Post-glacial population expansion and associated secondary contact are common features of North American phylogeography. Cases of incipient speciation such as these are considered especially informative in studying the process of speciation. In these cases, divergent populations have begun to accumulate disparate genetic and phenotypic traits, and may either fail or continue to speciate at secondary contact. The dynamic geography of North America's arid regions presents an ideal landscape for comparative study of these effects. Separating the two major deserts to the east and west is a combination of high-elevation features known as the Continental Divide. This has shown to be a boundary for eastern and western lineages in many desert taxa. Here we conduct comparative, multi-locus analyses of the historical biogeography and evolutionary histories of lineages within two colubrid snake species, *Arizona elegans* and *Rhinocheilus lecontei*, selected for their relative similarity in ecology as well as range, and for their close phylogenetic relationship. We recovered intraspecific phylogenies of each species as well as divergence time estimates and historical demographics. Our results indicate disparity between the two species in the intensity of population divergences, biogeographical histories of lineages, and levels of introgression between lineages. Major eastern and western clades are recovered in both species with varying levels of substructure. *Rhinocheilus lecontei* presents comparatively larger secondary contact between eastern and western lineages. The apparently differing responses of these organisms to one landscape merits further investigation through an ecological lens.

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**0522 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Kacey Dananay, Michael Benard

*Case Western Reserve University, Cleveland, OH, USA*

**Artificial Light at Night: Tests for Direct and Indirect Effects on American Toad Growth, Development and Behavior**

Artificial Light at Night (ALAN) impacts over 20% of the earth's surface, disrupting ecological interactions and individual physiology. We tested whether ALAN affected American toads through either direct impacts on individual toads or by altering the toads' ecological community. We conducted a two-phase experiment using outdoor mesocosms and indoor terraria. In the first phase, we raised toad larvae using a 2x2x2 factorial design manipulating the presence and absence of ALAN, opportunity for colonization (presence or absence of lids to control insect colonization) and the presence or absence of toads. We measured treatment effects on toad traits (growth, development, survival) and ecological community traits (algal growth, invertebrate abundance). The primary effect of ALAN in the first phase was to cause earlier metamorphosis and reduced variability in metamorphosis. We did not detect indirect effects of ALAN on toads mediated through changes in invertebrate colonization. In the second phase, we moved metamorphosing toads into laboratory terraria where they were separated into two post-metamorphic photoperiod treatments: ALAN or natural. In the second phase of the experiment, ALAN during the juvenile stage increased juvenile toad activity but reduced juvenile toad growth. Additionally, toads that experienced ALAN as larvae had reduced growth after metamorphosis, even when they were no longer exposed to ALAN. These results suggest ALAN has important direct effects on amphibians. Expanding our experiment to post-metamorphic life-stages not only revealed a carry-over effect but also suggested that short-term exposure to ALAN can increase activity and reduce growth.

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**0444 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Kaylan Dance[1], Jay Rooker[1], Brooke Shipley[2], David Wells[1]

*[1]Texas A&M University, Galveston, Texas, USA, [2]Coastal Fisheries- Artificial Reef Program, Texas Parks and Wildlife Department, Austin, Texas, USA*

**Feeding Ecology of Fishes at Artificial Reefs in the Northwest Gulf of Mexico**

Two heavily exploited species in the Gulf of Mexico (GOM), Red Snapper *Lutjanus campechanus* and Gray Triggerfish *Balistes capriscus*, were used as model species to compare the feeding ecology of a demersal (Red Snapper n=184) and midwater (Gray Triggerfish n=90) predator at nearshore (16-60 km) artificial reefs (ARs). Objectives were to compare dietary shifts of both species across different reef types (pyramids, concrete culverts, and quarry rocks) and estimate contribution rates of particulate organic matter (POM) and benthic microalgae (BMA) to each model species. Samples of model species

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were collected via vertical longline and trap surveys during 2014 and 2015. Epaxial muscle tissue was used to obtain species-specific stable isotope ratios of carbon ($\delta^{13}C$), nitrogen ($\delta^{15}N$), and sulfur ($\delta^{15}S$), and paired with gut content analyses. Differences in $\delta^{13}C$ and $\delta^{15}S$ of Red Snapper ($\delta^{13}C$ mean = -17.70, $\delta^{15}S$ mean = 18.70) and Gray triggerfish ($\delta^{13}C$ mean = 18.76, $\delta^{15}S$ mean = 20.32) were significant (ANCOVA, $p < 0.05$). Gut contents between species were also significantly different (ANOSIM, $p < .05$), with invertebrate fauna (bivalves, echinoderms, and gastropods) in the diets of Gray Triggerfish, and fish in the diets of Red Snapper contributing most to the dissimilarity (using SIMPER analysis) in gut contents. This study illustrates differences in stable isotope ratios and gut contents between species and discusses them across reef types, as well as the estimated contribution of POM and BMA to both model species.

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**0359 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Jon Davenport[1], Blake Hossack[2], LeeAnn Fishback[3]

*[1]Southeast Missouri State University, Cape Girardeau, MO, USA, [2]United States Geological Survey, Missoula, MT, USA, [3]Churchill Northern Studies Centre, Churchill, MB, Canada*

## Additive impacts of experimental climate change increase risk to an ectotherm at the Arctic's edge

Ectotherms are particularly susceptible to environmental change (e.g., warming and wetland drying). Several studies in temperate environments have examined the adaptive capacity of organisms to greater understand the potential repercussions of warming and associated accelerated drying for freshwater ecosystems. However, few experiments have examined these impacts in Arctic or Subarctic freshwater ecosystems, where the climate is changing most rapidly. To evaluate the capacity of a widespread ectotherm to anticipated environmental changes, we conducted a mesocosm experiment with the wood frog (*Rana sylvatica*) in the Subarctic. Three warming treatments were fully crossed with three drying treatments to simulate a range of predicted changes in wetland environments. We measured survival, growth rate, and size at metamorphosis. We predicted wetland warming and drying would act synergistically, with water temperature partially compensating for some of the negative effects of accelerated drying. Across all drying regimes, a 1°C increase in water temperature increased the odds of survival by 1.79, and tadpoles in 52-day and 64-day hydroperiod tanks were 4.1–4.3 times more likely to survive to metamorphosis than tadpoles in 45-day tanks. For individuals who survived to metamorphosis, there was only a weak negative effect of temperature on size. Our results reveal that one of the dominant herbivores in Subarctic wetlands, wood frog tadpoles, are capable of increasing their developmental rates in response to increased temperature and accelerated drying, but only in an additive manner. The strong negative effects of drying on frog survival suggest that drastic alterations may be occurring in Subarctic wetland communities.

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**0167 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Donald Davesne, Matt Friedman

*Department of Earth Sciences, University of Oxford, Oxford, UK*

### A History of Sea Serpents: Reassessing the Early Fossil Record of Lampridiformes (Teleostei: Acanthomorpha)

Lampridiformes is a morphologically distinctive group of marine pelagic acanthomorph teleosts, including iconic species such as the homeothermic opah (*Lampris guttatus*) and the giant elongated oarfish (*Regalecus glesne*). A relatively high number of Lampridiformes relatives are known in the fossil record, as early as the Late Cretaceous (~95 million years). However, the phylogenetic position of most of these fossil taxa is poorly constrained. In order to better understand the early evolution of Lampridiformes, we reviewed several Palaeogene fossil taxa within the most recent phylogenetic frameworks. For example, *Whitephippus* (Early Eocene of England) is redescribed with CT-scan data. In contrast with previous interpretations that included it within Ephippidae (spadefishes), we show that this taxon is one of the oldest anatomically modern Lampridiformes. On the other hand, the very strange *Bajaichthys* from the Middle Eocene of Italy, while described as an elongated lampridiform (Taeniosomi), probably does not belong to this group. Finally, we present a preliminary phylogenetic analysis of Lampridiformes including Palaeogene taxa alongside modern diversity. The deep-bodied, so-called "veliferoid" or "bathysome" fossil taxa are placed at varying positions in the tree, helping to break down the sequence of acquisition of modern lampridiform's characters states.

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**0247 Fish Systematics II, Salon F-H, Saturday 9 July 2016**

Donald Davesne[1], Cyril Gallut[2], Olga Otero[3]

*[1]Department of Earth Sciences, University of Oxford, Oxford, UK, [2]ISyEB, Université Pierre et Marie Curie/Muséum national d'Histoire naturelle, Paris, France, [3]IPHEP, Université de Poitiers, Poitiers, France*

### Towards a Consensus for Deep Intrarelationships of Acanthomorph Teleosts

Since the 2000s, numerous large-scale molecular phylogenies have restructured the spiny-rayed teleost (Acanthomorpha) evolutionary tree and challenged previous hypotheses, mainly based on anatomy. However, major uncertainties remain, imputable to the various topologies obtained by different molecular studies. This is particularly true for the first dichotomies of the acanthomorph tree. To address these uncertainties, we performed two sets of analyses: - analyses of a morphological dataset including extant and Upper Cretaceous fossil representatives of every major acanthomorph clade; - analyses of molecular datasets, including nuclear and mitochondrial markers, with a similar taxonomic coverage. The separate analyses of these datasets show how different lines of evidence converge towards a consensual acanthomorph tree. Acanthomorph monophyly is recovered by morphological data, individual nuclear gene partitions and

also by the mitogenome, but with low support values. A clade including Polymixiiformes (beardfishes), Percopsiformes (trout-perches), Gadiformes (cods and allies), Zeiformes (dories) and *Stylephorus* (tube-eye) is always recovered with high support, but the precise position of Polymixiiformes and *Stylephorus* is variable from one dataset to another. The inclusion of Ophidiiformes (cusk-eels and allies) and Batrachoidiformes (toadfishes) in a clade with Beryciformes (soldierfishes and allies) is also always recovered. Finally, Lampridiformes (oarfish and allies) are always recovered as sister-group to other acanthomorphs, but with a weak support.

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**1061 Fish Reproduction, Physiology, & Conservation, Balconies J & K, Sunday 10 July 2016**

Solomon David[1], Scott Hansen[4], Peter McIntyre[3], Andrew Rypel[4], Charles Madenjian[2], Eric Larson[5], Olivia King[7], Bryan Frenette[6], Wendy Stott[2]

*[1]John G. Shedd Aquarium, Chicago, IL, USA, [2]U.S. Geological Survey Great Lakes Science Center, Ann Arbor, MI, USA, [3]University of Wisconsin-Madison, Madison, WI, USA, [4]Wisconsin Department of Natural Resources, Madison, WI, USA, [5]University of Illinois Urbana-Champaign, Champaign, IL, USA, [6]Kansas State University, Manhattan, KS, USA, [7]North Central College, Naperville, IL, USA*

**Call It a Comeback: Reemergence and Restoration of Great Lakes Coregonid Fishes**

Coregonid fishes serve important ecological and economic roles throughout the Laurentian Great Lakes, both presently and historically. The Lake Whitefish (*Coregonus clupeaformis*) constitutes the largest commercial fishery in Lake Michigan. The Cisco (*Coregonus artedi*) was once the largest commercial fishery on multiple Great Lakes before crashing due to a combination of overfishing, habitat loss, and invasive species in the mid 20th century. River spawning migrations of Lake Whitefish greatly declined in the early 20th century due to habitat loss, but have reemerged in the past decade in northern Lake Michigan. The primary drivers for reemergence of these migrations are currently unknown; additionally, little is known regarding the ecology of these river-spawning populations. To investigate potential differences among migratory and non-migratory populations of Lake Whitefish, we compared stable isotope signatures (δ15N, δ13C), age and growth (otoliths), gill rakers, and morphometrics of three river- and two nearshore-spawning Lake Whitefish populations in Lake Michigan from 2012-2014. Results indicated river-spawning Lake Whitefish were significantly different in morphology and stable isotope signatures from nearshore-spawning Lake Whitefish in northern Lake Michigan, whereas differences in gill rakers were less distinct. These results will help identify migratory and non-migratory Lake Whitefish populations during non-spawning season sampling and harvest, as well as informing restoration efforts for Cisco and other coregonid fishes throughout the Great Lakes region.

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**0025 AES Conservation & Management III, Balconies L & M, Saturday 9 July 2016**

Lindsay Davidson, Nicholas Dulvy

*Simon Fraser University, Burnaby, Canada*

**Global Marine Protected Areas for Avoiding Extinctions**

Target 11 of the Convention on Biological Diversity (CBD) outlines that 10% of global coastal oceans should be designated as a Marine Protected Areas (MPA) by 2020. This area goal has driven rapid gains in global MPA coverage but it remains unclear whether threatened species are being protected. We find the area-grabbing approach of MPA designations will fail to avert extinctions of sharks, rays, and chimaeras (Class Chondrichthyes). We find that only 10 of the 99 most vulnerable and irreplaceable chondrichthyans meet the minimum protection target of 10% of their range within a MPA and only one (*Squalus raoulensis*) is found in a Marine Reserve - those areas that are no-take and strictly protected. However, to protect chondrichthyans the solution is simple. Using a unique dataset we identify twelve countries that harbour over half of the world's vulnerable and irreplaceable chondrichthyans, as well as three-quarters of wide-ranging threatened species within an area of less than 1% of the world's ice-free oceans. These countries have much room for conservation and management action in terms of (i) adequate Shark-Plans, (ii) shark finning regulations, (iii) conserving migratory sharks and rays, (iv) commitments to eliminating Illegal Unreported and Unregulated fishing. Looking forward, an additional 3.5% of the global ice-free EEZ area would protect 50% of the global distribution of the 99 threatened endemics - well below the 10% target. Our analysis lays the foundation for marine biodiversity conservation goals beyond 2020.

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**0032 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT**

Drew Davis[1], Cameron Siler[2], Jacob Kerby[1]

[1]*Department of Biology, University of South Dakota, Vermillion, SD, USA,*
[2]*Department of Biology, University of Oklahoma, Norman, OK, USA*

**Co-infection of *Batrachochytrium dendrobatidis* and Ranavirus in Amphibians from Northern Luzon, Philippines**

Amphibians are one of the most threatened groups of organisms on earth, with reports suggesting that one-third of the world's species are at risk of extinction. Although factors contributing to this biodiversity crisis include habitat loss, a major concern has been the emergence of infectious diseases, particularly *Batrachochytrium dendrobatidis* (*Bd*) and ranaviruses, which are known to cause large amphibian die-offs. At the core of mitigating negative effects these pathogens have on amphibian populations is a need for a comprehensive understanding of their distribution and of what amphibian species are particularly susceptible to infection. While there has been increasing interest in

understanding the distribution of these pathogens in tropical Southeast Asia, there are still large regions with limited information on the distribution of these pathogens. Here, we sampled both skin swabs and tissue (liver) samples from multiple species of anurans from Aurora Province, Luzon Island, Philippines for infection by both *Bd* and ranavirus. We report on pathogen prevalence and infection intensity as well as comment on conservation priorities in this region.

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**0526 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Mark Davis[1], Michael Dreslik[1], Sarah Baker[1], Chris Phillips[1], Charles Smith[2], Roger Repp[3], Gordon Schuett[4]

*[1]Illinois Natural History Survey, Champaign, IL, USA, [2]Wofford College, Spartanburg, SC, USA, [3]National Optical Astronomy Observatory, Tucson, AZ, USA, [4]Georgia State University, Atlanta, GA, USA*

## A Comparative Assessment of Pitviper Life Histories Using Robust Quantification

Biodiversity in the Anthropocene faces unprecedented challenges that may differentially impinge upon life stages of species. As such, quantifying life histories and assessing their elasticities and sensitivities can yield key insights into the endangerment process itself, while also informing adaptive management strategies. However, data to populate such models are hard won, particularly given the relatively long life spans of pitvipers, their often cryptic and semi-fossorial nature, and the periodicity and term of modern funding cycles. And yet the advent of the Endangered Species Act paved the way for long-term mark-and-recapture (MR) studies of imperiled pitvipers (e.g. Eastern Massasauga, *Sistrurus catenatus*; New Mexico Ridge-Nosed Rattlesnake, *Crotalus willardi obscurus*). These and studies of other pitviper species provide the fodder for a comparative assessment. Here we accessed long-term (>5 years) MR datasets for pitvipers and estimated fecundity and stage-specific survival rates. We constructed Leftkovich matrices for each species and conducted Eigenanalyses to yield asymptotic population growth (λ), stable stage distributions, and matrix element elasticities and sensitivities. Similarities and differences between pitviper species were then identified. The results of our analyses 1) underscore the importance of long-term datasets to parameterize population models, 2) identifies commonalities and disparities in pitviper life histories, 3) inform targeted adaptive management strategies aimed at promoting sensitive stage classes, and 4) yield a key step in developing population viability analyses for imperiled pitviper species.

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**0589 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

Matthew Davis

*St. Cloud State University, St. Cloud, MN, USA*

### Evolutionary Relationships and Patterns of Diversification among the Lizardfishes and their Allies (Teleostei: Aulopiformes)

This study focuses on the morphologically diverse and species-rich (~250 species) lineage of lizardfishes (Aulopiformes), which are found in marine habitats worldwide. Aulopiform fishes inhabit marine environments ranging from coral reefs to the deep sea, and possess adaptations (e.g., bioluminescent organs, predatory innovations, hermaphroditism) that may have impacted their diversification. For this study, the patterns and processes of diversification among aulopiform fishes are investigated. A densely sampled, multi locus, and temporal phylogenetic hypothesis of aulopiform evolutionary relationships is used to inform lineage diversification and character evolution (e.g., depth partitioning, bioluminescence, reproductive strategy) across the lizardfishes radiation.

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**0524 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Matthew Davis, Toby Daly-Engel

*University of West Florida, Pensacola, FL, USA*

### Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*) Rangewide Genetic Stock Structure

The Atlantic Sharpnose shark (*Rhizoprionodon terraenovae*) is a small coastal species associated with the subtropical and tropical waters of the Gulf of Mexico (GoM) and northwest Atlantic. The members of the genus *Rhizoprionodon* are often utilized by small-scale fisheries as an important resource, and *R. terraenovae* alone represents 46% of annual artisanal elasmobranch catches in the southern GoM. Despite the species' commonality in both artisanal and commercial fisheries, relatively little is known regarding its reproductive behavior, range limits, and movement patterns. We seek to characterize the fine-scale genetic connectivity of this species through statistical comparison of DNA sequences from both the mitochondrial and nuclear genome, including >650 base pairs of the control region and 10-12 microsatellite loci cross-amplified from congener species. To date we have accumulated over 500 *R. terraenovae* tissue samples from 10 sites throughout its range from Rhode Island to Belize, and collections are ongoing. With these data we delineate the patterns of gene flow, philopatry, and dispersal in *R. terraenovae*, information that will enable managers and conservationists to better protect and manage this species in the future.

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**0479 Fish Reproduction, Physiology, & Conservation, Balconies J & K, Sunday 10 July 2016**

Julie L Day[1], Ron Barnes[2], Darrick Weissenfluh[1]

*[1]U.S. Fish and Wildlife Service, Klamath Falls, OR, USA, [2]Gone Fishing, Klamath Falls, OR, USA*

## From Manuscript to Management: Development of a New Assisted Rearing Program for Endangered Klamath Suckers (Catostomidae)

Decades of inadequately abated natural and anthropogenic threats coupled with competing and often controversial water needs have resulted in the compromised status and endangered listing of numerous freshwater fishes, many of which are now artificially propagated in hatcheries. However, low survival of hatchery-reared fish is a commonly reported problem for many programs, particularly those being implemented in systems with substantial non-native predator populations. Extensive sampling for shortnose (*Chasmistes brevirostris*) and Lost River sucker (*Deltistes luxatus*) in the Klamath River Basin have failed to detect any new adult recruitment for at least two decades, elevating concern that senescence of the population will result in the demise of the species and prompting an investigation into propagation. Balancing the risks of interfering with natural ecological and evolutionary processes for the good of the species requires a substantial investment in recognizing synergies within the existing knowledge base prior to moving forward with program design. As such, we are developing a new assisted rearing program designed to address the need to minimize human intervention in the rearing process and alleviate risks associated with domestication. Wild-spawned fish are collected in relatively low numbers as larvae or young juveniles and reared in a series of earthen ponds that are operated as semi-natural mesocosms, and success to date has been promising. Here we present an overview of how key concepts identified in academic literature are incorporated into management actions associated with this program, and an update on initial collection and husbandry activities which commenced in November 2015.

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**0692 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Juan D. Daza[1], Virginia Abdala[4], Aaron M. Bauer[3]

*[1]Sam Houston State University, Huntsville, Texas, USA, [2]Marquette University, Milwaukee, Wisconsin, USA, [3]Villanova University, Villanova, Pennsylvania, USA, [4]Instituto Miguel Lillo, Universidad Nacional de Tucumán, San Miguel de Tucumán, Tucumán, Argentina*

## Synapomorphies and symplesiomorphies in geckos from the southern cone of South America: *Garthia* and *Homonota* (Squamata: Gekkota: Phyllodactylidae) revisited

The genus *Homonota* from southern South America comprises ten species of broad-headed geckos, which reach the austral limit for the Gekkota. Historically,

morphological data have supported the monophyly of a clade including *Homonota* and the Chilean genus *Garthia*, with the latter possibly embedded within the former. On the other hand, recent molecular evidence indicates that these two genera are in separate clades, and that *Homonota* is more closely related to the leaf toad geckos of the genus *Phyllodactylus*. Here we analyze a combined analysis of 659 morphological characters and eight nuclear loci in an analysis that includes *Garthia, Homonota*, *Phyllodactylus,* and other phyllodactylid geckos. Our results indicate that *Homonota* and *Garthia* are nearly indistinguishable on morphological grounds and share a vast majority of characters both externally and internally. The result of these analyses suggests many morphological states in *Garthia* and *Homonota* are symplesiomorphic in reference to the differentiation of the American leaf-toed geckos.

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**0703 Herp Morphology & Genetics, Galerie 3, Sunday 10 July 2016**

Juan D. Daza[1], Raynie Leard[1], Aaron M. Bauer[2], Emma Sherratt[3]

*[1]Sam Houston State University, Huntsville, Texas, USA, [2]Villanova University, Villanova, Pennsylvania, USA, [3]University of New England, Armidale, New South Wales, Australia*

**The Amber Gecko *Sphaerodactylus dommeli*: One Species or Two?**

The amber gecko *Sphaerodactylus dommeli* from Hispaniola was described in 1984 based on two specimens. These geckos date back to the late Early Miocene or early Middle Miocene, 15 to 20 ma. Since their discovery, there have been some claims that they are anoles and not geckos. Based on High-resolution x-ray computed tomography (HRXCT) data, we confirm that the two specimens are in fact geckos. In order to ascertain that these amber geckos are one or two species, we examined intraspecific size variation using a postnatal series of the Puerto Rican gecko species *Sphaerodactylus townsendi* including hatchlings and skeletally mature specimens. Cleared-and stained preparations and digital x-rays from *S. townsendi* specimens were measured digitally. Based on linear measurements we were able to determine that skeletally-mature specimens are about 2.4 times larger than the hatchlings. We demonstrated that the holotype of *S. dommeli* is 2.4 times larger than the paratype, suggesting they correspond to adult and hatchling stages, respectively. However morphological differences not attributable to observed ontogenetic changes in *S. townsendi* indicates that *S. dommeli* is represented by specimens from two distinct species; the paratype has a proportionally longer shorter snout, a well-developed lateral process of the postorbitofrontal, and pointed posteromedial laminae of the parietal, rather than rounded as in the holotype. Based on the new evidence, we conclude that the paratype of *S. dommeli* needs to be described as a separate species, adding to the large number of Dominican amber species that remain to be formally characterized.

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**0386 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Simon Dedman[1], Rick Officer[1], Deirdre Brophy[1], Maurice Clarke[2], Dave Reid[2]

*[1]Galway-Mayo Institute of Technology, Galway, Ireland, [2]Marine Institute, Galway, Ireland*

## Gbm.auto - a Decision Support Tool automating Boosted Regression Tree modelling of data-poor species abundance using environmental and human inputs, mapping essential habitats, and designing MSY-based MPAs considering stakeholder priorities

The gbm.auto R package suite automates and greatly simplifies delta log-normal Boosted Regression Tree spatial modelling, removing the high technical barrier that prevents many potential users from reaping the benefits of this powerful statistical modelling technique. The package and its documentation allow users with very little experience of R to generate maps of predicted abundance, representativeness maps for those abundance maps, bar plots of the relative influence of explanatory variables, dot and line plots of the relationships between explanatory variables and response variables, databases of the processed model objects, and a report explaining all the steps taken within the model. This process can be used to map essential habitats such as nursery grounds and spawning areas, to produce areas of key conservation importance for multiple species. Escapement biomass - the percentage of the stock which must be retained each year to conserve it - is then combined with the predicted abundance maps to create a Decision Support Tool that generates location and size options for MPAs to protect the target stocks, based on stakeholder priorities, especially the minimisation of fishing effort displacement. In bridging the gap between advanced statistical mathematics and conservation science/management/policy, these tools can allow improved spatial abundance predictions, and therefore better management and better conservation. This poster demonstrates how the package is used and the outputs it produces.

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**0264 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Simon Dedman[1], Rick Officer[1], Deirdre Brophy[1], Maurice Clarke[2], Dave Reid[0]

*[1]Galway-Mayo Institute of Technology, Galway, Ireland, [2]Marine Institute, Galway, Ireland*

## A flexible decision support tool for Maximum Sustainable Yield-based MPA design

Novel, spatial approaches have been called for to manage elasmobranchs, but existing techniques struggle to model abundance hotspots and essential habitats of data-poor stocks. When proposed MPA's are presented as definitive and singular solutions this can entrench an antagonistic relationship between fisherman and managers/scientists. We have used survey data and discarding records to develop Fmsy (fishing CPUE equating

to Maximum Sustainable Yield) and Bpa (precautionary minimum total biomass to support a species) proxies for these populations, allowing us to estimate the proportion of population biomass that must be conserved annually to meet PA or MSY thresholds, i.e. escapement. We have then applied Boosted Regression Tree modelling of survey catch and environmental factors such as depth, substrate and flow, to map skate and ray abundance hotspots. The outputs are combined with international fishing effort data (VMS) and fed into a custom-built Decision Support Tool (DST), to identify the location and size of candidate MPAs that could protect the escapement PA biomass while minimizing the displacement of fishing effort. The DST allows fishermen, managers and scientists to use spatial management, underpinned by fisheries science, to explore MPAs which incorporate different and often conflicting priorities. The entirety of this work has been integrated into a simple R package which takes surveyed CPUE and environmental data and produces CPUE hotspot maps for a whole study area, including for sensitive subsets such as nursery areas, and an MPA-generating DST incorporating stakeholder priorities.

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**0922 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Brian Deis, Kathleen Cole

*University of Hawaii at Manoa, Honolulu, HI, USA*

### Reproductive Behavior and Bi-directional Sex Change in a Cryptobenthic Reef Fish, *Eviota epiphanes* in Hawaii

*Eviota epiphanes*, a small (2cm TL), cryptobenthic species of goby (Family Gobiidae) has been documented as the most abundant fish on near shore reefs in Hawai`i. *Eviota epiphanes* (Family: Gobiidae) is a reef fish native to the Hawaiian Islands, and has been hypothesized to be a bi-directional hermaphrodite (i.e., able to alternate between sperm and ova production) (Cole 2010). In addition, elements of the courting behavior displayed by species in this genus are hypothesized to be phylogenetically informative (Sunobe 1998). Individuals were collected around Oahu and observed in aquaria in pairs of two ova-producing individuals, two sperm-producing individuals, and one ova-producing individual and one sperm-producing individual. Behavioral observations and, when appropriate, the associated presence of eggs, were recorded daily. From these data behaviors associated with reproduction in *E. epiphanes* were characterized and quantified, in order to test hypotheses proposed by Cole (2010) and Sunobe (1998). The results of this study demonstrated for the first time bi-directional sex change in *E. epiphanes*, and found courting behavior to be inconsistent with what is hypothesized as representative for the assigned *Eviota* clade in Sunobe (1998) to which *E. epiphanes* has been assigned (Karnella and Lachner 1980). In addition, significant differences were found in the frequency of certain behaviors between different pair types. This research is the first in-depth look into the social and reproductive behavior of *E. epiphanes* and, as such, will contribute to the growing literature on the biology of both serially hermaphroditic and cryptobenthic reef fishes.

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**0836 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Jennifer Deitloff[1], Jacob Fetterman[1], Todd Pierson[2]

*[1]Lock Haven University, Lock Haven, PA, USA, [2]University of Tennessee Knoxville, Knoxville, TN, USA*

### Variation in mating tactics of *Eurycea wilderae*: Does morphology correlate with mating strategy used by males?

Amphibians exhibit a wide variety of mating systems and characteristics, including variation in tactics used to find or acquire mates. Specifically, species within the *Eurycea bislineata* complex exhibit a continuum of male morphologies and diverse habitat associations. During this study we examined behavior of *Eurycea wilderae*, focusing on differences in behavior between the two different male morphologies common in this species. One form possesses long cirri and a slender head (cirriferous), and the other form has a larger, robust head (robust morph or previously described as Morph A in *E. wilderae*). Based on previous studies of *Eurycea* mating strategies, we tested three hypotheses: (1) Morph A males would display mate guarding behaviors, but males with the cirriferous morph would not; (2) neither morph would exhibit territoriality; and (3) the cirriferous morph would be able to detect, and would prefer areas containing, female pheromones. We did not find any support for the hypothesis about mate guarding: neither morph exhibited aggression towards males in the presence of females and, as expected, neither morph showed territoriality behaviors. We did determine that males likely detect and show a preference for areas that contain female pheromones; however, the male morphology types did not show a significant difference in this ability. This study demonstrates that the relationship previously described between male morphology and mate strategy in other *Eurycea* species does not hold true for all the species within this complex. We hope to continue to explore the differences in mating strategies within *Eurycea* in the future.

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**0801 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Caitlin Dempsey, Kimberly Richard, Lance Olson, Michelle Norden, Robert Hancoc

*Metropolitan State University of Denver, Denver, CO, USA*

### Who's out there: Integration of stationary point counts and conservation photography to assess reef fish biodiversity

In the face of declining coral reefs due to human impacts, periodic assessments of "reef health" have been implemented. Conventional scientific methods include standardized fish counts executed in defined areas on randomly selected reefs by trained SCUBA divers. These counts rely predominantly on *in situ* identifications of fishes by the divers

with adjunct photography being performed for unknown fishes. Examined in this study was the utilization of underwater photography and fish counts with intentions to enhance representation of the biodiversity in demersal reef fishes. We coupled stationary point count surveys in designated 10 M cylinders with free roaming photography to compare measurable indices of biodiversity between openly fished areas, and ecologically similar no-take preserve areas within the Florida Keys National Marine Sanctuary. The availability of high quality digital photography and videography conjoined with high capacity memory storage enabled a visual census to be catalogued in a greater capacity than past methods allowed. Preliminary results indicate differences in biodiversity between openly fished and the preserved reefs.

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**0169 General Ichthyology II, Balconies J & K, Sunday 10 July 2016**

John Denton

*American Museum of Natural History, New York, NY, USA*

**Diversification patterns in myctophiform fishes suggest a positive response to a range of oceanic perturbations**

Although the deep-sea environment is the largest ecosystem on the planet, little is known about how its species may respond to environmental changes over evolutionary timescales. Fishes in the order Myctophiformes (lanternfishes, blackchins) exhibit a worldwide distribution, extreme biomass abundance, and intermediate trophic position, making them a useful proxy for overall biotic response in the midwater environment. I analyze myctophiform diversification rates using a time-calibrated phylogeny, comprising 138 of the approximately 254 species in the order, and accounting for node calibration density uncertainty, and show that myctophiform fishes exhibit a continuously increasing diversification rate, in contrast with the patterns of decreasing or constant diversification through time inferred for other widespread clades. The increasing diversification rate in myctophiform fishes is accompanied by three major rate shift locations, with temporal patterns broadly coinciding with large-scale ocean acidification, anoxia, and cooling events responsible for thermohaline disruption and the establishment of deepwater circulation. These results suggest that diversification in myctophiform fishes may be positively responsive to a wide range of changes in oceanic climatic conditions.

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**0377 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Salon A-C, Friday 8 July 2016**

Robert Denton[1], Kyle McElroy[2], Laura Bankers[2], Joel Sharbrough[2], Maurine Neiman[2], Lisle Gibbs[1]

*[1]Ohio State University, Columbus, Ohio, USA, [2]University of Iowa, Iowa City, Iowa, USA*

## Quantifying Genome Theft and Characterizing Gene Expression Patterns in Unisexual *Ambystoma* Salamanders

Unisexual *Ambystoma* salamanders are an all-female vertebrate lineage with the potential to add and replace genomes from males of sexual *Ambystoma* salamander species. The result of this reproductive mode is a staggering diversity of genome compositions within unisexual salamanders: from triploid to pentaploid with genomes potentially representing five different species. While many unisexual animal lineages are considered "evolutionary weeds", this unisexual lineage is currently the oldest recognized in vertebrates (~5 mya) and unisexuals are abundant across a large area of eastern North America. We present two separate genetic analyses that potentially address the evolutionary success of unisexuals. First, we directly quantified the gene flow from two sexual species (*A. jeffersonianum* and *A. laterale*) into the unisexual lineage using species-specific microsatellites and model-based analyses. Second, we compared relative gene expression across the subgenomes of a triploid unisexual individual with three different parental genomes (*A. laterale*, *A. texanum*, and *A. tigrinum*). We used a competitive transcript mapping technique to show that expression is balanced across the unisexual's haploid genomes and the majority of genes that are differentially expressed are dominated by the *A. tigrinum* genome. This work presents one of strongest pieces of evidence for the "theft" of sperm in the unisexual genome and provides a new direction in understanding how sexual genomes behave after being captured into the unisexual lineage.

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**1010 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Brian Devlin, Tiffany Doan, Kevin Greene

*University of Central Florida, Orlando, Florida, USA*

### Differential Rates of Malarial Infection by *Plasmodium floridense* between two *Anolis* species in Central Florida

Central Florida is home to two species of *Anolis* lizards. *Anolis carolinensis* is native to the southeastern United States, whereas *Anolis sagrei* is an invasive species native to the islands of the Caribbean. *Plasmodium floridense* is a saurian malaria parasite known to infect both of these species, but the prevalence of infection by *P. floridense* of these two lizard species had never been examined in Central Florida. We hypothesized that *A. sagrei* would suffer a higher infection rate than *A. carolinensis* because the native species has coexisted with the parasite much longer, potentially evolving some resistance to infection. We captured lizards by either slip noose or by hand, and the third toe on the right rear leg was clipped for marking and for a blood sample. We measured parasite prevalence between these two species in multiple sites of Central Florida over 3 months in 2016. Presence and prevalence were based on examination of fixed and stained blood smears for 3 minutes under a microscope. The invasive *A. sagrei* was found to have a higher rate of *P. floridense* infection than *A. carolinensis*. Although the reason for differences in infection rate between the two species is not known, higher infection rates in *A. sagrei* may be related to their high population density. Further study could indicate patterns of distribution of *P. floridense* in the southeastern United States.

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**1119 HL, ASIH, SSAR: Eco-Evolutionary Dynamics Symposium, Salon D, Friday 8 July 2016**

Jayna L. DeVore, Michael Crossland, Richard Shine

*University of Sydney, NSW, Australia*

### Invasion and Evolving Plasticity: Influences of Disparate Predator Communities and Shifting Parental Investment on Cane Toad Plastic Responses

As exotic invasive species colonize new habitats they frequently encounter novel predator communities and shifts in competitive pressures. Plastic responses allow for rapid adaptation to unpredictable environments, thereby frequently enhancing performance, but the optimal plastic response might change as new habitats are colonized. Additionally, the severity of the costs incurred as a consequence of these responses may differ depending on their nature or the condition of the individual in question. We used common gardens in Australia and Hawaii to investigate the nature and cost of plastic responses to predation by dragonfly larvae and food limitation in

cane toad tadpoles from a variety of established populations and the Australian invasion front. In Australia, where the majority of predators find cane toads unpalatable, we found evidence of chemical plasticity in response to predator cues, whereas Hawaiian populations responded to predators through behavioral modifications. We also found that the costs of predator-induced plasticity were highest at the Australian invasion front and correlated with egg size, such that reductions in embryo volume along the invasion front drove reduced survival in predator-exposed treatments. This appears to be a consequence of shifting parental investment along advancing front, in which parents are investing in larger numbers of lower quality offspring to maximize population growth in newly colonized environments. The divergent trajectories in the evolution of these responses since toad introduction in the 1930s exemplify how quickly plastic responses to environmental cues can be modified, and has implications for both toads and their predators as the invasion advances.

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**0733 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Alyse DeVries, Paul Bartelt

*Waldorf College, Forest City, IA, USA*

### Response of Eastern Tiger Salamanders to Restored Wetlands on an Agricultural Landscape in North Central Iowa: Preliminary Results

Wetland drainage has predictable effects on amphibian populations; but, how soon after restoration will amphibians colonize wetlands? How do they use the intervening row-crop matrix to find these "islands" of wetlands? Over 150 years of agriculture has reduced prairie pothole wetlands in north Iowa to a fraction of its former expanse, but substantial amounts of wetlands have been restored over the last 20 years. We measured occupancy and colonization patterns of Eastern Tiger Salamanders (a species of conservation concern in Iowa) among recently restored wetlands in Winnebago County, IA. In 2014, we used visual encounter surveys and unbaited minnow traps to estimate occupancy in 45 ponds among 19 restored wetlands, including 14 ponds among 5 wetlands that were restored in 2013. Each pond was surveyed at least twice. In 2015, we used radio-telemetry, GPS, and a GIS to begin mapping movement and habitat use patterns of 12 salamanders. Combining results from both visual and trapping surveys, naïve estimates of salamander occupancy was 60% (27/45) of all ponds and 67.7% (21/31) of older ponds (2-20 years old). Occupancy models (ψ) showed that salamanders occupied 74+/-21% of all ponds and 90+/-26% of older ponds. Salamanders traveled an average daily distance of 12.4+/-8.2 m; they moved a total of 286.3+/-168.2 m for the season. Five (perhaps seven) salamanders were eaten by predators; one was killed by agricultural equipment. This year we are repeating telemetry with another 25 salamanders and collecting tissue samples for genetic analysis across a larger portion of the landscape.

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**0445 Fish Systematics II, Salon F-H, Saturday 9 July 2016**

Casey Dillman[1], Richard Vari[1], Brian Sidlauskas[2]

*[1]Smithsonian Institution, National Museum of Natural History, Washington, D.C., USA, [2]Oregon State University, Corvallis, OR, USA*

## A Complete Morphological Supermatrix for the Superfamily Anostomoidea (Teleostei: Characiformes). What can it tell us about history?

The freshwater superfamily Anostomoidea is endemic to the Neotropical realm, and is very diverse with nearly 300 species unequally assigned to 27 genera in four families. Decades of synthetic studies at the familial and generic levels have resulted in numerous monographs, and, more germane to the present study, a vast number of morphological character-state descriptions for various focal ingroup. From these publications 463 anatomical characters were culled and compiled. Each character was scored for 222 terminals via direct specimen examination. The resultant supermatrix was then examined in two distinct ways. The first used the full matrix to reconstruct hypotheses of relationships using non-parametric and parametric approaches. The second saw the supermatrix subdivided into character-complex matrices and then analyzed to build a phylogenetic hypothesis of relationships. Each of these was subsequently used in the construction of an MRP supertree for comparison with hypotheses obtained with the full supermatrix.

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**0199 AES Physiology, Paleontology, & Collections, Balconies L & M, Friday 8 July 2016**

Erin Dillon, Aaron O'Dea

*Smithsonian Tropical Research Institute, Panama City, Panama*

## Dermal Denticles as a Tool to Reveal Pre-exploitation Shark Communities

What were shark communities like before humans? Ecological surveys and historical records demonstrate significant declines in shark populations, yet pre-exploitation baselines are nonexistent. Fossil dermal denticles may offer insight into pre-human shark communities. Denticles are well-preserved in reef sediments, but their identification represents a major challenge. To address this problem, we built a large reference collection from museum and local collections comprising 215 denticles from 37 species within 16 elasmobranch families. Morphometric analysis revealed that denticle morphology is loosely tied to taxonomy, making species-level identification almost impossible. We found, however, that denticle traits are strongly correlated with life habit and feeding mode. Quantitative measurements of traits also corroborated existing qualitative functional groupings and refined the boundaries between them. For example, fast, predatory sharks possess thin, ridged 'drag reduction' denticles, whereas demersal sharks are characterized by thick 'abrasion strength' denticles. In a proof of concept, we extracted 254 denticles from a 7,000-year-old fossil reef and 602 denticles from comparable modern reefs in Bocas del Toro, Panama and classified them using the

reference collection. Denticle assemblages in Holocene and modern sediments corresponded well with families documented in the region. We found a significant decrease in the relative abundance of 'drag reduction' denticles and an increase in 'abrasion strength' denticles over the last ~7,000 years. Denticles in modern sediments can therefore supplement survey data given the rarity of sharks, and denticles in the recent fossil record may shed light on shifts in shark community composition over time.

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**0431 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Pavel Dimens, David Portnoy

*Texas A&M University - Corpus Christi, Corpus Christi, TX, USA*

### Population structure of a migratory small coastal shark, the blacknose shark *Carcharhinus acronotus*, across cryptic barriers to gene flow

For marine species existing along seemingly continuous habitat, identifying regional groups poses challenges because the ability to define a priori hypotheses with respect to population structure is limited. Further, in highly vagile species like the blacknose shark (*Carcharhinus acronotus*), individuals from independent populations may co-occur seasonally on feeding grounds. A recent study using microsatellite markers identified as many as five distinct populations spread across an area from South Carolina, USA to Campeche Banks, Mexico and the Bahamas but found ambiguity in the Florida Keys, an area that spans the divide between the U.S. Atlantic and eastern Gulf of Mexico populations, as well as their management units. This project used next-generation sequencing to identify single nucleotide polymorphisms (SNPs) across thousands of loci to distinguish between four possible scenarios of population structure and gene flow in the region: 1) the Keys are a zone of admixture between Atlantic and eastern Gulf of Mexico populations, 2) individuals from both populations are seasonally present in the Keys but there is no gene flow, 3) the Keys are a unique genetic unit, separate from Atlantic and Gulf of Mexico populations, 4) previous microsatellite markers were insufficient to resolve structure for the Keys and individuals there group distinctly with either Atlantic or Gulf populations.

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**0274 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Kyle Dineen, Brook Fluker

*Arkansas State University, Jonesboro, AR, USA*

## Genetic Structure and Diversity of Disjunct Populations of Rainbow Darters (*Etheostoma caeruleum*) and Southern Redbelly Dace (*Chrosomus erythrogaster*) Throughout the Mississippi Corridor

Conservation-based studies of North America's rich freshwater fish fauna have primarily focused on species with naturally small distributions or species with distributions recently fragmented by anthropogenic factors. However, our grasp of how migration and genetic diversity are affected by recent, natural isolation in common or widespread freshwater fishes is still limited. *Etheostoma caeruleum* and *Chrosomus erythrogaster* are excellent subjects for studying the impacts of recent, natural genetic isolation because of their widespread and overlapping distributions, high abundance, and replicated patterns of naturally disjunct populations on their range margins. Of particular interest are potentially isolated populations of both species on Crowley's Ridge in Arkansas and the Bluff Hills in Mississippi. Both regions are relatively recent geological formations that would have been colonized by these species within the last 10,000 years. In this study, we analyze microsatellite DNA loci from both species, with emphasis on the tributaries of the lower Mississippi river, to evaluate genetic diversity and connectivity among populations on Crowley's Ridge, the Bluff Hills, and larger core populations. We also use DNA sequence data to test hypotheses about the pattern and timing of colonization of Crowley's Ridge and the Bluff Hills. Results of this study will provide valuable information about the biogeographic and demographic history and conservation status of disjunct populations of *E. caeruleum* and *C. erythrogaster* from Crowley's Ridge and the Bluff Hills.

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**1045 HL: Social Behavior in Reptiles Symposium, Salon E, Saturday 9 July 2016**

Vladimir Dinets

*University of Tennessee, Knoxville, Tennessee, USA*

## Cooperative hunting in reptiles: an overview

The majority of extinct and extant reptiles are predators, but until a few years ago it was thought that they virtually all of them are exclusively solitary hunters, and observations to the contrary were ignored or left unpublished as abberrational. Now it is becoming clear that non-solitary hunting is used by numerous reptiles and might not be uncommon. I present an overview of what is known about group hunting, cooperative and even coordinated hunting in reptiles, including some yet unpublished data.

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**1085 General Herpetology, Balconies L & M, Sunday 10 July 2016**

José Pedro do Amaral[1], Duaa Mureb[2]

*[1]The University of Cincinnati Clermont College, Batavia, Ohio, USA, [2]The University of Cincinnati, Cincinnati, Ohio, USA*

**Patterns of movement during wall lizard thermoregulation**

Temperature is the most pervasive physiological factor that affects the way organisms work. Ectotherms such as wall lizards *Podarcis muralis* depend mainly on the physiological and behaviorally controlled exchange of heat with the environment to regulate their body temperature. Consequently, ectotherm thermoregulation is associated with movement. We tested the relationship between movement patterns and concomitant body temperature during wall lizards' thermoregulation. To do so, we tested the hypothesis that wall lizards move in a thermal gradient as a function of a predetermined set of selected (preferred) body temperatures. General models of computer-generated lizard movement patterns were used to test our hypothesis. We failed to reject the null hypotheses associated with the movement models, thus no movement pattern models adequately explained wall lizard movement. However, some models were better at approaching lizard movement. Albeit not perfect matches, these movement models show a promising degree of approximation to real lizard movement behavior.

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**0804 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Devon Donahue, Amanda Cramer, Mariangeles Arce, Mark Sabaj

*The Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA*

**Test of Variable Morphospecies in Neotropical Swamp Eels (Synbranchidae: *Synbranchus*) using Nucleotide Sequence Data**

Synbranchidae is a family of eel-shaped fishes with a remarkably disjunct distribution in tropical and subtropical freshwaters of the New and Old Worlds. Only three species of *Synbranchus* are currently treated as valid in South America: *S. lampreia, S. madeirae* and *S. marmoratus*. Collections of *Synbranchus* were recently made in the lower Xingu River Basin, Brazil, by the iXingu Project (NSF DEB-1257813). From those specimens, at least five distinct morphotypes were recognized on the basis of external morphology (e.g., head shape and color pattern). One morphotype represents an undescribed miniature species. Three small specimens were collected via trawling in the mouth of a tributary to the lower Xingu. One specimen measuring 65 mm TL bears several large eggs and is evidently a mature female. Preliminary analysis of molecular sequence data (16s) supports the recognition of some morphotypes as distinct monophyletic lineages. A more complete molecular analysis (including cytb and rag1) will test the utility of external morphology for identifying and diagnosing species of *Synbranchus*.

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**0338 Fish Behavior & Development, Salon A-C, Sunday 10 July 2016**

Terry Donaldson

*University of Guam Marine Laboratory, Mangilao, Guam, USA*

### Lek-like Mating Systems in Reef Fish Spawning Aggregations: What's Going on Here?

A number of reef fishes form aggregations for the purpose of courtship and spawning. There are two major types of spawning aggregation, transient and resident. Transient spawning aggregations are formed by species that migrate periodically from relatively distant home ranges to specific sites where they persist for days or weeks during a spawning cycle before returning home. Resident spawning aggregations often form daily, depending upon time of day or tidal state, and participants are drawn to a common site from relatively nearby territories or home ranges. There, they court and spawn over a matter of hours before returning to their place of origin. A number of spawning aggregation characteristics resemble those seen in leks. Lekking or lek-like behavior has been defined as a temporary aggregation of sexually active males for reproduction. Characteristic of the formation of leks and lekking behavior include reproductive synchrony, the presence of a lekking ground, sufficient mobility to allow travel to that lekking ground, little or no feeding while on the lekking ground, and little or no parental care. Other characteristics include reduced aggression but increased displays between males, dominance relationships (with dominant males occupying central positions within the lekking site), sexual dimorphism, male displays towards females within the lekking site, and selection by females of centrally-located males for spawning. These characteristics are consistent with observations of mating behavior in transient aggregations of some groupers (Epinephelidae) and triggerfishes (Balistidae), and in resident aggregating species of wrasses and parrotfishes (Labridae), and lizardfishes (Synodontidae) from the western Pacific.

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**0980 NIA II, Galerie 3, Sunday 10 July 2016**

Carlos DoNascimiento

*Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Villa de Leyva, Boyacá, Colombia*

### Disentangling the Systematics of the Neotropical Catfish Genus *Trichomycterus* (Siluriformes, Trichomycteridae)

The catfish genus *Trichomycterus* comprises 164 valid species that constitute more than half the taxonomic diversity of Trichomycteridae. However, authors broadly agree on the non-monophyletic status of the genus, and until recently even that of the whole subfamily Trichomycterinae. Except for a single unpublished PhD dissertation, comprehensive attempts to resolve the phylogenetic relationships of the genus or of the subfamily have not been made. This is mainly due to the complex taxonomic history of *Trichomycterus*, with several poorly known old nominal species, a broad geographic

distribution in Central and South America in both sides of the Andes, and an important number of new names continuously being added in the recent years. This background imposes some restrictions, mainly in the form of approaches restricted to a determined geographic region (at the basin scale). Here, we present the previous results of the analysis of the taxonomic diversity of *Trichomycterus* in northern South America (Colombia and Venezuela), providing data on the homoplastic nature of the purported synapomorphies of Trichomycterinae, recognition of smaller monophyletic subsets, and the rampantly non-monophyly of *Trichomycterus*, in the context of an extensive phylogenetic analysis of Trichomycteridae based on morphology.

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**0012 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Maureen A. Donnelly

*Florida International University, Miami, FL, USA*

**ASIH through the Secretary's Prism - 100 years of work laying a foundation for the next 100 years**

I will use the SUMMARY OF MEETINGS as published in *Copeia* and other historical sources to describe how our society has functioned during the first 100 years from the viewpoint of the Office of the Secretary. Some of the most notable members of the ASIH have served as Secretary (J.T. Nichols, E.R. Dunn, C.L. Hubbs, M.G. Netting, E.C. Raney, A.B. Grobman, R. Conant, J.A. Peters, R. Highton, B.B. Collette, C.R. Gilbert, B.R. Burr, D. Hendrickson, R.K. Johnson as well as myself as the most recent Secretary). I will describe how I became the Secretary following the tragic and untimely death of Robert K. Johnson in 2000, and some of the highlights of my years of service with 15 different presidents. As the first woman to serve in the Office of the Secretary I hope to inspire members of other underrepresented groups to take on active roles in the governance of the oldest society in North America that celebrates the conservation and scientific study of fishes, amphibians, and reptiles.

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**0996 HL: Social Behavior in Reptiles Symposium, Salon E, Saturday 9 July 2016**

Sean Doody

*Southeastern Louisiana University, Hammond, Louisiana, USA*

**Challenges and Future Directions of Social Behavior Research in Reptiles**

Social behavior in animals evolves to solve problems that are impossible or more difficult for individuals to resolve alone; yet the evolution of social behaviors creates new problems, and species and groups that are more solitary certainly have persisted over geological time. We have recently argued against a dichotomy of social behavior in vertebrates, instead calling for the recognition of diverse social behaviors among and

within groups. The social repertoires of more secretive animals like reptiles, however, often defy description, resulting in knowledge gaps so numerous that comparative analysis is futile. This problem is exacerbated by the bias towards studying endotherms, and by the more general trend away from the study of natural history. Fortunately, a relatively small but motivated group of researchers remain interested in social behavior in reptiles, from quite different perspectives and research directions. This somewhat eclectic group has recently uncovered remarkable reptilian social behaviors, illuminating our ignorance for both the diversity of social behavior in reptiles and their role for understanding the evolution of social behavior in vertebrates. I will use a few examples to illustrate, including the recent discovery of communal nesting in large conspicuous lizards.

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**0122 AES Conservation & Management III, Balconies L & M, Saturday 9 July 2016**

Mareike Dornhege, Anne McDonald

*Sophia University, Tokyo, Japan*

**Shifts in Shark Community Assemblage in the North Pacific Indicated by the Japanese Longline Fishery**

Japan's oldest shark longline fishery dates back to the 18th century. According to the FAO, until the 1940s, Japan registered the highest elasmobranch landings worldwide and is currently the 9th largest shark fishery worldwide. The national longline fishery for sharks is concentrated in the port of Kesennuma in Northern Japan and since the collapse of the Pacific tuna fishery in 2003, blue shark and billfish are the main target species. The goal of this study is to present an analysis of this fishery and its effects on the ecosystem through an integrated approach. Three methods have been employed: 1) analysis of historical documents from libraries, museums and fisheries cooperatives on the historical use and fisheries of shark, with a focus on determining peaks in fisheries and most landed species over the past centuries; 2) interviews with fishermen, vessel owners, shark product processors and other stakeholders to identify any shifts in species landed over the past 60 years; and 3) analysis of landing and market data that recorded elasmobranchs to the species or family level over the past 20 years to calculate CPUEs and biodiversity indices. Results indicate that historically, a wide variety of sharks were used and preferred depending on the product created while today, only three species account for more than 95% of the landings and most products. Both fishermen and processors report steep declines in *Squalus acanthias* and the genus *Charcharinus* compared to the three dominant species, a trend which is confirmed by the CPUE and biodiversity analysis.

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**0803 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Kaitlin K Doucette[1], Stephanie Mounaud[2], William Neirman[2], Andrew N Evans[1]

*[1]Department of Coastal Sciences, The University of Southern Mississippi, Ocean Springs, MS 39564, USA, [2]J. Craig Venter Institute, Rockville, MD 20850, USA*

## The Elasmobranch Microbiome: Changing Our Understanding of Vertebrate-Microbe Relationships

Communities of bacteria in digestive systems play a critical role in host physiology; however, the existence of non-pathogenic bacteria in other healthy tissues is unusual. Previous studies suggested that elasmobranch fishes, unique in numerous aspects of physiology, possess endogenous bacteria in tissues that are sterile in other vertebrates such as kidney, liver and blood. Surprisingly, this phenomenon has not been explored since initial publications in the late 1980s, which employed culture-based approaches to microbial characterization. Using modern methods (16S rRNA gene sequencing via the Illumina MiSEQ platform), we identified a diverse array of bacteria present in intestinal, hepatic and renal tissues of *Dasyatis sabina* (Atlantic stingray) and *Rhizoprionodon terraenovae* (Atlantic sharpnose shark) from the Gulf of Mexico. Using this preliminary data, we hope to elucidate the costs and benefits of symbiont bacteria to elasmobranch hosts. The results of this study suggest an unprecedented relationship between microbes and vertebrate hosts and raise compelling questions about the importance of resident bacteria to elasmobranch physiology, as well as the possible implications of differences in microbial diversity across individuals.

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**0919 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Alistair Dove[1], Harry Webb[1], Rafael De la Parra-Venegas[3], Christian Schreiber[1], Jeffrey Reid[1], Simon Pierce[5], Robert Hueter[4], Katie Hindle[2], LeeAnn Henry[2], Annalea Beard[2], Ross Leo[2], Elizabeth Clingham[2]

*[1]Georgia Aquarium, Atlanta, Georgia, USA, [2]St Helena Government, Jamestown, St Helena, UK, [3]Ch'ooj Ajauil AC, Cancun, Quintana Roo, Mexico, [4]Mote Marine Laboratory, Sarasota, Florida, USA, [5]Marine Megafauna Foundation, Tofo, Mozambique*

## St Helena Island provides important habitat for whale sharks

Studies of whale sharks in recent years have focused on near-coastal aggregations, but this approach does not tell the whole demographic story because these events are typically dominated by immature males. Remote oceanic islands have been hypothesized to be the site of mating or pupping in whale sharks, which are activities affiliated by definition with adults. One such island is St Helena in the South Atlantic, which was recently discovered to play host to a seasonally predictable population of adult whale sharks. Two collaborative expeditions have been conducted in 2015 and 2016 to document whale shark abundance and population composition, to characterize behavior and habitat use around the island, and to determine regional scale movement patterns using satellite telemetry. The whale shark population observed at St Helena

consisted of an approximately equal mix of mature males and females that were larger than the sub-adults seen in most coastal aggregation sites, but smaller than the large female animals seen regularly in the Galapagos. Two eyewitness accounts of mating behavior have been recorded at St Helena, but this behavior was not directly observed during the expeditions. Preliminary PAT telemetry data are showing a pattern of extraordinary deep diving in the vicinity of the island. A single useful track from the 2015 expedition suggests that St Helena whale sharks are connected to the west coast of Africa. We propose a regional movement pattern with animals feeding in coastal upwelling zones, and travelling to remote oceanic islands to fulfill aspects of the reproductive cycle.

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**0638 Fish Genetics, Salon D, Sunday 10 July 2016**

Thomas Dowling[1], Paul Marsh[2], Robert Clarkson[3]

*[1]Wayne State University, Detroit, MI, USA, [2]Marsh&Associates, Tempe, AZ, USA, [3]Bureau of Reclamation, Glendale, AZ, USA*

## Molecular markers identify segregation of two species of chubs (genus *Gila*) in an Arizona stream

Two species of cyprinid fish, *Gila robusta* and *G. nigra*, were once common to rivers and headwater streams of the Gila River drainage of the southwestern US, but are now being considered for listing. These taxa have been difficult to discriminate with morphology and also show high levels of genetic divergence among local populations but not species. Here we report on a study of these species from Fossil Creek, a spring-fed tributary of the Verde River that was managed extensively for hydropower generation beginning in the early 20th century. Projects were implemented in 2004-2005 to decommission the power facility and return full flows following construction of an artificial fish barrier near the terminus, chemical renovation upstream to remove non-native fishes, and subsequent repatriation of the native fish community. We examined genetic consequences of these management activities on the two chubs by comparing patterns of microsatellite and mtDNA variation from a temporal longitudinal series of post-project samples collected from above and below an enhanced barrier falls. Our data demonstrate that *G. robusta* has become more common downstream of the falls over time, with *G. nigra* becoming rare; however, *G. nigra* is able to persist upstream of the barrier in the absence of *G. robusta*. Results are consistent with specific status for *Gila robusta* and *G. nigra*, and have specific implications for the conservation and management of these forms.

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**0389 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016**

Danielle H. Drabeck, Antony M. Dean, Sharon A. Jansa

*University of Minnesota, Twin Cities, MN, USA*

**Convergent evolution of venom targeted nicotinic acetylcholine receptors in mammals that survive venomous snake bites**

Honey badgers (*Mellivora capensis*) prey upon and survive bites from venomous snakes (Family: Elapidae), but the molecular basis of their venom resistance is unknown. The muscular nicotinic cholinergic receptor (nAChR), targeted by snake alpha-neurotoxins, has evolved in some venom-resistant mammals to no longer bind these toxins. Through phylogenetic analysis of mammalian nAChR sequences, we show that honey badgers, hedgehogs, and pigs have independently acquired functionally equivalent amino acid replacements in the toxin-binding site of this receptor. These convergent amino acid changes impede toxin binding by introducing a positively charged amino acid in place of an uncharged aromatic residue. In venom-resistant mongooses, different replacements at these same sites are glycosylated, which is thought to disrupt binding through steric effects. Thus, it appears that resistance to snake venom alpha-neurotoxin has evolved at least four times among mammals through two distinct biochemical mechanisms operating at the same sites on the same receptor. This is the first comparative work demonstrating convergent adaptive response to snake venom in mammals, and suggests that snake venom evolution may be significantly impacted by a potential coevolutionary relationship with resistant mammalian predators.

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**0901 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, Salon A-C, Thursday 7 July 2016**

Mary Draghetti, Ken Oliveira

*University of Massachusetts Dartmouth, Dartmouth, MA, USA*

**The Effect of Cortisol on Growth and Body Composition of the American Eel, *Anguilla rostrata***

The American eel, *Anguilla rostrata,* is a catadromous species found in nearly every freshwater and coastal system along the western Atlantic. Immigrating elvers (YOY) must accumulate enough energy stores in order to maximize growth and survival during year one. Energy stores are critical to first year survival, particularly in areas of high stress. Stress, such as crowding, signals the release of cortisol from the ACTH-axis causing metabolic and physiological changes in teleost fishes. In order to determine the effect of cortisol on growth and body composition of the American eel, immigrating glass eels were collected from a coastal river in Massachusetts and fed diets containing varying doses of cortisol and dexamethasone in an attempt to mimic the stress response. Conversely, some eels were fed diets with varying levels of RU-486, metyrapone, and a mix of the two cortisol antagonists. These treatments were used to examine growth and

body composition of "unstressed" fish by blocking cortisol receptors and/or preventing cortisol synthesis. Bimonthly samples were examined for total length (mm), weight (g) and proximate body composition (% water, lipid, ash, and protein). Long-term exposure to cortisol in the first year of the eel's freshwater life history appears to negatively affect growth, resulting in decreased protein and lipid accumulation. Treatment with cortisol antagonists showed no significant effect on growth or body composition. Our results indicate that high stress environments, resulting in high cortisol secretion, may result in decreased growth and survival in the early freshwater life stage of American eels.

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**0145 Snake Ecology, Galerie 3, Sunday 10 July 2016**

Michael Dreslik[1], John Crawford[2], Sarah Baker[1], William Peterman[3], Christopher Phillips[1]

*[1]Illinois Natural History Survey, Champaign/Urbana, Illinois, USA, [2]National Great Rivers Research and Education Center, East Alton, Illinois, USA, [3]Ohio State University, Columbus, Ohio, USA*

## Factors Affecting the Detection Probability and Capture Yield of an Imperiled Species

Reptiles are in decline worldwide and despite their ecological importance, insufficient data exist to accurately assess many species at the population and landscape levels. Therefore estimating occupancy or abundance of imperiled species is a critical conservation concern. Certain taxa, such as snakes, can exhibit cryptic behaviors and occur at low densities, further hampering population assessments. To accurately evaluate snake populations it is important to understand and account for behavioral patterns influencing detectability, e.g. spring emergence for snakes. Since 1999, we have been monitoring an eastern massasauga *Sistrurus catenatus* population at Carlyle Lake, Illinois to provide a complete view of the species' ecology. We conducted annual visual encounter surveys during spring emergence periods in occupied and potential habitat. Our objectives for this study were to determine what factors affect detection probability and capture-yield of eastern massasaugas with the goal of maximizing both. Of 27 detection models examined, the best model included the size of habitat patch searched, start time, starting air temperature, mean three-day maximum air temperature, starting humidity, mean search effort, and solar radiation. Of the 26 capture yield models examined, the best model included the size of habitat patch searched, starting humidity, mean search effort, and solar radiation. Together, these models can be applied to design survey protocols maximizing detection and capture yield of individuals throughout the species' range.

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**0710 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Rachel Dreyer, Kim Bassos-Hull, Krystan Wilkinson, Breanna DeGroot

*Mote Marine Laboratory, Sarasota, FL, USA*

### When the Shark Bites and the Remora Sucks: Incidence of Injury on Spotted Eagle Rays (*Aetobatus narinari*) and Lesser Devil Rays (*Mobula hypostoma*)

The spotted eagle ray, *Aetobatus narinari*, and the lesser devil ray, *Mobula hypostoma*, have been the subjects of capture-tag-release studies off southwest Florida from 2009-2015. We analyzed data and photographs of *A. narinari* (2009 - 2015, n=518) and *M. hypostoma* (2013 - 2015, n=97) to determine incidence of injury inflicted by shark predators, other species such as remoras and marine mammals, and human activity. While predation was not actively observed by researchers, shark bite wounds and scars were documented in both *A. narinari* (n=45) and *M. hypostoma* (n=26). Remoras attach to the smooth, mucous-coated skin of rays and attachment sites are recognized by the pattern created by the remora's modified dorsal fin. Many *A. narinari* (n=390) and *M. hypostoma* (n=68) displayed recent wounds or healed scars from remora attachment. Of these animals, 23 and 12, respectively, had open wounds with bloody and/or reddened tissue. Recaptured *A. narinari* with remora scars on the first capture (n=25) displayed rapid healing, including one individual that displayed no remora attachment sites after 225 days at liberty. No *M. hypostoma* individuals were recaptured during this study; however, one individual held at our facility for 21 days showed near-complete healing from a shark bite wound observed at capture. Injuries inflicted by anthropogenic sources including boat scars, fishing line entanglement, and fishing hook embedment were observed on *A. narinari* (n=15) and *M. hypostoma* (n=3). This study confirms that *A. narinari* and *M. hypostoma* displayed significant healing abilities after non-fatal injuries.

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**0625 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Stephen Drozda, Jessica Hultberg, John Steffen

*Pennsylvania State University Erie, The Behrend College, Erie, Pennsylvania, USA*

### Effects of Carotenoid Access and Food Intake on Blood Reactive Oxygen Species Levels in Painted Turtles

Animals use carotenoid-based color patches because they represent visual signals that cannot be faked. Carotenoids are known to have multiple physiological benefits in animals. One benefit carotenoids have shown is their ability to scavenge free-radicals (i.e., Reactive Oxygen Species, or ROS). The purpose of this research was to determine if dietary carotenoid levels would influence the level of reactive oxygen species in the blood of *Chrysemys picta* (painted turtles). Turtles were randomly split into four groups and placed on a feeding regimen for 7 weeks: normal food amount with added carotenoids, reduced food amount with added carotenoids, normal food amount with no carotenoids, and reduced food amount with no carotenoids. Before and after the feeding regimen, flow cytometry was performed on the blood of each turtle to determine

their ROS levels. Results showed that the reduced food group maintained their weight, and the normal food group gained weight. Carotenoids did not affect ROS levels, but the weight maintenance group had higher ROS levels than the weight gain group. These results imply that carotenoid color patches are not used to communicate information about ROS levels. Future research should investigate why weight-maintaining animals have increased ROS levels compared to weight gaining animals.

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**0288 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

J. Marcus Drymon[1], John Froeschke[2], Andrea Kroetz[3], John Mareska[4], Sean Powers[1]

*[1]University of South Alabama, Dauphin Island, AL, USA, [2]Gulf of Mexico Fishery Management Council, Tampa, FL, USA, [3]NOAA Fisheries, Panama City, FL, USA, [4]Alabama Department of Conservation and Natural Resources, Marine Resources Division, Dauphin Island, AL, USA*

## Sex-specific seasonal changes in community dynamics of a northern Gulf of Mexico coastal shark assemblage

Abiotic factors are known to influence the distribution of marine organisms; however, the relative importance of abiotic drivers is often species and sex-specific. Understanding how species respond to changes in abiotic conditions is critical for successful conservation and management plans, and in light of future climate change. To investigate species and sex-specific seasonal changes in the community dynamics of coastal shark assemblage, we analyzed catch data from two concurrent bottom longline surveys. A combination of multivariate (PERMANOVA) and univariate (boosted regression trees) approaches was used to examine differences in the assemblage as a function of season and depth, and further explore the factors influencing the sex-specific probability of capture. From February 2011 through May 2013, 126 bottom longline sets were conducted, resulting in the capture of 1844 individuals across 19 elasmobranch taxa. Multivariate analysis revealed a community structured by season and depth. Boosted regression trees further revealed species and sex-specific differences in the factors driving species' distributions. For females, depth had the highest relative influence on the distribution of Atlantic sharpnose (*Rhizoprionodon terraenovae*), blacknose (*Carcharhinus acronotus*), and bull sharks (*C. leucas*), whereas bottom temperature and longitude had a larger relative influence on the distribution of male Atlantic sharpnose and blacktip sharks (*C. limbatus*). These results support the counterintuitive notion that despite having relatively small size at birth, Atlantic sharpnose and blacknose sharks may be using open waters for parturition. Our findings underscore the importance of quantifying species-specific abiotic drivers of shark distribution, particularly in light of impending climate change.

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**0456 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, SALON A-C, Thursday 7 July 2016**

Mason DuBois, Tanner Shea, Natalie Claunch, Rob Brewster, Emily Taylor

*California Polytechnic State University, San Luis Obispo, CA, USA*

**Testing the Oxygen Limitation Hypothesis in two *Sceloporus* Lizards**

The critical thermal maximum (CTMax) is a useful tool for researchers studying thermal ecology in ectotherms. While it is relatively well studied across various taxa, the physiological mechanisms driving this measurement of thermal tolerance are poorly understood. We tested the oxygen limitation hypothesis, which states that organisms reach the CTMax when their metabolic demand for oxygen surpasses their cardiovascular system's ability to deliver it, in two lizard species, *Sceloporus occidentalis* and *S. graciosus*. We sampled 95 lizards across four altitudes in the Sequoia National Forest, treating them with either normoxic (21% oxygen) or hypoxic (6% oxygen) air while heating them to observe how their CTMax responded to oxygen availability. The change in altitude resulted in lizards being treated with one of eight different partial pressures of oxygen ($P_{O2}$). We found that lizards treated with lower $P_{O2}$ had a significantly lower CTMax than lizards treated with higher $P_{O2}$. We also found intriguing evidence for the existence of a threshold $P_{O2}$, with a rapid decline in thermal tolerance when the $P_{O2}$ falls below this value. At low $P_{O2}$, there was a strong relationship between oxygen and the CTMax, suggesting that the CTMax is very sensitive to oxygen availability and providing strong support for the oxygen limitation hypothesis. These results have implications for climate change-driven alterations of species ranges: if oxygen is a limiting factor in the thermal tolerance of ectotherms, it may affect their ability to compensate for climate change by migrating into higher altitudes, where oxygen levels are low.

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**0661 AES Genetics, Genomics, Biogeography, & Systematics, Balconies J & K, Saturday 9 July 2016**

Drew Duckett[1], Greg Skomal[2], Adam Leache[3], Gavin Naylor[1]

*[1]College of Charleston, Charleston, SC, USA, [2]Massachusetts Department of Fish and Game, Boston, MA, USA, [3]University of Washington, Seattle, WA, USA*

**Contrasting mitochondrial and nuclear signals in Great White Sharks, *Carcharodon carcharias***

Understanding population structure is important for species management and protection. However, the accuracy of population inferences is often limited by both the number of samples obtained and the information-content of the molecular markers employed. Consequently, despite its popularity, global population structure in the great white shark, *Carcharodon carcharias*, remains poorly understood. Previous studies contrasting mitochondrial sequence and microsatellites in white sharks have indicated limited nuclear differentiation and possible sex-biased dispersal. Nonetheless, a poor

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understanding of nuclear patterns make the species appealing for the employment of a large nuclear dataset. The present study examines *C. carcharias* population structure and the possibility of male-mediated dispersal using whole mitochondrial genomes and ~350 nuclear loci obtained from hybridization sequence capture. The hypothesis of female philopatry is tested through multiple analyses, and alternative explanations are explored to reconcile signal discrepancies among markers.

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**0115 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Nicholas Dulvy[1], Will Stein[1], Chris Mull[1], Tyler Kuhn[2], Neil Aschliman[3], Lindsay Davidson[1], Jeff Joy[4], Gordon Smith[1], Arne Moers[1]

*[1]Simon Fraser University, Vancouver, Canada, [2]Yukon Beringia Interpretive Centre, Whitehorse, Canada, [3]St Ambrose University, Iowa, USA, [4]C Centre of Excellence HIV/AIDS, Vancouver, Canada*

**Using trees to save sharks and rays**

Inevitably, greatest conservation attention is given to the most charismatic or distinctive species while others equally deserving get left behind. How do we ensure that the less-charismatic underworld of chondrichthyans is prioritised for conservation action in an objective manner? We take advantage of recent advances in phylogenetic methods for combining genetic and taxonomic information to produce taxon-complete phylogenies to rank all 1192 chondrichthyan species by their evolutionary distinctiveness. First, we recovered a molecular phylogeny of 624 species based on 13 mitochondrial and 2 nuclear loci from GenBank and Barcode of Life. Second, this time-calibrated tree was in-filled with the remaining species for which there were no molecular data based on their known taxonomic affinities. We generated a distribution of 10,000 fully resolved, taxon-complete phylogenies. We describe the depths, habitats, and geographic locations with the greatest and least amount of evolutionary distinctiveness. We combined Evolutionary Distinctiveness information with known and inferred Global Endangerment scores to identify EDGE species and locations that embody the highest conservation priorities to mitigate the loss of chondrichthyans' unique evolutionary history.

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**0977 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Brian Durkin[1], Kaite Anderson[1], Teal Richards-Dimitrie[2], Richard Seigel[1]

*[1]Towson University, Towson, Maryland, USA, [2]Humboldt State University Sponsored Programs Foundation, Arcata, California, USA*

## Impacts of the Depredation of Northern Map Turtle (*Graptemys geographica*) Nests in a Fragmented and Altered Habitat

Habitat alteration negatively impacts turtle populations and important spatial resources including nesting habitat. In eastern Maryland, the Susquehanna River is divided by the Conowingo Hydroelectric Dam, fragmenting and altering the habitat of the state-endangered Northern Map Turtle (*Graptemys geographica*). Nesting habitat below the dam is altered through the erosion of sandy beaches, leaving largely suboptimal habitat. We studied the nesting ecology of Map Turtles from 2009-2015 to understand how these habitat changes impact nest success. Nesting was studied in three distinct habitats, a forested area along the river called Octoraro Beach, on the in-river Wood Island, and in the urbanized town of Port Deposit. Nesting intensity varied between sites and years. Wood Island and Octoraro Beach had the highest number of nests (37-111 nests per year) and Port Deposit had the fewest (4-8 per year). Nests at Octoraro Beach and Wood Island were subject to high rates of depredation, approaching 100% in some years, while only one nest was predated in Port Deposit. In 2012-2014, woody vegetation and brush was cleared at Octoraro Beach in an attempt to open and enhance the nesting habitat. In 2012 and 2013 nest depredation was low, 44% and 66% respectively, and Map Turtles were observed utilizing the cleared habitat. Depredation rates returned to 100% in 2014 when clearing of vegetation was not as extensive. In 2016, the effect of habitat manipulation on nest depredation rates will be experimentally tested at the Octoraro Beach site in order to determine its effectiveness as a management strategy.

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**1043 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

Julia Earl[1], Luke Pauley[2], Raymond Semlitsch[2]

*[1]Oklahoma State University, Stillwater, OK, USA, [2]University of Missouri, Columbia, MO, USA*

## Frogs as Fertilizer? Effects of Metamorph Amphibians on Plant Growth

Ponds can produce large amounts of amphibian biomass. Juvenile amphibians disperse away from their natal wetlands, creating a subsidy to the surrounding terrestrial ecosystem. However, it is unclear how this amphibian subsidy affects the terrestrial ecosystem. Metamorph amphibians are important prey for a variety of terrestrial consumers, but many metamorphs die of desiccation in drier years, potentially providing nutrients for decomposers and plants. We were interested in whether plants could benefit from nutrients exported from ponds by metamorph amphibians. We examined this by adding dead metamorph toads (*Anaxyrus americanus*) labeled with $N^{15}$

to two species of native Missouri plants and tomatoes grown in pots in a greenhouse. We examined the growth of plants under three densities of dead toads with and without added fertilizer. Further, we tested plant tissue for stable isotopes to see if plants incorporated nitrogen from the toads into their tissues. We found that all three species of plant had higher nitrogen isotopic ratios when grown with dead toads, indicating that the plants incorporated toad nitrogen into their tissues. Tomato plants had higher growth rates with realistic densities of dead metamorphs when compared with no metamorphs. Tomato plants also incorporated higher amounts of nitrogen from toad metamorphs in their fruit under low soil nutrients than with commercial fertilizers present. Our results indicate that plants near ponds could benefit from the export of nutrients from ponds by amphibian metamorphs. These subsidies will likely have the largest effects in terrestrial systems with low soil nutrients.

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**1044 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Julia Earl[1], Raymond Semlitsch[2]

[1]*Oklahoma State University, Stillwater, OK, USA,* [2]*University of Missouri, Columbia, MO, USA*

## High Variability in Metamorph Leg Length and Relationships to Resource Level

Amphibians exhibit high levels of phenotypic plasticity in time and size at metamorphosis in response to a variety of different environmental characteristics. Environmental characteristics can also induce changes in morphology. Previous work shows that intraspecific competition can alter the length of metamorph legs relative to their body size, though the differences among treatment often are small. Here, we show that relative leg length (leg length/body length) can be quite variable, as seen in four different species: *Hyla versicolor*, *Lithobates sylvaticus*, *Lithobates sphenocephalus,* and *Anaxyrus americanus* under experimental conditions. We measured relative leg length for metamorphs from aquatic mesocosm studies examining the effects of resource type and quality in the form of plant litter input. In most cases, treatments with lower resources (either no plant litter or plant litter with very low nutrient content, such as white pine) resulted in metamorphs with shorter legs relative to body length than treatments with higher resources. This effect of resource level on leg length suggests individual fitness consequences for metamorphs that spent their larval period in lower resource environments, such as closed canopy ponds with low quality leaf litter input. Shorter relative leg length was often highly correlated with body length and mass, but not time to metamorphosis. Metamorphs with shorter leg length often have reduced jumping performance. The correlation between relative leg length and body size may be one contributing mechanism to the general relationship between size at metamorphosis and fitness.

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**0791 Fish Conservation, Galerie 3, Sunday 10 July 2016**

David Edds[1], David Gillette[2], Bibhuti Jha[3], Bhogendra Mishra[4]

*[1]Emporia State University, Emporia, Kansas, USA, [2]University of North Carolina Asheville, Asheville, North Carolina, USA, [3]Kathmandu University, Dhulikhel, Nepal, [4]Asian Institute of Technology, Pathumthani, Thailand*

## Assessing fish community change in Nepal

In 2015-16, we are re-sampling fish assemblages at 40 sites in Nepal's Gandaki River basin that we sampled in 1984-86 and 1996 using standardized methodology. Preliminary analysis suggests a decline in fish species richness and absolute abundance. Our long-term dataset will allow us to compare the fish community across decades of human population growth, infrastructure development, and climate change in Nepal. Recent data indicate that warming is occurring faster in the Himalayas than in the rest of the world, with greatest increases at high altitudes; increasing temperatures coupled with faster glacier melt and decreasing precipitation likely will impact river discharge and the ecology of Himalayan fishes. The Gandaki is well suited for study of the impacts of increasing temperatures on riverine fish communities, given its extraordinary altitudinal gradient from headwaters on the Tibetan Plateau downstream to subtropical Gangetic Plains. We are examining historical and contemporary data to assess fish species loss or range shifts, and will determine whether any range shifts have kept pace with stream isotherm shifts over time. Our study should help us understand the response of Nepal's stream fishes to climate change, and aid policy makers and resource managers in conservation planning for Himalayan river ecosystems.

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**0826 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Robert Edman[1], Gorka Sancho[1], Bryan Frazier[2], Wally Bubley[2], John Kucklick[3]

*[1]College of Charleston, Charleston, SC, USA, [2]South Carolina Department of Natural Resources, Charleston, SC, USA, [3]National Institute of Standards and Technology, Charleston, SC, USA*

## Movement Patterns and Trophic Ecology of Tiger Sharks (*Galeocerdo cuvier*) Caught off the Southeast Coast of the United States

Exploitation of sharks has markedly increased in the past three decades, and this exploitation, coupled with degradation of essential habitats, can contribute to declining species abundance. Understanding the movement patterns and diet composition of sharks is central to creating and enacting appropriate management actions to preserve these animals and their habitats. The present study seeks to analyze the movement patterns and diet of Tiger Sharks caught in coastal waters of the southeast United States utilizing passive acoustic telemetry, satellite telemetry, and stable isotope analysis. Results show Tiger Sharks tagged in South Carolina during spring months move extensively in coastal and shelf waters. These movement patterns appear to differ from Tiger Sharks tagged in the Bahamas and Bermuda, which move primarily through shelf

and offshore waters. Results of Tiger Sharks tagged during autumn months indicate that these sharks may overwinter in offshore waters and in the Bahamas. Stable isotope analyses on multiple tissue types (blood, muscle, skin, and plasma) from captured Tiger Sharks confirm that smaller Tiger Sharks occupy a lower trophic level, and that this species undergoes an ontogenetic diet shift. Results of a Bayesian mixing model will be used to determine the proportions of different prey items in the diet of Tiger Sharks caught in South Carolina. Satellite and acoustic tracking of tagged sharks is ongoing, and the third year of tagging and collecting samples from Tiger Sharks is currently underway.

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**0958 Herp Morphology & Genetics, Galerie 3, Sunday 10 July 2016**

Danielle Edwards[1], Luciano Avila[2], Lorena Martinez[2], Jack Sites[3], Mariana Morando[2]

*[1]University of California, Merced, Merced, CA, USA, [2]Centro Nacional Patagónico – Consejo Nacional de Investigaciones Científicas Técnicas, Puerto Madryn, Chubut, Argentina, [3]Brigham Young University, Provo UT, USA*

**Evolution of niche and ecomorphological traits in a phylogenetic context in lizards of the *Liolaemus bibroni* complex (Squamata: Liolaemini)**

The South American lizard genus *Liolaemus* is one of the most ecologically diverse terrestrial vertebrate radiations on the planet. Given this ecological breadth, hypotheses abound regarding the evolutionary mechanisms by which species diversity in *Liolaemus* arises, including body size diversification driven by ecophysiological mechanisms and the evolution of viviparity. Unlike most putatively adaptive radiations – studies of sparsely sampled higher level phylogenies have failed to find an evolutionary relationship between ecomorphological and ecological niche evolution. By using a completely sampled phylogeny of the *L. bibronii* complex, a group representing the ecological diversity of all *Liolaemus* and including 23 described and candidate species, we used comparative phylogenetic analyses to look at 1) how niche and ecomorphological traits have evolved through time (i.e., using disparity-through-time analyses), and 2) whether or not ecomorphological trait evolution is correlated with niche evolution (phylogenetic correlation). The morphological disparity analyses showed clear evidence of increasing diversification (greater than null disparity) towards the present in ecomorphology and vegetative niche, with correlated evolution of these traits including multivariate axes describing variation in body shape and size. Unlike previous studies we find no relationships between body size and ALM – a composite variable explaining the change in temperature associated with latitude and elevation. Our results are both congruent with (i.e., diversification in body size) and contrary to (i.e., correlated evolution of body size and shape with vegetation) to studies at higher phylogenetic scales and with less complete sampling.

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**0440 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Ariel N. Egan[1], Toby S. Daly-Engel[1], J. Marcus Drymon[2]

*[1]University of West Florida, Pensacola, FL, USA, [2]University of South Alabama, Mobile, AL, USA*

## Multiple Paternity of the Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*)

The Atlantic sharpnose shark (*Rhizoprionodon terraenovae*) is an abundant, small coastal shark found in temperate and tropical waters of the western Atlantic and Gulf of Mexico, where it is an important part of both artisanal and commercial elasmobranch fisheries. Life history characteristics in this species are generally established, but the occurrence of multiple mating by females (polyandry) as a reproductive strategy remains undocumented. Studies indicate that polyandry is common among sharks, but to date no small coastal sharks have been studied. For this study, muscle tissue samples from 20 *R. terraenovae* broods were collected off the coast of Alabama. DNA will be extracted from all samples and microsatellite markers applied for parentage analysis. With these data, we aim to discern the occurrence and frequency of multiple mating in *R. terraenovae* over several reproductive seasons to examine how this trait varies over time. The results and information from this study may provide additional information about genetic diversity of the *R. terraenovae* population in the Gulf of Mexico. Different reproductive strategies can influence genetic diversity and fitness, and are therefore of interest for conservation management. If multiple paternity proves to be common in *R. terraenovae*, potential population-level consequences of exploitation by fisheries may need to be assessed to understand how fisheries affect the genetic diversity of this species.

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**0408 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jacob Egge, Ashley Farre, Christian McConnell, Heidi Schutz

*Pacific Lutheran University, Tacoma, WA, USA*

## Cryptic Speciation in the Brown Madtom, *Noturus phaeus*

The Brown Madtom, *Noturus phaeus*, is an ictalurid catfish distributed across a series of drainages in the Mississippi embayment spanning western Tennessee, western Mississippi, and Louisiana, USA. Previous phylogeographic analyses of populations sampled from across the range using DNA sequence data from the mitochondrial gene cytochrome *b* (*cytb*) recovered two deeply divergent haplotype lineages congruent with two geographic regions. One lineage was comprised of individuals from the Obion and Forked Deer drainages in western Tennessee, and the other lineage contained individuals from across all other populations. To test the hypothesis that these two lineages represented two cryptic species, we sequenced 59 individuals sampled from across the range for two additional nuclear loci (recombination activating gene 2, *rag2* and early growth response 2b, *egr2b*). Morphological variation among populations was

examined using over 110 museum specimens photographed from multiple angles, landmarked at 33 anatomical reference points, and analyzed using geometric morphometric techniques. Results of the phylogenetic analyses recovered two deeply divergent lineages, consistent with those recovered previously using *cytb* data. These lineages were consistently recovered with high support when each gene was analyzed separately, but also in analyses including both the mitochondrial and nuclear genes. Analyses of morphometric data, however, failed to recover any significant morphological differentiation between the lineages. These data are consistent with the presence of two morphologically cryptic phylogenetic species within *Noturus phaeus*, one corresponding with populations in the Obion and Forked Deer drainages, and another comprised of all other populations.

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**0048 Herp Conservation & Ecology, Galerie 2, Sunday 10 July 2016**

Tomoharu Eguchi, Scott Benson, David Foley, Karin Forney

*National Marine Fisheries Service, La Jolla, CA, USA*

### Predicting Overlap Between Drift Gillnet Fishing and Leatherback Turtle Habitat in the California Current Ecosystem

Concern over bycatch of protected species has become a key factor in shaping fisheries management decisions. In 2001, the National Marine Fisheries Service established an annual closure of a large mesh drift gillnet fishery (DGN) targeting swordfish from northern Oregon to central California between August 15 and November 15 due to concerns of bycatch of endangered leatherback turtles (the Pacific Leatherback Conservation Area; PLCA). The spatio-temporal constraints of the PLCA were developed to encompass nearly all previously observed bycatches in the fishery. The PLCA has been effective at reducing bycatch of leatherback turtles. In this study, we examine whether the timing of the current PLCA closure is optimal for leatherback turtle conservation by developing statistical models of leatherback turtle presence inside the PLCA based on environmental variables. We also examine finer-scale spatiotemporal patterns of potential overlap between the fishery and leatherback turtle foraging habitat using Maxent and Random Forests applied to logbook data and leatherback turtle telemetry data. Our results suggest that the current static closure period is the shortest and most effective for protecting the turtles while allowing fishing during low bycatch-risk periods. We also found that it is possible to predict foraging habitat of leatherback turtles and fishing effort using environmental variables. Identification of spatial and temporal hotspots of potential overlap between fishing effort and leatherback turtle distribution can form a basis for dynamic management approaches that limit fishing in high bycatch risk areas while permitting fishing in areas where overlap is unlikely to occur.

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**0200 AES GRUBER AWARD, Balconies J & K, Thursday 7 July 2016**

Samantha Ehnert, Jim Gelsleichter

*University of North Florida, Jacksonville, FL, USA*

### Mercury Accumulation and Effects in the Brain of Atlantic Sharpnose Sharks (*Rhizoprionodon terraenovae*)

Sharks often bioaccumulate mercury (Hg) in muscle to levels that threaten human health. However, few published studies have examined if the high Hg levels seen in shark muscle also occur in the shark brain, or if Hg accumulation affects shark neurophysiology. Therefore, this study examined if shark brains accumulate significant levels of Hg, if Hg accumulation occurs in certain subcomponent of the brain, and if Hg accumulation is associated with effects on the shark nervous system, with special focus on the Atlantic sharpnose shark (*Rhizoprionodon terraenovae*). Sharks were collected along the southeast U.S. coast. Muscle and brain Hg concentrations were determined using a Direct Mercury Analyzer. Correlations between brain Hg concentrations and levels of known biomarkers of Hg-induced neurological effects (e.g., levels of a protein biomarker of glial cell damage, S100b, and markers of oxidative stress) in shark cerebrospinal fluid (CSF) were examined. Brain Hg levels were correlated with muscle Hg levels, but were significantly lower and did not exceed most known thresholds for neurological effects, suggesting limited potential for such responses. Data on CSF biomarker levels support this premise, because they were not correlated with brain Hg levels. Higher Hg levels were measured in the forebrain of shark in comparison with the hindbrain, but levels in both were below threshold levels for effects. This study is the most extensive analysis of Hg in a single shark species, spanning most of its Atlantic range. It is also the first to examine neurological effects of Hg exposure in these animals.

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**0400 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Jean Elbers[1], Mary Brown[2], Sabrina Taylor[1]

*[1]School of Renewable Natural Resources, Louisiana State University and AgCenter, Baton Rouge, LA, USA, [2]Department of Infectious Diseases and Pathology, College of Veterinary Medicine, University of Florida, Gainesville, FL, USA*

### Tortoise immunomes shed light on genetic variation underlying infectious disease

Immune response genes control the immune system's response to pathogens and because changes in these genes can alter disease susceptibility, they are likely to be influenced by selection. Populations of threatened species generally possess low levels of genetic variation, and genetically depauperate hosts may be at greater risk of infectious disease contributing to extirpations. To better understand the genetic basis of infectious disease susceptibility in a species of conservation concern, we sequenced the immune response genes (i.e., immunomes) from 16 free-ranging gopher tortoises *Gopherus polyphemus* from 3 Florida populations (CF, FC, and OLD) with (n=10) or

without (n=6) clinical symptoms and that produced antibodies against one of causal agents for an infectious upper respiratory tract disease (URTD). We found several synonymous and non-synonymous SNPs and indels associated with URTD phenotypes. Genetic diversity was lowest in CF followed by OLD and FC. Population differentiation and admixture were as expected based on geographic proximity of populations. There were two SNPs putatively under selection according to $F_{ST}$ outlier tests, and there were 35 genes that deviated from neutrality according to Tajima's *D*. These results demonstrate that immunome sequencing of individuals with symptomatic and asymptomatic phenotypes from several populations can be conducive to better understanding the genetic basis of infectious disease by elucidating what genetic variation is associated with disease susceptibility. Immunome sequencing can also provide valuable information on levels of population genetic diversity, how populations are genetically differentiated, and what genetic variation may be under selection or deviating from neutrality.

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**0297 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Igbal Elhassan

*University of Bahri, Khartoum, Sudan*

### The Occurrence of the Green Sawfish (*Pristis zijsron*) along the Sudanese Red Sea with Observations on Some Reproductive Parameters

The aim of the study is to identify the species of sawfish in the Sudanese Red Sea and to assess its current status. Collection of data has been carried out since 2001 by the author. Data from fieldwork was compiled for the period 2001 to 2016, and during Oct 2015 to March 2016 data have been collected from bottom trawling in the southern Sudanese Red Sea Coast. Data have also been collected since 2011 through standard questioner and interviews with fishermen along the Sudanese Red Coast (Age 15 to 90). Identification of 21 rostra of adult sawfish (from 1978 to 2016), two adult sawfishes and juvenile sawfish were *Pristis zijsron.* The result of the questioners and the interviews showed that the sawfish were abundant along all the coastal lagoons (mersas) of the Sudanese Red Sea coast until the 1980s. Larger sizes of sawfish were from the north coast (about 6 m) while the maximum size recorded from the South coast was 375 cm. Current nursery areas of P. zijsron along the Sudanese Red seacoast were identified. Based on few specimens (four females) and reports from the fishers, birth dates are from early January to late April. The size of pregnant females ranges from 350 to 375 cm. The maximum numbers of the pups encountered were 8 while the minimum number of pups encountered were 6. Fishers reported 2. Size at birth ranges from 80 to 84 cm. The project is continuing.

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**0931 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Diego Elias, Kimberly Foster, Elyse Parker, Kyle R. Piller

*Southeastern Louisiana University, Hammond, Louisiana, USA*

### Re-evaluation of the Biogeographic history of *Pseudoxiphophorus* (Poeciliidae)

Poeciliidae is a family of live bearing fishes belonging to the order Cyprinodontiformes. The sub-family Poeciliinae, is comprised of 276 valid species, occurring from eastern United States to northeastern Argentina and the Caribbean, representing one of the most dominant groups of North and Middle American freshwater fishes. The genus *Pseudoxiphophorus* contains eight species and occurs from northern Nicaragua through the northern portion of Mexico. Recent molecular work indicated that cryptic diversity may exist within *Pseudoxiphophorus* and also suggested three major geological events that have shaped the biogeographic history of *Pseudoxiphophorus* in North and Middle America, the activity in the Trans-Mexican volcanic belt, the Polochic-Motagua fault and the appearance of the Isthmus of Tehuantepec. The objective of this work was to test if these geological events are congruent with divergence time estimates for the species within *Pseudoxiphophorus*. A time calibrated phylogeny was constructed using molecular markers and several fossil calibrations, and a biogeographic inference of ancestral areas for the species in the genus *Pseudoxiphophorus* was made. Our data sheds light into the evolutionary history of the genus *Pseudoxiphophorus*, and the complex history of freshwater fishes in Middle America.

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**0404 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H, Thursday 7 July 2016**

Diego Elias, Kyle Piller

*Southeastern Louisiana University, Hammond, Louisiana, USA*

### Digging through the trash: A phylogenetic examination of the Threadfin Shad, *Dorosoma petenense* (Günther 1867)

The genus *Dorosoma* (Clupeidae) is comprised of five recognized species: *Dorosoma cepedianum*, *D. smithi*, *D. anale*, *D. chavesi*, and *D. petenense*. The Threadfin Shad, *Dorosoma petenense*, is the most widespread species of the genus possessing a Nearctic to Neotropical distribution. However, the species is not continually distributed across its range, as a distributional break occurs within the Neo-volcanic Plateau in east central Mexico in a region known as Punta del Morro. The taxonomic status of *D. petenense* has been problematic, and others have recognized variation throughout its range. Furthermore there has not been a comprehensive systematic review of the species or the entire genus. The objectives of this study were to investigate the phylogenetic relationships of the species in the genus *Dorosoma*, and to conduct a phylogeographic analysis of *D. petenense* throughout its distributional range using multiple mtDNA and nDNA markers. The results from our multi-locus analysis of the species relationships

provide the first taxon complete phylogeny for *Dorosoma*. Our phylogeographic analysis suggests that *D. petenense* does not represent a single lineage, and previously synonymized species might be taxonomically valid. This work sheds light into the evolutionary history of the ichthyofauna in North and Middle America, and provides insights into the events that may have played a role in shaping the diversity of freshwater fishes in the region.

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**0847 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Duncan Elkins[1], Anna George[2], Sarah Hazzard[2], Bernie Kuhajda[2], Seth Wenger[1]

[1]*University of Georgia, Athens, GA, USA,* [2]*Tennessee Aquarium Conservation Institute, Chattanooga, TN, USA*

### Who follows the fish? Patterns in the fishes, mussels, and crayfishes of the Southeast

The southeastern United States is a global hotspot of temperate biodiversity for freshwater fishes and supports over 90% of the U.S. total species of mussels and nearly half of the global total for crayfish species. These species are also both highly endemic and, increasingly, imperiled; over the last two decades, the number of imperiled freshwater fish species in the Southeast has risen 125%. As part of a project funded by the National Fish and Wildlife Foundation to develop a multi-species conservation plan, we compiled native range maps for 592 species of freshwater fishes using museum records, corrected for recent taxonomic changes. Such plans are frequently hampered by data gaps and differing scales of data availability for the focal taxa, and this project is no exception— sampling data for fish were much more readily available. Previous biogeographic analyses, in drainages within and adjacent to our study area, demonstrate that the patterns of species richness for mussels tend to track fishes closely, likely due to the role of fish hosts in the mussels' life history. However, the concordance between patterns of fish and crayfish is less well studied. To test the hypothesis that fish may be used as a surrogate for other aquatic taxa, we attempt to characterize the scale and pattern of correlation between fish, mussel, and crayfish species presence, endemism, and imperilment at the sub-basin and basin scale.

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**0627 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, Salon A-C, Thursday 7 July 2016**

Laura Ellis[1], Walt Golet[2], James Sulikowski[1]

*[1]University of New England, Biddeford, ME, USA, [2]University of Maine, Orono, ME, USA*

## Utilizing Steroid Hormones within the Skeletal Muscle Tissue to determine sex-specific ratio f Atlantic Bluefin Tuna (*Thunnus thynnus*) in the Gulf of Maine

The Atlantic bluefin tuna (*Thunnus thynnus*) is prized among recreational and commercial fishermen, which has lead to the overexploitation of this species. To properly manage any fishery, routine biological sampling is required. This data is traditionally obtained through the gross examination of bodily tissues. However, the majority of bluefin tuna are eviscerated at sea. Thus individuals are landed lacking their gonads making sexual identification problematic and necessitating the development of an alternative technique for assessing reproductive biology. Previous studies suggest quantifying sex hormones and their metabolites within skeletal muscle tissue is a reliable means for determining reproductive characteristics of various fish species. Building off this premise, radioimmunoassay was used to quantify estradiol ($E_2$) and testosterone (T) concentrations from the muscle tissue of 22 females (FL:195+35cm; 119+71kg) and 29 males (FL:212+27cm; 130+47kg) landed in the New England bluefin tuna fishery between June-December from 2014. These results suggest female $E_2$ concentrations are higher (969+160pg/g) compared to males (770+94pg/g), while male T levels (1617+241pg/g) are higher than females (753+126pg/g). Based on these results, the levels of reproductive hormone in skeletal muscle tissue are currently being used to evaluate the sex and possible seasonal cyclical reproduction of individuals (>100″) landed in the New England fishery. These preliminary results will be presented at this years meeting.

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**0888 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Iain Emmons, Erika Nowak

*Northern Arizona University, Flagstaff, Arizona, USA*

## Winter Habitat Use and Behavior of the Northern Mexican Gartersnake (*Thamnophis eques megalops*) in North-central Arizona

The Northern Mexican Gartersnake (*Thamnophis eques megalops*) is a wetland and riparian obligate and federally threatened species that has experienced range-wide population declines in the United States. Habitat loss is considered one of the leading threats to survival, yet descriptions of ecological requirements are limited to relatively few studies. Our objectives for this radiotelemetry study were to identify winter behavior and retreat site use for Northern Mexican Gartersnakes in north-central Arizona. We located 22 winter retreat den sites for 21 snakes, and documented ingress,

egress, and duration of winter inactivity for nine individuals with internal, temperature-sensitive radio transmitters from 2012-2015. Snakes used burrows and cavities associated with a variety of habitat types located 0.5-156 m from the nearest water source. We documented winter surface activity by multiple snakes, including basking and changing den sites mid-season, the first known records of communal denning for the species, and approximately 3-5 months duration of winter inactivity between late October and mid-March. Our findings have direct implications for Northern Mexican Gartersnake management and recovery efforts, and build on previous winter habitat and behavior records for snakes in seasonally mild climates.

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**0845 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Alison Enchelmaier, Neil Hammerschlag

*University of Miami, Miami, FL, USA*

**Fish Diversity and Abundance in a Restored Mangrove Habitat**

Restoration and monitoring are important conservation tools to ensure the recovery and maintenance of human impacted habitats. Bill Baggs Cape Florida State Park, located in Miami, has been impacted by urban development and hurricanes, leading to the removal of much of the park's native habitat, including mangrove forest. While restoration efforts have been implemented, data on fish abundance and diversity in this critical habitat are lacking. We used BRUVs (baited remote underwater video) to examine the effectiveness of restoration efforts in the man-made mangrove pools in Bill Baggs Park. We then evaluated catch differences between BRUVs and seine net sampling to examine the viability of comparing historical data from previous studies. We observed several species utilizing the pools year-round, including barracuda and grey snapper. We discuss our results as they relate to the efficacy of small-scale restoration efforts in human-dominated ecosystems in subtropical regions.

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**0179 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Nicole Enright, Gavin Naylor

*College of Charleston, Charleston, South Carolina, USA*

**A Vicariance Model for Biogeography and Speciation in Elasmobranchs using Molecular Clocks**

Understanding rates of molecular evolution and dates of divergence in different species can provide useful insights into phenomena such as adaptation and speciation, and may allow one to make inferences about population structure and biogeography. Barriers such as the Isthmus of Panama and the Suez Canal are relatively new vicariant barriers separating two bodies of water inhabited by elasmobranchs, where no gene flow can

occur between the separated populations. Such structures provide opportunities to calibrate rates of molecular evolution across a diversity of marine taxa and to explore the influence of different life history parameters on estimated rates of molecular evolution. Elasmobranchs are well suited for such studies as they exhibit both a wide range of life history attributes and include several taxa whose populations have been separated by such vicariant events. In this study, rates of molecular evolution are contrasted for mitochondrial markers across a suite of elasmobranch sister taxa found on either side of vicariant barriers. Patterns of molecular evolution are examined for potential influence of different life history parameters including but not limited to ovipary versus vivipary, generation time, and effective population size.

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**0300 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

James Erdmann

*Southeastern Louisiana University, Hammond, Louisiana, USA*

### This little piggy gets roast beef: the significance of toe movements during amphibian feeding

Toe vibrations associated with feeding have been observed in several amphibian groups. Hypotheses for the purpose behind this behavior range from neurological disorder to active prey luring. I will test predictions of this poorly understood phenomenon with feeding trials and predator/prey movement and position tracking, using the Gulf Coast Toad (*Incilius nebulifer*) as the study predator and woodlice (*Amadillidium nasatum*) as the prey. Observations will be repeated on a soil and artificial paper substrate to test for the influence of stimulus transfer medium. The resulting video and feeding rate data will be analyzed using regression analysis and analysis of covariance.

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**0504 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Julia Ersan[1], Brian Halstead[1], Erica Wildy[2], Mike Casazza[1], Glenn Wylie[0]

*[1]US Geological Survey, Dixon, CA, USA, [2]California State University, East Bay, Hayward, CA, USA*

### Giant Gartersnakes (*Thamnophis gigas*) Selectively Forage on Native Anurans, Despite High Abundance of Introduced Prey

The introduction of exotic species can alter trophic dynamics of native species. Threatened giant gartersnakes (*Thamnophis gigas*) forage on a prey community that is comprised almost entirely of exotic species. We examined prey selection of giant gartersnakes by analyzing trap by-catch and regurgitated gut contents of snakes in four basins in the Sacramento Valley of California to determine whether these snakes actively

select their prey or if they are simply consuming what is abundant. Although non-native anuran and fish species dominate the available prey community, giant gartersnakes most strongly selected native Sierran treefrogs (*Pseudacris sierra*) metamorphs. If all prey types were equally available, giant gartersnakes would have selected Sierran treefrogs with a probability of 0.596 [0.0254 - 0.855]. Giant gartersnakes also were more likely to select introduced American bullfrog (*Lithobates catesbeianus*) adults over all tested introduced fishes. Managing prey communities to increase native amphibian abundance within the giant gartersnake's range might benefit populations of this rare snake.

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**0226 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Paula Escudero[1], Derek Tucker[2], Luciano Avila[1], Jack Sites[2], Mariana Morando[1]

*[1]IPEEC-CENPAT-CONICET, Puerto Madryn, Chubut, Argentina, [2]Brigham Young University, Provo, Utah, USA*

## Genetic Structure of a Population of *Liolaemus xanthoviridis* Inferred from Microsatellite Markers

Microsatellites are useful markers for addressing questions on an ecological time scale given that they are relative neutral to natural selection and show high levels of variability. No studies use these molecular markers to answer ecological questions in the widespread and species-rich lizard genus *Liolaemus*, and here we use these markers to estimate the population structure and paternity of several clutches of eggs within a population of *L. xanthoviridis.* The study took place in Bahía Isla Escondida, Chubut (Argentina), during four spring-summer seasons (2012 to 2015). We marked and sexed all individuals captured, and transported gravid females to our laboratory. Digits of marked lizards were used for molecular work, and we amplified 8 microsatellite loci to characterized genetic diversity, paternity, and population structure. Our results showed that genetic diversity higher than in other species of lizards, the paternity analysis revealed absence of multiple paternity and that over the entire sampling area there is only one population of *L. xanthoviridis.* High genetic diversity is important given the restricted geographic distribution of this species, and the absence of multiple paternity suggests that it has a relatively large effective population size.

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**0138 HL GRADUATE RESEARCH AWARD, Galerie 2, Thursday 7 July 2016**

Evan Eskew, Michael Miller, Janet Foley, Brian Todd

*University of California, Davis, Davis, CA, USA*

## Comparative Transcriptomics of Two Amphibian Host Species Exposed to the Emerging Fungal Pathogen *Batrachochytrium dendrobatidis*

The emerging disease chytridiomycosis, caused by the fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*), has devastated amphibian populations globally. However, *Bd*

infection has highly variable impacts on different host species. The mechanisms underlying differential host susceptibility to *Bd* are poorly understood, yet this understanding is critical to conserving species imperiled by disease. To characterize amphibian host responses to *Bd* infection, we conducted an experimental exposure trial with a disease-susceptible species, the wood frog (*Lithobates sylvaticus*), and a disease-resistant species, the American bullfrog (*L. catesbeianus*), followed by a comparative transcriptomic analysis using RNA-sequencing to examine gene expression changes associated with pathogen exposure. The two host species were each exposed to two different isolates of *Bd*: Section Line Lake (SL) *Bd*, which has a high virulence phenotype, and Carter Meadow (CM) *Bd*, which has lower virulence. Wood frogs exposed to SL *Bd* suffered significantly greater mortality than wood frogs exposed to CM *Bd* or sham controls, whereas there were no differences in American bullfrog survival attributable to *Bd* exposure. Our transcriptomic analysis revealed a greater number of sequencing reads mapping to *Bd* in wood frog samples, consistent with their greater *Bd* infection loads compared with American bullfrogs. Both host species showed greater numbers of genes differentially expressed in response to the highly virulent *Bd* compared with the lower virulence isolate. Overall, however, American bullfrogs had much less gene expression change in response to exposure than wood frogs, suggesting American bullfrogs may tolerate *Bd* infection through alternative morphological mechanisms, such as a thickened epidermis.

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**1103 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Robert Espinoza[1], Gregory Pauly[2], Jeanne Robertson[1]

*[1]California State University, Northridge, Northridge, California, USA, [2]Natural History Museum of Los Angeles County, Los Angeles, California, USA*

## Coming to America I: The Invasion History of the Mediterranean House Gecko (*Hemidactylus turcicus*) in the USA

Documenting the invasion history of an introduced species is the first step toward predicting its invasive potential and ecological impacts. Mediterranean House Geckos (MHGs; *Hemidactylus turcicus*) first appeared in the New World ~100 yr ago in Key West, Florida. Populations are now established from the northeastern US to Chile although their distribution is very patchy over most of this range. Because of their limited innate dispersal abilities and close association with humans, the modes of dispersal are a combination of localized movements (e.g., among houses within a neighborhood) and human-aided jump dispersal (purposefully or unintentionally) over longer distances. To assess which modes of dispersal were likely more prevalent, we assembled locality data from the literature, museum records, and citizen scientists to document the invasion history and current distribution of MHGs in the US. Despite their relatively recent colonization, MHGs have become established in >400 counties across 23 states. We found that although colonization generally followed an out-of-southern-Florida pattern of dispersal to the north and west, there were many instances of jump dispersal as well. The rate of dispersal has also increased dramatically over time, likely

because of the concomitant increase in vehicles, human relocations, and commercial shipping. Although these patterns indicate the geographic spread of this species over time, they do not reveal which populations are more likely to disperse or be moved and in what directions. Resolution of these questions will require genomic studies to reveal the fine-scale movements of MHGs into and across the US.

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## 0176 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon A-C, Friday 8 July 2016

Kory Evans[1], Brandon Waltz[1], Prosanta Chakrabarty[2], James Albert[1], Victor Tagliacollo[1]

*[1]University of Louisiana at Lafayette, Lafayette, Louisiana, USA, [2]Louisiana State University, Baton, Rouge, USA*

### Modularity begets brachycephaly: Repeated patterns of neurocranial evolution in Neotropical electric fishes.

The Neo-Darwinian view of adaptation by natural selection assumes that phenotypic variation is produced randomly with respect to function. However, developmental pathways are often buffered against the effects of mutations such that small changes in the timing of gene expression may generate non-random, functionally viable phenotypes. Here we explore the role of heterochrony in the production of ontogenetic variation and phylogenetic diversity in the neurocrania of Neotropical electric fishes (Gymnotiformes: Teleostei). We assess patterns of shape changes during growth and among adults of different species using landmark-based geometric morphometrics in an explicitly phylogenetic framework. We find the brachycephalic to dolichocephalic axis of neurocranial variance, broadly observed across many vertebrate groups, represents the largest component of shape variance (PC1) in development and evolution. We also find shape changes in the face and braincase regions are more integrated during growth in some taxa, and more modular in others, thereby suggesting tradeoffs in the developmental coordination of these two skull regions. These results suggest that neurocranial evolution in gymnotiform electric fishes is constrained by common genetic and developmental pathways present in all vertebrates, and that this biased production of variation has constrained the evolution of neurocranial morphology along lines of least developmental resistance.

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**0545 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Daniel Fahy, Richard Spieler, William Hamlett

*Nova Southeastern University, Halmos College of Natural Sciences and Oceanography, Guy Harvey Oceanographic Center, Dania Beach, Florida, USA*

## Synchrony of Male and Female Reproductive Parameters during the Biannual Reproductive Cycle of the Yellow Stingray, *Urobatis jamaicensis* (Myliobatiformes: Urotrygonidae)

A definitive, biannual reproductive cycle with mature females capable of producing two broods annually was documented for the yellow stingray (*Urobatis jamaicensis*) in southeast Florida. Pregnant females were collected during all months throughout the year, but exhibited two discretely overlapping periods of reproduction. The first cycle extended from January to August and the second cycle from July to February. Male and female stingrays each demonstrated mutual synchrony with consistent bimodal patterns measured for nearly all reproductive parameters. Combining data from individuals on: follicle development, ovulation, embryonic growth, and parturition identified the periodicities of the repetitive female cycles with ovulation and parturition coinciding from January through April (Feb-Mar peak), and July through October (Aug-Sep peak). Sequential patterns of follicle development, with concurrent vitellogenesis and limited reproductive intervals, enabled females to breed immediately following or shortly after parturition of the previous cycle. Gestational periods overlapped during the transition between consecutive cycles (Jan-Feb & Jul-Aug). Thus these periods often displayed the simultaneous occurrence of either term stage females completing the previous cycle, or post-ovulatory females at the onset of the subsequent cycle. Gestation rates of *ca*. 5 months were estimated from the timing between peak ovulation, and observations of both postpartum females and free swimming neonates. Bimodal patterns of spermatogenesis and male sperm storage maintained appropriate levels of synchrony between male and female biannual cycles. Additional support of a biannual cycle was provided by significant differences between fecundity and lateralization of uterine function during each reproductive cycle.

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**1008 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Luara Falcão[1], Matthew McDavitt[2], Vicente Faria[3]

*[1]Programa de Pós-graduação em Ciências Marinhas Tropicais, Instituto de Ciências do Mar - Labomar, Universidade Federal do Ceará, Fortaleza, Brazil, [2]National Legal Research Group Inc., Charlottesville, VA, USA, [3]Departamento de Ciências Biológicas, Universidade Federal do Ceará, Fortaleza, Brazil*

## International online trade of sawfish rostra

The sawfish are rays that belong to the family Pristidae. All five sawfish species are listed in Appendix I of CITES - Convention on International Trade in Endangered

Species of Wild Fauna and Flora. International trade of species included in this appendix is prohibited, either whole animals or parts of them, with the exception of trade authorized by CITES for scientific purposes. Despite the risk of extinction and the urgent need for conservation, the sawfish is still a target for capture and trade. This trade consists mainly of isolated fins and rostra, which have great cultural value beyond their intrinsic commercial value. The present study aimed to monitor the online international sawfish trade. The data were obtained by searches on *Google Images* using key words about sawfish trade. The search was conducted between March 2015 and January 2016 with a frequency of 3 to 4 times per week. The following data were recorded for each offer of a sawfish specimen: (1) photo, (2) species, (3) URL, (4) price, (5) seller's country, (6) delivery country, (7) size of rostra, (8) estimated rostra age (antique or recently collected), (9) product availability (whether it was already sold or not). A total of 403 isolated sawfish rostra available for trade were recorded. The result of this research is presented in the context of illegal sawfish trade as well as to highlight the need for monitoring of the online trade of such species.

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## 0838 Amphibian Reproduction & Herp Conservation, Galerie 3, Saturday 9 July 2016

Bryan Falk[1], Amy Yackel Adams[2], Robert Reed[2]

*[1]U.S. Geological Survey, Homestead, FL, USA, [2]U.S. Geological Survey, Fort Collins, CO, USA*

### How can we use activity patterns to improve the management of invasive reptiles?

A major obstacle in the research and management of invasive reptiles is the long search time necessary to find individual animals. Long search times may be reduced if the conditions when the animals are active (and likely to be encountered) are well understood. Furthermore, land managers planning rapid-response actions for newly invasive species may want to use information about activity patterns from closely related taxa to inform their searches. Using a large dataset of 2607 observations of 19 snake species in the Florida Everglades, we: 1) identify the covariates of activity for invasive Burmese pythons, and 2) evaluate whether covariates of activity are most similar among closely related species. Our results show how knowledge of activity patterns can improve invasive-reptile management by increasing search efficiency and informing rapid-response decisions.

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**0097 SSAR SEIBERT AWARD ECOLOGY, Galerie 3, Thursday 7 July 2016**

Vincent Farallo[1], Rebecca Wier[2], Donald Miles[1]

*[1]Ohio University, Athens, OH, USA, [2]John Carroll University, University Heights, OH, USA*

## Will behavioral compensation buffer species loss in a warming climate?

Identifying suitable thermal environments for a species is critical, because body temperature influences a myriad of physiological processes. Climate warming is projected to alter the thermal quality of habitats across the planet and the ability for ectothermic organisms to persist in contemporary habitats. One potential response to climate warming is to follow shifting habitats through dispersal. However, species with limited dispersal capacities must adapt to changing conditions or face extinction. Alternatively, species may use behavioral compensation to modulate the influence of environmental variation on physiological processes (Bogert effect). Plethodontid salamanders are lungless and breathe through their skin, resulting in high sensitivity to temperature and moisture. Most species have limited home ranges and low dispersal capacities, which makes them ideal to study behavioral compensation and how it may promote or constrain species persistence in altered thermal niches. In this study we tested the Bogert effect by determining whether several species of plethodontid salamanders select divergent microhabitats in different portions of their range to maintain similar thermal and hydric conditions. We used agar model salamanders and Thermochron iButtons to assess water loss rates and temperatures at various microhabitat types. We also conducted over 120 area constraint surveys to quantify what microhabitats salamanders were using and when they were being used. Specifically, we addressed two questions; 1) Do thermal and hydric conditions differ for microhabitats at different elevations and/or times?, and 2) Will salamanders utilize different microhabitats at different elevations and/or times?

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**0999 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Vicente Faria[1], João Eduardo Freitas[2], Bruno Macena[3], Andrey Castro[4], Pedro Afonso[5], Jorge Miguel Fontes[5], Simon Thorrold[6], Patricia Bordallo[7], Fábio Hazin[8], Tito Lotufo[9]

*[1]Departamento de Ciências Biológicas, Universidade Federal do Ceará, Fortaleza, Brazil, [2]Programa de Pós-graduação em Ciências Marinhas Tropicais, Instituto de Ciências do Mar - Labomar, Universidade Federal do Ceará, Fortaleza, Brazil, [3]Programa de Pós-graduação em Oceanografia, Departamento de Oceanografia, Universidade Federal de Pernambuco, Recife, Brazil, [4]Departamento de Ciências Naturais, Universidade Federal de São João del Rei, São João del Rei, Brazil, [5]MARE – Marine and Environmental Sciences Centre, University of the Azores, Azores, Portugal, [6]Biology Department, Woods Hole Oceanographic Institution, Woods Hole, MA, USA, [7]Embrapa Agroindústria Tropical, Fortaleza, Brazil, [8]Departamento de Pesca e Aquicultura, Universidade Federal Rural de Pernambuco, Recife, Brazil, [9]Instituto Oceanográfico, Universidade de São Paulo, São Paulo, Brazil*

## Population genetic structure of the whale shark, *Rhincodon typus*, in the Atlantic Ocean

Currently, there is no consensus about whale shark population genetic structure at a global scale. Proposed models based on the mitochondrial DNA control region and microsatellites include (a) a single circumtropical population with low geographic differentiation (mainly between Atlantic and Indian Oceans), and (b) two populations that rarely mix: Atlantic and Indo-Pacific. In both cases, genetic data about the whale shark in the Atlantic has been obtained from specimens sampled in the Gulf of Mexico/Caribbean. The goal of this study was to further describe the population genetics of whale sharks by sequencing the mitochondrial DNA control region (1,344 to 1,388 base pairs) from specimens sampled along previously unsampled Atlantic areas including the following regions and localities: southwest (Ceará, Bahia, and Santa Catarina, in the Brazilian coast; n=3), central (Saint Peter and Saint Paul Archipelago; n=4), and northwest (Azores Archipelago; n=3). We will present a network to describe the relationships among Atlantic whale shark mtDNA haplotypes. The Atlantic network will also be presented in a global context based on publicly available DNA sequences. Further analysis of the dataset will include an analysis of molecular variance to assess whale shark population genetic structure between Atlantic, Indian, and Pacific Oceans.

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**0870 Fish Conservation & Morphology, Galerie 2, Sunday 10 July 2016**

Stacy Farina

*Harvard University, Cambridge, MA, USA*

**Virtual fish gills: Computational modeling of gills to examine hydrodynamic trade-offs in fishes from diverse habitats**

When compared with air, water is a poor respiratory fluid, with a high viscosity and low dissolved oxygen concentration. Therefore, fluid dynamics potentially play a large role in natural selection of respiratory morphology of fishes that rely on aquatic respiration. While the mechanism of aquatic ventilation in ray-finned fishes is relatively conserved, there is a tremendous diversity in the morphology of this system, particularly regarding the microstructures of the gill tissues. Fish gill tissue consists of long filaments (primary lamellae), which are covered with small folds of tissue (secondary lamellae) that are the main site of gas exchange. These secondary lamellae vary considerably in shape, size, and spacing among species. In this study, I quantify hydrodynamic trade-offs of secondary lamellae morphology in species representing six ecological categories: open-ocean pelagic, bentho-pelagic, deep sea, benthic, pelagic freshwater, and diel vertically migrators. Using a 3D computational model of the secondary lamellae that I have developed in COMSOL Multiphysics, I model the hydrodynamics of the gills of each species based on measurements from scanning electron microscopy. By measuring flow rate through and around the secondary lamellae over a range of differential pressures, I examine the ecological trade-off between the volume of fluid in contact with the surface of the secondary lamellae and the ability of water to pass through the gills.

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**0298 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Jillian Farkas, Drew Davis, Brianna Henry, Jeff Wesner, Jacob Kerby

*University of South Dakota, Vermillion, South Dakota, USA*

**The Effect of Agricultural Runoff on Fish Habitat in the Prairie Pothole Region**

Agricultural tile drains expose wetlands to a suite of pesticides and other agrochemicals. Exposure to these contaminants affects wildlife either directly through toxicity, or indirectly by degrading habitat quality. Wetland habitat quality was measured using the South Dakota Wetland Rapid Assessment Protocol that included variables that estimate both abiotic (e.g., size of wetland, average buffer width, extent of damage caused by agricultural drainage) and biotic factors (e.g., interspersion of emergent to submergent vegetation, algal mat coverage) affecting wetland quality. Fish abundance and diversity were sampled via fish traps and seining. Using fish blood smears, we examined the extent of genotoxicity occurring within the individual by quantifying the number of micronuclei within erythrocytes, a bioindicator signifying that stress occurred during cell division. We examined how habitat quality and fish abundance, diversity, and

genotoxicity varied among 18 wetlands receiving three levels of agricultural tile drain input (reference, surface runoff, and tile drain effluent). Results indicated that tile drain wetlands have significantly lower habitat quality than reference sites. Preliminary data indicate that fish abundance and diversity did not differ among treatments, but clear differences among sites were observed for vegetation. Tile sites had significantly increased levels of floating algae and reduced amounts of submergent vegetation. Genotoxicity data is currently being analyzed, and data obtained from ongoing work should provide further information on how agricultural runoff potentially impacts native fish populations.

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**0810 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Terence Farrell[1], Sarah Smiley-Walters[2], Diane McColl[1]

*[1]Stetson University, DeLand, FL, USA, [2]The Ohio State University, Columbus, OH, USA*

## Pigmy rattlesnake (*Sistrurus miliarius*) foraging behavior in trials with skinks (*Scincella lateralis*) and centipedes (*Scolopendra viridis*)

Predators often evolve specialized behaviors to feed on dangerous prey. In vipers, many snakes prey on centipedes but this behavior has only been anecdotally studied. We ran laboratory foraging trials using 29 field captured pigmy rattlesnakes and one of two prey: giant centipedes (*Scolopendra viridis*) or little brown skinks (*Scincella lateralis*). Our goal was to determine how prey type influenced foraging behaviors. In skink trials, pigmy rattlesnakes were significantly more likely to form foraging coils or crater into the substrate than in centipede trials where active pursuit of prey was significantly more frequent. Centipedes were struck in significantly more trials than skinks and centipedes were also struck from significantly closer distances. Strike latency was significantly lower for centipedes than skinks. The location on the prey's body where the strike was directed did not differ in skink and centipede trails. The mean time from the strike to last locomotion of the prey and from strike to prey ingestion were both significantly longer for centipedes. Pigmy rattlesnakes exhibited several behaviors in centipede trials, including head elevation when approaching prey and prey throwing, that where never observed in skink trials. The differences observed in the behavioral trials were related to both snake and prey traits, including centipede resistance to rattlesnake venom. The plasticity observed in prestrike, strike, and poststrike foraging behaviors indicate pigmy rattlesnakes are effective predators on centipedes. The ecological and evolutionary implications of centipede consumption in vipers merits increased attention given its widespread occurrence and behavioral sophistication.

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**0102 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Thomas Farrugia, Andrew Seitz

*University of Alaska Fairbanks, Fairbanks, AK, USA*

### Developing the First Stock Assessment for Skates in Alaska: What Harvest Level is Sustainable?

Skates are in growing demand worldwide, specifically in European and Asian markets. Big (*Beringraja binoculata*) and longnose (*Raja rhina*) skates are the most commonly landed skates in Alaska and currently, these species are landed as non-target catch, partly because of a lack of information and formal stock assessments. Because skates are long-lived, slow-growing and late-maturing, they are vulnerable to overfishing, and management is unlikely to allow additional skate landings until skate populations are shown to be capable of sustaining increased harvest pressures. Recently, more species-specific information on these skates has made it possible to develop full stock assessments. Through cooperation with the National Marine Fisheries Service (NMFS), we developed the first stock assessment for big skates in Alaska, using Stock Synthesis (SS3), a powerful software package flexible enough to handle data-poor assessments. This single-sex model divides the fishery into longline and trawl fleets, and incorporates two survey data sets. The model shows that the big skate population in the Gulf of Alaska has declined since 2004, and suggests that the initial depletion of the stock has not yet pushed the population to the biomass at maximum sustainable yield. It is unlikely that skate landings could be substantially increased without jeopardizing the sustainability of the stock. A parallel model for longnose skates will also be developed and these models will be shared with NMFS, and used to evaluate the feasibility of expanding harvest opportunities and prosecuting directed fisheries for skates in Alaska.

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**0941 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT**

Jeremy Feinberg, Joanna Burger

*Rutgers University, New Brunswick, NJ, USA*

### Anuran disease surveillance: Examining tadpoles raised *in situ* within an extinction area

Frog declines, extirpations, and extinctions have occurred with increasing frequency around the world over the past several decades. Many such events have been linked to amphibian diseases. To explore what involvement, if any, disease might have had in one recent frog disappearance from the New York City metropolitan region, we conducted a disease-surveillance experiment using an in situ transplant design. We raised tadpoles of two regional leopard-frog species, *Rana* (=*Lithobates*) *kauffeldi* and *R. sphenocephala*, within enclosures deployed across historical wetlands and watersheds in an extinction zone on eastern Long Island. This work was repeated over three years and four separate

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trials, and we found evidence of three deadly frog diseases in our tadpoles: chytrid fungus (*Batrachochytrium dendrobatidis*), ranavirus, and a recently identified Perkinsea-like protist. We did not find all diseases at all sites, but each study site had tadpoles infected with at least one disease. In most cases, within-site results were fairly similar over repeated trials, revealing the somewhat unique disease signature of each individual wetland.

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**0997 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Chris Feldman[1], Andrew Durso[2], Charles Hanifin[3], Michael Pfrender[4], Peter Ducey[5], Amber Stokes[6], Kenneth Barnett[7], Edmund Brodie, III[8], Edmund Brodie, Jr[2]

*[1]University of Nevada-Reno, Reno, NV, USA, [2]Utah State University, Logan, UT, USA, [3]Utah State University, Uintah Basin, Vernal, UT, USA, [4]University of Notre Dame, Notre Dame, IN, USA, [5]State University of New York-Cortland, Cortland, NY, USA, [6]California State University Bakersfield, Bakersfield, CA, USA, [7]65 Meadow Rue Place, Ballston Spa, NY, USA, [8]University of Virginia, Charlottesville, VA, USA*

**Is there more than one way to skin a newt? Convergent toxin resistance in snakes is not due to a common genetic mechanism**

Convergent evolution of tetrodotoxin (TTX) resistance, at both the phenotypic and genetic levels, characterizes coevolutionary arms races between amphibians and their snake predators around the world, and reveals remarkable predictability in the process of adaptation. Here we examine the repeatability of the evolution of TTX-resistance in an undescribed predator-prey relationship between TTX-bearing Eastern Newts (*Notophthalmus viridescens*) and Eastern Hog-nosed Snakes (*Heterodon platirhinos*). We found that local newts contain levels of TTX dangerous enough to dissuade most predators, and that Eastern Hog-nosed Snakes within newt range are highly resistant to TTX. In fact, these populations of Eastern Hog-nosed Snakes are so resistant to TTX that the potential for current reciprocal selection might be limited. Unlike all other cases of TTX resistance in vertebrates, *H. platirhinos* lacks the adaptive amino acid substitutions in the skeletal muscle sodium channel ($Na_v1.4$) that reduce TTX-binding, suggesting that physiological resistance in Eastern Hog-nosed Snakes is conferred by an alternate genetic mechanism. Thus, phenotypic convergence in this case is not due to parallel molecular evolution, indicating that there may be more than one way for this adaptation to arise, even among closely related species.

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**0626 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Martín Femenías[3], Luciano J. Avila[1], Jack W. Sites, Jr.[2], Mariana Morando[1]

*[1]IPEEC-CONICET, Puerto Madryn, Argentina, [2]Brigham Young University, Provo, Utah, USA, [3]Universidad Nacional de la Patagonia San Juan Bosco, Puerto Madryn, Argentina*

## On the southernmost leiosaurid lizards: phylogeographic and evolutionary patterns of *Leiosaurus belli*, *Diplolaemus bibronii* and *Diplolaemus darwinii* based on the mitochondrial cytochrome b gene

The Leiosaurae species *Leiosaurus belli*, *Diplolaemus bibronii* and *Diplolaemus darwinii* are endemic to southern South America and are distributed over diverse habitats in the ecoregions of Monte and Patagonian Steppe. We sampled 124 localities representing all the distributional range of these species, and for 187 individuals we sequenced the mitochondrial gene cyt-b. We analyzed phylogeographic patterns in the light of historical Miocene-to-Pleistocene events of Patagonia. For *Leiosaurus belli* we inferred 3 allopatric haploclades with uncorrected genetic distances higher than 3%, suggesting that they may be different species. These divergences may have been related to the formation of the Negro, Neuquén and Limay rivers as they have been proposed as gene flow barriers for other lizard species. The northernmost populations show signs of recent expansion. *Diplolaemus darwinii* and *D. bibronii* have a southern Patagonia distribution and the latter shows signs of recent population expansion with no apparent role for the Deseado river on their genetic structure. The results of this study, coupled with those of other lizard species from this area, may be useful to define conservation strategies. We suggest a taxonomic review of *Leiosaurus belli*, including more molecular markers and integrating morphological, ecological and behavioral data.

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**0084 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Christina Feng, Michael Dreslik

*Illinois Natural History Survey, Champaign, IL, USA*

## Sex Differentiation in the Growth of Spotted Turtles (*Clemmys guttata*)

Understanding an organism's growth pattern is essential for informing a species' ecology, life history, and demography. For many chelonians, size correlates strongly with development and can be used to estimate the age at sexual maturity. We investigated organismal growth in an Illinois population of Spotted Turtles using long-term mark-recapture data collected from 1988-2015. We compiled the growth histories of 134 individuals with captures spanning 1-27 years for the size measurements of carapace length (CL) and plastron length (PL). We conducted a nonlinear regression analysis to determine what growth functions best fit the data and then expanded the best-fit function to account for sex. For both CL and PL, the data best fit the Weibull growth function. When reparametrizing the function for sex, the top model parameters included

sex-specific asymptotic size (A), growth rate (k), and slope of growth (m) parameters. For CL, there were an additional three competitive models that included the null model. For the top model, females had a slightly larger asymptotic adult CL (112.42mm) and PL (103.05mm) than did males (106.99mm and 92.30mm, respectively). This difference in PL is likely due to the necessity of tail articulation in males associated with copulation. Because growth differs among sexes, we calculated an ontogenetic SDI, which demonstrates a slight dimorphism ($0.90 < SDI \leq 1.10$) for CL and PL. We estimate the minimum age at sexual maturity for females to be 9.7-10.4 years based on minimum measurements (CL = 91.5mm, PL = 83mm) of gravid females captured during the study.

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## 0510 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016

Christina Feng[1], Dave Mauger[2], Jason Ross[1], Michael Dreslik[1]

*[1]Illinois Natural History Survey, Champaign, Illinois, USA, [2]Forest Preserve District of Will County (retired), Lockport, Illinois, USA*

### A Long-Term Demographic Analysis of Spotted Turtles (*Clemmys guttata*) in Illinois

Chelonians represent one of the most threatened vertebrate taxa, but the absence of adequate life history and demographic information hinders effective conservation efforts for most species. For freshwater turtles, collecting life history and demographic data is difficult due to their longevity, secretive nature, ontogenetic shifts, and relative inaccessibility. The semi-aquatic Spotted Turtle (*Clemmys guttata*) is listed as an endangered species in Illinois, and only two populations remain extant within the state. Since 1988, one of the populations has been the subject of a mark-recapture study to examine its long-term population dynamics. We compiled capture histories for 258 individual turtles (198 included in the analysis) and used Program RMark to compare 17 live-encounter Cormack-Jolly-Seber models using AICc rankings. These models represented all combinations of and interactions between the variables sex, time, and age. The top-ranked model included a constant survival probability and cohort-dependent recapture probabilities across survey years. We incorporated age as a time-dependent covariate and computed age-specific survival rates for 0 (hatchling) to 21 years. We calculated female fecundity rates from captures and radiographs of gravid females and combined these with female survival rates to construct a deterministic life table and Leslie matrix. Our results indicate survival rates and recapture probabilities vary substantially by age but have been relatively stable between years for the duration of this study.

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**0246 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Allyson Fenwick[1], Christopher Parkinson[2]

*[1]University of Central Oklahoma, Edmond, OK, USA, [2]University of Central Florida, Orlando, FL, USA*

**Taxon-dense Phylogeny of Crotalinae Using Combined Morphological and Multigene Analysis**

Pitvipers are not only of medical interest but also excellent model organisms for evolutionary and ecological questions. The group can be even more useful with a phylogeny including a maximal number of species. Although several studies have thoroughly sampled species relationships of genera or related groups of genera, the most comprehensive study to date included 126 of 231 currently-described species. One challenge is that DNA or specially-preserved tissues may not be available for newly described species or for those known from few specimens, but images or formalin-fixed specimens are often available for these taxa. This study combines morphological data for over 90% of species with multigene mitochondrial data for approximately 75% and a nuclear locus for 40%. We evaluate the placement of limited-data morphology-only taxa (approximately 98% incomplete in a matrix of over 4500 characters) and the effect of combining these independent datasets. We investigate pitviper intergeneric relationships, which have been historically difficult to resolve due to short internal branches. We discuss species- and genus-level relationships which have not been reported or have been controversial in prior work.

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**0161 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Jennifer Fernandez[1], Leigh Anne Harden[2], Brock Struecker[1], Joseph Milanovich[1]

*[1]Loyola University Chicago, Chicago, IL, USA, [2]Benedictine University, Lisle, IL, USA*

**Seasonal Blood Chemistry of Ornate Box Turtles in Restored Prairies of North-central Illinois**

The development and conversion of native prairies, primarily to agricultural land, has left only 3% of original native prairie habitat in the United States. In Illinois, *T. ornata* was recently listed as threatened and little remains known about the overall health of *T. ornata* populations in the smaller, restored/remnant prairies in north-central Illinois. We investigated the physiological health status of two *T. ornata* populations across one year using radiotelemetry, temperature dataloggers, and blood tissue collection. Turtles from two populations in Will and Grundy Counties, Illinois were followed one to three times per week from April 2015 – April 2016. Once per month between April to September 2015 we secured each turtle to take a blood sample (<0.25 ml) from the subcarapacial vein. A blood chemistry panel measuring concentrations of $Na^+$, $Cl^-$, $K^+$, $Ca^{2+}$, glucose,

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hematocrit, urea, hemoglobin, and creatinine was immediately performed on whole blood using an i-STAT point-of-care (POC) handheld blood analyzer and an i-STAT CHEM8+ cartridge. Whole blood was also used to create three blood smears per turtle to investigate blood cell morphology and parasites using a standard light microscope under 1000x (oil). Our results indicate seasonal variation in several blood chemistry metrics across both sites, driven by variation during spring months. Furthermore, our data did not show any measurable variation in blood cell morphology and no parasites were identified. An assessment of *T. ornata* populations, specifically data regarding the blood chemistry, is much needed to further establish specific conservation targets for this threatened species.

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**0594 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Luciana C Ferreira[1], Michele Thums[2], Andre Afonso[5], Adam Barnett[3], Richard Fitzpatrick[3], Neil Hammerschlag[4], Fabio Hazin[5], Michael Heithaus[6], Rory McAuley[7], Jessica Meeuwig[9], Mahmood Shivji[10], John Stevens[8], Ben Radford[2], Mark Meekan[2]

*[1]University of Western Australia/Australian Institute of Marine Science, Perth, WA, Australia, [2]Australian Institute of Marine Science, Perth, WA, Australia, [3]James Cook University, Cairns, QLD, Australia, [4]University of Miami, Miami, FL, USA, [5]Universidade Federal Rural de Pernambuco, Recife, PE, Brazil, [6]Florida International University, Miami, FL, USA, [7]Department of Fisheries, Government of Western Australia, Perth, WA, Australia, [8]CSIRO Marine and Atmospheric Research, Hobart, TAS, Australia, [9]University of Western Australia, Perth, WA, Australia, [10]Nova Southeastern University, Fort Lauderdale, FL, USA*

**Global Patterns in the Movements and Habitat Use of tiger sharks**

The expense and difficulties of capturing and tagging large apex predators such as tiger sharks means that most studies report movement and habitat use data for only a few individuals. This hampers our understanding of the ecological and environmental drivers of movement at both stock and population scales. To address this issue, we pooled data among tracking studies to create a database of tracks of 104 tiger sharks that were tagged in the Indian (Ningaloo Reef, Australia), the Pacific (Great Barrier Reef and Hawaii), and the Atlantic (Recife, Fernando de Noronha Brazil, Florida and Bahamas) Oceans. Monthly utilization distributions were calculated for each track using the Biased Random Bridge kernel method. Tracks were divided into periods of migration and residency and the migration section was analysed separately with a Step Selection Function. This method generates random steps around each location based on the real distribution of angles and steps as a way to estimate resource selection by comparing observed habitat used with available structures. We then modelled the resulting dataset with a binomial distribution using generalized additive mixed models with a range of environmental variables (SST, bathymetry, currents). Utilization distributions were also used as a response variable to identify the major drivers of movement and habitat use

for the species. We only found weak trends in migratory movements, suggesting high plasticity in spatial ecology of tiger sharks a trait that might be important in the success of the species as a top order predator in tropical oceans worldwide.

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**0349 General Ichthyology I, Balconies J & K, Sunday 10 July 2016**

Karen Field, Karen Maruska

*Louisiana State University, Baton Rouge, LA, USA*

### Context-dependent chemical signaling and social behaviors in reproductively-receptive female cichlids

Across vertebrates chemoreception provides crucial information about survival and reproduction. In several fish species, chemosensory signaling is crucial for social communication, and female-released compounds can elicit physiological and behavioral responses in males. These socially-relevant female-released compounds can be passively emitted through the skin and gills, or actively released through urine. It was previously shown that males of the highly social African cichlid, *Astatotilapia burtoni*, alter urination behaviors depending on social context, but whether females have evolved a similar chemosensory signaling mechanism is unknown. We tested the hypothesis that gravid (reproductively-receptive) females actively alter urination rate and social behavior in a context-dependent manner. Using an innocuous dye to visualize urine pulses, we exposed dye-injected gravid females to five conditions: dominant male, gravid female, brooding (non-receptive) female, juvenile fish, and no fish, and quantified urine release and social behaviors. We found that gravid females alter urination rates in a context-dependent manner with increased urination in both reproductive (dominant male exposure) and aggressive (brooding female exposure) settings, and that aggressive behaviors differ in the presence of females of different reproductive states. Further, urination rate and aggressive displays were positively correlated. This suggests that *A. burtoni* females have a similar chemosensory signaling mechanism to that of males, conveying reproductive status or body condition to males and to other females. Coupled with previous studies, these data demonstrate how intra- and inter-sexual social behaviors, including chemosensory signaling, are used by both sexes in varying contexts within a single species, shedding light on social communication in vertebrates.

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**0262 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Andrew Fields[1], Kevin Feldheim[2], Gregg Poulakis[3], Rachel Scharer[3], Demian Chapman[1]

*[1]Stony Brook University, Stony Brook, NY, USA, [2]The Field Museum, Chicago, IL, USA, [3]Florida Fish and Wildlife Conservation Commission, Port Charlotte, FL, USA*

## Insights on Smalltooth Sawfish, *Pristis pectinata*, Biology and Life History from Over a Decade of Genetic Sampling

Florida populations of smalltooth sawfish (*Pristis pectinata*) have declined up to 99% over the past several decades. Despite this, these populations are relatively robust genetically, exhibiting high levels of allelic richness and heterozygosity at microsatellite loci. Using this suite of microsatellite markers, we examined the mating system and potential reproductive philopatry at two sites in Florida: the Caloosahatchee River and the Peace River. Preliminary results have shown a biennial reproductive cycle and interannual site fidelity of mature females to these sites. Additionally, we describe the first documented cases of parthenogenesis in a normally sexually reproducing wild vertebrate. These results will be instrumental in guiding the recovery planning process for this species.

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**0796 AES Conservation & Management III, Balconies L & M, Saturday 9 July 2016**

Andrew Fields[1], Gunter Fisher[2], Stanley Shea[3], Huarong Zhang[3], Debra Abercrombie[4], Kevin Feldheim[5], Elizabeth Babcock[6], Demian Chapman[1]

*[1]Stony Brook University, Stony Brook, NY, USA, [2]Kadoorie Farm and Botanic Garden, Tai Po, Hong Kong, [3]BLOOM association, Central, Hong Kong, [4]Abercrombie and Fish, Port Jefferson Station, NY, USA, [5]Pritzker Laboratory for Molecular Systematics and Evolution, The Field Museum, Chicago, IL, USA, [6]Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL, USA*

## Species composition of the global shark fin trade assessed by a genetics-based survey of the retail market

Fisheries supplying the demand for the Cantonese delicacy shark fin soup are a major driver in the depletion of shark populations all over the world, prompting strong public support for new investments to address this global environmental problem. Understanding the species composition of the global dried shark fin trade will be an essential component of emerging efforts to improve the sustainability of these fisheries. We estimate the contemporary species composition of the fin trade by genetically surveying randomly collected samples (N=4,800) from the retail market of the Hong Kong Special Administrative Region (SAR), one of the world's largest shark fin trading and consumption centers. We estimate that at least 81-99 species of sharks, rays and chimeras occur in the fin trade yet the trade has become very focused on a small subset

of the sharks. The blue shark (*Prionace glauca*), a productive epipelagic species, has become the foundation of the trade (40.73-57.56%) as the importance of certain less prolific species has declined. The supplies of many of the other commonly traded species are likely to decline in the future due to overfishing and increasing regulation, while one third of all of the traded species are assessed by the International Union for the Conservation of Nature (IUCN) to be at high risk of extinction.

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**0222 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Derek Filipek[1], Ginny Adams[1], Donald Shepard[2]

*[1]University of Central Arkansas, Conway, Arkansas, USA, [2]University of Louisiana Monroe, Monroe, Louisiana, USA*

## Phylogeography and Historical Demography of the Queensnake, *Regina septemvittata*

The eastern United States has a complex physiography characterized by large river systems, extensive mountain ranges, and historical glacial cycles. These physiographical features have significantly impacted distributions and evolutionary patterns of species within the region. The Queensnake, *Regina septemvittata*, is a semi-aquatic snake with a mostly contiguous distribution throughout the eastern United States and a disjunct population in Arkansas. To determine how this species has been affected by physiographical factors, we sequenced the mitochondrial cytochrome *b* gene for *R. septemvittata* from throughout their distribution and inferred phylogeographic relationships, divergence times, and historical changes in population size. Using model-based phylogenetic methods, we inferred four geographically distinct lineages: an Arkansas lineage, an east-central lineage, a Gulf Coast lineage, and an Atlantic Coast lineage. Divergence times estimated using BEAST indicated that *R. septemvittata* originated in the Middle Miocene and the most recent common ancestor of all *R. septemvittata* was during the Late Pliocene. Divergence of Atlantic and Gulf coast lineages occurred during the Early Pleistocene whereas the Arkansas lineage diverged from the east-central lineage more recently during the Late Pleistocene. Historical demographical analyses indicated that population sizes of Arkansas, Gulf Coast, and Atlantic Coast lineages have been relatively stable. In contrast, the east-central lineage showed a stable population size until ~20,000 years ago when it displayed a marked increase, likely due to northward range expansion following glacial retreat after the Last Glacial Maximum. Our results underscore the importance of physiography in generating and maintaining biodiversity patterns in the eastern United States.

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**0225 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Derek Filipek[1], Ginny Adams[1], Donald Shepard[2]

*[1]University of Central Arkansas, Conway, Arkansas, USA, [2]University of Louisiana Monroe, Monroe, Louisiana, USA*

## The Role of the Ecological Niche in Lineage Diversification of Queensnakes, *Regina septemvittata*

The reduction in gene flow that facilitates population divergence and speciation can be due to 'hard' barriers such as rivers and mountains or 'soft' barriers such as variation in environmental conditions. Hard barriers are typically obvious physical features of the landscape that impact a large number of species similarly whereas soft barriers are more difficult to detect and may be species-specific. Ecological niche modeling is often used to characterize and compare the niches of different species or populations. These methods also provide a means to determine whether divergence is associated with soft barriers to gene flow and to examine patterns of niche evolution. We used freshwater environmental data layers to generate ecological niche models (ENMs) in Maxent for the four geographically distinct evolutionary lineages within the Queensnake, *Regina septemvittata*. We used ENMTools to determine if geographic boundaries between lineages were associated with abrupt environmental changes as would be predicted by the presence of a soft barrier to gene flow. We also used ENMTools to test whether niche conservatism or niche divergence has played the more prominent role in promoting and maintaining lineage divergence. ENMs showed that the region separating the disjunct Arkansas population from populations east of the Mississippi River has low suitability. Geographic boundaries between lineages varied in their degree of environmental change with some supporting the presence of a soft barrier; the existence of hard barriers was also evident. Environmental niches differed among lineages, indicating niche divergence has played the prominent role in lineage divergence.

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**0133 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Brittany Finucci[1], Carlos Bustamante[2], Emma Jones[3], Matthew Dunn[1]

*[1]Victoria University of Wellington, Wellington, New Zealand, [2]Molecular Fisheries Laboratory, University of Queensland, Brisbane, Australia, [3]National Institute of Water and Atmospheric Research (NIWA), Auckland, New Zealand*

## Specialized Diet of the Deep-sea Elasmobranch, the prickly dogfish (*Oxynotus bruniensis*)

Specialist diets have been identified amongst elasmobranch, although the degree of specialization can be subjected to individual specialists, competition, and fluctuations in spatial and temporal prey abundance and availability. Several examples of chondrichthyans playing a large role in diet of other chondrichthyans have been previously documented, although few are known from the deep-sea, and have included

large bodied species. The prickly dogfish *Oxynotus bruniensis* is a small (<75 cm), little known deep-sea elasmobranch distributed on the outer continental and upper slope of southern Australia and New Zealand. Specimens (n = 53) were collected from research trawls surveys and fisheries observers from around New Zealand at depths from 400 to 1300 m. Stomach contents were dissected and prey items were identified to the lowest possible taxon. Findings included longnose chimaera *Harriotta raleighana* embryos and vitellus from unknown origin. The mitochondrial genes *cox1* and *nadh2* were sequenced from 24 samples of homogenized stomach content (including vitellus and egg cases). DNA sequences reveals that *O. bruniensis* preys exclusively on the egg cases of oviparous chondrichthyans, including Pacific spookfish *Rhinochimaera pacifica* and brown chimaera *Chimaera carophila*. These findings are the first evidence of a wild shark relying solely on egg cases from other chondrichthyans as a food source. In addition to its low reproductive output and high distribution overlap with fishing efforts, the reliance on a specialized diet may make *O. bruniensis* a particular vulnerable species to overfishing.

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**0107 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Brittany Finucci[1], Matthew Dunn[1], Emma Jones[2]

[1]*Victoria University of Wellington, Wellington, New Zealand,* [2]*National Institute of Water and Atmospheric Research (NIWA), Auckland, New Zealand*

## Aggregative Behaviour and Social Structure in Deep-sea Chondrichthyans

A wide range of Chondrichthyans are known to form aggregations, associations or groupings. The motivation for these interactions have been attributed to foraging, reproduction, energy conservation, and social preference. Due to the highly mobile nature of sharks, in addition to the difficulty of following individuals in the open sea, most research on social interactions or associations has been limited to temperate, inshore species, with some degree of site fidelity. However, some of the earliest insights into the structure of shark groupings were gained from analysing commercial trawl catches. We evaluate the occurrence of social grouping in a range of common and infrequently caught deep-sea chondrichthyans (6 holocephalans, 10 elasmobranchs), including the estimation of companion preferences across sex and size classes, using a large data set from fisheries-independent research trawl surveys. Only a few species were found to engage in aggregative behaviour, and those that did had companion preferences that varied with sex, and fish density. Group composition changed with depth and density, and for some species, aggregations were repeatedly found in discreet locations. Most often, aggregations consisted largely of juveniles, and mature females were the least likely to form aggregations. However, this pattern was not true of all species. The existence and nature of aggregations will influence species relative vulnerability to fishing.

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**0435 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Taylor Fisher, Lesley Kim, Kory Evans, James Albert

*University of Louisiana at Lafayette, Lafayette, Louisiana, USA*

## Relationship Between Diet and Snout Morphology in Apteronotid Electric Fishes (Gymnotiformes) from the Amazon Basin

Apteronotid electric fishes in deep river channels of the Amazon and Orinoco Basins are species rich and exhibit pronounced differences in the morphology of the snout and oral jaws. However, the diet of these species is poorly known. We compared morphological and ecological variables using δ15N stable isotope, gut content, geometric morphometric, and habitat data for six species; *Compsaraia samueli* (n=20), *Porotergus gimbeli* (n=17), *Sternarchella orthos* (n=20), *Sternarchogiton nattereri* (n=20), *Sternarchorhamphus muelleri* (n=10), and *Sternarchorhynchus chaoi* (n=10), all collected using trawls at 5 - 10 m along river margins at Santarém (Eastern Amazon) and Iquitos (Western Amazon). δ15N values from epaxial muscle were used to estimate diet integrated over weeks, and gut content analysis to estimate diet at a single time point. PC1 of head shape was not correlated with average δ15N values, indicating that species with long and short snouts have a similar average trophic position (3.5 +/- 0.8). Species with short snouts have a greater range of variances in average trophic position (SD = 0.1-0.8) compared to species with long snouts (SD = 0.34-0.38). Species with short snouts had the least (*S. orthos*) and most (*P. gimbeli*) variable δ15N values. These results suggest that apteronotids collected in the same habitats consume similar prey items, although perhaps in different proportions, and that species with short snouts have both the least and most specialized diets. These results do not indicate trophic partitioning among species of the deep channel apteronotid ichthyofauna.

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**1107 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Robert Fisher[1], Peter Harlow[2], Ramesh Chand[3], Jone Niukula[4], Joeli Vadada[4], Baravi Thaman[4], Elenoa Seniloli[5], Tuverea Tuamoto[5], Sia Rasalato[6], Tui Yanuya[4], Stesha Pasachnik[7], Kim Lovich[7], Nunia Thomas-Moko[5]

*[1]U.S. Geological Survey, San Diego, California, USA, [2]Taronga Zoo, Mosman, NSW, Australia, [3]Kula Eco Park, Sigatoka, Fiji, [4]National Trust of Fiji Islands, Suva, Fiji, [5]NatureFiji-MareqetiViti, Suva, Fiji, [6]Birdlife Pacific, Suva, Fiji, [7]San Diego Zoo Global, San Diego, California, USA*

## Community-Based Recovery of the Monuriki Island Crested Iguana (*Brachylophus* cf. *vitiensis*) in Fiji

The Fijian Crested Iguanas (*Brachylophus* cf. *vitiensis*) are a critically endangered species restricted to a few small islands in the dry forest zone of Fiji. This dry forest habitat is also critically endangered and restricted to a few isolated patches on disparate islands. The population of iguanas on Monuriki Island (40.4 hectares) represents a putative new

species and is the third largest population of the Crested Iguanas that remains. Since its first documentation in the early 1980's it has been a well known location that local resorts have harvested iguanas from for display. In the late 1990's the first efforts to conserve and restore this island were discussed but it took until the development of the Crested Iguana Recovery Plan in 2008 that conservation was implemented. Since 2008, goats and rats have been removed from the island, and 10 pairs of iguanas were brought into captivity in Fiji for captive breeding. In 2015 the first 32 captive-bred iguanas were released back on the island. Twenty-six of these were radio-tracked for the short term to determine their fate, and 18 were found after 56 days indicating excellent short term survival. In February of 2016 Tropical Cyclone Winston passed through Fiji with a peak intensity of ten-minute sustained winds of 230 km/hr and removed most or all of the canopy leaves from trees on Monuriki Island. Results of the March/April island surveys which will document longer term survival will be presented and the success of the community based efforts will be discussed.

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**0751 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Lee Fitzgerald[1], Wade Ryberg[2]

*[1]Biodiversity Research and Teaching Collections, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas, USA, [2]Institute of Renewable Natural Resources, Texas A&M University, College Station, Texas, USA*

## Conservation Scaling: Confronting the mismatch between ecological knowledge and conservation strategies

A central question in conservation is "What allows a species to persist and conversely, what causes it to disappear?" The ecological answer depends on factors such as species' life history and sensitivity to landscape change. The relative importance of these processes varies with scale. The conservation answer depends on the match between ecological scaling and conservation scaling: the extent to which conservation measures are effective at multiple scales. Most conservation strategies, for example sustainable use, ecotourism, stopping illegal wildlife trade, and protecting endangered species are confronted with challenges related to scaling and mismatch. Our research on an endemic habitat specialist, the Dunes Sagebrush Lizard (*Sceloporus arenicolus*), lends insight to challenges of conservation scaling. Ecological studies reveal how population dynamics in these lizards scales from neighborhoods of interacting individuals up to the distribution of the species across its range. Moreover, the configuration of irreplaceable dune landforms are directly linked to population vital rates, neighborhood vitality, and population persistence. Fragmentation from oil and gas development in the Mescalero-Monahans Dunes disrupts both the geomorphologic processes that maintain dunes and the diffusion-dispersal dynamics that connect lizard neighborhoods. The extent of conservation measures in conservation agreements does not match the dynamics of ecological scaling in this system and may not confront the higher-level problem of fragmentation that drives species disappearance. The mismatch between conservation scaling and ecological scaling is a pervasive challenge to biodiversity conservation.

Conservation scientists might benefit from embracing realities of conservation scaling, and planning for the scaling limits of conservation interventions.

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**0858 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Cristín Keelin Fitzpatrick[1], Andrea Bernard[1], Filip Osaer[2], Krupskaya Narváez[2], Mahmood Shivji[1]

*[1]Save Our Seas Shark Research Center and Guy Harvey Research Institute, Nova Southeastern University, Dania Beach, Florida, USA, [2]ElasmoCan, Las Palmas de Gran Canaria, Spain*

## A Genetic Exploration in a Last Refuge: The Common Angelshark (*Squatina squatina*) in the Canary Islands

The common angelshark (*Squatina squatina*) has been extirpated from nearly the entirety of its historical eastern North Atlantic and Mediterranean range and is listed as 'Critically Endangered' by the IUCN Red List of Threatened Species. Currently, only a single known remnant population of any abundance exists, occurring within the waters surrounding the Canary Islands. Nothing is known about the genetic population dynamics of this species. To assess the common angelshark's genetic connectivity and diversity, tissue samples (n = 509) were collected between 2009-2016 from three separate islands within the archipelago: Gran Canaria and Tenerife – which are separated by a deep ocean channel (~3000 m) which potentially serves as a barrier to dispersal for this benthic species, and Lanzarote. To date, DNA sequences have been obtained from four mitochondrial loci [control region (CR) (n = 233), Cytochrome c oxidase subunit 1 (COI) (n = 16), NADH dehydrogenase subunit 4 (ND4) (n =28), and NADH dehydrogenase subunit 2 (ND2) (n =4)] revealing exceptionally low genetic diversity across all regions, as identical haplotypes were found in nearly all analyzed individuals. Additionally, next-generation sequencing has been used to develop a species-specific library for novel microsatellites and preliminary screening of each of 18 markers has shown these loci to be monomorphic across 16 individuals. Further screening of additional loci (mitochondrial and microsatellite) and individuals is ongoing. Such potentially low levels of genetic diversity may have far reaching implications for the persistence of this species and ultimately underscore the common angelsharks' highly vulnerable state.

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**0643 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday 7 July 2016**

Virginia Fleer, Chet Rakocinski

*University of Southern Mississippi- Gulf Coast Research Laboratory, Ocean Springs, MS, USA*

**Cryptic fish assemblages vary between artificial and historic oyster reefs in the Mississippi Sound**

Various natural and anthropogenic driven stresses on oyster reefs in the Mississippi Sound have recently led to extensive reef restoration efforts within this region. Reef restoration is primarily directed toward the overall goal of enhancing the production of commercially and recreationally important oysters and fishes, and secondarily toward the provision of other ecological services, including filtration, nutrient regeneration, and shoreline protection. However, functional assessments of restoration success are typically lacking. Through multifarious trophic connections within the oyster reef food web, resident cryptic fishes represent a critical element of proper oyster reef function. This study examines variation in cryptic fish assemblages between a historic reef and among three restored artificial reef sites in the MS Sound over four months in summer/fall 2014. Artificial reefs varied in terms of substrate (limestone/concrete and oyster shell), depth, water flow, and distance from shore. Sampling trays were deployed at reefs and retrieved every five weeks to examine spatio-temporal variation in cryptic fishes and invertebrates. Cryptic fish assemblages varied significantly seasonally ($P = 0.015$; PERMANOVA); and a temporal shift in assemblage structure at the historic reef occurred one month prior to that at the artificial reefs. The temporal shifts were further illustrated and elucidated by multidimensional scaling (MDS) and similarity percentages (SIMPER). This study is instrumental to understanding and elucidating the dynamics of cryptic fish species assemblages as indicators of proper ecological function between historic and artificial reefs in the Mississippi Sound.

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**0387 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Michelle Fleming, Ginny Adams, Reid Adams

*University of Central Arkansas, Conway, Arkansas, USA*

**Historic Changes in Centrarchidae Assemblage Patterns in the Saline River, Arkansas**

Links between land use change and persistence and stability of fish assemblages are not well understood and require long-term data sets. Data from fish faunal surveys conducted in 1971 and 1982 in the Saline River system, located in the Ouachita River basin of south central Arkansas, by students from University of Louisiana at Monroe were available to begin studying changes in fish assemblages and relationships with land use. Centrarchid assemblage patterns and historic land use were studied at 20 sites

sampled in both periods. Centrarchid species richness and total abundance generally increased from 1971 (13 species; 1,216) to 1982 (17 species; 2,528). *Lepomis megalotis* (75% and 63%) and *Lepomis macrochirus* (17% and 15%) had highest relative abundances during both collection periods, respectively. Mean similarity of centrarchid assemblages among time periods was low (Jaccard's: 0.33) and ranged from 0 to 0.75 across the 20 sites. *Lepomis cyanellus* and *Lepomis miniatus* increased in frequency of occurrence across sites by 35% in the upper Saline River from 1971 to 1982. Similarly, *Lepomis macrochirus* increased by 15%, *Lepomis gulosus* 20%, and *Micropterus salmoides* 25%. There was no significant correlation between land use and sunfish assemblage similarity (all $r < -0.02$; $p > 0.05$). However, there was an apparent upstream shift of lowland, pool-adapted species across the upper Saline River study sites. Moving forward, we will use historical (1971,1982) and more recent data to evaluate changes in land use and centrarchid assemblage patterns in the Saline River.

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**0525 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Daniela Flores[1], Jaymie Reneker[2], Daniel Warner[3], Fredric Janzen[1]

*[1]Iowa State University, Ames, IA, USA, [2]University of North Carolina Wilmington, Wilmington, NC, USA, [3]Auburn University, Auburn, AL, USA*

## Intrasexual size variation in *Chrysemys picta* as a potential indicator of reproductive strategies

Sexual dimorphism is observed in a wide variety of taxa, presumably stemming from sexual selection. Sexual size dimorphism in the painted turtle (*Chrysemys picta*) extends to intrasexual size variation, most notably in females. In this and many other oviparous species, parental care is limited to maternal effects in terms of egg size, yolk hormones, and nest microenvironment. Maternal nest-site choice is especially critical in species like *C. picta* that have temperature-dependent sex determination, in which incubation temperature permanently dictates the sex of the offspring. This two-part experiment combined field observation with a laboratory incubation study of *C. picta* to examine morphological indicators of a female's nesting behavior and measures of reproductive output. Nesting females in the field were characterized as flat, domed, or average based on carapace measurements. A measure of the thermal environment (i.e., vegetation cover) was quantified for each nest site and offspring sex ratios were obtained after egg incubation at the pivotal temperature of sex determination (i.e., 28°C). In the field study, more domed females exhibited a weak tendency to nest in sunnier sites. Egg incubation in the lab, however, did not detect any association between a female's shape and the sex of her offspring, implying that female *C. picta* do not have an intrinsic ability to alter their offspring sex ratio. These findings highlight a unique example of a morphology-behavior relationship in vertebrates.

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**1083 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

Brook Fluker

*Arkansas State University, Jonesboro, AR, USA*

### Identifying Phylogeographic Breaks in Darters Across the Gulf Coastal Plain of the Southeastern United States

One of the most prominent phylogeographic breaks among Gulf Coastal Plain species in the southeastern United States is the division between populations east and west of the Mississippi River (i.e., the Mississippi River discontinuity). Recent phylogeographic studies of darters distributed in this region have revealed unique patterns of diversification, yet concordant phylogeographic breaks have not yet been well identified. This study used mitochondrial and nuclear DNA sequence data from several Gulf Coastal Plain darter species including *Etheostoma chlorosoma*, *E. gracile*, and *E. parvipinne* to evaluate concordance of the east-west Mississippi phylogeographic break, and to gain a better understanding of factors that shape genetic structure in darters across the Gulf Coastal Plain. Preliminary analyses revealed that only one of the three species (*E. parvipinne*) exhibits a clean phylogeographic break east and west of the Mississippi River. For *E. gracile*, specimens from the Colorado River exhibit pre-Pleistocene (approx. 4 mya) divergence from all other populations, and more recent Pleistocene divergence was identified between two well-supported groups subdivided by the Mississippi Alluvial Plain in Arkansas. Preliminary analyses of *E. chlorosoma* recovered two well-supported clades roughly situated east and west of the Mississippi. However, individuals from the Sabine River were recovered in the "eastern" clade, indicating a need for additional sampling of *E. chlorosoma* to understand the complexity of this phylogeographic pattern. Ongoing work with additional nuclear DNA markers and increased sampling will be incorporated into this framework to further explore phylogeographic breaks among darters in the Gulf Coastal Plain.

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**0405 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

Brian Folt

*Auburn University, Auburn, Alabama, USA*

### Trees as Templates for the Abundance of Tropical Herpetofauna: A Test of the Guyer Hypothesis

Carbon input into terrestrial systems varies in space and time, in part due to the leaf-drop phenology and spatial distribution of tree species. In lowland wet Neotropical forests, deciduous canopy tree species differ in leaf-drop phenology: the majority of species shed leaves during the dry season, but this event occurs in the wet season for others. Because litter-drop events provides the trophic base for decomposing microorganisms, their arthropod consumers, and arthropod predators, Guyer (1988) hypothesized that leaf-drop phenology of tree species regulates the population and

community dynamics of terrestrial amphibians and reptiles; this hypothesis predicts that species with different leaf-drop phenology should support different abundance cycles of species through the year. Alternatively, mixture of leaf litter due to physical processes could diminish the effect of individual trees. In this study, I sought to test this hypothesis at La Selva, Costa Rica in two ways: 1) by monitoring the abundance of leaf litter, terrestrial arthropods, and herpetofauna beneath replicate plots of two tree species (*Dipteryx panamensis*, *Castilla elastica*) with distinct patterns of leaf drop, and 2) by manipulating the abundance of litter beneath *C. elastica*. Models describing demography (birth, death, immigration, emigration) and abundance of herpetofauna will be used to evaluate the Guyer (1988) hypothesis. If the results are consistent with the predictions, tree species may serve as templates for the terrestrial ecology of wet forest ecosystems.

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## 0391 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT

Brian Folt[1], John Jensen[2], Amber Teare[3], David Rostal[3]

*[1]Auburn University, Auburn, Alabama, USA, [2]Georgia Dept. of Natural Resources, Forsyth, Georgia, USA, [3]Georgia Southern University, Statesboro, Georgia, USA*

### Establishing Reference Demography for Conservation: A Case Study of *Macrochelys temminckii* in Spring Creek, Georgia

The conservation of large, long-lived turtle species is challenging because populations are sensitive to changes in adult survival and are difficult to sample. *Macrochelys temminckii* (Alligator Snapping Turtle) is a large freshwater turtle for which commercial harvest reduced populations through the species' range. Given declines and limited demographic knowledge for *Macrochelys*, we conducted a mark-recapture study of *M. temminckii* from 1997-2013 in Spring Creek, Georgia. We made 166 captures of 75 individuals using hoop-net traps. Observed and estimated population structure described an even adult sex ratio and adults more abundant than juveniles. Survival was higher for males (0.98) and females (0.95) than juveniles (0.86). We used the empirical demographic parameters described here to build an updated population model for *M. temminckii*. The model described population growth as consistent with a growing population ($\lambda = 1.013$), and population viability analysis found the population to grow over the next 50 yr in 93% of simulations. Application of the model to two western populations was consistent with a declining population in Oklahoma ($\lambda = 0.563$), at imminent risk of extirpation, but also revealed that a historically-harvested population in Arkansas may be in decline as well ($\lambda = 0.978$). This is the first study to document a stable and viable population of *Macrochelys*. We suggest that the demographic parameters described at Spring Creek are the best approximation of reference conditions for *Macrochelys* to date. The study provides a framework applicable for other large, long-lived, endangered turtle species for which demographic data are unavailable.

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**0727 General Ichthyology II, Balconies J & K, Sunday 10 July 2016**

João Pedro Fontenelle[1], William Crampton[2], Nathan Lovejoy[1]

*[1]University of Toronto Scarborough, Ontario, Canada, [2]University of Central Florida, Florida, USA*

## Does Water Color Matter? Phylogeny and Phylogeography of the Genus *Steatogenys* (Boulenger, 1898) (Gymnotiformes: Hypopomidae)

The rivers of the Amazon divide into high-conductivity systems (comprising sediment-rich white waters) flowing out of Andean erosion zones, and low-conductivity systems, comprising black water systems (high in humic acid and low in sediments) draining lowland Cenozoic formations and clear water systems (with intermediate sediment composition) draining Paleozoic formations. Waters with different conductivities are likely to affect the electric communication and navigation systems of weakly electric gymnotiform fishes. To investigate the evolutionary influences of water-type on electric fishes, we use the genus *Steatogenys* (Boulenger, 1898) as a model system. The species *S. elegans* and *S. duidae* are widely distributed across the Amazon and occur in the three main water types, while *S. ocellatus* is restricted to central upper Amazon black water rivers. We generated a phylogeny for the three valid species of *Steatogenys* using both mitochondrial and nuclear genes and evaluated the phylogeography of *S. duidae* and *S. elegans*. Our analyses confirm reciprocal monophyly for each recognized species of *Steatogenys*, and indicate two as-of-yet undescribed lineages within *S. elegans*. Our results indicate that the undescribed lineages within *S. elegans* are sympatric over broad spatial scales, but one lineage is associated with black and clear water, while the other is associated with white water habitats. This suggests that conductivity may play a role in lineage diversification of electric fishes.

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**0829 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Clifford Fontenot

*Southeastern Louisiana University, Hammond, LA, USA*

## The Influence of Hurricanes on Local Snake Abundance and Road Mortality: 11 Years of Data From a Southeastern Louisiana Wetland Assemblage

Long term studies are critical for understanding ecosystem function, and response to environmental change. Roads through ecosystems represent a transect through habitat, and can provide convenient access for sampling taxa, but can also result in mortality of animals crossing the road. Routine observations of high snake road mortality led me to question how populations could sustain such high chronic mortality. To address this, weekly night road surveys were conducted for 11 years (2003-2014) along a 37 km segment of Highway 51 in southeastern Louisiana, a land bridge between two major lakes, through marsh, and swamp. Peak abundance of snakes (14 species) occurred following weather induced flood events that submerged most of adjacent habitat, causing snakes to seek higher ground associated with the land bridge. However,

abundance remained high after well after the water level returned to normal, and declined gradually over the next three years to pre-flood numbers. This surge in local abundance increased occurrence on the road, and likelihood of being killed. There were significant differences among species in occurrence on the road, as well as condition (dead vs alive), which may be due to abundance, detectability, behavior, or other aspects of their ecology and natural history.

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**0267 General Ichthyology I, Balconies J & K, Sunday 10 July 2016**

Kassandra Ford[1], Samba Diallo[2], Frank Pezold[1]

*[1]Texas A&M University Corpus Christi, Corpus Christi, Texas, USA, [2]Centre National des Sciences Halieutiques de Boussoura, Conakry, Guinea*

### A new online reference to the freshwater and estuarine fishes of Guinea West Africa

A research collaboration was initiated in 2001 with the Direction National de Recherche Scientifique et Technique (CNRST) from Conakry, Guinea, to develop zoological research and reference resources for Guinean researchers and students. Funding was obtained from US National Science Foundation and the Critical Ecosystem Partnership Fund (CEPF) to launch five field collections for freshwater and estuarine fishes in Guinea over the one year period May 2002 to June 2003. Collections from May 2002 were centered on the Parc National du Haut Niger near Faranah, Guinea. In January 2003 collections were made in the freshwaters of the Fouta Djalon highlands and in several estuaries. Collections resumed in the Fouta Djalon in March and April, and additional estuarine collections were conducted in April. In May 2003 collections extended to southern Guinea. The 278 collections produced 51,099 specimens representing 286 species in 89 genera and 49 families. An online reference map with localities, dropdown species lists, and photographs of representative specimens is being developed to complement a research collection established at CNRST.

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**0995 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Sonja Fordham

*Shark Advocates International, Washington, DC, USA*

### Saving Sawfish: Progress and Priorities for Preventing Extinction and Promoting Recovery

The exceptionally high extinction risk for the world's sawfishes (family Pristidae), after decades of going largely unnoticed, has in recent years received significant attention. While resulting actions include the strongest possible commitments under global wildlife agreements, basic safeguards remain urgently needed in many key regions

where sawfish are highly endangered. In 2013, the last of the sawfish species was listed under Appendix I of the Convention on International Trade in Endangered Species (CITES), thereby essentially banning commercial, international trade in all sawfishes and their parts. Additional sawfish conservation needs were explored and prioritized during the development of the 2014 International Union for Conservation of Nature (IUCN) Global Sawfish Conservation Strategy. All five sawfish species were listed on Appendix I and II of the Convention on Migratory Species (CMS) later in 2014, bringing obligations for strict national protection and commitments to collaborate on regional conservation. In 2016, the sawfishes were also added to the scope of the CMS Memorandum of Understanding for Migratory Sharks, an agreement that is, on one hand, voluntary without mechanisms to ensure compliance, and, on the other, unique in the world with great promise for benefits. These advances, as well as the relatively effective US Recovery Plan for Smalltooth Sawfish *(Pristis pectinata)* under the Endangered Species Act, have sparked increased opportunities for researching and safeguarding sawfish in previously under-studied regions, including several developing countries. Implementation of these initiatives will be reviewed. Recommendations for priority next steps to prevent sawfish extinction and promote recovery will be offered.

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## 0197 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H, Thursday 7 July 2016

Kimberly Foster, Kyle Piller

*Southeastern Louisiana University, Hammond, LA, USA*

### Morphology of trophotaeniae within the subfamily Goodeinae (Goodeidae: Cyprinodontiformes)

The Goodeinae are a viviparous group of freshwater fishes (Cyprinodontiforms: Goodeidae) found in the Mesa Central of Mexico. The group contains 17 genera and 38 extant species. The embryos of every species in the subfamily are characterized by epithelial processes termed ‘trophotaeniae' that extend from the perianal lip into the ovarian lumen. Trophotaenial tissue is the site of nutrient uptake and gas exchange in larval goodeids, and attributed to a massive increase in embryonic dry weight. Historically, these structures have been used, in part, as a diagnostic character for goodeid taxonomy. Trophotaenial tissue has been examined for morphological descriptive purposes but only for a few species, and four general types have been recognized. This presentation will utilize gross examination, along with high resolution scanning electron microscopy to evaluate surface characteristics of the trophotaeniae. Our study included nearly all of the species in the subfamily, making it the most comprehensive study to date. Larval specimens were extracted from females using one ventral incision from below the pelvic fin to the dorso-ventral axis. The trophotaeniae were then run through a series of graded ethanol washes, critically point dried, mounted, and sputter coated. Various trophotaenial features were quantified and analyzed in a phylogenetic comparative framework to examine the evolution of this historically important taxonomic character.

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**0717 NIA II, Galerie 3, Sunday 10 July 2016**

Benjamin Frable[1], Bruno Melo[2], Claudio Oliveira[2], Brian Sidlauskas[1]

*[1]Oregon State University, Corvallis, Oregon, USA, [2]Universidade Estadual Paulista, Botucatu, São Paulo, Brazil*

## Paleoecological influence and the historical biogeography of the Neotropical fish family Prochilodontidae (Ostariophysi:Characiformes)

Members of characiform family Prochilodontidae are some of the most abundant fish by biomass in South America. This group is characterized by low morphological diversity, large size and extensive migratory behaviors. Prochildontid species are generally restricted to single basins with very little population structure within basins owing to their mass-schooling migratory life histories. Additionally, large body sizes and strong swimming ability allow them to overcome the small barriers, which often isolate populations of smaller fishes. Therefore, prochilodontid speciation and modern distributions most likely reflect historic environmental changes. As such, we use this widespread family to investigate the influence of large-scale paleoecological events, such as the rise of the Andean Eastern Cordilleras, and geographic barriers on diversification of Neotropical fishes. We present the first time-calibrated molecular phylogeny for Prochilodontidae and compare diversification events with known paleoecological events. Additionally, we use biogeographic model testing on hypotheses of diversification and origination. Our results indicate an ancient origin of the family with species differentiation mostly following the formation of the modern Amazon. The rise of the Eastern Cordillera is upheld as a significant impermeable barrier to dispersal. However, we find evidence of more recent exchange between the Magdalena and Maracaibo and over the Vaupes arch. The rapid and recent diversification of *Prochilodus* in eastern Brazil is likely the result of expansion from Amazon tributaries after the formation of the modern basin. Study of this widespread group provides a robust means for understanding how landscape evolution influenced the riot of modern diversity in the Neotropics.

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**0285 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Austin Francis, Jr., Jay Hodgson, Aaron Schrey

*Armstrong State University, Savannah, GA, USA*

## An Introductory Biology Laboratory on Form and Function Using Hammerhead Sharks

As part of an effort to improve student understanding and retention of evolution, a new introductory biology laboratory has been developed to illustrate how differences in form may result in differences in function. To accomplish this, students are asked to calculate drag force for different geometric shapes (with a known coefficient of drag) and

generate hypotheses about how each shape will perform when moving through a fluid. Students are then provided with 3D printed versions of these geometric shapes for performance testing. With the width and mass standardized for all shapes, students determine the sinking rate (cm/s) for each shape as it descends in a fluid filled, 16 cm diameter, 120 cm tall cylindrical testing chamber. Each shape is tested three times and the average velocity used to evaluate performance (with shorter times reflecting reduced drag). These results are then used by students to generate hypotheses about how different hammerhead shark cephalofoils may be expected to perform. Computed tomography (CT) scans of three species of hammerhead shark (*Sphyrna tudes*, *Sphyrna mokarran*, and *Eusphyra blochii*) and one conical-shaped shark species (*Rhizoprionodon terraenovae*) were used to print 3D models of shark heads for performance testing. To test student derived hypotheses, the experimental design for geometric shapes was replicated with the average sinking velocity determined for each shark head. Initial results indicate greater student engagement in the lab, student comprehension of the basic principles of evolution, and motivation to learn more.

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**0451 Fish Genetics, Salon D, Sunday 10 July 2016**

Michael Franklin, Chris Chabot, Larry Allen

*California State University Northridge, Northridge, CA, USA*

### A Baseline Investigation into the Population Structure of White Seabass, *Atractoscion nobilis*, in California and Mexican Waters Using Microsatellite DNA Analysis

The white seabass, *Atractoscion nobilis*, is a commercially important member of the Sciaenidae that has experienced historic exploitation by fisheries off the coast of southern California. For the present study, we sought to determine the levels of population connectivity among localities distributed throughout the species' range using nuclear microsatellite markers. Data from the present study have revealed distinct genetic breaks between the Southern California Bight, Pacific Baja California, and the Peninsula of Baja California.

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**0541 Fish Ecology II, Salon A-C, Saturday 9 July 2016**

Ryan Freedman[1], Chris Caldow[2], Jenn Caselle[1]

[1]*University of California Santa Barbara, Santa Barbara, CA, USA,* [2]*NOAA Channel Islands National Marine Sanctuary, Santa Barbara, CA, USA*

### Tropicalization and Community Change in the Transition Zone: A Case Study for Fish in the Channel Islands National Marine Sanctuary

Marine environment transition zones are at the confluence of warm and cold water bodies and are typically associated with high biodiversity due to the mixing of species

with different thermal associations. In the face of climate change, these transition zones may undergo changes in environmental parameters that in turn will alter local ecological communities. California's northern Channel Islands are an example of a transition zone that is at the boundary of the California Current and the California Countercurrent. PISCO has been conducting subtidal fish surveys around the Channel Islands since 1999 as a monitoring program implemented to long-term community change and anthropogenic influences. In an attempt to understand the effects of shifting climate on this transition zone, we classified species in the PISCO surveys as having tropical or temperate affinities and assessed changes in their abundance and biomass over time. We compared the shifts in the fish community to a suite of environmental parameters including Pacific Decadal Oscillation, North Pacific Gyre Oscillation, sea surface temperature, wind stress, kelp biomass, wave period, and wave height. Moving forward, we hope to use the environmental associations to give conservation managers a sense of the impacts of changing climate on ecosystem condition around the islands.

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**0152 Fish Reproduction, Physiology, & Conservation, Balconies J & K, Sunday 10 July 2016**

Bryan Frenette, Michael Tobler, Keith Gido

*Kansas State University, Manhattan, KS, USA*

**Physiological Constraints on the Distribution and Abundance of Two Prairie Stream Fishes in Relation to Thermal Regime**

Data collected over a 20-year period through the Long Term Ecological Research (LTER) program shows spatial and temporal variability in the distribution and abundance of fish species within Kings Creek on the Konza Prairie Biological Station. Variability in groundwater inputs in this system results in heterogeneous thermal regimes among reaches. Our research focuses on whether differences in thermal regimes influence the abundance and distribution of two herbivorous minnows (*Campostoma anomalum* and *Chrosomus erythrogaster*) within Kings Creek. We measured thermal maxima (CTMax) to test for inter- and intraspecific differences in physiological response to temperature. Analyses from a laboratory acclimation experiment found a significant effect of acclimation temperature on CTMax (two-way ANOVA, $F_{3,66} = 456.7$, $P < 0.001$), but no significant difference in CTMax between species (two-way ANOVA, $F_{1,66} = 3.401$, $P = 0.07$). Furthermore, field assays of CTMax collected during late 2015 and early 2016 show a similar trend, with no significant difference in CTMax between species (two-way ANOVA, $F_{1,54} = 0.00$, $P = 0.99$), while CTMax differed within species seasonally (two-way ANOVA, $F_{2,54} = 289.5$, $P < 0.001$). Results suggest these species have similar abilities to acclimate to variable thermal regimes. However, additional physiological data (e.g., metabolic rate and activity) are needed to verify these species performance under different thermal regimes.

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**0221 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Jennifer Frey, Ali Leggett

*Mississippi Department of Marine Resources, Biloxi, MS, USA*

### The Mississippi Department of Marine Resources Coastal Preserves Program: Biological Inventory and Monitoring

The Mississippi Department of Marine Resources (MDMR) Coastal Preserves Program which was developed in 1992 by authority of the Wetlands Protection Act. The Coastal Preserves Programs objective is to acquire, protect, and manage sensitive coastal wetland habitats along the Mississippi Gulf Coast, therefore ensuring the ecological health of Mississippi's coastal wetland ecosystems. The State currently has title to approximately 33, 000 acres of the designated 72,000 acres of crucial coastal wetland habitat within Mississippi's 20 coastal preserve sites (http://www.dmr.ms.gov/index.php/wildlife-a-plants/coastal-preserves). Since the Programs' inception management activities have centered on restoring the preserves to their 'natural' state through the use of invasive species control, burn management and replanting of native species. To further aid in these efforts staff has been conducting a biological inventory of preserve lands beginning with one preserve in each coastal county and conducting multi-seasonal trapping to give a baseline of herpetological species and aid in guiding management for the area. The areas include Ansley which is part of the Hancock County Marshes, Bells Ferry which is part of the Wolf River Watershed in Harrison County and Twelve Oaks which is part of Old Fort Bayou in Jackson County. Multiple survey methods have been implemented and will conclude in 2017. To date we have accounted for 102 species and 44 Herpetological species after 3 seasons of trapping monthly.

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**0328 SSAR SEIBERT ECOLOGY AWARD, Galerie 2, Friday 8 July 2016**

Kelley A. Fritz, Lucas J. Kirschman, Matt R. Whiles

*Southern Illinois University, Carbondale, IL, USA*

### Influence of Amphibians on Energy and Nutrient Fluxes across Aquatic-Terrestrial Boundaries of Temporary Ponds

Energy and nutrient subsidies across aquatic-terrestrial boundaries are recognized in systems ranging from oceanic islands to freshwater wetlands. Such subsidies are important for recipient habitats and can alter consumer distribution and increase consumer growth, abundance, and biomass. Temporary ponds can be closely linked to surrounding forests via forest-to-pond and pond-to-forest subsidies, including amphibian egg deposition and metamorph emergence. We intensively sampled amphibian assemblages in eight temporary ponds in Southern Illinois to quantify nutrient flows associated with egg deposition and metamorph emergence for ten species breeding in the ponds. We analyzed nitrogen (N), carbon (C), and phosphorous (P)

content of egg masses and recently emerged metamorphs of each species. Percent N in eggs ranged from 9.3 ± 0.4 to 11.1 ± 0.2, %C from 47.3 ± 0.9 to 52.6 ± 0.2, and %P from 0.03 ± 0.01 to 0.07 ± 0.03. We used these estimates to produce total amphibian nutrient budgets for each pond and species. Understanding the roles of amphibians in linking habitats is increasingly important in light of ongoing extirpations and population declines.

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**0856 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Bridgette Froeschke[1], John Froeschke[2]

*[1]The University of Tampa, Tampa, FL, USA, [2]Gulf of Mexico Fishery Management Council, Tampa, FL, USA*

## Habitat and Environmental Influences on the Distribution Patterns of Atlantic Croaker (*Micropogonias undulates*) and Spot (*Leiostomus xanthurus*) in the Aransas-Bay Complex in Texas, USA

Declining populations of fishery species underscore the importance of defining critical habitats. The goal of this study was to use an ecosystem-based approach to incorporate environmental changes into fisheries management plans for two scianenidae species. Specifically, this study developed predictive species habitat models that delineated critical nursery habitat for juvenile Atlantic croaker (*Micropogonias undulates*) and spot (*Leiostomus xanthurus*). These models were used to determine mechanisms of habitat selection within the Aransas Bay Complex. Species habitat models predicting the occurrence for both species were identified using Boosted Regression Trees (BRT) consisting of ten predictors: habitat type, dry weight of sediments, depth (m), dissolved oxygen (mg O2/L), temperature (°C), turbidity (cm), salinity, pH, distance to inlet, and month. The species habitat model for juvenile Atlantic croaker indicated that they were not associated with any particular habitat type, but were associated primarily with low temperatures (< 20°C), and depths greater than 2m. The model for juvenile spot indicated that they were associated with distance to the inlet, low percent dry weight of sediment (<25 percent), and low temperatures (<25°C). Our models indicate that EFH within the Aransas Bay Complex occur among all habitat types along the eastern side of Aransas Bay, and the north corner of Copano Bay. These findings provide a valuable new tool for fisheries managers to aid sustainable management of Atlantic croaker and spot in the Mission-Aransas Reserve ecosystem and provide crucial information needed to prioritize areas for habitat conservation and management in the Gulf of Mexico.

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**0886 Fish Conservation & Morphology, Galerie 2, Sunday 10 July 2016**

Bridgette Froeschke, Leslie Jones, Brian Garman

*The University of Tampa, Tampa, Florida, USA*

### The Influence of Gear Type, Environmental, Spatial, and Temporal Parameters on Distribution Patterns of Sheepshead (*Archosargus probatocephalus*) in Tampa Bay, Florida from 1996 to 2014

Long-term, fisheries-independent bag seine surveys and otter trawls conducted in Tampa Bay, Florida, USA from 1996-2014 were used to develop a spatio-temporal species-environmental model for sheepshead, *Archosargus probatocephalus*. Relationships between environmental predictors and sheepshead distribution were investigated using boosted regression trees (BRT). Results showed good model performance and suggested that, in relation to environmental factors, sheepshead distribution was most closely linked to gear type, month and year of collection, and salinity. Overall, probability of occurrence increased when using a 183m center-bag seine, and collections conducted during June, July and August. When examining the relationship of environmental factors on the occurrence of sheepshead for each gear separately (targeting different size classes), high salinities (>20 ppt) was the most influential environmental parameter for adult sheepshead, and temperature (below 10°C and above 25°C) was the most influential environmental parameter for juveniles. By interpolating the environmental predictors, monthly maps of the probability of capture were produced using ordinary kriging. Spatial patterns were also evident. The development of spatially explicit models allows for prioritization and conservation of areas in a region that has great potential for human disturbance and climate change impacts.

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**0699 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Joseph Aaron Frumkin, Kenshu Shimada

*Depaul University, Chicago IL, USA*

### Morphological Differences in Placoid Scales among the Three Extant Species of Thresher Sharks (Lamniformes: Alopiidae) and Their Functional Implications

The thresher sharks (Alopiidae) are a group of lamniform sharks consisting of three extant species: *Alopias pelagicus* (pelagic thresher), *A. superciliosus* (bigeye thresher), and *A. vulpinus* (common thresher). They are characterized by a highly elongate caudal fin that is as long as the rest of the body, and at least *A. pelagicus* and *A. vulpinus* are documented to use their caudal fin to hunt for small fish prey by stunning them. On the other hand, the hunting behavior of *A. superciliosus* has not been observed in the wild, but it has been suggested that the species must be a faster swimmer relative to *A. pelagicus* and *A. vulpinus* based on the skeletal architecture of their caudal fins. We test this hypothesis by comparing placoid scale morphologies among the three species. Samples were taken from preserved museum specimens on their lateral side of the body

above the pectoral fin immediately anterior to the first dorsal fin. Our preliminary study shows that all three species possess keeled scales consistent with most pelagic sharks. The average inter-keel distance is smaller for *A. superciliosus* (49.9 μm) compared to *A. pelagicus* (52.7 μm) and *A. vulpinus* (52.5 μm). The smaller inter-keel value in *A. superciliosus* suggests that the placoid scales of the species are better suited to reduce surface drag for faster swimming relative to scales of *A. pelagicus* and *A. vulpinus*. Therefore, our scale-based data support the hypothesis that *A. superciliosus* must be a faster swimming shark than *A. pelagicus* and *A. vulpinus*.

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**0698 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Michael Fulbright, David Penning

*University of Louisiana at Lafayette, Lafayette, LA, USA*

**Going Out on a Limb: Striking Constraints on a Semi-arboreal Ratsnake**

Aside from fleeing predators, snakes use defensive strikes to evade capture. Ratsnakes are semi-arboreal snakes that must dispel predators in both terrestrial and arboreal environments. However these differences in habitat choice may lead to differences in performance, which has remained untested until now. We measured defensive terrestrial and arboreal strikes to determine if snakes (N = 17) modulate their strike performance relative to the habitat they occupy. Maximum velocity, strike duration, and strike distance were significantly higher in terrestrial strikes compared to perched strikes ($p < 0.01$ for all). Performance of snakes in arboreal habitats is likely confounded by the need to use a portion of the posterior part of the body to maintain contact with limbs and prevent falling.

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**0711 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Lauren Fuller, Glenn Parsons

*University of Mississippi, Oxford, MS, USA*

**Sedation as a Means to Reduce Capture Stress of Sharks**

Capture stress is a significant problem in fisheries biology and may lead to reduced survivorship of bycaptured species. In some fisheries, sedation may be useful for capture stress reduction. In this study, we provide preliminary data regarding the effect of iso-eugenol (clove oil) sedation on the stress response of sharks via measurement of lactate and respiration rate. Sharks caught by hook-and-line (*Rhizoprionodon terraenovae*, *Carcharhinus isodon*, and *Carcharhinus limbatus*) were placed into a sealed respiration chamber in-situ containing iso-eugenol (treatment) or seawater (control) from which dissolved oxygen was continuously monitored to determine the respiration rate. Blood

samples were taken at 0, 10, 20 and 30 minute intervals and later analyzed for lactate. The results indicate that treatment has a significant effect on overall respiration rate in *R. terraenovae*. There is no significant difference in shark lactate levels between treatments, but the proposed sample size has not yet been achieved. These preliminary results suggest that iso-eugenol sedation may be useful for stress reduction in bycaptured sharks, thereby increasing survivorship after release.

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**0742 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

Andrew Furness[1], David Reznick[2], John Avise[1]

[1]*University of California, Irvine, Irvine, CA, USA,* [2]*University of California, Riverside, Riverside, CA, USA*

## Ecological, evolutionary, and human-mediated determinants of Poeciliid species richness on Caribbean islands

The theory of island biogeography provides a predictive framework relating species richness to island size and distance from the mainland, but the theory as originally formulated does not necessarily scale to large islands and continental landmasses that are capable of generating species through *in situ* speciation (rather than entirely by colonization). Here we apply biogeographic principles to a taxonomic group that has undergone a radiation on Caribbean islands: live-bearing fishes of the family Poeciliidae. We show that species richness on small islands results entirely from colonization and increases modestly with island area, whereas on larger islands species richness increases dramatically as a function of area due primarily to *in situ* speciation. This non-linear scaling pattern of species richness with island size is accommodated by a two-stage regression that incorporates these underlying ecological and evolutionary effects. Poeciliid fishes have been introduced widely, both as a byproduct of their popularity in the aquarium hobby and as a means of mosquito control. We show that such establishments have occurred disproportionately on islands depauperate in native species. We also show that the inclusion of species introduced by humans lessens the contribution of *in situ* speciation to total species richness, thereby strengthening and linearizing the species-area relationship.

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**1026 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H, Thursday 7 July 2016**

Brittany Furtado, Jessie Green, Loren Stearman, Ginny Adams, Reid Adams

*University of Central Arkansas, Conway, AR, USA*

**Investigating the Effect of Unconventional Natural Gas Development on Fish Population Size Structure**



The demand for natural gas has increased exponentially over the last 15 years and growth of unconventional natural gas development (UNGD) on the Fayetteville shale has occurred at a rate of 300-900 wells/year. Previous work, using Index of Biotic Integrity (IBI) metrics, has shown decreases in the relative abundance of fishes considered sensitive, based on specific reproductive and feeding requirements, and increases in the relative abundance of tolerant fishes with increasing UNGD. However, preliminary analysis of population structure indicated species we have grouped together, based on shared life history characteristics, do not necessarily exhibit the same relationship with UNGD. Analysis of length-frequency histograms for abundant species indicated fishes we have classified as sensitive (e.g. *Etheostoma spectabile* and *Etheostoma whipplei*), had an absence of young-of-year at High treatment sites in every year except for 2014. Interestingly, *Notropis boops*, a species traditionally considered sensitive due to its intolerance to sedimentation, displayed trends in size-frequency distribution that indicated greater evenness at High treatment sites. Furthermore, elucidation of robust relationships between fish population structure and UNGD has been difficult due to covarying landscape effects including percent pasture and hydrologic variability. To investigate the relative influence of UNGD on fish population structure we implemented an IT multiple regression approach with a priori selected predictor variables representing UNGD, hydrology, and land use with response variables representing size-related population structure. Initial results will be presented and their contribution to our understanding of the influence of UNGD on fish population structure will be discussed.

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**0960 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

Sandra P. Galeano, Kyle E. Harms

*Louisiana State University, Baton Rouge, LA, USA*

**Assembly Patterns of Leaf-litter Anurans on Neotropical Land-bridge Islands: Species Co-occurrence and The Role of Morphological Traits**

Species patterns traditionally have been used to identify the underlying mechanisms of community assembly. However, the study of co-occurrence patterns in animal communities has been limited, taking mostly a species identity approach and rarely considering intraspecific differences in traits other than body size. We examined co-occurrence patterns in the assembly of leaf-litter anurans at local and regional scales in

the Bocas del Toro Archipelago, Panama. We combined species and trait-based approaches using body size and coloration - a trait associated with aggressive behavior in the territorial *Oophaga pumilio*. We tested for non-random patterns of species co-occurrence and body size in anuran assemblages and asked whether those patterns varied once the distribution of highly conspicuous, more aggressive vs. less conspicuous, less aggressive frogs of *O. pumilio* was considered. We found random patterns of co-occurrence at local and regional scales for the entire assemblage. However, segregated patterns emerged at the regional scale for sub-matrices of islands with highly conspicuous morphs of *O. pumilio*. These results suggest that species composition of leaf-litter anuran communities in land-bridge archipelagos are mainly structured by random processes at local scales, whereas both random and deterministic processes influence their structure at the regional scale. Furthermore, because we did not find evidence of habitat effects on islands where highly conspicuous morphs exclusively occurred, our results also support the idea that species interactions underlie the segregated patterns. Our findings highlight the utility of considering morphological traits that associate with behavioral traits in the study of ecological assembly of animal communities.

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**0487 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Bannon Gallaher, Steven Beaupre

*University of Arkansas, Fayetteville, Arkansas, USA*

### Factors That Affect Home Range Size in the Timber Rattlesnake, *Crotalus horridus horridus*

As a result of higher energetic cost stemming from body size, a larger animal must acquire more energy than a smaller individual of the same species would to meet energetic requirements. In systems where food sources are ephemeral, meeting a higher energetic demand requires a larger search radius for prey. The main goal of this paper is to examine the relationship between body size and home range area in Timber Rattlesnakes (*Crotalus horridus horridus)*. Data used from this analysis came from an ongoing, 20 year study at McIlroy Wildlife Management Area, Madison Co., Arkansas. Timber Rattlesnakes *Crotalus horridus horridus* were tracked every three days using radio telemetry during the active season (March through October). From 1996 to 2015 a total of 140 individuals were tracked for approximately 10,000 records. Home range estimates were calculated using the Minimum Convex Polygon method in ArcMAP. In addition to body size the following variables were examined for their effect on home range area: sex, age, body condition index, landscape disturbances, and supplemental feeding. The results of this study will allow for more accurate individual based modeling and improve the use of Timber Rattlesnakes *Crotalus horridus horridus* as an indicator species.

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**0651 Fish Conservation, Galerie 3, Sunday 10 July 2016**

Grantly Galland, Anthony Rogers, Amanda Nickson

*The Pew Charitable Trusts, Washington, DC, USA*

**A first global value of commercial tuna fisheries**

Commercial fisheries are estimated to be worth billions of dollars each year, but a lack of understanding of the true economic value of marine fisheries places the stability of the populations and the sustainablity of their value at risk, particularly when these long term benefits are traded for short term economic gains. Commercial tuna fisheries are an important source of wealth and employment in places where fishing and processing is concentrated. To date, however, few studies have attempted to place a dollar value on this sector, at the global level. The seven most commercially important tunas are among some of the most economically valuable fishes on the planet. Canned tuna products provide millions of kilograms of inexpensive protein to markets around the world, while high-quality tuna steaks and sashimi provide a small amount of expensive protein to affluent markets in Asia, Europe, and North America. Here, we present a detailed estimate of the global value of tuna fisheries targeting Skipjack, Albacore, Bigeye, Yellowfin, Atlantic Bluefin, Pacific Bluefin, and Southern Bluefin tunas. The final estimated values demonstrate the importance of tuna fisheries as a major sector in commercial seafood production. Values are presented by species, gear type, ocean basin, and product stream, and estimates are provided for both dock value (based on prices paid to fishermen) and end value (based on prices paid by the ultimate consumer). Finally, we frame these values in a wider, management context and highlight regions and stocks where improved fisheries management could promote economic growth.

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**0680 AES Genetics, Genomics, Biogeography, & Systematics, Balconies J & K, Saturday 9 July 2016**

Tony Gamble[1], Martin Cohn[2], David Zarkower[3]

*[1]Marquette University, Milwaukee, WI, USA, [2]University of Florida, Gainesville, FL, USA, [3]University of Minnesota, Minneapolis, MN, USA*

**Sex-specific genetic markers and sex chromosomes in the Little Skate (*Leucoraja erinacea*)**

The Little Skate (*Leucoraja erinacea*) is an emerging model in the study of developmental biology and human disease. The ability to accurately sex individuals is vital to this research, particularly as it relates to gonadal development and other sex differences. Adults and advanced embryos can be sexed via examination of sexually dimorphic traits such as presence of claspers on male pelvic fins or differentiated gonads. However, early embryos cannot be morphologically sexed and there is no molecular test to differentiate males from females prior to sex determination. PCR sex tests have proven invaluable in other vertebrate model organisms such as mouse and chicken and a skate molecular sex test would aid the study of sexually dimorphic traits in early development. We

developed a PCR-based assay to sex *L. erinacea* using data from restriction site associated DNA sequencing, or RAD-seq. RAD-seq sequences restriction-digested DNA and can generate tens of thousands of molecular markers for analysis. We identified and validated three male-specific genetic markers by comparing RAD-seq data from ten male and nine female *L. erinacea*. These markers can identify the genetic sex of *L. erinacea* at all developmental stages and will significantly enhance developmental studies of this emerging vertebrate model. Furthermore, male-specific markers confirm an XY sex chromosome system in *L. erinacea*. We will discuss the implications of *L. erinacea* sex chromosomes on elasmobranch sex chromosome evolution and identify opportunities for further study.

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**0254 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Marissa Ganzfried, Brian Waldron, Matt Lee, Carl D. Anthony, Cari-Ann Hickerson

*John Carroll University, University Heights, OH, USA*

**Differential Foraging and Repeatability of Behavior Between Two Color Morphs of *Plethodon cinereus* Following Simulated Predation**

Behavioral repeatability greatly affects the capacity of an individual to respond to varying environments. When a behavior has high repeatability across time or across contexts, it is termed a behavioral syndrome (sometimes referred to as animal personality). However, not all behaviors exhibit the same level of repeatability and few studies have examined repeatability in amphibians. We examined the repeatability of foraging behavior in the Eastern Red-backed Salamander (*Plethodon cinereus*) before and after a simulated predation event. We tested several hypotheses: 1) Foraging behavior would be repeatable and consistent with previous studies; 2) Simulated predation would have a negative effect on foraging, increasing latency to feed and decreasing the proportion of prey items eaten in a given time period; and 3) Because striped color morphs of *P. cinereus* are more aggressive, striped individuals would exhibit more "bold" behavior and resume foraging sooner. We found that the predation treatment negatively affected foraging behavior in both morphs, and that simulated predation resulted in an increase in the repeatability of foraging behavior. Morphs did not significantly differ in latency to feed or proportion of prey eaten in either treatment. Our results suggest that within-individual foraging behavior in *P. cinereus* is generally not repeatable, but individuals' responses to predation are consistent over time. This distinction further illustrates the need to carefully define the behavior to be tested and experimental methodology in studying behavioral repeatability or behavioral syndromes.

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**0984 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon F-H, Friday 8 July 2016**

Eric Garcia, Giacomo Bernardi

*University of California Santa Cruz, Santa Cruz, CA, USA*

## Genomic Analysis of Disjunct Marine Fish Populations of the Northeastern Pacific and Sea of Cortez

Disjunct populations are formed after a physical barrier separates the populations of a species, which then has the potential to remain the same species or diverge depending on how effectively the barrier impedes gene flow. Disjunct populations provide an excellent opportunity to study the evolutionary processes of allopatric speciation. The sargo, *Anisotremus davidsonii* (Haemulidae), and the longjaw mudsucker, *Gillichthys mirabilis* (Gobiidae), have disjunct distributions with populations in the Pacific coast of California and Baja California and isolated populations in the upper half of the Sea of Cortez. These disjunct populations have been suggested to be at the initial phases of allopatric speciation. This project utilizes restriction site associated DNA (RADSeq) to produce a highly confident connectivity analysis of populations sampled across the Pacific and Sea of Cortez ranges of these species. The goals of this project are to (1) characterize the genomic structure of these populations and assess divergence levels across the Baja California peninsula, (2) determine the connectivity within each region and (3) explore the molecular signatures of incipient allopatric speciation. This study sheds light into the processes in the speciation continuum in these species and provides a deeper understanding of how populations are connected and how biodiversity might be shaped in these regions.

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**0365 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Donnell Gasbarrini[1], David Lesbarrères[1], Anna Sheppard[2], Ed Morris[2], Jacqueline Litzgus[1]

[1]*Laurentian University, Sudbury, Ontario, Canada,* [2]*Ontario Parks, Sudbury, Ontario, Canada*

## An Investigation into the Cause of a Mass Mortality Event of Blanding's turtles (*Emydoidea blandingii*) in Misery Bay Provincial Park, Ontario, Canada

Mass mortality events (MMEs) can remove up to 90% of individuals in a population, which is especially damaging to persistence of long-lived species with low capacity to recover. While MMEs are being documented with increased frequency, a limited understanding of the causes and consequences of MMEs remains. Our study aims to determine the causes of a MME of Blanding's turtles (*Emydoidea blandingii*), a threatened species, in a relatively pristine habitat at Misery Bay Provincial Park (MBPP), Ontario, Canada. The typical anthropogenic threats to turtles are minor or virtually absent in the MBPP setting, and yet 53 Blanding's turtles were found dead without obvious cause in

2013. Potential causes of death under consideration include predation in the active season and failed overwintering through either metabolic/respiratory acidosis, freezing, or winter predation. Telemetry and mark-recapture studies were used to monitor live animals, to look for clues to the cause of death, and to monitor overwintering habitat. Motion-sensor activated trail cameras were paired with a Blanding's turtle decoy, as a novel strategy to identify predators within the park. Potential predators identified include otter, mink, coyote, and raccoon. No significant differences in temperature and dissolved oxygen content of water were found between known overwintering sites and sites near where turtle carcasses were found. Based on evidence collected to date, predation seems a likely cause of death. The results of our study will be informative for the conservation of this population, and for the management of future MMEs.

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## 0368 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016

Donnell Gasbarrini[1], David Lesbarrères[1], Anna Sheppard[2], Ed Morris[2], Jacqueline Litzgus[1]

*[1]Laurentian University, Sudbury, Ontario, Canada, [2]Ontario Parks, Sudbury, Ontario, Canada*

### Examining Long Term Consequences of a Mass Mortality Event in the Long-Lived Species, *Emydoidea blandingii*

Little information pertaining to long-term effects of MMEs exists in the primary literature, especially in relation to long-lived species with limited capacity for natural recovery, such as chelonians. Such information can inform management plans to aid in ensuring the persistence of these populations into the future. A MME of Blanding's turtles (*Emydoidea blandingii*) in Misery Bay Provincial Park (MBPP) on Manitoulin Island, Ontario, Canada, was first reported and has been under investigation since 2013. With a sum of 53 dead ($n_{adult}$=44, $n_{subadult}$=6, $n_{juvenile}$=2, $n_{unkown}$=1) and 63 live ($n_{adult}$=46, $n_{subadult}$=5, $n_{juvenile}$=12) Blanding's turtles found, this event appears to have removed nearly half of the breeding population. Given the life history of Blanding's turtles, whose population persistence relies on adult survivorship, and as age at first reproduction is 14 years for males and 18-22 years for females, and average clutch size is 10.2 eggs/clutch, we hypothesized that the population at MBPP will continue to decline if unaided. Population viability analyses will be conducted on the MBPP Blanding's turtle population in an effort to determine the most efficient conservation and recovery strategies for this population. It is of the utmost importance to be aware of the natural and human-associated threats to species at risk, such as chelonians, and the long-term effects that these threats will have on population, and ultimately species' persistence, both locally and globally. The information gained through our study will inform recommendations of appropriate conservation strategies for this population, and will aid in the management of future MMEs elsewhere.

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**0044 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday 7 July 2016**

John Gatto, Joel Trexler

*Florida International University, Miami, Florida, USA*

### Endurance Tests Explain Recolonization Patterns Following Hydrological Disturbance

Inundation of floodplain ecosystems creates aquatic habitats and pulses in primary production. Immigration to newly inundated habitats is well documented, but the mechanisms that influence a species' ability to colonize successfully are poorly understood. Recent studies focus on the behavioral changes and directionality of fish movement caused by changing hydrology. However, recolonization may be limited by physiological, not behavioral, phenomena. We focus on how intraspecific differences in the critical swimming speed (UCRIT) can explain recolonization patterns following a dry-down. Twenty juveniles and 20 adult of varying lengths were tested independently for six coexisting species in the Florida Everglades. Individuals were placed in a Blazka-style swim chamber and allowed to acclimate at a low flow velocity (1-3 BLS) for 30 minutes. Following acclimation, the flow velocity was increased 2 cm/s every 5 minutes until the fish could no longer maintain station in the tunnel. We then compared the rank order of estimated UCRIT to the observed recolonization patterns over the past 17 years in the Florida Everglades. Spatial-temporal patterns of recolonization were consistent for each species, with some species taking several years to recover pre-drought densities following disturbance. Early colonizing species were associated with higher estimates of UCRIT (high endurance); whereas, late colonizing species had lower estimates (low endurance). Intraspecific variation in swimming ability was best explained by differences in body size. This study demonstrates that the critical swimming speed not only describes an individual's ability to maintain station at certain flow velocities, but acts as a metric of dispersal potential.

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**0482 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016**

Aaron Geheber

*University of Oklahoma, Norman, OK, USA*

### Incorporating Phylogenetic Relatedness Measures in Long-term Fish Community Studies: What can Temporal Patterns of Evolutionary Similarity Tell us?

Long-term studies of freshwater fish communities are invaluable and provide basic understanding of structural dynamics across time. Many studies have quantified stream fish community structure (i.e., based on species richness and abundance) across generous time scales; however, influences of mechanisms that might explain temporal dynamics are often difficult to discern. Mechanisms including competition, habitat

filtering, predator-prey interactions, and dispersal limitation may influence community structure and should be assessed to gain a greater understanding of long-term structural dynamics. By incorporating measures of phylogenetic relatedness among co-occurring species, it is possible to bring these processes to light. Because recently diverged taxa often retain similar ecological traits, patterns of evolutionary relatedness and patterns of ecological characteristics among community members may provide a useful link for identifying structuring mechanisms. For example, phylogenetic clustering among species may be the result of habitat filtering (i.e., closely related species have similar ecological requirements), whereas phylogenetic overdispersion may be the result of competitive exclusion (i.e., limiting similarity among close relatives). I demonstrate the utility of this phylogenetic approach for gaining a greater understanding of fish community dynamics using examples from Southeastern U.S. stream systems. Moreover, I discuss the requirements of, and visions for, this approach in relation to time, spatial scale, ecological traits, and system specificity.

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## 0286 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon A-C, Friday 8 July 2016

Daniel Geldof, Nicholas Gidmark

*University of Washington, Seattle, WA, USA*

### Heterochrony in two sculpins of the genus *Psychrolutes*: growth outpaces skeletal development in an apex predator among ichthyoplankton

In fishes, development is a plastic process, even among closely-related, sympatric taxa. Selective pressure manifests itself through morphological divergences in early life. Of particular interest in the present study is heterochrony: alterations in developmental rates of change. Examinations of skeletal development in the Soft Sculpin, *Psychrolutes sigalutes* and Tadpole Sculpin, *Psychrolutes paradoxus* revealed marked developmental differences between species. While *P. paradoxus* quickly develops an adult skeleton and settles in adult habitat, *P. sigalutes* undergoes a remarkably protracted transformation (the transition from larval to juvenile characters) over a period of three to four months. It reaches sizes in excess of 40 mm (75% of adult size) before settling. While the earliest phases of life focus on the development of feeding elements and a transition from larval/anguilliform locomotion to caudal/subcarangiform propulsion, the two species diverge quickly in postflexion development. With the exception of feeding elements, the skeleton of *P. sigalutes* remains largely incomplete to sizes beyond 25 mm in length. By shunting resources typically dedicated to skeletal growth towards the development of mass alone, *P. sigalutes* quickly grows larger than any cohabitant zooplankton. Hiding by the day and hunting by night, *P. sigalutes* relies on its mass and inertia to chase down smaller prey hampered by the viscosity of water. The seasonality of *P. sigalutes* gives it ample time to grow before the majority of larval fishes hatch. *Psychrolutes sigalutes* may be a specialized ichthyoplankton predator, responsible for the earlier settlement times of cohabitant larvae.

**0426 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Jim Gelsleichter, Morgan Eason

*University of North Florida, Jacksonville, FL, USA*

## Localization of progesterone receptors in reproductive organs of female bonnetheads (*Sphyrna tiburo*)

Previous studies on sharks have examined plasma concentrations of the gonadal steroids estradiol (E2), testosterone (T), and progesterone (P4) in elasmobranchs, and have provided strong evidence for their involvement in regulating various stages of reproduction. P4 in particular has been shown to be elevated during two specific periods of female reproduction in some sharks, ovulation and early gestation. However, while logical roles for P4 during these stages have been presented, virtually no published studies to date have examined the location of P4 receptors (PRs) in elasmobranch reproductive organs; this is generally needed to identify possible target organs and clarify potential roles for this hormone. Therefore, the goal of this study was to examine the location of PRs to identify possible targets in elasmobranchs. We examined the presence of PRs in histological sections of reproductive organs of female bonnetheads (*Sphyrna tiburo*) via immunocytochemistry using mouse monoclonal antibodies against PRs. Progesterone receptors were detected in multiple reproductive organs including the uterus, oviducal gland, and ovary. These data indicate multifaceted roles for P4 in elasmobranch reproduction. Data from other species of elasmobranchs will also be discussed to consider possible broad roles for P4 in elasmobranchs.

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**0422 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Jim Gelsleichter[1], R. Dean Grubbs[2], John Carlson[3]

[1]*University of North Florida, Jacksonville, FL, USA,* [2]*Florida State University Coastal and Marine Laboratory, St. Teresa, FL, USA,* [3]*NOAA Fisheries Service, Panama City, FL, USA*

## Updated information on the reproductive biology of the smalltooth sawfish *Pristis pectinata*

Due to overfishing and human destruction of its habitat, the smalltooth sawfish (*Pristis pectinata*) became listed as "endangered" under the U.S. Endangered Species Act in 2003 and it remains one of very few U.S. domestic marine fish to hold this undesirable designation. Because of this, conservation measures have been established to allow remnant U.S. sawfish populations to rebuild, but these efforts are hampered by a lack of information on sawfish life history, including reproduction. This study examined reproduction in adult male and female smalltooth sawfish using nonlethal approaches such as the analysis of circulating sex hormones and ultrasonography. Additional data were obtained from necropsies of sawfish that died unintentionally as a result of cold

stress or fishery interactions. Based on necropsy and hormone data, male sawfish appear to undergo spermatogenesis between fall and winter, after which they may exhibit male sperm storage and protracted mating activity until late spring. Based on necropsy data and ultrasonography, female sawfish appear to reproduce following a biennial cycle that includes follicular development from fall to spring, presumably followed by ovulation and mating in late spring, and a one-year gestation period from early summer to the subsequent spring. However, to date, sex hormone data has not been useful for clarifying female reproductive patterns. A hypothesized schedule for smalltooth sawfish reproduction is presented based on these multifaceted observations for use in management and conservation.

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**0752 Fish Conservation, Galerie 3, Sunday 10 July 2016**

Anna George[1], Duncan Elkins[2], Sarah Hazzard[1], Bernie Kuhajda[1], Seth Wenger[2]

*[1]Tennessee Aquarium Conservation Institute, Chattanooga, TN, USA, [2]University of Georgia River Basin Center, Athens, GA, USA*

## Conservation Planning for Southeastern Aquatic Biodiversity

The southeastern United States is a global hotspot of freshwater biodiversity, supporting almost two-thirds of the country's fish species, over 90% of the U.S. total species of mussels, and nearly half of the global total for crayfish species. Many of these species are narrow endemics. Unfortunately, this region is also a hotspot for imperilment; the number of imperiled freshwater fish species in the Southeast has risen 125% in the past 20 years. While the causes of this imperilment, including habitat modification or loss, development, and introduced species, have been extensively documented, efforts to reverse these trends have been hampered by limited funding and lack of public awareness. This project, funded by the National Fish and Wildlife Foundation, has used over 500,000 point records to compile range maps for 592 species of freshwater fishes. We used these ranges, combined with endemism and imperilment scores, to derive a set of priority areas that form the basis of an integrated conservation strategy at the watershed scale (8-digit HUC). This project's outcomes include a Southeastern Aquatic Biodiversity Conservation Strategy, a synthesis that identifies management actions, and policy recommendations appropriate to the threats and conservation capacity in each priority area. This strategy will serve as a guide for foundations interested in making investments in southeastern aquatic conservation, as well as for land and water conservation groups in the region.

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**0344 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Elitza Germanov[1], Andrea Marshall[2], I Gede Hendrawan[3], Neil Loneragan[1]

*[1]Murdoch University, Perth, WA, Australia, [2]Marine Megafauna Foundation, Truckee, CA, USA, [3]Udayana University, Denpassar, Bali, Indonesia*

## Plastics on the Menu: Microplastics are Present in the Feeding Habitats of Manta Rays

Microplastic marine debris is a ubiquitous, multi-facetted environmental issue. Recent advances in research have shed light on global microplastics estimates, threats to biodiversity and key focal regions for intervention. Yet there is limited knowledge of the potential for microplastic ingestion by threatened large filter feeders, such as manta rays, in regions highly implicated with plastic pollution. Here, we characterize microplastics concentrations in critical feeding habitats for manta rays (*Manta alfredi*), in Nusa Penida, Indonesia, an area fraught with marine plastic pollution. Using a 200-micron plankton net, we evaluated micro (<5mm) and meso (5-200mm) plastic pollution in top 0.5m of the water column during twelve individual feeding events. The majority of plastic pieces were in the 1-5mm size range (74.2%). Plastic pieces were comprised of soft (48.9%) or hard (38.8%) secondary micro and mesoplastics, with polystyrene beads and nylon fibers comprising the rest. Overall, the average concentration of plastic pieces in the feeding location was 1.12 X $10^{-4}$ pieces per cubic meter. Given the large quantities of water manta rays must filter to meet their daily energy demands, feeding activity in the study location will likely result in microplastic ingestion. We recommend that plastic waste cleanup and prevention be prioritized for critical feeding habitats for manta rays and other resident or seasonal large filter feeders.

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**0031 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Mackenzie Gerringer[1], Thomas Linley[2], Alan Jamieson[2], Jeffrey Drazen[1]

*[1]University of Hawaii, Honolulu, HI, USA, [2]University of Aberdeen, Aberdeen, Scotland, UK*

## Feeding Ecology of Abyssal and Hadal Fishes

The snailfishes, family Liparidae (Scorpaeniformes), have found notable success in the hadal zone from 6,000 – 8,200 m, comprising the dominant ichthyofauna in at least five trenches worldwide. Little is known about the biology of these deepest-living fishes, nor the drivers of their success at hadal depths. Using recent collections from the Mariana and Kermadec Trenches and neighboring abyssal depths, this study investigates the potential role of trophic ecology in structuring fish communities at the abyssal-hadal boundary. Stomach contents were analyzed from two hadal snailfishes, *Notoliparis kermadecensis* and a newly-discovered species from the Mariana Trench. Amphipods comprised the majority (Kermadec: 95.18%, Mariana: 97.36% index of relative importance) of stomach contents in both species. Decapod crustaceans, polychaetes (*N.*

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*kermadecensis* only), and remains of carrion squid and fish made up the remainder of contents. These results are compared to diet analyses of abyssal species (families Macrouridae, Ophidiidae, Zoarcidae) collected from near the trenches and the literature. These also contained amphipods however macrourids had a higher diversity of prey items, with larger proportions of carrion and fish remains, a trophic plasticity also found in previous studies. Suction feeding fishes like hadal liparids may find an advantage to descending into the trench – where amphipods are abundant. More generalist feeders and scavengers relying on carrion, such as macrourids, might not see this same nutritional advantage. This study provides the first focused look at the feeding ecology of the ocean's deepest-living fishes and informs new understanding of trophic interactions in the hadal zone.

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**0648 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Michael Ghedotti[1], Matthew Davis[2]

*[1]Regis University, Denver, Colorado, USA, [2]St. Cloud State University, St. Cloud, Minnesota, USA*

## Phylogenetic relationships of three fossil *Fundulus* species and the timing of divergence within the North American topminnows (Teleostei: Fundulidae)

The relationships of the fossil North American Topminnows and killifishes in the Family Fundulidae (Cyprinodontiformes) remain unclear despite the abundant material available for three of the fossil species. The availability of morphological and molecular data for the Fundulidae and the presence of dated fossil species from the western United States provide an opportunity to incorporate fossil evidence into our understanding of the evolution of the Fundulidae. In this study we address the relationships of the species †*Fundulus detillae,* †*F. lariversi,* and †*F. nevadensis* and the implications for the timing of the major speciation events in the family using morphological and DNA-sequence data for four genes. Our results support many of the prior hypotheses of relationships within the family. We confirmed †*Fundulus detillae* as a member of the subgenus *Plancterus*. The Miocene fossil species do not form a monophyletic group, and do not represent a discrete western radiation of *Fundulus.* †*Fundulus lariversi* is a member of subgenus *Fundulus* and †*F. nevadensis* is related to the subgenera Plancterus and Wileyichthys, but based on current evidence is not placed in a subgenus. The genus *Fundulus* diverged into its two component clades likely in the Eocene or Oligocene (mean age 34.6mya, 53-23mya) with both of these clades present in far western North America in the Miocene.

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**0712 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Sarah Gibson

*University of Kansas, Lawrence, Kansas, USA*

### Three-Dimensional Fish Fossils from a Triassic Texas Pond: Novel Anatomical Insights and Systematic Placement of a New Species of Redfieldiid Fish (Osteichthyes: Actinopterygii)

Fishes of the order Redfieldiiformes (~16 genera, 26 spp.) are an extinct group of lower actinopterygian fishes found globally in geologic deposits from the Early Mesozoic. Most specimens are either laterally or dorsoventrally flattened due to the weight of overlaying rock layers during the fossilization process, and are rarely found preserved uncrushed and in three dimensions. Reexamination of museum collections has produced several new partial specimens from the Upper Triassic Dockum Formation. These redfieldiiform specimens are exceptionally preserved in three dimensions, providing new insights into the anatomy of the skull. These specimens represent a new species diagnosable by a combination of unique traits found in the skull, including shape of maxilla, shape of preoperculum and associated cheek bones, pattern and articulation of bones in the snout, and patterns of sensory line canals in the dermal skull bones. Specimens of this new species display novel patterns in the sensory line canals of the skull that have never been observed in any other redfieldiiform. This new species is placed within a phylogenetic hypothesis of evolutionary relationships of redfieldiiform fishes.

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**0642 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Michael Gilbert, Michael Collyer

*Western Kentucky University, Bowling Green, Kentucky, USA*

### Impacts of Habitat Fragmentation on the Trophic Morphology of a Threatened Desert Fish (*Cyprinodon pecosensis*)

Drastic alterations to the North American Southwest's hydrology have highly influenced resident fish communities. In New Mexico and Texas, the Pecos River has been severely altered as a result of water manipulation, isolating backwaters and various habitats that were once connected to the main river. *Cyprinodon pecosensis* (the Pecos pupfish) has been highly impacted due to the effects of anthropogenic water manipulation, as well as species introductions. *C. pecosensis* populations have become isolated and scattered, residing in sinkholes, remnant lakes, and static backwaters, thus creating numerous micropopulations. The purpose of this study was to assess the morphological variation in feeding morphology that occurs in response to varied habitats, especially in terms of environmental factors and species co-occurrence. Landmark-based geometric morphometrics was used to assess shape variation across numerous populations comprising four general habitat types and 27 different localities, each with varied

community structures and salinities. Results from this study suggest that head and mandible morphology vary temporally, with year to year variation, as well as among different localities. As *C. pecosensis* is a threatened species, this research has important implications for future conservation and management. Additionally, these results could further aid in the understanding of preserving species in fragmented landscapes.

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**0734 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Morgan Gilbert, Allison Pease

*Texas Tech University, Lubbock, Texas, USA*

### Use of Habitat Fragments by Larval and Juvenile Fishes in Transitional Zones of an Aging Reservoir

Isolated coves formed by sedimentation provide novel habitats in Lake Texoma, an aging reservoir in Oklahoma and Texas, USA. These habitat fragments are periodically connected to the broader river-reservoir ecosystem on the arms of two physicochemically distinct rivers entering the reservoir (Red River and Washita River). Our objective was to examine the use of these habitats as nursery grounds by fishes associated with the reservoir and riverine ecosystems. Sampling was carried out from March through August in 2014 and 2015 using light traps and push nets to target larvae and juveniles. Differences in YOY fish abundance and assemblage structure were observed between river arms and individual fragments. Analyses using NMS and ANOSIM revealed significant differences in the structure of larval assemblages between years, and diversity was higher in the very wet, flooded 2015 season. While habitat generalists were dominant throughout our study area, some habitat fragments hosted species that are known to use river floodplain habitats for reproduction, especially during the year with more extensive hydrological connectivity. This work should provide managers with insights into the role that these novel habitats play in supplementing river-reservoir fish assemblages.

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**0117 Fish Systematics II, Salon F-H, Saturday 9 July 2016**

Anthony Gill[1], Jeffrey Leis[2,3]

[1]*Macleay Museum, University of Sydney, Sydney, New South Wales, Australia,* [2]*Ichthyology, Australian Museum Research Institute, Sydney, New South Wales, Australia,* [3]*Institute for Marine and Antarctic Research, University of Tasmania, Hobart, Tasmania, Australia*

### More than archetypal coral-reef fishes: Revision and relationships of the Acanthuroidei based on adult and larval morphology

Acanthuroid fishes are often considered archetypal coral-reef fishes. We use characters of both larvae and adults to redefine Acanthuroidei to include the traditional

acanthuroid families (Acanthuridae, Ephippidae, Luvaridae, Scatophagidae, Siganidae, Zanclidae) and taxa usually placed within the Percoidei (*Antigonia*, Chaetodontidae, Drepaneidae, Leiognathidae, Lobotidae, Pomacanthidae). These taxa share a specialised tooth ontogeny. Based on larval morphology (particularly head spination, skull sculpting, early developing posteriorly-placed pelvic fins, pigmentation, and body shape) and adult morphology (dorsal gill-arches) Lobotidae is newly diagnosed to include *Lobotes*, *Datnioides* and *Hapalogenys*. These three genera are traditionally placed in Lobotidae, Datnioididae and Haemulidae, respectively. Three-item analysis shows Lobotidae is sister to the remaining acanthuroids. *Antigonia* and Leiognathidae are nested within the traditional acanthuroids on the basis of synapomorphies including single postcleithrum, ≤ 5 branchiostegal rays, absent interarcual cartilage and larval morphology. We compare this acanthuroid phylogeny with recent gene-based phylogenies. The different gene-based phylogenies agree on some aspects, but disagree on others. Similarly, the morphology-based phylogeny has areas of both agreement and disagreement with the gene-based phylogenies. Areas of agreement include: removal of *Hapalogenys* from Haemulidae; inclusion of *Lobotes*, *Datnioides* and *Hapalogenys* in Lobotidae; Lobotidae, *Antigonia* and Leiognathidae related to at least some of the acanthuroid taxa as defined here; Luvaridae and Zanclidae included in Acanthuroidei. The redefined Acanthuroidei includes species that live in a wide variety of habitats: coral reefs, epipelagic oceans, muddy and sandy bottoms, outer continental shelves and slopes, estuaries, mangroves and even fresh water, but most acanthuroid species live on coral reefs.

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**0871 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Adam Gilles, Renae Reed, Ross Black

*Eastern Washington University, Cheney, WA, USA*

**Diet swap: Is trading native prey for invasive species impacting predator fitness?**

Native predators are known to adapt to introduced prey species and sometimes act as a control on those species. Multiple cases have been documented of native Natricine snakes switching their diet to non-native fishes and, in some cases, suppressing the non-native populations. In the Turnbull National Wildlife Refuge (Cheney, WA) such a case may be occurring. The brook stickleback (*Culaea inconstans*) is a non-native fish that has invaded a number of waterways on the TNWR, displacing native fish and amphibians. The wandering garter snake (*Thamnophis elegans vagrans*) may be utilizing brook stickleback as food source due to displacement of their native prey. This study explores the influence of the brook stickleback on three populations of wandering garter snake by examining individual fitness, feeding behavior and diet at different levels of exposure to brook stickleback. When comparing individual snake fitness, inferred with a scaled mass index, no significant differences between the populations were found. During lab-based

predation trials, snakes regularly exposed to brook stickleback had significantly lower successful predation rates than those historically or never exposed. The presence/absence of common prey DNA, and brook stickleback DNA, in snake fecal matter will be analyzed using PCR. The presence of the brook stickleback in the TNWR, while altering the diet and behavior of the wandering garter snake, may not significantly impact its fitness.

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**0855 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Matthew Girard, Leo Smith

*University of Kansas, Lawrence, KS, USA*

**Carangiformes: Relationships and Anatomical Investigation**

Carangiformes is a recently identified clade of 26 families, 1,072 species, which includes the traditional Pleuronectiformes and representatives of the traditional Percoidei and Scombroidei. Carangiforms are found in a diversity of habitats that range from Lake Tanganyika to the deep sea. This variation in habitat is mirrored by tremendous morphological variation, particularly modifications to their cranial and axial skeletons. Preliminary investigations and prior work on carangiform subgroups have shown that the external dorsal-fin structure and its internal supports are highly modified and a valuable source of phylogenetically informative characters. An expanded survey of variation in this skeletal system will be conducted and combined with other morphological features and DNA sequence data to work toward a well-supported phylogeny of the Carangiformes.

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**1087 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Melissa Giresi

*Texas A&M University, College Station, TX, USA*

**One *Mustelus*, two *Mustelus*, three *Mustelus*, more; assessing biodiversity of smoothhound sharks in the western Atlantic**

Taxonomic difficulties in distinguishing among species of smoothhound sharks present challenges in estimating biodiversity and in developing management plans that are in-line with species-specific sustainability. First, I will discuss the current state of knowledge of smoothhounds in the western Atlantic, including species composition, the availability of type specimens, species ranges, and conservation status for each of the species currently described from the region. Issues with species accounts and research gaps will be noted. Next, I will discuss assessments of genetic divergence among smoothhound species, including initial analyses showing that there may be un-described species in the western Atlantic. Lastly, I will describe a collaborative effort to

collect voucher specimens and genetic samples from countries throughout the western Atlantic with the goal to accurately determine the species composition/biodiversity of smoothhound sharks in the western Atlantic.

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**0464 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Donna A. Glinski[1], W. Matthew Henderson[2], Robin J. Van Meter[3], S. Thomas Purucker[2]

*[1]Oak Ridge Institute of Science and Education, Athens, GA, USA, [2]U.S. EPA, Office of Research and Development, NERL, Athens, GA, USA, [3]Washington College, Chestertown, MD, USA*

## Using *In Vitro* Derived Metabolic Rate Constants to Inform Amphibian Pesticide Exposure

Understanding pesticide exposure to non-target species is necessary to accurately assess the ecological risks these compounds pose. To evaluate the potential metabolic activation of pesticides in amphibians, *in vitro* metabolic rate constants were derived for atrazine (ATZ), triadimefon (TDN), fipronil (FIP) as well as their metabolites using non-linear fit of velocity versus concentration. For *in vitro* and *in vivo* exposures, ATZ was metabolized into deisopropyl atrazine (DIA) and desethyl atrazine (DEA); TDN was metabolized into two diastereomers of triadimenol (TDL), A and B, and FIP was primarily metabolized into fipronil sulfone. *In vitro* studies utilized American toad liver microsomes while 48 hr exposures with Fowler's toads were used for *in vivo* body burden determinations. Following *in vitro* studies, metabolic rate constants were calculated for all three pesticides and used to inform *in vivo* body burdens. DEA and DIA both exhibited similar maximum rates of velocity (Vmax) while the substrate concentration at half Vmax (Km) for DIA was higher than DEA. In concordance, *in vivo* DIA concentrations were an order of magnitude higher than DEA. All *in vivo* time points investigated for TDL exhibited higher body burdens for the TDL B metabolite. Fipronil sulfone's Vmax and Km were 177.9 pmol/min/mg and 10.9 μM, respectively. This *in vitro* to *in vivo* extrapolation can provide a high throughput method for testing pesticides on amphibians. Gaining knowledge on species-specific differences in metabolism of pesticides is important in estimating risk to amphibians since the toxicity of pesticide metabolites can differ from the parent compound.

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**0933 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Brad Glorioso, Hardin Waddle

*U.S. Geological Survey, Lafayette, LA, USA*

### Effect of Salinity on Anuran Occupancy in Big Thicket National Preserve, Texas

Coastal wetlands along the Gulf of Mexico are vulnerable to increased salinization due to coastal wetland loss, sea level rise, and surge associated with tropical storms and hurricanes. The Lower Cypress Tract of Big Thicket National Preserve is a low-lying tidally-influenced forested wetland along the Neches River near Beaumont, Texas. It is located downstream of the Neches River saltwater barrier, which ensures freshwater for human use. Anurans are particularly vulnerable to increased salinity, due to their water-permeable skin and aquatic egg and tadpole stages. In 2011 we sampled 32 randomly chosen sites south of the saltwater barrier. Then in 2012, an additional 20 sites were randomly chosen upstream of the saltwater barrier. We have sampled each of the sites 4-6 times per year from 2011-2015 using a combination of time-constrained nighttime visual encounter and manual call surveys. Salinities varied within and among years at our southern sites, from a high of 17 ppt during a 2011 drought to essentially fresh during high flow periods. We used dynamic occupancy modeling to determine the probability of occurrence over time for each anuran species at southern sites subject to salinity compared to the northern freshwater sites. Preliminary results show that occupancy rates are relatively stable, but some species had higher occupancy at northern sites, at least one species had a higher occupancy at southern sites, and some species showed no differences. Though short-term pulses in salinity may negatively affect individual anurans, chronic long-term exposure to salinity may eventually alter anuran communities.

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**0976 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Alicia Godersky

*University of Washington School of Aquatic and Fisheries Sciences, Seattle, WA, USA*

### Distribution of Larval Fishes in Puget Sound

Most marine fishes spend a period of their early life history as pelagic larvae, during which they are considered members of the zooplankton community. In Puget Sound, a uniquely deep estuary, information about spatial and temporal distribution, abundance, and water conditions associated with fish larvae is almost completely unavailable. Larval fishes were sorted from plankton samples collected in April and May 2011 from 61 sites across Puget Sound. These samples were collected as part of a collaborative effort between the National Marine Fisheries Service, Washington Tribes, and several researchers at the University of Washington who aimed to describe the structure of the food web throughout Puget Sound's nearshore habitat. Larvae were identified and rare

taxa were excluded from analysis. Thirty taxonomic groups were identified in at least five percent of samples, including 20 at the species level, two at the generic level, and eight at the family level. The following question was posed: Does month or basin explain the presence of a particular larval fish species. Generalized linear models (GLM's) were built to predict the presence of three taxa (*Clupea pallasii*, *Ammodytes personatus*, and *Platichthys stellatus*) based on month and basin. Results suggest that May explained the absence of *Clupea pallasii* and *Ammodytes personatus* relative to April. Additionally, Rosario Basin explained the presence of *Platichthys stellatus* and South Basin explained the absence of *Ammodytes personatus* relative to the other basins. Larval fish distribution appears to differ between basin and month in Puget Sound.

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**0322 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Cody Godwin

*Southeastern Louisiana University, Hammond Louisiana, USA*

**Assessment of ATV Impacts on Softshell Turtle Nests**

Recreational vehicle use (e.g., all terrain vehicles or ATV's) has become increasingly popular in recent years, and is particularly prevalent in the southeastern U.S. Numerous studies have indicated negative effects of ATV's on the environment, especially in and around wetlands, including wetland degradation, soil erosion, destruction of vegetative communities, and direct animal mortality via impact. However, the impact of ATV's on nest success of fresh water turtles has not been documented. The beaches of the Comite River in southeastern Louisiana bring into close contact ATVs and the nesting sites for two species of softshell turtles (*Apalone mutica* and *Apalone spinifera).* The present study aims to understand the impacts of the ATVs on softshell turtle nests and thus the turtle populations. A study performed in 1993-1994, when ATVs were absent, provides a baseline for assessing the current impacts. Preliminary analyses from the first field season show that ATV's impacted 35% of nests including 25% entirely destroyed. Second season objectives will be discussed.

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**0609 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Scott Goetz[1], Craig Guyer[1], Scott Boback[2], Christina Romagosa[3]

[1]*Auburn University, Auburn, AL, USA,* [2]*Dickinson College, Carlisle, PA, USA,* [3]*University of Florida, Gainesville, FL, USA*

**Snakes Fail to Recognize the Costs of Eating Invasive Cuban Treefrogs, *Osteopilus septentrionalis***

Native predators may incur sublethal costs by consuming nonindigenous prey that possess novel defensive toxins. In this study, we examine the prey preferences and

growth rate of a native generalist snake (Eastern Gartersnakes, *Thamnophis sirtalis*) in response to the chemically defended Cuban Treefrog (*Osteopilus septentrionalis*). We compared responses from snakes collected from uninvaded regions and those within the invasive range of *O. septentrionalis*. To assess prey preference, we explored the predatory responses of *T. sirtalis* to cues from *O. septentrionalis*, native Green Treefrogs (*Hyla cinerea*), and controls. Specifically, we assayed both digestively naïve neonatal and wild-caught adult snakes. To evaluate the nutritional value of *O. septentrionalis*, we monitored weight changes of wild-caught *T. sirtalis* fed exclusive diets of either *O. septentrionalis*, *H. cinerea*, or native fish (Golden Shiners, *Notemigonus crysoleucas*). We found that all three *T. sirtalis* experimental groups failed to exhibit a significant preference for *H. cinerea* prey scent over stimuli from *O. septentrionalis*, including neonates from invaded regions ($P = 0.99$), adults from invaded regions ($P = 0.14$), and neonates from noninvaded regions ($P = 0.33$). However, we found *T. sirtalis* gained significantly less weight in the *O. septentrionalis* diet treatment in both the invaded region (ANOVA; $F_{2, 28} = 4.82$, $P = 0.016$) and noninvaded region (ANCOVA; $F_{2, 24} = 3.55$, $P = 0.04$). Observations suggest *O. septentrionalis* toxins disrupt snake digestion. Our results indicate that *O. septentrionalis* could represent an evolutionary trap because *T. sirtalis* fails to recognize the inferior nutritional value of this nonindigenous species.

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## 1068 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT

Cory Goff[1], Caitlin Gabor[2], Susan Walls[3]

*[1]Texas State University, San Marcos, Texas, USA, [2]Texas State University, San Marcos, Texas, USA, [3]US Geological Survey, Gainesville, Florida, USA*

### Are Declining Populations of the Ornate Chorus Frog, *Pseudacris ornata*, More Stressed Than Stable Populations?

Climate change has become a significant driver in ecology, causing changes in environmental factors like temperature, humidity, precipitation, and sea level rise. In addition, other anthropogenic disturbances also alter habitat and reduce habitat quality. Together, populations may reach their tolerance limits whereby populations decline and become more isolated physically and genetically. One mechanism to assess how individuals and populations respond to changing conditions is to assess their physiological health. We examined stress hormone concentrations for populations of *Pseudacris ornata* throughout its range in Florida and southern Georgia. This species has shown rapid declines in the Florida peninsula yet populations appear to be stable in the Florida panhandle region. We obtained baseline water-borne corticosterone (CORT) release rates for tadpoles from multiple sites in four locations across an east-west transect in northern Florida and one location in southern Georgia. We also obtained stressed induced corticosterone levels for each site. We compared baseline and stress responses among sites. We predict that locations where the population has been declining will not show a stress response and that CORT will differ from the more stable

populations. We also explored environmental variables and related them to CORT release rates for each site. Together our study may aid in identifying factors affecting the observed declines and provide management implications.

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**0189 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Rachel Goodman[1], Amber Wright[0]

*[1]Hampden-Sydney College, Hampden Sydney, VA, USA, [2]University of Hawaii at Manoa, Honolulu, HI, USA*

## Survey of Ranavirus and *Batrachochytrium dendrobatidis* in Introduced Frogs in Hawaii

Ranavirus and *Batrachochytrium dendrobatidis* (Bd) are two emerging wildlife diseases that threaten amphibian populations globally. Hawaii does not have any native species of amphibians. However, there are six species of introduced amphibians, which may predate upon or compete with native species, and serve as reservoirs for pathogens. While Bd has been documented in *Eleutherodactylus coqui* frogs on the Island of Hawaii, it has not been surveyed in other amphibians or on other islands. The presence of ranavirus in amphibians or other ectothermic hosts has not yet been investigated in Hawaii. We report on a survey of the pathogens ranavirus and Bd in four introduced frog species on the island of Oahu. We collected 20-30 individuals per life stage from one or more populations of *Rana rugosa*, *Rana catesbeiana*, *Bufo marinus* and *Dendobates auratus*. Skin swabbing was done externally according to the standard for Bd sampling. Frogs were humanely euthanized and necropsied, and samples of liver, intestine, and kidney were collected for ranavirus sampling. We extracted DNA from all samples and used qPCR to test for the presence of Bd in swab samples and ranavirus in organ samples. We then compared presence and prevalence of the two pathogens among the species sampled. This study of pathogen surveillance in Hawaii has the potential to contribute to managing introduced frog populations, native wildlife, and global amphibian populations, as the islands are a major hub between Asia, the Pacific, and North America.

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**0329 Herp Biogeography, Salon D, Friday 8 July 2016**

Andrew Gottscho[1], Brad Hollingsworth[3], Julio Lemos-Espinal[4], Tod Reeder[2]

*[1]Smithsonian Institution, Washington, DC, USA, [2]San Diego State University, San Diego, CA, USA, [3]San Diego Natural History Museum, San Diego, CA, USA, [4]Facultad de Estudios Superiores, UNAM, Iztacala, MX, Mexico*

## Phylogeography of Peninsular Brush Lizards (Squamata: Phrynosomatidae: *Urosaurus*) in Baja California, Mexico using Restriction-Associated DNA Sequencing

The Black-tailed Brush Lizard (*Urosaurus nigricaudus*) and its sister species, the Baja California Brush Lizard (*U. lahtelai*) are endemic to the Baja California Peninsula, a region with a dynamic climatic and geologic history. Whereas *U. nigricaudus* is widespread across the peninsula, *U. lahtelai* is confined to a small region of granitic outcrops in the vicinity of Cataviña in the north-central peninsula, surrounded by *U. nigricaudus*. Furthermore, the validity of the taxon *U. microscutatus*, currently in synonymy with *U. nigricaudus*, has been recently supported and its synonymy may have been premature. We used restriction-associated DNA sequencing (RADseq) to investigate the phylogeography and species delimitation of *Urosaurus* in Baja California. We analyzed over 1,000 short-read loci for 42 individuals of *U. nigricaudus* and 6 individuals of *U. lahtelai*. Using a combination of population genetic clustering algorithms, concatenated phylogenies, and coalescent species tree/isolation-with-migration models, we found compelling evidence that *U. nigricaudus* is composed of two species (i.e. *U. microscutatus* is a valid species). Discrete phylogeographic breaks were found at the mid-peninsular region (Vizcaíno Desert) and in the southern peninsula (the western slope of the Sierra la Giganta), consistent with phylogeographic patterns in other co-distributed squamate reptile species. We found that northern populations have lower heterozygosity and are recently derived with respect to southern populations, with a northern range expansion into the range of *U. lahtelai*, most likely having occurred in the late Pleistocene. Possible taxonomic implications and comparative phylogeography of the peninsula as a whole will be discussed.

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**0970 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Johana Goyes-Vallejos[1], Kentwood Wells[1], T. Ulmar Grafe[2]

*[1]Ecology and Evolutionary Department, University of Connecticut, Storrs, CT, USA, [2]Faculty of Science, Universiti Brunei Darussalam, Gadong, Brunei Darussalam*

## Parental care behavior in males of the Smooth Guardian Frog *Limnonectes palavanensis* of Borneo

Amphibians have a great diversity of reproductive modes. However, only a few of these are associated with some kind of parental care. In Southeast Asia, species in the genus

*Limnonectes* exhibit a spectrum of parental care modes: from egg deposition in terrestrial nests to internal fertilization and tadpole viviparity. The smooth guardian frog *Limnonectes palavanensis*, found in Borneo, is one of only two species in the genus with egg attendance and tadpole transport. I studied the parental care behavior of *L. palavanensis* in the laboratory and in the field. After the eggs are laid on the forest floor, males stay with the clutch from oviposition until hatching, a process that takes between 9 and 11 days. Males do not call while caring for eggs and do not attract additional females. Using infrared video cameras, I found that tadpole retrieval can take up to 90 minutes. Tadpoles can break out of the egg capsule alone, but the male apparently stimulates hatching by touching the clutch with his fingers and chin. When free, tadpoles wriggle onto the male's back. Males transport the tadpoles to rain pools, intermittent streams and pig wallows. I observed males transporting numbers of tadpoles consistent with the clutch sizes observed in the laboratory, suggesting that males only take care of one clutch at a time. Due to this prolonged parental care, males might be removed from the mating pool and females may have difficulty finding receptive males. This could lead to female-female competition and a reversal in sex-roles.

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**0111 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Mark Grace[1], Laura Dias[2], Lance Garrison[3], Keith Mullin[1], Kathy Maze-Foley[4], Carrie Sinclair[1]

*[1]NOAA/NMFS/SEFSC/Mississippi Laboratories, Pascagoula, MS, USA, [2]Cooperative Institute for Marine and Atmospheric Studies, Univ. of Miami, Miami, FL, USA, [3]NOAA/NMFS/SEFSC/Miami Laboratory, Miami, FL, USA, [4]NOAA/NMFS/SEFSC Beaufort Laboratory Affiliate, Beaufort, NC, USA*

## Ectoparasitic Predators; Cookie Cutter Shark Bite Wounds on Cetaceans of the Gulf of Mexico

Cookie cutter sharks (Dalatiidae, Squaliformes) are often described as ectoparasitic predators of a variety of high trophic level prey species including cetaceans, tunas, billfishes, and squids. These sharks employ a unique feeding behavior that allows them to use their cookie-cutter like teeth to excise a nearly symmetrical oval flesh plug from the body of their prey. A data element of NOAA/NMFS/SEFSC surveys of Gulf of Mexico cetaceans is the documentation of the fresh wounds or scars that can be observed on cetaceans that approach vessels to bow ride or if they are otherwise close enough to allow observation. Cookie-cutter bite wounds were observed on eight percent of sightings (solitary or groups) represented by 11 dolphin species and two whale species. Pantropical spotted dolphin sightings (*Stenella attenuata* Gray 1846) had the most records of cookie cutter bite wounds (40%). In addition, during a Gulf of Mexico midwater trawling study targeting cetacean prey aggregations (fish and invertebrates), two cookie cutter sharks were sampled for stable isotopes (*Isistius brasilensis* Quoy & Gaimard 1824 and *I. plutodus* Garrick & Springer 1964). The ratio analysis of $^{13}C$ and $^{15}N$ positions these

ectoparasitic sharks in a high trophic level and provides verification that they feed on other high trophic level species.

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## 0016 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016

Molly Grace, Daniel Smith, Reed Noss

*University of Central Florida, Orlando, Florida, USA*

### Patterns of Anuran Abundance near Roads are Explained by Life History Traits

Roads and their associated effects (road-kill, pollution, etc.) have a largely negative impact on animals, especially amphibians, but not all species are affected to the same degree. Variation in life histories may explain some of these differences. Here, we test how abundance of anuran species in roadside habitats is correlated with an aspect of reproductive life history: number of eggs produced by a female per year. We found that as the average number of eggs produced increases, more individuals of that species are found in roadside habitats compared to control habitats. This implies either that populations of species with a greater reproductive rate are able to rebound more quickly from negative road impacts, or that there is a strong selective pressure on species with low reproductive rates to avoid roads.

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## 0844 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H, Thursday 7 July 2016

Jessica Grady, Courtney Weyand, Zachary Holtel, Eva Urdiales, C.M. Gienger, Rebecca Blanton

*Austin Peay State University, Clarksville, TN, USA*

### Scale shape variation in a speciose and highly imperiled group of fishes, the darters (Percidae: Etheostomatinae)

The species-rich darter clade (Percidae: Etheostomatinae) has a vast research history, however, studies of variation in scale microstructure have been limited to a small number of species. To describe phenotypic variation in darter scales and evaluate variation in the context of modern estimates of diversity and phylogeny, a pilot study was conducted using confocal microscopy. Darter scale shape and meristic data were taken from 236 individuals, representing 80 species, all genera, 26 subgenera, and 29 darter clades. Variation in number of ctenii and radii was observed among genera, subgenera and clades (*Percina* ctenii, radii: =19.9, 9.3; *Nothonotus*: =25.3, 13.4; *Etheostoma*: =24.9, 13.4; *Crystallaria*: =11.0, 6.3; *Ammocrypta*: =8.1, 6.9). Principle components analysis revealed *Ammocyrpta* and *Crystallaria* have shorter scale lengths and shorter ctenii relative to other genera. Variation among species and clades within each genus,

particularly *Percina* and *Etheostoma*, was also noted. Given the observed variation as well as previous work demonstrating that the morphological diversity of darters has been attributed to environmental conditions of streams, future work will investigate the impact of environment, behavior, and phylogeny on darter scale shape using geometric morphometrics. Because scales aid in reducing drag and facilitating movement, understanding the relative impact these factors have on morphological variation in darters will enhance knowledge of the response of this group of fishes to environmental changes.

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**0932 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Rachel Graham[1], Ivy Baremore[1], Samantha Strindberg[2]

[1]*MarAlliance, San Pedro, Belize,* [2]*Wildlife Conservation Society, California, USA*

## A Tale of Two Atolls: Differences in Elasmobranch Abundance and Density Between Two Offshore Atolls in Belize

Turneffe and Lighthouse Reef Atolls are two of the Atlantic Ocean's four atolls, forming part of the Meso-American Barrier Reef in Belize, with sharply contrasting protection status. Located approximately 50 km east of Belize City, Turneffe Atoll was recently declared a multi-zoned marine protected area; although gear types are restricted, it is still easily accessible to fishers. Lighthouse Reef Atoll is more remote and provides open access to fishing, bar two fully protected sites. The study examined the status of elasmofauna using three methods: longlines, Baited Remote Underwater Video (BRUV), and in water Distance Sampling (DS). Surveys were conducted at fixed stations from 2014-2016. Stations were randomly positioned at evenly-spaced locations throughout three habitat types: forereef, backreef, and lagoon. Data analyses included: catch-per-unit-effort (CPUE) for longline, MaxN and frequency of occurrence for BRUVs, and population size and density estimates from DS data. Generalized Linear Models (GLM) were used to assess differences in abundance by year, habitat, location, protection status, depth and environmental parameters. Results from the three consecutive survey years indicate that Lighthouse Reef Atoll, though much smaller, has significantly higher abundance and occurrence of shark species than Turneffe Atoll. Density and population size estimates of rays were similar between atolls. CPUE and MaxN were highest at both atolls for sharks on the windward forereef habitats. This study suggests high historic fishing mortality at Turneffe Atoll, where proximity to population centers negatively affects shark populations. Continued monitoring will help to determine the effectiveness of Turneffe Atoll in protecting elasmobranchs.

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**0902 Fish Reproduction, Physiology, & Conservation, Balconies J & K, Sunday 10 July 2016**

Jennifer Granneman, Steve Murawski, Ernst Peebles

*University of South Florida, College of Marine Science, St. Petersburg, FL, USA*

**Metal Exposure, as Documented in Otoliths, may be Detrimental to Gulf of Mexico Fish Health**

The incidence of external lesions on Gulf of Mexico (GoM) fishes increased just after the Deepwater Horizon (DWH) oil disaster, and then declined, yet a lack of baseline data makes it difficult to definitively link cause and effect. Our objectives were to: (1) determine if fish were exposed to metals associated with the DWH oil during the time period of the oil spill, and (2) examine patterns of oil-associated metal exposure, particularly among lesioned and non-lesioned fish. Otoliths record both fish age and microchemistry, enabling us to describe the lifetime chemical histories of fish. We analyzed otoliths from six offshore fish species collected from 2011 to 2013 in the GoM. Otoliths were analyzed for a suite of trace metals known to be associated with DWH crude oil. We found that the concentrations of oil-associated metals did not significantly change before, during, or after the DWH oil spill; however, metal exposure varied according to species-specific life history patterns. Additionally, lesioned fish had distinctive trace metal compositions in their otoliths, with $^{60}$Ni and $^{64}$Zn responsible for distinguishing lesioned from non-lesioned fish groups. Lesioned fish often had elevated otolith $^{60}$Ni and $^{64}$Zn before and after the DWH oil disaster. These findings suggest that lesioned individuals were exposed to a persistent source of metals in the GoM prior to the oil spill; this may have made them vulnerable to the DWH oil spill and resulted in lesion formation in response to DWH oil exposure.

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**0004 HL, ASIH, SSAR: Eco-Evolutionary Dynamics Symposium, Salon D, Friday 8 July 2016**

David Green, Andrew Hendry

*McGill University, Quebec, Canada*

**Eco-evolutionary dynamics - Introduction to the symposium**

Evolutionary changes in organisms are driven by ecological changes their surroundings. That much is obvious, but much less well known is how these interactions play out over short time scales, including periods of time most relevant to conservation and management. In the face of environmental change, when and how rapidly must accommodation via phenotypic plasticity yield to heritable adaption via evolution? How does rapid contemporary evolution, in turn, influence population dynamics, community composition or ecosystem function on similar time scales? Many of the best examples of research into the dynamic interactions between ecology and evolution are studies of fishes, amphibians or reptiles and this symposium is intended to showcase that research.

**0336 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Madeline Green[2], Blanche D'Anastasi[3], Jean-Paul Hobbs[4], Kevin Feldheim[5], Rory McAuly[6], Sterling Peverell[7], Jason Stapley[7], Sharon Appleyard[8], William White[8], Colin Simpfendorfer[1], Lynne van Herwerden[3]

*[1]Centre for Sustainable Tropical Fisheries and Aquaculture, James Cook University, Queensland, Australia, [2]Institute for Marine and Antarctic Studies, University of Tasmania, Tasmania, Australia, [3]College of Marine and Environmental Sciences, James Cook University, Queensland, Australia, [4]Department of Environment and Agriculture, Curtin University, Western Australia, Australia, [5]Laboratory for Systematics and Evolution, the Field Museum, Chicago, IL, USA, [6]Western Australian Government, Department of Fisheries, Western Australia, Australia, [7]Queensland Department of Primary Industries and Fisheries, Northern Fisheries Centre, Queensland, Australia, [8]National Research Collections Australia, CSIRO, Tasmania, Australia*

## Population Connectivity of Narrow Sawfish (*Anoxypristis cuspidata*) in Australia and Papua New Guinea using genetic markers

The Narrow or Knifetooth sawfish (*Anoxypristis cuspidata*) belongs to the most endangered family within the Class Chondrichthyes; the sawfishes. This species has undergone significant declines in range and abundance due to anthropogenic activities including fishing and habitat loss. Very little is known of adult movements and sex-biased behaviour that may be exhibited by Indo-Pacific populations. In order to better manage and protect this threatened species, understanding habitat usage and behaviour is critical. Using a combination of mitochondrial and nuclear (microsatellites) markers, this study identified the population structure of *A. cuspidata* in Australia and Papua New Guinea (PNG). Significant mitochondrial structuring was found for the east Australian coast population and other sampled locations both in northern Australia and PNG. Suggesting residency or philopatric behaviours are likely for females specifically on the east coast of Australia. Similarly, microsatellite markers identified a lack of connectivity between the east coast and all other locations across northern Australia (microsatellite markers were unavailable for PNG populations). Results from this work show the east Australian population of *A. cuspidata* have no genetic connectivity with other sampled Australian and PNG locations. Consequently, the east Australian population is likely to be less resilient than others if localised anthropogenic pressures remain. Microsatellite results require further investigation due to the low number of suitable markers available for the species. However, given the endangered status and lack of knowledge for *A. cuspidata* this study presents important findings, which can be used to improve management outcomes.

**0477 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016**

Dan Greenberg

*Simon Fraser University, Burnaby, Canada*

### Historical Diversification and Contemporary Extinction in Amphibians

Some clades diversify rapidly over time, while others remain depauperate. The causes for this are various, but many biological traits can influence the rates of speciation and extinction. Traits hypothesized to increase speciation rate include limited dispersal capacity, low and fluctuating population abundance, and ecological specialization. Many of these same traits are also associated with heightened rates of extinction, suggesting that rates of speciation and extinction may be correlated. Though this has long been recognized in fossil taxa it is rarely considered in the context of modern biodiversity loss. As amphibians are experiencing the highest rates of modern vertebrate extinction they provide an ideal system to test whether young and rapidly evolving clades also have the greatest extinction risks. I calculated net diversification rates for 275 genera of amphibians across different biogeographic regions and compared this to the proportion of assessed species threatened in each clade according to IUCN threat categories. I found that clades with higher diversification rates also had a greater proportion of threatened species, suggesting that the processes of speciation and extinction may indeed be coupled in amphibians. I explore possible mechanisms for this pattern, including the distribution of geographic range size and climatic specialization across these clades. These results suggest that, contrary to certain birds and mammals, the youngest and most speciose amphibian clades are likely to suffer disproportionately in the loss of amphibian diversity in the future.

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**0557 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday 7 July 2016**

Kathryn Greene, Shannon Pittman, Michael Dorcas

*Davidson College, Davidson, NC, USA*

### Factors Affecting the Dispersal and Settlement Decisions of Juvenile Spotted Salamanders (*Ambystoma maculatum)*

Spotted salamanders (*Ambystoma maculatum*) are pond-breeding amphibians that disperse into terrestrial habitat from natal wetlands after undergoing metamorphosis, relying on small-mammal burrows and coarse woody debris for refugia. Traversing through novel habitats dispose recently metamorphosed salamanders to risks that include density effects and predation. Salamanders may mitigate these risks via movement decisions, but movement strategies that reduce density effects may not be the optimal strategies for reducing predation pressure. To explore this potential behavioral trade-off, we conducted behavioral laboratory trials using 58 recently metamorphosed salamanders to determine how salamanders select burrows in the presence of

conspecifics. Our results show that salamanders were 84% more likely to settle in a burrow that was occupied by a conspecific than settling in an unoccupied burrow, indicating that juvenile salamanders may show conspecific attraction and/or trailing behavior during the dispersal phase. While conspecific attraction would increase the risk of density-dependent mortality, we hypothesized that trailing would reduce the impact of predation pressure through the dilution effect. To explore this concept, we used powder tracking to measure movements of anurans around the edge of salamander breeding ponds in night field surveys and used those data to parameterize individual-based simulation models to explore how trailing behavior and the resulting high densities of salamanders impact predation risks. We found that trailing behavior decreased the risk of predation, but only under certain assumptions about predator dispersion and behavior. These results suggest that behavioral trade-offs may be important drivers of salamander movement patterns.

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**0104 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Patrick Gregory

*University of Victoria, Victoria, BC, Canada*

**ASIH: A View from the North**

By area, Canada is the world's second largest country, but, by population size, it ranks 37th. Canada's herpetofauna is also small and, like the human population, most of it is concentrated along the country's southern border. In the 1960s, when I developed my interest in herpetology, there were virtually no academic herpetologists in Canada and I had to seek out ichthyologists for career advice, which led me to another ichthyologist, with whom I ended up doing my PhD. Thus, my relationship with ichthyologists is long-standing and it was only natural to me to turn to ASIH as my major professional affiliation. I attended my first ASIH meeting in 1970 in New Orleans and have attended almost every meeting since then. It also has been my pleasure to host two meetings and to serve the society in various capacities. Although I belong to other herpetological societies, including a now thriving one in Canada, ASIH remains my main professional home. My association with ASIH has had a tremendous influence on the development of my career, both in research and in administration. It also has given me enduring friends and colleagues. For me, the influence of ASIH extends well beyond its journal, *Copeia*, and well beyond the borders of the United States. Science and society need organism-based associations like ASIH and I hope that it will continue to prosper with the membership and active participation of new young scientists.

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**0144 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Galerie 3, Friday 8 July 2016**

Aaron Griffing[1], Juan Daza[2], Aaron Bauer[1]

[1]*Villanova University, Villanova, Pennsylvania, USA,* [2]*Sam Houston State University, Huntsville, Texas, USA*

## Developmental Osteology of Parafrontal Bones in *Aristelliger* and *Teratoscincus* (Squamata: Sphaerodactylidae)

Well-resolved phylogenetic hypotheses and ontogenetic data are often necessary to investigate the evolution of structural novelty. The Sphaerodactylidae comprises several genera of miniaturized geckos, including one of the smallest known amniotes. The genera *Aristelliger* and *Teratoscincus* are exceptions, with taxa reaching snout-to-vent lengths of up to 150 mm. These genera possess enigmatic, neomorphic, supraorbital ossifications, parafrontal bones, which are unique among squamates. Originally believed to be a product of evolutionary convergence, these structures have remained uninvestigated since their discovery. Though relationships between other Old World sphaerodactylids remain unresolved, recent molecular and morphological data has supported a close relationship between *Aristelliger* and *Teratoscincus*. We investigated the ontogeny of these bones in both *Aristelliger* and *Teratoscincus* to better understand the putative homology between the two genera and relationship between body size and the presence of parafrontal bones in sphaerodactylids. We hypothesized that the parafrontals of *Aristelliger* and *Teratoscincus* are homologous and that there is a threshold body size in sphaerodactylids, below which parafrontals do not develop, thus explaining their absence in miniaturized taxa. Histology was used to corroborate parafrontal homology. Cleared and stained, radiographed, and skeletonized specimens of various ontogenetic stages were used to verify the presence of parafrontals, and if present, measure the total surface area they occupied in seven species of *Aristelliger*, six species of *Teratoscincus*, and their respective sister taxa. Our data suggest that parafrontals are likely homologous and that the onset of parafrontal development is dependent on the ontogenetic stage, not a strict threshold size.

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**0729 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: EVOLUTION, GENETICS, & SYSTEMATICS**

Matt Grisnik, Alexander Murray, Herman Mays

*Marshall University, Huntington, West Virginia, USA*

## *Necturus* Phylogeny

The genus *Necturus* is made up of medium to large neotenic salamanders. Endemic to the Eastern half of North America, these salamanders can be found in most freshwater environments. There are currently five species recognized within the genus, but arguments have been made for further species division. Current members of this genus

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may be later classified as subspecies or may achieve full species status, although their current status remains debatable. As many as seven species are accepted by some and disagreement exists surrounding the species *Necturus maculosus* and *Necturus beyeri* . Previous studies have created phylogenies from allozymes, and more recently 4 nuclear genes, however the direct relationships between species within this genus are still under contention. The goal of this study is to establish phylogenetic relationships between members of the genus *Necturus*. This will be done by creating a phylogenetic tree using a combination of nuclear (nDNA) and mitochondrial DNA (mtDNA). The only other extant member of the family Proteidae, *Proteus anguinus* will be used as the outgroup. To date 6 nuclear loci and 2 mitochondrial loci have been amplified and sequenced. Specimens have been collected for all currently recognized species, and will be stored as museum specimens in various museum collections.

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## 0091 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Iwo Gross[1], Yong Wang[1], Callie Schweitzer[2]

*[1]Alabama A&M University, Huntsville, Alabama, USA, [2]USDA Forest Service Southern Research Station, Huntsville, Alabama, USA*

### Habitat use and dispersal of neonatal Copperheads (Crotalinae; *Agkistrodon*) in a managed southeastern forest

Recent studies have identified the neonatal snake cohort as an important dispersal vector in several species. Unfortunately, the comprehensive examination of early-life characteristics in snakes is logistically challenging as a result of ineffective tracking techniques and low detection probabilities in wild populations. In this study, we will examine the activity patterns, habitat use, and overwintering habitat requirements of gravid female Copperheads (*Agkistrodon contortrix*) and their offspring that inhabit Bankhead National Forest in northern Alabama. In advance of parturition, our radiotracked, gravid females will be placed in hardware cloth exclosures at their parturition sites until they give birth. Select neonates >4g will be tracked using harmonic direction finder (HDF) tags, which function by re-emitting incoming radio signals at a harmonic frequency that can be detected by a handheld transceiver and pinpointed using basic telemetry methods. These tags require no batteries, are lightweight (*ca.* 8 mg), and have a detection range appropriate for tracking small organisms. Macro- and microhabitat surveys will be conducted alongside tracking efforts of both age classes throughout the activity season. The simultaneous implementation of these methods will help us draw conclusions concerning vital snake nesting and overwintering habitat, and the variation in habitat use and survival across Copperhead age classes. Preliminary findings indicate that neonatal dispersal progresses in a linear "beads-on-a-string" pattern, and neonates favor microhabitat features associated with early-successional habitat types. Further application and development of our methodologies could address

other queries regarding the ecological role and characteristics of the neonatal snake cohort.

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**0722 ASIH: Lessons From, and Lessons For Symposium, Salon D, Sunday 10 July 2016**

Gary Grossman

*University of Georgia, Athens, GA, USA*

**Long-term Data in a Changing World: Lessons from Stream Fishes**

We are in a time of unprecedented environmental change, which makes the collection and analysis of long-term population data sets essential. Using examples from long-term data sets on a variety of common stream fishes from southern Appalachian streams, I discuss a variety of aspects of the collection, and analysis of long-term fish data sets including: 1) potential research questions, 2) sampling, 3) temporal scales, 4) approaches to data analysis, and 5) examination of the effects of density-dependent and density independent forces on these fishes. I also discuss issues of quality control and quality assurance for the analysis of existing data sets by scientists who were not involved in their collection. Quantifying the relative importance of density-dependent and density-independent on population persistence in fishes will be more important as climactic variability increases. The presence of density-dependence in populations suggests that they will have the capability to respond to environmental change, however, this may not be true for populations in which disturbance is the main cause of mortality and low abundance.

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**0795 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

R. Dean Grubbs[1], John Carlson[2], Mark Bond[3], Bianca Prohaska[4], Johanna Imhoff[4]

*[1]Florida State University Coastal and Marine Lab, St. Teresa, FL, USA, [2]NOAA Fisheries - SEFSC, Panama City, FL, USA, [3]Florida International University, Miami, FL, USA, [4]Florida State University, Tallahassee, FL, USA*

**Smalltooth Sawfish in Florida and the Bahamas – National Parks as Potential "Lifeboats" for Recovery**

The smalltooth sawfish (*Pristis pectinata*) is listed as *Critically Endangered* in the IUCN Red List of Threatened Species and *Endangered* under the United States' Endangered Species Act. The species is restricted to the Atlantic Ocean and populations declined throughout the range due to overfishing and habitat loss. Bycatch remains the largest source of direct mortality and continued habitat loss from urban development, agriculture, and freshwater diversion likely hinders recovery. Southwest Florida in the U.S. and the west side of Andros Island in the Bahamas are the only known regions where significant numbers of smalltooth sawfish remain. Both systems are

characterized by extensive mangrove estuaries with highly variable salinity and proximity to relatively deep shelf-edge habitats that are buffered from seasonal temperature extremes. Both systems also include substantial national parks that offer habitat protection (Everglades National Park – ENP; Andros West Side National Park - AWSNP) and telemetry data suggest there is little movement of sawfish between them. The human population density in southwest Florida is orders of magnitude higher than around Andros which influences water quality as well as fishing mortality risk. Recreational and charter fishing effort is very high in ENP, but very low in AWSNP. Similarly, commercial longline, trawl, and trap fisheries exploit the deeper shelf-edge habitats occupied by sawfish off Florida but similar habitats off the Bahamas are exposed to few commercial fishers. Florida and Andros Island may be critical to smalltooth sawfish recovery, therefore habitat quality and bycatch risk should be monitored closely.

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**0052 Squamate Biology, Balconies L & M, Sunday 10 July 2016**

Michael Grundler

*University of Michigan, Ann Arbor, MI, USA*

**SquamataBase: The Squamate Diet Database - *Building a "next-generation" natural history database for ecology and evolutionary biology***

Comparative studies on the evolution of squamate reptile feeding ecology stand to benefit enormously if data in the rich natural history literature on squamate diets become available in a digital format. In this talk I introduce and describe SquamataBase, which is an online relational database that I designed and developed as a repository to store and query published predator-prey observations involving squamate reptiles in nature. I describe the underlying database philosophy, introduce the website where data can be uploaded and accessed, and describe how other researchers can help contribute and curate data to increase the taxonomic and geographic breadth of the database.

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**0040 AES Physiology, Paleontology, & Collections, Balconies L & M, Friday 8 July 2016**

Leonardo Guida[1], Terence I. Walker[1], Cynthia Awruch[2], Richard D. Reina[1]

*[1]Monash University, Clayton, Victoria, Australia, [2]University of Tasmania, Hobart, Tasmania, Australia*

**Physiological Responses to the Pre-natal Stress of Fisheries Capture in Pregnant Southern Fiddler Rays (*Trygonorrhina dumerilii*) and Their Neonates**

Assessing fisheries impacts on elasmobranch populations has largely focused on quantifying both immediate and delayed mortality rates. However, very little is known about the sub-lethal effects of capture stress, particularly in pregnant females. Our study

is the first to investigate the consequences of capture on a pregnant elasmobranch species, the southern fiddler ray (*Trygonorrhina dumerilii*). Nineteen pregnant females were collected by hand in Swan Bay, Australia, and transported to aquaria where nine females were subjected to trawl capture (8 hr) followed immediately by air exposure (30 min). Immediately prior to, and for up to 28 days post trawling, all females were routinely sampled to monitor changes in total body mass (TBM), sex-steroid levels (17beta-estradiol, progesterone, testosterone) and granulocyte to lymphocyte ratio (G:L). At parturition, neonates were measured for total length (TL), TBM and where possible, G:L was also calculated. Trawling reduced maternal TBM and elevated the G:L for up to 28 days post trawling. Trawling did not significantly affect any sex-steroid titers, however all females reported lower than expected concentrations in all sex-steroids at 28 days post trawling. Neonates who experienced pre-natal stress were lower in TBM and TL, and had an elevated G:L. Our results suggest that depending on the magnitude of environmental stress experienced by a pregnant female, a single capture event (or multiple) is sufficient to influence current and future reproductive efforts.

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**0041 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Leonardo Guida, Terence I. Walker, Richard D. Reina

*Monash University, Clayton, Victoria, Australia*

### *Just chill & survive* – How the Behaviour of the Gummy Shark During Longline Capture Reduces the Physiological Stress Response

Many factors influence the physiological stress response to fisheries capture in elasmobranchs. However, the influence of sea surface temperatures (SST) and behaviour are unknown and crucial considering global fishing pressures. We investigated the effect of SST and behaviour on the physiological stress response to capture of the gummy shark, *Mustelus antarcticus*. Capture time for 23 *M. antarcticus* ranged 32-241 min as measured by hook timers or time depth recorders (TDR) in SSTs ranging 12-20°C. TDR data from 13 *M. antarcticus* were analysed to quantify capture behaviour as the percentage of time spent moving during capture. Several physiological variables measured from blood samples obtained immediately upon the animals' landing indicated that although warmer SSTs increased metabolic rate, the stress response to capture was not exacerbated by capture duration. During capture, movement occurred for an average of 10% of the time and since *M. antarcticus* can respire whilst stationary, restricted movement probably mitigated potential influences of increased SSTs and capture duration on the stress response. We highlight the importance of seasonal water temperatures and capture behaviour when assessing the resilience to fisheries capture and the implementation of appropriate fisheries management strategies.

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**0833 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Steven Guidos, Collin Waldrop

*University of North Carolina Wilmington, Wilmington, NC, USA*

### Food habits of spiny dogfish (*Squalus acanthias*) in coastal North Carolina waters

Spiny dogfish total catch limits established for commercial fisheries for the eastern United States favor northern states where high catch rates occur during the onset of a southward winter migration. Commercial fisheries regulations currently allocate portions of a coastwide quota to respective states assuming a single harvested population. There has been speculation that more than one population exists along the U.S. East Coast and that management strategies may require amendment. To explore this question, we examined the diets of spiny dogfish harvested in North Carolina coastal waters during winter 2016. Percent weight, frequency and occurrence for prey items were measured and compared to data published for localities north of Cape Hatteras. Preliminary findings indicate that dogfish prey on Atlantic menhaden, pigfish and amphipods while overwintering off North Carolina. Comparisons of dietary patterns across regions will be presented and implications for fisheries management will be discussed.

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**1027 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jill Guillette, Jason Ortega, Larry Kamees, Steven Beaupre

*University of Arkansas, Fayetteville, AK, USA*

### Response of Leukocyte Profiles to Corticosterone Manipulation in the Prairie Rattlesnake (*Crotalus viridis*)

Prior work has shown that when animals are stressed they have altered leukocyte profiles. The use of leukocyte profiles could provide an inexpensive and efficient method for determining stress. Here we present a validation of the use of leukocyte profiles for showing induced stress in Prairie Rattlesnakes (*Crotalus viridus*). Snakes (N=19) with masses ranging from 682g to 137g were used in a repeated measures design to examine the effect of hormone manipulation on leukocyte profiles. During each trial snakes were dosed with either corticosterone and sesame oil (1.1µg/g) or only sesame oil. Prior to dosing, baseline blood samples were collected to analyze a pre-dosing leukocyte count. Immediately after blood draw, snakes were placed into small chambers that would facilitate dosing located in an undisturbed room; 24 hours after baseline samples animals were dosed. The dosing mixture was left to be absorbed for 24 hours and a final blood sample was taken. Whole blood from each snake sample was used to create blood smears. Blood smears were stained with Wright-Geimsa stain. Slides were scored to determine the ratio of lymphocytes to neutrophils. Results of this study will be used in conjunction with plasma corticosterone assays to validate the use of leukocytes profiles for determining stress levels in pitvipers.

**0360 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Theresa Gunn, Christine Bedore

*Georgia Southern University, Statesboro, Georgia, USA*

## Environmental control of yellow stingray camouflage

Many reef fishes exhibit dynamic coloration and body patterns that can change under nervous control. Lowe et al (1996) showed that hammerheads in high UV environments have higher skin melanin concentrations, which likely functions as a protective mechanism against UV damage. However, several species of benthic sharks and rays likely alter melanin concentrations in the skin to provide background matching for camouflage. The yellow stingray (*Urobatis jamaicensis*) is a small, reef-dwelling elasmobranch with elaborate spot patterns that differs dramatically from other local stingrays, which are primarily uniformly drab. Because yellow stingrays likely match their environment as a predator avoidance strategy, melanin responses to UV may also be controlled by other environmental mechanisms such as background (e.g. sand, reef) color. To investigate the environmental parameters that induce changes in melanin concentration of yellow stingrays, we housed rays in one of four color environments: completely white, completely black, black walls and a white bottom, and white walls and a black bottom and one of two light environments: 24h light (UV present) and 24h dark (UV absent). We observed that the rays changed the brightness of their skin to match that of the bottom of their experimental tanks, regardless of presence or absence of UV light. We plan to further examine the underlying visual and physiological mechanisms that control color change in the yellow stingray.

**0345 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Tristan Guttridge[1], Lucy Howey-Jordan[3], Maurits Van Zinnicq Bergmann[1], Jean-Sebastien Finger[2], Steven Kessel[5], Jill Brooks[6], William Winram[7], Mark Bond[4], Lance Jordan[3], Christopher Bolte[1], Rachael Cashman[1], Nathaniel Grimes[1], Emily Tolentino[2], Samuel Gruber[8]

*[1]Bimini Biological Field Station Foundation, Bimini, Bahamas, [2]Humboldt University, Berlin, Germany, [3]Microwave Telemetry, MD, USA, [4]Florida International University, Miami, FL, USA, [5]Windsor University, Windsor, Canada, [6]Carleton University, Ottawa, Canada, [7]Watermen Project, Geneva, Switzerland, [8]University of Miami, FL, USA*

## Better in the Bahamas? Regional connectivity and seasonal residency of the great hammerhead shark in the U.S.A. and the Bahamas

The great hammerhead shark *Sphyrna mokarran*, is a large bodied, broadly distributed tropical shark typically restricted to coastal and shelf habitats. It is highly valued for its fins (in target and incidental fisheries), suffers high bycatch mortality coupled with low fecundity, and as a result is considered vulnerable to over-exploitation and population depletion. Although there is very little species specific data available, the absence of recent catch records give cause to suspect 25-year population declines across its range. Here, using a combination of satellite and acoustic telemetry we assessed the movement patterns and habitat use of the Endangered (IUCN Redlist) *S. mokarran* tagged in Bimini, The Bahamas, and Jupiter, Florida, USA. Since 2011, ten individuals were implanted with V16 acoustic transmitters and tracked through an acoustic array data share consortium off the coast of Jupiter. In January 2014 and 2015 in Bimini, 18 *S. mokarran* were fitted with V16 acoustic tags and four were tagged with high rate pop-off archival satellite tags. A receiver array was established in various habitats in Bimini to monitor their local movements. Results revealed large scale return migrations (up to 1200 km), seasonal residency to local areas (some for 5 months), site fidelity (annual return to Bimini and Jupiter for many individuals) and numerous international movements. These findings significantly enhance our understanding of the movement ecology of *S. mokarran* and will contribute to their improved conservation and management.

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**0385 General Herpetology, Galerie 2, Thursday 7 July 2016**

Jacquelyn Guzy, Clint Bush, Kelly Halloran, Meredith Swartwout, Chelsea Kross, John D. Willson

*University of Arkansas, Fayetteville, AR, USA*

## Distribution and Abundance of Introduced Seal Salamanders (*Desmognathus monticola*) in Northwest Arkansas, USA

Invasive species are one of the primary threats to global biodiversity and cause substantial economic damage worldwide. Invasive reptiles and amphibians are gaining recognition as an emerging group of harmful species [e.g. Burmese python (*Python m. bivittatus*), brown tree snake (*Boiga irregularis*), cane toad (*Rhinella marina*), and American bullfrog (*Lithobates catesbeianus*)]. In 2003 an introduced population of Seal Salamanders (*Desmognathus monticola*), was found in Northwest Arkansas, in Spavinaw Creek and genetic evidence confirmed an introduction from northern Georgia. Very little is known about the distribution and abundance of this non-native Arkansas population of *D. monticola*, thus, the primary objective of this study was to assess the current distribution and abundance of non-native *D. monticola* along Spavinaw Creek. To map the distribution of the species, we conducted repeated low intensity visual surveys along the Arkansas extent of Spavinaw Creek to examine occupancy probability relative to river mile and habitat covariates. We also conducted a short-term capture-mark-recapture study to estimate abundance of *D. monticola* at the original collection site on Spavinaw Creek. We found a clear geographic pattern of *D. monticola* distribution, with individuals found throughout the upper 10 km of Spavinaw Creek headwaters, at very high densities of up to 14.5 *D. monticola* per m2. Our results reveal that this recent invader is more widely distributed than previously recognized, and this distribution, in conjunction with high densities, suggests that *D. monticola* could have negative impacts on the ecosystems of Spavinaw Creek and surrounding watersheds in the Ozark highlands.

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**0798 Herp Morphology & Genetics, Galerie 3, Sunday 10 July 2016**

Travis Hagey[1], Christofer Clemente[0]

*[1]Michigan State University, East Lansing, Michigan, USA, [2]University of the Sunshine Coast, Sippy Downs, Queensland, Australia*

## Variation in Limb Length Across Lizards

Evolutionarily convergent traits are typically assumed to occur as a result of similar ecological conditions or genetic, developmental, or mechanical constraints. Although many examples of convergent morphologies have been described, convergence has rarely been looked at across large clades. We will quantify lizard limb and body length, investigating variation in slope and y-intercept values across clades. We hypothesize that different clades will exhibit unique regression values with ecologically convergent species also converging in limb length morphospace.

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**0709 Fish Systematics II, Salon F-H, Saturday 9 July 2016**

Dominik Halas

*University of Toronto Scarborough, Toronto, Canada*

### Nuclear loci support morphological, not mitochondrial, species delimitations in the *Notropis rubellus* species group

Over the past several decades, molecular phylogenetic data have revolutionized the study of the relationships of North American freshwater fishes; gene sequences are now available for the vast majority of taxa. Most taxa were initially assessed using mitochondrial genes only; frequently, the results of these studies suggested that traditional, morphologically-based species delimitations were incorrect. However, the increasing use of multi-locus genetic data in systematic studies is demonstrating, in many cases, that morphological-mitochondrial discordance is often due to mitochondrial introgression between species, rather than due to homoplastic and misleading morphological characters. The *Notropis rubellus* species group, a group of minnow species in the family Cyprinidae distributed throughout eastern North America, is one such case. Two previous studies, one using only mitochondrial data and the other using only morphological data, showed several incongruities in the geographical limits of species within the group. Now, using five nuclear loci in addition to mitochondrial sequences, I demonstrate that species boundaries within the group as determined using nuclear genetic data match those determined using morphological information, and that the incongruity of the mitochondrial data is due to introgression. This study serves as a warning that taxonomic decisions should not necessarily be made when discordance is discovered between mitochondrial and morphological data, until the cause for the discordance is determined.

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**0697 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Dominik Halas, Nathan Lovejoy, Nicholas Mandrak

*University of Toronto Scarborough, Toronto, Canada*

### Goldfish (*Carassius* spp.) Diversity in North America: Implications for Invasive Species Management

The Goldfish, Carassius *auratus*, a global invader, was first introduced to North America in the 1600s as a food fish and continues to be imported by the food and pet trades. This species and its five additional congeners have been shown to have negative ecological impacts in many areas where they have been introduced. As result, many North American jurisdictions have conducted risk assessments on, and developed regulations to prevent the introduction of, the other *Carassius* species. Most of these morphologically similar species are also raised for food or pets and have been introduced outside their

native ranges and, in some cases, this has led to hybridization. In this study, we genotyped North American specimens of wild-caught fish identified morphologically as *C. auratus* to confirm their true identity. We found that genetic diversity in North American *C. auratus* is minimal; one widespread cytochrome *b* haplotype is found in the vast majority of specimens. The Asian and eastern European species *Carassius gibelio* was confirmed to exist in Alberta and Saskatchewan, and the Japanese endemic *Carassius langsdorfii* is reported in North America for the first time. This study demonstrates that several species of *Carassius* have been introduced across North America under the guise of the common Goldfish. These findings have implications for proposed regulations on the importation of goldfishes other than *C. auratus* – some of them are already in North America!

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**0442 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Amber Hale, Mark Merchant

*McNeese State University, Lake Charles, LA, USA*

**Structure and expression analysis of crocodilian NF-κB in American alligators**

We are interested in crocodilian immune function, specifically Nuclear Factor kappa B (NF-kB) which is a pleiotropic transcription factor that plays a vital role in a variety of biological processes. Its regulatory role in the early phases of inflammation is critical for proper immune function. We found the NF-kB gene in all three lineages of crocodilians, and the deduced amino acid sequences show a high degree of identity with mammalian and avian species. We identified Dimerization, Death, and Rel domains, a nuclear localization signal, a signal sequence, and ankyrin repeats. Western blot analysis showed the presence of both the 50 kDa mature protein and the 105 kDa precursor protein in alligator liver (*Alligator mississippiensis*) liver. Immunohistochemistry was performed on livers taken from both healthy alligators and alligators inoculated with bacteria 24 hour prior. Immunohistochemistry shows a reduction of NF-kB in the cytoplasm and an increase of NF-kB presence in the nucleus of the hepatocytes from the inoculated alligator as compared to the hepatocytes of the healthy alligator. Because the structure, processing, expression, and nuclear translocation of crocodilian NF-kB is similar to the mammalian analog, we presume that the function is similar.

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**0523 Squamate Biology, Balconies L & M, Sunday 10 July 2016**

Ben Halliwell[1], Tobias Uller[2], Erik Wapstra[1], Geoffrey While[1]

*[1]University of Tasmania, Tasmania, Australia, [2]Edward Grey Institute, University of Oxford, Oxfordshire, UK*

## Habitat structure mediates social and mating behaviour in a family living lizard

The occurrence of kin-based social organisation represents a turning point in evolution whereby local genetic relatedness can be exploited to increase gene frequencies through behavioural cooperation with relatives. Insights into the factors responsible for both the diversity and stability of social systems are crucial for enhancing our understanding of key evolutionary processes. However the precise conditions that favour the origin and maintenance of sociality remain unclear. Both theoretical and empirical studies suggest that physical characteristics of the environment play a key role in mediating social complexity. Using experimental techniques in a semi-natural setting, we investigated how the physical structure of habitats influenced various aspects of social behavior in the family living skink, *Liopholis whitii*. We show that habitat structure influences several key aspects of social and mating behaviour, including male-female overlap, formation of social pair bonds and opportunities for sexual selection, but does not affect rates of polyandry or polygyny. We also present results from follow-up experiments investigating factors that mediate offspring dispersal and discuss our findings in the context of the origin and diversification of social complexity.



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**0384 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016**

Kelly M. Halloran[1], Jacquelyn C. Guzy[1], Jessica A. Homyack[2], John D. Willson[1]

*[1]University of Arkansas, Fayetteville, AR, USA, [2]Weyerhaeuser Company, Vanceboro, NC, USA*

## Effect of Timber Harvest on Survival and Movement of the Ouachita Dusky Salamander (*Desmognathus brimleyorum*)

Clearcut timber harvesting drastically alters forest ecosystems. In addition to conspicuous structural changes, timber harvesting can negatively affect some plethodontid salamanders. Using a Before-After-Control-Impact design, we are examining the effects of clearcut timber harvesting on a stream-dwelling salamander endemic to the Ouachita Mountains, *Desmognathus brimleyorum*. Due to their sensitivity to anthropogenic habitat alteration, amphibians like *D. brimleyorum* are considered bioindicators of ecosystem health, but few studies of forestry effects have focused on stream-dwelling salamanders or evaluated mechanisms driving observed shifts in abundance (e.g., mortality vs. movement). Under a robust design sampling framework, we conducted a capture-mark-recapture study at three streams within intensely managed pine forests in west-central Arkansas from May 2014-June 2016. The pinelands

surrounding two of the streams were harvested in January 2015 and 2016 respectively. For each capture/recapture, we recorded the location of each individual salamander to assess movement in the stream before and after harvest. Using program MARK, we estimated salamander survival over the course of two years and compared rates of change between the harvested and control streams. The results of this study will help inform management decisions aimed at conserving biodiversity and ecosystem integrity in landscapes managed for timber production.

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## 0971 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016

Brian Halstead[1], Patrick Kleeman[2]

*[1]U.S.Geological Survey, Dixon, CA, USA, [2]U.S. Geological Survey, Point Reyes, CA, USA*

### Ecology of California Red-legged Frogs (*Rana draytonii*) in Coastal Dune Systems

Habitat restoration is generally viewed as a positive conservation measure for plants and wildlife, but conflicts can arise if rare or endangered species rely upon non-native species or altered habitats. In much of coastal California, humans have stabilized inherently unstable coastal dune systems with non-native plants such as European beachgrass (*Ammophila arenaria*) and iceplant (*Carpobrotus edulis*), and efforts are underway to remove these invasive plants and re-establish dynamic dune systems dominated by native species. During dune restoration activities at Point Reyes National Seashore, California red-legged frogs (*Rana draytonii*) were found inhabiting coastal dune drainages. We studied the occurrence, spatial ecology, and habitat selection of California red-legged frogs in coastal dune drainages to understand their ecology in this ecosystem. We surveyed 25 sites in 20 seasonal drainages that run through dunes with independent double-observer surveys and found > 90% occupancy by California red-legged frogs. Radio telemetry of 22 adult frogs in three drainages indicated that from April through September, monitored frogs moved a mean distance of 78 m (range 0 - 620 m) between initial capture and last known location, and all frogs remained in the drainage in which they were initially captured, even though the habitat dried considerably. Frogs selected log jams and the bottom of drainages, and avoided invasive non-native plants. California red-legged frogs are widespread in coastal dune systems degraded by non-native vegetation at Point Reyes National Seashore; how they will respond to dune restoration remains a mystery.

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**0502 SSAR SEIBERT AWARD ECOLOGY, Galerie 3, Thursday 7 July 2016**

Gregor Hamilton[1], Randy Jennings[1], Bruce Christman[2], Erika Nowak[3]

*[1]Western New Mexico University, Silver City, NM, USA, [2]Private Conservation Herpetologist, Albuquerque, NM, USA, [3]Northern Arizona University, Flagstaff, AZ, USA*

## Effects of Invasive Crayfish on Dermal Scarring in Indigenous Gartersnakes (*Thamnophis*) in Southwestern New Mexico

Many freshwater ecosystems encounter stresses from climate change, habitat alteration, and invasive species. Organisms in freshwater ecosystems of the arid southwest are particularly susceptible to these stresses. The Gila and San Francisco River drainages in southwestern New Mexico are host to invasive crayfish. Three species of gartersnakes (*T. rufipunctatus*, *T. elegans*, and *T. cyrtopsis*), indigenous to southwestern New Mexico, are dependent on aquatic prey to varying degrees due to diverse diets and foraging strategies. Crayfish are thought to negatively impact gartersnake species through predation and through direct/indirect resource competition, although supporting data are limited. This study assessed the following aspects of gartersnake ecology related to dermal scarring as an indicator of injury: 1- differences in scarring among sites or correlated with the presence of invasive species of crayfish; 2- differences in scarring among gartersnake species; 3- differences in scarring among ages of gartersnakes; 4- effect of scarring on the health of garter-snakes (using SVL adjusted mass as a surrogate). Three study sites with recent populations of these snakes were surveyed during field seasons in 2014 and 2015: Tularosa River; Middle Fork of Gila River; and Saliz Creek. Scarring was not correlated with crayfish presence for any gartersnake species. *Thamnophis elegans* exhibited more scars at the Middle Fork than at other sites and exhibited more scars than *T. rufipunctatus*. *Thamnophis rufipunctatus* may be a more sensitive species to perturbations (negative correlation between scarring and health). These results were likely influenced by recent catastrophic wildfires and associated flooding.

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**0414 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Neil Hammerschlag[1], Shanta Barley[2], Duncan Irschick[3], Jessica Meeuwig[2], Emily Nelson[1], Mark Meekan[4]

*[1]University of Miami, Miami, Florida, USA, [2]Universiyt of Western Australia, Perth, Western Australia, Australia, [3]University of Massachusetts at Amherst, Amherst, Massachusetts, USA, [4]Australian Institute of Marine Science, Perth, Western Australia, Australia*

## Fishery depletion of sharks cause morphological changes in prey

The ecological and evolutionary consequences of shark population declines on ecosystems are of scientific and conservation concern. Here, we examine the indirect effects of humans on ecological communities via the depletion of sharks in large

ecosystems spanning hundreds of kilometers. We provide evidence that the removal of sharks drives changes in the morphological traits of seven different prey fishes that vary in behavior, body type, diet and trophic guild. On coral reefs that have experienced the selective removal of sharks, fishes have significantly smaller caudal fins and eyes compared to similar reefs with relatively intact shark populations. We suggest that these morphological changes represent a case of rapid evolution due to predator removals. Our findings further demonstrate the ecological and evolutionary importance of sharks and their need for effective and timely conservation.

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**0234 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Dawei Han[1], Bruce Young[2]

*[1]Truman State University, Kirksville, MO, USA, [2]A.T. Still University, Kirksville, MO, USA*

**The Root of Audition in Snakes**

The neural pathway for audition in snakes has never been detailed, and the limited previous studies have been contradictory. Snakes are likely to differ from the "typical" reptilian pattern due to: 1) the loss of internal coupling between the middle ears and the tympanum; 2) a biophysical preference for vibration detection over sound pressure detection; and 3) the apparent loss of all of the high frequency portion of the auditory response. Previous studies have shown little interspecific variation in the auditory performance of snakes, but habitat-related differences in the vestibular apparatus. In reptiles the peripheral portion of the VIIIth cranial nerve consist of anterior and posterior branches which lead to respective ganglia; axons from these ganglionic neurons project to the first-order cochlear and vestibular nuclei in the brainstem. Since the anterior and posterior branches can be mixed (containing both vestibular and cochlear axons), a clear understanding of this system is essential to a detailed map of the auditory system. A variety of species were selected for their phylogenetic position and habitat preferences. Complete serial histological sections were made through the auditory region, and 3-D neural reconstructions made of anterior and posterior branches and ganglia. Considerable variation was found in the size and branching pattern of both peripheral components of the VIIIth nerve; the relative size and spatial position of ganglia also varied. The pattern of variation suggests that phylogeny, rather than sensory specializations associated with specialized habitats, has the greatest influence on this portion of ophidian neuroanatomy.

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**0168 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Alexander Hansell[1], Janne Haugen[1], Sofia Gabriel[1], Kim Friedman[2], Steven Cadrin[2]

*[1]Department of Fisheries Oceanography, School for Marine Science and Technology, University of Massachusetts - Dartmouth, Fairhaven, MA, USA, [2]Marine and Inland Fisheries Branch, Food and Agriculture Organization of the United Nations (FAO), Rome, Italy*

## Impact of CITES Listing, Cop16, on the Scalloped Hammerhead, *Sphyrna lewini*, in Brazil

The Convention on International Trade in Endangered Species (CITES) is an international regulatory agreement between 181 countries that aims to ensure international trade does not threaten the survival of endangered species. In 2013, at the Conference of Parties to CITES (CoP16) the scalloped hammerhead (*Sphyrna lewini*) was listed in Appendix II, with a deferred activation date of 2014. To evaluate the effectiveness and impacts of this listing, a fishery assessment framework was created, to assess 5 key categories of the fishery i) governance, ii) fishers, iii) stocks, iv) trade and v) socio-cultural issues. This framework was applied to scalloped hammerhead fisheries in Brazil, as hammerhead captures in Brazil were noted as globally high before the CoP16 legislation. Changes across three subsections for each category and gaps in implementation, with suggestions for activities to address deficiencies, were documented. Information was obtained from reports and interviews from the United Nations Food and Agriculture Organization and Brazilian fisheries. This case study demonstrates the utility of a new fishery assessment framework to determine 'what is' and 'what isn't' working in managing a fishery for a CITES Appendix II listed species. Preliminary results reveal changes in all five categories and highlights growing artisanal fisheries and shark meat trade. Highlighting and monitoring a broad range of CITES related impacts on the Brazilian scalloped hammerhead fishery offers valuable feedback to management to evaluate current policy initiatives and drive adaptive management.

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**0170 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Alexander Hansell[1], Steven Kessel[3], Steven Cadrin[1], Gregory Skomal[4], Samuel Gruber[5], Tristan Guttridge[2]

*[1]Department of Fisheries Oceanography, School for Marine Science and Technology, University of Massachusetts - Dartmouth, Fairhaven, MA, USA, [2]Bimini Biological Filed Station, South, Bimini, Bahamas, [3]University of Windsor, Great Lakes Institute for Environmental Research, Windsor, ON, Canada, [4]Massachusetts Division of Marine Fisheries, New Bedford, MA, USA, [5]Division of Marine Biology and Fisheries, Rosenstiel School of Marine and Atmospheric Science, Miami, FL, USA*

## Demographics and Local Abundance Trends for the Coastal Shark Assemblage of Bimini, Bahamas

Understanding population dynamics is essential for implementing effective conservation and management of coastal sharks. Fishery-independent surveys can offer valuable information for data-limited situations. A 12-year (2004-2015) standardized, shallow water longline assessment was conducted monthly in the eastern coastal waters of Bimini, Bahamas. Each survey was comprised of five longline sets, totaling 75 hooks, with a soak time of 24 hours. A total of 684 sharks from nine species were caught over the course of the study with tiger (*Galeocerdo cuvier*), nurse (*Ginglymostoma cirratum*), blacktip (*Carcharhinus limbatus*) and lemon (*Negaprion brevirostris*) sharks comprising 94.9% of the catch. Based on total length, the majority of tiger (91.3%), nurse (54.4%), and lemon (81%) sharks were immature, while most blacktip sharks (84.6%) were mature. A sexual bias was noted in the data. The tiger (77.3%) and blacktip (58.3%) sharks were more often female, while the majority of lemon (73%) and nurse (56.8%) sharks were male. Furthermore, seasonal trends indicate an abundance of nurse, blacktip, and lemon sharks during the summer. Annual trends indicate an increasing tiger shark population and stable nurse, blacktip, and lemon shark populations. General additive models indicate that catch rates are influenced by month, year, temperature, tide, soak time, and lunar cycle.

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**0113 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Emma Hanslowe[1], Bryan Falk[1], Robert Reed[2]

*[1]United States Geological Survey, Homestead, Florida, USA, [2]United States Geological Survey, Fort Collins, Colorado, USA*

## Assessing Establishment Risk of Exotic Large-bodied Constrictor Snakes to the Florida Keys

The first reports of exotic large-bodied constrictor snakes from the Florida Keys occurred in 2002 and have since increased in frequency and credibility. A comprehensive summary of these reports is important for understanding propagule pressure and spatiotemporal trends of boas, pythons, and other large-bodied constrictors in the

Florida Keys. We compiled records of exotic constrictor snakes from the Florida Keys using available sources of information (Early Detection and Distribution Mapping System, Everglades National Park, Florida Museum of Natural History, Monroe County Sheriff's Office, our records, media accounts, and local contacts) and cross-referenced them to eliminate duplicates. We assigned credibility scores to each record. Over 100 specimens and/or reported sightings of exotic constrictor snakes have occurred in the Florida Keys over the past 14 years. Burmese pythons (*Python molurus bivittatus*), boa constrictors (*Boa constrictor*), and ball pythons (*Python regius*) are the most frequently reported species. Key Largo is the northernmost island of the Florida Keys and is adjacent to the established mainland population of invasive Burmese pythons. A recent spike in Burmese python captures on Key Largo implies that python population increases on the mainland may be driving dispersal to Key Largo and therefore increasing establishment risk. Increased public outreach as well as effective early detection and rapid response may be needed to prevent establishment and associated ecological impacts of boas and pythons in the Florida Keys.

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**0067 HL GRADUATE RESEARCH AWARD, Galerie 2, Thursday 7 July 2016**

Maggie Hantak, Shawn Kuchta

*Ohio University, Athens, Ohio, USA*

### Color Polymorphism in the Eastern Red-backed Salamander: Are the Morphs Equally Camouflaged?

Color polymorphism is the presence of two or more discrete, genetically determined color morphs in a population. In many cases, the ecological and evolutionary dynamics maintaining polymorphisms are not well understood. One hypothesis is that polymorphism is maintained by interactions with visual predators, either by way of apostatic selection, or by being differentially camouflaged in different microhabitats or seasons. In general, organisms that better blend into their background have an increased chance of survival. The Eastern Red-backed Salamander, *Plethodon cinereus*, contains two common color morphs, a striped morph and an unstriped morph. Presently, it is not known which of these two morphs is more cryptic, or if the answer to this question is context dependent. To address this question, I studied three populations in Ohio: a monomorphic striped population, a monomorphic unstriped population, and a polymorphic population. At these populations information was gathered on whether the two morphs differ in their relative camouflage across seasons, light conditions, and habitats. A spectrometer was used to collect reflectance measurements from color patches, providing measures of brightness, hue and chroma. Reflectance measurements were collected from background colors (leaf-litter), and salamanders from each population. I am running this color data through mathematical models of the avian and mammal visual system to quantify how well each morph blends into the background. Overall, this study will provide essential data for better understanding the adaptive basis of the polymorphism, and what evolutionary and ecological dynamics might be involved in its maintenance.

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**1056 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Antony Harold[1], Dana Warheit[1], Miranda Brooker[1], Tasneem Dossaji[1], Michelle D'Aguillo[2]

*[1]College of Charleston, Charleston, South Carolina, USA, [2]Duke University, Durham, North Carolina, USA*

### Ontogeny of jaw and pharyngobranchial dentition in the naked goby, *Gobiosoma bosc* (Teleostei: Gobiidae)

We undertook a study of the ontogeny of jaw and pharyngobranchial teeth in *Gobiosoma bosc*, a western North Atlantic estuarine goby species. A series of about 40 specimens ranging in size from 17 to 52 mm SL were cleared and counter-stained using standard methods. The lower jaw and the pharyngobranchial apparatus were removed in order that teeth could be oriented for measurement using an eye piece reticle. Based on our observations, in the smallest gobies (17 to 23 mm SL) teeth located on the premaxilla and dentary were slightly elongate and conical, and distributed in a villiform field. At body sizes of about 25 to 28 mm SL jaw teeth begin to be differentiated in three distinct types: a lateral row of robust, elongate and slightly recurved teeth, a medial row of similar, but more recurved teeth, and between those two series there is a field of short, straight teeth in a villiform field. Pharyngobranchial teeth are elongate, less curved and shorter than the enlarged jaw teeth in the same individual. The development of the two series of differentiated slightly hooked teeth of the jaws in larger naked gobies may be an adaptation for grasping the relatively large and mobile prey that form the bulk of their diet.

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**0568 Herp Biogeography, Salon D, Friday 8 July 2016**

Sean Harrington

*San Diego State University, California, USA*

### Phylogeographic structure within the Red Diamond Rattlesnake (*Crotalus ruber*) of Baja California: A genomic perspective based on RADseq data

The Red Diamond Rattlesnake, *Crotalus ruber*, is a large rattlesnake endemic to Baja California and Southern California. The distribution of *C. ruber* spans the entire Baja California Peninsula and extends north to Southern Los Angeles and San Bernadino Counties. Many mtDNA-based studies have investigated the phylogeographic structure of lineages that span the Baja California Peninsula and found spatially congruent breaks among taxa. However, studies using nuclear DNA to investigate the genetic structure and phylogeographic history of squamates across the peninsula have been scarce. We investigated the phylogeography of *C. ruber* to determine if this species shows breaks congruent with other species and characterize the processes that have produced spatial genetic structure. We used a next-generation DNA sequencing approach to obtain

thousands of RADseq loci from across the genome of individuals spanning the mainland range of *C. ruber*. Using a combination of clustering, phylogenetic, and population genetic modelling approaches, we show that mainland *C. ruber* is composed of distinct northern and southern populations that contact near Loreto, Baja California Sur, congruent with the contact zone between the traditionally recognized subspecies *C. ruber ruber* and *C. r. lucasensis* and major breaks between lineages in other groups. These populations show evidence of high levels of migration and admixture, particularly from the southern population into the northern population. We hypothesize that the observed structure is the result of historical isolation of these populations followed by secondary contact.

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**0346 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Phillip Harris[1], Do Van Tu[2]

[1]*The University of Alabama, Tuscaloosa, AL, USA,* [2]*Vietnam Academy of Science and Technology, Ha Noi, Viet Nam*

**The Freshwater Fishes of the Nam Chan River Basin, Vietnam**

In March and November 2015, researchers from the Vietnamese Academy of Science and Technology and The University of Alabama conducted a preliminary survey of freshwater fishes in the Hoang Lien-Van Ban Nature Preserve and Nam Chan River basin in northwestern Vietnam. Although this nature preserve is a recognized biodiversity hotspot in Vietnam for terrestrial taxa, aquatic taxa within the nature preserve and remaining river basin have never been surveyed despite development of multiple headwater hydroelectric dams in the nature preserve. We collected approximately 33 species of fishes from 15 locations in the basin. Within these collections are undescribed species of *Rhinogobius* (Gobiidae) and, possibly, *Vanmanenia* (Balitoridae).

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**0317 Fish Ecology II, Salon A-C, Saturday 9 July 2016**

Bret Harvey, Jason White

*USFS Redwood Sciences Lab, Arcata, CA, USA*

**Axes of Fear for Stream Fish: Water Depth and Distance to Cover**

To better understand habitat-specific predation risk for stream fish, we used an approach that assumes animals trade off food for safety and accurately assess risk such that predation risk can be measured as a foraging cost: animals demand greater harvest rates to occupy riskier locations. We measured the foraging cost of predation risk for juvenile salmonids at locations that varied in water depth and distance to cover. Measurements relied on a food delivery apparatus and direct observations that allowed estimation of giving-up harvest rates. Juvenile steelhead about 120 mm fork length

exhibited sharp increases in the harvest rates they demanded with decreasing water depth and refused to use the feeding device even when offered extreme food delivery rates in water ≤ 20 cm deep. Distance to cover also affected giving-up harvest rates, particularly between 25 cm and 75 cm from cover, but to a lesser extent overall than did water depth. Assuming the gradients we observed in giving-up harvest rates reflect predation risk, the results of this study can be applied to spatially explicit models of stream fish populations that incorporate risk into both habitat selection and mortality due to predation.

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**0766 Snake Ecology, Galerie 3, Sunday 10 July 2016**

Jessica Harvey, Karl Larsen

*Thompson Rivers University, Kamloops, British Columbia, Canada*

## Rattlesnake migration in Canada and its relationship to the thermal properties of landscapes

The selection of habitat by reptiles based on thermal criteria has been well-studied at smaller scales (i.e. microsite), but larger scale selection also may be important, particularly in colder climates. In Canada, Western Rattlesnakes (*Crotalus oreganus*) reach their northern limits in the province of British Columbia. Here, recent work has shown that the snakes not only use warm, low-elevation grasslands, but also higher-elevation forests. We investigated the reasons and implications of this dichotomy by monitoring the migratory movements of 35 snakes from 10 den sites, and comparing their habitat use to thermal landscape maps generated through GIS. We verified that this variation in migratory behaviour exists throughout the region, and also showed that the snakes using the forests moved relatively further during their migration, and also tended to use warmer areas within the landscape, thus compensating for this large-scale habitat use. These snakes also had better body condition. Potential benefits from using this migratory tactic also include outbreeding and food availability, other areas we are now beginning to explore. Overall, insight into the patterns and repercussions of using these different habitats will allow conservation plans to be tailored more specifically, perhaps even to individual dens. Climate change also has obvious, potential implications for the snakes due to shifting ecosystem boundaries and thermal regimes.

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**0310 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Philip Hastings[1], Kevin Conway[2]

*[1]Scripps Institution of Oceanography, La Jolla, California, USA, [2]Texas A&M University, College Station, Texas, USA*

## A New Species of Clingfish (Teleostei: Gobiesocidae) from Los Frailes Submarine Canyon, Gulf of California, Mexico, with Comments on Depth Distributions of Clingfishes

A new species of clingfish of the genus *Gobiesox* is described from a single specimen collected from 300 meters depth in the Los Frailes submarine canyon in the southwestern Gulf of California. The "Canyon Clingfish" is unique in the genus *Gobiesox* in having a lanceolate caudal fin, and is also distinguished by the combination of 14 dorsal-fin rays (first tiny and unsegmented), 11 anal-fin rays, 28 pectoral-fin rays, anus slightly closer to anal-fin origin than to posterior margin of pelvic disc, and dorsal-fin origin in front of vertical from anus. It is most similar to another eastern Pacific species, *Gobiesox eugrammus* Briggs, 1955, known from southern California, the coast of outer Baja California, and Isla Guadelupe. Heretofore the deepest record for a species of the genus *Gobiesox* is 82 m (*G. eugrammus* type locality at Guadalupe Island). While most species of clingfishes are found in relatively shallow waters, several genera have representatives in deep waters with only two species, *Alabes bathys* Hutchins, 2006 (known to 348 m) and *Kopua nuimata* Hardy, 1984 (to 337 m), found deeper than the Canyon Clingfish.

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**0623 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Jeff Hathaway

*Scales Nature Park, Orillia, ON, Canada*

## Next steps for the Saving Turtles at Risk Today (START) Project

The Saving Turtles at Risk Today (START) project is a multi-species project involving staff, trained volunteers, and community members. The large study area comprises approximately 2000 km2 of relatively natural Precambrian shield in central Ontario, Canada, with a mosaic of wetlands, water bodies, forests, and human habitation. Four years into this long-term project, one M.Sc. student has finished and two more are starting. Overall achievements, challenges and future directions will be briefly presented to elicit feedback and facilitate discussion. These include: habitat protection through species at risk observations, changes to marking methods, measuring the contribution of anthropogenic nest sites (i.e. roadsides) to the population using DNA techniques to develop a 'family tree', and the expansion of the project into an adjacent highly anthropogenic landscape.

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**0155 AES Conservation & Management I, Balconies L & M, Friday 8 July 2016**

Janne B. Haugen[1], Steven X. Cadrin[1], Alexander C. Hansell[1], Sofia M. Gabriel[1], Cate O'Keefe[1], Tobey H. Curtis[2], Kim Friedman[3]

*[1]Department of Fisheries Oceanography, School for Marine Science and Technology, University of Massachusetts - Dartmouth, Fairhaven, MA, USA, [2]National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office, Gloucester, MA, USA, [3]Marine and Inland Fisheries Branch, Food and Agriculture Organization of the United Nations, Rome, Italy*

## Evaluating the Impacts of CITES on the Northeast Atlantic Porbeagle *(Lamna nasus)* Stock

The porbeagle shark *(Lamna nasus)* was listed in the Convention on International Trade in Endangered Species (CITES) Appendix II in 2013, with the effective date in 2014. To evaluate the effectiveness of the adoption of porbeagle sharks into CITES, we created a broad fishery assessment framework to review and monitor impacts of this recent trade regulation. Information and data were collected for five sections of the framework: i) Governance, ii) Fishers, iii) Stocks, iv) Trade and v) Socio-Cultural issues, from the Food and Agriculture Organization and European fishery sources. Workshops and interviews with local communities and fishery managers were organized to generate feedback and input on the design and indicators used in the framework. We identified changes under three subsections of each of the five sections of the framework, and assessed the effectiveness and impacts of these changes, as well as the need for future support. Most of the impacts of the CITES listing, such as changes in policy and management, landings and handling of by-catch, were under sections i-iii in the framework, with less information available on the trade value chain, livelihoods and community awareness. Determining CITES related impacts on porbeagle shark stocks through time offers feedback to policy and management on what is and is not working, to ensure productive and sustainable management of porbeagle fisheries. This case study may serve as a demonstration of how a fishery assessment framework can be used for evaluation of other CITES listed species, including more data-limited elasmobranchs.

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**0746 NIA BEST STUDENT PAPER, Salon A-C, Friday 8 July 2016**

Frances Hauser[1], Katriina Ilves[2], Ryan Schott[1], Hernan Lopez-Fernandez[3], Belinda Chang[1]

*[1]University of Toronto, Toronto, ON, Canada, [2]Pace University, New York, NY, USA, [3]Royal Ontario Museum, Toronto, ON, Canada*

## Evolutionary Dynamics of the Dim-Light Visual Pigment in Neotropical Cichlid Fishes

Cichlid fishes of South and Central America comprise one of the most diverse fish families in the region, and vary considerably in trophic morphology, body shape, and

life history. Recent studies in this group also provide support for substantial increases in functional and lineage diversification in cichlids that invaded Central America. A comparatively understudied aspect of Neotropical cichlid ecology and evolution is the visual system. While evolutionary studies of African lake cichlids have underscored the importance of visual pigment (opsin gene) variation in their adaptive radiation, little is known of the visual pigment diversity in their Neotropical relatives. Moreover, few studies have investigated the ecological factors mediating opsin evolution in riverine, rather than lake-based radiations. We used cross-species hybrid enrichment to sequence opsin genes from 130 Neotropical cichlid species, spanning the diversity of the clade. Molecular evolutionary analyses of rhodopsin support high levels of positive diversifying selection across the Neotropical cichlid tree. The three most diverse Neotropical cichlid tribes (Cichlasomatini, Geophagini, and Heroini) showed evidence for strong positive selection in rhodopsin, and the highest molecular evolutionary rates were consistently found in Central American cichlids. Clade-based partitioning analyses supported divergence of rhodopsin following invasion into Central America, and recovered unique sites under positive selection, suggesting a divergence in rhodopsin function between South and Central American cichlids. These results highlight the efficacy of using ecological hypotheses to guide molecular evolutionary analyses, and also reveal key insights into visual pigment evolution in cichlid fishes.

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**0019 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Malorie Hayes

*Auburn University, Auburn, AL, USA*

**Mentorship and Membership, two keys to a successful future**

When preparing to give a talk for the ASIH Centennial, I reflected on the turning points in my early career. The path I am on now was never the path I intended to take. Instead, I started working closely with some passionate ichthyologists, and passion is contagious. When dealing with people who work with a group as amazing and diverse as fish, you find equally amazing and diverse people. Through the example of my personal experience, I hope to convey the importance of mentorship in building successful organismal biologists. Establishing strong, supportive relationships among experienced scientists and upcoming (and sometimes uncertain!) students will be one factor in sustaining the ASIH over the next 100 years.

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**0018 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Malorie Hayes, Jonathan Armbruster

*Auburn University, Auburn, AL, USA*

**A new genus of minnow in West Africa and a new species from the Ogooué River Basin in Gabon (Cypriniformes: Cyprinidae)**

Genus *Enteromius* (formerly '*Barbus*') includes nearly 300 species that lack informative phylogenetic placement, and the genus is likely composed of multiple genera in need of a diagnosis. This study describes a new genus formerly included in *Enteromius* as well as a new species. The new genus can be diagnosed by its lack of barbels, incomplete lateral line, and presence of a pseudotympanum. Five species are placed within the new genus: *Enteromius jae* (Boulenger 1903), *E. condei* (van den Bergh and Teugels 1998), *E. nounensis* (van den Bergh and Teugels 1998), and *E. parajae* (van den Bergh and Teugels, 1998), as well as the new species. A molecular phylogeny is also presented demonstrating the placement of the new genus and species in the context of *Enteromius*.

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**0229 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Mark Hayes

*Cherokee Nation Technologies/USGS, Fort Collins, Colorado, USA*

**Temporal Patterns of Invasion by Non-native Reptiles in Florida**

In southeastern United States the number of documented occurrences of non-native reptiles is increasing, suggesting that increasing densities of non-native reptiles may be adversely impacting ecosystems and native species of conservation concern. To help inform management decisions related to non-native reptiles, I used polynomial regression, Akaike information criterion (AIC), multi-model inference, and resulting polynomial functions to investigate temporal patterns of invasion by 14 non-native reptiles documented in Florida using 20 years of data in the Early Detection and Distribution Mapping System (EDDMapS) dataset. For each species I compiled occurrence data and fit third- and forth-order polynomial functions to data representing unique occurrences, then selected the best fitting model using AIC. I then used this function for each species as a first approximation model and used first and second derivatives of each function to estimate whether the number of new occurrences was increasing or decreasing, and whether such change was accelerating or decelerating. This analysis suggests the empirically-derived hypotheses that the number of unique occurrences documented for Argentine black and white tegus (*Tupinambis merianae*) and Green iguanas (*Iguana iguana*) are rapidly increasing relative to other species in Florida, and the number of unique locations documented for Nile monitors (*Varanus niloticus*) and Burmese pythons (*Python molurus*) are decreasing relative to other species. I conclude by briefly discussing potential biases in the EDDMapS data for reptiles, and

how these and similar results can be synthesized with species distribution models and spatial spread models to better understand biological invasions by non-native reptiles.

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**1069 HL: Social Behavior in Reptiles Symposium, Salon E, Saturday 9 July 2016**

Robert Heathcote[2], James Stroud[1]

*[1]Florida International University, Miami, FL, USA, [2]University of Exeter, England, UK*

**Social networks and species coexistence of *Anolis* lizards**

The use of social network theory (SNT) to examine how social network structure (SNS) might influence the social dynamics of non-human animals is still in its relative infancy. Even more overlooked are those animals formerly considered 'non-social', such as the reptiles. Using replicated allopatric and sympatric populations we investigated the underlying mechanisms which allow two ecologically and morphologically similar lizards - the Cuban brown anole (*A. sagrei*) and the Puerto Rican crested anole (*A. cristaellus*) - to coexist in Miami FL. We then trialed a new research method to construct social networks of both species across these conditions. This research aims to understand how species coexistence may affect sociality.

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**0782 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Steven Hein[1], Joshua Banta[2], Kate Hertweck[2], Mitch Barazowski[2], John Placyk[2]

*[1]Miami University, Oxford, OH, USA, [2]University of Texas at Tyler, Tyler, TX, USA*

**A Phylogenetic Reassessment of the Western Massasauga, *Sistrurus tergeminus*, and its Putative Subspecies**

The massasauga rattlesnake was recently divided into two distinct species, the Eastern, *Sistrurus catenatus*, and the Western, *S. tergeminus*, with the latter further being subdivided into the Prairie, *S. t. tergeminus*, and the Desert, *S. t edwardsii*. The subspecies boundaries between *S. t. tergeminus* and *S. t. edwardsii* were originally based on, in part, unreliable and highly variable morphological characteristics, requiring more modern approaches to testing the validity of these subspecies distinctions. Ecological niche models based on *a priori* geographical subspecies assignments display significantly different ecological niches between *S. t. tergeminus* and *S. t. edwardsii*. However, if these ecological distinctions are reflective of true evolutionary divergence as opposed to, for example, morphological plasticity to different habitat types or segregating genetic variation within a single species, then phylogenetic data should reveal reciprocal monophyly between the two subspecies. We used genetic data from eight genes, five nuclear and three mitochondrial, to evaluate the phylogenetic relationship between *S. t. tergeminus* and *S. t. edwardsii*. Our data indicate that *S. t. tergeminus* and *S. t. edwardsii* are not reciprocally monophyletic. Therefore, the ecological differences are not reflective of

the evolutionary history within the species, and the validity of these two subspecies as discrete taxa should be reconsidered. This work illustrates that ecological niche modeling can be misleading when morphological characteristics are used to classify the subspecies to be used for the models. Future studies should employ more sensitive molecular techniques, such as microsatellites or RAD Sequencing, to assess the gene flow populations.

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**0233 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Berlynna Heres, Shane Welch, Anne Axel, Thomas Pauley, Jayme Waldron

*Marshall University, Huntington, WV, USA*

**Ambush Site Selection in Eastern Diamondback Rattlesnakes Using Vegetation Analysis and Radio Telemetry**

We examined foraging site selection in Eastern Diamondback Rattlesnakes (*Crotalus adamanteus*, EDB). The EDB is an imperiled, ambush predator endemic to southeastern pine savannas and woodlands. Eastern diamondbacks prey on grainivores, such as rodents, who in turn feed primarily on nuts and berries (hard and soft mast). In this study, we hypothesized that intra-seasonal shifts in masting vegetation would cause intra-season shifts in ambush site selection in EDBs. We quantified EDB foraging site selection using radio telemetry data and vegetation analysis within a naturalized study site. When EDBs were encountered in ambush posture, i.e. tightly coiled, we quantified vegetation structure at the 'selected' location and at two random locations. We measured understory, overstory structure and masting characteristics within each vegetation plot. Over the study period (June-August), we quantified vegetation structure at 35 ambush sites and paired random locations, totaling 105 plots. We used conditional logistic regression to examine to model ambush site selection. We selected five *a priori* models to examine ambush site selection, including soft mast presence, hard mast presence, and canopy cover as predictors. Our top models supported our hypothesis, indicating a significant association with soft mast producing vegetation during times when soft mast was present. Hard mast presence was also an important predictor of EDB ambush sites. The results of this study indicate that EDB foraging site selection reflects mast availability, which should be considered in efforts to manage EDB populations and their prey.

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**0204 Lightning Talks, Galerie 2, Saturday 9 July 2016**

John Herman, Wendy Brosse

*Florida Gulf Coast University, Fort Myers, FL, USA*

### Movement ecology and natural history of *Crotalus adamanteus* (Eastern Diamondback Rattlesnake) in South Florida

*Crotalus adamanteus* (Eastern Diamondback Rattlesnake) is a large charismatic, although often misunderstood and maligned, species found in Southeastern USA. While reports about the decline of this species have been given for decades the majority of our knowledge is based on northern populations, e.g. Georgia and South Carolina. Here we present some of our preliminary findings about the movement ecology and natural history of a southern population with some comparisons to the current "northern" knowledge base. We recommend that future conservation management plans consider a more regional approach to account for natural history differences in wide-ranging species, such as many large-bodied snakes.

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**0911 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Rafael Hernández Guzmán[1], Luis H. Escalera-Vazquez[1], Ireri Suazo[2]

[1]*Cátedras CONACYT– Instituto de Investigaciones sobre los Recursos Naturales, Universidad Michoacana de San Nicolás de Hidalgo., Morelia, Michoacán, Mexico,* [2]*Instituto de Investigaciones sobre los Recursos Naturales, Universidad Michoacana de San Nicolás de Hidalgo., Morelia, Michoacán, Mexico*

### Predicting the Distribution of *Ambystoma ordinarium* Under Different Climate Scenarios in Central Mexico

Amphibians are susceptible to the effects of changing climates due to their restrictive physiological requirements and low vagility; however, little is known about which species are vulnerable to climate change. Species distribution models (SDMs) are used to assess the relationship between climate variables and species distributions, and to forecast changes in species distributions under climate change. Our objective in this study was to forecast changes in the distribution of *Ambystoma ordinarium* regarding different climate scenarios. Forty-eight records were selected to model current potential distribution and two scenarios based on 2070 climate projections (CCSM4-RCP 2.6 and CCSM4-RCP 8.5) using MaxEnt model. A total of six scenarios were simulated: three scenarios with two different threshold rules (minimum training presence (mtp) and the 10 percentile training presence (10ptp). Output maps were restricted to five physiographic sub provinces (four located in the Mexican Volcanic Belt and one located in the Sierra Madre del Sur). For all scenarios, the average training AUC for the replicate runs were higher than 0.985 ± 0.002, representing a good performance for current and projected geographical distributions of *A. ordinarium*. Under a conservative scenario, an average potential distribution area around 19,700 km2 was defined for current conditions, increasing to 20,300 km2 for CCSM4-RCP 2.6 and decreasing by 2,200 km2 if

CCSM4-RCP 8.5 scenario is expected. Results are useful for future conservation plans, and to identify changing landscapes related to climate change and it's the potential resilience of the habitat of *A. ordinarium* in the face of climate change.

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**0281 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Salon A-C, Friday 8 July 2016**

Alexandra Herrera[1], Kevin de Queiroz[2]

*[1]George Washington University, Washington, DC, USA, [2]National Museum of Natural History, Smithsonian Institution, Washington, DC, USA*

## Comparative Phylogeography of Three Widespread *Anolis* Species Across the Puerto Rico Bank

Geographic distribution of populations is the result of historical processes, including vicariance and dispersal. Tectonic movements and sea level changes affecting the Puerto Rican Bank (PRB; Puerto Rico and the Virgin Islands) indicate that the constituent islands have been isolated and reunited several times since the Miocene. *Anolis cristatellus, A. pulchellus and A. stratulus* are widely distributed on the PRB. We used DNA sequences to study genetic variation in these species, and contrast it with isolation patterns across the PRB. Analysis of population structure, phylogenetic analyses, divergence time estimation, and species delimitation analyses were performed for each species. Within *A. pulchellus*, a strongly supported divergence separates populations in south Puerto Rico (PR) from those in northeast PR and the Virgin Islands. This divergence occurred in the Pliocene, during the orogenesis in PR. *Anolis stratulus* exhibited a strongly supported divergence between populations in PR, Culebra and Vieques versus those in the Virgin Islands. This divergence occurred at the end of the Pliocene, after the formation of the Virgin Passage. Three populations are strongly supported within *A. cristatellus,* where East PR is sister to a clade formed by the Virgin Islands and south PR. Divergence between east PR and south PR+Virgin Islands was estimated at the Miocene-Pliocene transition, when the Mona and Virgin Passages formed. Divergence between south PR and the Virgin Islands was estimated at ca. 1.18 ma, during a glaciation event. Our results indicate that the three species have been differentially affected by the geological phenomena that shaped the PRB.

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**0061 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Michelle Heupel[1], Colin Simpfendorfer[2]

*[1]Australian Institute of Marine Science, Townsville, Qld, Australia, [2]James Cook University, Townsville, Qld, Australia*

**Drivers of reef shark movement: what's most important?**

Predator presence has been reported to influence the movement and behaviour patterns of prey species in various ecosystems. The movement of predators is thus key to the behaviour patterns of prey populations and defining their corresponding movements. However, the drivers of movement patterns in predators are much more difficult to define, especially in aquatic environments. Here we explore the movement patterns of reef sharks as a case study in drivers of marine predator movement. Long-term acoustic telemetry data collected from reef sharks (grey reef, blacktip reef, silvertip, tiger and bull sharks) within the Great Barrier Reef over a five year period were examined to determine potential drivers of movement. Telemetry data revealed complex movement patterns of reef sharks that vary by size, sex, species and habitat type. Some of the common drivers for coastal species, such as environmental conditions, appear to be irrelevant to most reef shark movements. This indicates biological drivers are more important in the movement patterns of these individuals. This talk will consider the importance of various drivers of reef shark movements and the implications of these drivers for defining ecosystem dynamics and within the context of conservation management.

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**0112 Squamate Biology, Balconies L & M, Sunday 10 July 2016**

Diana Hews[1], Ryan Seddon[1], Cuauhcihuatl Vital-Garcia[2], Jaime Zúñiga-Vega[3], Emília Martins[4]

*[1]Indiana State University, Terre Haute, IN, USA, [2]Universidad Nacional Autónoma de México, Mexico City, DF, Mexico, [3]Universidad Autónoma de Ciudad Juarez, Juarez, CH, Mexico, [4]Indiana University, Bloomington, IN, USA*

**Phylogenetic Analyses of *Sceloporus* Lizards Reveal that Species with Abdominal Blue Patches Have Higher Plasma Testosterone Levels**

Lineages with evolutionary losses and gains of sexually-selected traits are of special interest to biologists that study male and female correlations in trait expression. In male *Sceloporus* lizards, blue abdominal patches are ancestral, while absence of male blue patches is derived and has evolved several times. In the several species that have been studied, early exposure to androgens hormonally organizes the skin and blue patches are permanently expressed in adult males. The blue is exposed with specific postural displays used during male-male aggression. Hence expression of male blue in a given species may be associated with higher levels of territorial display behavior and activity, both of which are androgen-mediated behaviors. We test the hypothesis that males in blue species will have higher breeding-season levels of testosterone than males in non-

blue species. We selected blue-loss species and a closer blue relative of each, in several clades within *Sceloporus.* Analyses controlling for phylogeny (using phylogenetically independent contrasts and phylogenetic generalized least squares) revealed that, in species in which males are blue (*grammicus, parvus, graciosus, occidentalis*), both males and females have significantly higher plasma testosterone than the comparable sex in species in which males have lost the blue patches (*megalepidurus, cozumelae, siniferus, virgatus*). Hence breeding-season levels of testosterone appear to co-evolve with presence of blue abdominal patches in males, and females may simply show correlated responses. However, three study taxa had female gain of abdominal blue, and females in these species had the highest androgen levels and exhibit aggression, suggesting blue functionality.

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**0109 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Toby Hibbitts[1], Wade Ryberg[1], Dalton Neuharth[1], Connor Adams[1], Drew Dittmer[1], Johanna Harvey[1], Gary Voelker[1], Ben Labay[2], John Paul Pierre[2], Brad Wolaver[2], Travis LaDuc[2]

*[1]Texas A&M University, College Station, TX, USA, [2]University of Texas, Austin, TX, USA*

## Current Distribution and Phylogenetic Relationships of *Holbrookia lacerata* in Texas

The Spot-tailed Earless Lizard (*Holbrookia lacerata*) has been thought to be an uncommon species over most of its distribution. Surveys conducted in 2009 were only able to detect the species at or near 12 of the 219 historic localities and only one locality within the distribution of *H. l. subcaudalis*. Based on the few records observed in the 2009 surveys and the apparent extirpation of the species at locations in the south and east of the lizard's distribution it was petitioned for federal listing. Also, the USFWS found in its review of the petition that this species warranted further research to determine if federal listing was needed. In this study we conducted surveys across the entire historic distribution to determine the current species distribution and to collect tissues to determine if the northern (*H. l. lacerata*) and southern subspecies (*H. l. subcaudalis*) were genetically distinct from one another. We based our selection of survey sites on distribution modeling, visual inspection of habitat, and accessibility to low-traffic public roads. We used mtDNA (ND2) and nDNA (rag1) to investigate the validity of the two currently recognized subspecies.

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**0785 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Jeremy M. Higgs[1], Jill M. Hendon[1], Dana M. Bethea[2], James A. Sulikowski[3], Eric R. Hoffmayer[4], William B. Driggers[4]

*[1]The University of Southern Mississippi, Gulf Coast Research Laboratory, Center for Fisheries Research and Development, Ocean Springs, MS, USA, [2]National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City Laboratory, Panama City, FL, USA, [3]University of New England, Department of Marine Sciences, Marine Science Education and Research Center, Biddeford, ME, USA, [4]National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, Pascagoula, MS, USA*

## Age and growth of the finetooth shark, *Carcharhinus isodon*, in the northern Gulf of Mexico: a multi-model approach

Age, growth, and size and age at maturity estimates were examined for finetooth sharks (*Carcharhinus isodon*) in the northern Gulf of Mexico (GOM). Life history data were examined from a total of 711 finetooth sharks (424 female; 287 male) collected in coastal waters between Apalachicola Bay, Florida and East Bay, Louisiana from April 2007 through September 2013. Size and age at which 50% of the finetooth population was estimated to be mature was 1032 and 962 mm fork length (FL) and 4.1 and 3.6 years for females and males, respectively. The observed maximum size and age was 1384 and 1130-mm FL and 9.4 and 6.5 years for females and males, respectively. Sex-specific, two and three parameter von Bertalanffy, Gompertz, and logistic growth models were fitted to the size-at-age data and were found to be statistically significant $p < 0.05$. Examination of models of best fit to the data indicated female growth was best described by the logistic model and male growth was best described by the three parameter von Bertalanffy. Three parameter von Bertalanffy model estimates for females and males were: $L_\infty$ = 1308-mm FL and k = 0.26/yr and $L_\infty$ = 1164-mm FL and k = 0.32/yr, respectively. The findings of this study further expand knowledge of the life history estimates of finetooth sharks in the nGOM.

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**0702 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Cory Hillard, David Penning

*University of Louisiana at Lafayette, Lafayette, Louisiana, USA*

## Quantitative Effects of Body Temperature on Snake Strike Performance: New Insights Into the Elastic-Recoil Hypothesis

For many ectotherms, temperature has a profound effect on performance, such as for the sprint speeds of lizards. However, elastic-recoil mechanisms have allowed other

ectotherms to partially circumvent temperature dependence, such as the tongue-projection mechanisms of some salamanders and chameleons. Based on pre-strike muscle activation in a viper, previous work hypothesized that striking behavior in snakes is accomplished by elastic recoil of the muscle-tendon complex. With elastic-recoil mechanisms being partially independent of temperature, we would expect strike performance in snakes to be independent of temperature under the elastic-recoil hypothesis. However, work on another viper has shown that temperature significantly affects strike performance. Here, we set out to test the effects of temperature on defensive strike performance in adult western ratsnakes (*Pantherophis obsoletus*). To do this, we tested each snake across 5 temperatures (15-35°C) and recorded 3-8 defensive strikes at each body temperature using a high-speed camera (250 fps) and Tracker 4.87 software. We analyzed peak performance values for each of four strike variables: maximum strike distance (m), minimum strike duration (s), maximum strike velocity ($ms^{-1}$), and maximum strike acceleration ($ms^{-2}$). We treated each strike variable as a dependent variable and the temperature category as the independent variable (repeated measure) in order to characterize the effects of body temperature on strike performance.

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**0098 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Eric Hilton

*Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, USA*

## ASIH History, Personal Reminisces, and an Introduction to the Symposium: Setting the Stage for the Next 100 Years

Following the advice of William E. Bemis, my Ph.D. advisor, who upon my entry into graduate school guided me to find "my" professional society, the ASIH has, in a sense, been central to my professional life. This society seemed to be a natural fit, as my early exposure and first love of organismal biology stemmed largely from the influence of Alan M. Richmond and my experiences volunteering in the Herpetology collection at UMass, Amherst (only later did Willy bring me over to ichthyology!). I delivered my first professional research presentation at the 1997 meeting of the ASIH in Seattle. I published my first sole-authored paper in Copeia, which resulted from the first project I solely developed and saw through to publication; coincidentally this same paper was also the first I had rejected - both great learning experiences! I have since gone on to become involved with the Society in several capacities, and it was a particular honor to be asked to chair the committee charged with "appropriately celebrating the centennial" of the ASIH. This centennial process has been enlightening, as it has given me the opportunity to collaboratively delve into the history of ichthyology and herpetology from the perspective of the Society. It has also allowed me to interact with other members of the Society, from students to established ichthyologists and herpetologists, as we reflect on the role of the ASIH now and into the future. From these perspectives, this presentation will be partially historical, partially autobiographical, and partially prospective.

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**0682 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Eric Hilton[1], Ann Matarese[2], Duane Stevenson[2]

*[1]Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, USA, [2]NOAA-Fisheries, Alaska Fisheries Science Center, Seattle, WA, USA*

## Development of the Skeleton of the Northern Ronquil, *Ronquilus jordani*, With Notes on the Ontogeny and Osteology of Other Members of the Family Bathymasteridae (Zoarcoidei)

Bathymasteridae comprises seven species in three genera (*Ronquilus*, *Rathbunella*, and *Bathymaster*) distributed along the coast of the North Pacific Ocean. The family is often considered to be the basal-most family of Zoarcoidei; recent molecular studies recover it as a basal paraphyletic grade of the suborder. We examined the ontogeny of the skeleton in *R. jordani* based on cleared and stained specimens (8.2-115 mm SL) to better understand the skeleton of these fishes. Cartilages of neural and haemal arches are present in our smallest specimens, and centra are ossified by 15.0 mm. Ossification of the axial skeleton begins near the midpoint of the caudal vertebrae, and proceeds anteriorly and posteriorly from there. By 19.0 mm the axial skeleton is completely formed, and by 34 mm the median-fin rays are completely developed. At 8.2 mm the first cartilaginous elements of the caudal fin are present, and at 29.7 mm the caudal fin skeleton is completely ossified. Within the paired fins the dermal components of the pectoral girdle are among the first bones to form (e.g., cleithrum present by 8.2 mm), whereas the pelvic girdle forms later, with the pelvic bone just becoming differentiated at 13.5 mm. Ongoing work will extend this investigation to the elements of the cranium, forming a baseline for comparative ontogenetic studies within the family and among zoarcoid taxa.

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**0968 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Alice Hirschmann, Nelson Fagundes, Luiz Malabarba

*UFRGS, Porto Alegre, RS, Brazil*

## Why the young smiling tetra, *Bryconamericus lethostigmus*, doesn't smile (Characiformes: Characidae)

*Bryconamericus lethostigmus* was described as the type species of the monotypic characid genus *Odontostoechus*. Recently, a new proposal of classification of the Stevardiinae placed *Odontostoechus* as a junior synonym of a monophyletic genus *Bryconamericus sensu stricto*, while other studies comparing mouth morphology found it related to the genera *Bryconacidnus*, *Ceratobranchia*, *Monotocheirodon*, *Othonocheirodus*, *Rhinopetitia* and *Rhinobrycon*. We redescribe *B. lethostigmus* and analysed the mouth shape and the origin of a single tooth series in the premaxilla in a species of a group characterized by the presence of two tooth series. A total of 319 specimens were analysed morphologically.

This study demonstrates that the single tooth row in *B. lethostigmus* is originated from the merging of the external tooth row with the inner row during ontogeny, and disagrees with the primary hypothesis of homology between the mouth characters found in the *B. lethostigmus* and the genera *Bryconacidnus*, *Ceratobranchia*, *Monotocheirodon*, *Othonocheirodus*, *Rhinopetitia* and *Rhinobrycon*.

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**0771 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Caitlin Hirsh, Jason Ortega, Steven Beaupre

*University of Arkansas, Fayetteville, AR, USA*

### Validation of the use of doubly labeled water for measuring metabolic rate in Timber Rattlesnakes (*Crotalus horridus*)

The doubly labeled water method is an isotopic technique for measuring field metabolic rate and water flux rates of free-living animals. We present a validation of the use of doubly labeled water for measuring metabolic rate and water loss in Timber Rattlesnakes (*Crotalus horridus*). For this study seven animals of varying body size were used with masses ranging from 148 to 650 grams. Prior to dosing, blood samples were taken to establish background isotope levels for each animal. Snakes were injected with water enriched with isotopes of oxygen (18O) and hydrogen (2H, deuterium). The injected isotopes were then allowed to equilibrate with the animals' body water pool for 3 hours and then a second blood sample was taken. Following the second blood sample, animals were placed into metabolic chambers and metabolic rates ($VCO_2$ and $VO_2$) were measured using open-flow respirometry for 20 days. During metabolic measurements water loss for each snake was estimated via Drierite uptake. On the $20^{th}$ day, final blood samples were taken to determine isotope turnover rates. Measured $CO_2$ production by gas exchange will be compared to $CO_2$ production calculated from isotopic data. Water flux measured by Drierite uptake will be compared to water flux calculated from isotopic data. Despite years of application of the DLW technique, validation studies are few: our data are the first such validation in pitvipers.

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**0206 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016**

Nathaniel Hitt, Erin Snook, Danielle Massie

*US Geological Survey. Leetown Science Center, Kearneysville, WV, USA*

### Inference from long-term data for theoretical and applied freshwater fish ecology

We describe the utility of long-term fish community data for (a) testing ecological theory, (b) assessing climate and land use change, (c) monitoring ecological restoration,

and (d) modeling invasive species spread. We review a series of case studies from our research to demonstrate each topic. First, we describe a test of community assembly rules from resampling Burton and Odum (1945) sites in Virginia. We show that temporal variation exceeds spatial variation in several cases. Second, we describe several studies evaluating climate drivers for native brook trout populations in Appalachia. We show that brook trout recruitment is most sensitive to winter flows, and that this inference required multiyear data. Third, we describe inferences for monitoring fish population recovery after a dam removal in Virginia, highlighting the utility of time-series forecasting. Fourth, we show how long-term data enable analysis of invasive fish abundances in the Potomac River using hierarchical Bayesian modeling. We show that the precision of change-estimates increases (i.e, CIs decrease) with the length of the time-series. Central themes from the case studies are (a) long-term data are necessary for many theoretical and applied questions in fish ecology and (b) coordination with multiple investigators and institutions is often required to build sufficient datasets in this regard.

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**0572 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Joshua Hittie

*Loyola University Chicago, Chicago, IL, USA*

**Evolution of Life-History Characteristics in Gadiform Fishes**

Life -history characteristics (e.g., age and growth) have been used extensively to understand the temporal population dynamics of fish species. Few studies have examined these characteristics in a phylogenetic framework. Or even if such characteristics have phylogenetic signal. This study examines how life-history characteristics may have evolved in the suborder Gadoidei (cods), and how much of a phylogenetic foundation there may be for the evolution of these traits. A phylogeny of Gadoidei based on molecular data and incorporating representatives from all genera was constructed. Within this phylogenetic framework, life-history traits, including growth rates, age at maturity, and longevity were mapped to determined when these characteristics evolved, if they are broadly shared among the studied groups or if they characterize each group separately. To determine to what extent, common ancestry plays a role in the development of life-history traits in Gadoidei, ecological data, including habitat and trophic data, was analyzed for each target species in the study. If a group shares a close ancestry and has different ecologies but shares similar life history traits, it is hypothesized that phylogenetics plays a strong role in the evolution of life-history traits in addition to environmental pressures. This study will provide foundational information for future studies of Gadoidei in the face of climate change constraints.

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**0087 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Mackenzie Hlesciak, C. Tristan Stayton

*Bucknell University, Lewisburg, PA, USA*

**Analysis of evolutionary patterns and rates of sexual size dimorphism and sexual shape dimorphism in turtles**

We investigated large-scale patterns of the evolution of sexual shape dimorphism (SShD) and sexual size dimorphism (SSD) in turtles, through the following hypotheses: H1) Female and male turtles consistently differ in shape in all turtle species. H2) Female and male turtles show additional differences within certain habitats. H3) Rates of evolution of SSD and SShD vary among turtle families. H4) Rates of evolution of SSD and SShD vary among habitats. Hypotheses were tested using data from 255 turtle species (of which 226 had both males and females). We tested our first hypothesis by creating separate phylomorphospaces for both females and males, and analyzing the differences using phylogenetic MANOVA. We tested for differences in rates of SSD evolution using a Brownian model of rate variation, and for differences in the rates of SShD evolution using a modification of the compare.evol.rates function in the R package geomorph. There was no evidence of consistent shape differences between females and males across all turtles. SSD in aquatic species evolved significantly faster than in terrestrial species. SSD in aquatic species may evolve faster because of a greater variety of selective pressures that may be encountered in water as opposed to land, or different modes of sexual selection in different environments. The lack of consistent differences between sexes was surprising, but females and males of different species may achieve the same functional result with a variety of different shapes. Future studies will analyze SSD and SShD in turtles of different sizes, latitudes, and ecosystems.

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**0077 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016**

Christopher Hoagstrom

*Weber State University, Ogden, Utah, USA*

**Using long-term data to solve a minnow-conservation puzzle**

The U.S. Fish & Wildlife Service, with the New Mexico Department of Game & Fish, began long-term monitoring for federally protected (threatened) Pecos bluntnose shiner in 1992 as part of a five-year multi-agency Memorandum of Understanding, funded by the U.S. Bureau of Reclamation. This was in response to a jeopardy opinion targeting operation of Sumner Dam as an immediate threat to the protected population. Reclamation continues to support monitoring. Monitoring data from equably spaced locations sampled several times per year documented population crashes associated with dewatering, confirming that river desiccation jeopardized the population. Data

also confirmed perpetual restriction of adults to a less degraded river reach where shallow waters flowed across shifting sands. Length measurements made on all individuals captured from 1994 on allowed detailed population analyses, indicating population size reflected annual recruitment and suggesting negative relations of annual recruitment versus discharge. This supported the inference that high-flow associated spawning and propagule vulnerability to drift combined to reduce recruitment via elevated displacement when prolonged reservoir releases filled the degraded river channel. However, distributional data supported other evidence of some propagule retention in a less degraded reach. There was also support of independent evidence for inter-reach connectivity via apparent upstream dispersal of some displaced individuals. Long-term population data provided a context for hypothesis-driven studies, creating potential for focused management. But, many more years of comparable data are needed to better assess inter-decadal trends and allow independent assessment of recruitment in typical years (i.e. no desiccation) versus exceptional years (i.e. prolonged desiccation).

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**0105 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Kelly Hodgskins, Stephanie Greenleaf, Jonathan Hillman, Bruce Stallsmith

*University of Alabama in Huntsville, Huntsville, AL, USA*

## Reproductive Schedule of the Silver Shiner (*Notropis photogenis*) in the Flint River of Alabama

Many river-dwelling species of fish are dependent upon and stimulated by fluctuations in river flow for successful reproduction. This is especially true of pelagophils, a reproductive guild whose eggs and larvae require free drifting on river currents for several days. *Notropis photogenis* (Silver Shiner) is a rheophilic species with a broad distribution from Ontario to the southeastern United States including northern tributaries to the Tennessee River in Alabama. Little is known of its reproductive biology. The purpose of this study was to describe aspects of reproductive biology such as timing and pattern of ovarian development and oocyte maturation of *N. photogenis* in the Flint River of Alabama. We investigated whether and how abiotic cues such as river discharge and temperatures were related to ovulation and spawning. Monthly fish collections were made from August, 2011, to July, 2013. From these collections monthly gonadosomatic index (GSI) was evaluated, along with the status of ovarian maturation, oocyte maturation and size, and oocyte counts to establish fecundity and clutch size. Median monthly river discharges in cubic feet per second for 1999–2015 were obtained from the U.S. Geological Survey database. Observations over two years showed associations between daily mean discharge and months of peak GSI (February–April). Mean GSI peaked in March of both 2012 and 2013 when median flow was approximately 600 cfs. Large synchronous spawning events appear to occur during times of steady substantial discharge increases but after peaks of discharge > 3000 cfs.

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**0372 General Herpetology, Galerie 2, Saturday 9 July 2016**

Erin Hodson, Richard Lehtinen

*The College of Wooster, Wooster, Ohio, USA*

**Decline of an Adaptation in a Coral Snake Mimic**

Much research has attempted to elucidate the ways in which new adaptations arise. However, fewer studies have examined the ways in which former adaptations may be lost. One famous adaptation among vertebrates is found in harmless or mildly venomous snakes that mimic the coloration of highly venomous coral snakes. A lineage of particularly precise coral snake mimics are known in the genus *Erythrolamprus* (Dipsadidae). However, one species in this lineage is a relatively poor coral snake mimic: *E. ocellatus* endemic to the Caribbean island of Tobago. It has been suggested that this species is in the process of losing its coral snake mimic coloration. To assess hypotheses related to the apparent loss of effective mimicry in *E. ocellatus*, we took coloration measurements on museum specimens, conducted a field experiment on the islands of Trinidad and Tobago (the latter lacks coral snakes while they are present on the former), and reconstructed the evolutionary history of this lineage using molecular markers. Coloration data confirmed that *E. ocellatus* is an imperfect mimic and our field experiment showed that coral snakes and their mimics receive no protection from predators compared to controls on Tobago. Lastly, our phylogenetic analysis revealed *E. ocellatus* to be a relatively derived member of the coral snake mimic clade of *Erythrolamprus*. Together, these data support the mimetic breakdown hypothesis for imperfect mimicry in *E. ocellatus* and suggest that selection against coral snake resemblance in allopatry drove the decline of this adaptation.

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**0783 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Eric Hoffmayer, Adam Pollack, William Driggers, Christian Jones, Matthew Campbell

*National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, Pascagoula, MS, USA*

**Neritic distribution of bonnetheads, *Sphyrna tiburo*, indicates limited use of inshore nurseries in the western Gulf of Mexico**

The bonnethead, *Sphyrna tiburo*, is a small coastal shark species known to inhabit coastal waters of the northern Gulf of Mexico during spring, summer and fall. Despite showing a clear preference for shallow waters (10-25 m) during warm months, bonnetheads migrate to offshore deeper waters during winter; however, little is known about these seasonal movements or utilization of neritic waters. The objective of this study was to use fishery-independent bottom trawl data to describe the spatial distribution of bonnetheads in the northern Gulf of Mexico. From 1987-2014, 645 bonnetheads (274–1220 mm STL) were captured at 362 stations, with the majority of individuals collected (61%) being young-of-the-year. Catch rates of bonnetheads were higher in the western

Gulf of Mexico and their occurrence was relatively rare in neritic waters east of Mobile Bay. Sharks were captured in depths ranging from 5 to 71 m, with the majority of the sharks captured between 10 and 30 m. Despite their reported preference for shallow waters, 40% of bonnetheads were captured in waters deeper than 25 m. Furthermore, the use of deeper waters (25-55 m) by 46.4% of the young-of-the-year sharks suggests that nursery areas may not be as discrete as previously thought. It is widely stated that blue crabs are the primary prey of bonnetheads; however, stomach content analysis of 25 young-of-the-year individuals collected during the 2015 fall trawl survey indicated that mantis shrimp (*Squilla sp.*) was their primary prey and spatial analysis revealed that the distribution of the two species were highly correlated.

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## 0788 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon A-C, Friday 8 July 2016

Matthew Holding, Lisle Gibbs

*Ohio State University, Columbus, OH, USA*

### Migration, Drift, and the Outcomes of Coevolution between a Rattlesnake and its Venom-resistant Prey

Predators and prey coevolve to produce some of the most extreme and fascinating characteristics of animals, such as the toxic venoms of snakes and physiological venom resistance in their prey. But coevolution is not a simple race to the top: multiple contextual factors affect whether coevolution occurs, its strength, and its outcomes in geographically distinct populations. Recently, we showed a range wide signal of local adaptation of Northern Pacific Rattlesnake (*Crotalus o. oreganus*) venom to overcoming venom resistance in California ground squirrels. However, there is considerable variation in the strength and direction of this functional adaptation from one location to the next, with some locations showing patterns consistent with squirrels being ahead of the snakes. Coevolutionary theory predicts that two demographic factors, effective population size and migration, might explain these variable outcomes, because the species with the relatively higher migration rate and lower power of genetic drift is predicted to more easily climb peaks in the adaptive coevolutionary landscape. I have generated next-generation RAD-sequencing data for over one hundred individuals of both rattlesnakes and ground squirrels across 12 populations, and will use it to test these hypothesized links between demography and coevolution in these vertebrate enemies. Identifying and ranking the factors that drive variable coevolutionary outcomes among populations deepens our geographic mosaic understanding of the coevolutionary process, and relates coevolution to the maintenance of extreme phenotypic diversity within a single species, as exemplified by functional variation in the venoms of pitvipers.

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**0474 Fish Genetics, Salon D, Sunday 10 July 2016**

Christopher Hollenbeck, David Portnoy, John Gold

*Texas A&M University - Corpus Christi, Corpus Christi, Texas, USA*

### Population Genomics of Red Drum, *Sciaenops ocellatus*

Next-generation sequencing technologies have enabled cost-effective screening of thousands of genetic markers for nearly any species, allowing for the assessment of the relative effects of micro-evolutionary phenomena that impact the genome as a whole (e.g., genetic drift) and phenomena that have locus-specific impacts (e.g., natural selection). A population genomics assessment of red drum in the Gulf of Mexico (hereafter Gulf) and U.S. Atlantic Ocean (hereafter Atlantic) was conducted. A total of 563 juvenile (0-3 year old) red drum were sampled between 2008 and 2015 from 11 localities in the Gulf and Atlantic; spanning from South Carolina to Texas. Individuals were genotyped using double-digest Restriction Site-associated DNA (ddRAD) sequencing at 2,860 SNP loci, which were then collapsed into 1,539 multi-allelic RAD haplotype loci. Analysis of population structure with putatively neutral loci revealed three distinct genetic units of red drum, corresponding to western Gulf, eastern Gulf, and Atlantic regions. Population structure analysis with FST outlier loci, putatively under selection, suggested the presence of local adaptive differences among the three regions. A genetic linkage map was used to explore genomic patterns of differentiation and revealed distinct physical clustering of outlier loci and comparative genomics identified candidate genes in the regions of interest. The data highlight the value of combining dense genome-wide sampling of genetic markers with genomic position data to provide insight into the micro-evolutionary forces that create patterns of genomic variation in marine fishes.

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**0811 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Lisa Hollensead[1], Dean Grubbs[1], John Carlson[2], Dana Bethea[2]

*[1]Florida State University, Tallahassee, FL, USA, [2]NOAA NMFS, Panama City, FL, USA*

### Assessing Residence Time and Habitat Use of Juvenile *Pristis pectinata* Using Acoustic Monitoring in a Nursery

Highly productive estuaries have been shown to serve as nurseries for many marine fishes. However, few studies quantitatively measure the biotic characteristics that often drive a habitat's function as a nursery. This information is critical when developing recovery plans for endangered species, such as the smalltooth sawfish (*Pristis pectinata*). This study incorporated a combination of acoustic telemetry monitoring and quantification of biotic attributes in order to assess nursery habitat use of juvenile smalltooth sawfish. In order to monitor movements, thirty-two VEMCO VR2w receivers were deployed within Everglades National Park during 2011. The array was used to

quantify seasonal residency, determine emigration timing, and identify migration corridors. Benthic grain size and organic content along with mangrove prop root density and limb overhang were quantified throughout the study area. These habitat variables were used to construct logistic models in order to test for any relationship between habitat attributes and presence of tagged sawfish. Monitoring results of twenty sawfish were variable. Observed residency within the backcountry nursery ranged from days to several months with overwintering (N=5) occurring along Chokoloskee Island. Three individuals tagged in the backcountry exhibited directed emigration into Chokoloskee Bay in summer via the Lopez River which may be a migration corridor. Results also indicated that sawfish quickly moved through deep-water, narrow creeks and rivers between shallow tidally-influenced bays. A step wise regression analysis of hits per hour incorporating all habitat variables indicated that sawfish had an increased probability of being encountered in areas with high prop root density.

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**0505 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Watcharapong Hongjamrassilp, Philip Hastings

*Scripps Institution of Oceanography, University of California, San Diego, La Jolla, CA, USA*

**Evolution of the Unusual Gaping Display in the Sarcastic Fringehead (Blenniiformes: *Neoclinus blanchardi)***

The gaping display in which an open mouth is presented toward an intruder is one of the visual communication displays used by a variety of fishes and other vertebrates for territory defense. While it can be found in many groups of animals, the gaping display of *Neoclinus blanchardi* is exceptional compared to that of other fishes. This display is greatly amplified by lateral flaring of the extremely long maxillae, which makes the fish appear bigger, and by a bright color inside the oral cavity. To decipher the evolution of this display, we described the osteology and musculature associated with this display, and used the heterochrony framework to describe the morphological changes of the maxilla in an evolutionary timescale among three closely related species of *Neoclinus*: *N. stephensae*, *N. uninotatus*, and *N. blanchardi*. Geometric morphometry and PCA were used to quantify ontogenetic shape changes in males and females of all three species, and thin-plate spline analysis was used to generate a deformation grid of maxilla morphology. The results suggested that three structures are related to the exaggeration of this display in *N. blanchardi*: the buccopalatal membrane, the anterior joint system and posterior elongation of the maxilla, and the adductor mandibularis muscles. The enlarged maxilla of male *N. blanchardi* evolved via peramorphosis (acceleration) compared to the other species. In the largest males, the maxilla extends posteriorly well past the operculum and the expansion area comprises soft (unossified) tissue which is postulated to reduce the cost of this display.

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**0570 Fish Conservation & Morphology, Galerie 2, Sunday 10 July 2016**

Jan Jeffrey Hoover[1], Daniel P. Zielinski[2], Peter W. Sorensen[2]

*[1]US Army Engineer Research and Development Center, Vicksburg, MS, USA, [2]University of Minnesota, St. Paul, MN, USA*

## Swimming Performance and Hydraulic Containment of Bigheaded Carp (Hypophthalmichthys spp.)

High velocity flow fields have been suggested as a technique for containing invasive populations of Bighead Carp (*Hypophthalmichthys nobilis*) and Silver Carp (*H. molitrix*) but swimming performance of adult fish has not been described quantitatively. In spring 2015, we used a newly-designed and constructed 2935 L mobile swim tunnel to measure endurance at prolonged and burst swim speeds (< 10 min endurance) of both species in water velocities 76-244 cm/s. Carp 53.5-104.0 cm TL, 1.5-12.3 kg, were collected from a side channel of the Mississippi River and tested on-site in local water 13.1-25.9 C. Both species exhibited significant linear declines in endurance with increased water velocity, described by log-linear regression models. Maximum observed burst swim speeds for both species were low, < 3.0 body lengths/sec (BLS), but Bighead Carp (N=17) exhibited a steeper decline in endurance, and less point scatter ($R^2 = 0.78$, $p < 0.0001$) than Silver Carp (N = 43) which responded gradually to changes in water velocity and exhibited greater point scatter ($R^2 = 0.19$, $p = 0.0033$). Multiple regression models and an ontogenetic analysis of swimming endurance for both species demonstrated that water temperature and size of adults were negligible and non-significant influences respectively on endurance. Silver Carp, however, exhibited greater variation in behavior (e.g., non-performance, leaping) and in morphology (i.e., variation in length of lower caudal lobe) than Bighead Carp. These data may be used to develop guidelines for hydraulic containment of carp at lock-and-dams in the Upper Mississippi River.

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**0808 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Charlene Hopkins, Shawn Kuchta, Willem Roosenburg

*Ohio University, Athens, Ohio, USA*

## Amphibians Hit the Road: Assessing Roadway Mortality and Ecopassage Utilization along a Two-lane Highway

As roadways reduce amphibian population sizes, disrupt connectivity, and degrade habitat mitigation measures are increasingly being implemented. Barriers and ecopassages are a common strategy used to mitigate roadway impacts. Barriers limit access to roadways and may direct animals toward ecopassages, which are corridors designed to conduct animals safely over or under the roadway. The effectiveness of these mitigation measures for small animals remains poorly studied. We quantified levels of roadway mortality, ecopassage use, and amphibian populations, to assess the effectiveness of a barrier-ecopassage system along a two-lane highway. We also

conducted roadway crossing behavior, ecopassage use, and ecopassage style choice experiments. We will be presenting our findings thus far and directions for future research.

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**0634 HL GRADUATE RESEARCH AWARD, Galerie 2, Thursday 7 July 2016**

Ariel Horner[1], Eric Hoffman[1], Anna Savage[1], Tyler Hether[0]

*[1]University of Central Florida, Orlando, FL, USA, [2]University of Idaho, Moscow, ID, USA*

## Cryptic chytridiomycosis in declining anuran populations of the southeastern United States

Infectious disease is a well-known driver of faunal declines worldwide. In recent decades, emerging infectious diseases (EIDs) have increased for both humans and wildlife. Multiple herpetofaunal groups have been affected by pathogens, but amphibians have had the most significant population declines due to EIDs. North American amphibians have been impacted by two major emerging pathogens, the fungus *Batrachochytrium dendrobatitis (Bd)* and iridoviruses in the genus *Ranavirus (Rv)*. Amphibian populations have responded differently to these disease stressors; some populations have been almost wiped out while others have managed to persist. Environmental factors and host genetics may play important roles in disease dynamics, but few studies incorporate both of these components into their analyses. Our study investigates the effect of environmental and genetic factors on *Bd* and *Rv* infection prevalence and severity in a biodiversity hot spot, the southeastern US. We conducted a retrospective EID infection study on three amphibian species, using quantitative PCR to understand how emerging infectious pathogens have potentially impacted natural populations. By combining genetic factors and environmental variables into a general linear model for species with pathogen infection, we elucidate the relative roles of host genetics and environmental variables on predicting disease impact and spread. We conclude that by incorporating both genetic and environmental factors into conservation plans for amphibians, more effective management strategies can be developed to help protect the Southeast's amphibian biodiversity.

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**0410 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Blake Hossack[1], Ken Honeycutt[1], Todd Preston[2], Holly Puglis[3], William Battaglin[4], Kelly Smalling[5], Douglas Kent[6], Isabelle Cozzarelli[7], Katherine Skalak[7], Joanna Thamke[8], Bruce Smith[4], Chauncey Anderson[9]

*[1]US Geological Survey, Missoula, MT, USA, [2]US Geological Survey, Bozeman, MT, USA, [3]US Geological Survey, Columbia, MO, USA, [4]US Geological Survey, Denver, CO, USA, [5]US Geological Survey, Lawrenceville, NJ, USA, [6]US Geological Survey, Menlo Park, CA, USA, [7]US Geological Survey, Reston, VA, USA, [8]US Geological Survey, Helena, MT, USA, [9]US Geological Survey, Portland, OR, USA*

## Potential Effects of Waste Waters from Oil and Gas Extraction on Amphibians: Preliminary Results from a Multi-partner Investigation

Development of unconventional techniques for oil and gas extraction has fueled an unprecedented expansion of energy extraction and associated economic growth in the northern Great Plains. A large portion of this expansion has occurred in the Williston Basin and Prairie Pothole regions, a landscape with broad expanses of prairie and wetlands that have enormous ecological and economic value. Although disposal practices for waste waters produced during oil and gas extraction have improved greatly, occasional releases can result in large quantities of high-salinity brines that persist in the environment. There is a growing body of work focused on water and sediment chemistry in these areas, but research into effects of wastes on higher trophic levels in wetlands has been limited. We built on existing research and leveraged the work of multiple groups within USGS to conduct a controlled experiment that tests effects of sediment from reference and waste-affected wetlands on survival and growth of amphibian larvae, and estimated species richness and abundance of amphibians across several wetlands spanning a contamination gradient. We also performed chemical analysis of sediment, groundwater, surface water, and amphibian tissues. Results are intended to help inform management decisions about wildlife conservation in the region, efficacy of remediation actions, and improve protocols for management of future oil and gas wastes.

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**0051 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Md Anwar Hossain[1], Benjamin S. Thompson[2], Gawsia Wahidunnesssa Chowdhury[1], Samiul Mohsanin[2], Zubair H. Fahad[2], Heather J. Koldewey[3], Md Anwarul Islam[1]

*[1]Department of Zoology, University of Dhaka, Dhaka, Bangladesh, [2]WildTeam, Dhaka, Bangladesh, [3]Zoological Society of London, London, UK*

## Sawfish exploitation and status in Bangladesh

Sawfish are among the world's most threatened and understudied marine fishes. There are few studies on sawfish from outside Australian and USA waters - a significant

knowledge gap considering their circumtropical distribution and migratory nature. This paper presents the first assessment of sawfish exploitation and status in Bangladesh. A countrywide rapid assessment was undertaken between December 2011 and November 2012, using an interdisciplinary methodology. Fish landing stations, dry fish markets, and fishing villages were visited and a sawfish medicine maker was found and interviewed. In addition, interviews with national specialists at academic and fisheries institutions were undertaken. In total, 203 questionnaire surveys were conducted with fishers and traders in order to understand the extent of decline, potential drivers of declines, and local perceptions and uses of sawfish. Eighteen rostra were documented from museum archives and private collections, and unpublished data were sourced. Two sawfish species, *Pristis pristis* and *Anoxypristis cuspidata* were confirmed to be present in Bangladesh. General population declines were revealed. The average annual sawfish encounter rate (observations and catches) declined from 3.7 individuals using lifetime recall data (~22-year), to 1.5 using 5-year recall data, and further to 0.7 using 1-year recall data. The consensus from social research methods was that sawfish were caught as bycatch, with drift gill nets being cited as the most damaging gear type. Every respondent perceived sawfish as a useful animal. Conservation measures are proposed, including a local education and outreach programme to seek behavioural changes - primarily to release live sawfish.

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**0351 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Kyle Hovey, Emily Seiter, Erin Johnson, Ralph Saporito

*John Carroll University, University Heights, Ohio, USA*

### Do Variable Alkaloid Defenses in the Dendrobatid Poison Frog *Oophaga Pumilio* Provide Equal Protection from Microbial Pathogens?

Amphibians produce the majority of their defensive chemicals, but alkaloid defenses in poison frogs are instead sequestered from dietary arthropods. Alkaloids function as a defense against predators, and certain alkaloids appear to inhibit microbial growth. However, alkaloid defenses vary considerably among populations of poison frogs, reflecting geographic differences in availability of dietary arthropods. Consequently, environmentally driven differences in poison frog alkaloid defenses may have significant implications regarding their protection against pathogens. While natural alkaloid mixtures in poison frogs have recently been shown to inhibit growth of non-pathogenic bacteria and fungi, no studies have examined the effectiveness of alkaloids against microbes that infect frogs. Herein, we examined how alkaloid defenses in the strawberry poison frog, *Oophaga pumilio*, affect growth of the known anuran pathogens *Aeromonas hydrophila* and *Klebsiella pneumoniae*. Frogs were collected from five locations throughout Costa Rica that are known to vary in their alkaloid profiles. Alkaloids were isolated from individual skin samples, and extracts were assayed against both pathogens. Microbe subcultures were inoculated with extracted alkaloids to create dose-response curves, and spectrophotometry was used to compare growth between treatments. GC-MS was used to characterize and quantify alkaloids in frog extracts, and

our results suggest that variation in alkaloid defenses lead to differences in inhibition of these pathogens. This study provides the first evidence that alkaloid variation in a dendrobatid poison frog is associated with differences in inhibition of frog pathogens. Furthermore, our study provides further support that alkaloid defenses in poison frogs confer protection against both pathogens and predators.

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**0641 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Hunter Howell[1], Donald McKnight[2], Richard Seigel[1]

*[1]Towson University, Towson, MD, USA, [2]James Cook University, Townsville, Queensland, Australia*

## A Novel Method of Collecting Spotted Turtles (*Clemmys guttata*)

Effective sampling methods are important for accurate population size estimates and assessing long-term viability of threatened or endangered species. Because different sampling methods are biased towards captures of different sexes or different life stages of a population, it is necessary to determine which sampling method will most reliably and efficiently document a species of interest while minimizing systematic error. Spotted Turtles (*Clemmys guttata*) are listed as a threatened species in Canada, and are listed as an endangered species by the International Union for Conservation of Nature. They are also included in Appendix II of the Convention on International Trade of Endangered Species, and are currently under review for listing under the United States Endangered Species Act. It is, therefore, imperative to be able to effectively monitor *C. guttata* populations, but adequate survey methods for this species are currently lacking. Historically, *C. guttata* have been captured in the field by hand capture surveys and muddling. However, because *C. guttata* is a small, secretive, and cryptic species, hand capture surveys may not be the most effective sampling method. Traditionally, hoop net traps have been used as a collection method for many species of aquatic turtles and multiple variations of these traps exist. Recently, collapsible mesh minnow traps have become an important tool for collecting amphibians and reptiles; however, their effectiveness as a means of capturing *C. guttata* has not been tested. Here, we demonstrate the effectiveness of collapsible mesh minnow traps for collecting *C. guttata* at a site in central Maryland, USA.

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**0736 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Christopher Howey, Michaleia Mead, Mark Herr, Tracy Langkilde

*Pennsylvania State University, University Park, PA, USA*

### Thermoregulation and Predation Risk Trade-offs at Timber Rattlesnake Rookery Sites

Gravid timber rattlesnakes use open, rocky habitat as gestation rookeries where they are able to elevate body temperatures and meet increased energetic demands. Thus, thermal characteristics of rookery sites have fitness implications for snakes that occupy them. Rookery sites vary in how open the area surrounding the rookery is, which may affect thermal characteristics and exposure of snakes to visual predators. This study investigated whether a trade-off exists between thermal quality and risk of predation at rookery sites of varying openness. We found that as the amount of open area surrounding a rookery site increased, the percent canopy cover over the rookery decreased and the thermal environment improved (more often above preferred body temperature). There was no difference in the number of predators that visited the rookery sites, but more open rookeries were visited be a greater variety of predator species that may pose differential threats to adult versus juvenile snakes. These results suggest a possible ecological trade-off between thermal quality and risk of predation. Rookery sites more enclosed by trees had poorer thermal quality which may prolong gestation times and lead to a decreased survival rate for offspring if parturition is too delayed, but may increase survival rates of adults by excluding their visual predators. By contrast, more open rookeries could reduce gestation times and increase survival for offspring, but decrease survival of adults if they are seen by a potential predator.

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**0854 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Steven Hromada[1], C.A.F. Howey[2], C.M. Gienger[1]

*[1]Austin Peay State University, Clarksville, TN, USA, [2]Pennsylvania State University, State College, PA, USA*

### The Impacts of Prescribed Burns on Reptile and Amphibian Communities in Oak/Hickory Forests

Prescribed fire can have important impacts on an ecosystem. These impacts can be direct, in the form of injury and mortality to individuals, or indirect, in the form of changes to preferred resources available within the environment. Most research has focused on the direct impacts of the initial burn, and not on the indirect impacts of a recurring fire regime. Changes in habitat structure (such as a decrease in canopy cover or an increase in forb cover) from prescribed fire can increase availability of preferred microhabitats for some species while reducing the availability of preferred microhabitats of other species. We examined the responses of herpetofaunal communities to a prescribed fire regime in an Oak/Hickory forest located in Land Between the Lakes

National Recreation Area, KY. Four plots were established in an area that received large scale prescribed burns, and four were established in a similar area that has not received any recent fire treatment. Herpetofaunal communities were sampled using drift fences and artificial cover object arrays, and habitat attributes were sampled via transects. Although species richness did not differ between treatments, differences in relative abundances of reptile and amphibian species between treatments reflected differences in habitat structure between treatments. These results suggest that the habitat changes caused by a prescribed fire regime can have indirect impacts on reptile and amphibian populations and community structure.

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**0089 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Eric Hsu, Kate Jackson

*Whitman College, Walla Walla, Washington, USA*

### Developing a Multi-Access Key for Identification for West and Central African Snakes

For centuries, dichotomous keys have been the standard tool for identification of taxa. However, the effectiveness of conventional dichotomous keys is limited by the sequential nature of the couplets. If the information involved with any given couplet is unavailable, the key is unlikely to yield a correct identification. Multi-access keys have the potential to overcome this limitation; however, they present some challenges of their own. We created two multi-access keys for identification of snakes from West and Central Africa to the genus level, using data on 62 genera of snakes across 35 morphological characters in an effort to facilitate snake identification. Here, we describe the process and mechanics behind development of our multi-access key. We also comment on the benefits and shortcomings of multi-access keys - with a particular emphasis on the digital format - compared with dichotomous keys in particular and specimen identification in general.

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**0714 Fish Behavior & Development, Salon A-C, Sunday 10 July 2016**

Yinan Hu, Jacqueline F Webb

*University of Rhode Island, Kingston, RI, USA*

### Ontogeny of the Olfactory and Gustatory Systems in *Elacatinus* spp. (Gobiidae): Potential for Chemosensory-Guided Navigation in Pelagic Fish Larvae?

The ability of pelagic fish larvae to locate appropriate settlement sites has been attributed to their swimming abilities and to interpretation of cues by several different sensory modalities (e.g., vision, hearing, olfaction). The morphological analysis of the ontogeny of the peripheral sensory organs can shed light on their functional capacities,

when evaluated in the context of what is known about structure-function relationships in other species. Ontogenetic series of two gobies in the genus *Elacatinus* (*E. lori* [3-14 mm, n=33], *E. colini* [3.5-15 mm, n=24), from day-of-hatch through settlement, were prepared histologically (transverse serial sections; glycolmethacrylate resin or Paraplast, 5 or 8 μm thickness) and stained to visualize the olfactory epithelium and taste buds. Results show that during larval development, the thickness of the well-developed olfactory epithelium does not change appreciably, but the size of the sensory epithelium increases with fish size. The olfactory epithelium invaginates and becomes enclosed in a blind sac (the olfactory organ) with two nares around settlement; however, neither lamellae nor accessory nasal sacs (which would indicate the capacity for active nasal ventilation) are present. Taste buds are located on the lips, buccal valves, roof of mouth, gill arches [including pharyngeal jaws] and "tongue", and increase in number throughout ontogeny (with some inter-species differences), but the number of taste buds in the rostral portion of the mouth, in particular, increases around settlement. The functional implications of these ontogenetic trends for larval navigation will be discussed. Funded by NSF grant 1459546 to JFW.

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**0124 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday 7 July 2016**

Joshua Hubbell, Jake Schaefer

*University of Southern Mississippi, Hattiesburg, MS/Southeast, USA*

## Occupancy Modeling of the Yazoo Darter within the Upper Yazoo River System

The capacity of information that exists on many North American freshwater fishes distribution and niche requirements is surprisingly limited. Such information is necessary to aide in the conservation and management of rare species, in particular those that are listed as threatened or endangered. Site occupancy is a prevalent metric for evaluating populations, and occupancy models that account for the undetectability of a study's target species are useful tools providing solutions to these problems. In this study, I used a method that allows for spatial replication during a single visit to assess the current status of the Yazoo Darter *Etheostoma raneyi* within the Upper Yazoo River system. The modeling approach in this study enabled comparisons of covariates that influenced occupancy at two spatial scales (catchment and site). The results suggest that the percent occurrence of woody debris is the most important habitat component that influences the probability of occurrence of Yazoo Darters at the site scale. Furthermore, drainage area ($km^2$), and stream link magnitude appear to be the important hydrological components that influence the probability of occurrence at the catchment scale. Finally, occupancy models suggest that even small increases in urban cover in small headwater systems negatively affect Yazoo Darter populations.

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**0644 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Jeanette Huber[1], Gavin Naylor[1], Tanya Darden[2]

*[1]University of Charleston, South Carolina, Charleston, South Carolina, USA, [2]South Carolina Department of Natural Resources, Charleston, South Carolina, USA*

### From past to present: A global population structure and genetic diversity study of a critically endangered fish using historical specimens

The largetooth sawfish *Pristis pristis* (Linnaeus, 1758) is among the most critically endangered marine vertebrate species primarily due to anthropogenic effects compounded by their low intrinsic growth rates. Once globally abundant, they have been locally extirpated from much of their historical range over the last 200 years. However, due to their iconic and unique appearance, sawfish rostra are often well represented in museum collections around the world. Archival sawfish tissues can supplement contemporary samples in population genetic studies as well as assess the susceptibility of this coastal elasmobranch to genetic erosion. This study will take advantage of DNA hybridization gene capture and next generation sequencing (NGS) techniques that are optimal for obtaining whole mitochondrial genome sequences from even degraded tissues typical of historical specimens. A total of 163 samples representing 5 ocean basins will be used to examine, characterize and contrast genetic variation in historical and contemporary sawfish populations. Results will be used to identify contemporary management units and provide a historical baseline to guide global and regional sawfish conservation strategies.

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**1002 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Sarah Huber, Peter Konstantinidis, Eric Hilton, Deborah Steinberg

*Virginia Institute of Marine Science, Gloucester Point, VA, USA*

### Lessons Learned from Larval Fish Workshops at the Virginia Institute of Marine Science's Nunnally Ichthyology Collection

The Nunnally Ichthyology Collection at VIMS is conducting a project aimed at safeguarding its large collection of larval fishes, with the goals of: 1) improving storage of specimens; 2) identifying specimens; and 3) cataloging specimens and linking associated environmental data and images in a publicly accessed database. As part of this project, VIMS hosted two workshops (October 5-16, 2015, and June 6-17, 2016) for students, collection managers, research scientists, and volunteers. Participants learned how to sort and identify larval fishes, acquired information on preparation, storage, and curation of larval-fish collections, and learned imaging techniques. Here we present the results of these workshops, including assessment data on participant preparedness and the numbers of fishes that were processed. In October 2015, thirteen participants identified 4,694 individual fishes in 811 lots, comprising 100 families; nine of these families were new additions to the VIMS Collection. At the end of the workshop participants felt significantly more prepared to identify larvae, access identification

resources, store/organize collections, digitize specimens, and clear and stain larval fishes. A repeated theme in many comments on post-workshop assessments echoed the importance of the hands-on nature of this workshop, with immediate practice in identification of a broad diversity of larval fishes under the watchful eyes of internationally recognized larval fish taxonomists. Results of the June 2016 workshop will also be presented.

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**0663 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jessica Hultberg, Stephen Drozda, John Steffen

*Penn State Behrend, Erie, PA, USA*

**Sexual Dichromatism in Painted Turtles**

Sexual dichromatism is used for intersexual and intrasexual communication in many different species of animals. The purpose of this experiment was to determine if male and female turtles differ in red, yellow and UV colors. Painted turtles were collected in various ponds around Erie County. All the turtles were marked and their colors on various spots on their body were measured using reflectance spectrometry. The data collected from spectrometry ranged from 300 to 700nm. Male turtle chin stripes showed greater yellow chroma and overall brightness than females, greater leg stripe UV chroma than females, and greater neck stripe UV and carotenoid chroma than females. This suggests that turtles may use skin and shell color to indicate sex.

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**0939 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Elizabeth Hunt[1], Stuart Willis[1], Kevin Conway[2], David Portnoy[1]

*[1]Texas A&M University-Corpus Christi, Corpus Christi, TX, USA, [2]Texas A&M University, College Station, TX, USA*

**Inferring the phylogenetic relationships within two genera of fishes: insights into the biogeography of the northern Gulf of Mexico**

A suture zone can be defined as a geographic area where there is overlap between faunal assemblages and in which pairs of sister species may come back into contact and experience hybridization. While identifying these areas in terrestrial and freshwater environments is an active area of research, barriers to dispersal in the marine environment are less apparent. In the northern Gulf of Mexico (GOM) at least 15 putative sister taxa meet, with some evidence of hybridization, in an area roughly centered on Mobile Bay (~88◦°W), consistent with the presence of a northern GOM suture-zone, despite no obvious historical barriers. The present study aims to use enrichment of ultra-conserved DNA elements and next-generation sequencing to generate a robust phylogenetic hypothesis for *Ogcocephalus* batfishes and *Spheroides*

pufferfishes, two genera with sister taxa distributed on either side of the hypothesized suture zone. Resolving phylogenetic relationships within each genus will provide the necessary context to test the hypothesis that each pair of putative species are indeed sister taxa experiencing introgression in this zone. Genealogical concordance within these taxa and others would also provide evidence of a shared historical biogeographic event that influenced gene flow. This study serves as a prerequisite for future studies focusing on patterns of gene flow and selection as it relates to the northern GOM suture zone.

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**1034 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Nigel Hussey[1], Amanda Barkley[1], Jack Orr[2], Robert Hodgson[2], Steven Ferguson[2], Aaron Fisk[1]

[1]*University of Windsor - GLIER, Windsor, Ontario, Canada,* [2]*Fisheries and Oceans Canada, Winnipeg, Manitoba, Canada*

**Tracking the impossible at depth: mark report satellite tags reveal a large-scale directed migration of Greenland sharks**

The complexity of studying deep-sea ecosystems has resulted in relatively little focused research compared to coastal and photic zones. The remoteness of the Arctic compounds this further resulting in major knowledge gaps for a region heavily impacted by climate change and increasing anthropogenic activity. In a novel approach to track Greenland sharks (*Somniosus microcephalus*), multiple mark-report (mPATs) and a pop up archival (miniPAT) satellite tag were attached to five individual sharks in Steiness Fjord, the high Arctic. The tags were set to release every 8 ± 2 days (mean ± SD) over a total of 38 ± 4 days, resulting in five locations for three sharks and four locations for the last two. All tags successfully transmitted accurate locations within the first day of transmission except one. The tags revealed a highly directed movement of Greenland sharks traversing northern Baffin Bay from Jones Sound to Northwest Greenland that was consistent in time and distance among individuals. This is the first study to successfully track the continuous horizontal movements of Greenland sharks over large distances, and opens a new avenue for studying horizontal movements of deep-water species. The recorded temperature and depth time series data, combined with locations, also provide a tool to examine bathymetric and vertical temperature profile models to reconstruct horizontal movements. As deep-water species are typically some of the most vulnerable to over-exploitation as well as the most difficult to study, this new technology is providing a window into large-scale movements that can inform fisheries and conservation management.

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**0817 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Curtis Hutchinson[1], Catherine Malone[1], Gordon Schuett[2], Warren Booth[3]

*[1]Utah Valley University, Orem, UT, USA, [2]Georgia State University, Atlanta, GA, USA, [3]University of Tulsa, Tulsa, OK, USA*

## Facultative Parthenogenesis in North American pitvipers

Facultative parthenogenesis (asexual reproduction in a normally sexually reproducing organism) in reptiles has been gaining attention and appears to be quite prevalent in advanced snakes, such as pitvipers. Up to this point, parthenogenesis has been reported (through genetic confirmation or captive records) in three species of rattlesnake, *Crotalus horridus, C. unicolor,* and *C. viridis*, as well as three other pitvipers, the Copperhead (*Agkistrodon contortrix*), cottonmouth (*A. piscivorus*) and Fer-de-lance vipers (*Bothrops asper*). In an attempt to increase the knowledge and understanding of this reproductive phenomenon in advanced snakes, we will report on molecular analysis of four rattlesnake species, for which facultative parthenogenesis has gone previously undocumented. The four species of rattlesnake that we tested were: two specimens of Mexican Dusky rattlesnake (*C. triseriatus*), three specimens of Eastern Diamondback (*C. adamanteus*), two specimens of Prairie rattlesnake (*C. viridis*) and five of Western Massasauga (*Sistrusus tergeminus*). Blood and skin shed were collected from the 12 individuals, from which DNA was extracted and PCR performed for 18 different microsatellite loci. Genotypes were visualized and scored using the Li-Cor gel imaging system and analyzed for heterozygosity between mother and offspring within the same species.

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**0361 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jacob Hutton, Kate Donlon, William Ensign

*Kennesaw State University, Kennesaw, Georgia, USA*

## The Diets of Cave Salamanders (*Eurycea lucifuga*) from Pigeon Mountain Examined Using Non-Lethal Gastric Lavage Techniques

The Cave Salamander, *Eurycea lucifuga*, is a lungless plethodontid salamander broadly distributed in the southeastern United States. *Eurycea lucifuga* life history is well documented, but diet studies are limited and there is no information on fall diets. This study investigates fall diets of *E. lucifuga* in northern Georgia caves using non-lethal gastric lavage methods. A total of 31 prey items from five invertebrate orders were identified. Overall, we found less diversity than previous studies which is likely due to differences in sampling techniques and seasonal changes in insect availability. The stomach contents frequently had mucus coated boluses of non-prey items. Similar boluses have been observed in other studies and suggest that *E. lucifuga* has less than complete success in its attempts at prey capture.

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**0421 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT**

Mike Iacchetta, C. M. Gienger, A. Floyd Scott, Ben Beas

*Austin Peay State University, Clarksville, TN, USA*

### The Effect of Cattle on Amphibian and Reptile Communities in West Tennessee

We conducted ten years of reptile and amphibian surveys in western Tennessee to compare seasonal abundances of herpetofauna in habitats with access by cattle and habitats without access by cattle. Eighteen fishless ponds and their adjacent forested habitats were surveyed for amphibians and reptiles. Pond-dwelling amphibians were more abundant in habitats without cattle access, whereas, reptiles were more abundant in habitats with access by cattle. In cattle excluded habitats, *Ambystoma talpoideum* had a greater abundance and longer snout-vent length. In contrast, *Diadophis punctatus* were less abundance yet had longer snout-vent length in the same cattle excluded habitats. Areas with cattle access are associated with more open canopy habitat, which may create increased opportunities for thermoregulation in reptiles. Our results also suggest that cattle presence may alter the water quality of ponds and thus affect the abundance and body size of pond-dwelling amphibians.

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**0706 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

Katriina Ilves[1], Hernán López-Fernández[2]

*[1]Pace University, New York, NY, USA, [2]Royal Ontario Museum, Toronto, ON, Canada*

### A Targeted Exon approach for (Neotropical) Cichlid Phylogenomics

Here we present a targeted exon next-generation sequencing approach for investigating the evolutionary relationships of cichlid fishes (Cichlidae), with a particular focus on the Neotropical subfamily Cichlinae. A set of 923 primarily single-copy exons was identified and probes were designed through mining of the Nile tilapia (*Oreochromis niloticus*) genome. Sequence capture and assembly were robust, leading to a complete dataset of 415 exons for 141 species (147 terminals) of primarily Neotropical cichlids. Gene trees and species trees were calculated using alternative partitioning schemes and reconstruction methods and the resulting trees and approaches are compared and discussed. Overall, this approach yielded a well-resolved phylogeny of Neotropical cichlids that will be of utility for future assessments of the evolutionary and ecological processes within this diverse group of fishes. Furthermore, the general methodology employed here of exon targeting and capture should be applicable to any group of organisms with the availability of a reference genome.

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**0126 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

Katriina Ilves[2], Maria Claudia Malabarba[3], Hernán López-Fernández[1]

*[1]Royal Ontario Museum/Univ. of Toronto, Toronto, Ontario, Canada, [2]Pace University, New York, New York, USA, [3]Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil*

## Phylogenomics, Fossils and a Tip-dating approach to the Age of Neotropical Cichlids

Given the importance of cichlids as models in the study of macroevolution, the timing of their divergence has been the focus of several recent studies, but no consensus on the age of the family or its main clades has been reached. Differences in fossil calibrations, molecular markers and dating methods are all likely contributing to current disagreements regarding the age of cichlids. Central to recent studies of cichlid age are Eocene South American fossils (~47 Ma) identified as belonging to each of the three main tribes of the Neotropical clade, Cichlinae. In this study we expand a previous morphological dataset to a matrix of 150 characters of osteology and squamation for 74 living taxa from all Cichlinae clades and 5 Neotropical cichlid fossils. We use a phylogenomic exon-based hypothesis of Neotropical cichlid relationships (Ilves et al. Unpubl) to constraint sets of 10 concatenated exons with the morphological dataset and analyze them under a total-evidence, tip-dating Bayesian framework. We compare dates obtained with widely used ETOL genes with dates obtained with other exons and explore the effect of root priors on cichlid age estimates.

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**1041 AES GRUBER AWARD, Balconies J & K, Thursday 7 July 2016**

Johanna Imhoff, R. Dean Grubbs

*Florida State University, Tallahassee, Florida, USA*

## Comparative Mercury Contamination in Demersal Deep Sea Sharks in the Gulf of Mexico

As mid to upper trophic level predators, elasmobranchs are at risk of carrying high loads of bioaccumulating toxicants. Methylmercury (MeHg) is of particular concern in fishes because high levels of contamination can put humans at risk for reproductive and neurological problems via fish consumption. Research on MeHg contamination in deep sea sharks has shown that MeHg concentration increases with the size of the shark, often exceeds recommended values for safe human consumption and generally increases with increasing trophic level and with dependence on benthic versus pelagic food webs. MeHg is one of several pollutants that are of particular concern after an oil spill. It has been hypothesized that oil spills create ideal conditions for blooms in the bacteria that methylate mercury. As mid to upper trophic level predators, deep sea sharks have the potential to bioaccumulate high concentrations of MeHg and their high longevity may facilitate the persistence of high levels of MeHg in the system for long periods of time.

Therefore mercury analysis of coexisting deep sea sharks in a habitat near a source of anthropogenic pollution (i.e. the Deepwater Horizon Oil spill) could provide useful information on the roles of taxonomy and depth habitat in toxicological response of mesopredators after an oil spill. Methylmercury speciation and concentrations will be analyzed in six shark species that range from the continental shelf edge to the mid-slope and include both Carcarhiniformes (*Mustelus canis*, *M. sinusmexicanus*) and Squaliformes (*Squalus cubensis*, *S*. cf. mitsukurii, *Centrophorus uyato*, *C. granulosus*).

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**0723 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Rima Jabado, Reem Al Baharna, Sultan Al Ali, Mohsin Al Ameri, Ayesha Al Blooshi

*Environment Agency Abu Dhabi, Abu Dhabi, United Arab Emirates*

## The Last Stand of the Critically Endangered Green Sawfish, *Pristis zijsron*, in the Arabian Gulf?

Sawfishes represent one the most threatened group of marine fishes around the world. Historical declines have been documented throughout the geographic distribution of all five species and it has been suggested that they might be extinct as a functional component in Arabian Gulf coastal ecosystems. Interviews with fishermen were conducted across the United Arab Emirates (UAE) between November 2015-April 2016 to determine the national status of sawfishes, gather information on encounters and abundance, as well as identify locations where populations might still be found. Based on pictures and rostra from various sources, the only species recorded in UAE waters is the green sawfish, *Pristis zijsron*. Fishermen confirmed sawfishes had drastically declined in the last 20 years yet the majority of respondents reported encounters in the last five to ten years. Sawfishes were not perceived to be a culturally significant resource and when caught were mainly used as a source of food, with their high value fins sold to traders and rostra retained as decorations in houses. The consensus was that sawfish used to be targeted but are now only caught as incidental catch primarily with gillnets and hook and line. While results of this study provide evidence of a large decline in sawfishes in the past 20 years, they highlight the importance of Abu Dhabi waters as a region where sawfishes are still encountered and provide an area where research, monitoring, as well as conservation and recovery efforts should be focused to avoid local extinction and restore robust populations.

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**0658 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016**

Donald Jackson[1], Cindy Chu[2], Nigel Lester[2]

*[1]University of Toronto, Toronto, Ontario, Canada, [2]Ontario Ministry of Natural Resources & Forestry, Peterborough, Ontario, Canada*

## Long-term (and Large-scale) Monitoring of Lake Fish Communities in Ontario

Ontario has more than 250,000 lakes and managing these resources presents significant challenges given factors such as the very large spatial scale of Ontario, the diversity of natural environmental conditions, and the different demands and impacts on these systems (e.g. angling pressures) across Ontario. The Ontario government has several long-term monitoring programs across the province addressing various issues (fish populations, fish contaminants, water quality). We provide a brief overview of such programs and examine one, the Broad-scale Monitoring for Inland Lakes Program, in depth. This program samples approximately 150 lakes per year using a standardized protocol, with some lakes undergoing repeated sampling in a five-year cycle. We present issues related to how the program was started, how it is funded, and the design of the sampling program. We consider some challenges presented in developing and operating such a large program, in particular given the existence of other types of sampling programs. We highlight significant findings to date that are important to the funding agency, as well as how this program has provided important contributions to other research endeavors by government and academic researchers.

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**0153 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Kate Jackson[1], Ange-Ghislain Zassi-Boulou[2], Sylvestre Boudzoumou[2], Lise-Bethy Mavoungou[2], Chifundera Kusamba[3], Jennifer Meece[4], Kurt Reed[5], Rayna Bell[6], David Blackburn[7], Sonia Ghose[8], Eli Greenbaum[9]

*[1]Whitman College, Walla Walla, WA, USA, [2]Institut National de Recherche en Sciences Exactes et Naturelles, Brazzaville, Republic of Congo, [3]Centre de Recherche en Sciences Naturelles, Lwiro, Democratic Republic of Congo, [4]Marshfield Clinic Research Foundation, Marshfield, WI, USA, [5]University of Wisconsin School of Medicine and Public Health, Madison, WI, USA, [6]Museum of Vertebrate Zoology, Berkeley, CA, USA, [7]Florida Museum of Natural History, Gainesville, FL, USA, [8]University of California at Davis, Davis, CA, USA, [9]University of Texas at El Paso, El Paso, TX, USA*

## Prevalence of amphibian chytrid fungus across the Congo River drainage basin

Amphibian chytrid fungus (*Batrachochytrium dendrobatidis, Bd*) has been implicated as an important factor in the decline of amphibian species worldwide. The origin of *Bd* remains problematic, but several studies have pointed to Africa as the original source of the pathogen. Nonetheless, *Bd* remains less extensively studied in Africa than in other

continents. We tested 807 individuals from 12 amphibian families for the presence of *Bd*, from sites spread across 1,122,237 km$^2$ of the Congo River drainage basin, all at relatively low elevations (51-775 m.a.s.l.). We found *Bd* to be present in some individuals at most but not all sites. In total, 89 individuals tested positive for *Bd*, for an overall *Bd*-prevalence of 11.03%. We found no correlation between elevation and the presence of *Bd*, no correlation between season (wet or dry) and prevalence of *Bd*, and no higher incidence of *Bd* in individuals from any amphibian family relative to other families. In no instance did we observe signs of acute illness in any individual collected and tested for the presence of *Bd*. We discuss these results in the context of other recent surveys of *Bd* in Africa.

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## 0127 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT

Leah Jacobs, Kristine Kaiser, Jeanne Robertson

*California State University, Northridge, Northridge, CA, USA*

### Sex in the Lab: Examining Variation in Sperm Response in Divergent Populations of Red-eyed Treefrogs

The non-lethal collection of sperm from males is an important component for multiple captive breeding techniques, including ART protocols, sperm cryopreservation and in-vitro fertilization. However, the hormone and amount used in order to induce spermiation is highly variable among taxonomic families as well as closely related species. To date, no studies have examined the sperm response to exogenous hormones across highly differentiated populations within a species. We examined sperm viability and counts to the hormone LHRH among four divergent populations of a Neotropical frog, the red-eyed treefrog. We hypothesized that these highly differentiated populations would show variability in sperm response to two dosages, 2 µg/g and 4 µg/g, of the hormone LHRH. We collected spermic urine 3 hr post injection (PI). We found that although sperm count did not vary among populations, at least one population showed decreased sperm viability in response to LHRH. We then examined spermiation variation at 3, 7, 12, and 24 hours PI of LHRH for two allopatric populations of red-eyed treefrog. We found no difference in sperm viability or counts. However, we did detect a downward trend in sperm viability in both populations 3 hours PI. In conclusion, because ART often focuses on threatened species with small, isolated populations, the potential for evolutionary processes such as local adaptation and drift to act is high. The population-level differences in sperm viability we observed demonstrate that practitioners of ART should consider whether divergent responses to hormones may affect study designs and animal receptivity to ART protocols.

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**0841 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Lindsey James, Carsten Leimer, Max Bangs, Marlis Douglas, Whitney Anthonysamy, Michael Douglas

*University of Arkansas, Fayetteville, AR, USA*

**Fine-Scale Phylogeography of the Orangethroat Darter (*Etheostoma spectabile*) on the Ozark Plateau**

Smooth belly darters, *Etheostoma*, are sedentary, benthic species characterized by low dispersal abilities, which contributed to divergence into multiple species complexes during the last Pleistocene glaciation. Previous genetic studies resolved broad-scale relationships within several of these species complexes, including the Orangethroat Darter. Three proposed species of Orangethroat Darter occur on the Ozark Plateau, a region with high levels of endemism. However, fine-scale phylogeographic evaluation of Orangethroat Darter is lacking in this region. We examined variation among mitochondrial and nuclear genes of Orangethroat Darter collected from the Illinois, Elk, and White rivers. Our sequence data support three distinct genetic lineages with mixing in the Illinois River between two of these. Correct assessment of the species is essential for conservation of darters and preservation of biodiversity in the Ozark Plateau. This work is ongoing and will expand to include additional samples across a wider geographic range encompassing the Ozark Plateau and adjacent areas.

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**0645 Fish Genetics, Salon D, Sunday 10 July 2016**

Alexis Janosik[1], Mariah Pfleger[1], Steven Rider[2], Carol Johnston[3]

*[1]University of West Florida, Pensacola, FL, USA, [2]Alabama Division of Wildlife and Freshwater Fisheries, River and Stream Fisheries Lab, Auburn, AL, USA, [3]Auburn University, Auburn, AL, USA*

**Saving the Doomed: the Importance of Detection for Conservation of Sturgeon (Acipenseridae)**

Environmental DNA (eDNA) is a relatively new technique that has proven to be a successful tool for the detection of rare and/or spatially and temporally variable organisms. For aquatic species, field sampling can require extensive effort and may be unreliable in terms of determining the presence or absence of a target species, especially when the target species is rare. For this study we used eDNA to try to detect populations of Alabama sturgeon (*Scaphirhynchus suttkusi*) and Gulf sturgeon (*Acipenser oxyrinchus desotoi*) in the Mobile River Basin in southern Alabama. These two species of sturgeon make ideal model organisms for examination of this technique in the detection of rare species, as the Alabama sturgeon is critically endangered and the Gulf sturgeon is listed as vulnerable on the International Union for Conservation of Nature (IUCN) Red List. In spite of the critical need for information on these species, riverine sampling is expensive and produces low detection. Results using eDNA have revealed temporally logical, positive detections of Alabama and Gulf sturgeon throughout the Mobile River Basin

sites included in the study. Successful detection of these species could reveal vital information such as understanding of habitat use for management purposes as well as identify specific localities for field sampling.

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**0821 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H, Thursday 7 July 2016**

Francesco Janzen[1], Mark Sabaj-Pérez[2], Javier Maldonado-Ocampo[3], William Crampton[4], Nathan Lovejoy[1]

*[1]University of Toronto Scarborough, Toronto, Ontario, Canada, [2]The Academy of Natural Sciences, Philadelphia, Pennsylvania, USA, [3]Pontificia Universidad Javeriana, Bogotá, Cundinamarca, Colombia, [4]University of Central Florida, Orlando, Florida, USA*

## Molecular phylogeny of the Neotropical weakly-electric fishes of the order Gymnotiformes (Actinopterygii)

The order Gymnotiformes, commonly known as the knifefishes, is comprised of 200+ species divided into five families (Apteronotidae, Gymnotidae, Hypopomidae, Rhamphichthyidae, and Sternopygidae). They are found throughout Central and South America, and inhabit a variety of freshwater habitats. These fishes are capable of producing and detecting species-specific electrical signals using specialized electric organs and electroreceptors. For these reasons, knifefishes are excellent models for studying biogeography, speciation, and the evolution of communication. However, these studies rely on a clear understanding of gymnotiform phylogeny. To date, attempts at resolving the internal relationships of the Gymnotiformes have yet to produce an unambiguous, well-supported species-level phylogeny. In order to resolve the Gymnotiformes phylogeny, we used 171 species representatives from nearly all recognized clades and combined molecular data for seven nuclear and two mitochondrial genes. We performed parsimony, maximum likelihood, and Bayesian analyses to produce phylogenies of the order. We found support for the monophyly of all families within Gymnotiformes with the exception of the Hypopomidae *sensu* Mago-Leccia, which was not monophyletic because the genera *Steatogenys* and *Hypopygus* were more closely related to *Rhamphichthys* and *Gymnorhamphichthys* than to other hypopomids. Also of note was the prevalence of paraphyly and polyphyly of the genera found within the Apteronotidae. The genus *Sternarchella* showed paraphyly as *Magosternarchus* was nested within this group. Also, *Sternarchogiton*, *Porotergus*, and *Apteronotus* all showed instances of polyphyly. The genera *Sternarchorhynchus* and *Adontosternarchus* showed strong monophyletic support. Our study provides a robust phylogenetic framework for future evolutionary and ecological investigations of gymnotiform fishes.

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**0565 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Kortney Jaworski, Matthew Lattanzio

*Christopher Newport University, Newport News, VA, USA*

### Social and ecological consequences of sexual size dimorphism in the mountain spiny lizard (*Sceloporus jarrovii*)

The social and ecological dynamics of animal populations are often driven by asymmetries in morphology among individuals, which are typically exaggerated in species exhibiting sexual size dimorphism (SSD). However, to date, scant attention has been paid to the potential social and ecological consequences of SSD. Recent studies have shown that adult mountain spiny lizards (*Sceloporus jarrovii*), which exhibit male-biased SSD, exhibit sex- and size-related differentiation in thermal biological traits. Here we expand on that work by providing insight into the nature of the consequences of SSD on aspects of the ecological (diet and microhabitat use) and social (population spatial structure) dynamics of adult *S. jarrovii*. We collected data on the morphological attributes and microhabitat use of 89 lizards from a population in southeastern Arizona during June-July 2014. In addition, we also collected tissue samples from another sample of lizards from the same population for stable isotope analysis of their diet selection. Preliminary analyses support that the sexes diverge in their diet selection ($P<0.05$), but not in microhabitat use (i.e. perch type; $P>0.05$). Currently, we are incorporating additional data on 1) microhabitat quality and 2) spatial network structure into our study to evaluate the degree that SSD affects other aspects of ecology and individual association patterns in a population. We anticipate that our findings will provide key insight into how evolutionary phenomena like SSD may impact species' ecological interactions in the wild.

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**0769 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Howard L. Jelks[1], Thomas M. Orrell[2]

[1]*Wetlands and Aquatic Research Center, U.S. Geological Survey, Gainesville, FL, USA,* [2]*ITIS Program, National Museum of Natural History, Smithsonian Institution, Washington, DC, USA*

### Updating Fishes, Reptiles, and Amphibians in the Integrated Taxonomic Information System (ITIS)

The Integrated Taxonomic Information System (ITIS) is a partnership of federal agencies and other organizations from the United States and Canada with a common goal to provide an accessible database with reliable information on species names and their hierarchical organization. ITIS shares well-documented taxonomic data on over 830,000 scientific names, synonyms, and common names for terrestrial, marine, and freshwater species from all biological kingdoms and is worldwide in scope. It presents names in a standard classification that contains describing author, date of publication, geographic,

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and bibliographic information. New data are regularly added to ITIS, and existing data are periodically reviewed and updated based on the expert opinion of taxonomic data stewards from around the world. We are currently updating data on fishes, reptiles, and amphibians and welcome input from researchers on these taxa and other groups. More information can be found at www.itis.gov.

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**0964 AES GRUBER AWARD, Balconies J & K, Thursday 7 July 2016**

Jacob Jerome, Austin Gallagher, Neil Hammerschlag

*University of Miami, Miami, Florida, USA*

**Integrating Physiological and Behavioral Biomarkers of Fishing Capture Stress in Coastal Shark Species**

In both commercial and recreational fisheries, many sharks are captured and released alive but may suffer post-release fitness loss or even mortality due to capture stress. Thus, understanding behavioral and physiological responses of sharks to capture stress is important for determining best fishing practices and for establishing effective management strategies. In this study, we quantified sub-lethal effects of capture through monitoring blood glucose, hematocrit and reflex impairment on 5 species of coastal sharks: great hammerhead (*Sphyrna mokarran*), bull (*Carcharhinus leucas*), blacktip (*Carcharhinus limbatus*), nurse (*Ginglymostoma cirratum*) and tiger (*Galeocerdo cuvier*). We further evaluated inter- and intra- specific relationships between these parameters and fight time, sea surface temperature, dissolved oxygen, and season.

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**1102 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Matthew Jew, David A. Ebert, Paul J. Clerkin, Justin A. Cordova, Jessica Jang, Breanna Machuca, Melissa C. Nehmens, Catarina Pien, Amber Reichert, Victoria E. Vásquez, Kristin A. Walovich

*Moss Landing Marine Laboratories, Moss Landing, CA, USA*

**Looking for "Lost Sharks"**

Sharks, and their relatives the batoids and chimaeras, come in a variety of sizes and shapes, from the whale shark (*Rhincodon typus*), the world's largest fish, to the dwarf pygmy sharks (*Squaliolus* spp.), and occupy most marine and some freshwater habitats. There are more than 500 species of sharks, along with nearly 650 batoid and 50 chimaera species, bringing the overall total to about 1200 species of sharks and shark-like fishes. The diversity of sharks and their relatives has increased exponentially over the past decade with more than 230 new species having been described over the past decade. This represents nearly 20% of all shark species that have been described. Most of these new discoveries have come from the Indo-Australian region, followed by the Western

Indian Ocean and Western North Pacific regions. However, a review of the Red List status of Chondrichthyans indicates that 17.4% are threatened and nearly half (46.8%) are Data Deficient or have not been assessed. Despite such a rich and diverse fauna, the majority of sharks and their relatives have largely been "lost", having been overshadowed by a few large charismatic media mega-stars, such the White Shark (*Carcharodon carcharias*). In an effort to highlight and assess these little known, or unknown, species we have initiated a global program "Looking for Lost Sharks" to find and discover these lost sharks.

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**0478 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT**

Rachel Johannsen, Drew Davis, Jacob Kerby

*University of South Dakota, Vermillion, South Dakota, USA*

**Historic and Current Expected Distributions of Amphibian and Reptile Species in South Dakota**

Natural history collections and their use has greatly contributed to our understanding of individual species and ecological communities. Natural history collections are key to studying global biodiversity and are becoming more important due to the impending threat of climate change and its environmental effects. Continuing increases in human population, conversion of Conservation Reserve Program (CRP) lands to agriculture, spread of pathogens, habitat degradation from environmental contaminants, and climate change all likely have a strong negative impact on South Dakota amphibian and reptile species. There are a limited number of amphibian and reptile voucher specimens that have been collected from South Dakota, particularly when compared to other vertebrate groups. Previously compiled distribution maps of South Dakota amphibian and reptile species are now out of date due to newly available specimens. Georeferenced locality data from historic collections across South Dakota as well as data from newly collected specimens as part of on-going survey efforts in the state have been compiled to update species distribution maps. We have added around 600 specimens to the natural history collection that currently contains just over 2,000 specimens. Here, we present information about the status of South Dakota amphibian and reptile voucher specimens and present newly generated distribution maps to highlight regions of South Dakota that are data deficient.

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**0618 General Herpetology, Galerie 2, Saturday 9 July 2016**

Rebecca John[1], Robert Gitzen[1], Christine Easterwood[2]

*[1]Auburn University, Auburn, AL, USA, [2]Redstone Arsenal, Huntsville, AL, USA*

## Occupancy and Detection of Green Salamander (*Aneides aeneus*) on Redstone Arsenal, Alabama

Green Salamanders (*Aneides aeneus*) are a species of concern throughout their range due to habitat destruction and population declines. Redstone Arsenal, a US Military post near Huntsville, AL needs better information to manage the species. Occupancy surveys allow us to estimate the probability of a species given they are present in an area, while taking into account imperfect detection. Estimates of occupancy probability throughout Redstone Arsenal are critical for developing effective management plans for habitat and surrounding areas. During summer 2015 we conducted visual surveys of 99 sites within two strata of suitable habitat on the base. We detected no green salamanders within the northern strata. Surveys in the southern strata detected the species at 9 of 36 sites. Model selection using Akaike's Information Criterion (AICc) indicated that detection probability varied most in response to humidity and observer effects. Estimated detection probability per survey was 0.31 (95% CI 0.14-0.71) based on the null model. For each one percent increase in relative humidity, detection probability was 1.06 (95% CI 1.01-1.11) times as likely. Detection probability was not clearly related to temperature or survey time. Based on the model with the most support, the estimated probability of occupancy in the southern strata was 0.35 (95% CI 0.18-0.57). No strong relationships between habitat characteristics and occupancy were detected so far, but additional survey sites will be visited in summer 2016 to better understand the species distribution at Redstone. The survey protocol designed can be used outside of Redstone Arsenal, throughout the species' range.

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**0754 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jessica Johnson, Jarrett Johnson

*Western Kentucky University, Bowling Green, KY, USA*

## Growth and Survival of Salamanders Exposed to Different Formulations of Glyphosate-based Herbicide

Amphibian populations have been experiencing rapid declines worldwide in the past few decades. There are many proposed causations, including the use of agricultural chemicals such as herbicides. Glyphosate based herbicides are one of the most widely used herbicides. This study looks at the effects of different brands of glyphosate based herbicides, including those intended for aquatic use, on the survival and growth of axolotl larvae. Out of the four brands of glyphosate herbicide (Aquamaster, Aquaneat, Helosate plus, and Roundup Pro), the survival rates of Roundup Pro were the lowest. Most mortality occurred between the 3 mg/L and 6 mg/L concentrations, during which all those treated with Roundup Pro died. The growth, measured in terms of total snout

to tail length and also head width, appeared to be greatest in length for those larvae treated with Aquaneat brand herbicide. There was no significant difference in head width between treatment groups. These results indicate that Roundup Pro is lethal at concentrations of 6 mg/L, this indicates that the composition, which includes a surfactant, may be responsible. With this information, the next step in this study is to analyze the effects of different types of surfactants on axolotl larvae. The findings of this study are significant in that they would give insight as to if, and if so, how, modern agriculture could be contributing to the decline of amphibian populations.

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**0060 AES Genetics, Genomics, Biogeography, & Systematics, Balconies J & K, Saturday 9 July 2016**

Christian Jones[1], Eric Hoffmayer[1], Jill Hendon[2], Joseph Quattro[3], Justin Lewandowski[3], Mark Roberts[3], Gregg Poulakis[4], Matthew Ajemian[5], William Driggers[1], Marcelo de Carvalho[6], Mariana Rêgo[7], Fábio Hazin[7], J. Fernando Márquez-Farías[8]

*[1]National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, Pascagoula, MS, USA, [2]University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS, USA, [3]University of South Carolina, Department of Biology, Columbia, SC, USA, [4]Florida Fish and Wildlife Commission, Fish and Wildlife Research Institute, Port Charlotte, FL, USA, [5]Florida Atlantic University, Harbor Branch Oceanographic Institute, Fort Pierce, FL, USA, [6]Universidade de São Paulo, Instituto de Biociências, Departamento de Zoologia, São Paulo, SP, Brazil, [7]Universidade Federal Rural de Pernambuco, Departamento de Pesca, Recife, PE, Brazil, [8]Universidad Autónoma de Sinaloa, Facultad de Ciencias del Mar, Mazatlán, SIN, Mexico*

## *Rhinoptera brasiliensis* Müller, 1836 in the northern Gulf of Mexico

In 2007, three rays identified as *Rhinoptera brasiliensis* Müller, 1836, based on tooth series counts, were captured in the northern Gulf of Mexico (GOM), a region far outside their accepted range of the coastal waters of southern Brazil. Genetic analyses confirmed that these individuals were distinct from *Rhinoptera bonasus* (Mitchill, 1815), the only recognized indigenous species. Further analyses of over 300 specimens, including reference mitochondrial DNA sequences from voucher specimens, confirmed the widespread occurrence of two species of cownose rays in the northern GOM. Genetic analyses indicated the second species relates most closely to *R. brasiliensis*. The distributions of the two species differed, with *R. bonasus* being more prevalent in the eastern GOM, and *R. brasiliensis* in the western GOM. There was an approximately 90% rate of agreement between identifications based on tooth series counts (*R. bonasus* = 5 to 13, *R. brasiliensis* = 7 to 15), which have been the standard for differentiating among rhinopterids, and those based on mitochondrial DNA sequences. Analyses of morphological and skeletal data identified several discriminating characters. The shapes of several skeletal elements and spiral valve lamellae counts (*R. bonasus* = 26 to 28, *R. brasiliensis* = 29 to 31) also appeared to be consistently reliable in differentiating between

the two species. This is the first study to verify the occurrence and distribution of *R. brasiliensis* in the northern GOM; however, the close genetic relationships to other rhinopterid species, as well as the morphological similarity of the group as a whole, require additional research.

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**0797 AES Physiology, Paleontology, & Collections, Balconies L & M, Friday 8 July 2016**

Elizabeth R. Jones, Andrew N. Evans

*Department of Coastal Sciences, The University of Southern Mississippi, Ocean Springs, MS 39564, USA*

## Corticosteroid Receptors in the Atlantic Stingray, *Dasyatis sabina*: Sequence, Expression, and Physiological Implications

Elasmobranchs possess a unique corticosteroid called 1α-hydroxycorticosterone, or 1α-B, which is thought to mediate energy availability during stress (as a glucocorticoid hormone) and hydromineral balance during osmoregulation (as a mineralocorticoid hormone). The mechanisms underlying regulation of 1α-B's dual roles are poorly understood, however differentiation of these functions could occur via interaction with different receptor types. Elasmobranchs have two receptors capable of binding 1α-B: a glucocorticoid receptor (GR) and a mineralocorticoid receptor (MR). In other vertebrates, these receptors act by binding their corticosteroid ligand then migrating to the nucleus where they alter transcription of target genes. To investigate the role of elasmobranch corticosteroid receptors in 1α-B actions, we used degenerate PCR coupled with rapid amplification of cDNA ends (RACE) to isolate mRNAs encoding the GR and MR of the Atlantic stingray, *Dasyatis sabina*. Alignment of *D. sabina* GR and MR protein sequences with those of other vertebrate taxa revealed a high level of conservation in the DNA binding domain of the receptors and in amino acid residues involved in binding the steroid ligand (1α-B). Additionally, we used qPCR to examine the mRNA expression and abundance of GR and MR in a variety of tissues and found them to be ubiquitously expressed. These combined results indicate that the receptors for 1α-B function similarly to other vertebrate steroid receptors, and further support the hypothesis that 1α-B plays a central role in governing the stress and osmoregulatory physiology of elasmobranchs.

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**0352 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016**

Kenny Jones[1], Brook Fluker[1], Bernard Kuhajda[2]

*[1]Arkansas State University, Jonesboro, AR, USA, [2]Tennessee Aquarium Conservation Institute, Chattanooga, TN, USA*

### Conservation Genetics of the Blueface Darter (*Etheostoma* sp. cf. *zonistium*), a Rare Undescribed Fish in Northwest Alabama

Previous morphological work revealed that select populations of the Bandfin Darter (*Etheostoma zonistium*) in northwest Alabama represent a rare, undescribed species; the Blueface Darter (*E.* sp. cf. *zonistium*). With the description of the Blueface Darter forthcoming, its rarity, restricted distribution, and fragmented landscape will make it a potential candidate for listing under the Endangered Species Act following its description. The Blueface Darter has a peculiar distribution in tributaries of two distinct drainage basins; the Tennessee River (Bear and Little Bear creeks) and the Black Warrior River (Hubbard Creek of the Sipsey Fork). Further, population connectivity among tributaries of the upper Bear Creek system is potentially restricted by the Upper Bear Creek Reservoir. This study used mitochondrial (mt) DNA sequence data and microsatellite loci to test multiple hypotheses involving patterns of genetic variation within the Blueface Darter. Our results suggest three main conclusions that will help prioritize conservation needs for the Blueface Darter. (1) Both mtDNA and microsatellite data corroborate previous morphological analyses supporting the validity of the Blueface Darter as a distinct species; (2) mtDNA data suggests that the Hubbard Creek population is the result of a very recent inter-drainage transfer from Bear Creek. Hubbard Creek also exhibits a signature of founder effect based on microsatellite data (i.e., significant genetic structure and lower genetic variation compared to the Bear Creek population). (3) Our data shows possible reservoir-fragmentation effects for the Little Bear Creek population (i.e., significant genetic structure and lower genetic variation compared to the Bear Creek population).

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**0750 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Salon A-C, Friday 8 July 2016**

Gregory Jongsma[1], Eli Greenbaum[2], Mark-Oliver Roedel[3], David Blackburn[4]

*[1]California Academy of Sciences, San Francisco, CA, USA, [2]University of Texas, El Paso, El Paso, TX, USA, [3]Museum für Naturkunde, Berlin, Germany, [4]University of Florida, Gainesville, FL, USA*

### Diversity and Biogeography of Frogs in the Genus *Amnirana* (Family Ranidae) Across Sub-Saharan Africa

Frogs in the genus *Amnirana* (family Ranidae) present an ideal system for exploring the relationship between diversification and geography across sub-Saharan Africa because of their wide distribution spanning many potential biogeographic barriers and historical

forest refugia. Using multiple loci from the mitochondrial and nuclear genomes, we generated a highly supported species-level phylogeny that supports both the monophyly of African species of *Amnirana* and provides insight into relationships among these species. Large-scale sampling across the distribution of two widespread species, *A. albolabris* and *A. galamensis*, reveals undescribed cryptic diversity. Populations assigned to *A. albolabris* in western Africa are more closely related to *A. fonensis* and require recognition as a distinct species. Similarly, based on findings that populations of *A. galamensis* from the East African coast are genetically divergent and morphologically distinct, we elevate a previously recognized subspecies. We find that the biogeographic history of African *Amnirana* is complex and marked by several dispersal and vicariance events, including between West and Central Africa across the Dahomey Gap. In addition, the phylogeny reveals that the Lower Guinean Forest region has served as an important center of both interspecific and intraspecific diversifications for *Amnirana*, including for species endemic to this region.

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**0192 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Kathlene Joyce, Jacqueline Chivers, Craig Guyer, Malorie Hayes

*Auburn University, Auburn, AL, USA*

**Phylogeography of Slimy Salamanders in Alabama**

The genus *Plethodon* is one of the largest clades of salamanders in North America. In Alabama alone there are three possible species that converge. Morphological differences between species are seen in the variation in color and number of spots on an individual. These differences can be attributed to speciation or phenotypic plasticity within a species. This experiment specifically focuses on determining the phylogeography of three possible species of *Plethodon* salamanders in the state of Alabama: *Plethodon glutinosus*, *Plethodon grobmani*, and *Plethodon mississippi*. Based on genes stored on GenBank we chose the RPL12 gene from the study done by Fisher-Reid and Weins (2011) which is found in all three species and was defined in the study. In order to compare the differences in evolutionary rates we chose a mitochondrial gene, cytochrome b (cytb), to sequence. To examine phylogeographic relations in Alabama, RPL12 and cytb were then extracted from samples from the Auburn University Natural History Museum that were gathered throughout the state. The sequences were then sequenced using Sanger sequencing and then aligned using Geneious. Bayesian Inference was run in MrBayes 3.2.2 on CIPRES Science Gateway (Miller et al., 2010; Ronquist et al., 2012). This created phylogenetic trees that we could then use to understand the relationships between the three species. Our data and the sequences of RPL12 from Fisher-Ried show that there are no distinct groupings defining the species. The sequences of cytb that we isolated and provided by GenBank confirmed that there wasn't enough evidence to support three distinct species.

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**0713 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Armelle Jung[1], Mohamed Kamara[2], Salatou Sambou[3], Inluta Incom[4], Aissa Regalla[5], Amadeu Almeida[4], Ceuna Quade[4], Moussa Silla[6], Framoudou Doumbouya[6], Ebou Mbye[7], Gibril Gabis[7], Abdoulaye Diedhiou[8], Lamine Camara[9], Cécile Brigaudeau[1], Mika Diop[10], George Burgess[11]

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## Sawfishes in Northwestern Africa

Sawfishes historically were regarded as common in northwestern Africa, even being depicted on the banknotes and coins of the regional. Listed as critically endangered (IUCN Red List), *Pristis pristis* and *P. pectinata* are still encountered in the area but are poorly reported. The Africasaw project has developed a regional alert network for sawfishes in cooperation with national authorities and fisheries communities of the five countries of the area. The network allows us to collect field data on past and present distribution and biology of native sawfishes. Data from 705 sawfish encounters from 1865-2015 were gathered and analyzed. Capture gear most often involved seines/set nets (60% of the by-catches) followed by longlines and trawl nets. Sawfishes are encountered year-round, and all sizes are represented. Most neonates are caught just after the rainy season while actively mature animals are found during the transition season in the estuarine habitats. Our recent (post 2010, n=45) data identifies crucial hot spots in Guinea Bissau, Sierra Leone and Senegal that will be decisive for the future of the species. Sawfishes were alive at capture in 76% of the fully-documented catches (n=131), underscoring the major role of fishermen in release choice and the urgency to pursue sensitization actions with this user group. These elements are discussed within the perspective of the global sawfish conservation strategy.

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**0208 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Ingrid M. Kaatz[1], Aaron N. Rice[2], Phillip S. Lobel[3]

*[1]private researcher, Stamford, CT, USA, [2]Cornell Laboratory of Ornithology, Ithaca, NY, USA, [3]Boston University, Boston, MA, USA*

## Functional and descriptive morphological evidence for acoustic ability in fishes: a species database

Publications (n = 987) of fish bioacoustic studies encompass: hydrophone studies including functional morphology (n = 637), first record in 1943; morphological descriptions of acoustic mechanism components excluding bioacoustic data (n = 173), first record in 1857; and physiology (n = 177), first record in 1924. Publications per year were: morphology, 2 + 2 SD; physiology, 2 + 3 SD; and bioacoustics 9 + 9 SD. Mechanisms of species with statistically analyzed sounds (pattern, temporal and/or frequency measurements) associated with hypothesized volitional sound production in disturbance, free-moving agonism or reproduction or detected with passive acoustics were evaluated (n = 388 species; 69 families; 16 orders). Mechanism status per species was characterized for: unknown and known condition; mechanism type; and experimental evidence. Morphological correlates of known mechanisms in bioacoustically unexamined species were enumerated. Orders, families and species that require further examination of their potential acoustic ability based on morphology were enumerated.

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**0582 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Dovi Kacev[1], David Gillett[1], Eric Stein[1], Andrew Thompson[2]

*[1]Southern California Coastal Water Research Project, Costa Mesa, California, USA, [2]National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, California, USA*

## Developing a robust framework for applying metabarcoding analyses to identify pelagic ichthyoplankton in the California Current

Pelagic ecosystems are difficult to study due to their scale, vagility of their inhabitants, and myriad stochastic processes. Quantifying the spatial and temporal distribution of planktonic fish stages is a useful tool to better understand marine dynamics. Traditionally the study of ichthyoplankton has been a laborious and expensive process. The size and morphological similarity of many species at these life stages also makes ichthyoplankton analyses prone to identification errors. Over the past decade, DNA-based identification has been employed to more accurately identify morphologically indistinguishable species. Recent technological advances in high-throughput, multi-sample genetic sequencing developed to study microbiomes, have the potential to increase the spatio-temporal coverage of ichthyoplankton surveys, allowing for a better understanding of ecosystem dynamics. In this study, we test the use of a metabarcoding approach to identify pelagic ichthyoplankton. First, we determine which locus/loci are

the most efficient for barcoding fishes in the California Current. Second, we determine how accurate metabarcoding fish identification is relative to traditional, morphological approaches. Third, we test the detection threshold for particular species of interest to turn a presence only data set into a presence/pseudo-absence data set. Fourth, we test the sensitivity of the metabarcoding approach to extraction and amplification stochasticity. Finally, we will determine the optimum field protocols to maximize the efficacy of this metabarcoding approach. We aim to apply this metabarcoding protocol to improve fishery stock assessments and ecosystem assessments and enable the development of bioassessment indices to understand anthropogenic impacts on pelagic ecosystems.

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**0537 AES Morphology & Reproduction, Balconies L & M, Friday 8 July 2016**

Stephen Kajiura[1], Rachel Berquist[2], Tricia Meredith[1], Lawrence Frank[2]

*[1]Florida Atlantic University, Boca Raton, Florida, USA, [2]University of California San Diego, La Jolla, California, USA*

## Diffusion Tensor Magnetic Resonance Microscopy Reveals Novel Olfactory System Neural Organization in the Atlantic Stingray, *Dasyatis sabina*

All life on earth exhibits some degree of chemical sensitivity. Within the vertebrate clade, the organization of the olfactory system is largely conserved, despite their morphological diversity. Histological evidence suggests that the elasmobranch fishes demonstrate a remarkably different olfactory bulb organization than other vertebrates, including the teleost fishes. However, conventional histology is laborious, destroys intact structure, results in disjointed samples which must be reconstituted to elucidate three dimensional organization, and thus is inherently prone to tissue damage and registration errors. Here we show that Diffusion Tensor Microscopy (DTM) can be applied to facilitate Fiber Tract Mapping (FTM) of complex peripheral and central neural pathways. Using this non-invasive 3D digital imaging methodology, we imaged the olfactory organ and olfactory bulb of a basal vertebrate, the Atlantic stingray, *Dasyatis sabina*. We found that Olfactory Receptor Neurons (ORNs) project from the olfactory epithelium through the secondary and primary olfactory lamellae to the olfactory bulb. Within the bulb, the ORNs maintain their spatial integrity by projecting to glomeruli situated within one to two lamella widths of their point of origin producing a somatotopic bulbar organization. This contrasts with teleost fishes which possess a chemotopic organization whereby olfactory receptor neurons that share similar chemical sensitivity converge in glomeruli regardless of their point of origin within the olfactory epithelium. Our results illustrate the utility of DTM and FTM to efficiently inform us about intact neuronal structure by revealing a three dimensional bulbar organization that we believe may be fundamentally different from all other vertebrates.

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**1058 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Larry Kamees, Steven Beaupre

*University of Arkansas, Fayetteville, AR, USA*

**Thermal Conduction in an Ectothermic Ambush Predator**

The body temperature ($T_b$) of a terrestrial ectotherm is directly influenced by heat flux primarily due to radiation, convection, and conduction within the immediate environment. The ability to maintain relative thermal constancy within a fluctuating environment is essential to maintaining physiological processes. Pit vipers are ectothermic ambush predators that must effectively thermoregulate while relying on cryptic behavior and coloration to acquire prey. We used Timber Rattlesnakes (*Crotalus horridus*) to describe how large-bodied pit vipers maintain thermoregulation while in ambush. With a set of simplifying assumptions, we modeled ambush foraging snakes as a slab on the forest floor. Specifically, we asked: What is the rate of thermal conduction and is it sufficient to explain the thermoregulatory strategy of the Timber Rattlesnake? We used a simple conduction model to describe this relationship using the snake's surface temperature, the internal body temperature and the substrate temperature in contact with the snake. We hypothesize that thermal inertia plays an important role in assisting the snake to maintain $T_b$, despite ample environmental variance. Preliminary results indicate snakes are primarily conducting heat along a temperature gradient from dorsal to ventral. The results appear to support our hypothesis that thermal inertia and geometry are important factors in maintaining $T_b$.

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**0527 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jade Keehn[1], Andrew Durso[2], Susannah French[2], Chris Feldman[1]

*[1]University of Nevada, Reno, Reno, NV, USA, [2]Utah State University, Logan, UT, USA*

**Chronic stress response of side-blotched lizards (*Uta stansburiana*) at noisy California wind farms**

Anthropogenic disturbances can cause long-term stress for native wildlife, potentially compromising immune function, and ultimately reducing survival and recruitment. Here, we assess the potential consequences of chronic noise exposure in side-blotched lizards (*Uta stansburiana*) at three wind farms in Palm Springs, CA. Relative to paired control sites with no turbine noise, we predict that lizards at wind farms will exhibit increased plasma concentrations of reactive oxygen metabolites (dROM) resulting from elevated glucocorticoid hormone levels. Similarly, we anticipate less oxidative stress resistance (OXY) in these populations. To test these predictions, we caught lizards at six sites (n = 21 to 26 females per site), collected blood samples, and quantified (1) dROM and (2) OXY from plasma. We used linear regression to calculate average dROM and OXY values for each study site after correcting for length-specific mass and reproductive condition. Models indicated a trend towards higher stress (dROM) at noisy wind farms for two of three site pairs; however, these differences were not significant. Our results

from OXY data support a similar conclusion that noise stress from wind turbines does not substantially affect population health; rather, stress is locally variable and reflects other intrinsic and extrinsic factors.

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**1003 SSAR SEIBERT AWARD ECOLOGY, Galerie 3, Thursday 7 July 2016**

Matthew G. Keevil[1], Natasha Noble[1], Sean Boyle[1], David Lesbarrères[1], Ronald J. Brooks[2], Jacqueline D. Litzgus[1]

*[1]Laurentian University, Sudbury, Ontario, Canada, [2]University of Guelph, Guelph, Ontario, Canada*

## Inferring Causes and Consequences of Dispersal using Sex and Size Frequencies of Turtles Observed on Roads

Aquatic turtles encounter roads when seeking nesting habitat, when roads bisect habitat within individual home ranges, and during dispersal. We examined the demographic frequency of Painted Turtles (*Chrysemys picta*) and Snapping Turtles (*Chelydra serpentina*) observed on roads at multiple sites in Ontario to infer juvenile dispersal patterns. Hypotheses about the adaptive value of dispersal make differing predictions about sex-biases among dispersers. Inbreeding avoidance and kin competition for mates predict sex-biased dispersal while kin competition for resources predicts that both sexes disperse. Late age of maturity implies that resource competition may begin much earlier in life than mate competition or potential inbreeding. Therefore, we predicted that if local resource competition drives dispersal, then juveniles of both sexes will be overrepresented in our road sample. Conversely, if the function of dispersal depends mainly on selective pressures that operate after maturity, then we predict a later age and greater sex-bias among dispersers. Individuals observed on roads were measured and dead juveniles were retained to be sexed by dissection. We constructed integral projection models (IPMs) based on data from long-term studies in Algonquin Provincial Park to generate estimates of overall body size distributions within the study populations. We will test the relative representation of size and sex classes on roads against expected frequencies generated by IPMs. Individual contributions to population growth and viability depend on both age and sex, and knowledge of age and sex ratio of dispersers is critical for understanding how roads and other threats causing dispersal mortality might affect populations.

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**0480 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Steven Kell[1], Jacqueline Litzgus[2], Ron Brooks[1], John Fryxell[1]

*[1]University of Guelph, Guelph, Ontario, Canada, [2]Laurentian University, Sudbury, Ontario, Canada*

## Nest-site fidelity, search time and nest predation in Painted Turtles (*Chrysemys picta*)

Turtle populations are threatened by unnaturally high levels of nest predation, so female turtles should choose nesting locations to both maximize embryonic development and minimize nest predation. Nest-site fidelity, the tendency for a female to return to a given nesting location, may result in minimizing search time and therefore time susceptible to terrestrial predators while gravid. Similarly, nesting near one's primary aquatic habitat should reduce exposure time to predators, but can lead to high nest densities and therefore high predation rates through increased predator search efficiency. If female painted turtles (*Chrysemys picta*) show fidelity, search time should decrease with age as a result of gaining nesting experience. Furthermore, if predation rates are highest at high nest density, this may counteract the potential benefits of fidelity. Using monitored nesting locations from the Algonquin Park (Canada) long-term study and time-lapse videos of embankments, fidelity, search time, and nest predation data were collected and quantified. Females showed varying levels of fidelity by returning to the same $10m^2$, $30m^2$, $50m^2$, $80m^2$ section of embankment ($230m^2$) in 47%, 60%, 69%, and 80% of study years, respectively. As females increased in age, they increased their number of nesting attempts and nested in higher nest density areas. Across sites, intermediate densities had the lowest predation rates but within a site, nest survival was highest at high nest densities. This suggests that as females age, they increase search time to find better nesting locations and nest in higher density areas which could benefit nest survival through predator saturation.

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**0441 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Payton Kellenburger[1], Hanna Van Meter[1], Daniel Perkins[2], Bob Brodman, Timothy Rice

*[1]Saint Joseph's College, Indiana, USA, [2]Jasper County Soil & Water Conservation District, Indiana, USA*

## The Effects of Cover Crop on Amphibians

Cover crop is known to benefit soil and water quality, however little is known of the direct effects of cover crops on resident wildlife communities. In addition to the potential benefits to amphibian habitat near agriculture, wetlands may be exposed to herbicides when cover-crops are terminated before planting cash crops. Although little is known about the impact of cover-crops on amphibian populations, herbicides are known to be detrimental to amphibians. Our goal is to determine if using cover crop benefits amphibian communities adjacent to agriculture. We conducted a two year pilot

study by collecting data on the abundance and diversity of amphibians in five wetland-woodland complexes that are surrounded by cropland. We established cover crops on two of these sites, and the other three sites served as controls. To simulate herbicide exposure from cover crop termination we collected *Ambystoma tigrinum* larvae from control and treatment sites just before cover crops were terminated and raised them in the lab for 12 weeks. Half from each site were exposed to the glyphosate herbicide Roundup. We found no difference in overall abundance or species richness of amphibians between control and cover crop treated sites, however the diversity index of cover crop sites was significantly greater that control sites. We found an interactive effect of cover crop and herbicide that affected growth and development in larvae collected from control sites but found no difference in larvae from cover crop sites. This suggests a benefit of cover crops to salamander fitness.

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**0954 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Aimee Keller[1], Jason Cope[1], Anna Elz[1], Peter Frey[1], John Harms[1], James Orr[2], Linda Park[1], Vanessa Tuttle[1]

*[1]NMFS, Northwest Fisheries Science Center, Seattle, WA, USA, [2]NMFS, Alaska Fisheries Science Center, Seattle, WA, USA*

## Life History Differences Between Rougheye (*Sebastes aleutianus*) and Blackspotted (*S. melanostictus*) Rockfishes Based on Genetic Analysis

Cryptic and incipient speciation within rockfishes (genus *Sebastes*) abounds on the U.S. West Coast. Investigation into morphological, life history, and genetic differences between similar species continues to reveal important distinctions among known species as well as within currently recognized species. Ambiguity in the taxonomy and biology of such species may result in historical data being pooled inappropriately, potentially obscuring important life history differences and adding uncertainty to stock assessments. We identify differences in the depth, spatial distribution, and growth for the Rougheye (*S. aleutianus*)/Blackspotted (*S. melanostictus*) Rockfish complex, while also offering preliminary results into newly discovered genetic variability within Darkblotched Rockfish (*S. crameri*). Over 900 tissue samples were obtained for the Rougheye/Blackspotted Rockfish genetic analysis. The analysis employed a diagnostic Taqman assay of the ND3 mitochondrial region developed for this species pair. Although these species are challenging to distinguish in the field and via robust morphometrics and meristics methods, they are diagnosable using genetic techniques. Results indicate over 15% of the catch previously identified as Rougheye Rockfish may be Blackspotted Rockfish. These results have implications for long-term data sets including commercial landings and historical survey data. Color variability in Darkblotched Rockfish has elicited a similar investigation into stock structure. Preliminary analysis suggests similar levels of consistent genetic variation among over 70 samples at multiple loci. However, observed genetic differences and various morphometric and meristic characteristics among voucher specimens examined to date are not concordant. Further investigations are underway.

**0413 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Bryan Keller, Chip Cotton, Dean Grubbs

*Florida State University Coastal and Marine Laboratory, Tallahassee, FL, USA*

## Reproductive biology and embryonic development in two common deep-water dogfishes (*Squalus cubensis* and *S.* cf. *mitsukurii*) from the northern Gulf of Mexico

Little is known about the reproductive biology of most deep-sea sharks (>200m), despite comprising over half of all identified shark species. In conjunction with a project to examine the ecological effects of the 2010 Deepwater Horizon oil spill (Deep-C; www.deep-c.org), sharks were collected near Desoto Canyon in the northern Gulf of Mexico using demersal longlines in depths ranging from approximately 200-600m. Samples and data from 243 Cuban dogfish (*Squalus cubensis*) and 323 undescribed dogfish (*S.* cf. *mitsukurii*) (sexes combined) were collected to determine reproductive parameters. Modes of reproductive development, and hence maternal-embryonic nutritional relationships, vary greatly among elasmobranchs, and literature suggests lecithotrophic species experience a 20% (or more) loss in organic matter during embryogenesis, whereas matrotrophic species exhibit a lesser reduction, or in many cases an increase in organic matter. These changes in biomass reflect the net balance of metabolic losses of embryogenesis and any maternal nutritional supplementation during gestation. In this ongoing study, we are measuring wet, dry, and ash weights of eggs and embryos in over 70 gravid uteri to determine changes in organic matter during gestation and hence reveal the maternal-embryonic nutritional relationships for both species. Our results will suggest whether these species exhibit a lecithotrophic or matrotrophic mode of reproduction. Additionally, we also report size-related fecundity, ovarian cycle, and seasonality of mating. Such reproductive parameters, as well as the maternal-embryonic relationships among our study species, have not previously been reported and these results will shed light on the bioenergetics and scope for growth of these species.

**0741 HL, ASIH, SSAR: Eco-Evolutionary Dynamics Symposium, Salon D, Friday 8 July 2016**

Suzanne Kelson[1], Michael Miller[2], Stephanie Carlson[1]

*[1]University of California, Berkeley, Berkeley, California, USA, [2]University of California, Davis, Davis, California, USA*

### Eco-evolutionary dynamics in a Pacific salmonid: Connecting genotypes to ecological effects

There is a growing interest in understanding how genotypic diversity, through strong phenotypes, influences ecology. The salmonid *Oncorhynchus mykiss* is one species that expresses alternative phenotypes, ocean-migrating vs. freshwater-residents, which has been linked to a region of the genome (Pearse et al. 2014). Here, we explore how waterfalls influence the spatial distribution of resident vs. migratory genotypes in coastal streams in northern California, and the ecological consequences of life history zonation. We found that the largest waterfall in one stream influenced the distribution of resident and migratory life history haplotypes (preliminary results suggest 72% resident haplotypes above vs. 44% below the waterfall). Next, we found longitudinal differences in density and size structure that relates to this life history zonation, and has implications for the food web. In the same stream, the density of age-0 fish in the below-waterfall/migratory reach is almost 4x's higher, while the density of age-1+ fish is lower than the above-waterfall/resident reach ($P < 0.05$ for both comparisons). Additionally, we found that the age-1 and older individuals tend to feed at a higher trophic level than age-0 individuals (mean 8.162‰ vs. 5.96‰ δN15). The shift from age-0 dominated food webs in the migratory zone to age-1+ dominated food webs in the resident zone may represent a shift from a 3-level to a 4-level food web. Overall, we found that waterfalls influence the zonation of life history genotypes, which has implications for stream ecology through changes in the density and size structure of the top predator.

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**0280 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Jenny Kemper, Gavin Naylor

*Medical University of South Carolina, Charleston, SC, USA*

### A Species-Level Phylogeny of Chimaeroids Using Genomic Comparisons

Chimaeroids are a small and once diverse group of cartilaginous fishes with origins dating back at least 420 million years. Extant chimaeras, with 49 currently described species, represent the sister group to the sharks, skates and rays, and are also closely related to the extinct iniopterygians. While cartilaginous fishes as a whole are considered to be the oldest living group of jawed vertebrates and provide a unique reference for vertebrate evolution, the Chimaeriformes occupy the most basal position within this group. However, most molecular studies have focused on sharks and rays, and only used chimaeras as an outgroup. The few molecular studies that have

attempted to address intra-relationships among chimaeras have used only a few species, or do not include all the genera. To date, there have been no comprehensive molecular studies that have estimated the intra-relationships within these fishes. It is necessary to reconstruct the phylogenetic relationships among all the extant members in order to better estimate the ancestral state and predict how changes in genetic architecture may have evolved over time within the chimaeras and across vertebrates. Our objective in the current study was to estimate a species-level phylogeny of extant chimaeroids. We used a new method of DNA hybridization capture in which approximately 1265 nuclear, single-copy exons were captured, followed by next-generation sequencing. Additionally, whole mitochondrial genomes were captured by similar methods. The two datasets will be subjected to phylogenetic analyses to estimate a species-level phylogeny and topologies will be compared between datasets.

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**1113 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Christopher Kenaley[1], Alis Dicpinigaitis[1], Dylan Wainwright[2], Anna Kim[1], Jeanelle Ackerman[1], Reginald Paris[1], George Lauder[2]

*[1]Boston College, Chestnut Hill, MA, USA, [2]Harvard University, Cambridge, MA, USA*

**Mechanics of Fish Skin: Revisiting the External Tendon**

The skin of fishes provides several important functions, including protection from the external environment, water balance, and gas exchange. How the material properties of skin contributes to the performance of biomechanical systems such as locomotion has received little attention by scientists. Previous studies have revealed that the skin of "primitive" fishes, such as sharks and eels, constitutes a lateral tendon, a property that emerges from the skin's cross-helical arrangement of collagen fibers. It has been hypothesized that the lateral external tendon increases the mechanical advantage of the body musculature and stores elastic energy in fishes engaging in anguillform locomotion. This limited body of work also posits that more derived fishes relying on carangiform and thunnifrom propulsion lack an external tendon. We reevaluate these hypotheses by assessing the stiffness of trunk integument from fishes that represent clades across the fish tree of life and a gradient of the propulsive modes. Through uniaxial and biaxial stress-strain experiments, we assess whether material properties vary according to position along the trunk and with locomotor mode.

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**1112 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

Christopher Kenaley[1], John Yoo[1], Mary Toner[1], David Cartier[1], Anudeep Alberts[1], Dylan Wainwright[2]

*[1]Boston College, Chestnut Hill, MA, USA, [2]Harvard University, Cambridge, MA, USA*

### Mechanics of Fish Skin: Contrasting Material Properties Between Functional Systems

The skin of non-tetrapod fishes provides several important functions, including protection from the external environment, water balance, and gas exchange. The role skin plays in biomechanical systems such as locomotion and feeding has received little attention by scientists. With its cross-helical arrangement of collagen fibers, fish skin may contribute to swimming by maintaining hydrodynamic body shape and serve as a lateral tendon that increases the mechanical advantage of the body musculature and stores elastic energy. The material properties of fish skin that underlie these functions have been explored in detail in only a few species of sharks, an eel, and a few percomorph fishes. On the other hand, the role that skin plays in feeding and how its material properties enhance or constrain this complex and highly kinetic system has remain unstudied. For species that engage in suction feeding—the dominant mode of prey capture in fishes—skin plays an important role in the generation of subambient pressures by stretching with the kinetic skeletal elements of the head and sealing off the ventral and lateral aspects of the buccal cavity. Thus, unlike the skin of the trunk, the skin of the feeding apparatus must undergo substantial positive biaxial strains. Here we present the first data describing the stiffness of skin from the head to evaluate the hypothesis that, due to the contrast in function, the material properties of skin from the head differs considerably from those of skin over locomotor surfaces.

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**0517 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Joey Kennedy, Joseph Pechmann

*Western Carolina University, Cullowhee, NC, USA*

### Differences in Surface Activity Behaviors in Two Terrestrial Salamanders

Understanding animal behavior is important in understanding basic ecology including foraging opportunities, foraging success, and possible competitive interactions. I studied two terrestrial salamanders in the southern Appalachian Mountains, *Plethodon teyahalee* and *P. metcalfi*. *Plethodon teyahalee* is found at low elevations and *P. metcalfi* is found at high elevations. I studied both species at an intermediate elevation where their distributions overlap. My hypothesis was *P. teyahalee* and *P. metcalfi* exhibit different foraging behaviors, *P. teyahalee* foraging with its head sticking out from its burrow, and *P. metcalfi* leaving its burrow and foraging on the forest floor. To test this I collected 30 *P. teyahalee* and 30 *P. metcalfi* and implanted an individually numbered PIT (passive induced transponder) tag subcutaneously in each. I then released each tagged

salamander where it had been captured. On 13 nights over 5 weeks I used PIT tag telemetry to relocate the salamanders and record their behavior. I found that *P. teyahalee* and *P. metcalfi* exhibited different foraging behaviors: 66.7% of *P. teyahalee* normally foraged by poking their heads out of their burrows whereas 100% of *P. metcalfi* normally left their burrows completely to forage (P = 0.0017). *Plethodon metcalfi* are known to be more aggressive than *P. teyahalee*, so staying inside or near their burrow could be a way for the *P. teyahalee* to avoid confrontation with *P. metcalfi*. Since *P. teyahalee* are found at lower elevations where the climate is generally warmer and drier; staying inside its burrow could be an adaptation to reduce desiccation.

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**0263 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Matthew Q. Kennedy, Geoffrey N. Hughes, Jacqueline D. Litzgus

*Laurentian University, Sudbury, ON, Canada*

## Quantifying the success of rehabilitation in snapping turtles (*Chelydra serpentina*) through post-release measures of body condition and behaviour

The goal of wildlife rehabilitation is to return unhealthy or injured individuals to their native home ranges such that they no longer require human assistance for survival, and can assimilate into the already established population. Our project sought to investigate the success of rehabilitation on snapping turtles (*Chelydra serpentina*). Five snapping turtles from the Wild at Heart Animal Refuge Centre in Lively, Ontario were released after rehabilitation. These individuals were tracked using radio telemetry post-release and measures of body condition and spatial ecology were taken throughout the active season of 2015. Body condition was quantified using a comparison of carapace length and body mass for each turtle. Body conditions of rehabilitated turtles were then compared to 45 wild snapping turtles and no significant difference was found. Spatial ecology was quantified by size of home range during the active season. The home range size of three rehabilitated turtles tracked during the active season of 2015 were compared to 11 wild turtles. Home range sizes of rehabilitated turtles were found to be significantly smaller than wild turtles. These data can provide important information on the success of rehabilitation on freshwater turtles as we consider more conservation techniques to counteract declining populations.

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**1017 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Steven Kessel[1], David Yurkowski[1], Tarik Chekchak[2], Graham Hill[3], Rebecca Klaus[2], Ryan Walter[1], Nigel Hussey[1]

*[1]University of Windsor, Windsor, Canada, [2]Equipe Cousteau, Paris, France, [3]The Deep Aquarium, Hull, UK*

### Spatial use of coastal manta rays (*Manta alfredi*) in Sudan relative to marine reserve boundaries, and proximity to a proposed coastal development

Large coastal manta ray aggregations have been regularly observed off the north Sudanese coast of the Red Sea, yet almost no focused research has been conducted on these animals. The majority of sightings have occurred within the boundaries of the Dungonab Bay marine reserve, however, an island development within these boundaries has been proposed. Wildlife Computers® SPOT 4 tags were secured to the dorsal fins of three coastal manta rays. A two-state switching Bayesian State Space Model (BSSM), that allows movement parameters to switch between behavioural states, was fit to the recorded locations. Locations were then used to calculate home ranges at 50% and 95% Kernel Utilization Distributions (KUD). A total of 682 BSSM locations were recorded between 30 October 2012 and 6 November 2013. Of these, 98.5% fell within the reserve boundaries, 99.5% for manta 1, 91.5% for manta 2, and 100% for manta 3. The BSSM identified that all three mantas were resident/foraging during 99% of transmissions, with 50% and 95% KUD home ranges falling mainly within reserve boundaries. For all three manta rays combined (88.4%), and all individuals (manta 1 - 92.4%, manta 2 - 64.9%, manta 3 - 91.9%), the majority of locations occurred with 15 km of the proposed development. The distribution of recoded locations indicated that the established reserve boundary is spatially appropriate for protecting manta rays in the region. The close proximity of locations/home ranges to the proposed development highlights the potential threat of disruption to the local coastal manta ray population.

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**0846 SSAR SEIBERT AWARD ECOLOGY, Galerie 3, Thursday 7 July 2016**

Ethan J. Kessler

*Illinois Natural History Survey, Champaign, IL, USA*

### Assessing Eastern Box Turtle (*Terrapene carolina*) Habitat Selection with Public-Use LIDAR Data

Evaluating habitat selection is difficult with movement-limited organisms, such as reptiles and amphibians. Spatial autocorrelation of successive points is intrinsic in the movement paths of these animals and biases conclusions. These problems are compounded when habitat selection is evaluated on the landscape with freely available land use data. These map products are often subjective and not at a proper scale or resolution to illustrate habitat selection in species without unrestricted movement. Map products with too coarse resolution will average used and unused habitat into a single

pixel value, weakening evidence of habitat preference. LIDAR can create map products with sub-meter accuracy which can be tailored to project needs. LIDAR data are freely available from many government agencies and freeware is available to process these data. To test the value of LIDAR in habitat selection studies, map products of our study site were created for elevation, slope, canopy cover, and edge habitat. Habitat characteristics at radio locations of 25 individual *Terrapene carolina* tracked from May-November 2009 (92.8 locations/turtle) were compared to random points using a Step Selection Function (SSF). The SSF generated random points based on probabilistic movement patterns derived from observed daily movement. Habitat selection was assessed with conditional logistic regression, minimizing the effects of spatial autocorrelation. *T. carolina* preferred forested sites with uneven canopy cover (i.e. disturbed forest and edge). These results illustrate the utility of LIDAR based habitat selection models and provide new evidence of habitat selection in *T. carolina*.

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## 0316 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H, Thursday 7 July 2016

Lesley Kim, James Albert

*University of Louisiana at Lafayette, Lafayette, LA, USA*

### A New Species of *Gymnotus* Electric Fish (Teleostei: Gymnotiformes) from the Rio Aripuanã and Diversification of the G2 Clade

*Gymnotus* is the most species-rich and geographically widespread genus of gymnotiform electric fishes, and has been used to help understand mechanisms of diversification in Neotropical freshwater fishes at a continental scale. The G2 clade is currently known from four valid species (*G. anguillaris*, *G. cataniapo*, *G. pedanopterus*, and *G. tiquie*) restricted to rivers of the Guianas Shield, and several undescribed species. Here we use body-surface coloration, meristic, morphological, and osteological data, including cranial, laterosensory pore and postcranial characters, to diagnose a new species of the G2 clade from the rio Aripuanã, located in the Lower Madeira basin on the Brazilian Shield. Geometric morphometrics was also used to separate the new species from other G2 species, primarily based on the relative size of the face and braincase. We report biogeographic distributions for all G2 species as dot maps of all collection localities, and estimate ancestral geographic ranges and range evolution using the parametric biogeographic program BioGeoBEARS. We use the phylogeny of the G2 clade to test two alternative hypotheses regarding divergence times, using the formation of the modern East-draining Amazon at c. 10 Ma. Our analysis suggests that diversification in the G2 group occurred primarily by geographic range fragmentation (vicariance) from an ancestor distributed widely across the Guiana and Brazilian Shields ("Eastern Highlands"), with no documented examples of geographic range expansion (dispersal) or range contraction (extinction). These results are similar those of other *Gymnotus* and gymnotiform clades, where allopatric speciation and secondary contact due to geographic range expansion are commonly observed.

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**0884 HL GRADUATE RESEARCH AWARD, Galerie 2, Friday 8 July 2016**

Richard Kim[1], Brian Halstead[2], Eric Routman[1], Michael Casazza[2], Julie Andersen[3]

*[1]San Francisco State University, San Francisco, CA, USA, [2]U.S. Geological Survey, Western Ecological Research Center, Dixon, CA, USA, [3]Midpeninsula Regional Open Space District, Los Altos, CA, USA*

## Dietary Patterns in the Endangered San Francisco Gartersnake Revealed by Analysis of Prey DNA from Fecal Samples

Noninvasive genetic sampling provides great potential for diet studies of listed and rarely-encountered species, such as the endangered San Francisco gartersnake (*Thamnophis sirtalis tetrataenia*). Standard methods, including palpating snakes to force regurgitation of consumed prey, require that the stomach contents are undigested and identifiable, which can result in low sample size. PCR methods can detect the presence or absence of target prey species from DNA obtained from snake feces even if stomach contents of the snake have been completely digested upon capture. We collected 105 fecal samples from 89 *T. s. tetrataenia* individuals at two study sites in 2014 and 2015. We developed prey species-specific PCR primers to detect the presence of California Red-legged Frog (*Rana draytonii*), Sierran Treefrog (*Pseudacris sierra*), and American Bullfrog (*Lithobates catesbeianus*) DNA. At least one prey species was detected in 76 fecal samples. We analyzed the diet data using an occupancy model to account for imperfect detection of DNA using PCR and also assess how snake morphology and time were associated with prey use. For all prey species, the per-aliquot detection probabilities of PCRs were higher than 75%. Our results suggest that *T. s. tetrataenia* display an ontogenetic shift in diet away from Sierran Treefrogs, that they prey upon Sierran Treefrogs to a greater extent earlier in the year, and that they preyed upon California Red-legged Frogs to a greater extent in 2015 than in 2014. Fecal DNA provided valuable diet data from an endangered and rarely-encountered species that would not otherwise have been obtainable.

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**0571 General Herpetology, Galerie 2, Saturday 9 July 2016**

Laura B. Kimmel, Michelle L. Haynie, Allyson M. Fenwick, Paul A. Stone

*University of Central Oklahoma, Oklahoma City, OK, USA*

## Phylogeography of Sonoran Mud Turtles (*Kinosternon sonoriense*) in the Madrean Sky Islands based on Mitochondrial D-loop Analysis

When well-planned and executed, phylogeographic analyses can show historical patterns of gene flow and genetic isolation. Naturally fragmented freshwater habitats often create replicated natural experiments well-suited to phylogeographic study. The subdivided topography of individual mountain ranges in the Madrean Sky Islands in

New Mexico and Arizona make the habitat ideal for studying genetic variation of the Sonoran mud turtle at three levels: within drainages, among drainages, and among mountain ranges. Sonoran mud turtles are widespread across the American Southwest, and commonly make extensive terrestrial movements that increase the potential for gene flow within mountain ranges. This makes Sonoran mud turtles a good model for understanding how Pleistocene climate changes affected population dynamics of a variety of sky island organisms. We have sequenced two pieces of the mitochondrial DNA D-loop for three populations each from the Peloncillo, Galiuro, Huachuca, and Pajarito Mountains. Preliminary results show two common haplotypes, both found in multiple ranges. The rarer of two main haplotypes is most prevalent in the Pajarito and Huachuca Mountains. Our preliminary results indicate insufficient time has elapsed for significant D-loop sequence divergence and population differentiation. Future research will focus on optimization of six previously published microsatellite loci.

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**0666 Fish Ecology I, Salon A-C, Saturday 9 July 2016**

Holly Kindsvater[1], Marc Mangel[3], John Reynolds[2], Nick Dulvy[2]

*[1]Rutgers University, New Brunswick, NJ, USA, [2]Simon Fraser University, Burnaby, BC, Canada, [3]UC Santa Cruz, Santa Cruz, CA, USA*

## A New Framework Connecting Life History Traits, Population Dynamics, and the Ability to Withstand Environmental Change

Understanding the connection between life history traits and population dynamics is especially challenging in fishes. Fish populations are generally assumed to have strong density-dependent regulation, but inferring how it interacts with life history traits is complex. We build on previous work (e.g. Winemiller's life history triangle) to develop a comparative framework for categorizing life histories, POSE (Precocial–Opportunistic–Survivor–Episodic), which synthesizes how juvenile and adult mortality act as selective agents on offspring size, fecundity, age at maturity, and body size. This clarifies the link between density-dependence and life history traits. We illustrate this by comparing different species representing extreme life histories, including seahorses, herring, grouper, and sawfish. We show how life history differences among these species relate to their compensatory capacity – the ability of a species or population to withstand environmental change. Specifically, for each species we adapt a population dynamics model commonly used in fisheries management, which we use to quantify how differences in mortality affect changes in population productivity (production of eggs). Compensatory capacity is one component of a species' intrinsic sensitivity to overfishing; the other component is exposure. By comparing the sensitivities of different species, we highlight where governing agencies, including the IUCN, can use life-history traits to improve conservation and management of fishes.

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**0535 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Cragen King, Philip A. Hastings, Kevin W. Conway

*Texas A&M University, College Station, TX, USA*

### *Discotrema* or *Lepadichthys:* the phylogenetic position of *Lepadichthys lineatus* Briggs within the subfamily Diademichthyinae

The gobiesocid subfamily Diademichthyinae contains four genera of Indo-Pacific clingfishes: *Lepadichthys* Waite, 1904, *Diademichthys* Pfaff, 1942, *Discotrema* Briggs, 1976 and *Unguitrema* Fricke, 2014. Relatively little is known about the species of diademichthyine clingfishes and many descriptions are based on relatively few specimens or, in some cases, a single individual (e.g., *Discotrema zonatum* Craig & Randall, 2008). Consequently, the intrarelationships of diademichthyine clingfishes are poorly known, and the current generic placement of several species is questionable. For example, there is considerable debate (based on morphological characteristics) on the generic placement of *Lepadichthys lineatus* Briggs, 1966 and whether it should be placed within *Lepadichthys* or *Discotrema*. Using a combination of mitochondrial (COI and 12S) and nuclear genes (ZIC1 and GLYT) we investigate the phylogenetic position of *L. lineatus* in relation to other diademichthyine clingfishes to assess whether the original generic assignment of this species to *Lepadichthys* is an accurate reflection of evolutionary relationships. In addition, we also assess whether the Diademichthyinae and its largest generic grouping (*Lepadichthys)* are monophyletic.

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**0879 AES Conservation & Management III, Balconies L & M, Saturday 9 July 2016**

Michael Kinney[1], Dovi Kacev[1], Suzanne Kohin[2], Tomoharu Eguchi[2]

*[1]Ocean Associates; Under Contract to Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, La Jolla, California, USA, [2]Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, La Jolla, California, USA*

### Quantitative approach for analyzing telemetry data in data-limited situations

Horizontal behavior of highly migratory marine species is difficult to study due to numerous factors including wide-ranging movements, minimal surface time, and remoteness of their habitats. Satellite telemetry enables researchers to track individual movements, but population level inferences are rare, in many cases due to data limitations. We introduce a Bayesian modeling framework to address population level questions about traditionally data-limited species. We tested the framework using a large telemetry dataset for *Isurus oxyrinchus*. First, a permuted random forest analysis is implemented to determine which variables are statistically important. Next, a generalized additive mixed model is used to test that the remaining variables have a linear relationship with the response variable. Using rjags, an R package for analysis of Bayesian hierarchical models using Markov Chain Monte Carlo simulation, we then

developed a movement model to generate parameter estimates for each of the variables of interest. We also demonstrate how two commonly used maximum likelihood (MLE) mixed models can be similarly applied. By randomly reducing the tagging dataset by 25, 50, 75, and 90 percent and recalculating the parameter estimates, we demonstrate that this approach can be applied in data-limited situations. Lastly, the models are used to make forward predictions on novel data. Despite performing similarly, we advocate using the Bayesian approach over the MLE models due to the ability for later studies to easily utilize results of past study to inform working models, and the ability to use prior knowledge via informed priors in systems where such information is available.

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**0891 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Sarah Kirkpatrick, Vincent Cobb

*Middle Tennessee State University, Murfreesboro, TN, USA*

**Do Timber Rattlesnakes Exhibit Postprandial Thermophily in the Field?**

Increasing body temperature ($T_b$) during digestion can facilitate localized biochemical reactions and consequently increase passage rate of food through the digestive tract in terrestrial ectotherms. Snakes, particularly infrequent feeders, may benefit from an increase in digestion rate, because they typically feed on relatively large prey, which substantially increases their body mass. There is considerable evidence, particularly from laboratory studies, that postprandial thermophily can be attained through behavioral thermoregulation. However, there are compelling reasons, such as increased predation risk, that some snake species may not choose warmer $T_b$s during digestion. This study examined thermoregulation, before and after feeding, in free-ranging telemetered timber rattlesnakes (*Crotalus horridus*), an infrequently-feeding snake. *Crotalus horridus* were observed feeding naturally or offered large food items (laboratory rats weighing 30-50% of snake body mass). Continuous $T_b$s of 11 *C. horridus* were recorded during feeding events and indicated that limited postprandial thermophily occurred and is likely to be biologically irrelevant. Additionally, the thermal microhabitats selected by *C. horridus* immediately prior to digestion, during digestion, and after digestion did not differ. This lack of increased thermal selection is counter to the hypothesis of postprandial thermophily, which is generally assumed for most snakes. Because *C. horridus* is an ambush predator, it may sacrifice warmer $T_b$s to conserve energy and/or to avoid detection. Additionally, the climate in central Tennessee may be adequately warm to facilitate digestion without the need for selection of specific sites.

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**0215 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Galerie 3, Friday 8 July 2016**

Lucas Kirschman, Robin Warne

*Southern Illinois University, Carbondale, IL, USA*

### Critical Windows of Development: The Consequences of Physiological Stress and Phenotypic Plasticity in Larval Amphibians

Critical windows are periods during development when animals exhibit amplified plastic phenotypic responses to environmental conditions and stressors. These changes can be permanent and a change in one life stage can have consequences later in ontogeny. Understanding these changes is important in studies of developmental physiology, considering the ubiquity of anthropogenic stressors, many of which are capable of altering development during critical windows. Investigating the physiological consequences of stress-induced plasticity may be important for understanding how animals respond to habitat change. Amphibians are a model system for investigating the effects of altered development during critical windows. Late-stage larvae are sensitive to environmental stressors, which they translate into phenotypic responses via the physiological stress response. When stressors activate this response, they result in the release of corticosterone (CORT), the amphibian stress hormone. CORT accelerates development in late-stage larvae, allowing them to metamorphose quickly and escape suboptimal aquatic habitats. However, CORT is also a regulator or other physiological processes and our research has shown that CORT-mediated, accelerated development alters disease susceptibility, metabolism, macronutrient oxidation and nutrient stoichiometry. Furthermore, some of these affects may continue into adulthood. Here, we present a synthesis of the phenotypic effects of accelerated development, advocate the use of larval amphibians as experimental models for studies of critical windows, and suggest further research directions.

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**0937 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday 7 July 2016**

Amanda Kissel[1], Wendy Palen[1], Maureen Ryan[1], Mike Adams[2]

*[1]Simon Fraser University, Vancouver, British Columbia, Canada, [2]US Geological Survey, Corvallis, Oregon, USA*

### Adding up the stage-specific effects of climate change for montane amphibians

Anthropogenic climate change is expected to alter wetland hydrology at high elevations. Specifically, changes in the timing and form of precipitation may alter wetland hydroperiods, such that ephemeral wetlands dry sooner, and permanent wetlands become ephemeral. Species that rely on consistent water sources, such as amphibians, may experience a phenological mismatch between larval development and the period of time in which wetlands physically hold water. Post-metamorphic juveniles and adults

that feed on aquatic-breeding insects may also be affected by wetlands that dry earlier in the season through decreased prey abundance and increased desiccation risk. To address this, we monitored >60 Cascades frog (*Rana cascadae*) breeding sites within Olympic and Mt. Rainier National Parks in Washington state that span a range of hydroperiod types and quantified the proportion of reproductive effort lost as a result of wetland drying. We found that mortality occurs in all wetland hydroperiod types, and can result in a loss of up to 55% of reproductive effort in a population. We coupled this with a 14-year demographic dataset of *R. cascadae*, and found that adult survival increased with increasing snow pack and winter length. Combining these data with site-specific predictions of warming and drying in the 2040's and 2080's allows us to explore how climate change will affect *R. cascadae* populations now and in the future. These results can then be used to inform conservation decisions, such as removing non-native, predatory fish in permanent wetlands that may act as refuges for amphibians in the future.

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**0393 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Gisela Knightstep, Sarah McBride, Raymond Willis

*Midwestern State University, Wichita Falls, TX, USA*

## Morphological Determination of Valid Subspecies of Canyon Lizard (*Sceloporus merriami merriami*, *Sceloporus merriami annulatus*, and *Sceloporus merriami longipunctatus*) in the Chihuahuan Desert of West Texas

Since its description, relatively few studies have examined the comparative morphology of the canyon lizard, *Sceloporus merriami*, and its subsequent subspecies, Merriam's canyon lizard (*Sceloporus merriami merriami*), the Big Bend canyon lizard (*Sceloporus merriami annulatus*), and the Presidio canyon lizard (*Sceloporus merriami longipunctatus*). Geographical ranges of these subspecies are centered in southwestern Texas. In this study, the Dalquest Desert Research Station (DDRS) and surrounding areas were explored to capture and examine canyon lizard subspecies. From April 2015 to June of 2016, lizards were collected from rock facings within canyon systems of the Trans Pecos area and were subsequently weighed, photographed, and several morphological characteristics were measured and recorded. Museum specimens from surrounding Texas universities were also similarly photographed and measured for comparison to those captured at DDRS. Preliminary morphological data shows little variation among morphometric characters among DDRS specimens and museum specimens. Additionally there is little variation between DDRS and museum specimens. Paravertebral scale coloration and patterning on the dorsal surface as well as belly patches on males, yielded more variation. Results ranged from those documented in previous literature to patterns unlike any previously described. However, no one subspecies exhibited any consistent patterning among individuals. These data may indicate a possible intergradation zone or that the variation between subspecies can be explained as natural variation within one species rather their current designation of separate subspecies.

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**0994 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Adam Knox, Amy Yackel Adams, Robert Reed

*U.S. Geological Survey, Fort Collins, CO, USA*

### Transforming Rapid Response of Invasive Herps with Consumer Electronics

New technology is constantly transforming wildlife-project management and field-data collection. Enhanced data-collection efficiency is now readily feasible with the advent of cloud computing, tablet PCs, and cheap lithium batteries. For the Brown Treesnake Rapid Response Team (BTS RRT), a Guam-based team tasked with acting quickly in the event of a regional snake sighting, the use of portable tablets and free software has streamlined data collection and thus the speed at which analysis and management decisions can occur. This free system of data collection has transformed our conventional data collection techniques which were time intensive and burdensome to handle. The BTS RRT has also developed a ballistic method of capturing invasive herps detected at unreachable distances or in dangerous locations using a hobbyist product, the airsoft electric gun. Repurposing this relatively safe and readily available technology for invasive herp control could prove to be the difference between failed capture and successful control. In our talk, you will learn specifics of these technologies and how these electronic advances have enhanced the capabilities of our rapid response team.

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**0809 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Kristen Kohlhepp, Brian Greene

*Missouri State University, Springfield, Missouri, USA*

### Behavioral Responses by Cottonmouths (*Agkistrodon piscivorus*) to Olfactory and Visual Predatory Cues

Predator detection and assessment of predation risk have important survival consequences for animals. However, responses to predatory threats can vary with different stimuli. Chemical cues are important for predator recognition but visual cues may elicit defensive responses. Cottonmouths (Agkistrodon piscivorus) exhibit an array of antipredatory behaviors that have been thoroughly characterized in response to human aggressors, but their responses to cues from natural predators are poorly known. We conducted three experiments to evaluate cottonmouth responses to visual and chemical stimuli from predators and non-predators. Snakes exposed to predator chemical cues (canine saliva and domestic swine urine) exhibited elevated tongue-flick rates compared to non-predator (crayfish), and distilled water controls but did not perform any antipredatory behaviors. Snakes exposed to mobile silhouettes of predators and non-predators performed significantly more defensive displays in response to red-tailed hawk models than duck models or a blank control (clear Plexiglas shape).

However, snakes exposed to models of terrestrial predators and non-predators exhibited elevated responses to taxidermy mounted mink and muskrat compared to an inanimate object (log) of similar size and color. Our results are consistent with risk-sensitivity predictions in that cottonmouths can use chemical cues to recognize predators and distinguish them from non-predators, and distinguish predatory bird silhouettes from those of Non-predatory birds. However snakes generalized their antipredator responses to stationary mammalian predators and non-predators based on visual cues alone.

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**0867 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Melanie Kolacy, James Sulikowski, Teresa Dzieweczynski

*University of New England, Biddeford, Maine, USA*

**Effects of Temperature on Behavior and Brain Development of the Little Skate**

Over the last 10 years the Gulf of Maine (GOM), has experienced unprecedented warming trends. Research regarding the effects of climate change has primarily focused on bony fish, with minimal knowledge of the effects on elasmobranchs, particularly oviparous species. Recent research on the oviparous little skate has indicated that eggs deposited and incubated in warmer temperatures have shorter gestations and higher mortality rates before and after hatching. In order to better understand this observed mortality in neonate little skates, a series of behavioral tests were implemented to exam the possible linkage between increased ambient temperature and survivability. Here, oviposited eggs from a captive breeding stock were equally divided into two separate conditions. One group of egg cases (N=146) was held at ambient temperature conditions, while the second condition (N=130) simulated an elevated temperature condition of 5˚C above the ambient temperature. After hatching in these conditions, each little skate was measured, tagged, and returned to their respective temperature conditions. Possible differences in behavior were assessed using three assays; foraging, tapstartle responses, and activity levels. Preliminary results suggest higher foraging in all skates raised in ambient temperatures (N=19), while skates raised in elevated temperatures (N=14) fed minimally (14.3%) or not at all (85.7%). 50% of elevated skates displayed a delayed response and appeared to swim shorter distances when startled. However, both elevated and ambient skates seemed to display similar activity levels. These results are currently being analyzed and will be discussed at the AES Conference.

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**0834 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Matthew Kolmann[1], Swara Shah[1], Henil Patel[1], Dean Grubbs[2], Nathan Lovejoy[1]

*[1]University of Toronto Scarborough, Toronto, ON, Canada, [2]Florida State University Coastal and Marine Laboratory, St. Teresa, FL, USA*

## Ecological consequences of alternative muscle scaling in durophagous stingrays

Large jaw adductor muscles, robust jaws, and force-efficient jaw lever systems are hallmarks of durophagous vertebrates. Positive allometry of feeding performance is generally assumed for durophagous predators, for when juveniles compete with adults, earlier access to prey is necessitated. Bullnose rays represent a parallel evolutionary lineage (Myliobatinae) of durophagous stingrays, found in sympatry with related cownose rays (Rhinopterinae). The cranial anatomy of 15 bullnose rays (*Myliobatis freminvillei*) were analyzed using a biomechanical model which estimates bite force over ontogeny. Bullnose ray bite force scaling patterns were compared to those of two separate populations of cownose rays (*Rhinoptera bonasus*) from the Gulf of Mexico and Virginia, which have more catholic and more molluscivorous diets, respectively. Bullnose and cownose ray feeding apparatuses are both characterized by isometric conservation of jaw leverage (mechanical advantage) across their ontogeny, while most jaw adductor muscles grow with positive allometry. In contrast to cownose rays, bite force generation scaled isometrically in bullnose rays. In three lineages of durophagous stingrays, we find subtly different muscle scaling patterns, little evidence of skeletal remodeling facilitating increased jaw leverage, but clear differences in overall feeding performance over ontogeny. Ecologically, despite an earlier advantage in absolute jaw leverage, bullnose rays are eventually out-performed by sympatric cownose rays in Chesapeake Bay, despite the former preying on comparably stiffer prey (gastropods). Although the diet of bullnose rays may require greater crushing forces, cownose ray aggregations exposes these migratory, gregarious fishes to greater levels of interspecific competition than solitary bullnose rays.

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**0832 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Matthew Kolmann[1], Kenneth Welch[1], Adam Summers[2], Nathan Lovejoy[1]

*[1]University of Toronto Scarborough, Toronto, ON, Canada, [2]University of Washington, Seattle, WA, USA*

## Goats of the sea - bilaterally asymmetric chewing in an elasmobranch

Freshwater stingrays invaded the prehistoric Amazonian mega-lagoon around 14-28 mya, and now number 30+ species. They have diversified to fill an array of trophic niches across South American river basins though they lack the prey-processing pharyngeal jaws of teleosts. Several freshwater rays (Potamotrygonidae) are the only

insectivorous elasmobranchs, specializing on aquatic insect larva in particular. Concurrent with insectivory, in these rays we see asymmetrical jaw motion (chewing) during prey processing. A mainstay of mammalian feeding, asymmetric chewing has never been described in a cartilaginous or actinopterygian fish. We will present kinematic data on prey-processing in an insect-feeding freshwater stingray, *Potamotrygon motoro*. Asymmetrical jaw protrusion and substantial lateral movement of the jaws occurs when feeding on tough prey items like insects, presumably shearing the chitinous exoskeleton. Aiding in this, insectivorous rays can behaviorally reorient their teeth from a flattened surface to occluding cusps when feeding on tough prey, as the dental ligament is flexed at the medial jaw symphyses. Despite a simple jaw morphology, potamotrygonids accomplish impressive post-capture prey manipulation and processing by combining hydrodynamic forces with complex movements of the jaws. The impetus for kinematic flexibility of the oral jaws in stingrays may be the batoid penchant for de-coupling prey processing from prey capture: stingrays use their whole body to generate suction and apprehend prey. The de-coupled nature of the jaws from the cranium (euhyostyly), tethered and supported by muscles rather than articulated skeletal elements, may also play a role in explaining the highly-kinetic and adaptable stingray feeding apparatus.

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**0183 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Galerie 3, Friday 8 July 2016**

John Konvalina, Jonathan Stanley, Stanley Trauth

*Arkansas State University, Jonesboro, AR, USA*

## Sperm Morphometric Comparison of Two Snake Species in the Family Colubridae

Sperm morphometric studies within Serpentes are limited to only a few papers. To fill in this knowledge gap, we analyzed sperm morphometrics in two snake species, *Opheodrys aestivus* (N = 14) and *Nerodia rhombifer* (N = 41). For each specimen, 20 sperm were randomly selected and the following were measured: sperm head length, sperm tail length, and total sperm length. T-tests were used to check for significant differences in sperm morphological characters between the two species and an ANCOVA was used to test for correlations among sperm tail length, total sperm length and species. While SVL was significantly greater in *Nerodia rhombifer*, total sperm length was significantly greater in *Opheodrys aestivus*. Sperm tail length had a strong positive correlation ($r = 0.997$, $p < 0.001$) with total sperm length. Sperm head length was not significantly different between the two species, suggesting it may be genetically fixed. Many resources go into sperm tail growth so that individual sperm can swim faster and reach the ovum before competitors do. This explains the almost 1:1 correlation between sperm tail length and total sperm length. Overall, we conclude that total sperm length is determined solely by sperm tail length and is not influenced at all by sperm head length, SVL, or species. Future studies need to investigate other species in the family Colubridae to see if these trends are sustained.

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**0181 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

John Konvalina, Christopher Thigpen, Stanley Trauth

*Arkansas State University, Jonesboro, AR, USA*

## Population Dynamics of Chelonians in an Urban Lake in Jonesboro, Craighead County, Arkansas

We surveyed Craighead Lake in Jonesboro, Craighead County, Arkansas for aquatic turtles. From July 2, 2015 to October 9, 2015 six hoop-net traps baited with fish were placed around the lake. Traps were set twice a week and checked twelve hours after they were set. Carapace length, carapace width, plastron length, and plastron width were all measured for each individual. The individual's sex and species were also noted, and a notch was made in one or more of its scutes to aid in future identification. Finally, a photo was taken of each individual's carapace and plastron. A total of six species were captured with red-eared sliders (*Trachemys scripta*) being the most common. A single, female razor-backed musk turtle (*Sternotherus carinatus*) was found and represented a county record and the first record for this species above the 35°N parallel in Arkansas. The only recaptures were red-eared sliders. Using the Schnabel Index, we estimated there to be 171 red-eared sliders in Craighead Lake. Our findings indicate a diverse chelonian community with a thriving red-eared slider population. Future studies should continue to analyze the effect of urbanization on turtle population demographics.

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**1011 Fish Genetics, Salon D, Sunday 10 July 2016**

Trevor J. Krabbenhoft, Thomas E. Dowling

*Wayne State University, Detroit, MI, USA*

## Population Genomics and Local Adaptation in Invasive Sea Lamprey (*Petromyzon marinus*) in the Great Lakes

Sea lamprey (*Petromyzon marinus*) is an invasive species in the Laurentian Great Lakes, where they have caused significant damage to fisheries. Knowledge of tributary streams acting as sources of sea lamprey is needed to maximize effectiveness of control efforts. We used RAD-seq to assess the genetic distinctiveness of larval sea lampreys collected in tributaries across different eco-regions in the Great Lakes basin. We used single nucleotide polymorphism data (SNPs) to test the following hypotheses: (1) sea lampreys are genetically homogeneous among streams; (2) a few SNPs scattered across the genome exhibit signatures of adaptation to local stream conditions; (3) high $F_{st}$ SNPs can be used to diagnose stream-of-origin of lamprey collected in lake habitats. Differentiation among localities was generally low for most SNPs ($F_{st}$<0.05); however, a

few outlier SNPs exhibited significant differentiation among streams, consistent with local adaptation. Two of the outlier loci were located in genes possibly associated with lampricide metabolism and may reflect differences in lampricide treatment history among streams. These data illustrate that high levels of gene flow impact the majority of the genome; however, some loci may be locally adapted. Outlier loci potentially associated with lampricide treatment history are important candidates for future studies of lampricide resistance.

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**0253 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Andrea Kroetz, Dana Bethea, John Carlson

*NOAA Southeast Fisheries Science Center, Panama City, FL, USA*

### Predictive modeling of habitat use by juvenile smalltooth sawfish (*Pristis pectinata*)

Smalltooth sawfish, *Pristis pectinata*, like all species of sawfish, are among the most endangered of marine fishes. Successful recovery of sawfish populations requires juvenile recruitment success and initiatives now strive to include the protection of areas used by juveniles in order to promote survivorship. Initial studies using public encounter data have identified sheltered, shallow, mangrove areas as potential nursery habitat with subsequent studies finding warmer water temperatures and variable salinity associated with the capture of juvenile sawfish. However, further refinement is required to fully predict the essential features smalltooth sawfish require as juveniles. We analyzed data from fisheries independent gillnet surveys in south Florida to identify relationships between environmental predictors and juvenile smalltooth sawfish abundance and distribution. Boosted regression trees (BRT) were used to predict these relationships and identified environmental factors influencing juvenile smalltooth sawfish distribution. Model performance of the BRTs were high and identified salinity, water temperature, and presence of mangrove pneumatophores as the three factors having the most influence on juvenile smalltooth sawfish distribution. Probability of occurrence was determined by interpolating the BRT models to maps of south Florida using ordinary kriging. Depending on the predictor variable analyzed, predictability of juvenile smalltooth sawfish occurrence varied throughout the Everglades National Park. Results from our study will be essential to further refine this species' use of critical habitat. The construction of habitat models to identify potential nursery habitats will greatly add to the improvement of the smalltooth sawfish recovery plan.

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**0432 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Kylie Krohmaly, Matthew Lattanzio

*Christopher Newport University, Newport News, VA, USA*

**Male mate preference and the complex social dynamics of *Urosaurus ornatus***

In lizards, discrete color polymorphisms are associated with suites of traits that collectively reflect alternative mating tactics. In the ornate tree lizard (*Urosaurus ornatus*) both sexes are polymorphic in dewlap coloration. Previous studies support female morph differences preference towards the male morphs. However, scant attention has been paid to characterizing whether male color morphs also differ in mate preferences, even though males differ in social dominance behavior and have been observed to actively reject females, chasing them out of their territory. If males also diverge in mate preferences, then their behaviors may coincide with known patterns of female choice. We conducted a male mate choice experiment to test for male mate preference in *U. ornatus*, as well as evaluate whether preference behavior is morph-specific. We observed the behavior of blue and orange males in an experimental arena when provided a choice between an orange or yellow female, based solely on visual cues. We found that yellow and blue male morphs differ in their preference for the two female morphs. Specifically, whereas blue males preferred yellow females, yellow males exhibited no preference for either female morph. These findings support that male *U. ornatus* color morphs also diverge in mate preference; however, these preferences do not coincide with those observed in females from a previous study. We conclude that the complex social dynamics likely to result from such sex- and morph-specific mate preference behaviors may facilitate the maintenance of color polymorphism in this species.

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**1076 HL GRADUATE RESEARCH AWARD, Galerie 2, Thursday 7 July 2016**

Chelsea Kross, John Willson

*University of Arkansas, Fayetteville, AR, USA*

**Occupancy and Habitat Requirements of a Threatened Prairie Specialist, the Crawfish Frog (*Lithobates areolatus*), across Northwest Arkansas**

The Crawfish Frog (*Lithobates areolatus*) is a prairie-associated amphibian that is currently experiencing precipitous declines throughout its range. Due to the species' unique habitat requirements, the loss of prairie habitat is thought to be the primary cause of decline. As a species of special concern in Arkansas, identification of sites inhabited by *L. areolatus* is a valuable resource for land managers and policy makers when making land-use decisions and selecting sites for protection or restoration. Our objectives were to (1) locate extant populations of *L. areolatus* within Northwest Arkansas, (2) use occupancy modeling to determine landscape and habitat characteristics that are important predictors of *L. areolatus* occurrence. We conducted

repeated time-constrained auditory surveys at >60 potential *L. areolatus* breeding sites, including all historic localities in the region. We used occupancy modeling to examine relationships between occupancy probability of *L. areolatus* and other pond-breeding amphibians and current and historic land-use and land-cover. We documented *L. areolatus* at 14 sites, including 75% of historic localities. Our results suggest that *L. areolatus* is common in select regions of Northwest Arkansas but is threated by land-use change across much of this rapidly growing region. Understanding how land-use and habitat characteristics affect species occupancy is key to making informed land-use and conservation decisions.

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**0920 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

Ting Kuang[2], Luke Tornabene[1], Chenhong Li[2]

[1]*National Museum of Natural History: Smithsonian Institution, Washington, DC, USA,* [2]*Shanghai Ocean University, Shanghai, China*

## Phylogenomics of the Gobioidei (Teleostei: Gobiiformes) and possible evidence of adaptive evolution based on target-enrichment gene-capture data

The phylogenetic relationships of the Gobioidei (gobies, sleepers, and allies) have been contentious over the last decade. Trees based on mitochondrial genes, nuclear genes, or a combination of the two have yielded conflicting topologies. Despite these incongruences (many of which are related to differences in taxon sampling), one consistent trend across many studies has been the recovery of several well-supported clades that have since been recognized as families: Rhyacichthyidae, Odontobutidae, Eleotridae, Milyeringidae, Butidae, Thalasseleotridae, Gobiidae and Gobionellidae. The goal of this study was to use target-enrichment gene-capture data to investigate the family-level phylogenetic relationships of the Gobioidei, and specifically evaluate the monophyly of the proposed families and subfamilies within the group. Using a new set of 17,817 single-copy coding markers, we recovered a topology that was congruent with previous studies, and was robust to varying levels of missing data ranging from a complete-coverage 694 loci dataset to a 14,876 loci dataset with 80% of taxa missing for some loci. We also evaluated the ability of several data-filtering approaches to predict the phylogenetic accuracy of a given locus. We found that the clock-likeness of a locus was the strongest predictor of phylogenetic performance. Lastly, we evaluated the strength of selection across loci in lineages that have invaded land as well as those that live exclusively in subterranean habitats. We identified several candidate genes that may have experienced episodes of relaxed/intensified selection in lineages that live in terrestrial or subterranean habitats, indicating possible role of adaptive evolution.

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## 0550 ASIH STOYE GENERAL ICHTHYOLOGY AWARD, Galerie 2, Friday 8 July 2016

Kole Kubicek[1], Ralf Britz[2], Kevin Conway[1]

*[1]Texas A&M University, College Station, Texas, USA, [2]Natural History Museum, London, England, UK*

### Developmental Osteology of the Tadpole Madtom, *Noturus gyrinus*

The skeleton of catfishes (Siluriformes) is characterized by several autapomorphies, including extreme modification of certain elements (i.e., pectoral-fin spine, Weberian apparatus) and the presence of several elements presently presumed to be compound bones (i.e, parieto-supraoccipital) formed by fusion of plesiomorphically (for Otophysi) independent ossifications. Despite the vast number of anatomical investigations of the adult skeleton in catfishes, comprehensive information on its ontogeny remains scarce. A detailed study of the development of the catfish skeleton has the great potential to resolve some long-standing homology issues of bones in this group (e.g., is the parieto-supraoccipital the result of fusion or is the parietal absent?). As a first step towards a better understanding of the skeletal system of catfishes, we document the development of the entire skeleton in *Noturus gyrinus*, the Tadpole Madtom. Our investigation is based on approximately 150 cleared and double stained individuals (5.9-26.4 mm NL/SL). We examined and scored the presence/absence of 125 bones and compared the developmental sequence generated for *N. gyrinus* to those available for other otophysan (*Salminus brasilensis* and *Barbus holotaenia*) and non-otophysan (*Sciaenops ocellatus*) fishes.

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## 1046 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Salon A-C, Friday 8 July 2016

Arianna Kuhn[1], Marcelo Gehara[2], Christopher Raxworthy[2], Sara Ruane[3], Frank Burbrink[2]

*[1]City University of New York: Graduate Centers, New York, NY, USA, [2]American Museum of Natural History, New York, NY, USA, [3]Museum of Natural Science, Baton Rouge, LA, USA*

### Comparative Phylogeography of Malagasy Snakes

The island of Madagascar is renowned for its extreme biological diversity and complex ecological gradients, making it a model system for studies of phylogeography. Despite being an iconic biodiversity hotspot, few hypothesis driven tests of speciation mechanisms have been proposed for the evolution of its various endemic lineages. The pseudoxyrhophiines (Colubroidea: Lamprophiidae) are the dominant snake group on the island, represented by nearly 100 endemic species and hyperdiverse with respect to diet, habitat preference and morphology. This extreme diversity has been difficult to explain, partially due to a poor understanding of ecological factors contributing to speciation on Madagascar. Although the island has been historically stable, recent glacial fluctuations and subsequent climatic shifts may have significantly influenced the

distribution and population structure of Madagascar's endemic fauna. Using a multilocus dataset for 6 co-distributed species pairs and Approximate Bayesian Computation we will test for signal of simultaneous population expansion during interglacial cycles to address one of the main hypotheses for speciation on Madagascar: watershed refugia. If intraspecific diversity is attributed to Pleistocene retreat-dispersal watersheds, we anticipate to detect a large proportion of shared expansion events temporally and geographically coincident to these climatic shifts within known refugia zones. In the near future, we will compare the results of this multilocus study to similar tests using subgenomic data. While barriers to gene flow in Madagascar are not well known, our study may lend insight into the speciation dynamics of other vertebrate taxa across this endangered and fragmented habitat.

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**0987 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Andrew Kuhns[1], Ethan Kessler[1], Gary Glowacki[2]

*[1]Illinois Natural History Survey, Champaign, IL, USA, [2]Lake County Forest Preserve District, Grayslake, IL, USA*

**Habitat use of Hatchling Blanding's Turtles, *Emydoidea blandingii***

Hatchling Blanding's Turtles, *Emydoidea blandingii*, are notoriously difficult to detect and even in locations where the adult population is well studied, little is known about their habits. As part of a larger study examining the spatial ecology and demography of the Blanding's Turtle, in northeastern Illinois, we fit 18 hatchlings, taken from the nest, with transmitters and tracked them daily through the fall activity season. At each location, we recorded a suite of variables including: Shaded Air Temperature, Relative Humidity, Water Depth, Vegetation Type, Vegetation Height (cm), and Stem Density (using a Robel pole) at heights of 0-10 cm, 11 - 30 cm, 31-60 cm, and 61 - 100 cm. All variables were recorded in each of four 1 $m^2$ quadrats around the hatchling's location. These measurements were then immediately repeated at a previously determined random location within 9 meters of the hatchling. Using conditional logistic regression, we modeled differences between these 416 location pairs. After constructing a global model, we used significant terms from that model to generate post-hoc models to examine habitat preferences by hatchling. Our models suggest that hatchling Blanding's Turtle select areas in water, with lower mean vegetation height and cooler air temperature, in areas without *Typha sp.* and with *Salix* sp. present. Our results will be of interest to those managing lands with resident Blanding's Turtles as they may be directly applied to improve habitat for any hatchlings that are fortunate enough to escape nest predation.

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**0339 Fish Ecology I, Salon A-C, Saturday 9 July 2016**

Armand Kuris, Ana Garcia-Vedrenne, Sara Weinstein

*University of California, Santa Barbara, CA, USA*

### Trophic Position of Oarfish, *Regalecus* spp., in the Mesopelagic Food Web

Oarfishes, *Regalecus russelii* and *R. glesne*, are large mesopelagic predators, rarely seen or caught. Their feeding habits, diseases and predators are largely unknown. Oarfish stomach contents usually reveal a diet of krill. However, oarfish remains have never been confirmed in a possible predator. Examination of the gut contents of 19 *R. russelii* from southern California, Japan and Australia, coupled with earlier observations on *R. glesne*, permit us to expand the food web links of oarfish as both predator and prey in the mesopelagic zone. We derived evidence for these linkages from information on the life cycles of the abundant parasites of oarfish. New records of adult trematodes, nematodes and acanthocephalans reveal information about oarfish diets. Japanese oarfish hosted adult accacoelid trematodes, acquired when their larval stages were consumed in intermediate host gelatinous zooplankters; food items rarely observed at necropsy. Abundant specimens of adult acanthocephalans and a newly described nematode, *Spinitectus gabata*, support the role of krill in oarfish diets. Interestingly, larval parasitic stages of tapeworms and nematodes suggest elasmobranchs and cetaceans prey on oarfish. Larval tetraphyllidean tapeworms, based on sequence data as *Clistobothrium montaukensis*, matched adult parasites of the shortfin mako shark, *Isurus oxyrinchus*. The abundant larval nematodes, *Contracaecum* sp., mature only in birds or mammals. The depth at which oarfish live restricts the most probable predators to sperm and beaked whales. Thus, evidence from the parasite fauna of oarfish gives us the most comprehensive insight into the trophic role of a large teleost in deep oceanic waters.

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**0342 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Takahiro Kusaka[1], Koujirou Hara[2], Keisuke Furumitsu[2], Shinji Uehara[3], Yuta Yagi[3], Atsuko Yamaguchi[2], Naoki Yagishita[2]

*[1]Graduate school of Agriculture, Kinki University, Nara, Japan, [2]Graduate School of Fisheries and Environmental Sciences, Nagasaki University, Nagasaki, Japan, [3]Japan Sea National Fisheries Research Institute, Niigata, Japan*

### Genetic population structure of a Japanese common skate *Dipturus* cf. *kwangtungensis* in Japan inferred from mitochondrial cytochrome *b* gene

The genetic population structure of a Japanese common skate *Dipturus* cf. *kwangtungensis* in Japan was examined based on partial sequences of the mitochondrial (mt) cytochrome (cyt) *b* gene. We obtained 931 base pairs of the mt cyt *b* gene from 226 individuals around Japan, and revealed 59 polymorphic sites that defined 35 haplotypes. Neighbor-joining (NJ) tree and the minimum spanning network (MSN) of the haplotypes revealed two lineages: the first lineage contained populations in the Sea of Japan and the East China Sea, and the second lineage contained populations in the

Pacific coast. Moreover, the second lineage were subdivided into two populations (northern part of Honshu and Kochi populations). Significant genetic differentiation was detected between northern part of Honshu population, Kochi population, and the group containing geographic populations in the Sea of Japan and the East China Sea by both hierarchical molecular variance analysis and pairwise $F_{ST}$, which correspond to the results of both NJ tree and MSN. Haplotype diversity was high in each geographic population (0.521 - 0.884) except Kochi population (0.245). Nucleotide diversity was low in all geographic populations (0.0005 - 0.0031). The demographic history of *D*. cf. *kwangtungensis* estimated by mismatch distribution analyses and neutrality tests suggested a sudden population expansion occurred 88,000 - 141,000 years ago. The fall in sea level during glaciations in the Pleistocene may have caused the habitats of *D*. cf. *kwangtungensis* to deteriorate and that the rapid population expansions must have occurred during interglacial periods.

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**0516 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Matthew Kwiatkowski[1], Josh Pierce[2], Beau Gregory[3], James Childress[2], D. Craig Rudolph[2]

*[1]Stephen F. Austin State University, Nacogdoches, TX, USA, [2]Southern Research Station, Nacogdoches, TX, USA, [3]Louisiana Natural Heritage Program, Lake Charles, LA, USA*

## Genetic Structure and Diversity in Louisiana Pinesnakes, *Pituophis ruthveni*: Implications for Conservation and Management

The Louisiana Pinesnake, *Pituophis ruthveni*, has experienced considerable habitat alteration resulting in small, isolated populations. Historical data, current surveys, and modeling suggest population numbers are declining and may soon go extinct. Population decline and fragmentation may reduce gene flow leading to bottlenecks and inbreeding, further contributing to their demise. We investigated genetic diversity and structure in wild and captive Louisiana Pinesnakes under the hypothesis that two rivers act as barriers to gene flow. Samples were assigned to one of three populations (northern Louisiana, southern Louisiana, and Texas) and genotyped at 14 polymorphic microsatellite loci. We found modest genetic structure among the three a priori populations (pairwise $F_{ST}$ values for wild-caught samples ranged 0.026 – 0.06). Bayesian cluster analysis indicated four genetic clusters: a unique southern Louisiana cluster, a unique northern Louisiana cluster, one comprising samples from Texas and northern Louisiana, and one comprising all three. Observed heterozygosity was consistently lower than expected, and heterozygosity in wild-caught samples was lower than captive samples. Genetic bottlenecks were found in all populations. $F_{IS}$ values in wild populations (0.12 – 0.17) were consistently higher than captive populations (-0.19 – 0.07) and suggested moderate levels of inbreeding in wild snakes. Inbreeding could also become a problem for captive populations given the low number of founders. The wild northern Louisiana population exhibited a reduction in individual multilocus

heterozygosity over time. These results, considered with survey data and modeling, show that concern about population decline is warranted and genetic rescue should be considered for future management decisions.

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**0600 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Peter Kyne[1], Pierre Feutry[2], Rob Lindsay[3], Amos Shields[3], Albert Myoung[3], Rita Purack[3], Francis Miljat[3], Aaron Green[3], Theresa Lemon[3], Travis Maloney[3], Richard Pillans[4], Grant Johnson[5], Thor Saunders[5], Christy Davies[6], Richard Hillary[2], Mark Bravington[2]

*[1]Charles Darwin University, Darwin, Northern Territory, Australia, [2]CSIRO, Hobart, Tasmania, Australia, [3]Malak Malak Ranger Group, Daly River, Northern Territory, Australia, [4]CSIRO, Brisbane, Queensland, Australia, [5]Northern Territory Fisheries, Darwin, Northern Territory, Australia, [6]North Australian Indigenous Land and Sea Management Alliance, Darwin, Northern Territory, Australia*

## Floodplain Waterholes as High Risk Nursery Habitat for the Critically Endangered Largetooth Sawfish in Northern Australia

Northern Australia is a global hotspot for the Critically Endangered Largetooth Sawfish *Pristis pristis*. The region is characterized by a dynamic monsoonal wet-dry cycle with intense rainfall and freshwater flow in large river systems during the wet season and minimal rainfall during the dry season. The wet season results in inundation of river floodplains but as water retracts during the dry season, aquatic fauna is forced into remaining waterholes. Juvenile (0+ age class) sawfish were located in floodplain waterholes of the Daly River in Australia's Northern Territory. Sawfish occurred in both large and very small waterholes; in one case, a number of sawfish had to be relocated to the main river channel as their waterhole was close to drying out. A risk management protocol has been established for local Indigenous rangers to patrol floodplains annually to search for isolated sawfish at risk of mortality. All individuals were genotyped at thousands of loci allowing for full and half sibling inference. Combining kinship information with mitogenome haplotypes we were able to determine the minimum number of adult females responsible for one annual cohort. Although sample size was low, full sibling relationships amongst Daly River floodplain sawfish suggest dispersal of individuals of a litter across the floodplain. When considering samples from several rivers across northern Australia, full siblings were always identified from the same river. On the other hand, half-sibling pairs were also identified from different, often widely-dispersed rivers suggesting adults can disperse from one river to another to reproduce.

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**0503 General Herpetology, Salon D, Thursday 7 July 2016**

Brandon LaBumbard[1], Molly Bletz[2], Kate Chaplin[3], Doug Woodhams[1]

*[1]University of Massachusetts Boston, Boston, MA, USA, [2]Technical University of Braunschweig, Braunschweig, Germany, [3]University of Queensland, Queensland, Australia*

## Inhibition of pathogenic fungi using volatile organic compounds produced by bacteria

Emerging infectious diseases caused by fungi have increased over the past few decades and have become some of the most prevalent diseases affecting wildlife. Here, we focus on recently emerged pathogens in wildlife: *Batrachochytrium dendrobatidis* (*Bd*), *Batrachochytrium salamandrivorans* (*Bsal*), and *Fusarium keratoplasticum* in amphibians, *Mucor hiemalis* in fish, and *Ophidiomyces ophiodiicola* in snakes. These pathogens typically cause skin lesions, keratitis, and blood infections, with high mortality being reported. Symbiotic skin bacteria can be applied to treat and protect hosts from infection as some bacteria are capable of producing airborne volatile organic compounds (VOCs) for defense against pathogens. We tested 30 bacterial isolates from amphibian skin to determine which microbes are capable of inhibiting fungal growth by taking segmented petri plates and applying a bacterial isolate to one side and a fungal isolate to the other. Treatment plates were set up in triplicate and controls contained only the fungal isolate. Experimental plates were compared to controls to determine if the bacteria significantly inhibited fungal growth. We quantified bacterial isolates in terms of broad to narrow-scale antifungal activity, and identified isolates for next steps including soil inoculation and testing for host infection clearance. By conducting these *in vitro* studies, we determined which bacteria may be beneficial for *in vivo* probiotic treatments. By applying these beneficial bacteria to sites where susceptible hosts congregate, there is an increased chance of inoculating hosts with probiotics, or of reducing environmental reservoirs, thus protecting hosts from fungal infection.

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**0574 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Christian Lambarri, Hector Espinosa

*Instituto de Biologia, UNAM, Mexico City, Mexico*

## The genus *Dionda* in Mexican watersheds

Cypriniform fishes are the biggest monophyletic freshwater fish group across the world. These fishes have been classified according to external characters that not necessarily represent the evolutionary relationships among lineages, but are the result of historical considerations. The genus *Dionda* (family Cyprinidae, subfamily Leuciscinae) inhabits several watersheds in Chihuahua, Coahuila, Durango, Zacatecas, Tamaulipas (México) and Texas (USA); although has been suggested that this genus could be paraphyletic. The species *Dionda episcopa,* that inhabits the watersheds of the Conchos and Grande

rivers, has been considered as a complex of forms that share several convergent features and is widely sympatric along the north of Mexico. In this work we analyzed morphometric, meristic and genetic characters of 18 populations of *Dionda episcopa* from Mexico and USA, in order to evaluate inter and intra-population differences. Morphometric and meristic results did not show significant differences among specimens of distinct populations, but mitochondrial differentiation did show the genus *Dionda* to be polyphyletic. Also it is suggested that populations of the Conchos River could be re-classified as a new genus. Therefore *Dionda episcopa* Girard *sensu stricto* would be restricted to the Pecos River in Texas and excluded from the Mexican fish fauna.

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**0121 Snake Ecology, Galerie 3, Sunday 10 July 2016**

Bjorn Lardner[1], Amy A. Yackel Adams[2], Julie A. Savidge[1], Gordon H. Rodda[2], Robert N. Reed[2]

*[1]Colorado State University, Fort Collins, CO, USA, [2]U.S. Geological Survey, Fort Collins, CO, USA*

**Invasive Brown Treesnakes (*Boiga irregularis*) suppress the rat population that governs their vital rates**

The Brown Treesnake is known for having extirpated most of Guam's forest avifauna. We used mark-recapture over an 11-year period to monitor a population of Brown Treesnakes in a 5-ha enclosure on Guam. We also monitored the snakes' lizard and rat prey, and on two occasions we manipulated predators and prey via prey supplementation versus selective removal of all snakes ≥900 mm snout-vent length (SVL). Small juveniles relied on lizard prey (geckos and skinks) that were abundant throughout the study. The rat population fluctuated dramatically, but was usually very small. Adult snake growth was slow or arrested during periods of rat scarcity, and very large snakes declined in body condition or died during these periods. Little or no reproduction occurred under conditions of low rodent abundance. On the contrary, a moderate rodent irruption and our provision of supplemental food caused adult snakes to grow fast, reach large sizes, and to reproduce at a high rate. Also, our experimental removal of all rat-eating (≥900 mm SVL) individuals resulted in a dramatic rat irruption. The lizard-eating juveniles we had left behind gradually grew to a size at which they could capitalize on this large-prey bonanza, and once they matured, a reproductive burst ensued. Two years after the rat irruption, the recovering snake population once again exerted such a strong predatory impact that the rat population dropped to a very low level, and snake vital rates declined.

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**0554 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Matthew Lattanzio

*Christopher Newport University, Newport News, Virginia, USA*

## Diet shifts and the morphological response of tree lizards to recent climate change

Climate change has been implicated in numerous cases of population extinction worldwide, underscoring a growing need to determine how species respond successfully to climatic shifts. Thus far, many studies have documented shifts in body size across a wide variety of taxa in response to rising temperatures and restricted activity periods. However, the ecological mechanisms linking rising temperatures to morphological change remain unclear. Because species persistence in a climate-altered environment requires exploitation of shifting resource pools, and the energy gained from those resources affects growth rates, a change in diet over time may partly explain observed body size changes. Here I report on the nature of morphological responses of 20 tree lizard (*Urosaurus ornatus*) populations over the past 60 years in Arizona. I then evaluate the degree to which shifts in temperature, activity period and diet predict body size changes in 12 of those populations. I measured body size and head shape attributes of preserved *U. ornatus* specimens originally collected between 1951-1990, as well as lizards encountered during field surveys of those same populations in 2015. I then used stable isotopes to describe each population's diet (past and present). Preliminary findings support my prediction, indicating a 2.9 mm increase in mean body size that correlates with a change in diet over time ($r$=0.62, $P$<0.01). Currently, I am preparing the temperature and activity period data for each population's locality for incorporation into my statistical models. Overall, my findings should provide an integrative perspective on how ecological shifts contribute to long-term morphological change.

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**0205 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Matthew Lattanzio[1], Donald Miles[2]

[1]*Christopher Newport University, Newport News, VA, USA,* [2]*Ohio University, Athens, OH, USA*

## Trophic niche divergence among color morphs that exhibit alternative mating tactics

Discrete color morphs associated with alternative mating tactics are assumed to be ecologically equivalent. Yet suites of behaviors linked with reproduction can also favor habitat segregation and exploitation of different prey among morphs. In contrast, trophic polymorphisms are usually attributed to morphs exhibiting habitat or prey selectivity. An alternative hypothesis is that habitat variation generates a trophic polymorphism driven by differences in morph reproductive behavior, the spatial dispersion of morphs in a landscape, and their exposure to different prey types. In this scenario, morphs are allowed to vary in habitat or diet selectivity (e.g., specialist or

generalist) as they do in behavior, rather than being assumed to exhibit equivalent levels of ecological specialization. We test this hypothesis using male *Urosaurus ornatus* lizards that exhibit a discrete dewlap color polymorphism that reflects alternative mating tactics. We found blue morphs specialize on prey at higher trophic levels, yellow males display plasticity in trophic and morphological attributes, and orange males are trophic generalists. Our results also demonstrate that morph diet differences are enhanced in resource-limited habitats. We conclude that discrete behavioral morphs may also diverge in morphology and trophic niche. Jointly, these processes may enhance speciation rates in colour polymorphic taxa.

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**0608 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Ashley LaVere, Ann Somers, Catherine Matthews

*University of North Carolina at Greensboro, Greensboro, North Carolina, USA*

## A Dollar a Turtle or How Your State Can Gather Long-term, Quality Data on a Budget

The Box Turtle Connection (BTC), established in 2008, is a long-term, citizen science study on box turtles anticipated to last at least 100 years. The goal of the project is to assess population trends and health of box turtles in various bioregions of North Carolina. The BTC depends on trained volunteers, Project Leaders, who collect morphometric and health data on box turtles at 32 sites across the state. The project was designed to require minimal funding due to the partnership of agencies, universities and private individuals. From 2008-2015 we accumulated over 3300 entries in the database with over 2500 unique turtles at a cost of less than a dollar an entry. As we approach the end of the first decade of this project, we are assessing the quality of our data to assure its current and future integrity. Project Leaders are receiving site reports with constructive feedback that includes basic findings as well as flagged data for them to review. Overall, out of the 8196 data points evaluated, 5% were flagged for reexamination by Project Leaders. The amount and type of flagged data differs between sites, some projects having considerably more than others. All BTC data are available to researchers upon request.

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**0099 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Julia Lawson[1], Rachel Walls[1], Sonja Fordham[2], Mary O'Malley[3], Michelle Heupel[5], Guy Stevens[4], Daniel Fernando[10], Ania Budziak[6], Colin Simpfendorfer[7], Lindsay Davidson[1], Isabel Ender[4], Malcolm Francis[8], Giuseppe Notarbartolo di Sciara[9], Nicholas Dulvy[1]

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## Sympathy for the devil: a conservation strategy for devil and manta rays

Increased interest in luxury products and Traditional Chinese Medicine has been linked to depletion of both terrestrial and marine wildlife. Among the most rapidly emerging concerns with respect to these markets is the relatively new demand for gill plates, or Peng Yu Sai ("Fish Gills"), from devil and manta rays (subfamily Mobulinae). High value gill plates drive international trade supplied by largely unmonitored and unregulated bycatch and target fisheries around the world. Devil and manta rays are sensitive to overexploitation because of their exceptionally low productivity. Scientific research, conservation campaigns, and international and national protections that restrict fishing or trade have increased in recent years. Many key protections, however, apply only to manta rays. We review the state of scientific knowledge for these species, and summarize the geographic ranges, fisheries and national and international protections for these species. We use a conservation planning approach to develop the Global Devil and Manta Ray Conservation Strategy, specifying a vision, goals, objectives, and actions to advance the conservation of both devil and manta rays. Generally, there is greater scientific attention and conservation focused on manta compared to devil Rays. We discuss how the successes in manta ray conservation can be expanded to benefit devil rays. We also examine solutions for the two leading threats to both devil and manta rays - bycatch and target fisheries. Our paper suggests that given similarities in sensitivity and appearance, particularly of the dried gill plate product, some conservation measures should be expanded to include devil rays.

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**0034 Herp Biogeography, Salon D, Friday 8 July 2016**

Adam Leache, Jared Grummer, Ian Breckheimer

*University of Washington, Seattle, WA, USA*

### A Decadal Comparison of Hybrid Zone Dynamics in the Plateau Fence Lizard (*Sceloporus tristichus*) in Arizona

A dynamic and shifting hybrid zone between populations of the plateau fence lizard (*Sceloporus tristichus*) on the Mogollon Rim in Arizona has been well documented with morphology, chromosomes, mitochondrial DNA, and nuclear genes. In this study, a ddRADseq approach was used to collect SNP data to compare the dynamics of the hybrid zone over a 10-year period. Previous studies of chromosome polymorphism data revealed that that hybrid zone is moving northward at a rate of approximately 500 meters per decade. We conducted maximum likelihood cline fitting analyses to quantify the center and width of the hybrid zone for each sampling period (2002 vs. 2012). The SNP data provide further evidence that the cline is continuing to shift to the north, and at a higher rate of movement of 2 kilometers over the last decade. The mtDNA cline, which is infiltrated by the introgression of haplotypes from a neighboring species (*S. cowlesi*), is lagging in the wake of the nuclear cline by approximately 3 kilometers. The recent northward expansion of juniper trees into the Little Colorado River Basin is a possible mechanism for the shifting hybrid zone. We found some evidence for this hypothesis by quantifying broad-scale landcover changes in the study area, which identified an increased density of woodlands in the southern end of the hybrid zone. However, a fine-scale analysis of juniper expansion supports stable ecotone habitats over the last decade. Population processes such as unequal population densities, biased dispersal, or selection against hybrids could be driving cline movement.

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**0269 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Taylor Lee, Brook Fluker

*Arkansas State University, Jonesboro, AR, USA*

### Comparison of Water and Sediment Samples for Environmental DNA Detection of Rare Freshwater Fishes: a Case Study Using the Federally Threatened Leopard Darter, *Percina pantherina*

When sampling for rare or endangered species, traditional methods may not always be reliable due to low population numbers. The recent development of environmental DNA (eDNA) techniques represents a valuable tool to help counteract inefficiency associated with traditional sampling of rare species. One example for which eDNA may be useful in the detection of a rare fish species is the Leopard Darter, *Percina pantherina*. This federally threatened fish, endemic to the Little River system in Arkansas and Oklahoma, is experiencing drastic population decline and decrease in genetic variation. Traditional sampling has failed to detect *P. pantherina* in the Cossatot River since 2011

and Robinson Fork since 2006. The objectives of this project are to: (1) compare the effectiveness of two different eDNA sampling techniques, water and substrate, for detecting *P. pantherina*; (2) compare potential differences in detectability of *P. pantherina* among eDNA, seining, and snorkeling; and (3) to determine if there are extant populations of *P. pantherina* in the Cossatot River and Robinson Fork. Traditional sampling during February 2016 resulted in zero detection of *P. pantherina* within our focal systems. Species-specific primers that amplify a 137bp fragment of the cytochrome b gene were designed and in silico PCR screens using Primer Blast revealed a high degree of specificity for *P. pantherina*. These primers will be used with PCR and qPCR assays of eDNA samples to compare *P. pantherina* detectability between water and substrate samples, in addition to detection efficiency between traditional and eDNA sampling for winter and spring 2016 samples.

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**0327 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Ruth Leeney[1], Nick Dulvy[1], Frances Humber[2], Aude Carro[2]

*[1]Simon Fraser University, Burnaby, VA, Canada, [2]Blue Ventures, London, UK*

**Madagascar and Mozambique - the last hope for Africa's sawfishes?**

Sawfishes are critically endangered worldwide, but in many parts of their former range, current data on their continued existence, or extirpation, are lacking. This seriously hinders conservation efforts. Sawfishes are known to have been present historically in the western Indian Ocean but until recently, their current status in this region was unknown. Interview surveys were carried out in Mozambique in 2014, and Madagascar in 2015, to collect information on sawfish distribution, recent catches, socio-economic value and cultural importance. Several sites were identified in both countries where recent captures (in the same year in which interviews were conducted) were reported and where sawfishes are likely still present. Rostra from Green and Largetooth sawfishes were found in Mozambique, but only Largetooth Sawfish rostra were encountered in Madagascar. Gill nets were the fishing gear most commonly attributed to sawfish catches, and sawfishes had been encountered by both artisanal and industrial fishers. Sawfishes did not hold any cultural importance in Mozambique or for most of the communities visited in Madagascar, but have some socio-economic importance to fishers, primarily through the sale of their fins. The continued presence of sawfishes in these two WIO countries offers some hope that populations might recover throughout the region, if the appropriate conservation and management measures are rapidly put in place. These findings provide a baseline from which directed research and conservation efforts for sawfishes can be developed. A workshop was held in Mozambique in 2015 to encourage the development of a national conservation strategy for sawfishes.

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**0380 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Richard Lehtinen, Stephanie Andrus, Levi Fawcett, Alex Vanko

*The College of Wooster, Wooster, Ohio, USA*

## Something Old and Something New: Factors Influencing Coloration Patterns in the Bloody Bay Poison Frog (*Mannophryne olmonae*, Aromobatidae)

Poison frogs (Dendrobatidae) have justly received a large amount of attention regarding the function of their striking aposematic coloration. A diverse sister lineage of cryptically colored species (Aromobatidae), however, has received much less attention. To begin to fill this gap, we used digital photographs and image analysis software to quantify dorsal coloration in *Mannophryne olmonae* which is endemic to the Caribbean island of Tobago. We sampled 210 individuals from twelve populations and compared coloration patterns to substrate color, which varies throughout the island based on geological units and the presence of an introduced bamboo species. Our analyses revealed that dorsal coloration is significantly different among sites. Certain aspects of color were associated with the difference in color among rock types, whereas other aspects of color were influenced by the presence of the invasive bamboo (which lightens the color of the leaf litter). Laboratory experiments suggest that color variation is unlikely to be due to phenotypic plasticity. Dorsal coloration was also significantly different between arm and dorsum and leg measurements, suggesting that arm coloration is not cryptic and may be used for conspecific signaling. Thus, both ancient and recent factors as well as both natural and sexual selection appear to influence dorsal coloration in this species.

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**0757 AES Genetics, Genomics, Biogeography, & Systematics, Balconies J & K, Saturday 9 July 2016**

Agostino Leone[1], Gregory Neils Puncher[1], Francesco Ferretti[2], Emilio Sperone[3], Sandro Tripepi[3], Primo Micarelli[4], Andrea Gambarelli[5], Maurizio Sarà[6], Marco Arculeo[6], Giuliano Doria[7], Fulvio Garibaldi[8], Andrea Dall'Asta[9], Daniela Minelli[10], Elisabetta Cilli[11], Stefano Vanni[12], Fabrizio Serena[13], Alessia Cariani[1], Fausto Tinti[1]

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## Mediterranean Jaws: Origin of the Mediterranean Population of Great White Shark, *Carcharodon carcharias*, Inferred from aDNA variation

The origin of the Mediterranean great white shark (GWS) population has remained uncertain for a long time. Recently, comparative mtDNA analyses, based on four Mediterranean samples, indicated that Mediterranean GWS showed little genetic differentiation from Indo Pacific lineages and strong separation from closer Atlantic haplotypes. It was suggested that Mediterranean white sharks originated in the Pleistocene (~400Kya) from a long distance dispersal of individuals from Australia via South Africa. However, this hypothesis is incongruent with the presence of Mediterranean GWS fossils older than the Pleistocene. We addressed this data gap by analysing control region and COI gene fragments from mtDNA extracted from 18 historical specimens (30-193 years old) collected from Italian museums, research institutes and private collections. Phylogenetic analyses confirmed that the Mediterranean and Pacific populations have a closer evolutionary relationship rather than South-African and North Western Atlantic populations. Comparisons of genetic diversity across global populations highlighted that Mediterranean GWS have low haplotype and nucleotide diversity, while the Australian population has the highest values, suggesting a founder effect in the Mediterranean and a stable population in Australia with a long evolutionary history. Combined divergence time analyses, carried out using internal calibrations with fossil and paleo-geographical data or an estimated evolutionary rate, suggested that Mediterranean GWS originated in the early Pliocene (~5.3MYA). These results suggest a GWS historical long-dispersal and paleo-

colonization of the Mediterranean via a possible stepping stone model of eastward migration, from the Pacific through Central America, before the closure of the Central America Seaway.

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**0957 General Herpetology, Salon A-C, Thursday 7 July 2016**

Gavia Lertzman-Lepofsky, Amanda Kissel, Wendy Palen

*Simon Fraser University, Burnaby, BC, Canada*

### Desiccation Risk of Alpine Amphibians

Alpine ecosystems are sensitive barometers of climate change, and the combination of reduced annual snowfall, higher temperatures, and shorter winters are predicted to cause dramatic decreases in biodiversity. Ectotherms use both behavioural and physiological mechanisms to mediate environmental stress, but most research has exclusively used thermal physiology to predict risk posed by future climates. For amphibians, desiccation may be an equally important physiological limit given their highly permeable skin. We assessed desiccation risk of alpine anurans by measuring water loss rates in physical models, in both full sun and full shade during summer 2014, and evaluated the combination of predictors of water loss using an information theoretic approach. We combined these models with continuous temperature and precipitation data to predict the number of hours anurans would lose more than 35% water across the summer, a critical threshold. We found that models in the sun lost a critical amount of water up to 34.2% of the time during the day (502 out of 1464 hours), compared to 0% in the shade, and that no days exceeded the thermal critical maximum of 35°C. This suggests that focusing on thermal physiology may underestimate the risk posed by future climate warming by ignoring the bigger effect of water loss on anuran physiology. We interpret the difference between full sun and full shade calculations to approximate the potential for behaviour to mediate desiccation, and find that individuals in the shade can escape lethal water loss limits, implying that behaviour may mediate climate induced temperature increases.

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**0175 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Brenna A. Levine[1], Marlis R. Douglas[1], Julie A. Savidge[2], Bjorn Lardner[2], Robert Reed[3], Michael E. Douglas[1]

*[1]University of Arkansas, Fayetteville, AR, USA, [2]Colorado State University, Fort Collins, CO, USA, [3]United States Geological Survey, Fort Collins, CO, USA*

### SNP Discovery for Parentage and Kinship Analyses in the Brown Treesnake (*Boiga irregularis*) on Guam

The Brown Treesnake (*Boiga irregularis*; 'BTS') has caused ecological and economic harm to Guam since its accidental introduction following World War II, to include the

extirpation and extinction of bird species and costly damage to the island's electrical infrastructure. BTS control is largely accomplished with baited traps as well as detection and removal by hand. Yet, there is individual heterogeneity in susceptibility to these control efforts, some of which is unexplained by morphological covariates, prompting concern that existing approaches may inadvertently select for a population that is refractory to trapping. But is susceptibility to control heritable? Are close kin more similar to each other in susceptibility to control than are random individuals? And are certain genotypes associated with higher vital rates (e.g., growth rate, reproductive output)? Population genomic approaches, combined with parentage analyses, can yield accurate identification of kinship among individuals, which can then be analyzed in the context of morphological and trappability data to answer these questions. Here, we present the discovery of thousands of single nucleotide polymorphisms (SNPs) in BTS, as identified by Illumina sequencing of a double digest restriction site associated DNA (ddRAD) library prepared from a closed population on Guam (n = 54) and representing candidate markers for parentage and kinship analyses. Future efforts will involve genotyping of all available samples from this population (N = 322) for detailed analyses of parentage and kinship. This, in turn, will provide insight into correlates of reproductive success and the potential inheritance of trappability and detectability.

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**0399 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Diane Lewis[1], Daniel Saenz[2], Armen Nalian[1], Matthew Kwiatkowski[1], Alexandra Van Kley[1]

*[1]Stephen F. Austin State University, Nacogdoches, Texas, USA, [2]Southern Research Station, US Forest Service, Nacogdoches, Texas, USA*

## Land Use Determines Composition of Frog Skin Microbiome and Occurrence of *Batrachochytrium dendrobatidis*

Habitat loss and pathogens, particularly *Batrachochytrium dendrobatidis (Bd)*, have been identified as primary factors contributing to amphibian decline. These factors may cause decline independently or they may interact with one another. For example, habitat features that affect microclimate such as forest canopy density, natural vegetation and water temperature are good predictors of the presence of *Bd*. However, habitat loss is negatively associated with occurrence, prevalence and infection intensity of the fungal pathogen. Anurans are known to possess innate defenses against pathogens in the form of antimicrobial secretions produced in glands located primarily in the dorsal skin of frogs. In addition, recent evidence suggests that the probiotic role of symbiotic bacteria may be important in the defense against pathogens, specifically *Bd*. In this study we investigated how habitat, urbanization, and microbiome interplay in the context of *Bd* occurrence and pathogen load. We found that urban frogs had lower incidence and load of *Bd* while forested frogs had lower species richness and diversity of symbiotic bacteria. Symbiotic bacterial communities did not differ between *Bd*+ and *Bd*- frogs within habitat type suggesting that habitat, not bacterial community, was the main driver of *Bd* occurrence in our focal anuran populations with low-level *Bd* infections.

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**0334 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday 7 July 2016**

Mattie Lewis, Mollie Cashner

*Austin Peay State University, Clarksville, TN, USA*

### Seeing Red: Examining Color Vision in a Nest Host, the Creek Chub, and the Role of Red in Interspecific Communication in Nest Association

Nest association, the interaction in which one species utilizes the nest of another species to spawn, is common among minnows. The nest-building Creek Chub (*Semotilus atromaculatus*) is extremely territorial, and males defend nests by chasing away conspecific and heterospecific individuals. However, some minnow species are tolerated as nest associates, all of which exhibit bright red nuptial coloration. While this red coloration is likely important during intraspecific mating interactions, it could also play a role in interspecific communication between nest host and associates. To assess the potential role red coloration may play in interspecific communication, we first must establish the ability of nest hosts to detect red. We tested whether Creek Chubs can see red, green, orange, and or blue via classical conditioning. Wild Creek Chubs were collected and trained in groups of three individuals to identify the four focal colors. Each group was tested for recognition of each color based on feeding behavior. Responses were recorded in movements across tank and compared with fixed effect of color and random effect of tank in a two-way ANOVA. Red and blue color trials were significant ($p<0.0001$, $p<0.0003$, respectively) while orange and green trials were not ($p=0.3681$, $p=0.3937$, respectively). Additionally, various Student's t tests were conducted to compare effect sizes among focal colors of their respective trials. Knowing what colors the Creek Chub can see and differentiate between will give more insight into the complex behavior of nest association.

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**0151 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Lauren Liddon, Jake Schaefer

*The University of Southern Mississippi, Hattiesburg, MS, USA*

### Effects of Wave Exposure on the Structure of Fish Assemblages across an Exposure Gradient

Wave exposure can have a significant effect on the structure of fish assemblages of any coastal area. Few studies have explored the extent of this in salt marsh estuarine habitats, which is vulnerable to coastal erosion. Therefore, a study to better understand the possible effects of increased wave exposure on fish assemblages is needed as the threat of coastal erosion becomes increasingly prevalent. The Mississippi coastline has salt marsh habitat with many small bays and estuaries that provide shelter and produce

gradients of wave exposure ideal for this study. We sampled fish assemblages monthly for 5 years at several coastal sites to address questions about how wave action impacts fish assemblages. The sites were categorized based on the intensity of exposure (open/intermediate/sheltered). We predict that sites with similar wave exposures will exhibit similar trends in both species richness and fish abundance. We hypothesize that the sites with intermediate wave exposure will have the most fish diversity in accordance with the Intermediate Disturbance Hypothesis. These samples were taken on days with minimal wave action for the safety of the collection crew; Therefore, we plan to further this study by sampling these sites on waver days to determine if these trends continue.

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**0695 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Craig Lind, Terence Farrell

*Stetson University, DeLand, FL, USA*

**Hormonal Regulation of Maternal Care Behavior in a Viviparous Pitviper**

Several snake lineages have evolved maternal care behaviors including egg brooding and offspring defense. Maternal-offspring behaviors in these groups likely represent independent evolutionary events and may, as is the case for many better-studied vertebrate groups, be critical to fitness. However, almost nothing is known regarding the neuroendocrine pathways that regulate maternal-offspring social behavior in reptiles. In other vertebrates where such regulation has been studied, hypothalamic peptide hormones of the oxytocin and vasopressin family play a primary role in mediating both maternal and paternal care. To test the hypothesis that hypothalamic peptides mediate maternal care behaviors in a viviparous snake, we pharmacologically blocked the action of arginine vasotocin (AVT) in postparturient Pigmy Rattlesnakes, *Sisturus miliarius*, and monitored mother-offspring spatial relationships over time compared to saline-injected controls. The intensity of maternal care behaviors (estimated by the spatial relationships between mother and offspring) was positively related to maternal postparturient energetic status (i.e. body condition) in the control group. Blockade of AVT receptors disrupted the spatial association of mothers and offspring. Our results provide the first evidence that both energetic status and hypothalamic peptides may mediate mother-offspring social behavior in snakes. Further research is required to fully elucidate the neuroendocrine pathways linking energetic status and maternal care in reptiles.

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**1111 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT**

Luke Linhoff, Maureen Donnelly

*Florida International University, Miami, FL, USA*

## Captive versus wild: The spatial ecology of critically endangered Wyoming toads following reintroduction

In 1993, the Wyoming toad (*Anaxyrus baxteri*) was listed as extinct in the wild, but the toad survived in captivity. Multiple reintroduction attempts of the Wyoming toad between 1995 and 2012 had limited to no success. The species is still considered one of the rarest vertebrates in the world. Previous reintroductions of the Wyoming toad have typically utilized a *hard release* strategy for both translocation of larvae and adults. We examined two main questions. Can soft releasing toads improve establishment? How is the movement and behavior of reintroduced captive bred toads different from wild toads? In the summers of 2014 and 2015, we performed paired releases of four groups of captive bred adult toads at Mortenson Lake, Wyoming, USA. Captive bred toads were either hard released (n=12) or soft released (n=34) after acclimating in an outdoor enclosure for 14 days. One group of wild toads (n=12) was followed in 2015. All studied toads were fitted with a custom harness allowing for the external attachment of a harmonic tracking device. Toads were tracked for up to eight weeks to compare activity patterns, site fidelity, survival and spatial ecology. Compared to hard released toads, the soft released toads moved significantly shorter distances ($p<0.05$), had slower dispersal rates ($p<0.05$), and increased burrowing behavior ($p<0.05$). We recommend soft releases for all reintroduced adult toads. We will report on comparisons between wild and captive reared toads including mortality, activity patterns, and habitat use. The results have strong conservation management implications for amphibian reintroduction programs.

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**1110 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Luke Linhoff[1], Pritpal Soorae[2], Maureen Donnelly[1], Jennifer Germano[3], Gemma Harding[4], Michael Maunder[1], Michael McFadden[5], Joseph Mendelson[6], Allan Pessier[7], Michael Sredl[8]

*[1]Florida International University, Miami, FL, USA, [2]International Union for the Conservation of Nature, Abu Dhabi, United Arab Emirates, [3]New Zealand Department of Conservation, Hamilton, New Zealand, [4]Durrell Institute of Conservation and Ecology, University of Kent, Kent, UK, [5]Taronga Zoo, Sydney, NSW, Australia, [6]Zoo Atlanta, Atlanta, GA, USA, [7]Institute for Conservation Research, San Diego Zoo Global, San Diego, CA, USA, [8]Arizona Game and Fish Department, Arizona, USA*

## Developing the new IUCN Amphibian Conservation Translocations and Reintroduction Guidelines

Reintroductions and other conservation translocations are tools utilized by conservation practitioners for an increasing number of endangered species of flora and fauna. Amphibians are currently experiencing an unprecedented conservation crisis with hundreds of species threatened with extinction and many more in decline. Linked to the rapidity of these declines, the number of amphibian *ex situ* conservation programs and amphibian translocations have risen dramatically in the last two decades. However, translocation methods are often difficult, interdisciplinary, and highly variable across taxa. The International Union for the Conservation of Nature (IUCN) has published generalized best-practice guidelines for conservation reintroductions and other translocations that are applicable to a wide variety of organisms. However, successful conservation translocations may require largely different and specialized methodology dependent on the type of organism being reintroduced to the wild. We are developing a new set of amphibian-focused translocation guidelines through a major international collaboration of reintroduction practitioners with the guidance of the IUCN's Reintroduction Specialist Group and Amphibian Specialist Group. We will discuss the process for creating the document, the format and structure of the new guidelines, and the importance of creating best practice guidelines. The authors will also explain how the audience can provide feedback on the forthcoming documents.

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**0875 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon A-C, Friday 8 July 2016**

Amber Lisi, Ken Oliveira

*University of Massachusetts Dartmouth, Dartmouth, MA, USA*

## Reduction of Intestinal Tissue in Metamorphosing *Anguilla rostrata*: a histological study

The American eel, *Anguilla rostrata*, is a catadromous species that undergoes extensive morphological and physiological changes as it transitions from a benthic lifestyle to that

of a pelagic migratory species in preparation for its reproductive migration. One major change during this metamorphosis is the reduction of the gastrointestinal tract (GI). While low levels of apoptosis are vital to maintain healthy tissues, we propose that an elevated rate of apoptosis in the intestine during this life stage is the primary mechanism of reduction of intestinal tissues. In this study we use silver phase American eels, collected at the start of their seaward migration, to histologically examine the loss of the GI over time. To determine changes in area of longitudinal and circular muscle, lumen, and villi, and the effects of feeding, environment, and maturation state on the rate of reduction, histological sections from bi-weekly sampling (n=6) of eels from 6 experimental groups (freshwater, seawater, freshwater fed, seawater fed, freshwater matured, and seawater matured) were measured. Muscle, interstitial tissues, and circumference of intestinal cross sections were seen to reduce with time. Apoptosis was identified in paraffin embedded tissue sections through a nonisotopic approach (immunofluorescence TUNEL assay). Caspase mediated apoptosis was observed using isotopic methods (immunohistochemistry). These results suggest that the reduction of intestinal tissue is controlled by a developmental pathway rather than atrophy. This can add to our knowledge of the metamorphosis of the American eel, as well as provide insight into the potential effects of delayed migration due to anthropogenic activity.

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**0577 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday 7 July 2016**

Ryan Logan, Christopher Lowe

*California State University Long Beach, Long Beach, California, USA*

**Do They Stay or do They Go? Site Fidelity of Kelp Forest Gamefishes on a Large Artificial Reef in Southern California**

Artificial reefs (ARs) can be used to serve a number of purposes; however, in recent years the majority of AR deployment in the United States has focused on enhancing fishery resources for commercial and recreational fishermen. Diver-based fish survey techniques routinely demonstrate high fish abundance on ARs, yet a debate exists as to whether the fish found on ARs reside there and produce new fish biomass to the area, or if they are simply being attracted from adjacent natural reefs. To examine this, a passive acoustic telemetry array (38 receivers) was placed around the 178 acre Wheeler North Artificial Reef (WNAR) off the coast of San Clemente, California to determine whether fish tagged on the reef remain there, as well as if fish tagged on adjacent natural reefs move to the artificial reef. Barred sand bass (*P. nebulifer*), kelp bass (*Paralabrax clathratus*) and California sheephead (*Semicossyphus pulcher*) tagged on WNAR show varying levels of site fidelity to the AR with low (35%), moderate (52%) and high (74%) percentage of days detected since tagging, respectively. Additionally, the majority of fish tagged at adjacent natural reefs remain on the respective reef they were tagged, with little movement between reefs. To date, no fish tagged at adjacent natural reefs have been consistently detected (indicating residency) on WNAR. These data lend support to the

theory that artificial reefs are effective mitigation tools and may be used to increase regional fish biomass for commercial or recreational fishing activities.

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**0730 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Maxwell London[1], Kenshu Shimada[1], Michael J. Polcyn[2]

*[1]DePaul University, Chicago, IL, USA, [2]Southern Methodist University, Dallas, TX, USA*

### A Large Actinopterygian Bony Fish from the Upper Cretaceous Eagle Ford Group of Texas, USA

SMU 76938 is a 95-million-year-old fossil skeleton of a large, nearly complete actinopterygian bony fish housed in the Shuler Museum of Paleontology collection at Southern Methodist University in Dallas, Texas, USA. It was collected in the 1980s from the Tarrant Member (Upper Cenomanian) of the Upper Cretaceous Eagle Ford Group in Tarrant County, Texas, where it was under the North American Western Interior Seaway. The specimen presently exposes the left lateral side, and whereas parts of the skull and dorsal fin are damaged, the fish measures about 87 cm, 103 cm, and 119 cm in standard length, fork length, and total length, respectively, and about 18 cm in maximum body depth with a fusiform body plan. The vertebral column is nearly complete with a total vertebral count of at least 54, but no more than 58, and the caudal fin is well preserved, including its soft tissue outline. The overall morphology of the vertebrae and caudal fin is reminiscent of the Late Cretaceous bony fish genus *Pachyrhizodus*. Teeth in the specimen are conical with a lingual curvature, and they are small, measuring no more than 1.5 mm in height. Unlike *Pachyrhizodus*, teeth are not arranged in a linear tooth row, but rather villiform. Therefore, its exact taxonomic identify is presently uncertain, but a unique combination of anatomical characteristics suggests that SMU 76938 may belong to a new taxon that is closely allied to Pachyrhizodontidae.

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**0050 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Andrés López, Ilena Zanella

*Misión Tiburón, Guanacaste, Costa Rica*

### Habitat Use of Bull Sharks (*Carcharhinus leucas*) in Islas Murcielago, Guanacaste Conservation Area, Costa Rica

The Guanacaste Conservation Area (GCA), located in northwestern Costa Rica, is an UNESCO World Heritage Site. The marine protected area (MPA) is influenced by the phenomenon of upwelling, causing a drastic decline of surface water ´s temperature (14 ° C) during the dry season. In GCA are located the Islas Murcielago or "Bat Islands", visited by divers to see the natural congregations of bull sharks (*Carcharhinus leucas*). The

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bull shark is migratory and live in coastal waters, in marine and freshwater ecosystems. In spite of the critical habitat identified at GCA, the ecology, the behavior and the habitat use of bull sharks were never studied in this MPA. The aim of this project is study the habitat use of bull sharks in Islas Murciélagos to improve the management of the MPA. We hold an acoustic tagging program, between June 2013 and November 2014: 11 bull sharks are tagged with acoustic transmitters, and one receiver was deployed at Islas Murcielago. The receiver has recorded more than 49,000 detections, mainly during daylight hours (05:00-18:00). The data showed a strong fidelity of females to the island, however the number of detections during the dry season are significantly less than during the rainy season. The tendency to stay during daylight hours in the island is probably related to reproductive aspects, since it is common to see females with post-copula marks. In turn, the low number of detections during the night suggests that bull sharks move to feeding grounds.

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**0103 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

Yer Lor[1], David Boseto[2], Ken Maeda[3], Frank Pezold[1]

*[1]Texas A&M University - Corpus Christi, Corpus Christi, TX, USA, [2]Ecological Solutions, PO Box R36 Ranadi, Honiara, Solomon Islands, [3]Marine Genomics Unit, OIST Graduate University, 1919-1 Tancha, Onna-Son, Okinawa, Japan*

## Elucidating species diversity in the amphidromous Indo-Pacific goby genus *Stiphodon*

The taxonomy of the amphidromous Indo-Pacific goby genus *Stiphodon* has historically been chaotic and confusing. Amphidromous species live in freshwater as adults, but undergo a marine larval stage before returning to freshwater as juveniles. *Stiphodon* are herbivorous gobies that live in rocky bottomed, swiftly moving freshwaters throughout the Indo-Pacific region from Sri Lanka in the eastern Indian Ocean to French Polynesia. Male *Stiphodon* exhibit a diverse range of bright coloration, used to distinguish many of the species, while females are relatively drab with similar coloration and patterns. *Stiphodon* species are often difficult to distinguish because of subtle color differences between the males of some species, overlapping ranges of scale and ray counts, poor understanding of species distributions, and changing numbers of tooth and scale counts as specimens grow in size. Although *Stiphodon* has been included in two recent molecular studies, the focus was on studying the relationships amongst sicydiine gobies instead of diversity within the genus *Stiphodon*. As a result, it is hard to determine and understand the true diversity of the *Stiphodon* genus from molecular studies that only included four to six species and fewer than twenty specimens. Data from three nuclear genes (IRF2, RAG1, and rhodopsin) were examined to complement parallel mtDNA research. Results indicate that *Stiphodon* is a monophyletic group comprised of two subclades. Although the nuclear tree was not fully resolved, there were consistencies amongst the nuclear and mitochondrial datasets.

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**0991 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Kim Lovich[1], Matthew Shirley[2], Shawn Heflick[3]

*[1]San Diego Zoo Global, California, USA, [2]Rare Species Conservatory Foundation, Florida, USA, [3]Crocodile Conservation International Inc, Florida, USA*

### A Species Survival Plan Program for the West African Slender-snouted Crocodile (*Mecistops cataphractus*), a case study for the conservation of Critically Endangered crocodiles with *in* and *ex situ* partners

The West African slender-snouted crocodile is maintained in American Association of Zoos and Aquariums (AZA) facilities in conjunction with the Species Survival Program (SSP). As part of the SSP, breeding recommendations for North American captive populations are made based on the best available genetic and other information intended to support their long-term sustainability. We present San Diego Zoo Global's support of conservation initiatives for this Critically Endangered species in Cote d'Ivoire, but also throughout its distribution, as a case study of SSP involvement in *in situ* conservation action. By growing our partnership with the IUCN/SSC Crocodile Specialist Group and its members actively working to protect this species in the wild, we help increase awareness and positively impact crocodile conservation throughout West Africa. In particular, the SSP focuses on fundraising and driving education, capacity-building and awareness programs crocodilian conservation both *in* and *ex situ*. We present an overview of our fundraising strategy and our collaboration with other stakeholders invested in this species long-term survival, including organizations both locally, within West Africa, and globally. We hope our program can serve as a model for how to expand the connections between the international herpetological conservation community and local species conservation efforts.

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**0268 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Kelsey Low[1], Chris Phillips[1], Ethan Kessler[1], Jeanne Baker[2]

*[1]Illinois Natural History Survey, Champaign, IL, USA, [2]Fish and Wildlife Research Institute, Gainesville, FL, USA*

### Thermal Challenges of Overwintering Eastern Box Turtles (*Terrapene c. carolina*) in Eastern Illinois

Ectotherms must evolve to withstand the many challenges presented by winter in temperate ecosystems. The Eastern Box Turtle (*Terrapene c. carolina*) combats sub-zero temperatures by mobilizing glucose in the bloodstream. To determine the extent to which Eastern Box Turtles tolerate freezing in the wild, we collected temperature data adjacent to 24 over-wintering box turtles from November 2009 to April 2010 in Vermillion County, Illinois. We placed temperature probes in substrate near each individual brumating turtle at the depth of each form and removed them after the

turtles had emerged. Twenty-three turtles survived the winter and one was lost due to transmitter failure. Seven turtles were exposed to below-freezing temperatures for several days, and two experienced multiple freezing episodes. A general mixed model revealed that box turtles selected hibernacula on Southwestern facing slopes, which provide greater solar radiation and offer some shelter from winter winds, prevailing from the west and north-west.

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**0335 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Christopher G. Lowe[1], Connor White[1], Ryan Logan[1], Armand Barillotti[1], Chuck Winkler[2], Sal Jorgensen[3], John O'Sullivan[3]

*[1]California State University Long Beach, Long Beach, CA, USA, [2]Southern California Marine Institute, Terminal Island, CA, USA, [3]Monterey Bay Aquarium, Monterey, CA, USA*

**Nearshore movements of juvenile white sharks off southern California**

Over the last 10 years, there has been an increase in juvenile white sharks (< 2 m TL) caught and observed along the southern California (CA) coastline, with many animals observed within 100 m of the shoreline. Over the past 7 years we have tagged 32 juvenile white sharks with coded acoustic transmitters to track their long-term (multiple year) movements and site fidelity to nearshore locations throughout southern CA. Telemetry, catch and observation data have indicated that juvenile white sharks typically leave southern CA water and migrate south during the winter. However, in 2013 (n=1), 2014 (n=5) and 2015 (n=1) individuals were detected throughout the year in nearshore southern CA waters, due to the warmer than average water temperatures during those winters. In 2015 most detections came from two 7 km stretches of beach in southern Santa Monica Bay (SMB) (29.5% of Total Detections) and North Orange County (64.3% of Total Detections). Five Individuals tagged in SMB displayed high site fidelity to that area being detected for 88 to 163 days, with one up to 113 consecutive days. Similar patterns were observed along North Orange County with tagged individuals detected up to 135 days detected at that location. Three individuals moved between these two hotspots. These data suggests that individuals are spending large amounts of time in shallow coastal habitats and appear to have high fidelity to small spatial areas.

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**0447 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

William Ludt[1], Erica Kenworthy[1], Moises Bernal[2], Eva Salas[2], Prosanta Chakrabarty[1]

*[1]Louisiana State University, Baton Rouge, LA, USA, [2]California Academy of Sciences, San Francisco, CA, USA*

## Seeing Spots: Speciation and Population Genetics of Tropical Eastern Pacific Surgeonfishes

Sawtail surgeonfishes in the genus *Prionurus* are a relatively species poor group of herbivorous fishes. Recent studies have found that these fishes are split between two clades: (1) an Indo-Pacific clade with four species that are found mainly among temperate rocky reef habitats, and (2) a clade containing two Eastern Pacific species and a single East Atlantic species, all of which are found in more depauperate, warm water rocky reefs. Resolving the relationship between the two Eastern Pacific species, *Prionurus laticlavius* and *P. punctatus* has been problematic. A recent multi-locus phylogeny with multiple individuals of each species could not resolve the relationships between them. These two species have been traditionally separated by latitude, yet they occur in sympatry across Central America. Additionally, there are few morphological characters supporting their distinction. *Prionurus punctatus* is reported to have spots covering the entire body, while *P. laticlavius* only has them in the caudal region. Yet, observations suggest this trait is continuous in wild populations. Here we expand upon previous datasets with meristic counts and molecular data, including samples from Mexico, Costa Rica, and Panama. Using data from mitochondrial COI and control region, we use a population genetic approach to examine the divergence of these species throughout their range. Considering the morphological and genetic similarity of these two species, this study raises important questions regarding their taxonomic status. Furthermore, this system gives insight into possible mechanisms driving speciation in the Tropical Eastern Pacific.

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**0311 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H, Thursday 7 July 2016**

William Ludt[1], Corinne Myers[2]

*[1]Louisiana State University, Baton Rouge, LA, USA, [2]University of New Mexico, Albuquerque, NM, USA*

**What drives anti-tropical distributions across the fish tree of life?**

Anti-tropical species are uniquely distributed both north and south of the tropics, but lack tropical populations. Several hypotheses regarding the mechanisms responsible for these disjunct distributions have been suggested. For recent time scales, two main hypotheses have been difficult to distinguish: dispersal across the tropics during cooler glacial periods, or biotic exclusion from the tropics. These two hypotheses predict very different abiotic habitat suitability in the tropics: the former predicts that present-day tropics are not suitable, while the later predicts that they are. Here we take an ecological niche modelling (ENM) approach to testing these hypotheses using 32 species of teleost fishes from across the fish tree of life. The Maxent ENM algorithm was used to model northern and southern populations independently to determine degree of niche overlap. These predictions, and models trained with the full species distribution, were then projected onto LGM conditions to investigate the potential for a glacial dispersal corridor across the tropics. Our results indicate that both dispersal and biotic interactions may impact current species distributions, in species-specific ways. Moderate phylogenetic clustering supports this and suggests that the impact of glacial dispersal vs. biotic exclusion is not phylogenetically conserved. Notably, in many species modern northern and southern populations indicate at least some degree of abiotic niche divergence, which may reflect post-glacial adaptation and/or insipient speciation. Overall, this study highlights the species-specific nature of biogeographic patterns in their response to abiotic and biotic change since the last glacial maximum.

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**0519 AES GRUBER AWARD, Balconies J & K, Thursday 7 July 2016**

Sarah Luongo, Christopher G. Lowe

*California State University Long Beach, Long Beach, CA, USA*

**Feelin' the Heat, Seasonally Acclimated Metabolic $Q_{10}$ of the California Horn Shark, *Heterodontus francisci***

With global sea temperature rise, it is unclear how many marine ectothermic organisms will react, particularly elasmobranchs. A better understanding of their metabolic $Q_{10}$, temperature sensitivity, is needed in order to make realistic predictions as to how some populations will react over time. Oxygen consumption was used as a proxy to measure acclimated metabolic rates of the horn shark, *Heterodontus francisci*, at winter and summer temperatures (16 °C and 20 °C, respectively) typically experienced in a given year and to measure metabolic $Q_{10}$. Sharks were kept in a large holding tank at one of the desired temperatures for two weeks prior to the trial to allow for physiological

acclimation. Trial duration varied among individuals and temperature, trials took up to 12 hours with re-saturation of oxygen occurring when levels reached 80% of starting saturation. Sharks tested to date have ranged in size (37-45cm TL) and weight (0.41-0.679 kg) (n = 8). The resting, pre-prandial metabolic rates of the horn shark at 16°C and 20°C were 32.6 ± 9.5 mg $O_2$ $kg^{-1}$ $hr^{-1}$ and 44.4 ± 8.8 mg $O_2$ $kg^{-1}$ $hr^{-1}$, respectively. Of the eight horn sharks that we have tested, we estimate a metabolic $Q_{10}$ of 2.31. These data provide a baseline for understanding the current physiological state of these organisms relative to present sea conditions, but can be modeled to help predict and manage behavioral responses associated with increased sea temperature.

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**0556 AES Conservation & Management III, Balconies L & M, Saturday 9 July 2016**

Kady Lyons[1], Douglas H Adams[0]

*[1]CSULB, Long Beach, CA, USA, [2]Florida Fish & Wildlife Conservation Commission Fish & Wildlife Research Institute, Melbourne, FL, USA*

**Tissue distribution, accumulation, and maternal offloading of organochlorine contaminants in Bonnethead Sharks**

Legacy organochlorine contaminants (e.g. DDT, PCBs) continue to persist in the environment and accumulate in fish and wildlife long after use and production have ceased. Since these contaminants also biomagnify with trophic level they can be used as a tool for examining ecological relationships within and among related species. Organochlorine contaminants were measured in the liver, muscle and brain tissue of Bonnetheads (*Sphyrna tiburo*) from the southeastern U.S. over a range of size classes to determine patterns of accumulation as well as the extent of maternal offloading in a pseudo-placental elasmobranch. We found that a vast majority of organic contaminants accumulated in the livers of sharks of all stages, with brains having the next highest concentration followed by muscle tissue. Hepatic contaminant concentrations increased with size, however, male Bonnetheads were found to have greater concentrations than similarly-sized females. Adult females were found to be more efficient at transferring contaminants via ovulated eggs rather than across the placental structure during gestation. Nevertheless, the still developing embryos were exposed to substantial concentrations of contaminants during development. These findings warrant further investigation into the potential health impacts of this early-stage exposure as well as the influence of organic contaminants on brain development and neurological functioning in elasmobranchs.

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**0551 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Kady Lyons[1], Aaron Carlisle[2], Christopher G. Lowe[1]

*[1]CSULB, Long Beach, CA, USA, [2]Stanford, Pacific Grove, CA, USA*

## Influence of maturity on mercury accumulation over ontogeny in muscle and liver of male round stingrays

Mercury is naturally available in the environment and can readily bioaccumulate in marine animals. While mercury is known to accumulate in multiple tissues, distribution of this contaminant within different tissues and its dynamics are poorly understood in elasmobranchs. The round stingray (*Urobatis halleri*) is a locally abundant elasmobranch in southern California that represents an appropriate model to investigate patterns of mercury tissue distribution across age classes. Total mercury was measured in liver and muscle of male stingrays from Seal Beach, California, as well as from individuals from the offshore island of Santa Catalina. Stable isotope analysis was also performed on the muscle and plasma of a subset of rays over a range of age classes to investigate mercury accumulation with respect to trophic ecology. Mercury in both tissues was found to significantly increase with size, however, mercury accumulation was found to drastically increase after maturity. There were no patterns in $\delta^{15}N$ or $\delta^{13}C$ with size, although $\delta^{15}N$ was found to significantly increase with ontogeny in stingray whole blood, which reflects recent diet. Since SIA values were indistinguishable between adult and juvenile stingrays for muscle, it is unlikely that any ontogenetic changes in overall trophic ecology account for the substantial ontogenetic increases found in mercury with size. Rather, the strong accumulation pattern observed after maturity, and concomitant increase in $\delta^{15}N$ in whole blood, is likely due to factors that are influenced by reproduction (e.g. reproductive behavior, growth rate and biochemical changes in tissues) or mercury dynamics (e.g. tissue redistribution of mercury).

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**0412 AES Morphology & Reproduction, Balconies L & M, Friday 8 July 2016**

Kady Lyons[1], Chris L. Chabot[2], Corinne N. Paterson[2], Christopher G. Lowe[1]

*[1]California State University, Long Beach, Long Beach, California, USA, [2]California State University, Northridge, Northridge, California, USA*

## Who's My Daddy? Multiple Paternity and Evidence of Cryptic Female Choice in the Round Stingray (*Urobatis halleri*)

Polyandry resulting in multiply-sired litters has been documented in the majority of elasmobranch species examined to date. Although commonly observed, reasons for this mating system remain relatively obscured due to the logistical difficulty in sampling animals and the lack of a detailed understanding of many species' reproductive biology and ecology, especially in batoids and rays in particular. The round stingray (*Urobatis halleri*) is an abundant, well-studied elasmobranch distributed throughout the northeastern Pacific that is an excellent model for the testing of hypotheses regarding

multiple paternity in elasmobranchs. Twenty mid- to late-term pregnant females were sampled off the coast of Seal Beach California and their litters analyzed for the occurrence of multiple paternity using five nuclear microsatellite loci. We observed that two or more fathers sired 90% of litters and that reproductive skew was relatively low in 61% of the litters. Our data suggests that females have two distinct ovulating patterns that contribute to the high rates of multiple paternity and relatively even skew. In addition, we found no evidence of paternal genetic benefits; further suggesting that cryptic female choice through sequential ovulation is a mechanism by which a high rate of multiple paternity is maintained.

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**0726 AES Conservation & Management III, Balconies L & M, Saturday 9 July 2016**

Catherine Macdonald

*University of Miami, Miami, FL, USA*

**Media Coverage of Shark Attacks in Cape Town, South Africa, 1850-2000**

This paper uses newspaper articles (n=231) from the *Cape Times* and *Cape Argus*, published in Cape Town, South Africa, to measure changing human attitudes towards sharks and the risk of shark attack between 1850 and 2000. It analyzes popular reporting on the risks, causes, and social responses to human-shark interaction over time, tracing patterns of attack and assessing ways in which public attitudes and journalistic approaches have evolved during the last 150 years. Findings, based on both qualitative analysis of articles and quantitative data (generated through word counts and topic coding) suggest that the types of information considered important and the discourse around shark attack has changed gradually but significantly. Evidence from this data set shows that a shift in the way the media talked about sharks was underway even at the height of hysteria surrounding the release of the movie "Jaws," long before explicit conversations about shark conservation were part of public discourse. Findings reveal that historical data can help us understand the human-shark relationship diachronically, over longer time scales than are typically studied, and that this perspective could helpfully be factored into future management and conservation of shark species.



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**0324 HL, ASIH, SSAR: Eco-Evolutionary Dynamics Symposium, Salon D, Friday 8 July 2016**

Stewart Macdonald[1], John Llewelyn[1], Ben Phillips[2]

*[1]James Cook University, Townsville, Australia, [2]University of Melbourne, Melbourne, Australia*

### Using Connectivity to Identify Environmental Drivers of Local Adaptation

Local adaptation has been studied ever since Darwin and his finches. Despite this long and famous history, and despite being able to demonstrate local adaptation, we are still often unable to objectively determine the exact environmental drivers of local adaptation. Given the rapid rate of global change, understanding the specific drivers of local adaptation is vital. Conservation strategies designed to mitigate the impact of climate change on vulnerable species are urgently needed, and assisted gene flow (the translocation of pre-adapted individuals into more vulnerable populations) is one such strategy. Assisted gene flow, however, requires knowledge of where in the landscape we can find populations with pre-adapted climate-relevant traits; we cannot find these populations if we do not know the dominant climatic drivers of local adaptation. While simple assessments of geographic trait variation are a useful first step towards identifying drivers of adaptation, geographic variation — and its associations with environment — may represent plastic, rather than evolved differences. Additionally, the vast number of environment–trait combinations makes it difficult to determine which aspects of the environment populations adapt to. Here we argue that by incorporating a measure of landscape connectivity as a proxy for gene flow, we can differentiate between environment–trait relationships that are under selection versus those that reflect phenotypic plasticity. By doing so, we can rapidly shorten the list of environment–trait combinations that may be of adaptive significance. We demonstrate this method using data on geographic trait variation in a lizard species from Australia's Wet Tropics rainforest.

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**0064 AES Conservation & Management III, Balconies L & M, Saturday 9 July 2016**

M Aaron MacNeil[1], Christopher J Fonnesbeck[2]

*[1]Australian Institute of Marine Science, Townsville, Australia, [2]Vanderbilt University, Nashville, TN, USA*

### BRUVS relative abundance estimation for global shark surveys

The use of baited remote underwater visual surveys (BRUVS) for quantifying marine species and communities that are otherwise difficult to observe has become widespread. Yet inherent sampling biases confound naive comparisons of abundance or diversity that have been well-studied for passive sampling methods that do not attract individuals to bait. Here we outline various sources of sampling bias for BRUVS as they relate to estimating the relative abundance of reef-associated sharks around the world.

We develop a modelling framework to overcome BRUVS sampling biases and demonstrate its potential impact on real-world data. We conclude that, while remote sampling methods have great potential to catalyze understanding of the world's oceans, thoughtful models must be developed to ensure accurate interpretation of what are ultimately second-hand observations.

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**0716 Herp Ecology, Salon F-H, Sunday 10 July 2016**

John Maerz, Susan Wilde, Vanessa Kinney Terrell, Sonia Hernandez, Albert Mercurio, Brigette Haram, Clay Trimmer, Rebecca Boyd, Erin Cork

*University of Georgia, Athens, GA, USA*

## Amphibian and Reptile Vulnerability to *Hydrilla* Invasions and the Spread of *Aetokthonos hydrillicola*

*Aetokthonos hydrillicola* (*Ah*) is a novel cyanobacteria associated with submerged aquatic macrophytes (SAVs), particularly invasive plant *Hydrilla verticillata*. The direct or indirect ingestion of *Ah* positive *Hydrilla* is linked to vacuolar myelinopathy and mortality of birds and fish, suggesting potential to threaten other vertebrates. The southeastern United States is a hotspot for freshwater turtle and amphibian diversity. Turtles consume high amounts of SAVs, and tadpoles graze epiphytic biofilms. We report on the results of two exposure studies to determine whether turtles and tadpoles are sensitive to the *Ah* cyanotoxin. First, we fed *Ah* positive or negative *Hydrilla* to wild-caught Painted Turtles (*Chrysemys picta*). Between days 82 and 89, all turtles fed *Ah* positive *Hydrilla* displayed physical and/or neurologic impairment. Histologic examination of the brain and spinal cord confirmed vacuolations in all turtles fed *Aetokthonos* positive *Hydrilla*. None of the turtles fed *Aetokthonos* negative *Hydrilla* exhibited neurologic impairment or had detectable brain or spinal cord vacuolations. Second, we conducted four independent feeding trials with Bullfrog (*Lithobates catesbeianus*), Green frog (*L. clamitans*), and Southern Leopard Frog (*L. sphenocephalus*) tadpoles. Survival of tadpoles fed *Ah* positive *Hydrilla* was reduced by 60%-80% over ~35 days. Our results demonstrate sensitivity of common freshwater turtle and amphibian species to *Ah,* and we suggest that *Ah* spread linked to *Hydrilla* invasions poses a broad threat to all major vertebrate classes including freshwater turtles and anurans in a region of high taxonomic diversity.

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**0509 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Jared Maida[1], Christine Bishop[2], Mark Rakobowchuk[1], Karl Larsen[1]

*[1]Thompson Rivers University, Kamloops, British Columbia, Canada, [2]Environment and Climate Change Canada, Delta, British Columbia, Canada*

## Determining Rattlesnake (*Crotalus oreganus oreganus*) Response to Disturbance in British Columbia, Canada

The dry, arid grasslands of southern British Columbia are undergoing immense landscape changes in order to meet the needs of the growing population and tourism industry. Such changes result in the Northern Pacific Rattlesnake (*Crotalus o. oregnaus*) utilizing degraded habitats as well as locations conducive to more frequent human interactions. The main objective of my research is to increase our understanding of the behavioral and physiological responses rattlesnakes demonstrate to these types of disturbances. I am using a combination of radio-telemetry, mark-recapture and blood sampling techniques to determine a correlation between stress and habitat quality. Preliminary results suggest that baseline corticosternone blood plasma concentrations are elevated in rattlesnakes utilizing degraded habitats with frequent human interactions. Potentially, fencing is a mitigation tool for deflecting snakes away from these areas of apparent high-stress; however, the effects these barriers have on rattlesnake behavior are understudied. To that end, I also am assessing the impact fencing has on the distance, directionality and duration of rattlesnake migration and summer home range. Combined, the results and outcomes of my research will expand our understanding of the indirect and sub-lethal impacts disturbance has on rattlesnakes, providing insight to more thoughtful management and conservation strategies for this species.

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**0078 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Sarah Manka[1], Stephen Mullin[2]

*[1]Eastern Illinois University, Charleston, Illinois, USA, [2]Stephen F. Austin State University, Nacogdoches, Texas, USA*

## Reducing Snake Mortality During Migration: The Utility of the Hose-bridge

Various structures have been integrated into roadways such that the road itself does not impede wildlife movements between adjacent habitats. Where traffic volume is low, the costs of installing and maintaining such structures are typically prohibitive. We tested the efficacy of a hose-bridge deployed temporarily on a State Park road that allowed the passage of cars over it, and small wildlife species to cross through it. We predicted that, during the 4.5-week period of peak migratory movement, road-based mortality of Dekay's Brownsnakes (*Storeria dekayi*) would be less at the site having the hose-bridge, when compared to a similar section of road without a hose-bridge (control). We erected drift fences at both sites to guide snakes to each section of road and collected snakes that successfully crossed the road with arrays of cover objects and pitfall and funnel traps.

The speed limit on the road varied from 32-48 kph, but cars passing over the hose-bridge slowed to ≤8 kph. Snake mortality at the hose-bridge site was reduced compared to the control site. Mean mortality at both sites was lower than in previous years, which might be attributable to reduced vehicle speed or increased motorist awareness of migrating wildlife. Compared to the pattern recorded in the preceding four years, the hose-bridge and accompanying signage effectively decreased the road-based mortality of *Storeria dekayi* during their 2014 and 2015 Autumn migrations.

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**0985 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Rachel Manning[1], James W. Orr[2]

[1]*University of Washington, Seattle, WA, USA,* [2]*NOAA/National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, USA*

## Meristic Evidence for a New Snailfish (Scorpaeniformes: Liparidae) from the Eastern North Pacific Related to *Careproctus melanurus* Gilbert 1892

The genus *Careproctus* is a relatively diverse genus of the snailfish family Liparidae. It presently comprises about 140 species, with many undescribed species identified. Ranging from northern Japan to Baja California, *C. melanurus,* the Blacktail Snailfish, is one of the most commonly observed species in the genus and is among the most commonly collected liparids in the eastern North Pacific at depths of 200 m or greater. COI sequence data examined among adult snailfishes and their eggs found in lithodid crabs from Alaska suggested the presence of an unidentified liparid closely related to *C. melanurus* when sequences of several egg masses matched none of the sequences of 23 species initially compared for identification. Among the 23 species with no match was *C. melanurus*, recorded as the most common species found in eggs deposited in lithodids. However, the species was represented by a single individual from Washington. Only when sequence data was added from Alaska specimens did "*C. melanurus"* match the egg sequences. Sequence data between Washington and Alaska *C. melanurus* differed by at least 4% and therefore we hypothesized a new species was present. We collected meristic data from radiographs of over 50 specimens of *C. melanurus* from Alaska and the North American coast south of British Columbia. Alaskan specimens showed almost no overlap with southerly populations in vertebral and dorsal- and anal-fin ray counts. The holotype of *Careproctus melanurus* was collected off San Diego, California; therefore individuals from Alaska will likely be recognized as a new species.

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**0134 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Kelsey A. Marchand[1], Christopher M. Somers[1], Ray G. Poulin[2]

*[1]University of Regina, Regina, Saskatchewan, Canada, [2]Royal Saskatchewan Museum, Regina, Saskatchewan, Canada*

## Life on the Northern Edge: Overwintering Ecology of the Western Painted Turtle in Regina, Saskatchewan, Canada

Suitable overwintering conditions are a limiting factor for herpetofauna in Canada. As ectotherms in northern environments, they must seek refuge from freezing temperatures for the majority of their seasonal cycle. In Canada, freshwater turtles seek winter refuge in ice-covered waterbodies. However, they will be subject to low water temperatures and limited access to oxygen where they could be subject to freezing or metabolic acidosis. In this study, we are examining an urban population of the western painted turtle near the northern limit of the species range in Regina, Saskatchewan, Canada. Using radio telemetry, we located overwintering sites of 13 individuals. We are studying over-wintering site selection on several scales based on the habitat variables: ice thickness, water depth, water temperature, and dissolved oxygen content. In 2016 we found that turtles chose to be in areas with lower dissolved oxygen (used = 3.2 ± 3.6 mg/L; available = 9.1 ± 10.8 mg/L), warmer water (used = 2.0$^{o}$C ± 1.0; available = 1.1$^{o}$C ± 0.9), and deeper depths (used = 172 ± 66 cm; available = 57 ± 48 cm) compared to available sites. Our work will continue to provide information on important aspects of overwintering ecology of this species near the northern limit of its range.

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**0135 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Kelsey A. Marchand[1], Christopher M. Somers[1], Ray G. Poulin[2]

*[1]University of Regina, Regina, Saskatchewan, Canada, [2]Royal Saskatchewan Museum, Regina, Saskatchewan, Canada*

## Urban Habitat Selection and Resource Use of Western Painted Turtles near the Northern Limit of the Species Range

Reptiles in Saskatchewan live on the edge; the environment is extreme, and the anthropogenic influence on their habitat is extensive. The western painted turtle (*Chrysemys picta bellii*) is one of the most widely distributed subspecies in North America, reaching the northern limit of its natural range in western Canada. In the western provinces, populations are in decline largely due to habitat fragmentation and road mortality. In Saskatchewan, they are not considered at risk of extinction; however, little is known about the biology of the species. Over the next two years, we are conducting a study on turtles living in Regina's Wascana Marsh to begin to understand the habitats and resources required to survive in this urban environment. The primary

goals of the project are to determine population size and demography, home range size, and resource use of the population throughout the active season. This is being accomplished through a mark-recapture study, radio-telemetry, and stable isotopes analyses. During 2015 we processed 61 turtles (4 juveniles, 38 females, 19 males), of which 25 (18 females, 7 males) were outfitted with radio transmitters. We found that overall, females had larger home range sizes (331 ± 214 ha) across the active season than males (155 ± 106 ha), and both exhibited seasonal shifts in habitat preferences. Our work will continue to provide information on important aspects of the ecology of western painted turtles in the province of Saskatchewan.

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**0430 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Lara Marcus[1], Patti Virtue[1], Peter Nichols[2], Mark Meekan[3], Heidi Pethybridge[2]

*[1]Institute for Marine and Antarctic Studies, Hobart, TAS, Australia, [2]CSIRO Oceans & Atmosphere, Hobart, TAS, Australia, [3]Australian Institute of Marine Science, Perth, WA, Australia*

## Trophic Ecology of a Whale Shark Aggregation at Ningaloo Reef, Western Australia: a Stable Isotope Approach

We investigated the trophic ecology of whale sharks using carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotope analysis of sub-dermal tissue and an extensive set of potential prey including zooplankton and other pelagic organisms sampled from Ningaloo Reef, Western Australia over two consecutive years. Preliminary results showed that the stable isotopes of whale shark sub-dermal tissue were not significantly different between years or sex. A positive relationship was, however, found between $\delta^{13}C$ and $\delta^{15}N$ and shark total length, suggesting ontogenetic dietary changes. When comparing potential prey-predator interactions, $\delta^{15}N$ values of whale shark were similar to other zooplanktivores. More enriched $\delta^{13}C$ values in whale shark indicated that they may feed on other dietary sources not part of the pelagic ecosystem. Overall, stable isotope analysis combined with non-lethal sampling techniques have been used to successfully examine trophic intra-specific variability in whale sharks and to infer food web relationships.

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**0564 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Alex Marks, Tracey Sutton

*Nova Southeastern University, Dania Beach, FL, USA,*

### Reproductive Ecology of Dragonfishes (Family: Stomiidae) in the Gulf of Mexico

Dragonfishes (Family: Stomiidae) are dominant mesopelagic predators occurring throughout the world's oceans. Dragonfishes are ecologically important because they are trophic mediators, preying primarily upon lanternfishes, which are major zooplanktivores. While aspects of dragonfish feeding ecology have been quantified, little is known regarding their reproductive ecology. A key reason is insufficient sample sizes of mature adults due to the type of gear used; larger, sexually mature stomiid adults are more adept at net avoidance. Between 2010-2011, the Offshore Nekton Sampling and Analysis Program was initiated in the northern Gulf of Mexico over all four seasons using a discrete-depth sampling system and a large, commercial-sized midwater trawl. Gonads were dissected from 714 individuals belonging to 47 species of stomiids, of which 12 were dominant and subjected to detailed analysis. All species except *Chauliodus sloani* had sex ratios that did not significantly differ from the expected 1:1 ratio (male:female). *Aristostomias xenostoma* and *Photostomias guernei* were the only species in which the biomass ratio favored males. Female ovaries possessed an asynchronous oocyte development, suggesting that females are iteroparous batch spawners and able to spawn more than once each spawning season, or continuously throughout the year with no spawning season. Males exhibited a similar pattern. Data on size at maturity and length frequency distributions will be presented. Data such as these are essential for ecosystem-based modeling of global deep-pelagic ecosystems, which contain the overwhelming majority of earth's fish biomass.

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**0705 AES Genetics, Genomics, Biogeography, & Systematics, Balconies J & K, Saturday 9 July 2016**

Nicholas J. Marra[1,2], Minghui Wang[3], Paulina Pavinski Bitar[2], Qi Sun[3], Aleksey Komissarov[4], Stephen J. O'Brien[1,4], Michael J. Stanhope[2], Mahmood Shivji[1]

*[1]Save Our Seas Foundation Shark Research Center, Nova Southeastern University, Dania Beach, FL, USA, [2]Department of Population Medicine and Diagnostic Sciences, Cornell University, Ithaca, NY, USA, [3]Bioinformatics Facility, Cornell University, Ithaca, NY, USA, [4]Theodosius Dobzhansky Center for Genome Bioinformatics St. Petersburg State University, St. Petersburg, Russia*

### Comparative Genomics and Transcriptomics of Elasmobranchs: Insights into a Primitive Adaptive Immune System

The Elasmobranchii and Holocephali comprise the class Chondrichthyes and as a group represent the most basal vertebrate lineage with an adaptive immune system. To date,

studies of immune genes in elasmobranchs have been restricted to single species studies or to select loci. Here we report the results of our comparative transcriptomic and genomic analyses involving several elasmobranch species, focusing on characterization of the immunome. We present our RNA-seq analysis of heart tissue, revealing several striking immunogenetic differences between the four elasmobranchs and three teleost fishes included in our study. These differences included enrichment within the elasmobranchs of genes associated with adaptive immunity Genome Ontology terms, such as "antigen processing and presentation of exogenous peptide antigen via MHC class II", as well as evidence of positive selection of elasmobranch genes (e.g. *legumain*) classified within this same functional category. This in turn suggests that this particular immunological function may underlie some of the distinctive capabilities of the elasmobranch immune system. In regards to genomics, we report our updated and annotated assembly of the approximately 5 Gbp white shark genome, with over 100x sequencing coverage, and a gap percentage of 7%. We also report here for the first time, our assembled and annotated 3 Gbp great hammerhead genome. These completed shark genomes facilitate a thorough comparison of the immune gene content of two elasmobranch representatives to model vertebrates and the holocephalan, elephant shark, providing insights into shared features of elasmobranch genomes that drive functional and adaptive differences of their unique immune systems.

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**0904 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Nicholas J. Marra[1,2], Minghui Wang[3], Paulina Pavinski Bitar[2], Qi Sun[3], Aleksey Komissarov[4], Stephen J. O'Brien[1,4], Michael J. Stanhope[2], Mahmood Shivji[1]

[1]*Save Our Seas Foundation Shark Research Center, Nova Southeastern University, Dania Beach, FL, USA,* [2]*Department of Population Medicine and Diagnostic Sciences, Ithaca, NY, USA,* [3]*Bioinformatics Facility, Cornell University, Ithaca, NY, USA,* [4]*Theodosius Dobzhansky Center for Genome Bioinformatics, St. Petersburg, Russia*

## Genome Sequence of the White Shark (*Carcharodon carcharias*): Insights into Genome Size Evolution, Life History Characters, and a Primitive Adaptive Immune System

The white shark, *Carcharodon carcharias*, is a species of great interest to the public, shark biologists, and geneticists alike. Several of its life history characteristics are of evolutionary and/or ecological interest such as regional endothermy, its role as a large apex predator, long lifespan, and a primitive adaptive immune system. We have utilized a combination of quality trimmed single-end, paired-end, overlapping paired-end, and mate-paired Illumina sequencing data to obtain 104x coverage of the white shark genome, the largest chondrichthyan genome yet sequenced. In addition to estimating genome size (roughly 5 gbp) and repeat content (roughly 60% is comprised of repetitive content), we have employed the MAKER pipeline on the assembled data to provide annotations, resulting in about 34,000 predicted genes with an average size of 20.6 kbp. From these annotated loci we were able to gain insights into the genetics behind several aspects of white shark biology. For example, sharks are thought to lack color vision.

Accordingly, we were unable to identify the full complement of 5 traditional opsin genes needed for full color vision. However, genes for two possible color-absorbing opsins were identified and point to the possibility of limited color vision in this species. We also identified 193,576 microsatellites (23,586 perfect repeats) that could be adapted for conservation genetics studies in this and other lamnid species. Ongoing study of these genes, those encoding aspects of the adaptive immune system, and telomere length in this species, include some of the current efforts underway with this genome assembly and characterization.

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**0291 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Ashley N. Marranzino[1], Christopher P. Kenaley[2], John Psaltis[2], Ciara Dawson[1], Jacqueline F. Webb[1]

*[1]University of Rhode Island, Kingston, RI, USA, [2]Boston College, Chestnut Hill, MA, USA*

## Variation in the Morphology and Distribution of Photophores Among Stomiiform Genera

The use of bioluminescence is a common feature of fishes inhabiting dimly lit waters of the deep sea. Bioluminescence has been proposed as a mechanism for prey attraction, predator avoidance, signaling, and countershading. Photophores, the organs responsible for light production in most deep-sea fishes, are morphologically diverse; however, the varied function of these strikingly different organs is still poorly understood. While myctophids have interspecific and sexually dimorphic luminescent organs that mostly likely function in communication, variation in photophore morphology, distribution, and orientation is largely undocumented in other deep-sea taxa. The large lateral and ventral photophores are well known in stomiiform fishes, the most diverse clade of deep-sea fishes. Yet there remains little known about the numerous minute photophores that cover the head and trunk in many species. Preserved specimens representing a range of stomiiform genera were illuminated using epifluorescence (470-nm excitation wavelength) and photophore size, distribution, density, and orientation were quantified in defined locations on the head and body. Inter- and intra- specific variation in photophore density were both found among genera. Photophores were more densely placed ventrally, but minute photophores with variable orientation were found over the head and trunk in some genera. This variation in photophores reveals phylogenetic patterns that may be useful in taxonomic discrimination and suggest possible ecological functions of bioluminescence in these important deep-sea fishes.

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**0662 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon A-C, Friday 8 July 2016**

Ashley N. Marranzino, Jacqueline F. Webb

*University of Rhode Island, Kingston, RI, USA*

**Lateral Line Canals and Superficial Neuromasts in Stomiiform Fishes**

The morphology and functional roles of the mechanosensory lateral line system in deep-sea fishes are not well studied, and this is especially true for fishes in the Order Stomiiformes. Examination of whole specimens, whole mount hematoxylin staining, histology, SEM, and μCT imaging were used to describe lateral line morphology in a range of stomiiform genera. In depth analysis of *Argyropelecus* spp. (Sternoptychidae) revealed the presence of incompletely ossified supraorbital (SO), mandibular (MD) and preopercular (PO) canals and a proliferation of superficial neuromasts in linear series on the head and trunk, appearing as opaque, raised white dots in preserved specimens. *Cyclothone* spp. (Gonostomatidae), on the other hand, had no cranial canals but had a similar proliferation of superficial neuromasts similar in morphology to those of *Argyropelecus*. Representatives of other stomiiform genera (Phosichthyidae and Stomiidae) examined appeared to have either completely or incompletely ossified SO, MD, and PO canals; an infraorbital canal was found in some genera. Several genera had features similar to those identified as superficial neuromasts in *Argyropelecus* and *Cyclothone* on the head and in vertical rows on the trunk. Thus, it appears that there is a proliferation of superficial neuromasts in many stomiiform genera and that the lateral line system is more important for the behavior of fishes than has been previously suggested.

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**0639 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Carmen del Rocío Pedraza Marrón[1], Omar Domínguez Domínguez[0]

*[1]University of Puerto Rico, San Juan, San Juan, Puerto Rico, [2]Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Michoacán, Mexico*

**The biogeographic and evolutionary history of the *Malacoctenus* genus (Pisces: Labrisomidae) in the Tropical Eastern Pacific**

The Tropical Eastern Pacific (TEP) is a biogeographic region distinguished by a rocky coast, interrupted in two major portions by sandy bottoms called 'Sinaloan Gap' and 'Central American Gap'. The species of the genus *Malacoctenus* are strongly associated to rocky bottom habitats. Hence, the present study aimed to evaluate through the molecular markers Cytb, Rhod and Rag1, the influence of these habitat gaps on the genetic structure of their populations. Likelihood and bayesian approaches were used to infer population differentiation. Besides, genetic variation and population structure were calculated for widely distributed species. Our results show species of *Malacoctenus* as monophyletic. A biogeographic pattern was found corresponding to a genetic differentiation between the populations separated by the Central American Gap (*M.*

*ebisui* and sister species *M. margaritae-M. mexicanus*, *M. sudensis-M. zonifer*). The divergence times estimated for these populations (6.3 My for *M. zonifer – M. sudensis*, 5.1 My *M. mexicanus – M. margaritae* and 2.4 My for populations of *M. ebisui*) suggest that the unstable conditions of the ocean during late Miocene, early Pliocene and Pleistocene caused by glaciations in addition to the conformation of the Central American Gap, could have acted as historical barriers to gene flow. Also, the genetic differentiation on populations of these species suggests that the habitat gap and the oceanic gyres produced by seasonal upwellings represent contemporary factors driving the speciation of the group. Nevertheless, this pattern was not documented for *M. tetranemus*.

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**0934 AES Physiology, Paleontology, & Collections, Balconies L & M, Friday 8 July 2016**

Heather Marshall[1], Nicholas Whitney[1], Connor White[2], Diego Bernal[3], Enrico Gennari[4], Ryan Johnson[4], Christopher Fischer[5], Gregory Skomal[6]

*[1]Mote Marine Laboratory, Sarasota, FL, USA, [2]California State University Long Beach, Long Beach, CA, USA, [3]University of Massachusetts Dartmouth, North Dartmouth, MA, USA, [4]Oceans Research, Mossel Bay, South Africa, [5]OCEARCH, Park City, UT, USA, [6]Massachusetts Division of Marine Fisheries, New Bedford, MA, USA*

**The stress response and recovery behavior of the white shark (*Carcharodon carcharias*) after capture on handline gear**

With a growing white shark (*Carcharodon carcharias*) population in the western North Atlantic, incidental capture of this species has increased in recent years. Given the importance of post-release survivorship to population growth, a detailed assessment of the physiological effects of capture and their subsequent impacts on survivorship is warranted. The objectives of this research were to quantify relative acid-base, electrolyte, and metabolite disturbances in the blood of white sharks exposed to handline capture, air exposure, and handling, to examine immediate and delayed post-release mortality with satellite tracking, and to characterize post-release recovery in this species using accelerometry. For capture times ranging from 10-123 minutes, we did not find significant changes in blood stress parameters, which were consistent across individuals (n=29). Three individuals blood sampled multiple times during tagging exhibited no significant changes in blood biochemistry while out of the water, thereby indicating that the tagging event (i.e., time out of water) did not exacerbate the stress of capture. Individuals from which accelerometer data were obtained (N=4) showed a gradual increase in tailbeat frequency and amplitude in the first few hours after release, with three individuals exhibiting repetitive swim-glide ("yo-yo") diving behavior. Satellite tag data indicate survivorship for several months or years for most individuals. Overall, the white shark appears to be a robust species when exposed to hook-and-line capture stress.

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## 0880 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon F-H, Friday 8 July 2016

Bradley Martin[1], John Placyk[2], Roger Birkhead[3], Marlis Douglas[1], Michael Douglas[1]

*[1]University of Arkansas, Fayetteville, AR, USA, [2]University of Texas at Tyler, Tyler, TX, USA, [3]Auburn University, Auburn, AL, USA*

### Phylogenomics and an Assessment of Introgression in the North American Box Turtles (*Terrapene* spp.)

The North American box turtles (*Terrapene* spp.) are of conservation concern throughout their range. Their populations are in decline due, in part, to road-based mortality, loss and fragmentation of habitat, and invasive predators. In order to facilitate successful conservation management strategies, an accurate depiction of their classification needs to be established. However, despite recent efforts to resolve their classification using molecular phylogenetic data, some phylogenetic relationships have not been fully resolved, particularly regarding the four taxa inhabiting the southeastern United States. It has been suggested that the southeastern taxa, *T. carolina carolina*, *T. c. triunguis*, *T. c. major*, and *T. c. bauri*, might consist of at least two separate species and that introgression could be occurring. Given that many conservation efforts are focused at the species level, and often ignore subspecies, it is necessary to have an understanding of which taxa represent unique species. Furthermore, detecting introgression, or hybridization without introgression, allows managers to make more informed conservation decisions by identifying populations or areas that may need to be managed differently. Based on previous research, it is clear that a limited number of mitochondrial DNA genes or nuclear introns are not able to resolve the classification of these four taxa. Thus, we have employed double digest restriction-associated DNA sequencing (ddRAD), a reduced-representation next generation sequencing (NGS) technique, in order to 1) disentangle the phylogenetic relationships of the four southeastern taxa, and 2) assess whether hybridization or introgression is occurring between them.

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## 0694 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016

Daniel Martin[1], Cameron Aldridge[1], Larissa Bailey[1], Daniel Manier[2], Robert Reed[2]

*[1]Colorado State University, Fort Collins, Colorado, USA, [2]U.S. Geological Survey, Fort Collins, Colorado, USA*

### Distributions of Reptiles in the Great Plains: Ecological Insight from Historical Observations

Understanding the environmental factors that characterize reptile distributions is necessary for improving conservation of these species in a changing world. The Great Plains is characterized by environmental variation from both natural (e.g., temperature, precipitation) and anthropogenic (e.g., land-use change) sources. Thus, the central and

southern prairies are particularly useful for investigating how environmental variation may influence reptile distributions. Here, we use historic (1900-1977) and contemporary (1986-2012) occurrence data for select reptile species in a Species Distribution Modelling (SDM) approach to gain insight into which climate and habitat factors help shape change in reptile distributions over time. Examples will be presented for Texas Horned Lizard (*Phrynosoma cornutum*), Massasauga (*Sistrurus catenatus*), and Ornate Box Turtle (*Terrapene ornata*). For each species, we evaluate results of SDMs developed using General Linear Model and Boosted Regression Tree approaches. We suggest approaches for data collection and analysis that will enable validation of our occurrence-only distribution models, and reduce sampling bias, which should further improve insights into environmental drivers of change in reptile distributions.

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## 0704 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Daniel Martin[1], Larissa Bailey[1], Cameron Aldridge[1], Robert Reed[2], Daniel Manier[2]

*[1]Colorado State University, Fort Collins, Colorado, USA, [2]U.S. Geological Survey, Fort Collins, Colorado, USA*

### A Standardized Sampling Approach for Guiding Conservation of Terrestrial Reptiles

In the face of rapidly-changing climate and continued habitat alteration, it is increasingly important for wildlife conservation decisions to be guided by robust survey data that enable accurate estimates of occurrence. Much of our contemporary understanding of reptile distributions is based on presence-only records, and these data fail to provide complete information needed for critically evaluating changes in species' status over time and space. To guide improved landscape-scale conservation efforts, surveys for reptiles should include probability-based sampling approaches and standardized methods that (at least for many temperate species) enable incorporation of detection probability. Here, we describe the first landscape-scale standardized survey for terrestrial reptiles in North America. Our approach uses a probability-based design and simple, standardized survey protocols. We randomly-selected survey sites on public and private lands for which we had access in 8 states within the Great Plains. We used visual encounter surveys, including road and off-road-based methods and during day and night. Our sampling design is flexible enough to incorporate different detection methods that may be necessary for particular species and habitats. In addition, our landscape-scale approach could be adjusted for local or regional-scale sampling efforts by adjusting sample extent and intensity. The benefits of this approach include estimates of occupancy for species over time and space; these account for imperfect detection and misidentification bias, and include estimates of precision. This more robust effort should improve the quality of information available to guide future conservation and management decisions, and could be applied across North America.

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**0417 ASIH STOYE GENERAL ICHTHYOLOGY AWARD, Galerie 2, Friday 8 July 2016**

Rene Martin

*St. Cloud State University, St. Cloud, Minnesota, USA*

### Morphological Variance in the Dentition on the Oral Jaws in Lanternfishes (Teleostei: Myctophiformes)

Lanternfishes (Teleostei: Myctophiformes) are among the most species-rich (~250 species) and abundant (~50% of midwater fish biomass) mesopelagic (200–1000 m) fish lineages in oceanic systems worldwide. They are characterized by bioluminescent photophores and structures that produce and emit light. Few studies have focused on the anatomical structures associated with feeding in lanternfishes. Recent work indicates that there is considerable variation in upper-jaw length among lanternfish lineages. The broad variation in mouth size of lanternfishes indicates that this group may occupy a wider range of ecological niches than previously thought, and additional work is needed to study the evolution of variation in dentition across this species-rich assemblage of midwater fishes. Here we investigate the dentition on the oral jaws, including teeth located on the dentary, premaxilla, palatine, and mesopterygoid. Considerable variation in tooth morphology (e.g., cardiform, hooked, recurved, villiform) across the range of lanternfish lineages is identified, including the widespread evolution of heterodonty. The evolution of tooth variation is further investigated based on a phylogenetic hypothesis of lanternfish evolutionary relationships from nuclear and mitochondrial data.

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**0446 General Herpetology, Salon E, Thursday 7 July 2016**

Zachary Martin, Matthew Lattanzio

*Christopher Newport University, Newport News, Virginia, USA*

### Factors Affecting Morphological Variation in Common Garter Snakes (*Thamnophis sirtalis*) in the Southeastern US

Widespread taxa offer an ideal opportunity to study the factors contributing to morphological diversity among and within populations. Often, morphological variation is associated with either natural (i.e., differences in habitat use) or sexual (i.e., male-female differences) selection. The common garter snake (*Thamnophis sirtalis*) exhibits broad variation in morphology throughout its range. Although this species has been studied extensively in the central US and Canada, little is known regarding the extent and nature of its morphological diversity in the southeastern US. Here we evaluate patterns of morphological variation of *T. sirtalis* throughout Virginia in relation to their habitat use (based on collection locality) and sex. We measured the body size and head dimensions of 144 preserved snake specimens with known VA localities. We also

recorded their dorsal stripe width (in number of scales, measured at mid-body). We found that dorsal stripe width of *T. sirtalis* differed by habitat ($P < 0.05$), suggesting that environmental factors (e.g., habitat-specific predator milieu) may contribute to variation in this trait. In contrast, head dimensions varied by both habitat and sex (both $P < 0.05$), supporting an effect of those environmental factors on the extent of sexual dimorphism in this species. Currently, we are analyzing additional dorsal pattern data (i.e., lateral scale row count and checker patch size) for inclusion in this dataset. We will discuss our findings with reference to our planned geographic expansion throughout the southeastern US in order to provide a broader perspective on the nature and extent of *T. sirtalis'* morphological diversity.

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**0013 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Tamara Figueredo Martín[1], Yudisleyvis Ventura Díaz[1], Yandy Rodríguez Cueto[1], Dorka Cobián Rojas[2], Jorge Martínez Fernández[3], Sandra Chapman Stable[4], Jorge Tamayo Fonseca[5], Yoendry A. Paz Rodríguez[5], Alexis Medina Valmaseda[6], Roberto Fajardo Veloso[6], Yusniel Nuñez Acosta[7], Alexander Pupo Sánchez[7], Rachel Graham[8], Fabián Pina Amargós[1]

*[1]Centro de Investigaciones osterosde Ecosistemas C, Cayo Coco, Morón, Ciego de Ávila, Cuba, [2]Centro de Investigaciones y Servicios Ambientales, ECOVIDA, Pinar del Río, Cuba, [3]Centro de Investigaciones de Medio Ambiente Camagüey, Camagüey, Cuba, [4]CATEDES, Guantánamo, Guantánamo, Cuba, [5]BIOECO, Santiago de Cuba, Cuba, [6]Centro de Servicios Ambientales, Sancti Spíritus, Cuba, [7]Unidad de Medio Ambiente, Las Tunas, Cuba, [8]MarAlliance, San Pedro, Belize*

**Distribution of Smalltooth Sawfish (Latham, 1794) In Cuban Archipelago**

Smalltooth sawfish (*Pristis pectinata* Latham, 1794) is listed as Critically Endangered by the International Union for Conservation of Nature. During the last two decades, there have been few reports recorded for this species throughout its distributional range. A greater focus on the status of sawfish globally, including Cuba is yielding much needed information on the status of these species. The aim of this study was to use traditional ecological knowledge to assess whether sawfish are still extant in Cuban waters. To accomplish this objective structured interviews were applied. The sample was set as at least five interviews per fishing ports and diving centers throughout Cuba. Years of experience were the selection criterion for fishermen and dive masters interviewed. Cartographic schemes of each particular region were used as a support material, just to assist the localization of the sites. Using structured personal interviews conducted with fishery communities members (n=91) in nine of Cuba's 15 provinces, results suggest that 27 % of interviewees had either heard about sawfish or observed them firsthand. Sawfish have been fished (89 %) or observed (11 %) in 18 sites since the 1960s. At least 35 % of the reports occurred during the past decade, which suggests that sawfish persist in Cuba. The individuals that have fished or eat sawfish express that the meet is very tasty, also they normally keep the saw as a trophy.

**0878 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Christopher Martinez[1], John Denton[1], Jairo Arrojave[2], Melanie Stiassny[1]

*[1]American Museum of Natural History, New York, NY, USA, [2]Universidad Nacional Atonoma de Mexico, Ciudad de Mexico, DF, Mexico*

## Jaw Variation in the Trophically Diverse African Freshwater Family, Distichodontidae (Actinopterygii: Characiformes)

CANCELED

Distichodontid fishes are broadly distributed in freshwater systems of sub-Saharan Africa. Species employ a number of trophic strategies, ranging from detritivory, insectivory, piscivory, and even pterophagy. Superficially, the most prominent features of jaw variation in distichodontids occur among species with elongated versus truncated snouts. However, a number of less conspicuous, but nevertheless important, changes may be found in the underlying endoskeletal structure. Our primary goal for this research was to quantify morphological variation of distichodontid oral jaws and to assess patterns of shape variation in a comparative framework. We used soft tissue microCT scan data to reconstruct the cranial and jaw morphologies of distichodontids, using exemplar species to represent all but one of the 17 currently recognized genera (i.e., *Paraphago*). Prior to scanning, specimens were incubated in one percent phosphotungstic acid solution to aid in simultaneous visualization of soft muscle tissues and osteology. Three-dimensional geometric morphometrics were used to assess morphological variation of oral jaw skeletal components and associated muscle attachment sites. Morphological variation was characterized by multiple transformations of jaw structure that have undoubtedly influenced the functionality and overall kinesis of the distichodontid feeding system. Major sources of variation included the interdentary articulation (e.g., fusion versus digitation), mobility of the upper jaw, and dissociation of the dentary and anguloarticular. This work serves as the foundation for an ongoing study on the rates of trophic evolution in distichodontids, in which we aim to better understand the underlying mechanisms of jaw evolution in this group.

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**0905 AES Morphology & Reproduction, Balconies L & M, Friday 8 July 2016**

Christopher Martinez[1], F. James Rohlf[2], Michael Frisk[2]

*[1]American Museum of Natural History, New York, NY, USA, [2]Stony Brook University, Stony Brook, NY, USA*

## Have We Been Underrepresenting the Morphological and Ecological Diversity of Skates?

Skates (Batoidea: Rajoidei) are often characterized as a morphologically conserved clade. At some levels this is certainly true, but a strict adherence to this view may result in underrepresentation of morphological and associated ecological variation in skates. In order to assess the relative diversity of forms in rajoids, we used geometric

morphometrics to compare shape variation in an important feature of all batoids; their anteroposteriorly expanded pectoral fins. We found that while overall shape disparity (variance) was greater in stingrays (Batoidea: Myliobatoidei) than skates, the degree to which it was larger is slightly misleading due to a gap between strongly bimodal stingray morphotypes. The observed diversity of skate pectoral fins, as indicated by the relative location and distribution of shapes in batoid morphospace, points to marked variation in fin performance that also implies ecological variation of skates may be larger than it is sometimes credited for. Additionally, intraspecific variation within skates, in the form of sexually dimorphic pectoral fins, adds another dimension to shape diversity within this clade, which may also have ecological consequences of its own. Given these results, we advocate an updated and nuanced paradigm regarding the morphologically conserved skate clade that accommodates the level of body shape variation observed and the ecological implications thereof.

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## 0424 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016

Cindy Marin Martinez, Eric Hilton

*Virginia Institute of Marine Science, Gloucester Point, VA, USA*

### Larval Fish Assemblage Dynamics in the York River Estuary

The York River estuary, located in the southern portion of the Chesapeake Bay, provides habitat for the early life history stages of many estuarine, marine, and anadromous species. While in residence in the estuary larval fishes may experience high rates of mortality, which can influence variability in recruitment to adult populations. The VIMS Larval Fish Monitoring Program has been collecting larval fishes weekly during the night-time flood tide at a fixed station located on the York River at Gloucester Point, Virginia, since 2007. This nine-year time series allows us to investigate inter- and intra-annual patterns in the larval fish assemblage and examine how environmental conditions such as temperature and freshwater discharge affect the assemblage. As of May 2015, a total of 144,372 larvae have been collected, representing 41 taxa from 24 families. The assemblage is dominated by five taxa (*Anchoa* spp., *Gobiosoma bosc*, *Microgobius thalassinus*, *Micropogonias undulatus*, and *Anguilla rostrata*) that form 95% of the total larval fish catch. We evaluated the total mean larval fish density by year and season. Preliminary results show no annual variation in the mean density of larval fishes. The density of larval fishes is highest in the estuary between June and September; this pattern is driven primarily by the presence of resident taxa such as *Anchoa* spp. and *G. bosc*. Mean species diversity (Simpson's diversity index) indicates higher diversity from July through August. We present trends in the annual densities for five species: *Brevoortia tyrannus*, *Anchoa* sp., *Micropogonias undulatus*, *Leiostomus xanthurus*, and *Paralichthys dentatus*.

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**1057 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Ángel L. Martínez-González, Vivianis Gómez-Ospino, Glenys Tordecilla-Petro

*Fishery Biology Research Laboratory-FBRL, Department of Aquatic Sciences, University of Cordoba, Lorica, Cordoba, Colombia*

## Length-Weight Relationship of Chipe *Hoplosternum magdalenae* in the Cienaga Grande de Lorica, Colombia

The length-weight relationship of Chipe *Hoplosternum magdalenae* collected in the Cienaga Grande de Lorica, Colombia, between January and December 2005 were estimated. The length-weight relationship and condition factor were estimated with the equation $TW = a\ TL^b$ and $Cf = TW/TL^b$, respectively. The size ranged between 9.2 and 13.5 (11.1 ± 0.6) cm TL, the total weight between 16.0 and 44.0 (27.4 ± 4.3) g, and the mean length in the catch estimated was 11.2 cm TL. Length-weight relationship estimated was $WT = 0.103\ (\pm 0.17)\ LT^{2.32\ (\pm 0.17)}$, r =0.84, n =300, were the monthly growth coefficient ranged between 1.90 (March and April) and 2.88 (November), being negative allometric between February and July and isometric in the rest of study year, without statistically significant differences, while the condition factor ranged from 0.026 (November) and 0.283 (April), without statistically significant differences. The Chipe is a small fish with negative allometric growth, which has little correlation between the condition factor and the hydrological cycle of Cienaga Grande de Lorica.

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**0116 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Salon A-C, Friday 8 July 2016**

Audrey Matheny, Gary Thomas, Laura Kimmel, Allyson Fenwick, Paul Stone

*University of Central Oklahoma, Edmond, Oklahoma, USA*

## Hitchhikers Guide to Population Genetics: Mediterranean Geckos (*Hemidactylus turcicus*) at the University of Central Oklahoma

Exotic species are good models for understanding ecological and evolutionary processes because they adapt to new habitats over observable time periods. Mediterranean geckos engage in commensal relationships with humans and have been introduced throughout the world. Central Oklahoma is at the northern edge of the U.S. range and likely near the limit of the species' climate tolerance. During 1963-1965 and 1985-1997, geckos were repeatedly introduced to Howell Hall (35.654865 N, 97.472592 W) at the University of Central Oklahoma (UCO). Compared with the explosive spread of some exotics, geckos at UCO have dispersed slowly, colonizing 21 buildings in 19-53 years. This represents approximately half of the buildings on campus. We hypothesize a stepping stone model of dispersal among buildings consistent with demographic surveys conducted over the last decade. We predict that each building hosts a genetically isolated population and geckos exhibit genetic isolation with distance from the introduction site. We collected tissue samples from 10 individuals on each occupied building at UCO and genotyped 16 previously published microsatellites. Preliminary STRUCTURE and differentiation

analyses show two genetic clusters and support a stepping stone pattern of expansion. We are also analyzing RAD-Seq libraries for a subset of UCO samples. Future research will expand sampling to independent invasions in central Oklahoma and the original collection site in Texas.

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**0236 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Keiichi Matsuura

*National Museum of Nature and Science, Tsukuba, Ibaraki, Japan*

**Ichthyology Crossing the Pacific**

Today, ichthyologists use the internet, e-mail, and databases of fish collections. However, these tools did not exist when I started studying the systematics of fishes from the western edge of the Pacific in the early 1970s. To advance my knowledge of fishes, I determined it was important for me to join societies of ichthyologists in order to make acquaintances with senior ichthyologists who could share their knowledge and experiences as well as provide me access to their fish collections. As one of a number of ichthyological groups worldwide, the American Society of Ichthyologists and Herpetologists (ASIH) has always stood out as a landmark in the global ichthyological community. ASIH was helpful in providing me excellent examples of management and editorial policy when I was working with the Ichthyological Society of Japan as a member of the executive committee and editorial board. Facilitated by attendance at ASIH, Japanese ichthyologists have developed extensive partnership networks outside of Japan, which have led to many collaborations and successful symposia on the systematics of fishes being held in Tokyo in addition to Japan hosting the second and ninth Indo-Pacific Fish Conferences (2nd in Tokyo in 1985, 9th in Okinawa in 2013). I have no doubt that ASIH will continue developing as a scientific society and a leading force in ichthyology. My only suggestion is for ASIH to take an even greater step in widening networks of ichthyologists by uniting ichthyological societies throughout the world in the future.

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**0095 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016**

William Matthews, Edie Marsh-Matthews

*University of Oklahoma, Norman, OK, USA*

**Long-term studies in Piney and Brier Creeks, the Midwest, and stream sites in Oklahoma: Lessons learned over 40 years**

We review the history of, and "lessons learned" from, our studies of fish communities in Piney Creek, Arkansas, and Brier Creek, Oklahoma, spanning 40 years; surveys throughout the lower Midwest 17 years apart; and repeated samples at various sites in

Oklahoma and Arkansas. These long-term data on 30 streams, at intervals spanning years to decades, mostly developed serendipitously, based on work in graduate school (WJM), locations of employment and teaching, and personal life-decisions. Most surveys were either personally funded or supported by our institutions, and only a few have been based on extramural funding (like EPA support for our surveys in the 1990s). If you initiate long-term studies early in your career, pick a system where you enjoy working and are where you are willing return over years (even if it is at your own expense). Decide on things like: proximity to stream gages (ours were not) and weather monitoring sites (ours were, sort of); work on private versus public land; how to sample consistently, at a level you can sustain, and what field measurements, notes, and archival photographs can reliably be repeated over time with or without extramural funding. Be prepared to take advantage of opportunistic disturbances like floods or drought, or planned anthropogenic changes like urbanization. Finally, as both you and the study age, plan to bring in younger colleagues who can continue your/their work when you are no longer going to the field to keep valuable long-term data going to the benefit of your discipline.

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**0793 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon A-C, Friday 8 July 2016**

Jessica Maxfield, Kathleen Cole

*University of Hawaii at Manoa, Honolulu, HI, USA*

**Genetic and Morphological Changes in Serially Hermaphroditic Fishes Going from Ova to Sperm Production**

Hermaphroditism, the ability to change gamete type production at some point in adult life, is a wide spread strategy among teleost fishes and has arisen independently numerous times. The fish family Gobiidae, a group in which it has been hypothesized that hermaphroditism has evolved as many as five times, is the ideal system in which to explore both the evolution and development of sexual plasticity in fishes. This study examined shifts in sexual function from ova to sperm production in two marine gobies, *Eviota epiphanes* and *Lythrypnus dalli*, from both a morphological and a molecular perspective. This was accomplished by (i) using histological techniques to generate a morphological time series of fish gonads as they transitioned from ova to sperm production; and (ii) using whole transcriptome sequencing of brain and gonadal tissue over the same time series. The comparison of gene expression data with gonad morphology provides a means of directly assessing gene regulation of gonial cell proliferation and degeneration.



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**0672 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Gregory Mayer

*University of Wisconsin-Parkside, Kenosha, WI, USA*

**Variation and Distribution of an Endangered Species, *Anolis roosevelti***

*Anolis roosevelti* was described by Chapman Grant in 1931 on the basis of a single specimen from the island of Culebra. The following year he obtained an additional specimen from the same island, and the species has long been known from only these two specimens. However, in 1863, nearly 70 years earlier, Christian Reinhardt and Johannes Lütken, using the name *velifer* Cuvier, had provided an accurate description of *roosevelti* on the basis of specimens from Vieques, St. John, and Tortola. Inquiry into the fate of Reinhardt and Lütken's specimens led to the discovery of four specimens of *roosevelti*, three from Vieques and the fourth without data, from the collections in Copenhagen and Stockholm. On the basis of the now six known specimens, the species is redescribed and compared to the giant anole of Puerto Rico, *Anolis cuvieri* Merrem 1820 (= *velifer* Cuvier 1829). The species are amply distinct, *roosevelti* having a distinctly grooved snout, larger head scales, and reaching a larger size (162 mm SVL). The expansion of the known distribution of *roosevelti* shows that the eastern islands of the Puerto Rican Bank (the Passage and Virgin Islands) were widely inhabited by a distinct, geographic representative of the giant anoles.

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**0131 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Jillian McAllister

*University of Victoria, Victoria, British Columbia, Canada*

**Habitat Use of Columbia Spotted Frogs (*Rana luteiventris*) and Western Toads (Anaxyrus boreas) in the Drawdown Zone of a Hydroelectric Reservoir**

Understanding what habitat characteristics are selected by a species is critical for effective conservation and is especially important when human disturbance routinely alters habitat availability. Hydroelectric reservoir operations cause water fluctuations that inundate the drawdown zone and likely affect habitat use by species that inhabit the wetlands along this altered shoreline. I analyzed habitat selection by Columbia Spotted Frogs (*Rana luteiventris*) and Western Toads (*Anaxyrus boreas*) at ponds in the drawdown zone of the Kinbasket Reservoir in British Columbia, Canada. From May to August 2015 I conducted visual encounter surveys during which I collected species count data as well as habitat data. I measured vegetation height, percent cover, water pH, water temperature, water conductivity, and dissolved oxygen levels for ponds with and without *R. luteiventris* and *A. boreas*. I then used a generalized linear mixed-effects model (GLMM) to identify important habitat characteristics for these anuran

amphibians. Among taxa, habitat requirements may vary and these differences should be considered when planning for conservation.

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**1108 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: EVOLUTION, GENETICS, & SYSTEMATICS**

Lisa McBride, Sarah Corey-Rivas

*New Mexico Highlands University, Las Vegas, NM, USA*

**Metapopulation Structure of a Garter Snake Species Within the Mora River Watershed**

Much of New Mexico's riparian habitat is vulnerable to increasing drought and agricultural practices. These modifications to the riparian habitat provide a working model of larger scale changes occurring throughout the Southern Rocky Mountains. In this study, we use microsatellite markers to examine the population structures of a garter snake species to determine if particular land use is associated with patterns of gene flow in the Mora River watershed. Within two sampling seasons, 80 individuals were collected from five sites in riparian habitat within the Mora River Watershed (Mora County, New Mexico). Microsatellite genotypes were scored and analyzed using GENEPOP (v. 4.2), Arlequin (v. 3), and STRUCTURE (v. 2.3.4) to determine population structure, allelic diversity, and gene flow among the five locations. *Thamnophis* population patterns will help to identify corridors important for many riparian species and pinpoint critical sites needed for restoration. The results from this investigation will aid in identifying habitat connectivity, thus improving the future outlook for this species of garter snake and potentially, other members of riparian ecosystems in this area of the Southern Rockies.

CANCELED

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**0312 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Sarah McBride, Ray Willis

*Midwestern State University, Wichita Falls, TX, USA*

**The Molecular Determination of Valid Subspecies of Canyon Lizards (*Sceloporus merriami merriami*, *Sceloporus merriami annulatus*, and *Sceloporus merriami longipunctatus*) in the Chihuahuan Desert of West Texas**

The canyon lizard, *Sceloporus merriami*, inhabits the southwest region of Texas in the Chihuahuan desert. Three subspecies of this lizard (the Big Bend canyon lizard, *Sceloporus merriami annulatus,* the Presidio canyon lizard, *Sceloporus merriami longipunctatus* and Miriam's canyon lizard, *Sceloporus merriami merriami)* are shown to converge geographically at the Dalquest Desert Research Site. Historically it has been

shown that identification of these subspecies may be made by morphological characteristics alone, but very little phylogenetic research has been published that indicates if the three determined subspecies are valid. In this study, lizards from all three subspecies were captured to examine the phylogeny between them. From April to October of 2015, *Sceloporus merriami* were captured from rock facings within the canyon systems of the Trans Pecos area. Tissue samples were taken from each specimen and DNA was analyzed using maximum parsimony, maximum-likelihood and Bayesian methods. Preliminary results of examined sequences show little variation between subspecies. These data may indicate a possible intergradation zone between the Big Bend canyon lizard and the Presidio canyon lizard. It may also indicate that the differences between the three subspecies can be explained as natural variation within one species rather than attributed to their being classified as separate subspecies.

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**0348 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Brittany McCall, Brook Fluker

*Arkansas State University, Jonesboro, AR, USA*

**Spatiotemporal Population Dynamics of the Caddo Madtom (*Noturus taylori*)**

The Caddo Madtom (*Noturus taylori*), an endemic to the Ouachita Mountain Ecoregion, is one of Arkansas' Species of Greatest Conservation Need and has recently been petitioned for federal listing under the Endangered Species Act. The restricted distribution of *N. taylori* in the upper reaches of the Caddo and Ouachita rivers, limited suitable habitat, and a knowledge gap in life-history characteristics necessitates further research to determine the current status and long-term population dynamics of the species. A previous study using allozymes revealed that *N. taylori* exhibited small effective population sizes and provided evidence for historical between-drainage differentiation, in addition to more recent reservoir-induced within-drainage differentiation. Here, we use microsatellite DNA loci and mitochondrial (mt) cytochrome b DNA sequence data, in conjunction with intensive sampling of *N. taylori*, to test multiple hypotheses involving patterns of within and among drainage connectivity and spatiotemporal population dynamics. In addition, seasonal surveys (e.g. fall, winter, spring, and summer) of historical localities will be used to determine the current status of *N. taylori*. Preliminary results from winter 2016 surveys revealed low relative abundance for *N. taylori* (0.12 individuals per seine effort), with detection at approximately 50% of historical sites sampled. Microsatellite and mtDNA analyses will be used to further evaluate population connectivity and changes in effective population size through time, in addition to providing measures of genetic variation that will help to prioritize conservation needs for this rare species.

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**0693 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Louise McCallie

*Middle Tennessee State University, Murfreesboro, TN, USA*

**Herpetofauna Distribution in an Area of High Foot Traffic**

How do mountain biking trails and foot traffic affect the distribution of herpetofauna on protected land? A preliminary herpetological survey was performed of Jacobsburg State Park: a 1,168-acre property located in Wind Gap, Pennsylvania. In recent years, nineteen miles of trails for mountain biking and horseback riding have been added to the park, and the nearby township of Bushkill has continued to increase in size. The focus of this project was an area called Henry's Woods that includes an old-growth hemlock forest and easy access to Bushkill Creek. In the fall of 2014 through the spring of 2015, reptiles and amphibians were located in the park, and their GPS coordinates were recorded. The goal of this project was to visualize species distributions around an area of the park with high foot traffic and see if historically-located species were still present. It was found that despite the large number of daily visitors, several species of herpetofauna (including *Eurycea bislineata, Plethodon cinereus, Thamnophis sirtalis sirtalis,* and *Lithobates clamitans melanota*) were present and commonly found.

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**1036 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon A-C, Friday 8 July 2016**

Evan McCartney-Melstad[1], Jannet Vu[1], H. Bradley Shaffer[1]

*[1]UCLA, Los Angeles, CA, USA, [2]La Kretz Center for California Conservation Science, Los Angeles, CA, USA*

**Exon Capture Reveals Insights into the Conservation Status and Genome Organization of the Endangered California Tiger Salamander**

Hybridization of introduced species with threatened endemics represents a major conservation challenge. In California, the introduced barred tiger salamander (*Ambystoma tigrinum mavortium*) has been hybridizing with the native California tiger salamander for approximately 60 years, and management strategies for this species around the state hinge largely on the degree of admixture present in populations. Earlier work has uncovered drastically different patterns of spatial spread of alleles from different genes out from the introduction area, which indicates that a genomic-scale study is needed to understand the full extent and tempo of hybridization. We present exon capture results from over 1,000 salamanders for over distinct 5,000 genes, as well as a linkage map of these genes built from an F2 mapping family. Using these tools, we demonstrate how the wave of invasive alleles has spread since our tissue sampling began 30 years ago, and discuss the real-time conservation implications suggested by these data.

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**1093 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Eric McCluskey, Thomas Hetherington

*Ohio State University, Columbus, Ohio, USA*

### Species distribution modeling in Michigan for the Eastern Massasauga Rattlesnake

Species distribution models (SDM) have shown great promise for identifying suitable habitat to aid in conservation efforts for threatened and endangered species. However, determining the appropriate spatial extent for targeted conservation models can be difficult when trying to balance the needs to make a model representative of the range of habitats a species may be found in but not be too generalized so that it is has difficulty identifying suitable habitat in specific regions. We demonstrate how optimal SDMs for a threatened snake species, Eastern Massasauga (*Sistrurus catenatus*), vary within a single state. Massasauga live throughout Michigan but their distribution is concentrated in northern and southern parts of the state. As a candidate for federal listing, it is critically important to have information on the amount and distribution of suitable Massasauga habitat that remains. We found that a state-wide Massasauga SDM was not effective for mapping habitats in either northern or southern Michigan as the habitats utilized by the snakes were too disparate. Commonalities of Massasauga habitat in Michigan include poorly drained soils and an open canopy but these attributes are associated with coniferous swamps in northern Michigan and fens and wet prairie in southern Michigan. The most effective conservation oriented SDMs targeted northern and southern Michigan separately.

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**0684 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

Charlene McCord, Mark Westneat

*University of Chicago, Chicago, IL, USA*

### Functional Morphology of the Unique Triggerfish Jaw Apparatus (Teleostei: Balistidae)

The study of unusual vertebrate lineages is a valuable approach to furthering knowledge of functional morphology and exploring the boundaries of biomechanical and anatomical evolution. The peculiar trophic anatomy of the marine fish family Balistidae (triggerfishes) differs considerably from that of other coral reef-associated fishes and provides an excellent opportunity to investigate the structure and function of complex biomechanical systems. By combining techniques from comparative anatomy, geometric morphometrics, feeding kinematics, and computational biomechanics, we explored the functional morphology of the unique triggerfish jaw apparatus in detail. We identified three unique morphological features that directly affect enhanced bite performance and increased prey capture versatility in the balistid feeding system: 1) a novel sliding biomechanical jaw linkage; 2) mirrored anatomy and synchronous

rotational movement of the upper and lower jaws; and 3) extensively subdivided adductor mandibulae muscles. Considered together, these features may provide a way of coping at a systems level with the fundamental force versus velocity trade-off. Additionally, we analyzed our findings within a phylogenetic context and found several instances of significant morphological and functional convergence during the evolution of the triggerfish jaw system. This work was supported by NSF IGERT grant DGE-0903637, a 2011 NSF EAPSI grant to C. McCord, and NSF grant DEB 1112763 to M. Westneat.

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**0731 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Ciera McCoy, Craig Lind, Terence Farrell

*Stetson University, Deland, FL, USA*

## Seasonal Variation in Immune Function, Energetic Status, and Infection with Snake Fungal Disease in Free-Ranging Pigmy Rattlesnakes (*Sistrurus miliarius*) in Central Florida

The documentation of snake fungal disease (SFD), *Ophidiomyces ophiodiicola,* has increased sharply over the last decade. Researchers are unsure as to whether the spread and negative impacts of SFD are caused by the pathogen invading new populations, or if snakes have become more susceptible as the result of weakened immune responses. Pigmy rattlesnake (*Sistrurus miliarius*) populations in Central Florida have exhibited fungal infections for over two decades; however, local population sizes have remained relatively stable. Vulnerability to infection may vary seasonally as a result of thermal conditions and energetic tradeoffs. To determine if season, sex, and energetic status influence an individual's susceptibility to infection, we examined fungal infection severity, body condition, and serum complement activity (plasma bactericidal ability) in free-ranging pigmy rattlesnakes over the course of one year. Infection severity and bactericidal ability varied seasonally; however, pigmy rattlesnakes suffering from active SFD infections did not show deficits in innate immune function. Infected snakes were in significantly lower body condition when compared to the general population. Males sampled in the winter exhibited the lowest bactericidal ability compared to other groups. Females did not exhibit seasonal variation in plasma bactericidal ability. The relationship between seasonal variation in immune function and seasonal variation in infection was as expected in males but not females. Our results highlight the need for further research examining the extrinsic and intrinsic factors that explain individual variation in vulnerability to SFD.

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**0813 SSAR SEIBERT AWARD ECOLOGY, Galerie 3, Thursday 7 July 2016**

Samuel McCoy[1], Joseph Pechmann[1], Gabrielle Graeter[2]

*[1]Western Carolina University, Cullowhee, NC, USA, [2]North Carolina Wildlife Resources Commission, Asheville, NC, USA*

## Movements and Habitat Use of Bog Turtles in Atypical Wetland Habitat

The bog turtle (*Glyptemys muhlenbergii*) is one of the most endangered turtle species in North America. In the southern part of its range, its habitat is usually open-canopy bogs dominated by emergent vegetation, and the majority of populations are known from current or historic pastures. I studied the movements and habitat use of bog turtles in atypical wetland habitat in western North Carolina. Unlike most southeastern bog turtle wetlands, this bog has little recent human disturbance, is maintained by beavers, and 45% of the habitat is shrub/scrub. I captured six adults (2 male, 4 female) with traps in May 2015, and tracked them using radio telemetry until November 2015. Mean distances between consecutive turtle locations were 17.0 m (male) and 30.6 m (female), and mean home ranges were 0.4458 ha (male) and0.6064 ha (female). Turtle locations had deeper mud and water than random locations. Turtles preferred shrub/scrub habitat over other vegetation types, and standing water and especially beaver channels over dry areas. Females had greater movements and home ranges than males, likely due to migrations to nesting habitats. Gravid females nested in emergent vegetation, although shrub/scrub habitat was preferred overall. This use of shrub/scrub habitat is unique because bog turtles use predominantly emergent vegetation elsewhere in the south. However, in the northern part of its range wetlands adjacent to red maple swamps do contain some shrubs and trees. Thus, while emergent habitat is required for nesting, bog turtles may utilize a greater variety of non-nesting habitats than typically assumed.

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**0450 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Hannah McCurdy-Adams[1], Jeff Hathaway[2], Jacqueline Litzgus[1]

*[1]Laurentian University, Sudbury, Ontario, Canada, [2]Scales Nature Park, Orillia, Ontario, Canada*

## Freshwater Turtle Nest Predation Patterns in Relation to Anthropogenic Density

Abundances of animals that predate turtle eggs are higher where anthropogenic sources of food and decreases in populations of top predators allow middle-sized mesopredators to flourish. Many studies have found that the highest predation risk to turtle nests is within the first week after the eggs are laid, but other studies have found that depredation of turtle nests occurs throughout the incubation period. We monitored 3 roads in Ontario that connect high road and building density areas (Anthropogenic Density Area, ADA) to low ADA, for 3 species of nesting turtles in June, and determined the rate and pattern of nest depredation throughout incubation. We calculated the

percentage of predator interactions with nests that occurred weekly (PRED) and compared it among turtle species and to an expected PRED based on published studies. The 3 species of turtles had similar patterns of PRED that were all significantly different than the expected distribution of PRED. We will calculate relative nest predator abundance indices from trail camera photos to determine if nest predators are more abundant in higher ADA. We will compare PRED between relative abundances or nest predators and ADAs along each road transect. We will also compare the nest survival times, using a non-parametric product-limit survival analysis, among turtle species and ADAs along each road transect. Our findings will help form a consensus for nest caging protocols that will be most beneficial to turtle egg survival.

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## 0448 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, SALON A-C, Thursday 7 July 2016

Hannah McCurdy-Adams[1], Gabriela Mastromonaco[2], Jeff Hathaway[3], Jacqueline Litzgus[1]

*[1]Laurentian University, Sudbury, Ontario, Canada, [2]Toronto Zoo, Toronto, Ontario, Canada, [3]Scales Nature Park, Orillia, Ontario, Canada*

### Do Anthropogenic Factors or Sex Have a Greater Effect on Chronic Stress in Freshwater Turtles?

Wildlife near human altered landscapes can experience stress, but animals can adapt to chronic high stress situations such that their stress hormone levels readjust to new baselines. Chronically high stress hormone levels have been associated with decreased fitness in some reptile and amphibian species, but very little research has been completed on stress hormone levels in turtles, a taxon of particular conservation concern. We examined chronic stress hormone levels in Painted Turtles (*Chrysemys picta marginata*), Snapping Turtles (*Chelydra serpentina*), and Blanding's Turtles (E*mydoidea blandingii*) in areas with varying densities of anthropogenic structures. Extracts from turtle claws were analyzed for corticosterone (CORT) concentrations using enzyme immunoassays. Snapping Turtles were more likely to have above baseline CORT than Painted or Blanding's Turtles; however, for turtles that had above-baseline CORT, male Painted and Blanding's Turtles had relatively high CORT levels. Surprisingly, anthropogenic density did not seem to affect CORT levels, although variation in the date turtles were captured and the date enzyme immunoassays were run complicated our interpretations. CORT is not solely a byproduct of stress and more research needs to be done to understand the complex relationships between animals, anthropogenic influences, and stress. Globally, turtles are among the most at risk species and understanding turtle stress physiology can help inform mitigation strategies to improve their fitness.

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**0853 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, SALON A-C, Thursday 7 July 2016**

Caitlin McGarigal, Chris Lowe

*California State University Long Beach, Long Beach, CA, USA*

### Physiological Effects of Angling and Handling Stresses on Kelp Bass, *Paralabrax clathratus*, in Southern California

A common regulatory strategy in the management of gamefish species, including kelp bass (*Paralabrax clathratus*), is catch and release, yet the effects of capture-related stress on fish physiology and behavior are species-specific and remain largely unknown. Quantifying the physiological and behavioral impacts of catch and release will aid in managing the economically and ecologically valuable kelp bass fishery in southern California. Stress hormones and metabolic biomarker levels were quantified in blood samples collected from kelp bass caught on hook and line in the Catalina Island Marine Life Reserve. Baseline biomarker levels were established using blood samples collected in <3 min from time individuals were hooked. To experimentally determine the effects of angling and holding stress on biomarker elevation angled fish were held in coolers for either 10, 15, or 20 min before blood sampling. Glucose and lactate levels were significantly higher in experimental samples than baseline samples and increased significantly with holding duration, which reflects the time it takes for circulating cortisol to influence glucose levels and for lactate buildup in muscle to reach the blood. Recaptured fish were rapidly sampled to assess recovery after varying days at liberty (1-34 d) and in <24 hrs post-release both biomarker levels had returned to baseline. Neither biomarker correlated strongly with angling or handling times, which may be due to lack of sufficient fight duration (22 ± 0.0001 s) and air exposure (50 ± 0.0005 s). Cortisol analysis is ongoing and behavioral responses will be evaluated summer 2016.

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**0429 Fish Ecology II, Salon A-C, Saturday 9 July 2016**

Patrick McGrath, Brian Watkins, Ashleigh Magee, Eric Hilton

*Virginia Institute Of Marine Science, Gloucester Point, VA, USA*

### Age and Growth of Alewife (*Alosa pseudoharengus*) and Blueback Herring (*Alosa aestivalis*) from Virginia

Alewife (*Alosa pseudoharengus*) and Blueback Herring (*Alosa aestivalis*), collectively known as river herring, were once the most valuable food fishes in Virginia. These species experienced decline in their value to the fisheries resources of Virginia, and as early as the 1970s a significant decline in the stocks of these fishes was noted. This range-wide decline of stocks culminated in the Atlantic States Marine Fisheries Commission requiring moratoria on fisheries unless stocks within a jurisdiction were shown to be sustainable. Due in part to lack of available data to address the question of sustainability of river herring stocks in Virginia, a moratorium went into effect in 2012. To address these data deficiencies in population trends and abundance, the Virginia Institute of

Marine Science began monitoring the spawning stock biomass and juvenile abundance for both Alewife and Blueback Herring in 2014. In conjunction with this monitoring program, baseline biological data on river herring in Virginia are collected, including size structure, age composition, sex ratio, spawning history, and reproductive status for the stock in the Chickahominy River. This presentation will report on length and age data collected from both the spawning stock and juvenile river herring surveys to construct a variety of growth models. Akaike Information Criterion was used to select the best fit model and log likelihood was used to test for differences in growth model parameters between the sexes. Finally, the selected models were used to analyze current population demographics.

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**0497 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Erin McGrew[1], Carole Baldwin[2], Kevin W. Conway[1]

*[1]Texas A&M University, College Station, TX, USA, [2]National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA*

**Taxonomic Revision of the western Atlantic Skilletfish *Gobiesox strumosus***

The Skilletfish (*Gobiesox strumosus* Cope, 1870) is a small clingfish (Gobiesocidae) that inhabits intertidal zones throughout the western Atlantic from the U.S. to Belize. The Skilletfish is the only species of clingfish known to occur along the Atlantic coast of the U.S., including the Gulf of Mexico. Recent genetic data (COI) suggests that the Skilletfish comprises two distinct genetic lineages, including an Atlantic coast lineage (Atlantic coast from Virginia to Florida; encompassing the type locality) and a Gulf of Mexico lineage (northern coast of Gulf of Mexico, from Texas to Florida). Using a combination of genetics and morphological characters, we plan to investigate: (1) which of the available names from the synonymy of *G. strumosus* should be applied to the Gulf of Mexico lineage; (2) the geographic range of each species; and (3) which morphological characters are beneficial for distinguishing between the species of *Gobiesox* inhabiting the Atlantic coast of the U.S.

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**0130 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Jonathan McKenzie[1], Hannah Medd[0]

*[1]Florida SouthWestern State College, Ft. Myers, FL, USA, [2]American Shark Conservancy, Delray Beach, FL, USA*

**Preliminary Investigation on the Structure and Dynamics of Near-Shore Coastal Shark Assemblages off Southeast Florida**

The Florida marine ecoregion satisfies provisions as Essential Fish Habitat for sharks with many species utilizing the nearby, productive pelagic waters, tropical coral reefs, and estuaries during different stages of their life history. However, biologically

vulnerable shark species in Florida are subjected to fishing mortality through directed efforts and as bycatch by both commercial and recreational fishers. Using baited and un-baited video/photographic surveys we aim to provide spatial and temporal patterns of shark assemblages and identify possible environmental linkages. This project will use non-invasive techniques to collect data instead of using fishery-dependent or -independent catch records to provide useful data for the management and conservation of regional shark species. Diver Operated Video Systems and Baited Remote Underwater Video Systems are cost-effective, non-destructive methodologies that have been used to describe shark assemblages and can contribute to community education and awareness programs. This is the first attempt to survey shark assemblages using underwater video/photography survey techniques in multi-use areas along southeast Florida.

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**0945 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Ryan McKenzie

*Florida State University, Tallahasse, FL, USA*

**Sex and Size-specific Social Dominance and Exploitation of the Gulf Black Sea Bass**

Our knowledge of the reproductive behavioral ecology of many economically important marine fish species in Florida is remarkably poor. This limits our ability to understand their susceptibility to exploitation and design effective management policies. My current study explores the relationship between individual reproductive behavioral trends and the susceptibility of Gulf Black Sea Bass (*Centropristis striata melana*) to exploitation. The main objectives are to correlate the effects of sex and relative body size on the social dominance, catchability and susceptibility of individuals during their spawning season. A combination of captive behavioral trials and fishing surveys are used to address these objectives, and I report on the findings of my first field season.

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**0539 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Caleb McMahan[1], Luke Ginger[2], Marcy Cage[3], Prosanta Chakrabarty[3], Mark Johnston[1], Wilfredo Matamoros[4]

*[1]The Field Museum of Natural History, Chicago, IL, USA, [2]Field Environmental Instruments, Los Angeles, CA, USA, [3]LSU Museum of Natural Science, Baton Rouge, LA, USA, [4]Universidad de Ciencias y Artes de Chiapas, Chiapas, Mexico*

## Pleistocene to Holocene Expansion of the Black-belt cichlid in Central America, *Vieja maculicauda* (Teleostei: Cichlidae)

The distributions of many Northern Hemisphere organisms have been influenced by fluctuations in sea level and climatic conditions during Pleistocene glacial periods. Many studies illustrate a biogeographic history of expansion-contraction for organisms, associated with contraction during the cooler, drier Last Glacial Maximum and subsequent expansion during the warmer, moister Holocene. In contrast, the absence of glaciers and lower sea level in the tropics likely created available habitat for expansion of some taxa, particularly freshwater species. The Black-belt cichlid, *Vieja maculicauda*, is widely distributed across lowland reaches of rivers in the Atlantic slope of Central America from Belize to Panama. This study utilizes ecological niche modeling methodologies, associated with contemporary and paleoclimates, to make inferences regarding biogeographic history of this species and test the hypothesis of a northern to southern expansion of this species. Present-day niche models are congruent with the observed distribution of the species in Central America. Results show a lack of suitable habitat in northern Middle America during the Last Interglacial, with greatest range expansion during the Last Glacial Maximum and mid-Holocene. As temperatures and sea levels continue to rise in the future, expansion or contraction in the distribution of this species seems probable.

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**1025 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Sean McNearney, Travis West, Jennifer Seeley

*Metropolitan State University of Denver, Denver, Colorado, USA*

## Garter Snake (*Thamnophis* spp.) Habitat Partitioning

Habitat partitioning is the divergence of the habitat by competing species that use resources similarly, which assists in the two species coexistence. This research focuses on habitat partitioning within sympatric populations of the western terrestrial garter snake (*Thamnophis elegans*) and the plains garter snake (*Thamnophis radix*) in riparian habitats along the Colorado Front Range. We hypothesize that within sympatric populations *T. elegans* will be found closer to permanent water sources than *T. radix*. Along with abiotic measurements of the environment and biotic measurements of each captured snake, GPS coordinates were taken and entered into GIS to obtain distance to water. Preliminary data suggests *T. elegans* is found closer to water than T. radix; thus, habitat partitioning appears to be occurring among these sympatric populations.

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**0758 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, SALON A-C, Thursday 7 July 2016**

Michaleia Mead, Christopher Howey, Tracy Langkilde

*Penn State University, University Park, PA, USA*

### Impacts of pH and UV-B on stress and developmental rates of wood frog tadpoles: implications with regard to prescribed fire

Prescribed fire is a forest management tool used to mimic natural disturbances and alter forest landscapes, but may affect pH and UV-B levels within vernal pools. Both UV-B exposure and low pH can have behavioral effects and delay amphibian larval growth and development. The objective of this study was to determine how variations in pH and UV-B exposure interact to affect fitness relevant traits in a vernal pool amphibian in a controlled laboratory setting. Wood frog tadpoles were exposed to 3 pH (4.5, 5.5, and 6.5) and 3 UV-B (1, 3, and 5 hrs) treatments, using a fully-factorial design. We will discuss effects of these treatments on development rates, changes in body condition, survival, and corticosterone levels (proxy for stress). Our results suggest that prescribed fire may influence tadpole developmental rates and stress levels via effects on canopy cover (and thus UV-B exposure) and water pH of vernal pools. Future forest management practices may need to consider timing of burns in vernal pool habitat.

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**0678 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Mark Meekan[1], Lauren Fear[2], Andy Radford[2], Steve Simpson[3]

*[1]Australian Institute of Marine Science, WA, Australia, [2]School of Biological Sciences, University of Bristol, Bristol, UK, [3]Biosciences, College of Life & Environmental Sciences, University of Exeter, Exeter, UK*

### A Model Predator: The Influence of Predation Threat on the Behaviour, Abundance and Diversity of Coral Reef Fishes

Predators influence prey both directly, through consumption and indirectly, via effects on their behaviour. Behavioural impacts (termed "risk effects") on prey are sometimes subtle and difficult to measure, particularly in coral reef ecosystems, where attempts at predation by large meso- and apex predators such as sharks are rarely witnessed. Here, we used an experimental approach to explore the effects of the presence of sharks and large meso-predators on reef fishes. We examined the behaviour, size, identity, abundance and diversity of fishes visiting baited video camera systems (BRUVS) in the presence of life-size models of reef sharks (1.3 m Total Length, TL), large coral trout (1 m TL) small coral trout (0.4 m TL) and a plastic pipe control. We found evidence for risk effects in coral reef fishes whereby the presence of the model shark and large trout was correlated with lower mean and maximum numbers of smaller, meso-predatory species visiting the bait bag. The presence of these models was also correlated with a lower

species diversity of fish visiting the bait. Fish spent significantly greater periods of time around the bait (in the field of vision of the camera) in the presence of the small trout than when there was either a large trout or a shark model. Our approach shows how models can be used to manipulate and reveal risk effects of large predators in complex reef environments and demonstrates clear impacts of predation risk on coral reef fish communities.

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**1095 General Ichthyology II, Balconies J & K, Sunday 10 July 2016**

Veronica Mendoza, Héctor Espinosa

*Instituto de Biologia, UNAM, Ciudad de México, Mexico*

## Morphological Variation of Three Species of *Cynoscion* (Sciaenidae) in the Eastern Pacific

Species of the genus *Cynoscion* are commonly known as corvinas, croakers or weakfish, these fish species inhabit sandy bottoms of coastal waters and are economically important for fishery as well as for sport fishing. According to CONAPESCA, only in 2014, more than 13615 tons fresh weight of species of this genus were caught. *Cynoscion* is comprised of 24 recognized species, 13 of them are distributed in Mexico; however, the taxonomy of the group has historically been complicated and to date there is still no consensus on the number of valid species distributed in Mexico. This study aims to analyze the morphological variation between three species of croakers (*C. parvipinnis*, *C. reticulatus and C. xanthulus*) ranging from Southern California to Southern Colombia in order to test whether there are morphological differences between organisms of the sampled populations or not. Analysis of traditional taxonomy and geometric morphometrics were performed considering 21 morphometric characters for individuals belonging to 5 locations: 1) San Diego, California, 2) Baja California Sur, 3) Sonora, 4) Central Mexico and 5) Central America. The geometric characterization of the body shape indicates that there is morphological differentation between the populations studied, for *C. parvipinnis* the first principal component reports 53% of the variability, for *C. reticulatus* 52% and 35% for *C. xanthulus*.

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**0010 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Mark Merchant[1], Jenn Brueggen[4], Shawn Heflick[2], Curt Harbsmeier[4], Colette Adams[3], Amber Hale[1]

*[1]McNeese State University, Lake Charles, Louisiana, USA, [2]Crocodile Manor, Palm Bay, Florida, USA, [3]Gladys Porter Zoo, Brownsville, Texas, USA, [4]Independent, USA*

**Crocodilian Adaptation to Environment: A Croc of a Different Color**

The ability to change skin tone or color is a common trait among diverse taxa within the animal kingdom. Recent results in our laboratory have revealed that some crocodilian species exhibit color change in response to environment. Placement of crocodiles in white plastic tanks resulted in lighter skin tones, followed by darkening when placed in black chambers. These changes were visible to the naked eye within 10-15 minutes, and maximum change occurred at 90-120 minutes. Coverage of the eyes with tape resulted in darkening of the skin, which demonstrated that light stimulation via the eyes was involved in the color change response. Serum levels of alpha-melanocyte stimulating hormone in animals housed in white tanks were much higher than in the same animals when kept in black tanks, indicating a possible role for this peptide hormone in regulating skin color. Experimentation with a broad spectrum of crocodilian species revealed that members of the Family Croocodilidae exhibited far greater capacity to alter skin color than members of the Family Alligatoridae.

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**0859 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: EVOLUTION, GENETICS, & SYSTEMATICS**

Kathryn Mercier, Christopher Parkinson

*University of Central Florida, Orlando, Florida, USA*

**Unearthing the evolutionary history of Mole Skinks**

Mole skinks, *Plestiodon egregius*, are semi-fossorial lizards endemic to the North American coastal plain. They inhabit dry sandy substrates, including scrub, coastal berm, and coastal hammock in Florida, southern Alabama, and southern Georgia. Five subspecies of *P. egregius* were described in 1965 based on morphological characters such as tail coloration, scale counts and width of dorsal stripes. However, subsequent molecular phylogenies using cyt-b suggests these subspecies may not represent evolutionarily distinct lineages. Our aim was to investigate the evolutionary history of *P. egregius* with special emphasis on evaluating the validity of established subspecies. We obtained tissues from 133 *P. egregius* across their range. We sequenced two mitochondrial genes, ND4 and cyt-b, and one nuclear gene in all samples, then inferred a phylogeny using BEAST. This tree will be presented and discussed. The bluetail mole skink, *P. e. lividus*, is listed as federally threatened and there is a proposal to list both the Florida Keys mole skink (*P. e. egregius*) and Cedar Key mole skink (*P. e. insularis*). Thus,

our findings have taxonomic and management implications for this species. Future efforts will aim to expand sample collection, incorporate scale count data into phylogenetic analyses, and utilize double digest RADSeq to generate single nucleotide polymorphisms for increased resolution.

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**0014 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Daniel Mesquita[1], Gabriel Costa[2], Guarino Colli[3], Taís Costa[1], Donald Shepard[4], Laurie Vitt[5], Eric Pianka[6]

*[1]Universidade Federal da Paraíba, João Pessoa, PB, Brazil, [2]Universidade Federal do Rio Grande do Norte, Natal, RN, Brazil, [3]Universidade de Brasília, Brasília, DF, Brazil, [4]University of Louisiana at Monroe, Monroe, LA, USA, [5]University of Oklahoma, Norman, OK, USA, [6]University of Texas at Austin, Austin, TX, USA*

**Life history patterns of lizards of the world**

Identification of mechanisms that promote variation in life history traits is critical to understand the evolution of divergent reproductive strategies. Here we compiled a large life-history dataset (674 lizard populations, representing 297 species from 263 sites globally) to test a number of hypotheses regarding the evolution of life history traits in lizards. We found significant phylogenetic signal in most life history traits, although phylogenetic signal was not particularly high. Climatic variables influenced the evolution of many traits, with clutch frequency being positively related to precipitation and clutches of tropical lizards being smaller than those of temperate species. This result supports the hypothesis that in tropical and less seasonal climates, many lizards tend to reproduce repeatedly through the season producing smaller clutches during each reproductive episode. Our analysis also supported the hypothesis that viviparity has evolved in lizards as a response to cooler climates. Finally, we also found that variation in trait values explained by clade membership is unevenly distributed among lizard clades with basal clades and a few younger clades showing most variation. Our global analyses are largely consistent with life history theory and previous results based on smaller and scattered datasets, suggesting that these patterns are remarkably consistent across geographic and taxonomic scales.

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**0989 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Adriana Messyasz[1], Kirsten Monsen-Collar[1], MacKenzie Hall[2], Lisa Hazard[1]

*[1]Montclair State University, Montclair, NJ, USA, [2]NJ Division of Fish and Wildlife, Trenton, NJ, USA*

**Environmental correlates of *Ranavirus* disease distribution in New Jersey**

Amphibian pathogens are contributing to the global decline and extinction of many species, and are thus a significant potential threat. Variation in environmental conditions

may influence either pathogen presence or susceptibility of amphibians to pathogen infection. Very little is known about how environmental factors may influence *Ranavirus* (Iridoviridae), a virus affecting aquatic ectothermic vertebrates. It is hypothesized that water quality, landscape characteristics, habitat characteristics, and the community of amphibian species present can potentially affect either presence of the disease or amphibian susceptibility to disease. Sites in New Jersey studied in 2013 and 2014 (Smith et al. unpub.) and known to be either positive or negative for *Ranavirus* were used to evaluate the effects of biotic and abiotic factors that we hypothesized might influence *Ranavirus* distribution. We measured water quality, landscape and pool characteristics, extent and type of human activity, and amphibian species present. We also tested for presence of *Ranavirus* and documented two apparent outbreaks of disease in wood frogs in 2015. Disease presence/absence and prevalence were not consistent within sites from year to year, making correlations with static environmental factors difficult to ascertain. If environmental predictors of *Ranavirus* infection can be determined, it may be possible to predict habitats more likely to be susceptible to *Ranavirus* outbreaks and potentially prioritize management activities to reduce the impact of *Ranavirus*. Research supported by the MSU CSAM Science Honors Innovation Program, MSU PSE&G Institute for Sustainability Studies, and NJ DEP Conserve Wildlife Matching Fund.

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**0164 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Salon A-C, Friday 8 July 2016**

Margarita Metallinou[1], Jeffrey Weinell[1], Benjamin Karin[1], Werner Conradie[2], Philipp Wagner[3], Andreas Schmitz[4], Todd Jackman[1], Aaron Bauer[1]

*[1]Villanova University, Villanova, PA, USA, [2]Port Elizabeth Museum (Bayworld), Port Elizabeth, South Africa, [3]Zoologische Staatssammlung Mu□nchen, Munich, Germany, [4]Natural History Museum of Geneva, Geneva, Switzerland*

## A single origin of extreme matrotrophy in African skinks

Most mammals and ~20 % of squamates (lizards and snakes) are viviparous, whereas all crocodilians, birds, and turtles are oviparous. Viviparity evolved > 100 times in squamates, including multiple times in Mabuyinae (Reptilia: Scincidae), making this group ideal for studying the evolution of nutritional patterns associated with viviparity. Previous studies suggest that extreme matrotrophy, the support of virtually all of embryonic development by maternal nutrients, evolved as many as three times in reptiles: in ancestral Neotropical Mabuyinae (63 species), *Eumecia* (2 species; Africa), and *Trachylepis ivensii* (Africa). However, no explicit phylogenetic hypotheses exist for understanding the evolution of extreme matrotrophy. Using multilocus DNA data, we inferred a species tree for Mabuyinae that implies that *T. ivensii* is sister to *Eumecia*, suggesting that extreme matrotrophy evolved only once in African skinks, with histotrophy giving rise to hemotrophy.

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**0548 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Matthew Metcalf, Brent Jackson, Dave Ceilley, John Herman, Edwin Everham

*Florida Gulf Coast University, Fort Myers, Florida, USA*

### A Preliminary Comparison of Home-Range Sizes for the Eastern Indigo Snake (*Drymarchon couperi*) from Disturbed vs Non-Disturbed Sites in South Florida

The Eastern Indigo Snake (*Drymarchon couperi*) is federally threatened in the United States and has the largest home range documented for any snake species in North America. Most studies on this species have focused on populations throughout southern Georgia and north-central Florida. However, information is lacking from the literature for *D. couperi* in its southernmost range. Due to climatic and habitat differences between south Georgia and south Florida, basic life history may vary for this species across its range. We conducted a previous radio-telemetry study from an abandoned citrus grove (disturbed site) in Martin County, FL, that found *D. couperi* had greatly reduced home range sizes than were previously reported for more northern populations. These findings will allow a stronger understanding of *D. couperi* life history traits such as home range sizes, refugia use, and seasonal habitat preferences in southern Florida, which should inform management plans for the southern populations of this species.

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**0967 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Alexandra Meyer, Larry G. Allen

*California State University, Northridge, Northridge, California, USA*

### Identification of SNP Loci in the Shovelnose Guitarfish, *Rhinobatos productus* Using Next-Generation Sequencing

The use of single nucleotide polymorphism (SNP) data from Restriction Site Associated DNA sequencing (RAD-seq) is rapidly taking the place of microsatellites in studies of population connectivity using nuclear DNA. In general, SNP loci reveal more fine-scale genetic structure than microsatellites, given the relative abundance of SNPs within the genome and their relatively low mutation rate, leading to more stability over microevolutionary time (Coates *et al*. 2009). Despite these advantages, the application of RAD-seq and SNP comparison to the genetic analysis of elasmobranch fishes remains largely untried. In a pilot study, DNA was extracted from tissue collected from *Rhinobatos productus* (shovelnose guitarfish, Ayres 1854) and genomic libraries were extracted from the DNA using the 2bRAD sequencing protocol (Wang *et al*. 2012). Libraries were successfully extracted from 10 individuals, with varying degrees of product concentration. *R. productus* is an especially viable candidate for population genetic studies as the species is easily accessible and has a relatively small geographic range, from the Gulf of California to Central California. Prior studies have indicated that *R. productus* is restricted by known phylogeographic barriers, particularly the tip of Baja

California Sur, as evidenced by low population connectivity at the mitochondrial level (Sandoval-Castillo *et al*. 2004). Though no studies have been produced studying the nuclear population genetic structure, *R. productus* seems to be a viable candidate for the use of 2bRAD sequencing for the detection and analysis of SNP loci in order to describe the overall population structure.

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**0521 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Carl Meyer[2], Kim Holland[1], Melanie Hutchinson[2], James Anderson[1], Mark Royer[1], Danny Coffey[1]

*[1]University of Hawaii, Honolulu, HI, USA, [2]Hawaii Institute of Marine Biology, Kaneohe, HI, USA*

**New Insights into Coastal Habitat Use By Tiger Sharks In Hawaii**

An anomalous increase in shark bites around Maui in 2012 and 2013 highlighted gaps in our understanding of tiger shark movements in these waters. We used satellite and acoustic telemetry to quantify tiger shark spatial dynamics around Maui, and to determine their presence in near shore areas used for ocean recreation. Each shark had unique home range characteristics but there were several common themes of space and habitat use among individuals. For example, tiger shark home ranges typically included waters around several adjacent islands, and sharks were most frequently detected over coastal shelf habitat within the 200 m isobath. Most individuals utilized clearly-defined core areas associated with relatively wide areas of shelf and strong currents. Core use areas around Maui were often adjacent to ocean recreation beaches. Coastal shelf habitats around Maui are considerably more extensive than around any other Main Hawaiian Island (MHI), suggesting Maui waters might support more sharks than other neighboring islands, and may perhaps be an important feeding or reproductive habitat for tiger sharks from throughout the MHI. Collectively, these factors may partly explain higher long-term shark bite incident rates in Maui waters compared to other Hawaiian Islands.

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**0615 AES Physiology, Paleontology, & Collections, Balconies L & M, Friday 8 July 2016**

Lauren Meyer, Madeline Green

*Shark Share Global, Hobart, Tasmania, Australia*

**Shark Share Global: a virtual tissue bank for collaborative elasmobranch research**

With more than a quarter of elasmobranchs considered endangered and another 47 per cent lacking basic biological data, there has never been a more crucial time for shark and ray scientists to work collaboratively and efficiently to understand the biology, ecology

and physiology of elasmobranchs. Although opportunistic tissue collection occurs often in the field, in many cases not all potential samples are collected, samples are disposed of due to a lack of institutional storage, or they are left in freezers for potential future projects, which may not materialize. Additionally, sourcing samples for research projects remains challenging without broad global connections. Here, we propose an online database (Shark Share Global) to help overcome sampling inefficiencies and provide a user-friendly platform for sharing elasmobranch tissues. By creating a virtual global tissue bank, Shark Share Global is able to facilitate collaborative efforts, increasing multidisciplinary research without drastically increasing project costs. Here, we will introduce the database, its functionality and expected outcomes for the greater elasmobranch research community.

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**0619 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Lauren Meyer[1], Charlie Huveneers[1], Peter Nichols[2], Heidi Pethybridge[2], Barry Bruce[2], Crystal Beckman[3]

*[1]Flinders University, Adelaide, South Australia, Australia, [2]CSIRO, Hobart, Tasmania, Australia, [3]SARDI, Adelaide, South Australia, Australia*

## Bait, Berley and Biochemistry - Using Biochemistry to Assess the Impact of South Australia's Cage-Diving Industry on Local White Sharks *Carcharodon carcharias*

Wildlife tourism is considered the fastest growing sector of the tourism industry, bringing in billions of dollars around the world and with it, a myriad of management and conservation challenges. In Australia, the Neptune Islands Group Marine Park is home to nation's largest aggregation of adult white shark (*Carcharodon carcharias*) and Australia's only white shark cage-diving industry. Previous studies have shown that the industry here has induced changes to white shark swimming patterns and residency and therefore has been identified as a potential threat to the recovery of the species. Yet, there have not been any studies investigating the nutritional effects of interacting with the cage-diving industry. For example, the time spent interacting with tethered bait (tuna heads, gills and guts) and around cage-diving vessels might disrupt the natural foraging behaviour of white sharks and their ability to feed on seals, which is presumably the primary reason for white shark visiting and residing at seal colonies. Using stable isotopes and lipid signatures to evaluate dietary sources and trophic niche, we investigate the impact of tourism on the feeding ecology of white sharks.

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**0765 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon F-H, Friday 8 July 2016**

Savannah Michaelsen[2], Kyle Piller[1]

*[1]Southeastern Louisiana University, Hammond, LA, USA, [2]Virginia Institute of Marine Science, Gloucester Point, VA, USA*

### Examining the impact of the Deepwater Horizon oil spill on genetic diversity and migration in red drum (Sciaenidae: *Sciaenops ocellatus*) in Louisiana waters

Understanding patterns of genetic diversity and movement are necessary for effective fisheries management, especially in species affected by large-scale anthropogenic disasters such as oil spills. In April 2010, the Deepwater Horizon oil spill discharged more than 4.9 million barrels of oil into the Gulf of Mexico, affecting many marine species. One such species impacted was the red drum (Sciaenidae: *Sciaenops ocellatus*), a recreationally important marine-estuarine fish. Red drum are distributed across the northern Gulf of Mexico, particularly in areas heavily impacted by the 2010 oil spill. Scientific studies examining the effects of oil spills have traditionally focused on physiological and reproductive impacts; however, little is known about the effect of oil spills on genetic diversity, effective population size, population structure, and gene flow. In this study, 18 microsatellite loci were used to evaluate genetic diversity, population structure, and migration in 300 red drum sampled before (n=173) and after (n=182) the Deep Horizon oil spill. Results indicate that despite heavy oil spill impact in sampled estuaries, red drum showed little to no detectable genetic changes post-oil spill. Resistance to genetic change may be due to reduced fishing pressure due to the oil spill, avoidance behavior, large population sizes, or genetic effects that operate on a longer time-scale. This study provides insight into the impact of oil spills on the genetic characteristics of marine fish populations, and establishes a baseline for future genetic studies of red drum.

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**0848 Fish Ecology I, Salon A-C, Saturday 9 July 2016**

Alejandra Mickle, Dean Grubbs, Jeffrey Chanton

*Florida State University, Tallahassee, FL, USA*

### Feeding Ecology and Mercury Bioaccumulation in Gulf of Mexico Myxinids

We investigated the feeding ecology and trophic structure of *Eptatretus springeri, Eptatretus minor*, *Myxine mcmillanae*, using nitrogen ($\delta^{15}N$), carbon ($\delta^{13}C$) and sulfur ($\delta^{34}S$) isotopes. We investigated spatial and temporal variation in feeding habits as well as intraspecific variation in trophic ecology. *E. springeri* was by far the most common of the species captured and had the lowest $\delta^{15}N$ value (12.8 ‰) followed by *E. minor* (13.4 ‰) and *M. mcmillanae* (14.9 ‰). *E. springeri* had the most depleted $\delta^{34}S$ values, but the highest lipid content ($\Delta\delta^{13}C$) suggesting it feeds more selectively on benthic invertebrates and it stocks lipids in its muscle tissue for potential periods of fasting

when food resources are scarce. *E. minors* $\delta^{13}C$ values did not vary from *E. springeri,* suggesting a food web with similar basal resources but different isotopic niches. *M. mcmillanae* had the highest $\delta^{15}N$ and $\delta^{34}S$ values suggesting a primarily pelagic sourced diet potentially based on carrion consumption. Overall, we did not observe significant relationships with depth and body size (TL) but we did see opposing trends for the *Eptatretus* species with depth. *E. minor* displayed lower $\delta^{15}N$ values with depth while *E. springeri's* values increased with depth. We observed significant spatial, temporal and spatiotemporal shifts in mean stable isotope values. With higher values observed on the Western sites. We observed significant inter and interspecific variation in Hg concentrations with the highest concentrations in *M. mcmillanae* (11.9 ppm) followed by *E. minor* (2.1 ppm) and *E. springeri* (1.2 ppm).

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**0073 General Herpetology, Galerie 2, Saturday 9 July 2016**

Joseph Milanovich[1], Stanislaw Warcholek[1], Brock Struecker[1], Leigh Anne Harden[2]

*[1]Loyola University Chicago, Chicago, IL, USA, [2]Benedictine University, Lisle, IL, USA*

## A Look Underground at the Ornate Box Turtle: Hibernal Thermal Ecology and Microhabitat of Hibernacula in North-central Illinois

Habitat loss, fragmentation, and land use change has led to significant declines of taxa in the United States and species dependent on prairie habitat have thus also declined. One such species, the Ornate Box Turtle (*Terrapene ornata*), has recently been listed as threatened in Illinois and, despite evidence of healthy populations of *T. ornata* in northwestern Illinois, little is known regarding the demography and life history of *T. ornata* in north-central Illinois. An assessment of *T. ornata* populations, specifically data regarding the characteristics of hibernacula are needed to further establish specific conservation targets for this threatened species. Using radio-telemetry, we located hibernacula in 2014 (n=7) and 2015 (n=18). Soil and vegetation characteristics of both random plots and hibernacula plots were quantified and compared, along with thermal data from turtles collected from iButton temperature loggers. Across two years, *T. ornata* descended into hibernation between 10 September and 9 October, and ascended between 10 and 22 April. When compared to random plots, *Terrapene ornata* selected hibernacula with significantly greater %sand and lower %silt and %clay, lower % herbaceous ground cover, and higher %bare ground, leaf litter and shrubs. Our results indicate there are specific periods in fall and spring that are associated with *T. ornata* hibernation decent and ascent, which are likely driven by ambient temperatures. Further, *T. ornata* hibernacula plots had measurably different microhabitat when compared to random plots, possibly providing a more stable hibernacula environment.

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**0851 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT**

Alice R. Millikin[1], Sarah K. Woodley[2], Drew R. Davis[3], James T. Anderson[1]

*[1]West Virginia University, Morgantown, WV, USA, [2]Duquesne University, Pittsburgh, PA, USA, [3]University of South Dakota, Vermillion, SD, USA*

### Water-borne Hormone Levels of Spotted Salamanders (*Ambystoma maculatum*) in Created Wetlands

Small isolated wetlands are critical breeding habitat for many amphibians. Many of these wetlands are susceptible to destruction due to lack of regulation. Therefore, it is important to create new suitable habitat to mitigate loss. One measure of suitable habitat is to examine physiological health of the population. Concentrations of the stress hormone corticosterone can indicate the status of population health and habitat quality. Chronic stress can lead to suppression of growth, metamorphosis and immune function. The objective of our research was to determine if certain habitat characteristics in created wetlands are conducive to healthy Spotted Salamander (*Ambystoma maculatum*) populations, quantified by corticosterone levels. From May-June 2015, we sampled Spotted Salamander larvae (n=10/wetland) in 28 wetlands created between 2011 and 2014 in the Monongahela National Forest, West Virginia. We collected environmental data including vegetation cover and water quality at each wetland. This study is among the first to use the new, non-invasive water-borne hormone sampling method in the field and the first use of it with Spotted Salamanders. After catching salamanders with aquatic nets or seines, they were contained in 20 ml of water in individual cups for one hour then removed. The water-borne sample was frozen within 10 hours of capture. We used enzyme immunoassay kits to detect corticosterone levels which ranged from 0 - 13.5 pg/TL/h in our samples. Our results improve understanding of water-borne hormone levels and how they relate to habitat quality. This research also increases knowledge of an unprotected habitat which can improve mitigation success.

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**0125 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Mark Mills, Jessica Yehle Rix, Brock Couch

*Missouri Western State University, St. Joseph, MO, USA*

### Amphibians Using Man-Made Vernal Pools in Missouri: A Four-Year Study With A Comparison of Techniques

Vernal pools were constructed in Mark Twain National Forest, Missouri, to provide a water source for wildlife and breeding sites for amphibians. Seventeen of these vernal pools, in Washington and Crawford counties, have been monitored for amphibian breeding over the last four years. Our goal was to document amphibian use of these pools, and in particular breeding activity. During the study, different methods of

trapping amphibians were evaluated. Minnow traps, dip nets, and aquatic invertebrate traps with and without lights were used. Mature adults, juveniles, and larvae of various species were trapped and monitored. Call surveys and visual monitoring of egg masses were also completed. Species documented breeding in or present in these pools included *Anaxyrus americanus, Anaxyrus fowleri, Hyla chrysoscelis, Pseudacris crucifer, Pseudacris triseriata, Lithobates catesbeiana, Lithobates clamitans, Lithobates palustris, Lithobates sphenocephala, Ambystoma maculatum,* and *Ambystoma opacum*. We will present our results as well as a comparison of sampling and monitoring techniques.

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**1048 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Joshua Millwood[1], David Neely[2], Casey Morrow[3], Michael Sandel[1]

*[1]The University of West Alabama, Livingston, Alabama, USA, [2]Tennessee Aquarium Conservation Institute, Chattanooga, Tennessee, USA, [3]Microbiome and Gnotobiotic Animal Core, UAB, Birmingham, Alabama, USA*

## A Comparison of Host Genetics and Environmental Effects on the Dermal Microbiome of Banded Sculpin (*Cottus carolinae*)

The "slime" layer of fishes is of ecological and evolutionary importance, as it is inhabited by a co-evolving community of microbes, including commensals and potential pathogens. The diversity and dynamics of this community are influenced by the host genetics and the environment, but the relative contributions of these two factors remain largely unexplored. We are applying high-throughput molecular techniques to test for differential host and environment effects on the microbiome of Banded Sculpin (*Cottus carolinae*), a species with strong population structure and a broad geographic range. We focus on the Mobile River Basin, where the species occupies both upland and lowland habitats. One population is found in Rabbit Creek, Clark County, AL; which is part of the Tombigbee River drainage. The other is found in Reedy Creek, Clarke County, AL; which is part of the Alabama River drainage. While these populations are within 15 miles of each other, and nearly 100 miles from upland populations, they do not share a recent common ancestor. Genetic evidence allies the Rabbit Creek population to species found in the Black Warrior drainage while the Reedy Creek population is more similar to sculpins found in the Cahaba and Tallapoosa Rivers. The microbiome analysis reveals significant direct effects of genes (clades) and environment, as well an interaction effect. We discuss the relative importance of each, along with future directions involving the application of phylogenetic comparative methods to microbiome analysis.

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**0033 General Ichthyology I, Balconies J & K, Sunday 10 July 2016**

Mario Minder, Mark Pyron

*Ball State University, Muncie, IN, USA*

**Are Diets of Native Fishes the Same as Silver Carp in the Wabash River?**

Abstract- Silver Carp (*Hypophthalmichthys molitrix*) are an invasive species present in many rivers in the United States. Due to their low trophic position, identifying the effect Silver Carp have on an ecosystem is difficult. Silver Carp consume plankton that is used by native larval fish and filter feeders in other invaded rivers. We collected diet samples from invasive Silver Carp and two native filter feeders (Gizzard Shad and Bigmouth Buffalo) during spring and summer of 2015 at three sites on the Wabash River to test for dietary overlap. Diet items were identified to major group and quantified. Diet proportions were compared among seasons, sites, and species. Diet selectivity was calculated using the Manly-Chesson index. δ13C and δ15N isotope analyses used dorsal muscle tissue from Silver Carp and two potential competitors. Silver Carp diets were significantly dissimilar among seasons (ANOSIM, $R = 0.591$, $P < 0.001$), but we did not find a significant difference among sample sites, or compared to native fishes. Silver Carp positively selected Cyanobacteria in the spring, but switched to selecting Diatoms and Chlorophyta in the summer. Silver Carp isotopes were consistent among seasons, and Gizzard Shad δ15N and δ13C varied seasonally.

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**0453 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Shawna Mitchell[1], Joshua Ennen[1], Kristen Cecala[2], Jon Davenport[3], Lindsey Liles[2], Mary Lou Hoffacker[2]

*[1]Tennessee Aquarium Conservation Institute, Chattanooga, TN, USA, [2]Sewanee: The University of the South, Sewanee, TN, USA, [3]Southeast Missouri State University, Cape Girardeau, MO, USA*

**Pit-tag Retention and Behavioral Characteristics of *Desmognathus* in Recirculating Artificial Streams**

Most mark-recapture models estimating population estimates, such as survivorship and population size, assume individual marks, which uniquely identify an individual, are retained throughout the duration of the study. Various methods such as photography of spot patterns, toe clips, radiotelemetry, and implanted reflector tags have been used to mark and track salamanders. Passive Integrated Transponder (PIT) tags are increasingly used as "marks" to identify individuals in the wild. However, very few studies have explored retention rates of PIT tags in salamanders. This study was conducted in concert with an experiment quantifying competitive interactions between two *Desmognathus* species, *D. monticola* and *D. quadramaculatus*, in ambient and elevated water temperatures. The purpose of our study was twofold. We aimed to calculate PIT tag (i.e., Biomark HPT8, 8.4mm) retention rates within the two species and also to investigate behavior within the artificial streams. After 37 days, 100 percent of the individual

salamanders retained their PIT tags. In artificial streams with elevated temperatures, interspecific treatments were almost twice as likely to cohabitate as intraspecific treatments. At ambient temperatures, cohabitation rates did not differ between interspecific and intraspecific treatments. Frequency of cohabitation among species and among temperatures was significantly different ($G = 13.60$, $df = 1$, $p < 0.001$). Overall, we found that PIT tags can be retained in *Desmognathus* species for at least 37 days and that elevated temperatures can have an unexpected effect on cohabitation of two competitive species.

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**0947 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Tim Mitchell[1], Erik Larson[2], John Iverson[3], Fred Janzen[4]

*[1]Auburn University, Auburn, AL, USA, [2]NOAA, Boulder, CO, USA, [3]Earlham College, Richmond, IN, USA, [4]Iowa State University, Ames, IA, USA*

## Patterns of hatchling mortality during hibernation of the painted turtle (*Chrysemys picta*)

Some ectotherms have evolved remarkable adaptations for survival at cold temperatures, and cold-hardiness influences the distribution of many ectotherms at high latitudes. Hatchlings of some temperate aquatic turtles have been well-studied ecophysiological models for vertebrate cold tolerance because of their interesting subterranean overwintering behavior. After hatching from eggs, many temperate hatchlings remain in the terrestrial nest over winter, emerging the following spring. These turtles employ multiple strategies (supercooling and freeze tolerance) to survive subzero temperatures. Despite these remarkable adaptations, many hatchlings perish due to harsh abiotic conditions during winter. While the physiology of cold tolerance has been the focus of much research, important ecological considerations remain understudied. Here we present results from parallel multi-year observational studies of two painted turtle (*Chrysemys picta*) populations located in Nebraska and Illinois. We examine the intersection of maternal nest-site choice and abiotic conditions (snow cover, ambient temperature, etc.) on temperatures within painted turtle nests during winter, and the relationship between winter nest temperatures and sex-specific offspring mortality in those nests. Preliminary results suggest maternal nest-site choice has little influence on winter nest temperatures, whereas ambient temperature and snow cover are essential for predicting nest thermal environments and pre-emergence hatchling mortality. These findings suggest that estimates of mortality can be obtained during this life stage from weather data.

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**0597 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Muhammad Moazzam, Rab Nawaz, Saba Ayub

*WWF-Pakistan, Karachi, Pakistan*

### Shark in the bycatch of tuna gillnet fisheries of Pakistan: A serious threats to their vulnerable population

Pakistan has a substantially large tuna gillnet fleet consisting of about 700 large wooden fishing boats which ply in the offshore waters of Pakistan and in the Area Beyond National Jurisdiction adjacent to its Exclusive Economic Zone. These vessels use long gillnets having a length of more than 7 km. Shark, pelagic rays, whale shark and mobulids are among the major bycatch of the tuna gillnet operations. Shortfin mako, (*Isurus oxyrinchus*) and pelagic thresher (*Alopias pelagicus*) are among the most common sharks whereas silky (*Carcharhinus falciformis*), oceanic whitetip (*Carcharhinus longimanus*) and scalloped hammerhead (*Sphyrna lewini*) are also represented in the catches. Among rays, pelagic stingray (Pteroplatytrygon violacea) is occasionally caught whereas mobulids are represented by 6 species; of which spinetail mobula (*Mobula japonica*) is the most common species. Whale sharks are also found to be entangled in gillnet fishing gears on many occasions. This is for the first time quantitative and qualitative data about elasmobranch catches in the pelagic gillnets being used in the Arabian Sea is documented. In the paper, information about seasonal abundance and spatial distribution of various elasmobranchs is also presented. For the protection of some of the important elasmobranchs including whale shark (*Rhincodon typus*) and mobulids which are commonly entangled in the gillnets, a program for their safe release was initiated. Through this program, 25 whale sharks, 10 mobulids and 1 pelagic stingray were successfully released in a period of about 20 months.

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**0569 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Muhammad Moazzam, Hamid Badar Osmany

*Marine Fisheries Department, Government of Pakistan, Karachi, Pakistan*

### Are sawfishes locally extinct in Pakistan? Recent evidences suggest otherwise!

Three species of sawfishes were known to occur in Pakistan including knifetooth sawfish (*Anoxypristis cuspidatus*), common sawfish (*Pristis pristis*) and largecomb sawfish (*P. zijsron*). Of these, *P. pristis* was reported to be the most common species occurring in the lower reaches of the River Indus, associated estuarine areas, lagoons and shallow coastal waters.. There used to an important fisheries for sawfishes along the coast of Pakistan. Introduction of nylon net and proliferation of bottom set gillnetting in 1960s and 1970s respectively led to the decline in the catches and by 1980 the target fishery for sawfish collapsed. Although some specimens were occasionally caught but it was generally believed that sawfishes are locally extinct in Pakistan. A study was initiated in 2013 to record any sawfish caught by fishermen along the coast of Pakistan. During last

three years only five authentic records of their occurrence were made. One specimen of *A. cuspidatus* was caught in the Khajar Creek (Indus Delta) whereas remaining 4 specimens collected from shallow coastal waters were identified as *P. pristis.* There are another 5 records of sawfishes during this period in which species could not be identified and there are some uncertainly associated with these records. In the paper, a review of the status of sawfishes is made. The collected data indicates that sawfishes are not extinct in Pakistan although they are very rare in occurrence. Considering their rarity the need for the conservation of sawfishes in Pakistan cannot be over-emphasized.

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**0896 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Ivan Moberly, Brad Moon

*University of Louisiana at Lafayette, Lafayette, LA, USA*

**The Interplay between Setae, Gripping Ability, and Locomotor Kinematics in an Arboreal Lizard (*Furcifer oustaleti*)**

Arboreal habitats present some of the greatest challenges to movement, as they contain complex mixtures of perches with various diameters, inclines, and spacing. Likely as a response to the different mechanical demands of moving in these complex habitats, the form and function of arboreal animals can be quite distinct from those of terrestrial animals. Chameleons serve as excellent models for the study of arboreal locomotion, as they are largely arboreal specialists and possess diverse characteristics that enables them move smoothly and slowly through their complex environments. For example, the zygodactylous feet and prehensile tails of chameleons have friction-enhancing microstructure (setae) on the substrate-contacting surfaces, allowing for effective gripping of the supporting substrate. This research examines how subdigital and subcaudal setae affect the gripping performance and kinematics in Oustalet's chameleons (*Furcifer oustaleti*) across perches of different orientations and diameters. I measured the maximal performance of chameleons (N = 20) gripping perches of different diameters and orientations prior to and following setae interference. I also quantified three-dimensional locomotor kinematics prior to and following setae interference to determine if chameleons need to modulate their movement patterns in the absence of friction-enhancing setae. This research shows the importance of setae in caudal and manual gripping of small perch diameters and locomotion in chameleons.

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**0406 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Iliana Mock, Kevin Conway

*Texas A&M University, College Station, TX, USA*

### An overview of oral keratinization in North American cyprinids (Teleostei: Cyprinidae)

Despite the absence of oral jaw teeth, algivory is widespread across Cypriniformes and is likely facilitated by keratinization of oromandibular structures, including the lips and, occasionally, the epithelium covering the jaw bones. Unculi (minute keratinous projections arising from the surface of epidermal cells sensu Roberts1982) on the oromandibular surfaces of some algivorous African/Asian cyprinids and Asian cobitoids are currently hypothesized to function as abrasive structures, responsible for the removal of algae from the substrate. Previous investigations of oral keratinization in cypriniforms are restricted to old-world taxa, and very little is known about the diversity, distribution and nature of oral keratinization in North American cyprinids. In this study, we use a combination of scanning electron microscopy (SEM) and histology to investigate the extent and distribution of keratinized epithelia on the oral surfaces of North American cyprinids, including representatives of all currently recognized genera. Based on our observations, we attempt to address the following questions: (1) What is the distribution of oral keratinization across North American cyprinid taxa? (2) What is the nature of oral keratinization (including the size, shape and location of unculi throughout the mouthparts) in those North American cyprinids that exhibit this character? Finally, we assess whether a correlation exists between oral keratinization and gut length.

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**1038 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Brian Moe[1], Charles Cotton[2]

[1]*Florida State University, Department of Biological Science, Tallahassee, FL, USA,*
[2]*Florida State University, Coastal and Marine Laboratory, St. Teresa, FL, USA*

### Estimating length-at-age for the little gulper shark *Centrophorus* cf. *uyato* in the Gulf of Mexico: an evaluation of alternative aging techniques

Basic life history information is necessary for the proper development of stock assessments and appropriate management plans. However, life history parameters for many deep-water species of sharks are lacking or entirely absent. Though deep-water sharks in general are presumed to be less resilient to population depletion than their shallow-water counterparts, resource managers require basic, species-specific life history information to impose appropriate harvest limits and prevent overfishing. This study is intended to provide the first length-at-age estimates for the little gulper shark *Centrophorus* cf. *uyato*, a species for which basic life history information is mostly lacking. Dorsal fin spines will be aged using standard methods (transverse sectioning, staining,

polishing), as well as emerging methods (computed tomography scanning and near-infrared spectroscopy). This study will determine the most effective method of age determination for this species and provide the first age estimates for *C.* cf. *uyato* in the Gulf of Mexico. The results of this study will lead to a full age and growth study for this population.

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**1042 AES Conservation & Management I, Balconies L & M, Friday 8 July 2016**

Brian Moe[1], Paul Venturelli[2]

[1]*Florida State University, Department of Biological Science, Tallahassee, FL, USA,* [2]*University of Minnesota, Department of Fisheries, Wildlife and Conservation Biology, St. Paul, MN, USA*

**Modeling elasmobranch growth: an application of biphasic growth theory**

The von Bertalanffy growth model is the most commonly used growth model in elasmobranch literature. However, this model has been criticized for its failure to account for the change in energy allocation at the onset of maturity, and therefore growth that occurs after a fish matures. The Lester growth model (LGM) is a biphasic alternative to the von Bertalanffy growth model that incorporates life history trade-offs between reproduction, growth, and survival to describe lifetime growth as a straight line (immature phase) and a curve (mature phase). We used 52 datasets from 29 elasmobranch species to compare the performance of the LGM to four conventional growth models (von Bertalanffy, Gompertz, logistic, and a two-phase von Bertalanffy). According to Akaike Information Criterion (AICc), the LGM was the best fitting model for 80.8% of datasets. Our results show clear support for the LGM as a means of describing lifetime growth of some of the world's most common, endangered, and economically important elasmobranchs; and bring into question the default status of conventional growth models in the elasmobranch literature.

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**0749 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016**

Travis Moe, Patrick Brown

*Northern Michigan University, Marquette, MI, USA*

**A Review of Studies of Neonicotinoid Effects on Anurans**

Population declines, in some cases leading to extirpations, have been observed in amphibians around the world. Many of these declines are linked to pesticide exposure. Anurans are commonly exposed to agrochemicals, particularly those inhabiting aquatic environments that are near agricultural fields. Pesticides have been implicated in anuran population declines. Neonicotinoids are a group of relatively new, systemic, synthetic chemical insecticides that can persist in the soil for up to one year. They are

also the most widely used family of insecticides in the world. Neonicotinoids likely have an impact on a breadth of non-target organisms. Numerous studies have demonstrated adverse effects of neonicotinoids on organisms such as bees and birds. The current knowledge of the effects that neonicotinoids have on anurans is limited to a relatively small number of studies conducted on a handful of species. In this review, I address the status of our current knowledge regarding neonicotinoid effects on anurans, as well as the gaps and areas for further research.

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**0240 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Shabnam Mohammadi

*Utah State University, Logan, UT, USA*

**Student Involvement in the American Society of Ichthyologists and Herpetologists**

Student members of the American Society of Ichthyologists and Herpetologists (ASIH) have contributed significantly to the operations of the society and the annual Joint Meeting of Ichthyologists and Herpetologists. Students serve important roles on committees that deal with the planning of meetings and the future directions of ASIH as well as help raise funds for travel awards and contribute to the conservation efforts of the society. In this talk I overview the various roles students fulfill each year and highlight some of our past prominent student members; what contributions they've made to the society and where they are now.

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**0415 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Patrick D. Moldowan[1], Ronald J. Brooks[2], Jacqueline D. Litzgus[1]

*[1]Laurentian University, Sudbury, Ontario, Canada, [2]University of Guelph, Guelph, Ontario, Canada*

**Assessing cranial dimorphism in the Midland Painted Turtle (*Chrysemys picta marginata*) using a photographic questionnaire**

The ability to accurately identify the sex of animals is important in population demography studies, and in many species the sexes can be distinguished based on secondary sexual traits. For example, emydid turtles (Testudines: Emydidae) demonstrate a number of sexually dimorphic characters, including cranial size and structure. Field observations from a long-term study of Midland Painted Turtles (*Chrysemys picta marginata*) in Algonquin Provincial Park, Ontario, Canada, suggested distinct differences in cranial morphology between the sexes. We evaluated these putative sexual differences in by conducting a visual questionnaire involving human observers of varying levels of "turtle experience" (novice, beginner, intermediate and

advanced). Observers were capable of distinguishing the sexes based solely on head morphology with a high degree of accuracy (between 79-86% success) across experience levels. Observers identified head shape as a defining cranial character between the sexes. We conclude that visual questionnaires provide a quantifiable method of assessing dimorphic characters that can be used in addition to traditional morphometrics or geometric morphometrics to demonstrate visual, rather than simply statistical, differences among characters and between sexes. Despite the breadth of research conducted on *C. picta,* our study includes the first detailed description, assessment, and discussion of the functional significance of cranial dimorphism in this model species.

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**0438 SSAR SEIBERT AWARD ECOLOGY, Galerie 3, Thursday 7 July 2016**

Patrick D. Moldowan[1], Ronald J. Brooks[2], Jacqueline D. Litzgus[1]

*[1]Laurentian University, Sudbury, Ontario, Canada, [2]University of Guelph, Guelph, Ontario, Canada*

## Sex, shells, and weaponry: Coercive reproductive tactics in the Midland Painted Turtle, *Chrysemys picta marginata*

The mating strategy of the Painted Turtle (*Chrysemys picta*) is well recognized as involving an elaborate male courtship display coupled with female mate choice. During breeding, male *C. picta* demonstrate stereotyped titillation behavior including the stroking of a female with elongate foreclaws. It is thought that female *C. picta* choose mates on the basis of courtship display and/or traits that demonstrate male quality. However, *in situ* field observations and experimental trials from a long-term study of *C. picta* in Algonquin Provincial Park (Ontario, Canada) demonstrate that males also exhibit an alternative, coercive mating strategy. Males are equipped with prominent tomiodonts, tooth-like cusps of the beak, that cause extensive wounding to the head and neck of females and seemingly function as sexual weapons promoting mate acquiescence. Over 100 hours of video recordings from experimental trials during the spring and fall (2013) breeding periods will be summarized. The courtship and pre-copulatory behaviors of males, including titillation, chasing, biting, forced submergence of females, and shell clattering, were quantified. Male reproductive tactics shift from courtship to coercion across ontogeny, and male size predicts the occurrence and frequency of coercive behavior. Our findings show that male *C. picta* use their tomiodonts as sexual weapons for mate coercion. Continued study of sexual dimorphism and variation in male phenotype is of interest to test sexual selection and mating strategy theory. As a group with a rich evolutionary history, turtles are a fascinating taxon in which to ask questions about mating system evolution.

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**0515 HL GRADUATE RESEARCH AWARD, Galerie 2, Friday 8 July 2016**

Lori Monday, Alex Ano, W.B. Cash

*University of Central Arkansas, Conway, AR, USA*

### A Novel Approach to Quantifying Melanism in the Red-Eared Slider Turtle (*Trachemys scripta elegans*)

A common technique used for scoring melanism in freshwater turtles uses a subjective quantification scale based on 0 (no melanism), 1 (in between 1 and 2), and 2 (full melanism). Lovich *et al.* (1990) proposed that melanism could be measured from photographs of the turtles' surfaces. In our study, we used a standardized photographic process and image-processing software package (ImageJ) to quantify the relative proportion melanism expression on the plastron in slider turtles. The plastron of each turtle was lightly cleaned and photographed in a light box with standardized lighting. Images were white balanced prior to uploading to ImageJ. Plastron images were analyzed for total proportion of melanic pigment. Mean male plastron melanism was 0.53 ± 0.03 SE and mean female plastron melanism was 0.57 ± 0.03 SE. There was no significant difference in proportion melanism between males and females (p-value = 0.174). A subset of turtles was analyzed for pre-scute and post-scute shed. Mean melanism proportion was 0.77 ± 0.06 SE for pre-scute shed and 0.50 ± 0.07 SE for post-scute shed. There was a significant difference in proportion melanism, such that post-scute shed turtles had proportionally lower melanism (p=0.040). This novel method provides a more objective quantification of melanic pigment in slider turtles and an overall value reflecting the degree of melanism of individuals. These data will be used to compare the progression of melanism in individual turtles over time. This study is part of a larger study addressing melanism and important endocrine correlates of melanin production.

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**1066 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Lori Monday, W.B. Cash

*University of Central Arkansas, Conway, AR, USA*

### The Effects of Brief Laboratory Handling on Plasma Corticosterone Concentrations in the Red-Eared Slider Turtle (*Trachemys scripta elegans*)

In some vertebrate species, plasma corticosterone concentrations are affected by the handling of an organism or the holding an organism in captivity (Cash *et al.*, 1997). Our study was conducted to determine if laboratory handling or short-term captivity affects plasma corticosterone concentrations in the slider turtle. Wild-caught turtles were brought into the laboratory and placed in individual containers for a 36 h acclimation period. After random placement into groups, experimental turtles were handled for one minute, while control group turtles were not disturbed. One hour after handling the experimental group, blood samples were taken at 0 min (T0), 30 min (T30), and 60 min (T60) for all turtles. Corticosterone ELISA tests resulted in mean plasma concentrations

at T0 of 0.454 ng/mL ± 0.093 SE and 0.674 ng/mL ± 0.243 SE for the handled and control groups respectively. There was no significant difference in the control and handled group's baseline (T0) corticosterone concentrations (p=0.419). Additionally, there were no significant differences found between the handled and control groups at T30 (p=0.199) or T60 (p=0.248). Our results show that slider turtle concentrations are not affected by these basic laboratory management techniques.

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**0561 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Carmen G. Montana[1], Craig A. Layman[2], Christopher Schalk[3]

*[1]Sam Houston State University, Huntsville, TX, USA, [2]North Carolina State University, Raleigh, NC, USA, [3]Texas A&M University, College Station, TX, USA*

## Patterns of intraspecific and interspecific variation in stoichiometry of four central North Carolina stream fishes

Organismal stoichiometry is often influenced by key processes such as trophic interactions and nutrient cycling. Previous studies have suggested that life history traits and environmental variability are important factors that influence consumer stoichiometry. In this study we analyzed carbon (C), nitrogen (N), and phosphorous (P) concentrations in four fish species (two centrarchids and two cyprinids) from four Piedmont streams of North Carolina along varying degrees of anthropogenic impact to determine the interspecific and intraspecific patterns of consumer stoichiometry. Taxonomic identity and body size had a significant effect on elemental stoichiometry of the fishes, with the two centrarchid species having higher P content compared to cyprinids. Phosphorus content increased significantly with body size in centrarchids but not in cyprinids. Changes in stream water properties (the amount of impervious surface associated with increasing urbanization) also appear to explain some of the variation in elemental composition of basal resources and primary consumers. Both cyprinids had high values of N content while one species of centrarchid, *Lepomis cyanellus*, had higher values of P content at streams with greater degree of impervious surfaces. Patterns across streams were less clear for fishes, but the variation in fish stoichiometry among streams warrants further study.

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**0558 Fish Ecology I, Salon A-C, Saturday 9 July 2016**

Carmen G. Montana[1], Rocío Rodiles-Hernández[2], Miriam Soria-Barreto[2]

*[1]Sam Houston State University, Huntsville, TX, USA, [2]ECOSUR-Department of Biodiversity Conservation, San Cristobal, Chiapas, Mexico, [3]ECOSUR-Department of Biodiversity Conservation and Fish Collection, San Cristobal, Chiapas, Mexico*

**Food web dynamics in a Mesoamerica floodplain river**

The Usumacinta River (Mexico), one of the largest rivers in Mesoamerica with high diversity of fishes. A construction of a dam for hydropower has been proposed in this river, but changes in its diversity and productivity cannot be adequately predicted without the understanding of interactions between hydrology, food web structures and fish dynamics. We surveyed fishes in tributaries, floodplain lagoons, and the main river channel of the Usumacinta during the low water period and analyzed carbon ($^{13}\delta C$) and nitrogen ($^{15}\delta N$) stable isotope ratios of fishes and primary producers to investigate food web structure. During this season, aquatic food webs in the Usumacinta main channel appeared to be supported by allochthonous sources, while in-stream sources increased in importance in floodplain lagoons and some tributaries in the lower Usumacinta. Nitrogen signatures of fish assemblages from tributaries, including the Tzendales River (upper Usumacinta) and Chacamax River (middle Usumacinta) were significantly higher when compared to other tributaries and floodplain lagoons. $^{13}\delta C$ and $^{15}\delta N$ isotopic ratios of some target fish species (*Dorosoma anale*, *Dorosoma Petenense*, *Astyanax aeneus*, *Thorichthys helleri*, and *Cathorops aguadulce*) revealed significant spatial variation. Individuals of these target species collected in lagoons were less enriched in $^{15}\delta N$ but more enriched in $^{13}\delta C$ than those collected in the tributaries and main-channel. Our results highlight the importance allochthonous sources in maintaining fish biomass during the low waters, but also how fluvial gradients affects aquatic food webs through changes in the relative availability of basal carbon sources and the richness and functional composition of consumer assemblages.

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**0906 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Ricardo Montero[1], Juan Diego Daza[2], Nicholas Holovacs[2], Eduard L. Stanley[3], Cecilia Guerra[1]

*[1]Facultad de Ciencias Naturales, Universidad Nacional de Tucumán, San Miguel de Tucuman, Tucuman, Argentina, [2]Department of Biological Sciences, Sam Houston State University, Huntsville, Texas, USA, [3]Department of Herpetology, Florida Museum of Natural History, Gainesville, Florida, USA*

**The shovel headed *Calyptommatus leiolepis* (Gymnophtalmidae)**

Body elongation and limb reduction are two independent processes that have produced a wide array of body shape combinations in several groups (Anguidae, Dibamidae, Pygopodidae, Scincidae, Cordylidae, Gymnophtalmidae, Amphisbaenia, Serpentes). *Calyptommatus leiolepis* is a fossorial sand swimmer with a moderately elongated body

and a short tail. The head exhibits a wide array of adaptations such a shovel-like snout with a well-developed horizontal keel, nasal cartilages that produce a sand-guard to protect the nostrils, reduced eyes covered by a brille, lack of forelimbs and extreme reduction of hindlimbs, and imbricated scales among others. We study skeletal morphology Based on High-resolution computed tomography (HRCT) data obtained at the American Museum of Natural History de Nueva York on a General Electric phoenix v|tome|x s240 system. Digital models and segmentation was done using Avizo lite 9.0. Some of the distinguishing features of *Calyptommatus* include the cartilaginous labial keel, a triradiated jugal (with digit-like projections), a well-developed pectoral girdle (with no limbs), uncinated process in the ribcage, and a single digit in the hind limbs. We compared the morphological features of this species with other fossorial gymnophtalmid lizards.

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**0944 HL GRADUATE RESEARCH AWARD, Galerie 2, Friday 8 July 2016**

Jennie Mook[1], Eric Schauber[1], Raymond Moody[2]

[1]*Southern Illinois University, Carbondale, IL, USA,* [2]*Natural Resources Department, Tinker Air Force Base, OK, USA*

## Using Harmonic Radar to Estimate Home Range Movements in Hatchling Texas Horned Lizards

Texas horned lizards are currently listed as a species of concern in Oklahoma and threatened in Texas, making research crucial to management and conservation efforts. Over the past decade, the population at Tinker Air Force Base in Oklahoma has become increasingly isolated due to encroaching urbanization. While there has been much research on this species, little is known about the hatchling life stage. Understanding their movements to better enhance survival of hatchling Texas horned lizards is imperative for estimating population viability for the species. Until now, monitoring hatchlings has proven difficult due to small size and limited technology. However, harmonic radar has proven to be a possible alternative for tracking small organisms. This study is the first to use harmonic radar to track the movements of horned lizard hatchlings, enabling us to learn more about hatchling survival rates and mortality-related details, as well as information about home-range sizes. Preliminary results have found success with using harmonic radar to monitor hatchlings (n=42) using Schottky barrier diodes (S2), aluminum, and PET. Diodes weighed less than 0.02g and were detected using a RECCO Detector 8 from up to 3m away. The earliest results show that hatchlings inhabit home ranges of 0.216 ± 0.184 ha using 95% KDEs. Our work can serve as a model approach to aid in conserving horned lizard populations and increasing population growth rates throughout their habitat.

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**0949 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Alec Moore

*IUCN Shark Specialist Group/Bangor University, Bangor, UK*

**Guitarfishes: can learning from the sawfish disaster prevent a similar fate?**

Sawfishes (Pristidae) and guitarfishes (Rhynchobatidae, Rhinobatidae, Rhinidae) share numerous characteristics: they are large, distinctive shark-like rays found in shallow water close to humans that are vulnerable to capture and economically valuable. For the sawfishes, scientists and managers largely failed to recognise, document, and prevent catastrophic global declines, making realistic attempts at their recovery impossible or extraordinarily difficult in most cases. However, this experience can provide valuable lessons to try and ensure the same mistakes are not made for guitarfishes: a group that remains poorly researched with alarming declines reported for some species. Drawing on first-hand experiences with fisheries in Arabia and West Africa, information on guitarfish taxonomy, fisheries, utilisation and research is reviewed in order to identify priorities for scientists, managers, and conservationists.

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**0436 HL: Social Behavior in Reptiles Symposium, Salon E, Saturday 9 July 2016**

Jennifer Moore[1], James Gillingham[2], David Clark[3], Nicola Nelson[4]

*[1]Grand Valley State University, Allendale, MI, USA, [2]Central Michigan University, Mount Pleasant, MI, USA, [3]Alma College, Alma, MI, USA, [4]Victoria University of Wellington, Wellington, New Zealand*

**Social Behavior of Tuatara**

Tuatara (*Sphenodon punctatus*) possess a rich and complex array of social behaviors, which have evolved within the contexts of territoriality, mating, and nesting. This talk will provide an overview of research that has addressed social behavior in tuatara, which is a relict species of the ancient reptilian order Rhynchocephalia. We combined observational behavioral data, experimental behavioral data, and genetic data to investigate; 1) visual signaling among combative males, 2) courtship and mate guarding, 3) mating success and paternity, and 4) communal nesting and nest guarding by females. Generally, phenotypic characteristics like body size and crest morphology are important predictors of male success in combat and reproduction. Tuatara exhibit a defined spatial structure and mate guarding that results in mostly seasonal monogamy with low levels of polyandry and polygyny. Nests benefit from female guarding, as a defense against excavation by communally nesting conspecific females. Our research supports the evolution of similar behaviors across diverse reptile lineages (e.g., orders Rhynchocephalia and Squamata) and adds to the growing body of evidence showing that reptile social behavior is much more complex than we previously thought.

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**0402 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Nickolas Moreno[1], William Allen[2], Tony Gamble[3], Ylenia Chiari[1]

*[1]University of South Alabama, Mobile, AL, USA, [2]Swansea University, Swansea, UK, [3]Marquette University, Milwaukee, WI, USA*

## Evolution of Color Pattern in Geckos

Coloration in animals has different purposes ranging from camouflage, signaling, mimicry, and temperature regulation. In vertebrates, coloration has been widely studied in some groups (fish, mammals, birds), but data for reptiles are still limited to a few examples. Among reptiles, geckos show a wide range of variation in color patterns. The function of color patterns in geckos is still largely unknown. We studied the influence of phylogeny, time of activity (diurnal vs nocturnal), and habitat use (sand, arid rocky outcrops, forested rocky outcrops, shrub, tree, and leaf litter) on color pattern variation in geckos. We created a database of 439 pictures of gecko species (only adults, and males for species with sexual dimorphism) and selected dorsal views of the trunk of the geckos for best assessment of color pattern. Activity time and habitat type were obtained for each species from published data. Photos of geckos were arranged along a gradient of similarity by seven independent people to assign a numeric value to each color pattern for the analyses. The influence of phylogeny on variation in color pattern was measured using a phylogenetic generalized least-squares approach. Our hypothesis is that phylogeny, time of activity and habitat type will all have a strong influence on geckos color pattern variation. We expect more disorganized patterns to be associated with nocturnal species and complex habitats for cryptic functions. Our results support the influence of phylogeny on color pattern variation ($\lambda$=0.42), with little or no significance of time of activity and habitat type.

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**0761 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Clark Morgan, Jim Gelsleichter

*University of North Florida, Jacksonville, Florida, USA*

## A Survey of Shark Abundance on Northeast Florida Beaches

Long-term abundance surveys are necessary for identifying trends in the status of fish populations that are the target of commercial and/or recreational fisheries. This is especially the case for populations of certain fish like sharks and their relatives, which grow slowly and often take a long period of time to rebuild from fishery-associated declines. In this presentation, we provide preliminary data on the species composition and abundance of shark populations that use nearshore waters on the northeast Florida coast from the initial years of a new survey focusing on shark abundance in coastal habitats. The overall goal of this survey is to examine long-term patterns in large and small coastal shark abundance on northeast Florida beaches along with conducting more comprehensive assessments of shark life history, especially reproduction, so that still-unclear questions about certain commercially- and/or recreationally-important shark

species can be addressed. These questions include but are not limited to: the status of state-protected, but largely unsurveyed species such as the lemon shark (*Negaprion brevirostris*) and tiger shark (*Galeocerdo cuvier*), the current status of aggressively managed large and small coastal shark species that have traditionally made up a significant contribution of commercial or recreational shark landings, and the reproductive biology of still-poorly studied species such as *N. brevirostris*.

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**0840 Herp Conservation & Ecology, Galerie 2, Sunday 10 July 2016**

Krista Mougey, Gad Perry

*Texas Tech University, Lubbock, Texas, USA*

## Status of the Stout Iguana (*Cyclura pinguis*) on Guana Island, British Virgin Islands

The stout iguana (*Cyclura pinguis*) is one of nine species of West Indian iguana that collectively are recognized as the single most endangered group of lizards in the world. The species was once ~~found throughout the Greater Puerto Rican Bank~~, but currently survives exclusively in the British Virgin Islands, with the only remaining natural population occurring on Anegada. Between 1984 and 1986, eight adult *C. pinguis* were translocated to Guana Island to found an insurance population, and offspring have been observed every year since 1987. In 2014 we conducted capture-mark-resight and distance sampling surveys to estimate population abundance on Guana. We captured 169 individuals and recorded over 800 sight and resight records of both marked and unmarked individuals within the core research area. An additional 154 iguana sightings were recorded during distance sampling protocols conducted in the outlying portions of the island. Abundance of the adult Guana *C. pinguis* population is estimated to be around 400 individuals, and at the beginning of the hatching season, there were also an estimated 150 hatchlings. Density remains low in areas with high feral sheep abundance. Current efforts to cull feral sheep may have dramatic impacts on the iguana population. As conservation concerns within the British Virgin Islands continue to increase, insurance populations, such as the one on Guana, may play a critical role in the long-term conservation of the species.



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**0820 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016**

Genevieve Mount, Jeremy Brown

*Louisiana State University, Baton Rogue, LA, USA*

### Climbing the Squamate Tree of Life: Do our current models provide robust trees?

The current trend in phylogenetics is to gather as much genetic data as possible in an attempt to provide fully resolved species trees. This trend is evident in efforts to reconstruct the squamate tree of life, with multiple recently published papers compiling increasing amounts of sequence data. Although these studies show consistent support for most major familial relationships, the underlying datasets are not independent and their results conflict strongly with relationships favored by morphological analyses. In order to evaluate whether the relationships favored by molecular studies are truly robust, we need to objectively test the rigor of their conclusions in a way that is not solely dependent on internal consistency. To accomplish this goal, we have developed and applied Bayesian posterior predictive methods to explore our confidence in the accuracy of phylogenetic conclusions based on currently available models of sequence evolution. Understanding how the adequacy of our models affects our inferences is a critical, yet underutilized, step for drawing robust phylogenetic conclusions from large datasets. Our analyses of the squamate tree of life data provide an example of how to use these methods and have also resulted in the development of novel test statistics and refined analytical strategies.

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**0543 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Kat Mowle, Jim Gelsleichter

*University of North Florida, Jacksonville, FL, USA*

### Characterization of the Vitellogenin Cycle in the Bonnethead Shark *Sphyrna tiburo*

Vitellogenin (Vtg) is a precursor to yolk-proteins that is known to be produced in the liver under the control of the hormone estradiol (E2) in reproductively active females of most non-mammalian vertebrates. Previous studies have examined Vtg production in a wide variety of fishes, but no studies to date have done so in a placental viviparous elasmobranch. Therefore, the purpose of this study is to examine Vtg production in a viviparous shark species, the yolk-sac placental bonnethead shark *Sphyrna tiburo*. Specifically, this study focuses on determining where Vtg is produced in *S. tiburo*, how reproductive steroid hormones influence Vtg production, and what temporal patterns occur in Vtg levels throughout the species' reproductive cycle. In this preliminary stage of this study, Vtg presence in the plasma of *S. tiburo* individuals from all reproductive stages was analyzed using immunoblotting techniques. So far, Vtg has been detected in the plasma of *S. tiburo* individuals collected in the fall postpartum/mating stage of their

reproductive cycle. Additional work will examine Vtg presence in *S. tiburo* liver and ovaries, and the presence of receptors for hormones likely involved in regulating Vtg production, including estradiol and progesterone, using immunocytochemistry and in situ hybridization.

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**0546 AES Morphology & Reproduction, Balconies L & M, Friday 8 July 2016**

Joshua Moyer, William Bemis

*Cornell University, Ithaca, NY, USA*

**Shark Teeth as Edged Weapons: Serrated Teeth of Three Species of Selachians**

Prior to European contact, South Pacific islanders used serrated shark teeth as components of tools and weapons. They did this because serrated shark teeth are remarkably effective at slicing through soft tissues. To understand more about the forms and functions of serrated shark teeth, we examined the morphology and histology of tooth serrations in three species: the Tiger Shark (*Galeocerdo cuvier*), Blue Shark (*Prionace glauca*), and White Shark (*Carcharodon carcharias*). We show that there are two basic types of serrations. Primary serrations consist of three layers of enameloid with underlying dentine filling the serration's base. All three species studied have primary serrations, although the dentine component differs (orthodentine in Tiger and Blue sharks; osteodentine in the White Shark). Smaller secondary serrations are found in the Tiger Shark, formed solely by enameloid with no contribution from underlying dentine. Secondary serrations are effectively "serrations within serrations" that allow teeth to cut at different scales. We propose that the cutting edges of Tiger Shark teeth, equipped with serrations at different scales, are linked to a diet that includes large, hard-shelled prey (e.g., sea turtles) as well as smaller, softer prey such as fishes. We discuss other aspects of serration form and function by making analogies to man-made cutting implements, such as knives and saws.

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**0508 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Andy Mueller, C.M. Gienger

*Austin Peay State University, Clarksville, TN, USA*

**Thermal Ecology of Copperheads (*Agkistrodon contortrix*)**

Body temperature is directly related to the physiology and behavior of ectotherms and the ability to thermoregulate is crucial for the survival and development of the organism. *Agkistrodon contortrix* (Copperhead snakes) are relatively common, wide-ranging viperids, and their sit-and-wait ambush foraging strategy suggests that they are more likely to be passive thermoconformers within their thermal environment than active thermoregulators. Evaluating the thermal ecology of copperheads requires us to

look at the body temperature of the snake ($T_b$), the operative temperatures available to snakes in their environment ($T_e$), and the preferred body temperature range of the snake ($T_{set}$). This study takes place at Land Between the Lakes National Recreation Area (LBL) in Kentucky, where 12 male snakes were implanted with radio transmitters and temperature dataloggers to record body temperature. Preliminary data will be used to estimate the degree to which snakes actively thermoregulate versus passively thermoconform to temperatures in their environment.

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**0213 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Christopher Mull, Nicholas Dulvy

*Simon Fraser University, Burnaby, BC, Canada*

**Size doesn't matter: offspring production scales across sharks, skates, rays and chimaeras**

Chondrichthyans are a unique clade that exhibits every described form of reproductive mode found in vertebrates, with large variation in reproductive traits (e.g. age at maturity, reproductive lifespan, fecundity). Measurements of offspring production are critical for addressing ecological and evolutionary hypotheses about life histories. Here we examine how total offspring production (biomass of offspring yr-1) and maternal investment (biomass of individual pups) vary with maternal body size across 624 chondrichthyan species. Total offspring production scales with maternal body mass across all species with mothers producing ~10% of their body mass in offspring yr-1. Around this scaling, variation is attributed predominantly to reproductive mode with live-bearing matrotrophs, specifically placental and lipid histotrophic species, exhibiting higher total offspring production. In contrast maternal investment did not scale with maternal mass and all variation was attributable to reproductive mode, with matrotrophic species exhibiting larger offspring relative to maternal size. Because much life history data in chondrichthyans is not complete and patterns of missing information are not completely random, observed patterns may be biased by the available data. To address this we also examine these same patterns using phylogenetically imputed life history traits. Incorporating phylogenetic information reduced the error rate of imputed missing values and observed patterns did not change. Phylogenetic imputation provides a potentially useful tool for generating reliable estimates of life history traits based on morphology, ecology and shared evolutionary history in lieu of difficult to obtain empirical measurements.

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**0333 HL: Social Behavior in Reptiles Symposium, Salon E, Saturday 9 July 2016**

Kirke Lindencrone Munch[1], Daniel Nobel[2], Geoffrey While[1]

*[1]University of Tasmania, Hobart, Australia, [2]University of New South Wales, Sydney, Australia*

**Mate familiarity influences social learning strategies in a monogamous lizard**

Evidence suggests that animals are able to acquire new information using different learning strategies. Social learning, whereby the action of an animal facilitates the acquisition of new information by another, was until recently thought taxonomically biased towards birds and mammals. However, species previously thought asocial, also benefit from using social learning to gain information about their environment. While strong reliance on socially acquired information appears as an optimal strategy for an animal as it limits the costly process of trial and error learning it might not always be the case as social information might be out-of-date or maladaptive in some contexts. The extent to which an animal prefers social over asocial information may be a result of its own ability to learn or the social status of individual it is learning from. Using *Liopholis whitii*, a long-term monogamous lizard from Eastern Australia, I examined whether social factors such as partner familiarity influenced the extent to which an individuals utilised social information. I found evidence that social status influenced a female's reliance on social learning with females demonstrated by their social partner learning both the association and the reversal tasks quicker and with fewer errors than females presented with unfamiliar demonstrators or those without demonstration. These findings present the first evidence of that social context affects learning strategies in lizards and suggests that lizards are able to differentiate among social cues and make weighted decisions on the reliability of the source of information.



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**0230 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

Bruce Mundy[1], Mackenzie Gerringer[2], Astrid Leitner[2], Randal Singer[3]

*[1]NOAA National Marine Fisheries Service Pacific Islands Fisheries Science Center, Honolulu, Hawai`i, USA, [2]University of Hawaii School of Ocean and Earth Science and Technology, Honolulu, Hawai`i, USA, [3]University of Florida, Florida Museum of Natural History, Gainesville, Florida, USA*

**Bridging a Deep Gap: First Records of Wide-spread Bathyal and Abyssal Fish Genera from the Central North Pacific Gyre**

The bathyal and abyssal benthic faunas of the central Pacific Ocean are among the most poorly known on Earth, even in the relatively well-studied Hawaiian Islands. The incomplete understanding of the deep-sea fish fauna of the central Pacific was emphasized by observations made in 2015 during telepresence-enabled surveys from the NOAA vessel *Okeanos Explorer* using an unmanned, remotely operated vehicle (ROV) in the Papahānaumokuākea Marine National Monument in the Northwestern Hawaiian

Islands, the Geologist Seamounts west-south-west of Hawai‘ i Island, Johnston Atoll, and the Karin Seamounts. The 32 ROV dives at 954-4829 m focused on manganese-encrusted ridges and seamounts that are difficult to sample using trawls and traps. Of the 33 fish genera observed, 8 (24%) had not previously been recorded from the central North Pacific and four others had been previously recorded only once. Because the *Okeanos Explorer* surveys focused on unexplored depths of the region, most of the genera seen (73%) were new records from one or more of the four areas surveyed. The distinctive genera newly recorded in the region from these surveys were the halosaurid *Halosaurus*, the synaphobranchid *Ilyophis*; an anguilliform resembling *Coloconger*; and the ophidiids *Bassogigas*, *Epetriodus*, *Eretmichthys*, *Leucicorus*, and a tentatively identified *Porogadus*. The Okeanos Explorer videos are the first records of live individuals in situ for most of those genera, as well as others seen during the expedition (e.g., *Venefica*, *Solocisquama*). Products of the *Okeanos Explorer* expeditions are available at links in the vessel's website (http://oceanexplorer.noaa.gov/okeanos/welcome.html).

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**1094 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

Thomas Munroe

*National Systematics Laboratory, Smithsonian Institution, Washington, DC, USA*

## Ocean Exploration, Morphological and Molecular Approaches Contribute to Discoveries of Unrecognized Diversity of Tonguefishes (Pleuronectiformes: Cynoglossidae)

Members of the flatfish family Cynoglossidae are small to medium-sized, sinistral flatfishes found worldwide in temperate and tropical seas. The majority of tonguefishes are small-sized species usually reaching adult sizes under 30 cm SL. Tonguefishes are found in a diversity of marine and estuarine habitats ranging from subtidal estuarine waters to deepwater habitats on the outer continental shelf and upper continental slope to about 1500 meters. With 164 species recognized in three genera (*Cynoglossus*, *Paraplagusia* and *Symphurus*), the Cynoglossidae is one of the most diverse of the 14 families of flatfishes (Pleuronectiformes). Among the genera, *Symphurus* is the most diverse (96 species), followed by *Cynoglossus* (60 species) and *Paraplagusia* (7 species). During the past 30 years, the recognized species diversity of tonguefishes has increased steadily with new species being discovered in a variety of marine habitats including those in shallow, tropical seas to deepwater habitats at hydrothermal vents. At present, 26 species representing 15.9% of the standing diversity of the family awaits description. Among these 26 species are 17 nominal species of *Symphurus*, eight species of *Cynoglossus*, and at least one species of *Paraplagusia*. Increased recognition of diversity within this family is being discovered in specimens collected in recent ocean exploration, re-examination of historical collections of specimens, and with identification of species complexes and cryptic species using molecular techniques.

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## 0039 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016

Henry Mushinsky

*University of South Florida, Tampa, FL, USA*

### On Being a Member of Professional Societies and President of the ASIH

Membership in professional societies has become less significant since the advent of all things electronic. The excitement of getting hard copies of journals because one belongs to a society is lost on most young scientists. Yet, senior scientists are loyal society members who receive journals and attend annual JMIH meetings; many continue to do so well after formal retirement. What is the magnet that continues to draw individuals into professional societies? I have always viewed the scientific program of a societal meeting as part of the whole, an equally important part is the camaraderie one develops with fellow colleagues and their students. The relationships established early in one's career can have profound lasting effects on your professional development and success. Individuals who become involved in their societies often are asked to participate in societal business and can assume leadership roles. As a past president of three North American herpetological societies I have found great satisfaction knowing that my contributions have helped shaped each society. Foremost in my mind is bringing together the AES, ASIH, HL, and the SSAR to establish the Joint Meeting of Ichthyologists and Herpetologists. The uniting of these four societies for an annual meeting could only be accomplished with substantial cooperation and trust by the officers of each society. A trust established through years of working toward a common goal. Young scientists need to step up and become leaders as the challenges to our societies grow greater each year.

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## 0071 Amphibian Reproduction & Herp Conservation, Galerie 3, Saturday 9 July 2016

Erin Muths[1], Brad Lambert[2], Scott Schneider[2], Rob Schorr[2], Larissa Bailey[3]

*[1]U.S. Geological Survey, Fort Collins, CO, USA, [2]Colorado Natural Heritage Program, Fort Collins, CO, USA, [3]Colorado State University, Fort Collins, CO, USA*

### Long-term Demography: Movements and disease

Information about population dynamics (e.g., movement of individuals among sites or among populations, changes in demography) *prior* to perturbation is lacking for many species of concern. Perturbations, caused by climate change, disease or other stressors can lead to population declines and conservation concerns. Without baseline information our ability to identify and respond to agents of population decline is challenged. Such information helps to establish the effects of, and then address, perceived stressors. There are only a handful of boreal toad (*Anaxyrus boreas*) populations remaining in the southern Rocky Mountains (SRM), USA and very few are disease-free. Boreal toads in the SRM putatively represent a distinct population segment and are being considered for Federal listing as endangered. Despite the apparent region-

wide occurrence of the amphibian chytrid fungus (Bd), our focal populations revealed no evidence of this pathogen until recently. Long-term data during a disease-free-phase elevate these populations to a vital resource for understanding the dynamics not only in this system but for inferring the consequences of disease to other similar systems. We present data on these populations from demographic and mechanical (the movement of animals and disease across the landscape) perspectives.

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**1064 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016**

Edward Myers[1], Frank Burbrink[1]

*[1]College of Staten Island - CUNY, Staten Island, NY, USA, [2]American Museum of Natural History, New York, NY, USA*

**Asynchronous diversification of snakes in the North American Warm Deserts**

The Western Continental Divide has been shown to be a phylogeographic break across a diversity of taxa within the warm deserts of North America. It is hypothesized that this region is a contact zone between closely related species that were previously isolated from one another during Quaternary glaciation in desert refugia. In spite of this barrier's importance in North American biogeography and biodiversity, no study has simultaneously examined multiple species spanning this region to investigate phylogeographic histories. Here, we have generated Rad-seq data to test competing models of demographic history and speciation in 13 co-distributed snake species complexes for a total of 475 individuals. Population structuring methods corroborate lineage divergence found in mtDNA highlighting the importance of this region in generating the biodiversity of western North America. Model testing of alternative demographic scenarios, however, suggest that each taxon pair has responded to past changes in climate asynchronously with contrasting demographic histories. This illustrates that the last glacial maximum has not been the driving force of diversification within this region and that there is little shared history among the taxa studied. Furthermore these results suggest that the snake fauna of this region are at different stages of the speciation continuum.

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**1018 Herp Conservation & Ecology, Galerie 2, Sunday 10 July 2016**

Melia Nafus[1], Todd Esque[2], Kenneth Nussear[3], Roy Averill-Murray[4], Ronald Swaisgood[1]

*[1]Institute for Conservation Research, San Diego Zoo Global, 15600 San Pasqual Rd. Escondido CA, 92027, USA, [2]U.S. Geological Survey, 160 N. Stephanie Street, Henderson, NV 89074, USA, [3]University of Nevada Reno, Department of Geography, 1664 N. Virginia St. Reno, Nevada, USA, [4]U.S. Fish and Wildlife Service, 1340 Financial BLVD, #234 Reno, Nevada 89502, USA*

## Seeking to Hide: Habitat Effects on Dispersal and Survival of Translocated Juvenile Desert Tortoises

In spite of growing use of translocation and reintroduction as conservation tools in wildlife conservation programs, their overall efficacy remains inconsistent. One of many factors that can contribute to failed translocations is the release of animals into poor quality or otherwise inadequate habitat, especially for reptiles. Here we sought to use a targeted approach to test the ability of habitat characteristics to improve translocation outcomes through reducing post-release dispersal and increasing survivorship of translocated juvenile desert tortoises (*Gopherus agassizii*). We selected three habitat characteristics, including burrow abundance, substrate, and dry water ways (washes), which have been tied to habitat selection, ecology, or fitness of desert tortoises. We subsequently tested the relationship of these habitat characteristics to dispersal, survival, and fatal encounters with predators up to one year after release. All three characteristics were important for either post-release dispersal or survival, but they were not all important for both. Overall, habitat characteristics were an effective tool to improve translocation outcomes in the first year after release.

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**1089 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Ashleigh Nakata, Leah Rice, Alexandria Martini, Abby Lindel, Kelsey Renfro, Stacy Kosiba, Michelle Norden

*Metropolitan State University of Denver, Denver, Colorado, USA*

## Male Choice and pair-bond success in the monogamous, biparental convict cichlid (*Amatitlania nigrofasciata*)

Most studies in sexual selection focus on female mate choice; however, in biparental organisms, male mate choice may be equally important. Convict cichlids (*Amatitlania nigrofasciatus*) are biparental and pair-bond formation significantly increases when males are given a choice of more than one female. In this study, we focused on male mate choice by determining which factors increase pair-bond formation. We predicted that pair-bond formation would increase when two females are present and when females interact in competition. This experiment had 4 treatment groups: 1 female, control; 2 females, no interaction; 2 females, with female interaction, without male observation; 2 females, with female interaction, with male observation. Females were separated into

their own compartments with the larger female on one side and the smaller female on the other side with a neutral compartment in the middle. Males had free range in the front of the tank to choose between the two females. An average of 5 observations of the males' location were taken every day for 21 days. The male's choice was defined as him spending at least 70% of the observations with one female. Male courtship is filmed for 15 minutes on days 1, 7, and 14 to confirm his choice. Preliminary data suggests that female interaction increases pair-bond formation and males prefer larger females.

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**0481 Fish Genetics, Salon D, Sunday 10 July 2016**

Chloe Nash, Michelle Kraczkowski, Barry Chernoff

*Wesleyan University, Middletown, CT, USA*

### Genetic Structure of *Atherinomorus stipes*, Hardhead Silverside, in Belize and Florida based upon *nd2*

Little is known about the natural history, biology, and population-genetic structure of the Hardhead Silverside, *Atherinomorus stipes*, a small schooling fish found throughout the Caribbean. Our field observations of *A. stipes* found that populations tend to be in close association with the shoreline in mangrove or seagrass habitats. Due to this potential island based population structuring, *A. stipes* presents an interesting opportunity to examine questions about gene flow, isolation by distance, and the number of colonization events at smaller and larger geographic scales. For this study, the mitochondrial gene *nd2* was amplified from 394 samples collected from seven different Belizean cays and from eight different Floridian keys. Results show surprisingly high haplotype diversity both within and between island groups, as well as a high prevalence of unique haplotypes within each island population. Interestingly, the island groups also exhibit similar genetic structures: high levels of heterogeneity and no correlation between geographic distance and genetic differentiation. Genetic divergence suggests that Belizean and Floridian groups have little to no geneflow between them; genetic divergence between Belizean and Floridian island groups averaged greater than 4%. Statistical analyses of each island group indicate that they are evolving under different models of evolution, suggesting that they are under differing selection pressures.

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**0799 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Cody Nash[1], Jill Hendon[2], Toby Daly-Engel[1]

*[1]University of West Florida, Pensacola, FL, USA, [2]Center for Fisheries Research and Development, Gulf Coast Research Laboratory, The University of Southern Mississippi, Ocean Springs, MS, USA*

## Frequency of multiple paternity in the finetooth shark, *Carcharhinus isodon*, in the Northern Gulf of Mexico

The finetooth shark, *Carcharhinus isodon*, is a poorly understood shark species inhabiting the coastal waters of the Southeastern U.S. They are a common shallow-water species found in the Atlantic Ocean from South Carolina to Florida as well as in the Gulf of Mexico (GoM). In the GoM, *C. isodon* is targeted by some artisanal and commercial fisheries and is regularly caught in others as by-catch. It is thought that they are currently being overfished in the GoM. Despite their ubiquity, little is known about their life history and reproductive biology. We seek to gain a better understanding of the reproductive biology of this species by determining the frequency of multiple paternity within a Northern GoM population. Samples have been collected off of the Mississippi coast from nearly 100 females and their litters over a period of three years. Ten or more species-specific and cross-amplified microsatellite loci will be used to estimate the number of non-maternal alleles within each litter. This will allow us to infer the frequency of multiple paternity in this population. Multiple paternity is common in sharks, and could have a significant impact on their genetic diversity. The evolution of this behavior is poorly understood, and further study could lead to deeper knowledge of its adaptive advantage. This, in turn, will allow for improved management decisions regarding *C. isodon* and other sharks.

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**0914 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

N. Nasif[1], R. Montero[1], G. Esteban[1], J. D. Daza[2]

*[1]Facultad de Ciencias Naturales e Instituto Miguel Lillo, INSUGEO, Universidad Nacional de Tucumán, San Miguel de Tucumán, Tucumán, Argentina, [2]Department of Biological Sciences, Sam Houston State University, Huntsville, Texas, USA*

## The first record of Amphisbaenidae (Squamata, Amphisbaenia) from northwestern Argentina (Andalhuala Formation), one of the oldest from South America (Zancleano, Early Pliocene)

The large outcrops from Puerta de Corral Quemado, Catamarca, Argentina, are exceptional because of the abundant and diverse vertebrate fossils. However, the knowledge of fossils other than mammals is very scarce. Here we present preliminary data from an amphisbaenid lizard from the Andalhuala formation (Late Miocene - Early Pliocene). The specimen is an almost complete and articulated skull. This fossil can be attributed the family Amphisbaenidae based on the following combination of characters: solid and strong skull, parietal roofing completely and closing the braincase laterally,

extensive basioccipital plate, sagittal crest, double occipital condyle; stout dentary. The fossil was temporary assigned to the genus *Amphisbaena* based on the presence of a low number of teeth, tooth crowns mostly straight, one enlarged tooth in the mandible, lack of retroarticular process, low saggital crest, columella with a large footplate directed lateroventrally. We cannot determine if this fossils belongs to any of the known species of the genus due to the anterior portion of the skull is missing (which would show characters that may define the species). The fossil was found in an upper layer of Andalhuala formation, and the estimated age ranges between 4.4 Ma and 3.66 + 0.05 Ma (Zancleano, Early Pliocene). This is the first record of an Amphisbenidae with exact chronestratrigrafic precedence and one of the oldest from South America.

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**0528 General Herpetology, Salon E, Thursday 7 July 2016**

Roman Nava-Landeros[1], Andrés Vega[1], Kris Kaiser[2], Jeanne Robertson[1]

*[1]California State University, Northridge, Northridge, CA, USA, [2]Pomona College, Pomona, CA, USA*

## Local Standard of Beauty: Non-clinal Assortative Mating Along a Red-eyed Treefrog Cline

Intraspecific clines provide key insights into the mechanisms that mediate lineage divergence. We examine the extent to which premating reproductive isolation varies along a genetic and phenotypic cline of populations of red-eyed treefrogs (*Agalychnis callidryas*) in Costa Rica and Panama. Our study had two aims: first, to quantify premating reproductive isolation (RI) using female mate choice and, second, to examine the relationship between reproductive isolation and phenotypic and genetic distance. We assessed female choice using a two-choice Y-design enclosure in three populations (Gamboa, Panama; Manzanillo and La Selva, Costa Rica). Females from each population were presented with a choice between a local and non-local male stimulus. We tested 38-40 females per population; 18-20 trials were conducted with the local and one non-local male and 20 trials with the alternate non-local male. For the male stimulus, we used plasticine models that were painted to represent focal populations and mounted on a rotating platform to simulate movement. Models were paired with population-appropriate acoustic stimuli. Choice was documented within a 10-minute trial. Log-linear modeling showed that females preferred local males, but assortative mating was not clinal. We quantified RI in JMATING and quantified genetic and phenotypic distances in calls and color as Euclidean distance. RI does not vary with genetic or phenotypic diversity. We discuss our finding of non-clinal assortative mating in red-eyed treefrogs in light expected levels of reproductive isolation for intraspecific populations.

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**0309 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Gavin Naylor[1], Jason Davies[2]

*[1]College of Charleston, Charleston, SC, USA, [2]Jason Davies Ltd, London, UK*

### An Interactive Online Database About the Biology of Sharks, Skates, Rays and Chimaeras

We have assembled an online database that, when completed, will provide information on all described extant species of sharks rays and chimaeras. Scientific illustrations and distribution maps will be provided for all currently described species, while interactive CT scans of skeletal elements will be included for representatives of most chondrichthyan families. The information is presented in an evolutionary framework derived from an analysis of genome scale DNA sequence data. We will demonstrate some of the key features and tools associated with the database during the presentation.

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**1109 ASIH STOYE AWARD CONSERVATION, Salon F-H, Friday 8 July 2016**

Kevin M. Neal, H. Bradley Shaffer

*UCLA Department of Ecology and Evolutionary Biology, Los Angeles, CA, USA*

### Population Genetic Structure and Conservation Units of the Western Spadefoot Toad, *Spea hammondii*

The western spadefoot toad, *Spea hammondii*, is well-recognized as a threatened species: California has identified it as a Species of Special Concern, and the U.S. Fish and Wildlife Service has concluded that a 12-month review to consider listing under the Endangered Species Act is justified. *S. hammondii*, however, covers a substantial range, from Northern California into Baja California, and without further analysis it is unclear if different management practices may be merited for different populations within the species. Using five nuclear loci, I assessed the spatial genetic structure of *S. hammondii* using STRUCTURE. The delta-K method supported K=2, with distinct northern and southern clusters split by the Transverse Ranges in south-central California. K=3, showing the highest likelihood, revealed additional substructure in the northern cluster, with the Southern Coast Ranges appearing to isolate individuals from a Central Valley and Santa Barbara cluster. The clustering of Santa Barbara individuals with Central Valley individuals, despite being much closer geographically to the Southern Coast Ranges cluster, suggests Santa Barbara may host a relict population of Central Valley spadefoots or that the Southern Coast Ranges cluster may be experiencing divergent selection. A mitochondrial DNA phylogeny additionally supports the hierarchical STRUCTURE clusters. These results, demonstrating strong spatial genetic clustering, indicate that populations of *S. hammondii* may merit independent consideration as conservation units.

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**0869 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Melissa Nehmens[1], Kevin Feldheim[2], David Ebert[1]

*[1]Pacific Shark Research Center, Moss Landing Marine Laboratories, 8272 Moss Landing Rd., Moss Landing, CA 95039, USA, [2]Field Museum, Pritzker Laboratory for Molecular Systematics and Evolution, Chicago, IL, USA*

## What Are They Doing Down There: An Investigation of Multiple Paternity in a Deep-Sea Shark

The Southern Lanternshark, *Etmopterus granulosus*, is a deep-sea shark commonly found throughout the southern oceans and frequently caught as bycatch in deep-sea fisheries. Outside of Australian and New Zealand waters little information is available on its reproductive biology, including multiple paternity. To date, few studies have been undertaken to determine whether multiple paternity occurs in deep-sea species such as *E. granulosus*. In this study, 18 litters of *E. granulosus* were opportunistically collected as bycatch along the Madagascar Ridge and Walter Shoal in the Southwestern Indian Ocean and examined for multiple paternity. Novel microsatellite markers were developed to test for the presence and frequency of multiple paternity. Additionally, litter size and polyandry as they relate to female size were examined to determine if a relationship exists between these parameters. As a reproductive strategy, multiple paternity may greatly benefit the overall fitness of the population and individual females by increasing genetic diversity. Examination of the mating system in this common deep-sea species will improve our understanding of its life history, and may have important conservation and fisheries management implications.

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**0381 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Emily Nelson, Hannah Calich, Neil Hammerschlag

*University of Miami, Miami, FL, USA*

## Shark Abundance and CPUE in South Florida: A habitat use analysis using ArcGIS

Predator abundance can have far-reaching impacts on ecosystem structure, functioning, and resilience through top-down pathways. At healthy numbers, predators such as sharks serve to keep population levels in check throughout the entire food web. However, sharks are experiencing significant population declines due to anthropogenic impacts such as overfishing. We present data from an ongoing shark abundance and movement study in South Florida. ArcGIS was used to quantify the habitat use of 13 shark species in the sub-tropical Atlantic Ocean and Gulf of Mexico from 2008 to 2016. Spatiotemporal trends in shark abundance and catch per unit effort (CPUE) were examined in relation to shark sex and maturity level. The study examines habitat use for the various species in relation to a number of different variables including season, sex,

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and maturity level. Changes in habitat use over time (particularly with relation to increasing anthropogenic impact) can help to predict abundance, movement, and habitat preferences of sharks. This is especially important in forming effective management and prioritizing areas for conservation.

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**0860 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Tyler Newburn[1], Michael Sandel[1], Casey Morrow[2]

[1]*University of West Alabama, Livingston, AL, USA,* [2]*University of Alabama at Birmingham, Birmingham, AL, USA*

## Characterization of the Dermal Mucosal Microbiome of Red Drum (*Sciaenops ocellatus*)

The teleost dermal mucosa is a host-mediated ecosystem for commensal microbes, and the first line of defense against pathogens. Despite advances in microbial taxonomy and DNA sequencing technology, microbial diversity within fish "slime" remains poorly described. We provide the first description of a microbiome in the dermal mucosa of the Red Drum (*Sciaenops ocellatus*), a euryhaline sportfish of conservation concern in the southeastern United States. Following the Deepwater Horizon Oil Spill, Red Drum became an important target for microbial surveillance, because an outbreak of dermal lesions was reportedly due to *Mycobacterium ulcerans* – the etiologic agent for Buruli Ulcer. We hypothesized that *M. ulcerans* was carried east along the Gulf Loop Current during and after the Oil Spill. To test the hypothesis, and to characterize the dermal mucosal microbiome of healthy Red Drum, we collected 75 specimens from coastal waters of Mississippi, Alabama, and Florida. We applied Next Generation Sequencing to quantify the proportion of DNA fragments assigned to known microbe families, genera, and species. We report substantial variation in microbiome diversity in the dermal mucosa of Red Drum, but low incidence (0-3%) of *Mycobacterium*. Results show that Proteobacteria, including *Vibrio* sp. dominate the dermal mucosa of Red Drum, at least in marine environments. The apparently low incidence of *Mycobacterium* is discussed, and two new hypotheses are posed to explain disease variability documented since 2013. Ongoing research seeks to identify the mechanism for host mediation of the dermal microbiome, and to identify keystone microbial species within this largely unexplored ecosystem.

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**1012 Herp Biogeography, Salon D, Friday 8 July 2016**

Catherine Newman, Christopher Austin

*Louisiana State University, Baton Rouge, LA, USA*

### Reconstructing the evolutionary history of a large-genome salamander, *Plethodon serratus*, using next-generation sequencing of ultraconserved elements

Studies of amphibian phylogenetics have largely failed to adopt new methods using next generation sequencing technology, primarily due to the extremely large genome size of many species – especially salamanders. We use a salamander endemic to the southeastern US, *Plethodon serratus*, to test the utility of an established protocol for next generation sequencing of ultraconserved elements (UCEs) in resolving instraspecific systematics and evolutionary history. We apply genetics and spatially explicit climate analyses to test the hypothesis that the disjunct regions of the *P. serratus* species range are climatic refugia and that the species was more broadly distributed during glacial maxima. Despite the challenges of applying next generation sequencing methods to organisms with large genomes, we were able to generate a data set consisting of over 600 million reads for 87 *P. serratus* samples. Phylogenies of concatenated data sets are largely concordant with previous analyses of Sanger data, but the UCE data set yields phylogenies with stronger nodal support, clarifying relationships among clades. Results show that *P. serratus* is comprised of multiple lineages, and the four regions are not reciprocally monophyletic. Niche and paleodistribution modeling results suggest that *P. serratus* expanded from the Appalachians during the cooler Last Glacial Maximum and has since been restricted to its current disjunct distribution by a warming climate. Our results demonstrate that established UCE protocols can successfully be used to reconstruct intraspecific phylogenies of salamander species, providing a powerful tool for future studies on evolutionary biogeography of amphibians and other organisms with large genomes.

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**0403 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Kyle Newton, Stephen Kajiura

*Florida Atlantic University, Boca Raton, FL, USA*

### I Knew I Should've Taken That Left Turn in Albuquerque: Using Magnetic Field Polarity to Solve a Navigational Task in the Yellow Stingray, *Urobatis jamaicensis*

Our previous work has demonstrated that yellow stingrays can detect changes in magnetic field strength and inclination angle, learn a behavioral task and remember it for up to six months. This study tests the hypothesis that stingrays can use magnetic cues to solve a navigational task. Yellow stingrays were held in a flow through seawater tank under a 12:12 hour light-dark cycle, fed every two days, and allowed to acclimate to the experimental apparatus for seven days. Prior to training the stingrays were fasted to

increase motivation. Training sessions occurred every two days and consisted of 10 two-minute trails per session. Each magnetic stimulus training trial consisted of placing an individual stingray into a T-maze with the starting arm aligned with the axis of the local geomagnetic field. The magnetic field polarity at intersection of the T-maze was randomly manipulated 90 degrees to the left or right such that north always indicated the correct, and south indicated the incorrect, arm to receive the food reward. The learning criterion was defined as the stingray making the correct choice ≥70% during a training session for three consecutive sessions. Once the criterion was met the training stopped and the stingrays were reverse trained to associate south with the food reward. Stingrays were exposed to progressively smaller changes in stimuli to determine the threshold for a behavioral response. Threshold responses were used to determine the feasibility of a stingray using the geomagnetic field polarity as a cue during a biologically relevant navigational task.

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**0272 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Stuart V Nielsen[1], Paul M Oliver[2]

*[1]University of Mississippi, Oxford, MS, USA, [2]Australian National University, Canberra, ACT, Australia*

## Stripes, jewels and spines: further investigations into the evolution of defensive strategies in a chemically defended gecko radiation (*Strophurus*, Diplodactylidae)

The geckos in the genus *Strophurus* (Diplodactylidae) are one of only two squamate lineages with specialized caudal defensive glands. Many species in this genus also have distinctive caudal ornamentation combined with bright and/or contrasting colour pattern elements on the iris, tail and especially the lining of the mouth that are hypothesized to be adaptations for specialized, deimatic defensive functions. We present the first multilocus, phylogenetic analysis of the biogeography and evolution of all recognized taxa of *Strophurus*. Contrary to previous phenotypic and ecological assessments, our phylogenetic analyses delineate four divergent lineages. Three lineages are relatively small, species-poor, cryptically coloured and lack precloacal pores and putative deimatic elements. In contrast, the remaining lineage is comparatively species rich, attains a larger body size, possesses precloacal pores and shows extensive variation in caudal ornamentation and often bright and/or contrasting eye, tail and mouth coloration. The three less diverse lineages have smaller distributions and tend to be associated with spinifex hummock grasses or rocks, whereas the fourth is much more widespread and utilizes exposed diurnal microhabitats on shrubs and trees. Biogeographical analyses also indicate that – in contrast to many other Australian radiations – the arid biome is the ancestral area of occupation for *Strophurus*, with multiple inferred shifts into surrounding sclerophyll and monsoon biomes. This study emphasizes that – independent of caudal defensive glands – it appears to be a shift in

microhabitat use that correlates with the accumulation of bright and contrasting coloration elements, secondary sexual characters and the widest geographic distribution.

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**0955 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Adrián Nieto-Montes de Oca[2], Anthony Barley[1], Rubi Meza-Lázaro[2], Uri García-Vázquez[2], Joan Zamora-Abrego[3], Robert Thomson[1], Adam Leaché[4]

*[1]University of Hawaii, Honolulu, HI, USA, [2]Universidad Nacional Autónoma de México, Ciudad Universitaria, México, Mexico, [3]Universidad Nacional de Colombia, Medellín, Antioquía, Colombia, [4]University of Washington, Seattle, WA, USA*

**Phylogenomics of the knob-scaled lizards (*Xenosaurus*)**

Knob-scaled lizards of the genus *Xenosaurus* are a unique radiation of lizards that are highly genetically and phenotypically distinct from their closest living relatives. Species of *Xenosaurus* are generally characterized as being crevice-dwelling habitat specialists with small, patchy geographic distributions. The evolutionary history of this group has never been investigated using molecular data. We use a genomic dataset collected for all described species and subspecies to reconstruct a well resolved phylogeny for the genus, and examine species limits. By employing a broad suite of phylogenetic models, we find *Xenosaurus* to be composed of four major clades that are concordant with different Mexican biogeographic regions. We also find that species diversity in knob-scaled lizards appears to be underestimated by current taxonomy.

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**0895 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Zachary Nikolakis[1], Melissa Miller[1], John Kinsella[2], Josh Friers[3], Lindsey Garner[4], Frank Mazzotti[4], Craig Guyer[1], Christina Romagosa[0]

*[1]Auburn University, Auburn, AL, USA, [2]Helmwest Laboratories, Missoula, MT, USA, [3]US Department of Agriculture Wildlife Services, Homestead, FL, USA, [4]University of Florida Research and Education Center, Davie, FL, USA, [5]Wildlife, Ecology and Conservation, University of Florida, Gainesville, FL, USA*

**Novel Host-Parasite Records from Non-Native Lizards in South Florida**

Non-indigenous species (NIS) of reptiles have inhabited southern Florida since the 1800's; yet, little is known of their potential to introduce parasites and pathogens within their invaded range. Novel parasites introduced by NIS lizards may adversely affect native taxa that are immunologically naïve. We investigated the host-parasite relationships of NIS lizards collected from southern Florida to identify their endoparasites and to explore their potential for introducing non-native parasites to native taxa. Intestinal and lung parasites were recovered from 6 of 9 wild-caught NIS

lizard species. We identified a total of 13 parasite species using morphological and molecular analyses. We report four parasite species (*Sambonia lohrmanni, Ozolaimus megatyphlon*, *O. cirratus*, and *Raillietiella affinis*) novel to North America as well as the first documentation of a snake parasite (*R. orientalis)* infecting lizards. Parasite prevalence and infection intensity are reported for species (*Varanus niloticus,* n= 51; *Tupinambis merianae,* n= 535) from which we were able to obtain large samples sizes. Prevalence of *R. orientalis* was 3.2 % in *T. merianae* and average infection intensity was 1.54 parasites per host. Prevalence of *S. lohrmanni* was 4.1 % in *V. niloticus* with an infection intensity of 1.0 parasite per host. Our results suggest that native reptilian taxa may be at risk of infection by novel parasites. Furthermore, the effect of novel parasites on native reptiles may be exacerbated if native reptiles are immunologically naïve to NIS parasites, reducing their ability to tolerate or mitigate infection.

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**0595 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Brad Norman, Samantha Reynolds, David Morgan

*Murdoch University, Western Australia, Australia*

## Does the whale shark aggregate along the Western Australian coastline beyond Ningaloo Reef?

Whale sharks (*Rhincodon typus*) seasonally aggregate at Western Australia's Ningaloo Reef in the Austral autumn and winter, but their occurrence beyond this region during spring and summer remains elusive. The aggregation at Ningaloo Reef coincides with a pulse of productivity following mass coral spawning in early autumn, with the population during this period dominated by juveniles that amass for feeding purposes. To investigate their movement patterns beyond Ningaloo Reef, whale sharks were fitted with SPOT (n = 13) or SPLASH (n = 1) tags between April and September (2010 - 2014). Tagged whale sharks ranged in total length (TL) from 3.5 to 9 m. Each whale shark was also photographed for their subsequent identification using Wildbook for Whale Sharks, and their years of residency at Ningaloo Reef determined. Temporal and spatial observations of whale shark sightings were also determined through the conducting of interviews with people throughout 14 coastal towns along the Western Australian coastline, as well as through historical sightings and the Wildbook database. Satellite tracking revealed that all sharks remained within relative close proximity to the Western Australian coast, travelling a mean minimum distance of 1667 (+304 SE) km. Public reports, coupled with satellite tracking, demonstrated that whale sharks inhabit the majority of the Western Australian coast (from 35°S to 12°S), and that seasonal migrations beyond Ningaloo Reef may be to the north or south and may similarly be associated with areas of increased productivity.



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**0057 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Andrew Nosal[1], Daniel Cartamil[1], Chi Lam[2], Philip Hastings[1]

*[1]Scripps Institution of Oceanography, La Jolla, CA, USA, [2]University of Massachusetts - Boston, Boston, MA, USA*

## Movement Ecology of Juvenile Blue (*Prionace glauca*) and Mako Sharks (*Isurus oxyrinchus*) off Southern California and Baja California, Mexico

The movements of juvenile Blue (*Prionace glauca*) and Mako Sharks (*Isurus oxyrinchus*) were quantified off southern California and Baja California, Mexico. Five Blues (mean FL=77±11 cm; range: 67-95 cm) and five Makos (mean FL=80±9 cm; range: 70-89 cm were tagged with pop-up archival X-Tags (Microwave Telemetry). The tracking periods ranged from 13 to 86 d (mean=45±24 d) with net displacement between tagging and pop-up locations averaging 259±90 km for Blues (range: 167-375 km) and 265±164 km for Makos (range: 95-501 km). Based on geolocation estimates, horizontal movements occupied an area from the continental slope to approximately 400 km offshore. Both species spent the majority of their time just below the surface with only occasional dives below 50 m (Blue max depth: 224 m; Mako max depth: 194 m). Both species exhibited diel vertical migration, with that of Blues being particularly pronounced, generally occupying deeper water at night (day: 77.3% of time spent at <2 m and 21.3% at 2-50 m; night: 45.8% at 0-2 m and 52.5% at 2-50 m). In contrast, Makos generally occupied shallower water at night (day: 19.7% of time spent at <2 m and 77.8% at 2-50 m; night: 31.4% at 0-2 m and 67.3% at 2-50 m). Unique to Makos was a conspicuous avoidance of surface waters between approximately 0900 and 1500 h, which may be related to thermoregulation. This is the first study to track such small Mako and Blue Sharks and offers insight into nursery habitat and niche partitioning amongst juvenile pelagic sharks.

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**0774 AES GRUBER AWARD, Balconies J & K, Thursday 7 July 2016**

Robert Nowicki, Michael Heithaus

*Florida International University, Miami, FL, USA*

## Response of an apex predator, the tiger shark, *Galeocerdo cuvier*, to widespread seagrass decline

Seagrasses support a wide variety of taxa through their extensive ecosystem functions. These functions include provisioning of food as well as habitat. Despite their functional importance, seagrasses are declining worldwide at a rapid and accelerating rate. These declines have strong implications for seagrass associated communities which rely on them. While the effects of seagrass loss have been documented on some megafauna like green turtles (*Chelonia mydas*), there is relatively little information on how such declines impact highly mobile apex predators like large sharks. Because of their trophic removal from seagrasses and the variability of loss effects on shark prey, large sharks may exhibit different responses to resource decline than anticipated. Here we use a long term dataset

of prey abundance and shark catch data to assess the effects of a widespread seagrass decline on the tiger shark community of Shark Bay, Western Australia. We find that though some shark prey appear less abundant, tiger sharks themselves may exhibit resilience to resource loss. We further discuss what may drive the observed patterns and what this may mean more generally.

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**0172 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Leroy Nuñez, Kenneth Krysko, Michael Avery

*University of Florida, Gainesville, FL, USA*

## Molecular analyses of two non-indigenous lizard species in Florida: testing hypotheses of introduction pathways, species identity, and native range origins

As of 2010, Florida had the largest number of introduced and established non-indigenous herpetofaunal species in the entire world (Krysko et al 2011a). With the advent of molecular methodologies, we have the capabilities to test hypotheses regarding introduction pathways, species identity, and native range origins. This study examines two cases of introduced and established lizard species in Florida. The first example involves the Black Spiny-tailed Iguana, *Ctenosaura similis* (Gray 1831), and its introduction and subsequent range expansion is hypothesized to have originated from a single introduction event along the southwestern coast on Gasparilla Island, where an island resident released three lizards originally taken from Mexico for pets in the late 1970s. To test this invasion pathway hypothesis, we analyzed genetic diversity of mitochondrial DNA (mtDNA) from individuals collected along the southwestern coast and compared them with individuals from other introduced populations in Florida. The second example involves African Agamas, *Agama* Daudin 1802, and its identity is hypothesized to be the African Rainbow Lizard, *A. agama africana* Hallowell 1844, based on color patterns and hypothesized origins (i.e., Benin, Ghana, and Togo) of imported specimens for the pet trade. Recent systematic studies within the native range of the *Agama* complex have resulted in multiple taxonomic revisions. Because native range sequence data are now available on GenBank, we compared sequence data from introduced *Agama* collected in Florida to test hypotheses regarding species identity and native range origins.

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**0212 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016**

Martin O'Connell

*University of New Orleans, New Orleans, Louisiana, USA*

### Lessons from Long-term Studies of Fish Assemblages in the Pontchartrain Basin, Louisiana

In the Pontchartrain Basin of southeastern Louisiana, fish assemblages consist of a combination of freshwater, estuarine-resident, estuarine-dependent, and marine species. Assessing both natural and anthropogenic impacts on these assemblages can be difficult in that many of these species are adapted to be resilient to environmental change and the estuarine habitats they inhabit are highly variable by definition. Scientists and graduate students of the Nekton Research Laboratory (NRL) at the University of New Orleans have used long-term and historical data as a means to better detect event-driven changes in fish assemblages. Analyzing long-term data gives the researcher the ability to separate the 'signal' from the 'noise' using larger sets of data. Through this approach, the NRL has been able to successfully study potential environmental impacts from hurricanes, oil spills, river spillway openings, and other events. These research projects have provided insights as to what works best when using long-term fish assemblage data from estuarine habitats. First, if one uses historical data collected by someone else, then all attempts should be made to interact personally with these scientists and learn first-hand about the details of the data collection. Second, do not be afraid to use 'messy' historical data sets. These can often be salvaged through proper database management, even if large portions of data may be unusable. Third, a master's degree is often time-limited to about two years. Allowing the student to combine current and historical data provides her or him more information to develop a useful research project.

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**0640 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Katherine O'Donnell[1], Fred Johnson[1], Mathieu Bonneau[2], Julien Martin[1], Paul Fackler[3], Susan Walls[1]

*[1]US Geological Survey, Wetland and Aquatic Research Center, Gainesville, FL, USA, [2]University of Florida, Wildlife Ecology and Conservation, Gainesville, FL, USA, [3]North Carolina State University, Agriculture and Resource Economics, Raleigh, NC, USA*

### Using Structured Decision Making (SDM) and Category Count Models to Develop Optimal Management Policies for Imperiled Salamander Recovery

Frosted flatwoods salamanders, *Ambystoma cingulatum*, are federally-listed pond-breeding salamanders that inhabit pine-wiregrass ecosystems. They have likely declined due to destruction of longleaf pine ecosystems and habitat degradation from fire suppression. To explicitly address uncertainty regarding habitat restoration needs for flatwoods salamander recovery, we used structured decision making to develop an adaptive management framework for St. Marks NWR. We identified the need for state-

dependent decisions, and defined states as combinations of habitat suitability (***U***nsuitable or ***S***uitable) and occupancy (***O***ccupied or ***U***noccupied): S/O; S/U; U/O; U/U. We specified management actions for each state, and used expert elicitation to generate transition probabilities between states under two management portfolios: (A) "future status quo" (frequent growing season burns), and (B) additional actions (head-starting, fine-scale restoration). We then used stochastic dynamic programming (category count model) to develop a preliminary optimal management policy.

We first estimated the ecological damage cost of each state - representing the projected total cost to restore a pond to target state S/O. We projected that additional management actions (portfolio B) would decrease projected restoration costs (mean = 67.7%). The time to reach the S/O state would also decrease under portfolio B - U/U, S/U, and U/O ponds would require 83.0%, 71.9%, and 73.0% less time to reach state S/O, respectively. Our preliminary optimal management policy is to use the additional actions (portfolio B), except when confidence in portfolio B is low (<10%). Although portfolio B is more costly than A per year, reduced time to reach state S/O outweighs the additional cost.

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**0293 Fish Genetics, Salon D, Sunday 10 July 2016**

Shannon J. O'Leary[1], Christopher M. Hollenbeck[2], John R. Gold[1], David S. Portnoy[2]

*[1]Harte Research Institute, Texas A&M Corpus Christi, Corpus Christi, TX, USA, [2]Life Science Department, Texas A&M Corpus Christi, Corpus Christi, TX, USA*

**Genomics as a Tool for Restoration Enhancement of Southern Flounder**

Southern flounder, *Paralichthys lethostigma*, historically supported a substantial fishery along the Texas coast. Recent low year-class strength have raised concerns that spawning stocks may be overfished. Current management plans include rearing juveniles in hatcheries to restock Texas bays and estuaries. Here, we used two hatchery-reared families consisting of two sets of parents and approximately 200 offspring and double digest restriction-site-associated DNA (ddRAD) sequencing to create a reduced representation library consisting of several thousand single-nucleotide polymorphisms located throughout the genome. The relative position of these markers was determined to create a high-density genetic map spanning 24 linkage groups corresponding to southern flounder chromosomes. Further, this map was used to identify regions of shared synteny between southern flounder and other fish species for which genome assemblies are available. The same markers can be used to determine patterns of population structure and connectivity between wild populations in Texas bays and estuaries. In combination, this information will enrich the restoration efforts by providing the foundation for brood-selection based on inherent spatial genetic variation within the species and ultimately furthering the understanding of the adaptive potential and resilience of southern flounder to future changes in local environmental conditions.

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**0148 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Glynn O'Neill, Brannon Hardy, Prosanta Chakrabarty

*LSU Museum of Natural Science, Baton Rouge, LA, USA*

**Updating Fish Distributions Five Years After the Gulf of Mexico Oil Spill**

The effects of the 2010 Gulf of Mexico Oil Spill on the endemic marine ichthyofauna is still not well known. To assist in solving this problem we have examined collection's records for each of the 77 endemic Gulf fish species. The information was gathered using the Global Biodiversity Information Facility, also known as GBIF, and FishNet2. From our work we hope that this information can be used to determine which species have been affected by the oil spill and which ones need to be the target of conservation efforts.

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**0029 AES Genetics, Genomics, Biogeography, & Systematics, Balconies J & K, Saturday 9 July 2016**

Owen O'Shea[1], Elizabeth Wallace[2]

*[1]Cape Eleuthera Insitute, Eleuthera, Bahamas, [2]Florida Fish and Wildlife Conservation Commision, Florida, USA*

**Gene flow and connectivity in an elusive batoid from The Bahamas**

Anthropogenic incursions to coastal habitats have the potential to disrupt residency patterns and connectivity among stingray populations. Furthermore, these impacts may disrupt migratory pathways, particularly in island nations where deep ocean troughs provide challenges to dispersal and potentially, population renewal. The Caribbean whiptail stingray (*Himantura schmardae*) is an elusive dasyatid, popular in anecdote, rare in its known range, only recorded in The Bahamas from one sighting in 1968 and which taxonomic placement remains to be fully evaluated. This research aims to determine genetic connectivity of seemingly isolated populations of this ray across multiple spatial scales within the Exuma Sound, central Bahamas. Genomic DNA will be obtained from wild rays across three locations spanning from south Eleuthera to Great Exuma including The Exuma island chain. Genetic samples will be analysed by amplifying the mitochondrial cytochrome b gene to verify species, before all individuals are screened for a large array of single nucleotide polymorphisms (SNPs) to determine genetic population structure and familial relationships. The novel SNP array will be developed using advanced next generation sequencing technology. This next-generation methodology will allow for the determination of high-resolution genetic relatedness over restricted temporal scales highlighting potential migratory pathways across just one or two generations, instead of traditional historical radiation. These data can be used to directly create frameworks for management and conservation initiatives in The

Bahamas for coastal and nearshore environments, but also provide much needed data on this cryptic species in the northern portion of its range.

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**0275 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Luz Ochoa[1], Fabio Roxo[1], Alessio Datovo[2], Mark Sabaj[3], Claudio Oliveira[1]

*[1]Universidade Estadual Paulista Julio de Mezquita Filho, Botucatu, São Paulo, Brazil, [2]Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil, [3]The Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA*

## Molecular phylogeny and diversification process of the family Trichomycteridae (Actinopterygii: Siluriformes)

The spectacular diversity of Life on earth is the result of intricate biological process such as adaptive radiations and allopatric speciation, which are strongly dependents on historical and ecological events. These processes are characterized by rapid diversification into staggering numbers of species and phenotypes. The Trichomycteridae is the second most diverse family of the order Siluriformes with about 284 valid species. Its members are widely distributed through the freshwaters of Central and South America, exhibiting an exceptional ecological and phenotypic disparity. Trichomycterid diversity is unevenly distributed across the family with 72% of species concentrated into a single subfamily, Trichomycterinae. Patterns of high richness of species and morphological diversity has been observed in different groups of species and associated mainly with process of rapid diversification and adaptive radiation, that can be evaluated through the identification of rapid changes in evolutionary rates. Using a time calibrated molecular phylogeny of Trichomycteridae and speciation analysis in BAMM, we identified high and constant increasing in diversification rate in a monophyletic Trichomycterinae. This result suggests that allopatric speciation associated with geological and climatic changes in South America might have played a central role in the diversification of the subfamily. The probable absence of historical and current competitors and predators in rheophilics habitats where trichomycterids live may suggest that ecological opportunity could have played a role in facilitating the accelerated evolution in ancestral lineages of this group.

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**1022 Fish Conservation & Morphology, Galerie 2, Sunday 10 July 2016**

Charles W. Olaya-Nieto, Ángel L. Martínez-González, Fredys F. Segura-Guevara

*Fishery Biology Research Laboratory-FBRL, Department of Aquatic Sciences. University of Cordoba, Lorica, Cordoba, Colombia*

## Multiannual Length-Weight Relationship of Moncholo *Hoplias malabaricus* in the Cienaga de Ayapel, Colombia

To estimate the Length-weight of Moncholo *Hoplias malabaricus* in the Cienaga de Ayapel, 2407 specimens were collected among 2006 and 2010 years. The size ranged between 19.3 and 44.1 cm TL, the total weight between 62.0 and 1158.0 g and the mean length in the catch was 32.4 cm TL. The length-weight relationship was TW = 0.004 (± 0.07) LT3.28 (± 0.05), r =0.95, n =2407. All growth coefficients were positive allometric, including the 2006-2010 period, ranging from 3.09 (2010 year) to 3.19 (2007 year), without statistically significant differences, while the condition factor ranged from 0.006 (2007 and 2009 years) to 0.008 (2010 year), also with no significant statistical difference. As no statistically significant differences were found between growth coefficients neither among condition factors, estimated parameters of length-weight relationship, it is inferred that Moncholo has maintained its growth momentum in the Cienaga de Ayapel.

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**1090 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jesse Olsen[1], Kapil Mandrekar[2], Donald Stewart[2]

*[1]Review Only Synchronized breathing and sound production of juvenile Arapaima Mu□ller, 1843 (Osteoglossiformes: Osteoglossidae) Journal: Neotropical Ichthyology Manuscript ID NI-2015-0136.R1 Manus, Blacksburg, VA, USA, [2]State University of New York College of Environmental Sciences and Forestry, Syracuse, NY, USA*

## Synchronized Breathing and Sound Production of Juvenile *Arapaima* Mu□ller, 1843 (Osteoglossiformes: Osteoglossidae)

*Arapaima* spp. (Mu□ller, 1843) are large, commercially important freshwater fishes endemic to the Amazon and Essequibo rivers of South America. Arapaima are obligate air breathers with amodified lung-like swim bladder. Surfacing to respire exposes arapaima to heightened predation risk, especially small juveniles. Surfacing in synchrony could reduce predation risk of individual arapaima. Many fishes produce characteristic sounds as a predation defense when attacked, however, these sounds have not been reported for arapaima. An investigation of predation defenses of juvenile arapaima was conducted by quantifying breathing frequency patterns over a diel cycle. Also, the ability to produce disturbance sounds was evaluated by grasping the fish. Young arapaima exhibited synchronized breathing throughout the day; mean number of arapaima per breathing event was significantly higher ($p < 0.01$) during daylight than after dark. More pronounced synchronized breathing during daytime suggests a response to greater predation risk. Sounds were recorded from juvenile arapaima; however, these sounds did not appear to have characteristics typical of disturbance

sounds. This first demonstration of sound production by arapaima raises the possibility that these sounds could be used in various social contexts. Further investigations are needed to determine how these arapaima sound signals are used.

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**0419 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Emily Olson, Matthew Davis

*St. Cloud State University, Saint Cloud, MN, USA*

**The Evolution of Fangs in Lizardfishes and their Allies (Teleostei: Aulopiformes)**

The extreme habitats of the deep sea (depths ≥200 m) have produced fascinating evolutionary transformations among the >5,000 species of marine fishes that have invaded this realm. These transformations include thin/reduced bones, hermaphroditism, enlarged or reduced eyes, and large mouths with dagger-like teeth. This study focuses on one such lineage of deep-sea fishes that have evolved enlarged fangs, the order Aulopiformes (lizardfishes). Lizardfishes are predatory fishes that feed on marine vertebrates and invertebrates and are considered key predators in their various ecosystems. Some aulopiform fishes, including lancetfishes (Alepisauridae) and sabretooth fishes (Evermannellidae), have evolved enlarged fangs. The goal of this study is to explore the evolution of fangs in lizardfishes to address the following questions: (1) How many times have fangs evolved independently across the evolutionary history of lizardfishes, and (2) Is there a correlation between the evolution of fangs and habitat? Character evolution of fangs among lizardfishes is investigated using a taxonomically robust hypothesis of aulopiform evolutionary relationships based on nuclear and mitochondrial data.

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**0476 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Alex Ontkos

*Florida International University, Miami, Florida, USA*

**The Effect of Landscape Structure on Predatory Fish Movements in the Florida Everglades**

The freshwater marshes of the Florida Everglades experience seasonal expansion and contraction as water availability fluctuates. These spatiotemporal changes create a dynamic landscape that is directly impacted by human activities. Landscape features and man-made structures influence fish movements as they migrate in response to hydrological change. We used radio telemetry to examine the ability of landscape features to facilitate or hinder movement of large-bodied predatory fish, Florida gar

(*Lepisosteus platyrhincus*) and largemouth bass (*Micropterus salmoides*), in a focal area of the Everglades. This area is a field-scale Physical Model characterized by levee removal and canal backfilling in order to restore historical hydrology and increase landscape-level connectivity. Following surgically implanting tags, we located fish weekly to determine home range, habitat selection, and movement path structure. We characterized the habitat at each location point to assign resistance values to abiotic and biotic landscape features based on time required to transit habitats. In the future, these resistance values will be used to construct least-cost path models in order to characterize large-scale movements for these species in the Everglades landscape. Analysis of landscape resistance has been overlooked in wetland systems, but may have broad implications for ecological restorations and conservation initiatives.

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**0687 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jason Ortega, Steven Beaupre

*University of Arkansas, Fayetteville, AR, USA*

### The Effect of Prey Type on Digestive Performance in the Western Cottonmouth (*Agkistrodon piscivorous leucostoma*)

A predator's seemingly wide diet breadth may not coincide with the scope of its digestive performance when fed a wide array of prey. In our continued efforts to examine the interplay between prey preference and digestive physiology, digestive performance was examined in the Western Cottonmouth (*Agkistrodon piscivorus leucostoma*). Snakes (N=30) were used in feeding trials in a repeated-measures design to assess their ability to digest three different prey types (fish, frog, and mouse). To reduce variation in meal size and ensure meal ingestion, meals were fed as gavaged homogenates. Target meal size was 15% of snake mass. Meals were given on a weekly basis and each prey type was given to each snake as four consecutive meals. To determine passage time each meal was marked with a non-toxic florescent powder; which also enabled the identification of each meal type as it passed through the gastrointestinal system. Energy densities of the three diets (C) and the resulting feces (F) and urates (U) were determined through bomb calorimetry of lyophilized samples. For each prey type passage time, assimilated energy (AE = C-F), and metabolizable energy (ME=C-F-U) was determined. Data on the variation in digestive performance due to prey type will help in the interpretation of other work investigating snake prey preference and the metabolic cost of digesting different prey types.



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**1075 AES Conservation & Management I, Balconies L & M, Friday 8 July 2016**

Geoffrey Osgood[1], Easton White[2], Julia Baum[1]

*[1]University of Victoria, Victoria, BC, Canada, [2]University of California, Davis, Davis, CA, USA*

### The influence of shark population characteristics on statistical inference of population trends

Analyses of abundance data are critically important for understanding shark population trends. Shark abundance time series are typically short, highly variable, and with a high proportion of zeros - all properties that make typical analytical methods challenging or potentially unreliable. Shark behavior such as schooling and mobility also can complicate estimates of trends in abundance. We evaluated how analytical methods influence estimates of shark population trends by applying different statistical models to both simulated and empirical shark population data. We assessed the effects of the magnitude of changes in population abundance (trend strength), variability in population abundance, and the degree of zero inflation on the ability of different types of generalized linear models (GLMs) to make accurate inferences about population trends for common, rare, and schooling model shark species, as well as for populations with different movement patterns. We then compared the results of different GLMs fit on a long-term time series of shark and ray observations at Cocos Island off Costa Rica. Stronger trends, higher variability, zero inflation, and mobile behavior result in less reliable conclusions about declines, especially for rare sharks. Overall, the conclusions from different models do not differ substantially, particularly when declines are not severe, although binomial models and linear regressions are often inaccurate on both simulated and real data. Monitoring decisions require reliable information on trends and so dispersion in real shark populations should be carefully considered in data collection and the choice of appropriate GLMs.

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**0696 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Olga Otero, Aurélie Pinton

*iPHEP, UMR7262 CNRS, Poitiers, France*

### What fishes tell us about long term environmental change on Earth: case studies in the Tertiary of continental Africa

Studying African fossil and modern fish, we explore the correlation between fish evolutionary history and environmental change at a continental scale: through (1) the phylogeographical study of the catfish genus *Synodontis*, chosen because of its modern distribution and rich fossil record, and (2) the examination of the distribution of extant and fossil lungfish, of the catfish *Calarius* and of *Semlikiichthys*, an extinct acanthomorph. We correlate these fish histories with climate change and geological events in Africa throughout the Tertiary. Basin geomorphology and connectivity appear to have a great impact notably on fish ancient diversification, a conclusion also corroborated by

checking existing phylogenies of other fish that overlap with our region of interest. So, while an increasing number of studies support correlation between fish evolution and basin history at shallow time scales, our studies and a few others demonstrate the relevance of fish evolution to work also at deeper time and larger geological scales. Moreover, when available, the inclusion of fossils appears crucial. They not only allow the calibration of molecular clocks but also reveal ancient distributions and evolutionary events. For instance, the fossil record suggests that lungfish suffered great extinction in Africa before the radiation of *Protopterus* crown group, and its tardive dispersion. Indeed, the deeper we are going in time the more they will constitute most of or even the whole relevant sample. At last, information on fish (paleo)ecology provides useful data to qualify the aquatic systems that have prevailed at the time of connection between basins.

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**0873 General Herpetology, Galerie 2, Saturday 9 July 2016**

Katharine Ozenberger[1], Mark Hayes[0]

*[1]University of Illinois, Chicago, Illinois, USA, [2]CNT/USGS, Fort Collins, Colorado, USA*

## Assessing the Quality of Early Detection and Distribution Mapping System (EDDMapS) Data for Use in Analyzing the Distributions and Spread of Invasive Reptiles

Occurrence records of invasive reptiles maintained in online data repositories can provide insights into the current and potential distributions and spread of invasive reptile species. However, due to data collection methods and reporting, there are several potential sources of error and bias associated with such datasets that can influence the analysis and mapping of invasive reptile data. We evaluated the importance of positional uncertainty and spatial bias associated with occurrence records from the Early Detection and Distribution Mapping System (EDDMapS) for three invasive reptile species in Florida: Burmese pythons (*Python molurus*, N = 2,069), Argentine tegus (*Tupinambis merianae*, N = 1,044), and Nile monitors (*Varanus niloticus*, N = 531). The Argentine tegu and Nile monitor data had lower positional uncertainty (estimated mean < 150 meters) than the Burmese python data (estimated mean ~ 500 m). These estimated positional uncertainties indicate that these data can reliably be used for species distribution and spatial spread modeling at a resolution of, for example, 1 $km^2$ or 5 $km^2$, but that analysis at a higher resolution (e.g., < 500 $m^2$) may not be appropriate. There tends to be high apparent sampling bias associated with each species in different regions of Florida, and occurrence locations are often clearly associated with roads and urban areas. Thus, the substantial sampling bias in this dataset should be considered carefully prior to analysis of the current distributions and spatial spread of these reptiles, or before using these data to develop parameter estimates for spatial spread models.

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**0123 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Larry M. Page

*Florida Museum of Natural History, Gainesville, Florida, USA*

**ASIH at 100: The Past and the Future**

For 100 years, ASIH has been a highly successful society for scientists and students interested in research on fishes, amphibians, and reptiles. *Copeia* is a respected journal, and annual meetings of ASIH are important venues for bringing together scientists and students to discuss current research and develop new projects and collaborations. ASIH has been the most influential scientific society for me throughout my career, from 1968 to today, and has been critical to the professional development of most individuals in North America who call themselves ichthyologists and herpetologists. To remain so significant, it is imperative that ASIH evolve with science and with the interests of society. In recent years, ASIH has not been as open to change as it could have been, with membership dropping dramatically — perhaps as a result of the resistance to change. We need to reassess our priorities, goals, and organizational structure. Suggestions, including some potential new initiatives, will be suggested for moving the society forward in the next 100 years.

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**0162 HL, ASIH, SSAR: Eco-Evolutionary Dynamics Symposium, Salon D, Friday 8 July 2016**

Eric Palkovacs, David Fryxell

*University of California Santa Cruz, Santa Cruz, CA, USA*

**Some Like It Hot: Thermal Adaptation Exacerbates the Ecological Consequences of Warming**

Predictions about the impacts of climate change on ecosystems have been based largely on studies that place organisms adapted to current climate conditions into future climate scenarios. Such an approach assumes that today's organisms will be interacting in tomorrow's climate. However, climate change causes adaptive evolution, which may change ecological interactions and alter predictions for ecosystem responses. We tested whether thermal adaptation in a freshwater fish, the western mosquitofish (*Gambusia affinis*), has ecological effects and asked whether those effects dampen or exacerbate the consequences of warming. We used recently diverged mosquitofish populations from a warm-source and a cool-source to examine divergence in traits. We then tested ecosystem effects in ambient and warmed (+2 C) experimental ponds. Populations showed trait divergence consistent with thermal adaptation; warm-source fish grew slower and were relatively smaller at maturity. In experimental ponds, warming reduced zooplankton body size and biomass. The introduction of mosquitofish exacerbated this effect, with the warm-source population causing a greater shift towards small-bodied zooplankton taxa than the cool-source population. Our results suggest that thermal adaptation may be an important pathway by which climate warming can

impact ecosystems. Experiments that test the ecosystems effects of climate warming using organisms adapted to current climate conditions may underestimate these effects.

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**0366 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Galerie 3, Friday 8 July 2016**

Daniel Paluh, Aaron Bauer

*Villanova University, Villanova, PA, USA*

### Through Thick and Thin: Comparative Skull Anatomy of Terrestrial and Crevice-dwelling *Trachylepis* Skinks (Squamata: Scincidae) using microCT

Skinks account for more than 25% of all lizard species; however, little is known about the diversity of their skull morphology and representatives of fewer than half of all genera have been characterized osteologically. Mabuyine skinks of the genus *Trachylepis* are the dominant, fully limbed skinks in Sub-Saharan Africa, and nearly all species have the same generalized body plan. Although a few rock crevice-dwelling species possess slight body compression, extreme dorsoventral compression is observed only in *Trachylepis laevis*. We investigated the detailed skull anatomy of three *Trachylepis* skinks (*T. laevis*, *T. sulcata*, and a new species allied to *T. affinis*) using high-resolution X-ray micro-computed tomography. Our goals were to 1) review the scincid cranial osteology literature in a phylogenetic context, 2) provide a detailed anatomical baseline for the large mabuyine lineage and 3) investigate the morphological adaptations of the highly modified *T. laevis.* Our results demonstrate that all three taxa possess nine premaxillary tooth loci and an obliterated Meckelian canal, two postulated synapomorphies of Mabuyinae. The postorbital is present only in *T. sulcata* and *T.* sp., and an unidentified ossification is situated dorsal to the quadrate in *T. sulcata. Trachylepis laevis* possesses a flat skull roof, many strongly recumbent elements, a dorsoventrally compressed neurocranium, elongate posterior lower jaws, and reduced coronoid processes. We hypothesize that these modifications are functional consequences of the extreme rupicolous habits of this species and may reflect increased capabilities of cranial kinesis. Our study is the first element-by-element description of a skink using computed tomography technology.

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Aliki Panagopoulou[1,2,3], Samir H. Patel[1], Stephen J. Morreale[4], Dimitris Margaritoulis[2], Frank V. Paladino[3,5], James R. Spotila[1,3]

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## Using Satellite Telemetry to Optimize Protection of Loggerhead Turtles *(Caretta caretta)* Nesting on Crete, Greece

The effective conservation management of any protected species requires knowledge of key ecological processes regarding its habitat preferences and high-use areas during different phases of its life. We used satellite telemetry to obtain information relevant to the conservation of loggerhead turtles nesting on Rethymno, Greece. During 2011, we deployed satellite transmitters on nesting females tracking them for the duration of the egg-laying season. We used ultrasound imaging to determine internesting status by confirming the presence of mature follicles in their ovaries, which indicated that these turtles would return after approximately two weeks to lay another clutch. We collected location data from 37 internesting intervals for 20 different females. We found that 20% of the studied individuals (n=5) travelled to locations up to 110 km away during the internesting interval. Ultrasound imaging indicated that they probably used these other locations as alternative nesting sites for at least one of their subsequent clutches, exhibiting low site fidelity which may be indicative of a bet hedging strategy. We also found that during the internesting interval, turtles occupied an area of approximately 4,240 $km^2$ encompassing almost the entire north coast of Crete. We defined high-use areas by combining overlapped Minimum Convex Polygons and Fixed Kernel Analyses on ArcGIS® and found that the designated protected site offshore Rethymno did not sufficiently cover important habitats for this population. These findings have important conservation implications as they indicate a clear need for an expansion of the site to ensure protection of loggerheads during the reproductive period.

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**0216 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Sebastián Pardo[1], Holly Kindsvater[1], Elizabeth Cuevas-Zimbrón[2], Oscar Sosa-Nishizaki[2], Juan Carlos Pérez-Jiménez[3], Nicholas Dulvy[1]

*[1]Earth to Ocean Research Group, Department of Biological Sciences, Simon Fraser University, Burnaby, BC, Canada, [2]Laboratorio de Ecología Pesquera, Departamento de Oceanografía Biológica, CICESE, Ensenada, Baja California, Mexico, [3]iencias de la Sustentabilidad, El Colegio de la Frontera Sur, Lerma, Campeche, Mexico*

## Devil in the Details: Growth, Productivity, and Extinction Risk of a Data-sparse Devil Ray

Devil rays (*Mobula* spp.) face rapidly intensifying fishing pressure to meet the ongoing international trade and demand for their gill plates. This has been exacerbated by trade regulation of manta ray gill plates following their 2014 CITES listing. Furthermore, the paucity of information on growth, mortality, and fishing effort for devil rays make quantifying population growth rates and extinction risk challenging. Here, we use a published size-at-age dataset for a large-bodied devil ray species, the Spinetail Devil Ray (*Mobula japanica*), to estimate somatic growth rates, age at maturity, maximum age and natural and fishing mortality. From these estimates, we go on to calculate a plausible distribution of the maximum intrinsic population growth rate ($r_{max}$) and place the productivity of this large devil ray in context by comparing it to 95 other chondrichthyan species. We find evidence that larger devil rays have low somatic growth rate, low annual reproductive output, and low maximum population growth rates, suggesting they have low productivity. Devil ray maximum intrinsic population growth rate is very similar to that of manta rays, indicating devil rays can potentially be driven to local extinction at low levels of fishing mortality. We show that fishing rates of a small-scale artisanal Mexican fishery were up to three times greater than the natural mortality rate, and twice as high as our estimate of $r_{max}$, and therefore unsustainable. Our approach can be applied to assess the limits of fishing and extinction risk of any species with indeterminate growth, even with sparse size-at-age data.

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**0081 Plenary, Thursday 7 July 2016**

Lynne Parenti

*National Museum of Natural History, Smithsonian Institution, Washington, DC, USA*

## Out of Bounds

ASIH is my principal scientific society. I attended my first meeting in Gainesville, Florida, in 1977 and every one since. The 2016 meetings in New Orleans are my 40th in a row. Why? Because ASIH is the preeminent society for systematic ichthyology. I have presented all of my major research results, ideas and questions on fishes at ASIH meetings. There is really nowhere else to go and be readily understood. As we celebrate the first hundred years of our Society, it is natural that we look ahead to the next century: what do we want to change and what do we want to preserve? I draw on my

experience in the museum profession in which we face similar questions. We ignite interest in collections by expanding their uses and increasing access to them. I will discuss some novel uses of collections at the National Museum of Natural History such as The Smithsonian Artist Research Fellowship (SARF) program which pairs outstanding visual artists with museum scientists. The artists conduct research and create new artwork. The scientists and artists explore the same new technologies, such as 3D printing, at the same time. We learn from each other. This is but one example of collaboration across traditional boundaries. ASIH too can be invigorated by crossing traditional boundaries to increase access and diversity, sharing our various stories and giving all members a voice. The future of our Society depends on it.

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## 0395 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H, Thursday 7 July 2016

Elyse Parker, Kyle Piller

*Southeastern Louisiana University, Hammond, Louisiana, USA*

### Historical biogeography of the livebearing splitfins (Cyprinodontiformes: Goodeinae) in the Mesa Central

The Goodeinae are a diverse group of small, viviparous freshwater fishes distributed throughout the Mesa Central of Mexico. Since the early Miocene, the landscape of the Mesa Central has been continuously altered by widespread volcanism and tectonic activity, resulting in a complex hydrologic system characterized by repeated isolation and reconnection of drainage systems. Previous studies of the historical biogeography of the Goodeinae agree that basin compartmentalization and river piracy played significant roles in driving patterns of diversification within the clade. However, the spatial and temporal patterns of goodeine diversification with regard to many individual species remain uncertain. A more complete understanding of the biogeographic history of the Goodeinae relies on formulation of a well-supported phylogeny for the subfamily, but recent molecular phylogenetic analyses, all of which are based only on mitochondrial DNA sequence data, have produced incongruent tree topologies. The objectives of this study were to employ novel molecular data and comparative phylogenetic approaches in order to infer the evolution of the geographic distribution of Goodeinae in the Mesa Central. The phylogenetic relationships of all goodeine species were recovered using a dataset of 10 nuclear genes analyzed under Maximum Likelihood and Bayesian frameworks. A time-calibrated phylogeny produced using the nDNA sequence data and several fossil calibration points was used to estimate divergence times within the clade. Finally, we analyzed the time-calibrated phylogeny in the context of current geographic distribution data in the program Lagrange to provide the first likelihood-based inference of the biogeographic history of the subfamily Goodeinae.

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**0926 Snake Ecology, Galerie 3, Sunday 10 July 2016**

M. Rockwell Parker[1], Saumya M. Patel[2], Jennifer Zachry[2], Bruce A. Kimball[3]

*[1]James Madison University, Harrisonburg, VA, USA, [2]Washington and Lee University, Lexington, VA, USA, [3]USDA NWRC Monell, Philadelphia, PA, USA*

## The smell of success: pheromones in brown tree snakes and their hormonal regulation

Sex pheromones act as potent sexual signals mediating mate choice and as such can be powerful tools implemented in management strategies for pest and invasive species. At least one invasive reptile species, the brown tree snake (*Boiga irregularis*), is known to use chemical cues from the skin to locate potential mates, especially in its invasive range on Guam. Male *Boiga* respond to female scent, can follow female skin lipid trails and show courtship behavior to isolated lipids. Expression of many sexually dimorphic signals in vertebrates couples tightly with underlying steroid hormone levels. In garter snakes, estrogen implantation feminizes males by inducing female-typical pheromone expression and makes them attractive to wild males. Our goal was to use estrogen implantation to manipulate putative pheromone expression in male brown tree snakes and determine the effect of implantation on male attractiveness. Male brown tree snakes (n=7) were given estradiol implants, and we extracted skin lipids from snake sheds before and after implantation. Estrogen significantly altered expression of long-chain methyl ketones in the brown tree snakes, specifically the longer, monunsaturated ketones. In behavioral trials, implanted males elicited high tongue-flick rates and mild courtship behavior from control males. However, this courtship behavior was not as intense as that directed toward females. We hope to determine the attractive components from our extracts that may serve as attractants in trapping efforts in place on Guam. Evolutionarily, our results indicate that estrogen-activated female pheromone expression may be a conserved endocrine mechanism of semiochemical production, at least in Colubridae.

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**0972 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

M. Rockwell Parker[1], Shannon A. Richard[1], Kara A. Rush[1], Helen B. Plylar[2], Ricky J. A. Flores[1], Michael S. Grace[2], Michael L. Avery[3]

*[1]James Madison University, Harrisonburg, VA, USA, [2]Florida Institute of Technology, Melbourne, FL, USA, [3]USDA, Gainesville, FL, USA*

## Chemical communication in Burmese pythons

Invasive predators pose significant problems at the ecosystem level, but solutions have been reached historically by implementing reproduction-based strategies. The Burmese python (*Python bivittatus*) is an invasive species of concern in the Florida Everglades that threatens native vertebrates, especially birds and mammals. The reproductive biology of these pythons is poorly understood in the Everglades, and the primary goal of our research is to establish fundamental knowledge of their chemical communication at the

behavioral and chemical levels of inquiry. Sex pheromones in multiple species of snakes reside in the skin's lipid matrix that can be extracted from shed skins. We isolated different components of the skin lipids of male and female pythons via fractionation and analyzed these fractions with GC-MS. So far, we have identified sexually dimorphic variation in cholesterol metabolites in the extracts and are determining expression differences between sexes and seasons. We have also begun testing the whole lipid extracts in behavioral trials with male pythons using a Y-maze containing either male or female scent. Males demonstrated increased chemosensory investigation toward female, but not male, scent. Males also showed an array of behaviors in the Y-maze outside the predicted breeding season in their invasive range, and we are currently testing additional males within the breeding window to see if the behaviors change and/or intensify. If chemical cues are used by Burmese pythons to locate mates, such scents could be useful in current field strategies for controlling this invasive predator.

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**0563 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Mickey Parker[1], Matt Goode[0]

*[1]Texas A&M University, College Station, TX, USA, [2]University of Arizona, Tucson, AZ, USA*

### Translocation as a Mitigation Strategy for Flat-tailed Horned Lizards (*Phrynosoma mcallii*) in Southwestern Arizona

In 2012, construction of an airfield on the Barry M. Goldwater Range (BMGR) commenced in an area of high-quality Flat-tailed Horned Lizard habitat. The Flat-tailed Horned Lizard (*Phrynosoma mcallii*, FTHL) is a state-protected species whose range in Arizona is located primarily within the BMGR. As part of a larger project designed to assess the overall effects of the Joint Strike Fighter Program on the FTHL, we examined translocation as a mitigation strategy. Before construction of the airfield began, the footprint of the facility was fenced, and we removed 499 FTHLs from the enclosed area. To study the effects of translocation distance, we placed some lizards immediately adjacent to the exclusion fence at the point closest to their capture location, and translocated others to sites several kilometers away. At translocation sites, we conducted surveys immediately post-translocation and throughout the following year. We outfitted a subset of translocated lizards with radiotransmitters and located them several times per week. We compared movement patterns, home range characteristics, behavior, and survival of translocated FTHLs with non-translocated individuals. We did not observe any effect of translocation distance. In the months immediately post-translocation, translocated male and female lizards had significantly larger home ranges than non-translocated lizards, and translocated males exhibited significantly straighter movements than non-translocated males. There was no difference in daily movement between translocated and non-translocated FTHL of either sex. We observed no differences in movement or home range characteristics the following year. Translocated FTHLs had consistently lower survival than non-translocated lizards, but not significantly so.

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**0373 General Herpetology , Salon F-H, Thursday 7 July 2016**

Adam Parlin[1], José Pedro Sousa do Amaral[2], Paul Schaeffer[1], Hank Stevens[1]

*[1]Miami University, Oxford, OH, USA, [2]University of Cincinnati Clermont College, Batavia, OH, USA*

### Thermoregulatory Performance of Eastern Box Turtles (*Terrapene carolina carolina*) in Southwest Ohio

Monitoring organisms in the field provides novel insight into the interaction between an undisturbed organism and their environment under natural conditions. Recent advances in biologging technology have allowed for fine-scale, detailed data collection of movement and physiology on individual organisms. Ectothermic species are constantly exchanging heat with their environment and thus are reliant on daily environmental conditions and ambient temperatures. Species near the northern edge of their distribution are subjected to suboptimal environmental conditions that could impact thermoregulatory performance. We investigated the thermoregulatory strategy and effectiveness of thermoregulation for free-ranging Eastern box turtles (*Terrapene carolina carolina*) in Southwest Ohio over two seasons of turtle activity from May until October in 2014 and 2015. Southwest Ohio represents a part of the northern distribution for *T. carolina* and forested habitat is highly fragmented due to agriculture in the immediate area. Box turtles were monitored for up to two weeks in the field recording internal body temperature, external shell temperature, and operant model temperature. Operant models were place in open and closed habitats, based on how canopy cover was hypothesized to influence thermal quality of the habitat. We found significant effects of year and season on the thermal accuracy and effectiveness of thermoregulation, and significant effects of year, season, and habitat on the thermal quality. Box turtles were thermoconforming with their environment in 2014 and 2015 throughout their activity season. Our findings suggest that environmental conditions considerably impact thermoregulatory performance in *T. carolina*.

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**0142 General Ichthyology I, Balconies J & K, Sunday 10 July 2016**

Phillip Parsley[1], David R. Stewart[2]

*[1]Middle Tennessee State University, Murfreesboro, Tennessee, USA, [2]U.S. Fish and Wildlife Service, Albuquerque, New Mexico, USA*

### Investigating the Utility and Relative Accuracy of Nonlethal Ageing Structures to Age Two Nonnative (Brook Trout and Brown Trout) and One Native (Rio Grande Cutthroat Trout) Trout Species Collected in Carson National Forest, New Mexico

The ability to age fish accurately is an important step in properly assessing and managing fish populations. Numerous calcified structures have been used to estimate

the ages of fish, and the usefulness of each structure varies among structures as well as species. Additionally, the use of lethal or nonlethal ageing structures may play a central role in the feasibility of gathering age data for some species that may be recreationally important or threatened. The primary purpose of this study was to investigate the utility of scales, pelvic fin rays, and sagittal otoliths for ageing two nonnative game species (Brook Trout *Salvelinus fontinalis* and Brown Trout *Salmo trutta*) and one native trout species (Rio Grande Cutthroat Trout *Oncorhynchus clarkii virginalis*) listed as a species of concern with the objective of finding a suitable nonlethal ageing structure. To evaluate the suitability of the various ageing techniques, precision and relative accuracy of the estimated ages were compared for the three species. Two independent readers, age bias plots, coefficients of variation, and percent agreement were used to measure bias among structures for each reader and precision between readers for each structure. Relative accuracy was investigated by comparing mean otolith age estimates versus mean scale and fin ray estimates as well. The ability to use nonlethal ageing structures for ageing would be very beneficial for fisheries biologists trying to manage these trout populations, and may influence biologists elsewhere to consider using these techniques as well.

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**0147 Fish Ecology II, Salon A-C, Saturday 9 July 2016**

Glenn Parsons

*The University of Mississippi, University, MS, USA*

### Shark Attack, Fisheries Landings, and Environmental Parameters: Getting to the Meat of the Topic

Using public domain and research data bases, I conducted an analysis of the inter-relationships between shark attack, beach attendance, environmental parameters, and commercial and recreational landings of sharks and their prey species in Florida coastal waters between 1994 and 2013. The intent was to investigate the potential cause(s) of temporal variation in shark attack. Of several environmental parameters examined, only rainfall was found to be a significant ($p = 0.03$) albeit weak, predictor of shark attack accounting for 23% of the variation in attack, with attacks increasing during low rainfall years. Recreational landings of Atlantic sharpnose sharks, (*Rhizoprionodon terraenovae*) and commercial landings of round scad (*Decapterus punctatus*) were each a highly significant ($p = 0.001$, and 0.008, respectively) predictor of attack accounting for 45 and 32%, respectively of the variation in attack. Day-use coastal Florida State Park visitors were used as an indicator of beach attendance but described only 21% of the variation in shark attack and was weakly significant ($p = 0.04$). A best-fit multiple regression that included rainfall, sharpnose shark and blacktip (*Carcharhinus limbatus*) landings, and days with thunderstorms provided the highest significance ($p < 0.0001$) and explained 80.3% of the variation in shark attack. I used path analysis to further delineate inter-relationships and to investigate potential causation. The primary driver of annual variation in shark attack may be a result of movement of sharks in and out of inshore

waters in response to changes in shark condition, movement of preferred prey items, and/or variation in environmental parameters.

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**0659 AES Genetics, Genomics, Biogeography, & Systematics, Balconies J & K, Saturday 9 July 2016**

Kristene Parsons, Jan McDowell, Heidi Brightman, Eric Hilton, Robert Latour

*Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA, USA*

### Review of the Smooth Butterfly Ray, *Gymnura micrura* (Myliobatiformes: Gymnuridae) Reveals a Species Complex in the Western North Atlantic Ocean

The Smooth Butterfly Ray, *Gymnura micrura* Bloch & Schneider 1801, is considered a wide-ranging species that occurs in warm temperate and tropical Atlantic waters from the U.S. to Brazil. In shallow coastal regions, *G. micrura* is common bycatch in demersal fisheries due to habitat overlap with commercially valuable marine resources. However, incidental catch data and life history parameters are lacking for this species in U.S. waters, and the identification of *G. micrura* has been complicated by morphological variation in this species. Previous taxonomic descriptions do not fully account for sexual dimorphism or other variations in the morphology and life history observed throughout its range, and type material is not available. Resolving the taxonomy of *G. micrura* is crucial for the assessment of populations and their vulnerability to fisheries interactions. In this study, we revised the taxonomy of *G. micrura* based on morphological characters, genetics, and life history of specimens from Suriname (type locality) and the Atlantic and Gulf coasts of the U.S. Multivariate ordination (non-metric multidimensional scaling) analyses of morphometric data, discrete morphological characters (e.g. color patterns), and genetic analyses using mitochondrial (ND2, ND4, CO1, Cytb) and nuclear (RAG1) gene sequences revealed a complex of three distinct species across the western Central and North Atlantic. Taxonomic descriptions and life history aspects of *G. micrura* and the two new species from U.S. waters will be presented, and implications for future assessments of populations will be discussed.

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**0959 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Melanie Partin

*Southeastern Louisiana University, Hammond, LA, USA*

### The Effects of Traffic Noise on Energetic Costs of Calling and Physiological Stress in *Hyla chrysoscelis*

Noise pollution is an increasing concern throughout the world due to potential impacts it could have on the environment and wildlife, particularly in species using acoustic

communication. Changes in calling characteristics in anurans and other animals in response to noise have been well established in the literature. It has been speculated that these changes could lead to increased metabolic costs of calling. Traffic noise has been shown to cause physiological stress in different organisms. Raised concentrations of corticosterone has been found in White's tree frogs and female wood frogs in response to traffic noise. I seek to test the hypothesis that *Hyla chrysoscelis* males will exhibit increased energetic costs of calling and a physiological stress response through increased corticosterone to high levels of traffic noise. Fieldwork will be conducted at six sites, three of which will be temporary pools in the presence of high traffic noise, while the others will be in pristine sites (lacking traffic noise). 100µl blood samples will be taken through cardiac puncture with heparinized hypodermic needles, and corticosterone concentrations will be measured via ELISA assays. Frogs will then be placed into a respirometry chamber, and oxygen consumption will be measured after vocalization resumes to assess the energetic cost of calling. I suspect that in frogs exposed to traffic noises oxygen consumption will become elevated, and corticosterone concentration will be higher relative to the pristine sites. This would indicate that excessive traffic noise could be deleterious for anurans, which would influence conservation concerns of many species.

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**1035 General Ichthyology, Galerie 2, Friday 8 July 2016**

Michael Pauers[1,2,3]

*[1]Milwaukee Public Museum, Milwaukee, WI, USA, [2]University of Wisconsin - Waukesha, Waukesha, WI, USA, [3]UW Milwaukee School of Freshwater Science, Milwaukee, WI, USA*

## Two New and Remarkably Similarly Colored Species of *Labeotropheus* (Perciformes: Cichlidae) from Lake Malawi, Africa

The haplochromine cichlid genus *Labeotropheus* is endemic to Lake Malawi, Africa. This genus presently contains two recognized species, *Labeotropheus fuelleborni* and *L. trewavasae*. As currently recognized, both species consist of geographically isolated populations scattered throughout the lake, each distinguished by a unique male nuptial color pattern. While other such allopatric populations of Lake Malawi cichlids have been described as different species, those of *Labeotropheus* have not, largely due to misunderstandings or misinterpretations of criteria applied to other Malawian endemics. Taking a refined approach to the recognition of putative *Labeotropheus* species, I use morphological, meristic, and color characteristics to describe two new, very similarly colored, species of *Labeotropheus*, both of which are found near Katale Island alongside the Luromo peninsula in northwestern Lake Malawi.

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**1106 Amphibian Reproduction & Herp Conservation, Galerie 3, Saturday 9 July 2016**

Gregory Pauly

*Natural History Museum of Los Angeles County, Los Angeles, California, USA*

### Is California the Next Florida?: The Rapid Increase of Nonnative Reptiles and Amphibians in Southern California as Documented through Citizen Science

Urbanization presents one of the world's greatest biodiversity threats. Not only is urbanization responsible for habitat modification, but the number of people and goods moving through urbanized areas also increases the chance of nonnative species being introduced. As a further complication, urbanized areas largely consist of private property (e.g., backyards) that is difficult for biologists to access. Citizen science, however, can provide an effective method for documenting biodiversity in urban areas. Consider the Greater Los Angeles Area, which is the second largest metropolitan region in the US, and also sits within the California Floristic Province (CFP), one of the Earth's 35 biodiversity hotspots. This region is home to 18.6 million people, the 5th busiest airport in the world, and the busiest container port in the US. With so many people and goods moving through the region, coupled with Southern California's mild Mediterranean climate, there is an extremely high threat of nonnative species becoming established. The Reptiles and Amphibians of Southern California (RASCals) citizen science project was designed to understand how species ranges have been impacted by urbanization. This is done by comparing modern citizen science records to historical museum records. Further, observations have resulted in discoveries of four new state records and 16 new county records of nonnative reptiles and amphibians. Some of these observations have resulted in citizen scientists and museum researchers co-authoring peer-reviewed, scientific publications. Importantly, these citizen science efforts have rapidly generated data from urban settings that biologists otherwise could not access.

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**0191 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

Luke Pearson, WB Cash

*University of Central Arkansas, Conway, Arkansas, USA*

### Seasonal Variations in Corticosterone and Testosterone Concentrations of Male Ouachita Map Turtles (*Graptemys ouachitensis*)

A limited number of studies have examined seasonal testosterone (T) fluctuations in freshwater turtles, with even fewer studies focusing on changes in the stress hormone corticosterone (CORT) and the acute stress response. From September to October 2013 and March to November 2014, we captured 125 male Ouachita map turtles (*Graptemys ouachitensis*) from the Arkansas River using hoop nets and basking traps. Within ten minutes of initial trap disturbance, baseline samples were acquired, while stress-induced samples were obtained 30 minutes after trap disturbance. ELISAs were used to analyze

CORT and T concentrations. Baseline CORT concentrations were significantly higher in the summer months (July - August 2014; mean range: 0.99 ng/ml - 1.72 ng/ml) compared to the fall months (October - November 2014: 0.36 ng/ml - 0.38 ng/ml). Similarly, stress-induced CORT concentrations were significantly higher from May - September 2014 (2.95 ng/ml - 5.93 ng/ml) when compared to October - November 2014 (0.97 ng/ml - 1.14 ng/ml). Summer increases in both baseline and stress-induced CORT could be a factor of higher temperatures or coincide with a higher metabolic rate. Testosterone concentrations peaked in September - October 2013 and September 2014 (3.57 ng/ml - 5.77 ng/ml), suggesting that gonadal recrudescence may be occurring at this time period. During these months, low baseline and stress-induced CORT concentrations may be a result of adrenocortical modulation to minimize negative effects on reproduction, or as a preparation for winter. This seasonal hormone variability can show us how an organism handles stressful stimuli during important life-history stages.

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**0981 SSAR SEIBERT AWARD ECOLOGY, Galerie 3, Thursday 7 July 2016**

Phillip Pearson, Daniel Warner

*Auburn University, Auburn, Alabama, USA*

## Do Seasonal Changes in Developmental Temperature Have Season-Specific Fitness Consequences in a Lizard?

Rapidly changing environmental conditions can reduce the fitness value of a phenotype. Phenotypic plasticity can solve this problem by enabling individuals to develop phenotypes that are suited to their immediate environment. Seasonal shifts in environmental conditions are particularly important because they provide predictable cues to which organisms can respond in adaptive ways. For example, seasonal changes in temperature can induce phenotypes at different times of the year that have season-specific fitness benefits. Reptilian embryos are especially sensitive to their developmental environment. Our previous study has shown that temperature during different times of the season can affect phenotypes and performance. In this study, we assessed whether the timing of oviposition is adaptively matched to the thermal environment that embryos experience at a given time of the reproductive season. We used the brown anole lizard (*Anolis sagrei*), which has an extended reproductive season (April-October), to address this question. Eggs were collected from two temporally-separated breeding colonies and exposed to two incubation treatments that mimicked the natural fluctuations in nest site temperatures during early and late periods of the reproductive season. Hatchlings were measured, and their locomotor performance was assessed in the lab, and then released on an island to quantify growth and survival. Preliminary data suggests that eggs exposed to early-season temperatures have lower survival and longer incubation periods than those experiencing late-season temperatures. Further evaluation of the interactive effects of the timing of oviposition and season-specific incubation temperature will provide insights into how embryos might be adapted to season-specific developmental environments.

**0720 NIA II, Galerie 3, Sunday 10 July 2016**

Allison Pease[1], Krista Capps[2], Rocío Rodiles-Hernández[3], Maria Mercedes Castillo[4], Manuel Mendoza-Carranza[4]

*[1]Texas Tech University, Lubbock, Texas, USA, [2]University of Georgia, Athens, Georgia, USA, [3]El Colegio de la Frontera Sur, San Cristobal de las Casas, Chiapas, Mexico, [4]El Colegio de la Frontera Sur, Villahermosa, Tabasco, Mexico*

## Fish Assemblages and Aquatic Food-web Structure in Two Mesoamerican River Networks with Contrasting Flow Regimes

The Grijalva-Usumacinta region is a center of freshwater biodiversity and endemism in southern Mexico that provides critical resources to local communities. Our objectives were to survey aquatic assemblages, examine feeding ecology of fishes, and investigate fisheries resource use in the Río Usumacinta, which currently is undammed. Additionally, we collected the same information in the Río Grijalva, a large, impounded river which joins the Usumacinta at its delta. In both systems, we compared habitats in the main-stem rivers as well as smaller tributary streams. We observed remarkable fish diversity in the Usumacinta basin, whereas fish diversity was lower in reaches of the Grijalva basin. Stable isotope analysis revealed that fish production in the main stem of the Río Usumacinta was supported by a broader variety of food resources compared to the Río Grijalva. In both basins, the diversity of resources used by fishes was higher in protected areas. Riparian production sources were especially important in supporting food webs in the Usumacinta and its tributaries. The natural flow regime in the Usumacinta appears to promote resource diversity by maintaining habitat heterogeneity and providing connectivity to riparian forests. The absence of impoundments in the Usumacinta allows for dispersal of highly valued migratory species, such as snook (*Centropomus* species) and shrimp (*Macrobrachium carcinus*). Conservation of aquatic ecosystem connectivity in this system thus preserves the diversity and value of fisheries services provided by the river.

**1082 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Joseph Pechmann[1], John Tupy[1], James Lee[2], Matthew Atkinson[1], Michael Sisson[3], Danna Baxley[4], Robin Overstreet[5]

*[1]Western Carolina University, Cullowhee, NC, USA, [2]The Nature Conservancy, Camp Shelby, MS, USA, [3]Florida Fish and Wildlife Conservation Commission, Panama City, FL, USA, [4]Kentucky Department of Wildlife and Fisheries Resources, Frankfort, KY, USA, [5]Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS, USA*

## Translocation Efforts Highlight Vulnerabilities of the Endangered Dusky Gopher Frog

Recovery of the endangered dusky gopher frog, *Rana sevosa*, requires establishing new populations. We translocated 4687 hatchlings from 2004-2008, 3771 head-started tadpoles mostly from 2004-2010, and 4647 metamorphs mostly from 2012-2015 to TNC1 pond on restored agroforestry land in Mississippi. We translocated 2791 tadpoles headstarted 1 or 2 months and 147 metamorphs from 2013-2014 to Pony Ranch Pond (PRP), a recently deepened, cleared, and burned wetland in DeSoto National Forest. We also translocated 242 headstarted tadpoles to cages in PRP in 2014 or cages in PRP, TNC1, or New Pond (NP) in 2015. There was limited evidence of survival and reproduction of translocated *R. sevosa* at TNC1: 1 egg mass in 2008, 2010, and 2015, 5 in 2014, and 8 in 2016; natural tadpoles in 2012; 1 male calling in 2008 and 4-5 calling in 2010 and 2012-2016. Survival to metamorphosis of free-swimming tadpoles at PRP was 1.6-2.5% after 1-month headstarting in 2013, 2.7-4.3% after 2-month headstarting in 2013, and 0.09-0.26% after headstarting in 2014. Survival to metamorphosis in cages in 2014 was 3% and 36% for tadpoles headstarted 1 month and 2 months, respectively. Survival of caged tadpoles in 2015 was zero for those headstarted 1 month and zero, 4%, and 24% for those headstarted 2 months and translocated to NP, PRP, and TNC1, respectively. Mortality of caged, and presumably free-swimming, tadpoles was mostly from the parasite *Dermomycoides*. Lack of terrestrial burrows may limit survival at TNC1. We recommend translocating metamorphs rather than tadpoles because of low tadpole survival.

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**0154 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Christopher Peck[1], Randy Singer[2], Christopher Mah[3], Bart Philip[1], Prosanta Chakrabarty[1]

*[1]LSU Museum of Natural Science, Baton Rouge, LA, USA, [2]Florida Museum of Natural History, Gainesville, FL, USA, [3]Smithsonian, Washington, USA*

**Examination of the Ross Ice Sea Shelf Fauna**

The Ross Ice Shelf, the world's largest body of floating ice, is largely an underexplored area. To the surprise of many, the area under the shelf, hosts a healthy, diverse community of life. The Ross Ice Shelf and the waters beneath it have recently been explored by drilling, submersibles, and other means. Images of communities of organisms were obtained during this recent exploration and show a surprising diversity and disparity of life. These organisms were grouped and organized based on morphology and geographic location. The organisms were then identified and further sorted by the authors and the scientific community through crowd sourcing. We are now in the process of compiling a checklist of the observed organisms based on number and geographic location.

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**1005 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Emily Peele[1], Thomas Lankford[1], Paul Barrington[2], Jennifer Wyffels[3]

*[1]University of North Carolina, Wilmington, Wilmington, NC, USA, [2]North Carolina Aquarium at Fort Fisher, Kure Beach, NC, USA, [3]South-East Zoo Alliance for Reproduction & Conservation, Yulee, FL, USA*

**Ageing bonnethead shark (*Sphyrna tiburo*) pups using umbilicus morphology**

Wound healing at the umbilicus or site of placental connection for neonate bonnethead sharks, *Sphyrna tiburo*, was studied for two litters born and maintained at the North Carolina Aquarium, Fort Fisher. Photographic images of the abdomen were taken at weekly intervals beginning at parturition and area of open 'wound' was isolated and calculated digitally. For non-surviving pups, the umbilicus was preserved and examined using scanning electron microscopy. Umbilicus healing pattern was characterized into one of 6 stages: (1) umbilical stump present (2) closed wound with denticle-free epidermis (3) contraction and bridging of denticle covered epidermis near the middle of the umbilicus (4) anterior terminus of umbilicus remains denticle free (5) complete covering of scar with denticles varying in morphology and distribution and (6) uniform denticle orientation and morphology over umbilicus. Complete epithelialization or wound closure occurs shortly after parturition, following the loss of umbilical stump (4 ± 1 SD days). Visible umbilical scar healing is dominated by the final, or maturation stage of wound healing as represented by eruption and orientation of dermal denticles. Rate of wound healing was dependent on initial wound area, but progressed to stage 4 for all sharks after 3 weeks. No pups advanced to stage 6 during the timeframe of this

study (150 days). Through detailed study of temporal changes in appearance of the umbilical wound, a more accurate aging technique for wild caught neonatal sharks is possible. Determining age of pups helps identify and improve the management of nursery habitats for coastal shark species.

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**0819 ASIH STOYE GENERAL ICHTHYOLOGY AWARD, Galerie 2, Friday 8 July 2016**

Brian Pena, Larry Allen

*California State University Northridge, Northridge, CA, USA*

**Age Structure and Growth Rates of Vermilion Rockfish, *Sebastes miniatus*, Along the California Coast**

Inaccurate information of life histories can be detrimental to stock assessments and management because they may lead to erroneous estimates of population size which could lead to overexploitation. Among rockfish species targeted by recreational anglers, the vermilion rockfish (*Sebastes miniatus*) is one of the most commonly caught in southern California. Vermilion rockfish populations have declined in size and age in southern California since the 1980s due to fishing pressure. They show low genetic connectivity along their distribution suggesting a presence of subpopulations in regions bordered by biogeographic barriers. Unfortunately, a discovery of a deeper-living cryptic species confounds past assessments. The current study will investigate and clarify the age and growth data of the true vermilion rockfish in California focusing on regions containing identified subpopulations. We will compare populations from four sites along California; Cape Mendocino, Monterey Bay, Santa Barbara, Los Angeles regions. After sampling two sites, we have found smaller individuals in Los Angeles than Santa Barbara. Growth curves between these two sites differ but further investigation is warranted. Further exploitation of vermilion rockfish could reduce genetic diversity and shift demographics of this species. If age and growth rates differ between sites, regional-scale management may help ensure the persistence of healthy and sustainable populations of vermilion rockfish.

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**0630 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

David Penning

*University of Louisiana at Lafayette, Lafayette, LA, USA*

**The Scaling of Bite Force and Constriction Pressure in Kingsnakes (*Lampropeltis getula*): Proximate Determinants and Correlated Performance**

Across diverse vertebrates, bite force has been linked to important ecological and evolutionary consequences. However, one important lineage of vertebrates that rely

heavily on this performance trait is missing from the bite-force literature: the snakes. Many snakes rely heavily on biting to subjugate prey while a constriction coil is formed, and others use biting exclusively without employing additional prey-handling behaviors. In addition to biting, constriction is an important predation mechanism for many snakes. Here, I quantify bite force and constriction pressures in kingsnakes (*Lampropeltis getula*). Furthermore, I explore the proximate determinants of bite force and their relations to constriction pressure to test for trade-offs among performance traits. Bite force increased linearly with all head and body measures, and head height was the best predictor of bite force. Bite force in kingsnakes was within the range of values reported for lizards, but their performance was lower relative to body size compared to lizards. Peak constriction pressure also increased with all body measures. Biting and constricting use two different parts of the musculoskeletal system. Biting and constriction performances are positively and significantly correlated with one another, suggesting that there is no functional trade-off between these two performance traits. Future work targeting snakes that rely more heavily on biting may reveal a greater range of bite performance in these diverse and successful predators.

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**0628 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, SALON A-C, Thursday 7 July 2016**

David Penning, Brad Moon

*University of Louisiana at Lafayette, Lafayette, LA, USA*

## The King of Snakes: Performance and Morphology of Intraguild Predators (*Lampropeltis*) and their Prey (*Pantherophis*)

Across ecosystems and trophic levels, predators are usually larger than their prey, and when trophic morphology converges, predators typically avoid predation on intraguild competitors unless the prey are notably smaller in size. However, a currently unexplained exception occurs in kingsnakes in the genus *Lampropeltis*. Kingsnakes are able to capture, constrict, and consume other snakes that are not only larger than themselves, but that are also powerful constrictors (such as ratsnakes in the genus *Pantherophis*). The mechanisms of their success as intraguild predators on other constrictors are not yet known. To begin addressing these mechanisms, we studied the scaling of muscle cross-sectional area, pulling force as an indicator of escape performance, and constriction pressure as a measure of predation performance across the ontogeny of six species of snakes (*L. californiae, L. floridana, L. holbrooki, P. alleghaniensis, P. guttatus,* and *P. obsoletus*). Muscle cross-sectional area ($cm^2$) scaled similarly for all snakes, and there was no significant difference in escape performance (peak pulling force) among these six species. However, all kingsnakes exerted significantly higher pressures on their prey than all ratsnakes. The superior constriction performance by kingsnakes derives in part from their consistent and distinctive coil posture. The similar escape performance among species indicates that kingsnakes win in predatory encounters because of their superior constriction performance, not because

ratsnakes have inferior escape performance. Potential differences in muscle structure and function need to be tested in future research.

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**0925 General Herpetology, Salon A-C, Thursday 7 July 2016**

Leah Perez[1], James Childress[2], Matthew Kwiatkowski[1], Daniel Saenz[2], Jennifer Gumm[1]

*[1]Stephen F. Austin State University, Nacogdoches, TX, USA, [2]Southern Research Station, US Forest Service, Nacogdoches, TX, USA*

**Calling behavior and call structure of sympatric treefrogs in eastern Texas**

This study examines spatial and temporal patterns in the call behavior of *Hyla versicolor* and *H. chrysoscelis* in woodland ponds in East Texas. Additionally, spectrum analysis is used to evaluate differences in call structure based on spatial and temporal patterns in the call behavior. Two species of gray treefrog, Cope's Gray Treefrog (*Hyla chrysoscelis*) and the Gray Treefrog (*Hyla versicolor*), occur sympatrically in East Texas. *Hyla versicolor* is a tetraploid species originating from separate hybridization events of the diploid *H. chrysoscelis* with extinct diploid anurans. Many studies have been conducted on call structure and behavior of *H. chrysoscelis* and *H. versicolor*, though there are fewer studies on the natural history of these species, and no studies have examined these species in East Texas. We sampled 8 ponds, 4 in the Stephen F. Austin Experimental Forest and 4 in the Davy Crockett National Forest. Auditory data was collected from 01 January 2010 to 31 December 2014, with one-minute samples recorded every hour over a 6-hour period during which the species typically call. Analysis of the audio files identified the presence or absence of each species at each sampling point. Additionally, spectrum analysis of call duration and pulse rate will determine if calls change over time, or based on the community composition. Preliminary results show differences in species composition of calling frogs across ponds and that ponds vary in how calling behavior changed over the 5-year sampling period.

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**0489 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016**

Joshuah Perkin

*Tennessee Technological University, Cookeville, TN, USA*

**Rubber bands & ratchets: Why does it take so much MacGyvering to establish a long-term freshwater fish community study?**

Long-term fish community (LTFC) studies either make use of existing data or include collection of new data. For junior faculty in their first academic post, the former approach is a mechanism for generating the short-term productivity necessary for earning tenure. However, collection of new data with the ultimate goal of a LTFC study

might be viewed as conflicting with limited resources (e.g., time!). Here, I present a two-part framework that first illustrates the utility of existing LTFC data, and then highlights barriers blocking generation of new LTFC datasets by young scientists. Legacy data from noted ichthyologists molded my view of the benefit of LTFC datasets, including how anthropogenic environmental alterations shape the future of fish communities. By standing on the shoulders of these giants, my colleagues and I have synthesized multi-decadal changes in fish communities as existing within: (1) states of dynamic equilibrium in which community structure might be stretched but will eventually return (i.e., the rubber bands), or (2) vortex mechanisms in which community change is directional without any hope for return (i.e., the ratchets). Understanding the constraints and contexts in which these opposing responses manifest is one area in which new LTFC data will be crucial. Nevertheless, many mechanisms dissuade the collection of new LTFC datasets, such as time constraints, funding limitations, administrator skepticisms, and expectations for junior faculty. I share my own experiences with addressing these barriers by "MacGyvering" unexpected solutions and hope that discussions with owners of established LTFC datasets will provide guidance for the future.

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**0899 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016**

Cassidy Peterson, Robert Latour

*Virginia Institute of Marine Science, Gloucester Point, VA, USA*

**Abundance and Community Interactions of Atlantic Coastal Sharks**

Broad-scale analyses of shark population and community dynamics are particularly challenging given the complex life history strategies employed and their vast migratory patterns. Consequently, studies are generally limited to analyzing small-scale, localized dynamics that can be examined from easily accessible, nearshore environments. Survey-based trends in abundance frequently display data conflict, and shark interspecies interactions have never been assessed at a wide geographic scale. We used generalized linear models (GLMs) to estimate annual indices of abundance from eight species of Atlantic coastal sharks from six fishery-independent surveys along the U.S. east coast and within the Gulf of Mexico. These conflicting indices of abundance were input into a dynamic factor analysis (DFA) model with large-scale climatic indices and anthropogenic forces as covariates to produce simplified species-specific trends of abundance for each species throughout the sampled distribution. We input common trends into a multivariate, first-order autoregressive, state-space (MARSS-1) model to estimate interspecies interactions and density dependence. Broad-scale interactions were compared to localized interactions generated from MARSS-1 analyses on GLM-based indices of abundance calculated from individual surveys. Large coastal species showed similar patterns of abundance since 1975, while small coastal species showed more regional variability in abundance. We have been able to quantitatively show density dependence in seven species and seven broad-scale (and three localized) interspecies interactions. These results may assist in assessment efforts by reducing conflicting

information input into stock assessment models, and accounting for community relationships that may affect population growth rate of various species.

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**0787 Fish Ecology I, Salon A-C, Saturday 9 July 2016**

Cheston Peterson[1], Erica Holdridge[3], Dean Grubbs[2]

*[1]Florida State University, Tallahassee, FL, USA, [2]FSU Coastal and Marine Laboratory, St. Teresa, FL, USA, [3]Yale University, New Haven, CT, USA*

### Trophic ecology of two species of ariid catfishes: gut contents, stable isotope analysis, and comparisons with small coastal sharks

We examined the trophic ecology of two species of ariid catfishes (hardhead catfish, *Ariopsis felis*; and gafftopsail catfish, *Bagre marinus*) collected from the northwest coast of Florida using gut content and stable isotope analyses. We found both species to have diverse diets with some overlap, but stable isotope analysis suggested gafftopsail catfish generally feed at higher relative trophic levels than hardhead catfish. Comparisons with published diet information and stable isotope data collected in the same study for a set of small coastal sharks suggest considerable trophic overlap between the catfishes and sharks. The results of this study suggest ariid catfishes may be important predators in coastal ecosystems, given their high relative abundance in many habitats, despite them being commonly overlooked in marine ecology.

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**0748 Squamate Biology, Balconies L & M, Sunday 10 July 2016**

Christopher R. Peterson, Arthur C. Echternacht

*University of Tennessee, Knoxville, Tennessee, USA*

### Intraspecific color and habitat use variation in *Anolis conspersus*

Intraspecific divergence spurred by differing ecological conditions can provide insights into early stages of speciation. Anoles are a model clade for studying habitat-based divergence and speciation. *Anolis conspersus* (the Grand Cayman blue-throated anole) is endemic to a small island and has body coloration patterns that are spatially arranged despite a lack of wider environmental gradients. I examined ecological, morphological, and genetic variation among and within *A. conspersus* populations to evaluate potential divergence along a small scale. I evaluated morphological and ecological characters of anoles at 16 sites across their native range, recorded body coloration. Hierarchical Bayesian indicated minimal differences in habitat use among color and pattern variants once spatial variation was taken into account.

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**0024 Fish Ecology I, Salon A-C, Saturday 9 July 2016**

Mark Peterson[1], Paul Grammer[1], Jeanne-Marie Havrylkoff[3], William Slack[2]

*[1]University of Southern Mississippi, Ocean Springs, MS, USA, [2]2U.S. Army Engineer Research and Development Center, Vicksburg, MS, USA, [3]Florida Fish and Wildlife Conservation Commission, Tallahassee, FL, USA*

## Nearshore Movements and Connectivity of Gulf Sturgeon in Non-island, Shallow Designated Critical Habitat Adjacent to a Commercial Port and a Maintained Navigation Channel Within Mississippi Sound

Dogma concerning the western Gulf Sturgeon population indicates large subadults/adults migrate from rivers in fall to barrier island areas whereas small subadults/juveniles remain in the estuary; up river immigration follows in spring. To test this, we used a two-year data set from an acoustic network around the Port of Gulfport positioned between the Pearl and Pascagoula Rivers. From September 2012 - May 2013, we documented between 3 and 6 fish on each receiver totaling 12,285 raw detections among 19 receivers were detected; 5 adult and 1 juvenile (east gate), 3 adult and 2 subadult (west gate), and 5 adult, 1 subadult, and 1 juvenile (Port footprint). Only 30% of Gulf Sturgeon had a high number of days and high number of detections. From October 2013 - May 2014, between 3 and 9 fish were detected on each receiver but only 2,371 raw detections; 6 adult, 1 subadult, and 2 juvenile (east gate), 8 adult, 1 subadult, and 1 juvenile (west gate), and 9 adult, 3 subadult and 2 juvenile in the Port footprint. Five (29.4%) fish had a high numbers of days compared to the rest of the fish; however, all fish exhibited a transient presence pattern. Three adult Pearl and two Pascagoula fishes were detected in both periods. Two adult Gulf Sturgeon captured/tagged in the Choctawhatchee/Blackwater and Escambia drainages, Florida, on 9 April 2014 totaled 105 detections. Adults, unexpectedly, had the greatest number of detections in these shallow, non-island critical habitats and suggests repeatable regional-scale movements into non-barrier islands habitats.

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**0369 General Ichthyology I, Balconies J & K, Sunday 10 July 2016**

Frank Pezold[1], Ray Schmidt[2], Melanie Stiassny[3]

*[1]Texas A&M University - Corpus Christi, Corpus Christi, Texas, USA, [2]Smithsonian Mpala Research Centre, Nanyuki, Laikipia County, Kenya, [3]American Museum of Natural History, New York, New York, USA*

## Fishes of the Geebo – Dugbe River Confluence, Liberia, with an Emphasis on Tributary Creeks

The Geebo-Dugbe watershed lies in Sinoe County, in southern Liberia between Sapo National Park and the Grand Kru-River Gee National Forest. This region is believed to serve as a wildlife corridor between the two preserves but its diversity has been little studied. Fishes were sampled in the region during February 2014 using a backpack shocker, seines, dipnets and gillnets. Most sites sampled were on first or second order

streams. Forty-five species representing 20 families were recorded from the watershed. The diversity of species obtained in this small area of the Dugbe River basin compares well with studies of other West African rivers in the Upper Guinean Province. *Epiplatys olbrechtsi*, an undescribed *Epiplatys* species, *'Barbus'* cf. *guildi*, *Hemichromis bimaculatus*, *Bryconalestes longipinnis* and *Amphilius atesuensis* were commonly encountered in the small streams. The most abundant species taken from cascades in the Geebo River were *Doumea chapuissi*, *Labeobarbus wurtzi*, *Parasicydium bandama* and *Sicydium crenilabrum*. Four species reported here represent new records for Liberia – *Bryconalestes derhami*, '*Barbus*' cf. *guildi*, *Parasicydium bandama* and *Sicydium crenilabrum,* and six other species discovered in the basin represent range extensions.

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**0259 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Nicole Phillips[1], David Morgan[2]

*[1]University of Southern Mississippi, Hattiesburg, Mississippi, USA, [2]Murdoch University, Murdoch, Western Australia, Australia*

## Genetic Bottlenecks in *Pristis* Sawfishes in Australia

Australia is recognized as the last stronghold for three of the four *Pristis* sawfishes. This study examined patterns of genetic diversity in Australian *Pristis* sawfishes to assess their genetic 'health' and whether there was evidence of genetic bottlenecks in these populations. Based on data for a portion of the mitochondrial DNA and microsatellite loci, the overall levels of genetic diversity for each of *P. pristis, P. zijsron* and *P. clavata* were moderate. However, the assemblages of *P. zijsron* and *P. clavata* in northeast Australia appear to have lower levels of genetic diversity than those in the northwest. Furthermore, there is a signature of a genetic bottleneck in all three species that is especially pronounced in *P. clavata* in northeast Australia. Demographic analyses and preliminary genetic data generated from historic sawfish rostra were used to evaluate whether these declines in genetic diversity were the result of recent bottlenecks or historic founder effects. Understanding temporal patterns of genetic diversity is important in the conservation of critically endangered and endangered sawfishes because it informs on whether the levels of genetic diversity observed in contemporary populations have been sustained for long periods of time or whether they are the result of more recent anthropogenic activities.

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**0499 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Catarina Pien, David Ebert

*Moss Landing Marine Laboratories, Moss Landing, CA, USA*

**Characterization of the elasmobranch assemblage in Elkhorn Slough, CA**

Elkhorn Slough is an estuarine embayment that drains directly into the Monterey Bay. Over the last few decades, Elkhorn Slough has undergone several natural and anthropogenic changes, the most significant being the building of Moss Landing Harbor, which greatly altered the environment to become more marine, with higher current, tidal prism, and rates of erosion. Along with these physical changes, the biological composition of elasmobranchs has also changed over time. Certain species such as the Thornback Ray *Platyrhinoidis triseriata* have increased in abundance, while others such as the Shovelnose Guitarfish *Rhinobatos productus* and Grey Smoothhound *Mustelus californicus* have become scarce in Elkhorn Slough. This study aims to create a baseline for the elasmobranch species currently using Elkhorn Slough, and to understand which variables influence their presence, as well as their abundance. Between April 2015 and July 2016, longlines and gillnets were used to sample elasmobranchs. Specimens were measured, sexed, and their locations were recorded. Temperature, salinity, oxygen, and turbidity were also recorded. Spatial and statistical analyses will be used to determine which species are most abundant, where they are most densely located, whether segregation (sex, size, species) occurs, when species are seasonally migrating, and which factors are playing an important role in the presence and abundance of these species in an important California estuary. Attaining a better understanding of what attracts these species to Elkhorn Slough will allow for better management of these species, which play an important role in the dynamics of California estuaries.

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**0257 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Josh Pierce[1], Craig Rudolph[1], Steve Reichling[2], Emlyn Smith[3], Beau Gregory[4]

*[1]USDA Forest Service, Southern Research Station, Nacogdoches, TX, USA, [2]Memphis Zoo, Memphis, TN, USA, [3]USDA Forest Service, Kisatchie National Forest, Bentley, LA, USA, [4]Louisiana Department of Wildlife and Fisheries, Lake Charles, LA, USA*

**The Louisiana Pine Snake Reintroduction with Comments on Monitoring Techniques**

Ongoing surveys suggest that the Louisiana Pine Snake (*Pituophis ruthveni*) is rapidly declining; and currently occupied habitat is limited to a few small blocks of degraded and highly fragmented habitat. Research suggests that this species requires frequently burned sites with a well developed herbaceous understory capable of supporting populations of its primary prey, Baird's Pocket Gopher (*Geomys breviceps*). Recent changes in management practices on U. S. Forest Service lands have resulted in restoration of substantial blocks of suitable habitat, which are now available for

reintroduction. A captive population consisting of approximately 100 individuals has been established from wild-caught snakes from Bienville Parish, LA. A reintroduction site was established in 2010 which is located on the Catahoula District of the Kisatchie National Forest. Sixty individuals have been released to date. The current protocol is to continue to breed captive snakes and release 50% of available animals as neonates immediately following post-natal shed, while the remaining snakes will be head-started and released the following April. Currently, automated pit tag recorders and trapping are the primary monitoring techniques. We will compare the results of these techniques and discuss the pros and cons of each.

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**1032 Fish Genetics, Salon D, Sunday 10 July 2016**

Tyler Pilger[1], Keith Gido[2], David Propst[1], James Whitney[3], Thomas Turner[1]

*[1]University of New Mexico, Albuquerque, NM, USA, [2]Kansas State University, Manhattan, KS, USA, [3]Pittsburg State University, Pittsburg, KS, USA*

## Wildfires differentially affect population genetics of native and nonnative fishes of the Gila River

Wildfires are important disturbance events for terrestrial and aquatic ecosystems throughout western North America. Wildfire related ash and debris flows can strongly influence fish communities yet there is little empirical data on their influence on genetic diversity and spatial structuring. Population genetic monitoring was used to characterize genetic summary statistics for eight fish species (six native, two nonnative) and evaluate genetic responses to flooding and ash and debris flows resulting from a series of three catastrophic wildfires (in 2011, 2012, and 2013) in the Upper Gila Basin in New Mexico. Three species exhibited declines in heterozygosity and/or allelic richness and decreased linkage disequilibrium effective size ($N_{eD}$) over the course of the study, whereas other species were more resilient. Variance effective size ($N_{eV}$) using temporal samples was also estimated for species and was generally low indicating substantial changes in allele frequencies over time. In conjunction with temporal changes in genetic structure ($F_{ST}$), these data suggest substantial demographic changes occurred for several species. By comparing temporal changes in genetic diversity and structure spanning pre-disturbance through recovery phases, we developed a conceptual framework that makes explicit predictions concerning the trajectory of genetic summary statistics. Applying our framework across species revealed differences in relative roles of dispersal and local compensatory reproduction to resilience and recovery following large disturbances.

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**0433 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

Kyle Piller[1], Alan Lemmon[2], Emily Moriarty Lemmon[2]

*[1]Southeastern Louisiana University, Hammond, LA, USA, [2]Florida State University, Tallahassee, FL, USA*

## Interrelationships of Cyprinodontiform Fishes Using Anchored Phylogenomics

The order Cyprinodontiformes is a diverse and well known group of fishes that includes ten families (Aplocheilidae, Rivulidae, Profundulidae, Fundulidae, Nothobranchiidae, Valenciidae, Anablepidae, Poeciliidae, Cyprinodontidae, and Goodeidae) and more than 800 species that are globally distributed in tropical and temperate, freshwater, and estuarine habitats. The evolutionary relationships among the families within the order, based on different molecular and morphological data sets, have remained uncertain. Therefore, the objective of this study was to use a targeted enrichment approach known as anchored hybrid enrichment, to better understand the phylogenetic relationships among the families of cyprinodontiform fishes. This study included more than 100 individuals representing all cyprinodontiform families. Phylogenetic analyses recovered many of the same relationships from previous studies, and novel, well supported placements of other families. The results from this study will provide the robust, historical framework needed to investigate a plethora of questions in cyprinodontiform biogeography, taxonomy, evolutionary biology, and physiology.

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**0549 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Amanda Pinion[1], Daemin Kim[2], Kevin Conway[3]

*[1]Texas A&M University, College Station, TX, USA, [2]Ewha Womans University, Seoul, Republic of Korea, [3]Texas A&M University, College Station, TX, USA*

## Variation in tuberculation across the range of the Sand Shiner *Notropis stramineus* (Teleostei: Cyprinidae)

The Sand Shiner *Notropis stramineus* (Cope, 1865) is a small, widespread species of North American minnow found in small rivers and streams from southern Canada to northern Mexico. Recent unpublished analyses of genetic data (nuclear and mitochondrial genes) have revealed several geographically isolated populations of *N. stramineus* to be highly divergent (uncorrected p-values 6-10% between certain populations; 0-1% within populations) suggesting that the Sand Shiner may represent a species complex of similar looking, yet genetically distinct species. Despite these genetic differences, there are no currently known morphological traits that can be consistently used to distinguish (i.e., diagnose) the genetic lineages of Sand Shiners. Members of Cyprinidae often display sexual dimorphism in the size and abundance of tubercles and characters of tuberculation have been used previously to distinguish between closely related (and potentially recently diverged) sister taxa. Using scanning electron microscopy (SEM), we

investigate the location, size and general morphology of tubercles in males belonging to different genetic lineages of Sand Shiners to assess the utility of characters of tuberculation for distinguishing between putative species within the Sand Shiner species complex.

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**1015 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Matthew Pintar, William Resetarits

*University of Mississippi, Oxford, MS, USA*

**Functionality of the spotted salamander egg mass polymorphism**

The spotted salamander, *Ambystoma maculatum*, exhibits a unique polymorphism in the structure and appearance of its egg masses. This polymorphism is genetically determined and is due to the substitution of one protein in the outer jelly layer of egg masses. Based on the observation that the proportion of white egg masses in ponds across its range correlated with dissolved nutrient levels, we tested whether this polymorphism is advantageous to egg masses in ponds with different nutrient levels using two mesocosm experiments and by collecting field data from natural ponds at the University of Mississippi Field Station (UMFS). Larvae from white egg masses were larger upon hatching in low nutrient conditions than those from clear egg masses, and these differences persisted throughout the larval period. Higher proportions of white egg masses were found in ponds with low conductivity (an indicator of dissolved nutrient levels) at UMFS. These results support the idea that polymorphisms can be adaptations to, and are maintained by, environmental heterogeneity.

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**1020 SSAR SEIBERT AWARD ECOLOGY, Galerie 3, Thursday 7 July 2016**

Matthew Pintar, William Resetarits

*University of Mississippi, Oxford, MS, USA*

**Oviposition preference matches larval performance in Cope's gray treefrog**

Oviposition site selection by breeding amphibians determines larval habitat for their offspring. Many amphibians breed in temporary ponds, which vary in hydroperiod and levels of competition, predation, and resource abundance. Newly filled ponds have fewer competitors and predators and more periphyton and phytoplankton, which are more palatable food sources for anuran larvae. We tested for oviposition site preference between old and new water pools in *Hyla chrysoscelis*, Cope's gray treefrog, a species with better larval performance in newly filled pools. Consistent with larval performance and the observation that anurans often breed in ponds immediately after they fill, *H. chrysoscelis* selectively oviposited in new pools. Conductivity was significantly lower

and dissolved oxygen significantly higher in new versus old pools, and these may be cues of pond age and productivity, respectively. We demonstrate that adult oviposition site selection preferences match larval performance differences seen in previous work and that this preference is not simply for newly filled ponds but for ponds with a recent influx of water. These results further suggest novel ways for land managers to increase amphibian populations. Draining ponds will increase their attractiveness to breeding females who simultaneously avoid fish and choose new water.

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**0770 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Brendan Pinto[1], Anthony Russell[2], Timothy Higham[3], Laurie Vitt[4], Guarino Colli[5], Tony Gamble[1]

*[1]Marquette University, Milwaukee, Wisconsin, USA, [2]University of Calgary, Calgary, Alberta, Canada, [3]University of California, Riverside, Riverside, California, USA, [4]University of Oklahoma, Norman, Oklahoma, USA, [5]Universidad de Brasília, 70910-900 Brasília, Districto Federal, Brazil*

## Population Genetic Structure of the Gecko *Gonatodes humeralis*

Geckos of the genus *Gonatodes* occur in Central and South America and scattered islands in the Caribbean. *Gonatodes humeralis* has the most extensive distribution in the genus and occurs across northern South America including Amazonia, the Guianan shield, and Trinidad. Furthermore, *G. humeralis* occupies a broader range of microhabitats than its congeners. Interestingly, it has recently been shown to also have a functional digital adhesive apparatus, distinguishing it from all other *Gonatodes*, which lack adhesive toepads. Adhesive digits may be considered a key innovation and could explain the broad distribution and expanded niche breadth of this species. As a consequence, we might expect that the recent evolution of digital adhesion enabled *G. humeralis* to rapidly expand into its current broad distribution as a single widespread species. This would contrast with most other widespread Amazonian taxa that have been shown to be species complexes made up of multiple, often cryptic, species. To test this hypothesis, we generated two molecular genetic datasets from 31 individuals from across the species' range: one using restriction-site associated DNA sequencing (RAD-seq); and a second composed of two mitochondrial genes. We constructed maximum likelihood trees for both datasets using *RAxML*, accounting for RAD-seq SNP bias, and population structuring using the software *Structure*. Preliminary results indicate a structured population, with individuals from Trinidad being distinct from the rest of South America and limited genetic structure distinguishing eastern and western Amazonia.

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**0008 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Javier Pinto, Omar Torres

*PUCE, Quito, Ecuador*

## Ecology of a Community of Lizards (*Anolis*: Dactyloidae) in Yasuni National Park, Ecuador

Despite having been extensively studied in the Caribbean, information on *Anolis* from the mainland is scarce. In this study, morphology was analyzed and related to trophic ecology, temperature and habitat use on a community of *Anolis* in one of the most biodiverse places on the planet, Yasuní National Park (PNY), specifically in the Yasuní Research Station of PUCE (ECY). This community includes six species: *A. fuscoauratus, A. ortonii, A. scypheus, A. transversalis, A. trachyderma* and *A. punctatus*. Using morphological variables, we determined that the structures that form the limbs mostly contribute to the morphological variation between species. By comparing morphological variables with the size of the diet we determined that the snout-vent length is closely related to the size of the prey. Also, by comparing each species with Caribbean "ecomorphs" we observed that *A. ortonii* bears some resemblance to the crown-giant ectomorph, regardless the snout-vent length. Using ecological data we determined habitat, microhabitat and perch height preferences. With respect to thermal ecology, the *Anolis* community ECY maintains the body temperature on the air temperature (~ 2 ° C). The snout-vent length influences the size of the prey consumed, although was not related to volume and total number of preys in the stomach. Niche breadth values indicated that the six species consumed several prey types. There is no clear trophic niche partitioning. Overlap values, showed that the community shares resources (diet, habitat and microhabitat). Additionally, a null model showed that there were ecological mechanisms influencing overlapping niches.

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**0544 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Amber Pitt[1], Joseph Tavano[2], Robert Baldwin[2], Benjamin Stegenga[2]

[1]*Trinity College, Hartford, CT, USA,* [2]*Clemson University, Clemson, SC, USA*

## Movement Ecology Demonstrates the Importance of Maintaining Diverse Aquatic Systems within Intact Forest Ecosystems for Amphibian Conservation

Effective biodiversity conservation and policy require a firm understanding of movement ecology because of the role individuals' movements play in maintaining genetic diversity and population, community, and ecosystem dynamics across spatiotemporal scales. Studies focused on movement ecology allow for effective identification and prioritization of critical habitats and movement corridors for species conservation. We examined the movements and habitat use of anurans in forested landscapes with diverse aquatic resources in a temperate ecoregion in order to 1) identify critical habitats and movement corridors and 2) evaluate biological connectivity among diverse aquatic and terrestrial habitats. Radio-telemetry was used to track the

movements and habitat selection of three sympatric anuran species [wood frogs (*Lithobates sylvaticus*), southern leopard frogs (*Lithobates sphenocephalus*), and green frogs (*Lithobates clamitans*)] in two index landscapes containing diverse aquatic features. Wood frogs and southern leopard frogs moved among ephemeral wetland, marsh, and stream habitats. Green frogs used ephemeral wetland, swamp, and stream habitats. In terrestrial habitats, wood frogs and green frogs selected areas with ample deciduous leaf ground cover; southern leopard frogs selected areas with ample fern ground cover. The variation in habitat use by the three anuran species supports the importance of conserving heterogeneous features within a landscape in order to maintain biodiversity. Furthermore, anurans serve as mobile link organisms biologically connecting ephemeral and permanent water bodies, including lentic and lotic systems, and terrestrial habitats.

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## 0837 Amphibian Reproduction & Herp Conservation, Galerie 3, Saturday 9 July 2016

Shannon Pittman[1], Paul Andreadis[2], Ian Bartoszek[3], Cailin Ervin[4], Robert Reed[5], Patrick Zollner[6], Michael Dorcas[7]

*[1]Davidson College, Davidson, NC, USA, [2]Denison University, Granville, OH, USA, [3]Conservancy of Southwest Florida, Naples, FL, USA, [4]Conservancy of Southwest Florida, Naples, FL, USA, [5]USGS, Fort Collins, CO, USA, [6]Purdue University, West Lafayette, IN, USA, [7]Davidson College, Davidson, NC, USA*

### Simulating Dispersal Patterns of Neonatal Burmese Pythons (*Python molurus bivittatus*) in South Florida

Predicting the dynamics of spatial spread of invasive species is central to implementing the most effective control and containment measures. Accounting for complex animal behaviors in models of spatial spread can give rise to more accurate predictions of the dynamics of invasions. Individual-based models (IBMs) can incorporate behavioral complexity in movement and provide a method for predicting the effects of movement and dispersal strategies on spread dynamics. The Burmese python (*Python molurus bivittatus*) is a potentially devastating invasive species to the unique ecosystems of South Florida. We radiotracked 14 neonatal Burmese pythons for 6 months in South Florida. We used behavioral and survival data from the radiotelemetry study to parameterize an individual-based model of python dispersal. We simulated dispersal through habitats of differing types to generate dispersal patterns under a range of landscape composition scenarios. These dispersal patterns will be used to predict scenarios for the range-wide expansion of Burmese pythons in Florida.

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**0302 Amphibian Reproduction & Herp Conservation, Galerie 3, Saturday 9 July 2016**

Renata Platenberg, Kelcie Troutman, Avram Primack

*University of the Virgin Islands, St Thomas, U.S. Virgin Islands*

### Frogs and Cell Phones: An Experiment with Citizen Scientists in the Virgin Islands

Frogs are important ecosystem health indicators that are currently undergoing significant declines on a global scale. On the island of St Thomas in the US Virgin Islands, frogs are experiencing ongoing habitat loss, pressures from invasive species, and altered activity periods due to shifts in seasonal precipitation. Current knowledge of island-wide trends in frog status is based on monitoring using standardized aural surveys conducted at random points along a transect route (i.e., a road). In order to examine frog response to more specific drivers, such as land use change and presence of invasives, data is needed at more points across the island that can be correlated with landscape features, but this work is labor and time intensive and many locations are simply not accessible. We conducted an experimental synoptic survey using a citizen science model where community members submitted cell phone recordings collected during a specific time window, along with a screenshot of their location coordinates. Participants were recruited over social media and through schools. Over 300 recordings were submitted from 6 islands in both the US and British Virgin Islands. Survey locations were mapped using GIS; recordings were classified using sound analysis software and verified aurally. There were a few limitations that affected data quality, which can be reduced with better public communication. This effort also resulted in increased dialog about wildlife conservation, as measured by comments and "likes" in social media. Overall, this method holds promise for increasing our understanding of and ability to manage these important species.

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**0076 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Jeffrey Plumlee, David Wells

*Texas A&M University at Galveston, Galveston, TX, USA*

### Feeding ecology of three coastal sharks in the northwest Gulf of Mexico

The feeding ecology of three coastal shark species, Atlantic sharpnose (*Rhizoprionodon terraenovae*), bonnethead (*Sphyrna tiburo*), and blacktip (*Carcharhinus limbatus*) sharks were examined in the northwest Gulf of Mexico (GOM). A total of 601 (305 Atlantic sharpnose, 239 bonnethead, and 57 blacktip) sharks were collected over two years via dockside sampling from recreational anglers in Galveston, Texas. All individuals had stomach contents examined, and a subset (50 Atlantic sharpnose, 50 bonnethead, and 36 blacktip) were analyzed for stable isotopes (carbon, nitrogen, and sulfur) in muscle tissue, revealing short-term and long-term feeding strategies. Both blacktip and Atlantic sharpnose stomach contents consisted of teleost fish with % index of relative importance

(IRIs) of 98.95 and 91.16% respectively, whereas bonnethead diets were dominated by crustaceans (%IRI = 87.20). Stable isotope analysis revealed bonnetheads had higher mean carbon (δ13C) and lower sulfur (δ34S) values, indicating inshore feeding and a preference for benthic invertebrates. Atlantic sharpnose and blacktips were shown to feed on similar prey using stomach content analysis, yet Atlantic sharpnose had a broader diet including cephalopods and crustaceans in addition to teleost fishes. Differences were further established using nitrogen (δ15N) values, which were significantly lower for Atlantic sharpnose than blacktips. Collectively, stomach contents and stable isotope analyses support different feeding strategies of three common shark species. Sulfur (δ34S), in addition, appears to serve as a natural tracer, distinguishing benthic versus pelagic feeding patterns in elasmobranchs. This study provides important ecosystem-based feeding information of upper trophic-level predators in coastal waters of the northwestern GOM.

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## 0244 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016

Helen Plylar[1], Clifford Fontenot[2]

*[1]Florida Institute of Technology, Melbourne, FL, USA, [2]Southeastern Louisiana University, Hammond, LA, USA*

### Eye:body Allometry and Scaling: Do Small Snakes Really Have Big Eyes?

Vertebrate eye size is a function of body size, but is influenced by ontogeny and ecology (e.g., large eyes facilitate night vision). Allometric scaling of most body size parameters in snakes (e.g., Snout-Vent length, tail length, skull morphology), are well studied. However, despite anecdotal observations that neonate snakes have relatively large eyes, the apparent allometric relationship has not been empirically tested. This is of particular interest because eye morphology directly affects optical system function. To assess eye/body size scaling, we measured eye, head, and body size in the semiaquatic natricine snakes *Nerodia cyclopion* and *N. fasciata*. Body size increased at a significantly higher rate than head size and eye size (negative allometry), i.e., small snakes indeed have relatively large eyes. However, there were interspecific differences in eye shape, where eyes of *N. fasciata* were wider in diameter, but those of *N. cyclopion* were longer (axial length). Having relatively large eyes in small snakes may represent a minimum functional eye size, whereas difference in eye shape suggests differences in visual ecology.

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**0805 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Abby Pomento, Blair Perry, Robert Denton, H. Lisle Gibbs, Matthew Holding

*Ohio State University, Columbus, OH, USA*

### No Safety in the Trees: Local and Species-level Adaptation of an Arboreal Squirrel to the Venom of Sympatric Rattlesnakes

Some squirrel species respond to variable selection strength from venomous snakes with population-level variation in venom resistance, while some rattlesnake species possess venom that is more effective at overcoming venom resistance. A simultaneous functional evaluation of resistance variation within and between species can link resistance variation to its direct evolutionary causes across these disparate evolutionary scales. Here, we compared the effectiveness of squirrel sera in inhibiting rattlesnake (*Crotalus* sp.) venom metalloproteinase activity between populations and between species to test for a response to local variation in selection from snakes and for the existence of specialization of two resistant squirrel species to their sympatric snake predators. We found that Timber Rattlesnake (*C. horridus*) venom inhibition by Eastern gray squirrels is higher at a site where the rattlesnakes are present, which suggests selection maintains venom resistance in populations separated by short distances. Next, we performed a reciprocal cross of venoms and sera from two snakes and two squirrel species that showed squirrel resistance is lower when venom is derived from allopatric snake species, indicating evolutionary tracking of the sympatric venom accompanied by a cost of this specialization if challenged by a different snake's venom. This pattern can be explained if inhibitors must recognize venom proteins and resistance evolution tracks venom evolution. The many squirrel and rattlesnake species present across North America may be engaging in pairwise (co) evolutionary interactions, offering a rich system to jointly investigate the effects of phylogeny, life history, and the broader ecological community on coevolving molecular adaptations.

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**0877 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Daniel Portik

*University of Texas at Arlington, Arlington, Texas, USA*

### A phylogenomic comparative analysis of sexual size dimorphism and body size evolution in African Reed Frogs

The African anuran family Hyperoliidae exhibits considerable variation in body size across species and between the sexes. Using phylogenomic data (1,000+ exons), I reconstructed the evolutionary relationships of the family and investigated the evolution of sexual size dimorphism. My examination of the body sizes of hyperoliid species revealed this family largely exhibits female-biased SSD, and I find evidence for an isometric scaling relationship between body sizes of the sexes. Within the genus

*Hyperolius* I found significant differences in the evolutionary trend of male and female body sizes, namely selection for a single optimal female body size and strong directional selection for males occurring in different subclades. I propose the functional relationship between female body size and arboreal oviposition may be opposing the selection for increased fecundity associated with larger female sizes. The body sizes of males may be the result of a combination of interspecific resource partitioning, division of acoustic space, and reproductive character displacement.

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**0370 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Gregg Poulakis[1], Karissa Lear[3], Rachel Scharer[1], Nicholas Whitney[2]

*[1]Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, Charlotte Harbor Field Laboratory, Port Charlotte, FL, USA, [2]Behavioral Ecology and Physiology Program, Mote Marine Laboratory, Sarasota, FL, USA, [3]Freshwater Fish Group and Fish Health Unit, Centre for Fish and Fisheries Research, School of Veterinary and Life Sciences, Murdoch University, Murdoch, WA, Australia*

**Where and How do Smalltooth Sawfish, *Pristis pectinata*, Spend Time in their Nurseries? Insights from Acoustic and Accelerometer Data**

In recent decades, use of telemetry to determine general locations of many fish species has improved our understanding of broad habitat use patterns. However, these studies are limited in their ability to provide insights into specific behaviors or reasons for using specific habitats. Recently, acceleration data loggers (ADLs) have been developed to quantify behavioral parameters (e.g., % time active, resting, feeding, mating) based on the animal's movements. Although ADLs provide data on behavior and physiology they do not provide information on animal location. For this reason, we used acoustic and ADL tags concurrently to improve our understanding of endangered Smalltooth Sawfish (*Pristis pectinata*) ecology in the Peace River, Florida. In 2014 and 2015, seven juveniles (808-1831 mm stretch total length; <2 yr old) were double tagged and one was double tagged twice. Preliminary ADL data analyses have indicated a diel pattern of hourly activity with juveniles more active at night (mean = 77.5% ± 26.5 SE) than during the day (mean = 63.1% ± 31.3 SE). Acoustic data showed that juveniles resided in protected backwater habitats near red mangrove shorelines during the day and moved into open water habitats away from shore at night. Brief events of high acceleration amplitude and frequency, which may be indicative of foraging, occurred during day and night. This suggests that the diel patterns of activity and location within the nursery were not solely related to foraging. Water temperature, depth, and tide will be examined to determine how they may have influenced habitat use.

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**0046 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Savannah Price, Diana Hews

*Indiana State University, Terre Haute, IN, USA*

## Are Blue Color Patches Used in Female Aggression in an Unusual *Sceloporus* Species with Ornamented Females?

Ornamental coloration serves a variety of roles in animals. These roles have been well-studied in many male vertebrates but females have received far less attention. In many species, males are more colorful and aggressive than females. In most *Sceloporus* lizards, males use ornamental colors as a "badge of status" during aggressive encounters. *Sceloporus jarrovii* is unusual in that both sexes have bright blue abdominal patches and show patterns of seasonally-elevated aggression. My research focuses on the role of blue patches in aggressive encounters of female *S. jarrovii,* which I am studying with manipulative and correlational approaches. Here I present the experimental study results, in which I staged intrusions between size-matched pairs of females. I presented free-ranging focal females with tethered intruders with patches painted either white or blue. The paint treatments matched the two extremes of variation for this population, measured from digital images of adult females taken in previous years. I hypothesized that patches are signals of fighting ability used by females during aggressive encounters. This hypothesis makes several predictions based on color of the focal and color of the intruder. Importantly, it predicts that blue-painted intruders will elicit the most aggression from focals whose natural patch coloration is more blue. For this analysis, I first classed focal females as being in the top or bottom 50$^{th}$ percentile of "blue" using data taken from digital images of abdominal patches with Adobe Photoshop™ and summarized with a principle components analysis (PCA). I then summarized focal female behavior using PCA.

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**0062 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Bianca Prohaska[1], R. Dean Grubbs[1], Dana Bethea[2], Gregg Poulakis[3], Rachel Scharer[3]

*[1]Florida State University, Tallahassee, FL, USA, [2]NOAA Fisheries Panama City Lab, Panama City, FL, USA, [3]FWC, Port Charlotte, FL, USA*

## Physiological Ecology of Smalltooth Sawfish (*Pristis pectinata*) in Florida Waters

Similar to other species of elasmobranchs, smalltooth sawfish are slow growing, mature late in life, and produce relatively few young, all factors which have contributed to the sensitivity of smalltooth sawfish to dramatic population declines from overfishing, bycatch in commercial fisheries, recreational fishing, and habitat loss. Currently, nothing is known regarding the physiological stress response of these fish to capture or to other

physiological challenges such as habitat loss, and in the absence of basic biological data, effective conservation plans cannot be formulated, making populations highly susceptible to further declines. We plan to elucidate the basic stress physiology of these fish over ontogeny, determine the implications of recreational fishing pressures in light of their physiology, and determine if habitat loss has resulted in chronic stress in these fishes. To address these research interests, a blood sample will be immediately collected from the caudal vein of each smalltooth sawfish upon capture to attain a suite of blood chemical parameters that will include: pH, lactate, $pCO_2$, $HCO_3$, K+, glucose, and hematocrit. Preliminary results suggest that the stress response to fishing capture in smalltooth sawfish is relatively low compared to other elasmobranchs examined to date. Additionally, preliminary results indicate that young of the year smalltooth sawfish have a higher stress response to capture than that of juveniles or adults, but this response is still relatively low compared to other elasmobranchs studied to date.

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## 0174 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016

David Propst[1], Keith Gido[2]

*[1]University of New Mexico, Albuquerque, NM, USA, [2]Kansas State University, Manhattan, KS, USA*

### Using Long-term Datasets to Characterize Effects of Major Disturbances on Dynamics of Arid-land Fish Assemblages

Over the past 30 years five major floods, two droughts, and two major wildfires have occurred in the Gila-San Francisco River drainage of southwest New Mexico. Given the magnitude of each event, measurable, if not major, changes in fish assemblage structure (species density, population size structure, and assemblage richness) following each event were expected. We used fish and habitat data collected annually during autumn since 1988 from six permanent study sites in the Gila-San Francisco Drainage to characterize the effects of these disturbances on fish assemblages. Floods typically reduced abundance of nonnative fishes, but had minimal effect on native fish metrics. Effects of wildfire were dependent on geographic proximity to fire and portion of watershed burned. Drought, especially when coupled with wildfire, was the most assemblage altering disturbance. Recovery time to pre-disturbance conditions was variable across species and was associated with intensity and duration of disturbance. Generally, recovery from floods was rapid whereas recovery from prolonged drought/major wildfire took years. When conceived, our long-term monitoring program was not specifically designed to characterize the effects of major disturbances, but rather to be sufficiently robust to accurately capture long-term species population trends, acquire life history information, understand habitat-species relationships, and relate assemblage structure to important biotic and abiotic drivers. Time and budget constraints limited what data could be collected, but understanding drivers of observed changes would have been enhanced by site-specific stream discharge, temperature, and channel profile, as well as estimates of capture efficiency across a range of conditions.

**0903 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: PHYSIOLOGY & MORPHOLOGY**

Jake Pruett[1], Stephanie Campos[2], Helena Soini[3], Milos Novotny[3], Cuaucihuatl Vital-Garcia[4], J. Jaime Zúñiga-Vega[5], Emilia Martins[2], Diana Hews[1]

*[1]Department of Biology, Indiana State University, Terre Haute, IN, USA, [2]Department of Biology and Center for the Integrative Study of Animal Behavior, Indiana University, Bloomington, IN, USA, [3]Institute for Pheromone Research and Department of Chemistry, Indiana University, Bloomington, IN, USA, [4]Departmento de Ciencias Veterinarias, Instituto de Ciencias Biomedicas, Universidad Nacional Autonoma de Ciudad Juarez, Juarez, Chihuahua, Mexico, [5]Departamento de Ecologia y Recursos Naturales, Facultad de Ciencias, Universidad Nacional Autonoma de Mexico, Distrito Federal, Mexico*

## Polymorphic Male Blue-bellied Lizards (*Sceloporus parvus*) Exhibit Differences in Circulating Testosterone Levels and Relative Abundance of Volatile Organic Compounds

Polymorphic signaling traits can be associated with differences in physiology, morphology or behavior, and can be linked to alternative reproductive tactics. Within a species, males that exhibit polymorphic signaling traits often differ in levels of aggression and/or territoriality. Male Blue-bellied lizards (*Sceloporus parvus*) exhibit polymorphic throat coloration that is exposed during aggressive displays to territory intruders. Some males of this species have throat patches with only blue and white (BW) coloration while others have yellow and blue throat patches (YB). We asked whether other phenotypic traits differed between BW and YB males. We measured mite loads, baseline plasma concentrations of testosterone and corticosterone, and relative abundance of volatile organic compounds (VOCs) in femoral gland (FG) secretions. Mite loads tended to be higher for BW males compared to YB males, but the difference in mite loads was not significant. Plasma concentrations of testosterone were significantly lower in BW males relative to YB males, but plasma concentrations of corticosterone did not differ between morphs. Relative abundance of VOCs also differed between the morphs with FG secretions of BW males containing more dodecanoic, hexadecanoic and oleic acid. Differences in circulating testosterone may be linked to differences in territoriality and aggression, and differences in abundance of VOCs could be sufficient to provide information about morph identity. Evidence suggest that VOCs are important chemosignal components in other vertebrates, and these compounds may have signal function in *Sceloporus* FG secretions that are used by males to mark territory boundaries.

**0066 Herp Biogeography, Salon D, Friday 8 July 2016**

Alex Pyron

*GWU, Washington DC, USA*

**Integrating phylogenomic and morphological data to assess candidate species-delimitation models in Brown and Red-bellied snakes (*Storeria*)**

Systematics at the species level is still marked by theoretical and empirical tensions among the desire to identify geographic lineages, delimit species, and estimate their relationships. These goals are often confounded because each relies, at least to some extent, on the others being known. However, recently developed methods can simultaneously address all three. Furthermore, next-generation genomic sequencing allows us to generate large-scale molecular datasets to examine variation within species at a fine scale. Finally, a renaissance in morphological species-validation allows us to integrate historical species definitions with coalescent models for species delimitation. Here, we investigate the applicability of these methods in an empirical case, in the Nearctic snake genus *Storeria*. Integrating trait data into species delimitation reduces the number of species delimited from molecular data alone. While molecular data support 8 distinct species-level lineages, including morphological data reduces this to 4. The taxa *S. dekayi*, *S. occipitomaculata*, *S. storerioides*, and *S. victa* are considered distinct, monotypic species, with no subspecies recognized. We highlight the need for careful assessment of species delimitation, combining both computational genetic methods as well as traditional character-based descriptions. It is now possible to identify phylogeographic lineages, delimit species using molecular and morphological data, and estimate their relationships in a single coherent set of analyses. Moving forward, this will allow for more rapid and objective assessments of cryptic diversity at the species level.

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**0027 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016**

Mark Pyron, Robert Shields, Mario Minder

*Ball State University, Muncie, IN, USA*

**Long-term fish assemblages of the Wabash River is not enough**

We studied the long-term fish assemblages of the Wabash River, Indiana in an attempt to identify causes or correlates of a community shift that occurred in the 1990s. Fish collection data are phenomenal for some analyses. However, the patterns from assemblage analyses still require additional information to quantify mechanisms and/or causes of observed patterns. Additional long-term data that would be useful are water chemistry, phytoplankton, macroinvertebrates, and agricultural management. We have only agricultural management information that documented changes in fertilizer practices. Our most recent approach to examining long-term fish assemblages is with food webs that are quantified by analyzing tissue of organisms for isotope ratios. We compared recent food webs to historical food webs by using our fish collections and

museum specimens as tissue sources. Our first approach was a bulk tissue analysis of carbon and nitrogen isotope ratios. This allowed us to examine trophic levels and potential carbon sources. Our more recent approach is compound specific amino acid isotope analysis, which allowed us to identify primary producers in a food web.

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## 0494 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon F-H, Friday 8 July 2016

Quynh N. Quach[1], R. Graham Reynolds[2], Liam J. Revell[3]

*[1]University of Massachusetts Boston, Boston, MA, USA, [2]University of North Carolina Ashville, Ashville, NC, USA, [3]University of Massachusetts Boston, Boston, MA, USA*

### Phylogeography and Population Structure of *Anolis cristatellus* on the island of Vieques

Genetics of island populations of a widespread species can provide important insights into the diversification process that might otherwise go undetected in phenotypic studies. Here, we present results from a study of genetic variability within a tropical lizard, *Anolis cristatellus*, on the Puerto Rican Spanish Virgin Island of Vieques. We examined the phylogeography and population structure of *A. cristatellus* on Vieques in relation to populations on Puerto Rico and the other Virgin Islands. We estimated a mitochondrial gene tree using NADH 2 (ND2) sequences from 382 samples across the island and found that *A. cristatellus* population on Vieques are mitochondrially paraphyletic with deeply divergent clades exhibiting well-defined geographic structure, suggesting that these clades are naturally divergent and do not reflect anthropogenic activities. We are currently using restriction-site associated DNA (RAD) data generated by next-generation sequencing for a subset of samples to investigate whether nuclear divergence reflect the pattern obtained for mitochondrial DNA, as well as to evaluate the genetic diversity, population structure, and level of gene flow among populations on the island of Vieques.

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**0883 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Andrea M. Quattrini[1], Adela Roa-Varon[2], Randy Singer[3], Jason D. Chaytor[4], Amanda W.J. Demopoulos[5]

*[1]Harvey Mudd College, Department of Biology, Claremont, CA, USA, [2]Virginia Institute of Marine Science, Fisheries Science, Gloucester Point, VA, USA, [3]iDigBio/University of Florida, Interdisciplinary Ecology, Gainesville, FL, USA, [4]US Geological Survey Woods Hole Coastal and Marine Science Center, Woods Hole, MA, USA, [5]US Geological Survey, Wetland and Aquatic Research Center, Gainesville, FL, USA*

## Mesophotic and Deep-Sea Demersal Fish Assemblages on Rugged Hardbottoms of the Greater-Lesser Antilles Transition Zone

Caribbean fish communities in shallow waters have been well studied along the Greater and Lesser Antilles for decades; however, the mesophotic (>50 m) and deep (>200 m) assemblages remain poorly known due to the challenges associated with surveying greater depths. Numerous seafloor features (e.g., seamounts, ridges, canyons) punctuate the insular margins and increase habitat heterogeneity, which may enhance diversity of deeper demersal fishes in the region. Recent (2013-2015) expeditions in the area using the *E/Vs Nautilus* and *Okeanos Explorer* and *ROVs Hercules* and *Deep Discoverer* surveyed fish communities during 26 dives across different seafloor features at depths ranging from 98 to 4060 m. These surveys enabled us to investigate whether demersal fish assemblages differed among seafloor features and/or in response to water mass characteristics in the region. A total of 3,372 demersal fishes representing at least 152 species in 60 families were documented. Seven species previously not reported from the Caribbean were documented (*Lepidion sp., Odontomacrurus murrayi, Haplomacrurus nudirostris, Coryphaenoides leptolepis, Centrodraco acanthopoma, Deania* sp., *Paraliparis* sp.). Many mesophotic reef species were also observed deeper than previously recorded, including the butterflyfishes *Chaetodon sedentarius* and *Prognathodes aculeatus* and the lionfish *P. volitans*. Fish assemblages were dissimilar across depth, with species turnover closely matching water mass boundaries. No assemblage differences were found among different seafloor features. This study further supports the importance of water masses influencing distribution of demersal fishes in the deep sea and demonstrates how little is still known about the biogeography of numerous deep-sea and mesophotic fishes.

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**0602 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

Claudio Quezada-Romegialli[1], Gloria Arratia[4], Irma Vila[2], David Véliz[3]

*[1]Universidad de Antofagasta, Antofagasta, Chile, [2]Universidad de Chile, Santiago, Chile, [3]Universidad de Chile & Instituto de Ecología y Biodiversidad, Santiago, Chile, [4]The Kansas University Biodiversity Institute & Natural History Museum, Lawrence, KS, USA*

## The Abanico Basin and the Biogeography of the Andean Ichthyofauna

South America possesses the largest ichthyofauna of any region in the world, yet the majority of this diversity is concentrated in the Neotropical region. Mostly due to its considerable lower fish richness, the research in Southern South America has been pushed into the background, despite the systematic and biogeographic relevance of several endemic taxa. In the southern cone of South America, biogeographic regionalization traditionally has been based on qualitative evidence established by experts and without considering a hierarchical regionalization. Besides, biogeographic hypotheses are built or interpreted grounded on narrative of possible -but sometimes unlikely- geological or historical events. Following an evolutionary biogeography approach, in this presentation we seek to delimit the Andean region with quantitatively methods and to diagnose sub-regions and provinces following a hierarchical system of biogeographical regionalization. A geobiotic scenario is constructed reviewing available paleontological and geological evidence that allowed us to propose an important stage for the evolution of the Andean ichthyofauna: the Abanico Basin hypothesis. A system of fluvio-lacustrine system of freshwater interconnected basins was developed between upper Eocene and lower Miocene, where nowadays it is located the Andes Range (27°-44° South Latitude). Subsequent tectonic inversion established a water divisory in this area and the geological evidence states a mechanism of hydrological connections between the disconnected watersheds of recent times. The predictions of the Abanico Basin hypothesis are further tested with phylogenetic and population genetics data of catfishes of the Trichomycteridae family and a discussion of the current distribution of fishes in this area is given.

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**0861 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Danielle Quinn[1], Julia Whidden[2], Trevor Avery[1]

*[1]Acadia University, Wolfville, Nova Scotia, Canada, [2]University of Miami, Miami, Florida, USA*

## Quantifying and Interpreting Evidence of School and Site Fidelity of Little Skate (*Leucoraja erinacea*) and Winter Skate (*Leucoraja ocellata*) in a Spatially Confined Area in the Bay of Fundy, Canada

The overarching goal was to provide a general overview of at-risk species in spatially confined areas, including the identification of potential approaches to analyze

movement patterns, and school/site fidelity. The Inner Bay of Fundy is home to several at-risk fish species, including Little skate (*Leucoraja erinacea*; Near Threatened, IUCN 2009), and Winter skate (*Leucoraja ocellata;* Endangered, IUCN 2009). These sibling species are sympatric, and inhabit a region with the highest tides in the world, fluctuating nearly 16 m twice daily. Skate movement patterns are poorly understood, particularly when compared to the body of literature that exists on the small and large-scale movements of rays and sharks. Uniquely-numbered dart tags were applied to over 2800 little and winter skate at a fixed tagging site from 2012 – 2015, and 5 – 10 % were recaptured. The high frequency of recaptures and temporal span over which these recaptures occurred provide valuable data regarding movement patterns. There was a high frequency of individuals tagged together being caught together, up to three years later. A novel approach to quantifying school and site fidelity was used to describe these patterns. These observations provide insight into the schooling and movement behavior of these at-risk species of skate in the confines of the Inner Bay of Fundy.

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## 0088 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Milica Radanovic[1], Joseph Milanovich[1], Kyle Barrett[2], John Crawford[3]

*[1]Loyola University Chicago, Chicago, IL, USA, [2]Clemson University, Clemson, SC, USA, [3]National Great Rivers Research and Education Center, East Alton, IL, USA*

### An Ecological Trap? When Given A Choice Tadpoles Choose Nutrition Despite Toxicity

Invasion of aquatic plants is undoubtedly contributing to the food web dynamics of wetland ecosystems. Studies have identified some aquatic invasive plants to have concentrations of nutrients and secondary compounds that are higher than their native counterparts. An ecological trap may result if animals selectively forage on invasive species because of their nutrientive value, but have reduced fitness as a consequence of the plant's secondary compounds. The purpose of this study was to examine whether invasion by purple loosestrife (*Lythrum salicaria*), a plant with both high secondary compounds and high nutrient content, creates an ecological trap for anuran larvae. We used a mesocosm framework and stable isotopes to examine the dietary contributions of purple loosestrife and native hardwood litter to larval wood frogs (*Lithobates sylvaticus*) and southern leopard frogs (*Lithobates sphenocephalus*). We utilized the isotopic signatures ($^{13}C$ and $^{15}N$) of basal resources and metamorphic frogs, and the MixSIAR Baysien isotopic mixing model program, to reconstruct the contributions of purple loosestrife and native hardwood litter to frog larvae when presented with both options. Our results suggested that tadpoles consume a higher percentage of purple loosestrife compared to native hardwood litter when presented with both options – despite the high secondary compounds of purple loosestrife. These results further suggests purple loosestrife, and perhaps other invasives, could create an ecological trap in invaded wetlands by providing a quality food resource with respect to nutrition that is actively

chosen, but consequently reducing survival, and potentially fitness, presumably from secondary compound plant traits.

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**0173 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Alex Radi[1], Christopher Beachy[2]

*[1]Minot State University, Minot, ND, USA, [2]Southeastern Louisiana University, Hammond, LA, USA*

**The Tiger in Winter: larval *Ambystoma mavortium* under the ice**

Larval *Ambystoma mavortium* in North Dakota spend the winter months (late October - early April) restricted underneath a thick (0.5 - 1.3 m) icesheet. During February and March, 2012, we observed larval *A. mavortium* in Swalls Lake, Ward County, North Dakota, USA. We drilled holes in the ice using an ice auger equipped with 20.3 cm blade. We established three ice-hole grids. Each grid had nine holes in a 3 X 3 arrangement on a 20 X 20 m square (i.e., four holes were the corners of the square). We used an Aqua-Vu underwater 760 color camera equipped with video recorder. When salamanders were viewed among vegetation, we used an average cattail stem diameter of 11.8 mm for calibration using ImageJ to estimate salamander size. Water temperatures ranged from 2.2 to 3.0$^{o}$C. Observation depths ranged from 0.2 to 2 m. We viewed a total of 224 salamanders during our four observation periods (i.e., an average of 56 salamanders observed in an area of 13.85 m$^2$, or 4.04 salamanders/m$^2$). Using a total lake area of 45,285 m$^2$ provides a coarse winter population estimate of approximately 183,102 salamanders in Swalls Lake.

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**0606 HL GRADUATE RESEARCH AWARD, Galerie 2, Thursday 7 July 2016**

Noelikanto Ramamonjisoa, Yosihiro Natuhara

*Nagoya University, Nagoya, Aichi, Japan*

**Mouthpart Diversity and Functional Roles of Tadpoles in Stream Ecosystems in Ranomafana Madagascar**

Tropical tadpoles typically show great diversity in their feeding modes and niche. Although they can represent the largest biomass in streams, very little is known about their diet and functional roles. We investigated the trophic ecology and the relative impact of tadpoles on stream ecosystem functioning in Ranomafana Madagascar, which harbors the world's most species-rich stream tadpole communities with 11 feeding guilds and no less than 44 species. We hypothesized that tadpoles' trophic position and functional roles would change with their mouthpart. We used stable carbon-nitrogen isotope to estimate the trophic position of six feeding guilds and conducted field incubation experiments to quantify the contribution of tadpoles in stream nutrient

cycling (through excretion and egestion). Further, we used enclosures in a natural stream setting to quantify the effects of tadpole diversity and abundance on leaf litter decomposition, one of the most important processes in stream ecosystem. Species mainly differed in their carbon isotope ratio and exhibited little difference in nitrogen isotope ratio. Surprisingly, although some feeding guilds exhibited nearly similar stable isotope values, they differed in nutrient excretion rates in ammonium and dissolved phosphorus. In the enclosure experiment, we found that the two most common guilds (generalized morphology and funnel mouth guilds) influenced litter decomposition through different pathways and interestingly, effects were density-dependent. There was little evidence of additive effects of species diversity though. It appears that functional roles of tadpoles are related to their feeding behavior, which could be in direct relation with their mouthparts.

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**0614 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Noelikanto Ramamonjisoa[1], Serge Ndriantsoa[2], Yosihiro Natuhara[1]

*[1]Nagoya University, Nagoya, Aichi, Japan, [2]University of Antananarivo, Antananarivo, Madagascar*

## Long Term Impact of Selective Logging on Larval and Adult Frog Communities in a Tropical Forest in Madagascar

Selective logging and land conversion are common threats to biodiversity in many tropical countries. Still, there are controversies about their effects on amphibian communities. With more than 120 frog species, Ranomafana is an excellent model to investigate these effects. One third of Ranomafana National Park was selectively logged in 1986 and the remaining is still primary forest. Adjacent to the park are agricultural areas. We took advantage of this "naturally established" field experiment to investigate the effect of selective logging and degraded habitats on larval and adult frog communities. We surveyed four streams in each habitat over two breeding seasons. We conducted nocturnal visual and auditory surveys along 50 m transects to census adult frogs and applied standard methods to sample tadpoles. Compared to the primary forest, larval and adult frog abundances were lower in agricultural areas and in the selectively logged forest. Frog abundance did not differ between agricultural areas and the selectively logged forest. However, the selectively logged forest harbored higher abundance of tadpoles. We recorded the lowest and the highest species diversity in the selectively logged forest and the agricultural area, respectively. This high diversity may be due to the existence of edge-specialist species, and also because some species seldom found in forest habitats become more frequently recorded in agricultural areas. Classically thought to bear little effect on terrestrial habitats, selective logging can have long term negative impact on stream-breeding amphibian communities. Even 30 years post-logging, the amphibian community has not yet recovered.

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**0767 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Lindsey Ramirez, Paul V. Zimba

*Texas A&M University - Corpus Christi, Corpus Christi, Texas, USA*

## Does elevated salinity induce a physiological response in Texas diamondback terrapin (*Malaclemys terrapin littoralis*)?

Freshwater inflow is essential for providing key nutrients for estuarine environments. However, reduction of freshwater inflow can alter the function and structure of estuarine conditions and resources with detrimental consequences. One mechanism to determine the effects of reduced freshwater inflow is through the use of a bioindicator species. The purpose of this study was to determine the physiological effects of elevated salinity on stress hormone production, blood chemistry, and distribution patterns in the Texas diamondback terrapin (*Malaclemys terrapin littoralis*) as a bioindicator to evaluate the health and stability of the Nueces and Mission-Aransas Estuaries. Current results consist of preliminary data assessments. The collected samples have been processed for electrolytes but still require further analysis. Plasma samples will be analyzed using ELISA test kits for corticosterone, cytochrome P450, and prolactin to determine the presence and concentration of stress hormones. Blood chemistry analysis will evaluate glucose, albumin, total protein, bilirubin, creatinine, blood urea nitrogen, and uric acid. Recapture data will be used to map movement patterns for recaptured terrapins, calculate measurements of total distance moved for each individual and straight-line distance between the farthest points of movement. Although terrapins have been studied within traditional (i.e., polyhaline) estuarine systems that receive adequate freshwater inflow, little research has occurred on the Texas subspecies whose populations often occur in a reverse (i.e., hypersaline) estuarine environment. The results of this research will provide the first physiological assessment of Texas diamondback terrapins under hypersaline conditions utilizing hormones as indicators.

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**0202 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Lea Randall[1], Des Smith[2], Breana Jones[1], David Prescott[3], Axel Moehrenschlager[1]

*[1]Calgary Zoological Society, Calgary, Alberta, Canada, [2]Wildland Consultants Ltd., Barrington, Christchurch, New Caledonia, [3]Alberta Environment and Parks, Red Deer, Alberta, Canada*

## Seasonal and Annual Occupancy Dynamics of an Imperiled Amphibian

A detailed understanding of the population dynamics of many amphibian species is lacking despite concerns about declining amphibian biodiversity and abundance. We explore temporal patterns of occupancy and underlying extinction and colonization dynamics in a regionally imperiled amphibian species, the Northern leopard frog (*Lithobates pipiens*) in Alberta. Our study contributes to elucidating regional occupancy dynamics at northern latitudes, where climate extremes likely have a profound effect on

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seasonal occupancy. We find that occupancy varied more dramatically between seasons than years. Between spring and summer, colonization was high and extinction low; inversely, with low spring and higher summer occupancy. Colonization was low and extinction high over the winter. The dynamics of extinction and colonization are complex, making conservation management challenging. Our results reveal that Northern leopard frog occupancy was constant over the last five years and thus there is no evidence of decline or recovery within our study area. Changes to equilibrium occupancy are most sensitive to increasing colonization in the spring or declining extinction in the summer. Therefore, conservation and management efforts should target actions that are likely to increase spring colonization; this could be achieved through translocations or improving the quality or access to breeding habitat. Because summer occupancy is already high, it may be difficult to improve further. Nevertheless, summer extinction could be reduced by predator control, increasing water quality or hydroperiod of wetlands, or increasing the quality or quantity of summer habitat.

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**0141 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Zachary Randall, Larry Page

*Florida Museum of Natural History, Gainesville, Florida, USA*

## Conveying Thailand freshwater fish diversity through live fish photography

Through efforts of the NSF-funded All Cypriniformes Species Inventory project, collections of fishes have been made at 125 sites in Thailand over the past three years. These efforts have resulted in documenting and increasing information on fish diversity and distributions, and have led to the discovery of several species new to science. At most of these sites, photographs were taken of live fishes that previously were without high resolution images. The images provide natural coloration patterns of many described and undescribed species. Coloration and skin transparency of a specimen are no longer visible when it is preserved in ethanol, making live color photographs extremely valuable for field identifications. Methods for live fish photography will be presented, and image exemplars of diversity across major drainages of Thailand will be shown. All imaged specimens from the Thailand expeditions are associated with specimens vouchered at the Florida Museum of Natural History (FLMNH). Specimen records and images can be viewed online at the FLMNH Fish Division's Specify Web Portal http://specifyportal.flmnh.ufl.edu/fishes/.

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**0876 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Racine Rangel, Darren Johnson

*California State University Long Beach, Long Beach, CA, USA*

### Evaluating the effects of temperature on the metabolic rate of the Bluebanded Goby (*Lythrypnus dalli)*

As ocean temperatures steadily rise, marine species will be exposed to more extreme diel and seasonal fluctuations. These overall temperature increases may expose sedentary species like the Bluebanded Goby (*Lythrypnus dalli*) to temperatures that are at or over their physiological optima. Coping with temperatures above physiological optima may have consequences that result in costly trade-offs between metabolism, and processes such as development, growth, and fecundity. However, basic metabolic rates of reef fishes with limited movement are relatively unknown. Using respirometry, we estimated basic oxygen consumption ($V_f$), mass-specific oxygen consumption ($MO_2$), and metabolic rate (MR) of *L. dalli* at two different temperatures (16°C and 20°C). To date, 15 replicate trials have been conducted (n=11 at 16°C), and (n=4 at 20°C). Preliminary findings of this ongoing study suggest slight increases in $V_f$, $MO_2$, and MR at 20°C when compared to 16°C, though these differences are non-significant with our current sample size. These results lay the groundwork for understanding how changes in ocean temperature will affect metabolism and subsequent energy allocation for sedentary species.

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**0355 ASIH STOYE GENERAL ICHTHYOLOGY AWARD, Galerie 2, Friday 8 July 2016**

Mary Rath, Kenny Jones, Lindsey Martin, Alexsis Mross, Starlene Loerch, Alexandra Hook, Brook Fluker

*Arkansas State University, Jonesboro, AR, USA*

### Saving the Endangered Dead: a Comparison of Rehydration Methods for Desiccated Preserved Fish Specimens

Natural history collections are valuable resources for studies in biodiversity, taxonomy, phylogenetics, ecology, and beyond. However, many collections deal with desiccated fluid-preserved specimens as a result of budget constraints, curator turnover, and/or inadequate staff. The Arkansas State University Museum of Zoology (ASUMZ) Ichthyology Collection houses approximately 13,000 specimen lots, but approximately 600 have experienced desiccation as a result of unsuitable storage containers. This project evaluated the efficacy of three specimen rehydration methods: (1) a surfactant-based method that used a 1% soap solution; (2) a previously published method that used a high humidity chamber; and (3) a control method that involved simply refilling with 70% ethanol. Success of specimen rehydration was quantified as relative weight (grams/standard length) and as percent weight gain before and after rehydration

procedures. Repeated measures ANOVA revealed significant differences in relative weight before and after rehydration ($P < 0.0001$); however, the three methods did not differ significantly from one another. One-way ANOVA yielded significant results for percent weight gain ($P = 0.002$): 102% for the soap method; 86% for the chamber method; and 83% for the control method. Pairwise comparisons indicated that the soap method differed from chamber ($P = 0.014$) and control ($P = 0.003$), but chamber and control methods were not different ($P = 1.000$). Despite the success of each method, the surfactant-based method is preferred due to the rapid rate of rehydration. This project provides hope for saving desiccated fluid-preserved specimens that may otherwise be discarded and forever lost from the historical record.

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## 0256 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY

Rhett Rautsaw[1], Steffany Medina[1], Christopher Yanick[1], Scott Martin[2], M. Rebecca Bolt[3], Richard Seigel[2], Christopher Parkinson[1]

*[1]University of Central Florida, Orlando, FL, USA, [2]Towson University, Towson, MD, USA, [3]Integrated Mission Support Services, Kennedy Space Center, FL, USA*

### Determining Usage of Wildlife Corridors by Gopher Tortoises (*Gopherus polyphemus*)

Understanding movements of an organism across a broad landscape is vital for conservation efforts. Such studies can unveil novel habitat usage or identify necessary habitat connectivity. Disruption of habitat connectivity can lead to genetic isolation of populations and prevent movement in the event of ecological disturbances. We aim to determine how gopher tortoises are using intermediate habitats connecting coastal dunes and inland scrub, defined as a landscape corridor. This study takes place at Kennedy Space Center (KSC) along a roadside shoulder that connects coastal and inland habitats. We predicted that due to the unsuitable habitat, tortoises in the corridor would function only as transients moving between more suitable coastal and inland habitats. We used radio telemetry of tortoises in the corridor and compared these data to movements of both coastal and inland tortoises. Twenty tortoises within the corridor were captured by hand and fitted with radio-transmitters. Tracking has taken place on a weekly basis since May 2015. Gopher tortoises in corridors were found to occupy minimum convex polygon home range sizes of 0-9.9 ha ($\bar{x}$=1.3±2.2 ha). The home ranges of inland tortoises are 0.3-5.3 ha ($\bar{x}$=1.7±1.5 ha) and those of coastal tortoises are 0-6.2 ha ($\bar{x}$=1.5±1.9 ha). Due to large variances, it can be concluded that neither inland nor coastal tortoise home ranges are different from corridor tortoises. This lack of differences suggests that corridor tortoises function as residents within the corridor itself instead of as transients between larger habitat patches.

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**0493 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Austin Ray[1], Scott Glaberman[1], Pierre Moisson[2], Miguel Carretero[3], Ylenia Chiari[1]

*[1]University of South Alabama, Mobile, AL, USA, [2]A Cupulatta Turtle Center, Ucciani, Corse, France, [3]CIBIO Institute, Vairão, Portugal*

**Estimates of Relative Preferred Temperatures in Turtles**

Global climate change can negatively affect biological systems. These effects vary across ecosystems and species. However, ectothermic organisms are thought to be more sensitive to any climate change as their own homeostatic processes depend on environmental conditions. Ectotherms have various strategies to regulate body temperature such as moving between sunlit and shaded areas. Because of the importance that environmental temperature has on the biology of ectothermic organisms, uncovering the preferred temperature for ectothermic species and how they select these temperatures is of vital importance to understand how climate change may affect them. In this work, we examined the preferred temperature(s) and thermoregulatory behavior of nine different species of turtles (8 Testudinae and 1 Emydidae) in a semi-controlled environment. We examined whether individuals from each species sought higher or lower environmental temperatures in outdoor enclosures in which there were also indoor shelters available. Temperatures of each individual were continuously measured every twenty minutes for three months by attaching a data-logger on the carapace. Dataloggers were also placed in the enclosure of each species to obtain data on environmental temperatures available to the animals. Preferred temperature(s) and thermoregulatory behavior were analyzed across species and between sexes. Our results indicate that temperature selection generally varies between species, but not sexes, except for one species (*C. denticulata*). Among the studied species, *T. carolina* selects overall lower temperatures than the other species. Temperature selection does not seem to be necessarily related to differences in temperatures in the natural habitat of each species.

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**0514 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Katherine Rebein[2], Adam Parlin[1], Paul Schaeffer[1]

*[1]Miami University, Oxford, OH, USA, [2]Hendrix College, Conway, AR, USA*

**Interactions between physiology and habitat of eastern box turtles (*Terrapene carolina carolina)***

Through continuous field surveillance, the interactions between an organism and its native environment can be understood at both a micro-habitat and broad landscape level. Advances in biologging technology have allowed for the acquisition of detailed field data concerning movement, physiology, and behavior of individual organisms. Additionally, these field data can be utilized to observe the use of available habitat and

the potential impact of human development upon those habitats. We monitored eastern Box turtles (*Terrapene carolina carolina*) in their natural habitat during their active season, from May through September, in order to gain a deeper understanding of the primary characteristics of their chosen habitat within available habitats. We examined each turtles use of various landscape characteristics, including slope and canopy cover. Environmental temperature, and movement patterns, including the sinuosity of movement and home range sizes, were measured through use of GPS, temperature loggers, and thread-trailing. Home range was calculated using a minimal convex polygon and varied from 0.14 ha to 8.4 ha across a two-week monitoring period. We found no correlation between the turtle's external microclimate temperature and the home range size. Box turtles selected habitat characteristics in areas with moderate slope and high canopy cover relative to the available habitat.

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**0461 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Renae Reed, Adam Gilles, Ross Black

*Eastern Washington University, Cheney, WA, USA*

**Rage against the Anthropocene: associative learning of invasive fish in larval salamanders**

Within the Anthropocene, the biotic fabric of Earth is in tangles. Biodiversity is threatened by biotic homogenization, the expansion of invasive species ranges and concurrent contraction of native ones, a mechanism which emphasizes predator-prey relationships. Due to a lack of evolutionary or ecological history, native prey species may be unable to recognize or respond to a functionally novel invasive predator. This study examined amphibian antipredator adaptations in the context of an invasive predator. We found that larval long-toed salamanders (*Ambystoma macrodactylum columbianum*) did not identify an invasive fish, the brook stickleback (*Culaea inconstans*), as a predatory threat without the aid of a conspecific diet cue. After conditioning to cues from fish fed a conspecific diet, salamanders were then able to label the fish as a threat and respond with generalized antipredator behavior. Conditioned salamanders also expressed an accelerated rate of progression towards metamorphosis, reducing their time in the water with the predator. When faced with an invasive predatory species, amphibians may be well suited to adapt due to a suite of plastic responses in behavior and life history.



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**0276 General Ichthyology I, Balconies J & K, Sunday 10 July 2016**

Rosalee Reese[1], Thomas Turner[1], David Propst[1], Keith Gido[2]

*[1]University of New Mexico, Albuquerque, NM, USA, [2]Kansas State University, Manhattan, KS, USA*

## Retrospective food web analysis of the Gila River reveals limited resource availability during drought

The relatively pristine Upper Gila River in New Mexico is a stronghold for endemic native fishes despite the presence of nonnative fishes. In other, more severely human-impacted tributaries in the Colorado River basin, nonnative fishes are a major factor in native species extirpation. We tested whether negative effects of nonnatives on natives are compounded during challenging hydrologic conditions (i.e., drought). Stable isotope analysis (SIA) allows estimation of trophic position, and trophic niche width. Fish specimens were selected from natural history collections to represent a time series that encompasses wet and dry years, as well as varying non-native abundances. We estimated 'isotopic niche space' by plotting $\delta^{13}C$ vs. $\delta^{15}N$ for native and nonnative fishes and statistically compared breadth and overlap in niches among species. During drought periods, the availability of resources is constrained, causing isotopic niches of nonnatives and natives to overlap, which increases the potential for competition. In wet periods, resource space is broader, suggesting reduced overlap of resource use. SIA of museum specimens offers the potential to test key hypotheses about the impact of non-native species on an endemic fauna, and provide understanding of the environmental context that non-native species negatively impact native fishes. Such understanding is important for conservation of the Gila River, where climate change and pending water diversion could lead to further decline of native fish abundance.

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**0362 General Ichthyology II, Balconies J & K, Sunday 10 July 2016**

David Reeves[1], Ryan Munnelly[1], Edward Chesney[2], Donald Baltz[1]

*[1]Department of Oceanography and Coastal Sciences, Louisiana State University, Baton Rouge, LA, USA, [2]Louisiana Universities Marine Consortium, Chauvin, LA, USA*

## Fish Assemblage Structure at Small Oil and Gas Platforms on and around a Sand Shoal in the Northern Gulf of Mexico

Nearshore Louisiana is a dynamic coastal region that is home to thousands of oil and gas platforms and the world's second largest hypoxic zone (DO <2 mg/L). From July to September of 2014, a camera array and YSI sonde were used to characterize fish assemblages and hydrography at platforms on Ship Shoal (shoal platforms) and off the shoal (landward and seaward platforms). Differences in the diversity and counts of demersal fishes drove significant variation in fish assemblages between platforms on and off the shoal, but there was little variation for pelagic fishes. There were 32-37% more demersal species at shoal platforms than landward and seaward platforms. Higher counts of *Sciaenops ocellatus*, *Lutjanus griseus*, *Archosargus probatocephalus*, and

*Chaetodipterus faber* at shoal platforms resulted in significant differences in demersal fish assemblages. Higher demersal fish counts and diversity on the shoal may be related to less intense hypoxia on than off the shoal. Hypoxia on the shoal was intermittent and only detected during 57% of sampling trips. Persistent hypoxia overlaid bottoms off the shoal and was 77-81% thicker than hypoxia on the shoal. Shoal platforms were more important for demersal fishes than platforms adjacent to the shoal and may have provided refuge from intense hypoxia in surrounding areas. A growing body of research demonstrates the importance of Ship Shoal for demersal species, but the shoal remains unprotected and is a site of substantial dredging.

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**1080 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Amber Reichert[1], Lonny Lundsten[2], David Ebert[1]

*[1]Moss Landing Marine Laboratories, Moss Landing, CA, USA, [2]Monterey Bay Aquarium Research Institute, Moss Landing, CA, USA, [3]California Academy of Sciences, San Francisco, CA, USA*

### First North Pacific records of the pointy nosed blue chimaera, *Hydrolagus* cf. *trolli* (Chondrichthyes: Chimaeriformes: Chimaeridae)

The occurrence of *Hydrolagus* cf. *trolli* is reported for the first time from the central and eastern North Pacific Ocean. Using video taken during ROV surveys, specimens were identified using MBARI's Video Annotation and Reference System database (VARS). This is a geographic range extension for this species, as it was previously only known to occur in the southern Pacific Ocean off of Australia, New Zealand, New Caledonia, and Chile.

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**0443 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Brendan Reid[1], Ella Viola[2], Jenna Pantophlet[2], Seth Wollney[2], Evelyn Jensen[3], Michael Russello[3], John Iverson[4], Marcus Peery[5], Christopher Raxworthy[1], Jamie Kass[2], Eugenia Naro-Maciel[2]

*[1]American Museum of Natural History, New York, NY, USA, [2]City University of New York, College of Staten Island, New York, NY, USA, [3]University of British Columbia-Okanagan, Okanagan, BC, Canada, [4]Earlham College, Richmond, IN, USA, [5]University of Wisconsin, Madison, WI, USA*

### Reconciling taxonomy, phylogeography, and historical demography in the widely distributed painted turtle (*Chrysemys picta*)

Traditional subspecific taxonomic divisions based on morphology are often based on implicit assumptions of phylogeographic history. For many Nearctic taxa, morphological variability within species has been attributed to isolation within multiple

warm refugia during glacial periods followed by Holocene range expansion. We examined concordance between traditional taxonomy and phylogeographic patterns for the continentally-distributed painted turtle (*Chrysemys picta*) by combining population-level genetic data (11 microsatellites and one mitochondrial locus) for nine populations with published mitochondrial sequence data. Genetic clustering in Structure identified 4 discrete groups exhibiting varying levels of concordance with subspecies divisions based on microsatellite data. Three eastern painted turtle (*C. p. picta*) populations from New York clustered together; however, midland painted turtles (*C. p. marginata*) from Indiana clustered with western painted turtles (*C. p. bellii*) from Wisconsin, and *bellii* populations from Nebraska and British Columbia were identified as reciprocally distinct clusters. While both mitochondrial and microsatellite loci exhibited strong isolation by distance, traditional subspecies groupings also explained a significant proportion of genetic similarity among sites for mtDNA (but not microsatellites). Bayesian skyline plots suggested population expansion in *marginata* directly after the last glacial maximum and more recent expansion in *picta* and *bellii*. These phylogeographic patterns are potentially consistent with either isolation in glacial refugia followed by secondary contact or spatially structured range expansion. Moving forward, we plan to combine ecological niche modeling with spatial coalescent simulations in order to identify whether glacial isolation or post-glacial range expansion has played a greater role in structuring genetic diversity within this species.

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**0802 NIA I, Salon E, Friday 8 July 2016**

Roberto Reis, Edson Pereira

*PUCRS - Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, RS, Brazil*

## Description of a New Genus and Three New Species of Suckermouth Catfish (Siluriformes: Loricariidae) from Eastern Brazil

A new genus and three new species of neoplecostomine loricariid are decribed from eastern Brazil, states of Minas Gerais, Espirito Santo and Bahia. The new genus is diagnosed among neoplecostomines by one exclusive synapomorphy: the dorsal surface of the mesethmoid bone with a conspicuous declivity in its anterior portion, and an additional 28 non-exclusive synapomorphies from their osteology, external morphology and teeth. The species in the new genus can be readily distinguished from all other neoplecostomines by the shape of the caudal peduncle, which is somewhat flat dorsally and very flat ventrally (though *Pareiorhina rudolphi* and *Pareiorhaphis bahianus* also have a flat caudal peduncle), and comparatively larger eyes. The new genus is further distinguished from *Neoplecostomus* and *Isbrueckerichthys* by completely lacking plates in the abdomen, and from *Pareiorhaphis* and *Hirtella* by lacking hypertrophied odontodes as a secondary sexual dimorphism of mature males. It is further distinguished from *Pareiorhina* by having a well-developed adipose fin (absent in *Pareiorhina*) and from *Kronichthys* by its wide, rounded head shape in dorsal view (narrow and nearly rectangular in adult *Kronichthys*). The three new species occur in the Doce River in

Espirito Santo and Minas Gerais states, and in smaller coastal river basins in Espirito Santo and southern Bahia, and are distinguished from each other based on differences in their body proportions, color and teeth numbers. Among the Neoplecostominae, the new genus is more closely related to *Kronichthys*, forming a clade sister to all remaining members of the subfamily.

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**0583 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Kelsey Renfro, Alexandria Martini, Abbegayle Lindel

*Metropolitan State University, Denver, CO, USA*

**Compositional Dynamics of Striped Parrotfish Herds on a Florida Reef**

The striped parrotfish, *Scarus iserti,* is an abundant fish within the Florida Barrier reef. Like other parrotfish, this sequentially hermaphroditic protogynous fish passes after larval recruitment through a juvenile phase (JP), an initial (female) phase (IP) and a terminal (male) phase (TP). Generally, initial phase striped parrotfish will join a defended feeding territory, a nonterritorial stationary herd or a roving group depending on environmental conditions and population size. Recording these behaviors in a natural setting is both qualitatively and quantitatively improved with the use of modern video cameras. During on-going morning SCUBA dives on the Florida Barrier reef off of Marathon Key, FL, U.S.A., all phases of striped parrotfish, were observed in groups and recorded within several different inner and outer reefs, fishing and no-take zones. Several types of groups were observed: exclusively IP striped parrotfish, striped parrotfish of mostly IP with some TP, and mixed groups of predominantly IP striped parrotfish and other species including IP stoplight parrotfish *Sparisoma viride*, JP and IP Clown Wrasses *Halichoeres maculinna* , IP slippery dick *Halichoeres bivittatus* and IP blue tang *Acanthurus coeruleus*. Differences in groups (group size, fish length and species composition) between inner and outer reef locations and take versus no-take locations do not indicate clear relationships. Documenting the composition of these groups using video technology allows for accurate species identification, the capacity to collect a wealth of data, and the ability to revisit observed behaviors.

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**0656 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

R. Graham Reynolds[4], Alberto Puente-Rolon[5], Anthony Geneva[1], Kevin Aviles-Rodriguez[3], Nicholas Herrmann[1]

*[1]Harvard University, Cambridge, MA, USA, [2]Museum of Comparative Zoology, Cambridge, MA, USA, [3]University of Massachusetts Boston, Boston, MA, USA, [4]University of North Carolina Asheville, Asheville, NC, USA, [5]Universidad Interamericana de Puerto Rico, Recinto de Arecibo, Arecibo, PR, Puerto Rico*

**Discovery of a Remarkable New Boa from the Bahamas**

The Bahamas Archipelago is currently known to support three of the 11 recognized species of West Indian boas (genus *Chilabothrus*) on the Little Bahama Bank, Great Bahama Bank, and four of the southern Bahamas banks. Here we report the discovery of a new species from the Central Bahamas. We describe *Chilabothrus argentum* sp. nov. (Silver Boa) based on morphometric and genetic data obtained from 33 individuals. This new boa has a greatly reduced coloration relative to other Bahamian boas, is highly arboreal, and is 3.3% (pairwise) divergent from other West Indian boas in a mitochondrially encoded protein. We estimated a mitochondrial coalescent time of 2.7MY for this species, and phylogenetic analysis suggests that it is sister to the *C. strigilatus*/*C. striatus*/*C. exsul* clade. The existence of this new boa provides greater resolution of the historical biogeography of the West Indian boas in the Bahamas Archipelago, further supporting multiple colonization of this region from Hispaniola as well as speciation and divergence events dating to the late Pliocene/early Pleistocene. We additionally discuss conservation implications and concerns for this new boa, which we have assessed as being Critically Endangered based on IUCN Red List criteria and hence find to be one of the most endangered boid snakes globally.

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**0532 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Emanuell Ribeiro[1], Dahiana Arcila[2], Ricardo Betancur[1]

*[1]University of Puerto Rico, San Juan, Puerto Rico, [2]George Washington University, Washington, D.C., USA*

**The end-Cretaceous mass extinction promoted lineage diversification, morphological disparity and habitat shifts in the spectacular radiation of carangimorph fishes**

The fish tree of life has become increasingly well resolved in recent years and these advances are now allowing ichthyologists to study the factors shaping macroevolutionary dynamics in major groups. For instance, short internodes observed at the base of several percomorph clades suggest that rapid radiations have played an important role in their diversification. Here, we investigated the tempo and mode of diversification in carangimorph fishes (~1100 species), a recently defined clade of percomorphs that includes benthic and pelagic dwellers with disparate phenotypes,

including some of the most astonishing fish forms (e.g., flatfishes, billfishes, remoras, barracudas, and archerfishes). Specifically, we assessed how ecological opportunity affected lineage diversity, phenotypic evolution, and ecological transitions between benthic and pelagic habitats in carangimorphs. To test these ideas, we estimated a multi-locus time tree that covers all major carangimorph lineages and ~10% of the species diversity, and quantified body shape disparity using geometric morphometrics. Analyses of diversification rates trough time show a peak during the Paleogene (66-60 mya), followed by a rapid rate drop. Likewise, plots of disparity through time show an abrupt decline in sub-clade morphology during this time period, which also correlates with a marked incidence of habitat shifts. Taken together, these results suggest that all major lineages and body plans in Carangimorpharia originated in an early burst triggered by the Cretaceous-Paleogene mass extinction, which ultimately allowed the occupation of newly released niches along the benthic-pelagic axis.

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**1120 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Sierra Riccobono[1], Manalle Al Salamah[1], O. Thomas Lorenz[2]

*[1]University of New Orleans, New Orleans, LA, USA, [2]Georgia Southwestern State University, Americus, GA, USA*

**Shoal bass prey handling of native and non-native crayfish in Georgia**

The spread of non-native Rio Grande cichlids (Herichthys cyanoguttatus) in the Greater New Orleans Metropolitan Area (GNOMA) has included the brackish habitats of Lake Pontchartrain and the La Branche Wetlands. To determine the potential spread of this species in brackish habitats, we studied the effects of three different salinity levels on the biology of H. cyanoguttatus. The highest salinity tolerated, before cessation of feeding & eventual death, was 30.0 psu. No cichlids survived to the acclimation point of full seawater (35.0 psu). Body mass increased significantly less with this higher salinity treatment. Interestingly, aggression levels were higher with brackish versus freshwater conditions. After a period of six months, the difference in growth between fresh and brackish conditions became significant, indicating a potential detriment to juvenile fish living in brackish conditions for long periods of time. The significance of this study is that most higher-salinity habitats in Louisiana, even those approaching sea water, can be tolerated by this species.

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**0270 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Travis Richards[1], Tracey Sutton[2], David Wells[1]

*[1]Texas A&M University at Galveston, Galveston, TX, USA, [2]Nova Southeastern University, Dania Beach, FL, USA*

## A Trophic Analysis of Deep-Pelagic Assemblages in the Northern Gulf of Mexico

The *Deepwater Horizon* oil spill, which released hydrocarbons into the deep-pelagic environment of the Gulf of Mexico (GoM), revealed significant data gaps with respect to the Gulf's largest habitat and resulted in a concerted effort to understand the structure and function of deep-pelagic assemblages. As part of a larger collaborative effort tasked with characterizing assemblage structure of the GoM deep-pelagic fauna and determining the biotic and abiotic drivers underlying that structure, we examined the isotopic ratios of model taxa in order to (1) establish an isotopic baseline for bathypelagic, mesopelagic, and epipelagic assemblages of the northern GoM, (2) trace the vertical flow of organic matter among these three depth domains via active (vertical migration) and passive transport (sinking marine snow), and (3) investigate potential spatial and temporal variation in trophic structure of deep-pelagic assemblages. In 2015, samples were collected during two cruises in the northern GoM using a 10-$m^2$ MOCNESS midwater trawl sampling specific stratified depths from the surface to 1500 m. Here we present preliminary isotopic data from the deep-pelagic food web which represent several distinct trophic levels including carbon sources, zooplankton, gelatinous zooplankton, cephalopods, and fishes encompassing an array of feeding strategies (planktivores, gelativores, piscivores), and vertical distributions (migratory vs. non-migratory). By describing the trophic structure of deep-pelagic assemblages and evaluating the nature of vertical trophic connectivity in the GoM, this project will provide baseline trophic data to inform ecosystem models and identify taxa that may serve as important "vectors" between depth domains in the oceanic GoM.

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**1104 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Jonathan Richmond[1], Andrew Gottscho[2], Tod Reeder[2]

*[1]U.S. Geological Survey, San Diego, CA, USA, [2]San Diego State University, San Diego, CA, USA*

## Does Next-Generation Sequencing Data Support the Case for Parallel Ecological Speciation in Scincid Lizards of the *Plestiodon skiltonianus* Species Group?

Scincid lizards of the *Plestiodon skiltonianus* species complex are a candidate example of parallel speciation, where repeated independent evolution of the same reproductive isolating mechanism has led to multiple speciation events within the complex. The isolating mechanism is caused mainly by body size divergence between sister species

pairs that have diverged in their ecology, suggesting that natural selection has been an underlying driver of speciation in this group. In this talk, we review previous phylogenetic, population genetic, morphological, and behavioral studies that identified the mechanism of speciation within the *P. skiltonianus* group, and discuss the implications of a newly generated restriction-associated digest sequencing (RADseq) dataset on the existing evidence for parallel speciation. New findings based on the RADseq data challenge this earlier evidence and have led to some reinterpretation about the process and outcomes of speciation in this clade. Our results also raise concern about the phylogenetic evidence for parallel speciation in other taxonomic groups, including some that are considered well-established examples of the process.

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**1097 Herp Biogeography, Salon D, Friday 8 July 2016**

Eric Rittmeyer

*Australian National University, Canberra, Australia*

**Comparative Biogeography of Reptiles Across the Torres Strait**

Species distributions and the relationships among populations are influenced by a wide variety of factors. These include not only modern factors, such as climate, habitat availability, and species-specific factors like natural history and vagility, but also, perhaps more importantly, historic factors, including past habitat distributions and historic connectivity among regions. In the Australo-Papuan region, the repeated emergence of the Sahul Shelf during Pleistocene glaciations and the resultant land bridge formation connecting northern Australia to southern New Guinea likely played a key role in the close biotic similarity between these regions. We examine the biogeographic impact of Sahul Shelf emergence in a comparative context using mitochondrial DNA sequences for several lizard taxa. We find strikingly disparate patterns among taxa, with some showing little to no divergence between the northern Cape York Peninsula and the trans-Fly region of south-central New Guinea, and others showing relatively deep divergences. We also find some taxa with closer relationships between the northeastern Top End and New Guinea than between either and the Cape York populations, despite the closer geographic proximity and greater historic connectivity between Cape York and New Guinea. Increased sampling of both taxa and loci are clearly critical to determine the importance of various factors in driving these patterns, and to fully elucidate the biogeographic complexity of this dynamic region.

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**0992 Amphibian Reproduction & Herp Conservation, Galerie 3, Saturday 9 July 2016**

Jesus A. Rivas, Steven Salinas

*New Mexico Highlands University, Las Vegas, NM, USA*

**Invasive American Bullfrog (*Lithobates catesbeianus*) Friend or foe?**

Disturbance on an ecosystem may bring it to a different state than before the disturbance. Recovering from this disturbance could be a simple matter of time or may involve more complex situations. Some ecosystems develop stable alternate states from which they cannot easily be restored. American Bullfrog has been introduced in a many habitats affecting variety of organisms by preying on them and by outcompeting others. However the impact that they do in the ecosystem has seldom being quantified experimentally. In this contribution we eradicated Bullfrogs from a section of the Mora River and left another one unchanged and monitored the abundance of other aquatic organism in both sites to assess the impact of Bullfrogs. Bullfrogs exert top down control on many aquatic organisms. They negatively affect the abundance of Northern Crayfish (*Orconectes virilis*), another invasive, as well as fishes and keep fish parasites to a lower level. Elimination of Bullfrogs seems to be associated with an irruption of Northern Crayfish. While the data are preliminary and we expect the response to the eradication to take several years, at this point we are asking the question of whether eliminating Bullfrogs helped or hurt the ecosystem. Northern Crayfish are an aggressive invader that can make tremendous impact on the ecosystem. Monitoring this population in the long term will allow us to know if the Crayfish crashes after the initial irruption, or if it finds an alternate state where it is more harmful to the ecosystem than when the Bullfrogs were present.

CANCELED

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**0616 General Herpetology, Salon F-H, Thursday 7 July 2016**

Zachary Rivas, Anna Savage

*University of Central Florida, Orlando, FL, USA*

**Exploring the Relationship between *A. hydrophila* and *B. dendrobatidis* in Two Species of North American Anurans**

For several decades amphibian populations have been declining. Historically, the bacteria *A. hydrophila* (Ah) was hypothesized to be the causal factor in amphibian disease and population declines. However, with the discovery of a chytrid fungus, *Batrachochytrium dendrobatidis* (Bd) in 1998, which was identified on the skin of amphibians during documented mortality events, Ah research became of minor interest as focus shifted to Bd. Recent studies into the immunocompromising abilities of Bd, however, have opened new questions about its relationship with Ah and their combined effects on a host. In this study, we explore the relationship between infection with these two pathogens, Bd and Ah, in two amphibian species from distinct regions of the United

States. We developed a novel qPCR assay to measure the microbial load of Ah on the skin of two anuran species, *Lithobates yavapaiensis* (N=232) and *Pseudacris ornata* (N=169), which have confirmed Bd infections. We use a logistic regression model to identify whether significant relationships exist between these two pathogens, disease, and death. We find that even amongst the most severely infected frogs, Ah is not detectable on the skin and only appears post-mortem. We therefore conclude that Ah is an opportunistic bacteria, scavenging on anurans only after mortality events. This research is the first known study to quantitatively assess Ah in amphibians in conjunction with Bd. While there is no causal relationship between these pathogens, future work will examine potential Ah infections in other organs to more fully understand the relationship between Bd and Ah.

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**0776 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Nelson Rivera[1], Brian Folt[2]

*[1]Siena College, Loudonville, New York, USA, [2]Auburn University, Auburn, Alabama, USA*

## Landscape-scale Community Assembly of Glassfrogs (Centrolenidae) in a Lowland Caribbean Wet Forest

Most ecological studies of glassfrogs (Centrolenidae) to date have examined aspects of reproductive biology and population demography, but no studies have examined factors influencing community assembly. In this study, we sought to increase our understanding of the community assembly of glassfrogs by testing the hypothesis that species and assemblages occupy different habitats on a landscape scale at La Selva. We performed repeated nocturnal frog calling surveys across a gradient of riparian habitats from first to fifth-order streams, and built occupancy models to test for patterns of species occupancy, community assembly, species richness (alpha diversity), and species turnover (beta diversity). Detection probability of all species increased with rainfall and decreased with temperature; these variables may be correlated. We observed significant differences in patterns of species occupancy and community assembly across a stream-order gradient: occupancy of two species increased with stream order (*Teratohyla pulverata*, *Hyalinobatrachium fleischmanni*), occupancy of one species decreased (*Teratohyla spinosa*), and occupancy of one species did not vary (*Espadarana prosoblepon*); these patterns of occupancy resulted in assemblage-level differences across stream order. We developed four *a priori* hypotheses describing how alpha and beta diversity could be shaped across the stream-order gradient, and evaluated which hypothesis is most consistent with the observed patterns in our study. We discuss hypotheses which may drive distinctive patterns in species occupancy and community assembly of glassfrogs across the landscape at La Selva and other Neotropical sites.

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**0852 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

Adela Roa-Varon[1], Chenhong Li[2], Weicai Wang[2], Eric Hilton[1]

*[1]Virginia Institute of Marine Science, Gloucester Point, VA, USA, [2]Shanghai Ocean University, Shanghai, China*

## Phylogenetic Relationships within the Family Merlucciidae (Gadiformes) using Genome-Wide Protein Coding Genes

Even though the hakes (Merlucciidae) are commercially very important, the phylogeny and taxonomy of the genus *Merluccius* (16 of the 24 putative members of the family) are not well understood. The species of this genus are morphologically similar and have overlapping geographic ranges, and different species are often captured together, hindering effective management of this group. At present there is no consensus regarding either the limits of Merlucciidae (e.g., inclusion or not of the genera *Lyconus*, *Lyconodes* and *Macruronus*) or its phylogenetic placement within Gadiformes. Previous studies of the family, based on allozymes, mtDNA, or mtDNA and nDNA data, have been based on different sets of taxa, making conclusions and comparisons difficult. This study expands on past studies of Merlucciidae by combining greater taxonomic sampling with more extensive molecular character sampling, and by incorporating NGS approaches to molecular data acquisition and analysis. A targeted sequencing approach was used to generate a data set of single-copy protein-coding genes for 17 terminal taxa. The taxonomic sampling included all the currently regarded valid species within the genus *Merluccius*, with *Gadus morhua* used as an outgroup. A better understanding of the systematics of Merlucciidae will provide a necessary underpinning for conserving biological diversity and optimizing the use of fisheries resources in a sustainable way. This is particularly timely because of the commercial importance of some hakes, and the dramatic declines in their abundance and commercial landings. Here, we will present preliminary results from this study and discuss the implications of our findings for conservation.

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**1079 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Mark Roberts[1], Jeffrey Schwenter[2], Michael Arendt[2], Charles Innis[3], Kathryn Levasseur[1], Melissa Cook[4], Joseph Quattro[1]

*[1]University of South Carolina, Columbia, SC, USA, [2]South Carolina Department of Natural Resources, Charleston, SC, USA, [3]New England Aquarium, Boston, MA, USA, [4]NOAA Fisheries, Pascagoula, MS, USA*

## Allele frequency variation across juvenile pelagic habitats in the endangered Kemp's ridley sea turtle

While nesting is only a small fraction of a marine turtle's life history, it has been well characterized for decades. In contrast, it is only recently that the dominant, inwater, component has been the focus of comprehensive studies. Characterizations of inwater

aggregates of marine turtles have become an increasingly important aspect of sea turtle conservation management. Kemp's ridley sea turtles nest almost exclusively in the Western Gulf of Mexico (GOM) from Texas, USA to Veracruz, MX; with the highest density nesting occurring at Rancho Nuevo, Tamaulipas, MX. Based both on captures and oceanic modeling, hatchlings that are dispersing towards post-emergence pelagic habitats are thought to be predominantly retained in the western and northern Gulf of Mexico, though some are transported by the Florida Current into the Gulf Stream and then shuttled into the NW Atlantic. Oceanic models indicate that the relative percentages of hatchlings entering one or the other of these two habitats change from year to year depending on the variable GOM current systems. Consequently, the predicted survival rates of these cohorts also vary considerably - sometimes by as much as an order of magnitude. Such large variations in cohort survival and dispersal may result in significantly different allele frequencies across the range of juvenile habitats due to what are effectively variable degrees of population bottlenecks. To test for patterns reflecting this, we analyze genetic diversity and allele frequency differences in 300 juvenile Kemp's ridley sea turtles from three disparate juvenile habitats: northern GOM, South Carolina, and New England.

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**0063 NIA I, Salon E, Friday 8 July 2016**

D Ross Robertson[1], Benjamin C Victor[2], Nuno Simoes[3]

*[1]Smithsonian Tropical Research Institute, Balboa, Panama, Panama, [2]Nova SE University, Dania Beach, FL, USA, [3]UNAM, Sisal, Yucatan, Mexico*

**An Indo-Pacific damselfish in the Gulf of Mexico: opening a can of worms**

In 2013 a damselfish of the Indo-Pacific genus *Neopomacentrus* was found to be common on inshore reefs in the extreme southwest corner of the Gulf of Mexico. In 2014-15 it was recorded on other reefs spread across 650km of that area, but not further afield in- or outside the Gulf. It evidently has been there for quite some time and is well established. Three hypotheses have been proposed to explain its origins: carried by a freighter ship; carried by a translocated oil-platform; or the release of aquarium-trade fish. Preliminary mtDNA barcode data neither clarified the Indo-Pacific source(s) from which the GoM fish came, nor provided evidence to support any of those hypotheses. New mtDNA barcode data point to a source in the northern Indian Ocean and suggest the aquarium trade as the most likely origin, but also indicate that a major taxonomic revision of the genus is required, as it contains various unnamed genetic lineages, including the species in the GoM.

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**0993 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Jeanne Robertson[1], Gregory Pauly[2], Matthew Dickson[1], Jason Warner[1], Kenneth Krysko[3], Robert Espinoza[1]

*[1]California State University, Northridge, Northridge, CA, USA, [2]Natural History Museum of Los Angeles County, Los Angeles, CA, USA, [3]Florida Museum of Natural History, Gainesville, FL, USA*

## Coming to America II: A Genetic View of the Invasion History of the Mediterranean House Gecko (*Hemidactylus turcicus*) in the USA

Despite a relatively recent introduction into southern Florida a century ago, Mediterranean House Geckos (MHGs; *Hemidactylus turcicus*) have successfully colonized diverse climatic regions throughout the New World. In the US, MHGs are established in >400 counties across 23 states. We have documented physiological differences in lab-acclimated MHGs that are consistent with adaptation to their invaded climates across four climatic regions of the US. However, we do not know whether the rapid and successful invasion of MHGs occurred from a single point with subsequent dispersal, or whether US populations represent multiple independent invasions from the Mediterranean region. A single origin would indicate that populations with physiological differences are capable of rapid adaptive evolution. Alternatively, multiple invasions from individuals occurring in climatically distinct regions of their native range could explain these physiological differences among climatically distinct introduced populations. We analyzed mtDNA sequences to determine whether US populations represent a single or multiple invasions. Previous studies identified two mtDNA (cytb) lineages (A and B) in the native range. We sampled 170 MHGs from 26 localities across the US to determine the distribution of these haplogroups. We found that both haplogroups occur in the US. The B lineage is widespread and the A lineage is restricted to Riverside, CA and Lafayette, LA. There are no localities with only the A lineage. We conclude that the US has likely experienced multiple MHG invasions from the native range; however, resolution of the fine-scale invasion history of these geckos will require genomic analyses.

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**0913 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jeanne M. Robertson[1], Rachel S. Rhymer[1], Maria Akopyan[1], Eduardo A. Sanabria[2], Lorena B. Quiroga[3], Robert E. Espinoza[1]

*[1]California State University, Northridge, Northridge, California, USA, [2]Universidad Nacional de San Juan, San Juan, San Juan, Argentina, [3]Universidad Nacional de Cuyo, Mendoza, Mendoza, Argentina*

## Life on the Rocks: Shallow Genetic Structure in a Narrowly Endemic Lizard from the Argentine Puna

Narrowly endemic species often have small geographic ranges, which can have implications for population genetic structure and gene flow. *Phymaturus extrilidus* (Liolaemidae) is a recently described rock-dwelling lizard from the high-elevation (>3100 m) desert region (Puna) of San Juan, Argentina. The known geographic range of this species is limited to three mountainside passes covered by rocky outcrops and separated from each other by 1–3 km of largely unsuitable (boulder-free) habitat. Demographic data based on a 2-y mark–recapture study at one site indicated a strongly female-biased adult population (~2F:1M), suggestive of male-biased dispersal. We examined the population genetic structure of 65 individuals captured at the three sites using 12 microsatellite loci. We found weak genetic structure across the three sites, with low but significant estimates of $F_{ST}$ (0.01–0.02). STRUCTURE analyses indicated that lizards from these sites belong to a single genetic deme. Combined, the population genetic analyses indicate that sites are not demographically isolated despite the seemingly inhospitable intervening habitat. Next we amplified a portion of the mtDNA NADH4 gene from 5–7 individuals per site to examine the evolutionary history of the populations. Our sampling revealed five unique haplotypes with few nucleotide differences. The two most common haplotypes (frequency of 66% and 14%) were present at all sites, indicating that this narrow endemic species has undergone a recent evolutionary expansion with historical admixture across its range. A field-based study of migration and dispersal patterns is needed to determine the extent of current gene flow among sites.

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**0210 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Robert Robins, Lawrence Page, James Williams, Zachary Randall, Griffin Sheehy

*Florida Museum of Natural History, University of Florida, Gainesville, FL, USA*

## Freshwater Fishes of Florida

The distinctive Freshwater Fish Fauna of Florida is notable in composition and for lack of comprehensive treatment as a state book or atlas. Drawing on more than 60,000 vouchered specimen lots from museums and new observations in the field, a distributional atlas of fishes in the fresh waters of Florida is nearing completion. The work treats 223 species, including 49 marine fishes frequently encountered in freshwater environments. Three freshwater species are endemic to Florida (Seminole Killifish,

*Fundulus seminolis*, Flagfish, *Jordanella floridae*, and Okaloosa Darter, *Etheostoma okaloosae*). Forty-seven freshwater species are introduced, including 37 species from foreign countries. Dot distribution maps based on verified museum records are provided for all species, and inset maps showing the complete distribution in the United States and Canada are provided for North American freshwater species. Provided in each species account are life color photos, a description of key characters for identification, a comparison to similar species where necessary, and a summary of typical habitats.

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**0936 Squamate Biology, Balconies L & M, Sunday 10 July 2016**

Zachary Rodriguez, Christopher Austin

*Louisiana State University, Baton Rouge, LA, USA*

**Why so green? Investigating the evolutionary history of unusual traits in New Guinea lizards**

To shed light on the evolutionary processes that encourage or restrict particular traits, we can examine the history of key biological innovations. One group of Australasian lizards (genus: *Prasinohaema*) has developed an extraordinary physiology: green blood. The green coloration of the blood, muscles, and bones is caused by high levels of the bile pigment biliverdin (>700µm/L). Accumulation of biliverdin in other animals is cytotoxic, neurotoxic, and causes a pathological condition known as jaundice. To better understand the evolutionary history of green blood, we provide a robust historical framework using sequence capture of nuclear regions flanking ultraconserved elements. Using extensive genomic sampling, we estimated species-level relationships (phylogeny) of *Prasinohaema* and other closely related taxa in this group. Our results suggest multiple, independent origins of green blood, indicating that evolutionary processes are acting on these lizards and causing them to converge on this bizarre trait.

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**0740 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Hilary B Rollins, Michael F Benard

*Case Western Reserve University, Cleveland, Ohio, USA*

**How do climate-change induced phenological shifts alter terrestrial competition between two amphibians?**

Climate change is creating warmer, more variable winters and earlier springs which may shift the phenology of species, altering the nature or timing of important interactions. Wood frogs (*Rana sylvatica*) are shifting their phenology in response to climate change while American toads (*Bufo americanus*) are not. These amphibians share aquatic and terrestrial habitats and consume similar prey. To examine the effects of phenological shifts on competition between amphibians in the terrestrial environment,

we tested how growth and survival of post-metamorphic toads were affected by the size and metamorphic timing of wood frogs. We used mesocosms where we manipulated food and larval incubation temperature to raise wood frogs of four phenotypes: small size and early metamorphosis, large size and early metamorphosis, small size and late metamorphosis, large size and late metamorphosis. Three wood frogs of one phenotype were placed in terrestrial enclosures at metamorphosis along with four newly metamorphosed toads. All toads were raised to the same size and metamorphic timing. We then tracked growth and survival of all amphibians for 14 weeks in the terrestrial enclosures. Smaller initial wood frogs produced larger toads but decreased toad survival. This effect could be a result of larger wood frogs consuming more resources initially. Our results indicate that phenology mediated shifts in size are important to competition and are more broadly applicable in the context that climate change is likely to lead to smaller amphibians. Understanding how shifting phenology alters interspecific interactions will aid our predictions of the effects of climate change.

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**0295 Turtle Ecology, Salon A-C, Sunday 10 July 2016**

Francis Rose[1], Thomas Simpson[1], Ivana Mali[2]

[1]*Texas State University, San Marcos, Texas, USA,* [2]*Eastern New Mexico University, Portales, New Mexico, USA*

## Nesting and Repeated Use of Exit Sites for Nesting by Two Freshwater Turtles, *Pseudenys texana* and *Trachemys scripta*: Results from a 20-year study

Texas State University purchased Spring Lake, Hays County, Texas in 1994. Two hundred springs emanate from the Edwards Aquifer and supply approximately 170 cubic feet/sec. (110 million gallons of water/day) that maintains a constant water temperature of 22 $C^0$ throughout the lake. The springs were impounded in the 1840s producing a 600 m spring-run. A static slough, surrounded by a golf course and recreational fields, has its confluence mid-way of the eastern shore of the lake. The lake and slough produce an aquatic system with 8.5 surface ha. Over 5,400 turtles of four species were marked since 1996, including 1857 *Pseudemys texana* and 1080 *Trachemys scripta*. Monitoring confirmed that females of both species repeatedly selected specific areas to exit the water for nest construction, in many cases traveling long distances. Known nesting excursions (*P. texana* =1,226; *T. scripta* = 529) allowed us to evaluate repeated use of shoreline exit areas among years. Nesting events within years (*P. texana* = 668; *T. scripta* = 360) confirmed that many females repeatedly used the same exit areas among and within years. These data allow us to discuss the concept of natal homing versus homing to nesting exit areas of these two species in this population, to estimate the percent of females that nest annually, and to elaborate the timing of nesting by individuals within a season.

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## 0331 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016

Jason Ross, Michael Dreslik

*Illinois Natural History Survey, Champaign, IL, USA*

### Spatial Ecology of the Smooth Softshell Turtle (*Apalone mutica*) in the Kaskaskia River of Illinois

Conservation of animal populations requires knowledge of spatial ecology including movement, home range, and habitat preference. The Smooth Softshell Turtle (*Apalone mutica*) is a sexually dimorphic species inhabiting rivers of the Midwestern United States. There may be sexual differences in spatial ecology, but field studies over multiple years are lacking. Our objectives were to determine variables influencing movement rate (m/day), home range size (ha), and habitat preference of *A. mutica* in two reaches of the Kaskaskia River in south-central Illinois from 2013-2014. We radio-equipped 40 *A. mutica* and collected location, environmental, and habitat data at every radio-location. The mean movement rate was 140.5 m/day (SE=16.7, n=29). A mixed-effects model indicated movement rate increased with water temperature, decreased with Julian date, and was higher in the larger stream order. We used kernel density estimates to calculate core area (50% isopleth) and home range area (95% isopleth). The mean core area for all turtles was 5.13 ha (SE=0.75, n=23) and mean home range area was 18.08 ha (SE=2.73, n=23). A linear model indicated home range size increased with movement rate and number of radio-locations and was larger in the higher stream order. We determined habitat preference using compositional analysis with categories of bar, pool, bar-pool transition, run, and channelized. Home ranges were almost exclusively in the main river channel. Males preferred bars and females preferred pools over all other habitats. Overall, there were clear sexual differences in habitat preference, but sexual differences in movement rate and home range size were less pronounced.

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## 0332 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY

Jason Ross, Michael Dreslik

*Illinois Natural History Survey, Champaign, IL, USA*

### Population and Community Structure of Smooth Softshell (*Apalone mutica*) and Spiny Softshell (*Apalone spinifera*) Turtles in the Kaskaskia River of Illinois

The Smooth Softshell Turtle (*Apalone mutica*) is generally considered a large river specialist whereas the Spiny Softshell Turtle (*Apalone spinifera*) is considered a generalist. We investigated the co-occurrence of these species in two reaches of the Kaskaskia River in Illinois. Our objectives were to determine placement in the turtle community and if relative abundance, sex ratios, juvenile to adult ratios, and population size structure differ between reaches. We set 133 traps (8,400 trap hrs) upstream and 177 traps (12,803

trap hrs) downstream from June through October of 2013. Upstream turtle species richness (S) was 7, Shannon Diversity (H') was 1.25, and species evenness (J') was 0.64 and downstream S was 6, H' was 1.27, and J' was 0.71. We captured 37 *A. mutica* and 80 *A. spinifera* upstream and 56 *A. mutica* and 3 *A. spinifera* downstream. In terms of abundance, *A. mutica* ranked 3rd upstream and 2nd downstream, whereas *A. spinifera* ranked 1st upstream and 6th downstream. Chi-square tests showed a significant difference in softshell species abundance between reaches ($p<0.001$) and *A. mutica* sex ratio between reaches ($p<0.001$). Body size (PL) for both species did not differ between reaches but there was a sex and species effect driven by the large sizes of female *A. spinifera*. Preliminary results suggest *A. mutica* is fairly common in both reaches; whereas *A. spinifera* is common upstream but rare downstream. Some aspects of population structure may also differ between reaches. Overall, our results suggest these species can co-occur in moderately sized streams.

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**0278 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Stephen Ross[1,2]

*[1]University of New Mexico, Albuquerque, NM, USA, [2]Eco-Consulting Services, LLC, Pagosa Springs, CO, USA*

**ASIH, our Biology Family: Looking Back, Looking Forward, Celebrating 100 Years**

Oh, the Places you will Go! Oh, the People you will Meet! Oh, the Things you will See! A Tribute to the Dedication, Research, Teaching, and Support of Professors, Mentors, Students, and Colleagues from my experience of nearly half a century in ASIH. A Tribute to the Natural World that offers our Biology Family such amazing and diverse opportunities to follow and share our Passions and to tell our Stories!

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**0745 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

David Rostal

*Georgia Southern University, Statesboro, Georgia 30460, USA*

**Twenty Year Study of Habitat Characteristics, Reproduction, Home Range, Growth and Recruitment in *Gopherus polyphemus* in Southeast Georgia**

*Gopherus polyphemus* is an inhabitant of sandhill habitat, either scrub habitat as seen in Florida or longleaf pine wiregrass habitat as seen in Georgia. Here I present data over two decades (1994 to 2015) on population structure, reproduction including TSD, home range size, growth, age assessment and recruitment on Fort Stewart Army Reservation in southeast Georgia. FSAR is fire managed for longleaf pine and wiregrass. Over 550 tortoises have been marked during this period. Tortoises select habitat with low canopy and moderately low vegetation. Burrows are located in areas with direct sunlight most

of the day. Adult sex ratio is 1:1. Females are vitellogenic in the fall when most edible vegetation is available and mating is observed to occur. Hibernation lasts from November to March in most years. Females ovulate in late April to early May and nesting can occur from mid-May to late June depending on weather. Female tortoises are significantly larger than males and produce one clutch per year on average. Clutch size influenced by female size. Incubation takes 80 to 100 days depending on weather. Hatching success is 80% or higher in most years. Wet years tend to produce more males due to soil cooling while warm years produce more males. The pivotal temperature (approximately 29C) is consistent with over turtle species in the southeast USA. Tortoises mature at approximately 18 years and are fully mature at 26 cm straight carapace length (SCL). Home range size varies dramatically between years and tortoises shift home ranges commonly.

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**0822 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

Betsie B. Rothermel[1], K. Nicole White[2], Michael T. White[1], Kelly R. Zamudio[3], Tracey D. Tuberville[2]

*[1]Archbold Biological Station, Venus, FL, USA, [2]University of Georgia, Athens, GA, USA, [3]Cornell University, Ithaca, NY, USA*

**Patterns of reproductive output in Gopher Tortoises inhabiting modified sandhill in southern Florida, USA**

Demographic information is needed to inform range-wide management of the Gopher Tortoise (*Gopherus polyphemus*), a long-lived species of conservation concern in the southeastern USA. A previous study by Ashton et al. (2007) demonstrated that Gopher Tortoises in southern populations produce larger clutches, a pattern correlated with latitudinal differences in productivity. Here we present new information on reproductive output of tortoises inhabiting Red Hill at Archbold Biological Station, one of the southernmost populations included in Ashton et al.'s analysis. We acquired clutch data from 14 nests excavated in 2015 and six gravid females that were radiographed or killed by vehicles in 1976-1986. Maternity of nests was confirmed by genotyping hatchlings and all potential mothers. Mean carapace length of females was 307 mm (range 239-344) and clutch size (CS) averaged 8.25 ± 2.17 (range 5-12 eggs). Intermediate-sized females did not produce larger clutches; thus the polynomial relationship reported by Ashton et al. for another southern population remains an anomalous result. In the Red Hill population, CS increases linearly with female size ($R^2 = 0.603$, $p < 0.0005$) and females living in a field dominated by exotic pasturegrass had significantly larger clutches than females inhabiting native sandhill and oak scrub (ANCOVA: Habitat $F_{1,17} = 8.871$, $p = 0.008$). However, there appears to be a trade-off between CS and hatchling mass. Overall, our data strengthen the main finding of Ashton et al. and also reveal significant within-population variation in reproductive output related to both female body size and habitat.

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**0483 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016**

Erica Rottmann, Kyle Piller

*Southeastern Louisiana University, Hammond, LA, USA*

### Searching for a Needle in a Haystack:Environmental DNA (eDNA) Detection of Rare Fishes in the Pearl River

The Pearl River is a 6th order stream in the Gulf Coastal Plain with the fourth greatest discharge into the Gulf of Mexico. It is home to 119 known species of fishes. Thirteen of these species are of special conservation concern, and ten of those are small-bodied fishes. Traditional shoreline sampling has been conducted regularly on the Pearl River for more than fifty years. However, these methods may often fail to detect some of the rare fishes due to the difficulty of sampling in their preferred habitats. This study was conducted to determine if environmental DNA (eDNA) sampling was capable of detecting rare fishes, especially small-bodied ones, in a river of this size. Water samples were collected quarterly from four transects across the Pearl River over the course of one year to encompass all seasons and potential life history stages of the species of interest. Species-specific primers were designed for eDNA detection of four fishes of conservation concern, the gulf sturgeon, *Ascipenser oxyrinchus*, the frecklebelly madtom, *Noturus munitis*, the freckled darter, *Percina lenticula*, and the pearl darter, *Percina aurora*. The results of this study could have management implications in regards to the conservation status and seasonal occurrence of these imperiled Louisiana fishes.

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**0744 Turtle Ecology, Salon A-C, Sunday 10 July 2016**

Christopher Rowe[1], Ryan Woodland[1], Paula Henry[2]

[1]*University of Maryland Center for Environmental Science, Chesapeake Biological Laboratory, Solomons, MD, USA,* [2]*U.S. Geological Survey, Patuxent Wildlife Research Center, Beltsville, MD, USA*

### Assessing Sea Level Rise and Future Habitat Availability for Diamondback Terrapins in Maryland

We used existing data on nesting site use by diamondback terrapins (> 700 nests) and projections from a model of future coastal habitat distributions ("SLAMM") to evaluate potential effects of sea level rise (SLR) on habitat availability for terrapins in the Eastern and Western Shores of the Maryland portion of the Chesapeake Bay, and in Maryland's coastal bays. We examined three scenarios for SLR in the Chesapeake Bay, consisting of projected increases of 39, 69, or 100 cm by year 2100 ($SLR_{39}$, $SLR_{69}$, and $SLR_{100}$). The models suggest that most observed nesting sites (82 – 92 %) will be inundated by year 2100. The models predict a net loss of brackish marsh, a critical feeding habitat, of ~ 30 ($SLR_{39}$) to ~ 50 % ($SLR_{100}$) on the Western Shore and ~ 300 ($SLR_{39}$) to ~ 600 % ($SLR_{100}$) on

the Eastern Shore by 2100. Coastal bays will also experience a reduction of up to ~ 60 % ($SLR_{100}$) in salt marsh over this period. Nesting habitats (beach and undeveloped coastal dry land) responded differently to SLR. Beach area increased or remained relatively constant in all three regions, whereas undeveloped dry land declined in all regions, being most pronounced on the Eastern Shore where a ~ 400 to ~ 600 % decline within the study area is projected. The future terrapin population in the Bay will encounter a different abundance and distribution of critical habitat types, perhaps affecting the capacity of the system to support the population at its current level.

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**0624 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

John Rowe, Mariah Nawrot, David Clark

*Alma College, Alma, Michigan, USA*

## Thermoregulation in a North Temperate Population of Midland Painted Turtles (*Chrysemys picta marginata*): Temporal Patterns and Intersexual Differences

The regulation of body temperature ($T_b$) is important for energy acquisition in ectotherms but may be challenging and costly at northern latitudes. We studied thermoregulation in a north temperate population of Midland Painted Turtles (*Chrysemys picta marginata*) in a small pond in central Michigan. Cycling of mean daily body temperature ($T_b$) began as early as March and continued through October. The thermoregulatory setpoint was 25–31 °C. During summer, thermal accuracy ($d_b$) values were highest during the afternoon hours when thermal quality ($d_e$) values were highest but thermal effectiveness values ($d_e$ - $d_b$) indicated that turtles selected temperatures that were higher than average $T_e$ values throughout the early morning hours. Mean hourly $T_b$ and thermal accuracy and effectiveness were significantly higher on sunny days when compared to cloudy days. Thermal effectiveness was relatively low during April and October, increased during May and remained high between June and August. Turtles had relatively low investment in thermoregulation during the fall months apparently as an energy conservation measure prior to hibernation. Males more effectively thermoregulated than did females during April, May and October, possibly to facilitate mate searching behaviors, but females more effectively thermoregulated during September, possibly to facilitate vitellogenesis prior to hibernation. Thermal exploitation values ($E_x$) indicated that our turtles spent as much, or more, time within $T_{set}$ than other north temperate reptile species, including north temperate painted turtles, most likely due the relatively high thermal quality of our aquatic environment.

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**1029 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Freya E. Rowland, Thomas L. Anderson, Jacob J. Burkhart, Brittany H. Ousterhout, Dana L. Drake, Arianne F. Messerman, Raymond D. Semlitsch

*University of Missouri, Columbia, MO, USA*

### Nutrient Concentrations, Slope, and Area Predict Amphibian Richness in Intermediate-Sized Ponds

Understanding what factors structure and maintain species diversity is one of the most basic ecological questions. Previous work from more than 200 intensively sampled ponds at Fort Leonard Wood, MO, USA indicates small ponds have a high probability of drying and large ponds are often colonized by predators such as fish. These combined mechanisms mean that amphibian diversity and richness tend to peak in intermediate-sized ponds. However, not all intermediate-sized have high diversity and richness, and the reasons for this are unknown. We sampled 41 ponds of intermediate area for nutrients and pond physical features. We then tested whether amphibian richness and diversity could be explained by total nitrogen, total phosphorus, volatile suspended solids, age of the pond, pond bank slope, canopy cover, and area. Nitrogen and phosphorus were negatively related to pond richness, but neither explained diversity. Pond age and canopy cover were not significant predictors of either richness or diversity, but slope was correlated with both. Despite restricting pond area, we found a positive relationship between area and richness. Our data increase the understanding of how abiotic factors can shape pond communities in landscapes.

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**0460 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Freya E. Rowland, Ricardo M. Holdo, Raymond D. Semlitsch

*University of Missouri, Columbia, MO 65211, USA*

### Leaf Litter Subsidy Gradients Differentially Influence Pond Ecosystem Properties

Spatial subsidies can strongly affect ecosystem dynamics. The small size and high perimeter-to-surface ratio of ponds makes them an excellent system for understanding the effects of variation in cross-ecosystem subsidies. Most previous studies have explored only very low or very high resource subsidy values in ponds. This emphasis on extremes assumes linear relationships and thus fails to capture potential nonlinear effects along a gradient of inputs seen in real systems. To test the effects of subsidies in ponds, we manipulated leaf litter to seven levels in 1000-L replicated mesocosms during the summer of 2015. We used a simple pond food web that included southern leopard frog tadpoles (*Lithobates sphenocephalus*) and spotted salamander larvae (*Ambystoma maculatum*) as the top consumers. We measured dissolved N and P; dissolved organic carbon (DOC); dissolved oxygen (DO); phytoplankton and periphyton biomass; and

amphibian biomass export. We hypothesized that leaf litter would increase nutrient supply and DOC; decrease algal biomass; and that amphibian biomass export would closely track with primary production. Our results suggest that leaf litter subsidies can affect abiotic and biotic components of ponds differently. Increased leaf litter linearly increased phytoplankton biomass and concentrations of dissolved N and P. DOC and periphyton biomass, however, increased exponentially. Leaf litter decreased DO linearly. Frog biomass export increased with increased subsidy, while salamander biomass export increased up to moderate subsidy levels, before decreasing to almost zero at high subsidies. These data show that a dose-dependent approach is fundamental for understanding how subsidies affect pond ecosystem properties.

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**0394 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Amy Rowley[1], Toby Daly-Engel[3], Mariana Rego[4], Francisco Garcia-Gonzalez[5], John Fitzpatrick[2]

*[1]University of Manchester, Manchester, UK, [2]Stockholm University, Stockholm, Sweden, [3]University of West Florida, Pensacola, FL, USA, [4]Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil, [5]Doñana Biological Station, Sevilla, Spain*

**Sexual Selection and the Evolution of Reproductive Traits in Sharks and Rays**

When females mate with multiple males in a single reproductive cycle, sexually selected processes of female mate choice and competition among males can continue after mating has taken place. While genetic analyses have confirmed that female promiscuity is widespread among sharks and rays, the extent of this multiple mating - and thus the intensity of sexual selection - varies considerably among species. Here we consider how post-mating sexual selection drives the evolution of male reproductive traits across elasmobranch species. Males of species in which females mate promiscuously invest more in sperm producing tissue and produce sperm with longer flagella. These findings shed light on evolutionary responses to sexual selection in a basal vertebrate group and provide valuable insights into the breeding biology of this enigmatic group of fishes.

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**0579 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Jodi Rowley[1], Dao Tran[2], Greta Frankham[1], Anthony Dekker[3], Huy Hoang[2]

*[1]Australian Museum Research Institute, Sydney, NSW, Australia, [2]Faculty of Biology, University of Science-Ho Chi Minh City, Ho Chi Minh City, Viet Nam, [3]Dekker Consulting, Manuka, ACT, Australia*

**Little Brown Frogs That Sound Like Crickets: Gone Before We Even Know They Exist?**

Given that amphibians are one of the most threatened groups of organisms on the planet, our inability to diagnose their true diversity is likely to have significant

conservation consequences. This is particularly true in areas undergoing rapid deforestation, such as Southeast Asia. The Southeast Asian genus *Leptolalax* is a group of small-bodied, morphologically conserved frogs that inhabit the forest-floor. We examined a particularly small-bodied and morphologically conserved subset, the *Leptolalax applebyi* group, using a combination of molecular, morphometric, and acoustic data to identify previously unknown diversity within. In order to predict the geographic distribution of the group, estimate the effects of habitat loss and assess the degree of habitat protection, we used our locality data to perform ecological niche modelling using MaxEnt. Molecular, acoustic and subtle morphometric differences revealed a significant underestimation of diversity, with at least five new species uncovered. The *L. applebyi* group is predicted to have historically occurred over a large area of Vietnam, a considerable portion of which has already been deforested. Less than a quarter of the remaining forest predicted to be suitable for the group falls within current protected areas. The predicted distribution of the *L. applebyi* group extends into unsurveyed watershed basins, each potentially containing unsampled diversity, some of which may have already been lost due to deforestation. It is likely that we have lost species in this group before we even realized they existed.

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**0186 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Meagan Roy, Carol Johnston

*Auburn University, Auburn, AL, USA*

### From GIS to eDNA: A habitat risk assessment and breeding site projection for the Slackwater Darter *(Etheostoma boschungi)*

Habitat alteration and fragmentation are the leading causes in decline for many small freshwater fish species. These declines are even further magnified for migratory species such as the Slackwater Darter (*Etheostoma boschungi*) that depend upon a separate habitat for breeding. Even if the non-breeding habitat remains viable, degraded breeding habitat results in failed reproductive efforts and thus declining populations. The Slackwater Darter is endemic only to a few tributaries of the Tennessee River in Alabama and Tennessee, and loss of connectivity between breeding and non-breeding sites as well as increasing urban and agricultural development has left populations greatly reduced throughout much of its natural range. By incorporating land-use, hydrological variables, and passage-barrier data layers into a GIS database, this project aims to relate ecosystem parameters to darter presence and determine which of the existing habitat within the species' current range is most at risk and most receptive to any potential conservation and restoration efforts. We intend to develop a functional GIS model that will not only allow us to analyze the relationship between viable Slackwater Darter populations and habitat, but also enable us to predict where new, undocumented breeding sites might occur—specifically, in Limestone Creek. We can then test the viability of our model and predictions by incorporating eDNA sampling techniques. This project allows us an opportunity to examine the habitat condition-presence relationship of the Slackwater Darter throughout the entirety of its range while also

offering us the opportunity to identify new populations within a previously-undocumented tributary.

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**0506 Amphibian Reproduction & Herp Conservation, Galerie 3, Saturday 9 July 2016**

Elizabeth Roznik[2], Ross Alford[1]

*[1]James Cook University, Townsville, Queensland, Australia, [2]University of South Florida, Tampa, Florida, USA*

### Thermal and hydric environments interact with behavior to affect *Batrachochytrium dendrobatidis* infection in Australian rainforest frogs

We tracked infected and uninfected individuals of three species of stream-associated rainforest frogs (*Litoria nannotis, L. rheocola*, and *L. serrata*), recorded their body temperatures, and measured relative desiccation rates at their locations. The body temperatures and desiccation rates of individual frogs in nature are significantly related to their *Batrachochytrium dendrobatidis* (*Bd*) infection status. In all of our study species, the probability of infection increased as rates of desiccation at their locations decreased, so frogs that chose wetter locations were more likely to be infected. Temperature relations were more complex; infected frogs had cooler body temperatures than uninfected frogs in *Litoria rheocola* and *L. serrata*, however in *L. nannotis*, infected frogs had more stable and moderate body temperatures than uninfected frogs. These results reveal correlations, but not whether differences among individuals in behaviour and microhabitat use cause changes in infection probability or are the consequences of individual infection status. To separate cause from consequence, we recorded body temperatures and water use of naturally infected and uninfected individuals of *L.nannotis* and *L. serrata* in thermal gradients, then re-tested the same individuals after all frogs had lost their infections. Infection by *B. dendrobatidis* changed the behaviour of *L. nannotis*, but not that of *L. serrata*. The locomotor performance of *L. nannotis* was also significantly affected by *Bd* infection. Whether behavioural differences between infected and uninfected frogs are the cause or the consequence of *Bd* infection thus differs among frog species.

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**0296 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Sara Ruane[1], Jordyn deHaan[2], Lindsey Shapiro[3]

*[1]LSU Museum of Natural Science, Baton Rouge, LA, USA, [2]Louisiana State University, Baton Rouge, LA, USA, [3]Briarcliff High School, Briarclilff Manor, NY, USA*

### Assessing Arboreal Snake Traits Across Families and Zoogeographic Regions

Over 600 species of snakes worldwide can be classified as arboreal, at least partially. Despite much research interest on these snakes with respect to musculature and pulmonary adaptations for life off the ground, there has been no assessment of what morphological and ecological traits characterize arboreal snakes worldwide, if any. For example, do arboreal snakes show higher rates of certain colorations, such as green and brown? Are arboreal snakes more likely to be rear-fanged than non-arboreal snakes? Is arboreality evenly distributed among the major snake clades or is it found only within certain groups? Do certain zoogeographic regions have higher proportions of arboreal taxa than others? How these characteristics relate to phylogeny is also relevant, as certain traits may be due to shared ancestry rather than specifically due to an arboreal lifestyle. Using a dataset curated from the literature, we explore the ecological and natural history characteristics of arboreal snakes on a global scale.

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**0220 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Cassandra Ruck[1], Andrea Bernard[1], Fabio Hazin[2], Rima Jabado[3], Mahmood Shivji[1]

*[1]Save Our Seas Shark Research Center USA, Nova Southeastern University, 8000 N Ocean Drive, Dania Beach, FL, USA, [2]Universidade Federal Rural de Pernambuco, Recife, PE 52171-032, Brazil, [3]Gulf Elasmo Project, P.O Box 29588, Dubai, United Arab Emirates*

### Global-Scale Genetic Population Structure and Diversity in the Oceanic Whitetip Shark, *Carcharhinus longimanus*

The oceanic whitetip, *Carcharhinus longimanus*, is a circumtropical, pelagic shark of high conservation concern (IUCN Red List: "Critically Endangered" in the W North and W Central Atlantic and "Vulnerable" globally). We present an updated assessment of the global population structure, genetic diversity, and demographic history of this shark based on analysis of two mitochondrial genome regions (whole control region and partial NADH dehydrogenase subunit 4 (ND4) gene) and nine nuclear microsatellite loci. No population differentiation was detected between the north and south Atlantic. However, significant structure was consistently detected between the Western Atlantic and Indo-Pacific Oceans across both mitochondrial and nuclear markers. This population structure was coupled with deep geographic mitochondrial haplotype mixing and evidence of contemporary migration between the Western Atlantic and Indo-Pacific Oceans. We theorize that semi-permeable thermal barriers are responsible for the differentiation between the Western Atlantic and Indo-Pacific. Additionally, a

signal of matrilineal structure between the Indian and the Pacific Oceans was detected with AMOVA and pairwise analyses of the ND4 gene (pairwise ΦST = 0.051, P = 0.046; pairwise Jost's D = 0.311, 95% CI = 0.020, 0.061). Relatively low mtDNA genetic diversity (concatenated mtCR-ND4: π = 0.32% ± 0.17%) compared to other globally distributed elasmobranch species raises concern for the future genetic health of these populations. Overall, despite the global distribution and high mobility of *C. longimanus*, significant population structure exists between the Western Atlantic and Indo-Pacific Oceans, and effective management strategies must take this into consideration.

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**0083 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: CONSERVATION & MANAGEMENT**

Lacy Rucker[1], Yong Wang[1], Callie Schweitzer[2]

[1]*Alabama A&M University, Normal, AL, USA,* [2]*USDA Forest Service, Southern Research Station, Huntsville, AL, USA*

## Amphibian Use of Road Ruts as Breeding Wetlands Located in Upland Hardwood Forests

Amphibians have been known to use a wide array of temporary and permanent bodies of water as breeding wetlands. The use of road ruts by amphibians as oviposition sites has yet to be fully explored. The purpose of this study was to evaluate road ruts located on a property access road with a wide variety of traffic. Our study site was located in an upland hardwood forest system on the mid-Cumberland Plateau in Grundy County, Tennessee. Road ruts were marked using a GPS unit prior to the 2015 field season, and randomized in Excel. Half of the marked road ruts were sampled during the peak breeding season of 2015 (May-September). Sampling events consisted of opportunistic encounter surveys, visual encounter surveys, hand captures, and dip-net surveys, and were conducted every 6-9 days. Damage for each road rut was delineated into one of five categories before each sampling event with I being little to no damage and VI being severe damage. The maximum length (m), width (m), and depth (mm) were recorded at every sampling event. Morphometric measurements was recorded on all collected individuals. The results of this study will improve our understanding of amphibian breeding in high traffic areas on primitive roads. This information will also provide land managers and private landowners the knowledge to help reduce negative impacts of road rut damage on amphibian populations on the Cumberland Plateau.

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**0915 HL GRADUATE RESEARCH AWARD, Galerie 2, Thursday 7 July 2016**

Ariana Rupp, David Sever

*Southeastern Louisiana University, Hammond, Louisiana, USA*

### Histology and Ultrastructure of Seasonal Variation of Mental Glands and Caudal Courtship Glands in Three Genera of Plethodontid Salamanders

Salamanders in the family Plethodontidae exhibit a unique tail-straddle walk during courtship that can include the use of sexually dimorphic mental glands and caudal courtship glands. Mental glands are found in the skin of the lower jaw and caudal courtship glands are found in the skin of the dorsal base of the tail in some male plethodontids and both are thought to increase female receptivity during courtship. While many histological studies of mental glands have observed intergeneric morphological variation, only four light microscopy studies of caudal courtship glands exist and there are even fewer ultrastructural studies. It was hypothesized that similar intergeneric morphological variation would be seen in caudal courtship glands as had already been seen in mental glands, and that glands would vary seasonally just as mental glands hypertrophy during the breeding season. Males and females from three genera, *Plethodon*, *Eurycea*, and *Desmognathus,* were collected throughout the year. Tissues from the chin and the dorsal base of the tail in both males and females were taken from each collected individual and analyzed using either light or electron microscopy. Results show that there is intergeneric morphological and seasonal variation of mental and caudal courtship glands in these genera. The data available for mental gland characters can be optimized on a phylogeny of plethodontids in order to learn about evolution of these glands, however, more data must be collected on caudal courtship glands before optimization would be useful for studying their evolution.

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**0789 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Matthew Russell, Kyle Hovey, Sarah Bolton, Ralph Saporito

*John Carroll University, University Heights, Ohio, USA*

### Investigating the Relationship Between Boldness, Coloration, and Chemical Defense in the Dendrobatid Poison Frog *Oophaga pumilio*

Organisms that are chemically defended often advertise their defenses to potential predators. One form of advertisement is through conspicuous coloration, which can serve as a warning of unpalatability to predators. Advertisement may also be enhanced through bold behaviors, which may include slower movements and escape tactics. The dendrobatid poison frog *Oophaga pumilio* possesses alkaloid-based chemical defenses, is brightly colored (aposematic), and behaves more boldly than cryptically colored, non-chemically defended frogs. Interestingly, *O. pumilio* exhibits considerable variation in alkaloid defenses and coloration throughout their natural geographic range in Costa Rica. It is currently unknown, however, whether coloration and alkaloid defenses correspond to differences in bold behavior. The present study investigated the

relationship between alkaloid defenses, coloration, and bold behavior among three different populations of *O. pumilio* in Costa Rica. Our field-based study provides evidence that bold behaviors are largely related to the quantity and type of alkaloid defenses in *O. pumilio*.

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**0725 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Peter Russo, Alexander Zorrilla, Christopher Murray

*Southeastern Louisiana University, Hammond, LA, USA*

### Cranial variation amongst independent lineages of New Guinea crocodile (*Crocodylus novaeguineae*)

The island of New Guinea is home to the crocodilian species *Crocodylus novaeguineae*. This species inhabits fresh water lakes and wetlands on both the northern and southern coast of the island separated by the New Guinea Highlands. This physical barrier has geographically isolated the northern and southern populations of *C. novaeguineae* and is hypothesized to inhibit genetic exchange between them. Several morphological and reproductive characteristics vary between the northern and southern population (premaxilla to maxilla length ratio, postoccipital series, seasonal nesting variation, etc.). Mitochondrial DNA and microsatellite analysis reveals divergence and suspected isolation between northern and southern populations. Here, we quantify cranial shape variation between the populations of *C. novaeguineae* on the northern and southern side of the Central Highlands. We analyzed both dorsal and ventral sides of *C. novaeguineae* skulls from four populations in an attempt to elucidate diagnostic characters based on current independent lineages.

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**0612 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Wade Ryberg[1], Lee Fitzgerald[2], Danielle Walkup[2], Toby Hibbitts[2]

[1]*Texas A&M Institute of Renewable Natural Resources, College Station, Texas, USA,* [2]*Texas A&M University Department of Wildlife and Fisheries Sciences, College Station, Texas, USA*

### Behavioral trials demonstrate roads are persistent barriers to movements of the Dunes Sagebrush Lizard

Ecological research has shown many negative effects of roads on native biodiversity, including fragmentation and conversion of habitat, subdivision of populations into smaller and more vulnerable fractions, and increased rates of mortality from vehicular collisions. The mechanisms through which roads harm animal populations vary across taxa, and reversing negative road effects is a challenge for conservation. In some cases, it is unclear if road effects can ever be mitigated. As such, a toolkit of species-specific management techniques may need to be developed to mitigate negative road effects.

The Dunes Sagebrush Lizard, *Sceloporus arenicolus*, is a psammophilic, habitat specialist endemic to the Mescalero-Monahans Sandhills ecosystem of New Mexico and Texas. Within this ecosystem, caliche roads created for oil and gas extraction fragment Shinnery Oak sand-dune landforms occupied by *S. arenicolus*. We conducted behavior trials in experimental enclosures to test how the smallest caliche roads may restrict *S. arenicolus* movements. We also conducted trials to evaluate whether a constructed sand-crossing could minimize road effects on movements of *S. arenicolus*. Our results supported the hypothesis that *S. arenicolus* avoids the road surface, which means that roads persistently affect behavior even when traffic is not present. Our results also indicate that road crossing structures had no effect on *S. arenicolus* movements. These findings help demonstrate how roads have created isolated populations that appear to experience increased demographic stochasticity and eventual extirpation. Our study guides conservation plans for *S. arenicolus*, and contributes to our understanding of road effects on biodiversity in general.

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**0732 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Mark Sabaj

*The Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA*

**Phenomenological Monsters**

According to Big Bang theory, the universe originated approximately 13.8 billion years ago during the Planck Epoch, an acutely brief period of time that stretched from zero to $10^{-43}$ seconds. Coincidentally, some molecular clock estimates date the origin of the Percomorpha towards the end of the Planck Epoch. The ASIH Epoch began 100 years BP. Alternative molecular clock estimates date the origin of percomorphs significantly closer to the founding of the society by three organismal biologists: John Treadwell Nichols, Henry Weed Fowler and Dwight Franklin. The true origin of the Percomorpha lies somewhere between those two subjective estimates. Such truths can be hypothesized, tested and falsified, but only arrogantly treated as unassailable. Our society is bound in large part by a dogged pursuit of elusive truths via multiple lines of research that iteratively build on historical evidence, and the application of our findings to real world issues concerning the classification and conservation of fishes, amphibians and reptiles.

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**0217 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Allison Sacerdote-Velat, Charles Calafiore, Lisa Raimondi

*Lincoln Park Zoo, Chicago, Illinois, USA*

### Nest survival of Smooth Greensnakes, *Opheodrys vernalis*, in Illinois Grasslands

Smooth Greensnakes, *Opheodrys vernalis*, are declining range-wide and are designated as State Endangered or Species in Greatest Conservation Need in many states. As part of an ongoing conservation assessment, wild nests were monitored to determine survival rates in several Illinois counties. Only five nests with 29 eggs were encountered in 2014, with 58% hatching success. 194 eggs from 24 nests were monitored in 2015, and we confirmed fates of 141 eggs. The remaining 53 eggs were in various states of decay at the final check, making it challenging to ascertain whether or not hatching occurred. Of the eggs with known fates, 19% hatched and 81% failed. Had the 53 eggs with uncertain fates been successful, hatching success would reach 41%. Had the 53 eggs failed, hatching success would decrease to 14%. We documented several incidences of nest failure attributable to invertebrates, including predation by ants and ground beetles, and burying by crayfish. Nest failure also resulted from a plant germinating through a clutch, eggs becoming moldy in poorly drained nest sites, or eggs desiccating as the substrate dried in August. For *Opheodrys vernali*s, reproductive output is limited compared to the viviparous snakes of the region with similar body size. From sensitivity analyses, we determined that survival from egg to one year old has the greatest effect on the population growth rate as compared to other life stages. Through *ex situ* incubation, we are increasing hatching success as part of a headstarting program, expected to improve population growth.

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**0501 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Allison Sacerdote-Velat, Mary Beth Manjerovic, Rachel Santymire, Lisa Raimondi

*Lincoln Park Zoo, Chicago, IL, USA*

### Understanding the relationship among *Batrachochytrium dendrobatidis*, stress physiology and land use in amphibians in the Chicago, IL region

We examined variation in incidence of *Batrachochytrium dendrobatidis* (*Bd*) and stress physiology in amphibians in 40 sites, spanning 10 watersheds within the Chicago, IL region. Sampling sites were forest preserves classified as urban, suburban, industrial, or rural. We used a novel, non-invasive technique to sample cortisol via dermal swabs while collecting *Bd* samples. Our *Bd* sampling focused on American bullfrogs, green frogs, and northern leopard frogs. However, additional species were opportunistically sampled, including red-spotted newts, spotted, tiger, and blue-spotted salamanders, American toads, western chorus frogs, spring peepers, and wood frogs. Positive *Bd* swabs were collected from 13 of 40 sites (32.5%), with positive sites in all land use categories. Of 466 samples, 7.2% tested positive for Bd but few were symptomatic for

chytridiomycosis. We validated our non-invasive glucocorticoid sampling technique with wild and zoo-housed amphibians which will allow us to examine variation in cortisol in relation to *Bd* status, species, and land use category in the future.

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**0874 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016**

Heather Saco, Ginny Adams, Reid Adams

*University of Central Arkansas, Conway, Arkansas, USA*

**Changes in Land Use and Fish Assemblages in Four Ozark Highland Streams over Four Decades**

Long-term studies evaluating land use and fish assemblage structure are often lacking but necessary to further understanding of anthropogenic influence on local fish assemblages. Land use is known to influence aquatic ecosystems and the aquatic biota. Sylamore, Piney, Jane's and Big creeks are in the White River drainage in north central Arkansas. During summers 2014 and 2015, we sampled fishes at 39 sites across the four drainages. Sites, dates, and sampling methodology were consistent with previous data collected during the 1970's. We used the NWALT dataset to determine historic (1974) and current (2012) land use for all systems. Fish assemblage persistence and stability were calculated for each site sampled and analyzed in relation to catchment land use. Persistence was highly correlated with percent land use across all systems (forest rho=0.46, pasture -0.45, urban -0.52). In addition, stability was significantly correlated with percent forest (0.43) and pasture (-0.41) across all systems. Seven species showed significant range expansions across all four systems, and one range reduction was detected in *Micropterus dolomieu* (reduced from 20 to four sites). At sites where *Micropterus dolomieu* was missing in the current collection, we observed colonization of *Micropterus punctulatus* and *M. salmoides*. An apparent downstream shift of headwaters species, *Semotilus atromaculatus* and *Chrosomus erythrogaster*, was detected in two of the systems and suggests a change in upstream hydrology. In-stream habitat reflected changes in land use and may provide proximate factors that explain the correlation between assemblage shifts and land use.

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**1063 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Cyrus Sadeghian, Chad Hargrave

*Sam Houston State University, Huntsville, TX, USA*

**Leaf Litter Analysis on the Mortality and Growth Rates of the Western Mosquito Fish (*Gambusia affinis*)**

The primary threats to biodiversity such as habitat loss, overexploitation, pollution, climate change and invasive species are all well documented to alter ecosystem

properties and endanger countless species globally. A tree native to eastern Asia called the Chinese tallow tree (*Triadica sebifera*) has negatively affected local organisms since its introduction in the early 1900s for wax-based products and herbal medicine. The abundance has increased drastically over the past 30 years where tallow has nearly doubled in East Texas, and has tripled in Louisiana and Mississippi. There has been little documentation about the effects of Chinese tallow on freshwater fish. Leaf litter inputs into lentic ponds and pools of water serves as a high nutritional source of terrestrial input. Freshwater fish species use nesting areas in the more shallow areas of ponds where they are either pre-dug in the substrate or in leafy debris. This is represented less in lotic, low-gradient stream habitats simply because chemical changes in water are more temporary compared to lentic waters. However, the Western mosquitofish is present throughout both types of waters in Texas. I intend to assess the effect of tallow leaf litter concentration on the development of a live-bearing fish (*Gambusia affinis*) through a comprehensive leaf litter analysis. Mosquitofish will be raised under normal lentic conditions where they will be under direct influence of the tannin content of either the invasive Chinese tallow leaf litter, or the native sycamore, and willow leaf litter. Aspects of mortality and growth (mass/length) will be measured.

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**1033 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

David Saenz, Kirk Winemiller

*Texas A&M University, College Station, Texas, USA*

**Electric fishes of the Amazon: preliminary field work on signaling adaptations**

Gymnotiform fishes are a diverse and widely distributed order of Neotropical fish frequently studied for their ability to generate and detect electric fields. These nocturnal fish use electrolocation as a means of navigating and foraging in dark turbid waters. The waveforms and frequencies of their electric organ discharges (EODs) are species specific, allowing them to use electrocommunication for identifying and signaling conspecifics during social interactions. A number of studies suggest that the efficiency of the EODs varies significantly with the habitat's water chemistry. In fact, it has been well characterized that species using different types of EODs (pulse vs. wave) are for the most part found in different habitats. This preliminary study focuses on the evolution of signaling adaptations and how they might be related to the ecology of these fish. Specifically, we investigated the evolution of a mechanism regulated by adrenocorticotropic hormone (ACTH) through which some species are able to increase the amplitude of their EOD. Preliminary results suggest that not all gymnotiforms are able to increase the amplitude of their EOD and that ACTH might play different roles between families.

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**0465 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Veronica Saenz[1], Jamie Voyles[2], Bree Rosenblum[3], Corinne Zawacki[1]

*[1]University of Pittsburgh, Pittsburgh, PA, USA, [2]University of Nevada, Reno, NV, USA, [3]UC Berkeley, Berkeley, CA, USA*

## How Does *Batrachochytrium dendrobatidis* Pathogenicity Change After An Epidemic?

*Batrachochytrium dendrobatidis* (Bd), a fungus pathogenic to amphibians, is an ideal system in which to study the potential for changes in pathogen virulence over time. Survey work conducted in western Panama since 2012 suggests that while mortality rates are still high and many amphibian species have disappeared, some populations of susceptible hosts are persisting many years after in this area. For example, harlequin frogs (*Atelopus varius*) and common rocket frogs (*Colostethus panamensis*) experienced severe declines due to Bd outbreaks in 2004 - 2006 and were thought to be locally extinct. However, surviving populations of both species have been recently found in the same areas. One possible explanation for this would be a decrease in the pathogenicity of Bd with time since the outbreak. To test for this, we compared pathogenicity between historic (during epidemic) and contemporary (8-10 years post-epidemic) Bd isolates using a combination of *in vitro* phenotypic assays and *in vivo* inoculation experiments. While we did observe variation in the timing of sporangium maturity and zoospore production among fungal isolates, we did not find evidence to clearly support the hypothesis that Bd has decreased in pathogenicity since the Panamanian epidemic. Additional studies are needed to address the potential for changes in host defenses to explain the apparent recovery of susceptible hosts in western Panama.

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**0956 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Kathleen Sagarin, Christopher Sheil

*John Carroll University, University Heights, OH, USA*

## Heterochrony of Cranial Bones in Amniota and the Phylogenetic Placement of Turtles

This study presents a meta-analysis of ossification sequence data for the skull of amniotes to addresses heterochrony of temporal bones. Parsimov-based Genetic Inference was used to reconstruct ancestral sequences of ossification and to infer instances of heterochrony on a constraint phylogenetic tree. Multiple analyses were run to evaluate implications of heterochrony when: 1) turtles are placed at each of three different locations on the amniote tree (i.e., sister to all other reptiles, as members of Lepidosauromorpha, and as members of Archosauromorpha); and 2) when different datasets were analyzed (i.e., a larger set of data with a large number of taxa but with some missing data, and a smaller number of taxa with no missing data). All permutations of these analyses were explored, as were the performance of different classes of bones (endochondral vs dermal) in each analysis. Endochondral bones were

not found to shift more often than dermal bones. Results of the analyses of the smaller dataset do not support any particular placement of turtles over another based on the number of evolutionary shifts in bone position. Results of the analyses of the larger dataset differed dramatically when turtles were considered archosauromorphs, rather than sister to all reptiles or as lepidosauromorphs. This later result would require that turtles experienced rapid modification of the diapsid skull to become functionally anapsid.

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**1055 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Norma Salcedo

*Francis Marion University, Florence, SC, USA*

**Fleshy Excrescence Explorations: the Skin from the Supraoccipital Region of two *Chaetostoma* species (Siluriformes: Loricariidae)**

A longitudinal outgrowth of skin (fleshy excrescence) on the posterior border of the supraoccipital bone has been reported to be present, and particularly conspicuous, on several species of the genus *Chaetostoma*. The nature of this structure was explored by means of scanning electron microscopy (SEM) and light microscopy (LM). SEM revealed abundant goblet cells and Type II taste buds on the skin of specimens that exhibit a fleshy excrescence, while specimens that lack the fleshy excrescence exhibit a reduced number of goblet cells and Type III taste buds. LM revealed differences in the thickness of the epidermis, whereas the specimens with the fleshy excrescence have an epithelium with four to five layers, with two layers of low columnar cells on the basement membrane, polygonal to rounded cells in the middle, and flattened cells on the surface; while the specimens that lack the fleshy excrescence have an epithelium with three to four layers of all polygonal to rounded cells. These morphological differences indicate possible behavioral differences associated to detection of chemical cues by fish species within *Chaetostoma*.

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**1086 Herp Conservation & Ecology, Galerie 2, Sunday 10 July 2016**

Steven Salinas, Alfonso Trujillo, Justin Saiz, Lisa McBride, Son Tran, Jesús Rivas

*New Mexico Highlands University, Las Vegas, New Mexico, USA*

**Is the American Bullfrog (*Lithobates catesbeianus*) as successful and invader as it seems, or does it receive help from other invasives?**

Invasive species can negatively affect the diversity of native species by disturbing native trophic interactions. Often times invaders work in synergy with other invaders so the role of each invasive difficult to tear apart. Analyzing the diet of a population of American Bullfrogs we found a large proportion (over 80%) of Northern Crayfish (*Orconectes virilis*), another invasive. Given the high proportion of Crayfish on the diet,

we surmised that Bullfrogs may be playing a role of top-down control on the Crayfish. In this study we explore the importance of top-down control on Crayfish population by Bullfrogs, and predatory introduced trout Rainbow Trout (*Oncorhynchus mykiss*). We studied and Crayfish density at a) a site with Bullfrogs Trout predation, b) a site with Bullfrogs but no trout, and c) a site where only Crayfish occur. Early results show that in areas without trout but with Bullfrogs predation, Crayfish populations are 4.4 times higher than in areas with both predators; and when both predators are missing Crayfish population is 12 times higher. Our data strongly suggest that these two predators exert important top down control on Crayfish. Management programs to control these species must include a comprehensive control of all species involved to avoid the mesopredators to irrupt.

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**0198 Fish Ecology I, Salon E, Friday 8 July 2016**

Jessica Sanchez, Joel Trexler

*Florida International University, Miami, FL, USA*

### Testing a hypothesis for the evolution of herbivory using the Sailfin Molly (*Poecilia latipinna*) in the Florida Everglades

Herbivorous diets are of poor quality relative to those containing animal items, limiting the available energy to sustain life processes such as maintenance, growth and reproduction. But, herbivory evolved and has been maintained throughout many lineages alongside animal-containing diets, so it is adaptive in certain circumstances. Here, we test the "heterotrophic facilitation" hypothesis, which states that herbivory is adaptive because herbivores supplement their diets by indirectly consuming heterotrophs associated with primary producers. In lab and field studies, we manipulated the autotrophic: heterotrophic (A:H) composition of algae (using shading and Phosphorus) and examined the effects of this varying food quality on lipid assimilation, growth and survival of the sailfin molly (*Poecilia latipinna*) in the Everglades. Fish showed no differences in the A:H ratios of their tissues ($F=0.893$; $df=2$; $p=0.478$), suggesting that they assimilate algal and bacterial-derived lipids at the same rate, regardless of their dietary abundance. Interestingly, fish fed algae grown in Light only, Shade only and Light + P conditions grew better than those fed Shade + P algae or a carnivore (control) diet ($F=3.924$; $df=4$; $p=0.02$). However, those fed Light only and Shade only algae also experienced high survival ($F=3.78$; $df=4$;$p=0.026$). Based on this evidence, diets comprised of intermediate levels of both autotrophs and heterotrophs (e.g. Shade only and Light only treatments) promote increased growth and survival more than diets with higher or lower A:H ratios. Therefore, our results support the "heterotrophic facilitation" hypothesis as a potential explanation for the adaptive evolution of herbivory in freshwater systems.

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**1072 Fish Systematics II, Salon F-H, Saturday 9 July 2016**

Michael Sandel

*The University of West Alabama, Livingston, Alabama, USA*

### Deep, Cold, Dark and Old: Accounting for Non-neutral DNA Sequence Variation Reconciles the Perciformes Mitochondrial Phylogeny

History has shown that the limits and interrelationships of Perciformes are not resolved by phylogenetic analysis of morphology or mitochondrial DNA alone. Conversely, analyses of multi-locus nuclear data revealed concordant and well-supported Acanthomorph subgroups, including Perciformes. The origins of phylogenetic discordance in mtDNA gene trees remain largely unexplained, despite a relatively robust literature on the general function and evolution of the vertebrate mitochondrial genome. Here, I investigate the role of homoplasy and functional diversification on the inference of mtDNA phylogeny, with a focus on the limits and interrelationships of Perciformes. I use published and novel mitochondrial genomes to account for four putative sources of incongruence (character sampling, taxon sampling, nucleotide saturation, and natural selection). Specific attention is paid to members of Cottioidei and Scorpaenoidei which exhibit extraordinary physiological adaptations likely to involve mtDNA. Nine new mitochondrial genomes are presented, representing the most long-lived bony fish, the deepest-swimming freshwater fish, a troglomorph, and their close relatives. Results suggest that natural selection introduces systematic error in phylogenetic datasets that is not detected by traditional selection scans, and that statistical correction of this error reconciles the mtDNA gene tree with strongly supported patterns observed in multi-locus nuclear studies. Results do not discount the utility of mtDNA as a phylogenetic marker, but highlight the need for more sophisticated approaches to integrating mtDNA and nuclear datasets. An integrated understanding of mtDNA function and evolution highlights the importance of historical studies, which are likely to serve as valuable resources for the study of character evolution.

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**0243 HL GRADUATE RESEARCH AWARD, Galerie 2, Friday 8 July 2016**

Mark Sandfoss[1], Coleman Sheehy III[2], Harvey Lillywhite[1]

*[1]Department of Biology, University of Florida, Gainesville, Florida, USA, [2]Seahorse Key Marine Laboratory, University of Florida, Gainesville, Florida, USA*

### Collapse of a Unique Bird-Snake Mutualism on Seahorse Key, Florida

Seahorse Key (SHK) supports a large population of Florida cottonmouth snakes, *Agkistrodon conanti*, which have a unique mutualistic and trophic association with colonially nesting water birds. Each spring >10,000 birds nest on SHK and provide an influx of food in the form of dropped or regurgitated fish that these snakes scavenge on the ground. Because of this allochthonous input of trophic resources, the cottonmouth

population on SHK has become relatively dense and many snakes are large (≥1 m) compared to snakes on adjacent islands without large bird rookeries. Suddenly and unexpectedly, the birds abandoned their nests during April, 2015, and did not return. Given the significant trophic dependence on fish carrion provided by nesting birds, we expected to observe an eventual decline in body condition and numbers of cottonmouth snakes on SHK. We examined historical data collected from 1999 to 2016 on the abundance and body size of snakes to quantify how the removal of food resources has affected the SHK population. Preliminary data suggest reductions have occurred in the abundance and body condition of cottonmouths between pre- and post- bird abandonment periods. We are continuing to monitor the population to quantify how the change in availability of fish carrion is affecting the snakes on SHK. Loss of the bird rookery as a source of energy suggests that the snake population on SHK will continue to decline. In contrast, numbers of cottonmouths are expected to increase on other islands adjacent to SHK where avian nesting is increasing.

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**0054 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Andrew Savage, Bruce Felgenhauer

*University of Louisiana at Lafayette, Lafayette, Louisiana, USA*

**Associations between the pink wormfish, *Microdesmus longipinnis* (Weymouth), and the ghost shrimp, *Lepidophthalmus louisianensis* (Schmitt), in artificial burrows**

*Microdesmus longipinnis* (Weymouth) is a small estuarine teleost fish that is known to feed on the eggs of the axiid shrimp, *Lepidophthalmus louisianensis* (Schmitt). In the course of collecting *M. longipinnis* for physiological studies we noticed that there seemed to be a higher preference towards burrows of non-gravid and male shrimp than one would expect if the driving force behind this relationship was exclusively predatory towards eggs. Laboratory experiments were used to expand upon the understanding of the relationship between these two animals and attempt to determine if *M. longipinnis* shows a higher preference towards burrows containing male shrimp as compared to those burrows with no shrimp. The expectation that being that a non-random rate of association towards the male shrimp will suggest that the fish are not seeking out burrows based solely on food availability and supports the need for more research into this relationship. *M. longipinnis* was found to positively associate with male *L. louisianensis* when compared to empty burrows supporting the idea of a more complex relationship that has previously been reported in the literature.

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**0652 Herp Morphology & Genetics, Galerie 3, Sunday 10 July 2016**

Anna Savage[1], Brian Gratwicke[2], Katherine Hope[2], Ed Bronikowski[2], Robert Fleischer[2]

*[1]University of Central Florida, Orlando, FL, USA, [2]Smithsonian Institution, Washington, DC, USA*

## Acquired immunity causes susceptibility in frogs infected with a deadly fungus

The fungal disease chytridiomycosis has devastated amphibian populations worldwide. Functional genomic contributions to host susceptibility and pathogen virulence remain enigmatic, particularly the role of immune function, immunogenetic variation, and fungal genomic variation in contributing to variable infection outcomes. We conducted experimental infections in an amphibian host with intraspecific and intrapopulation variation in chytridiomycosis susceptibility to assess the functional genomic response to infection in two important immune tissues: the skin, where infection occurs, and the spleen, where amphibian immune responses are generated. We find significant differences in acquired, inflammatory, and innate immune gene expression profiles among surviving versus susceptible individuals, highlighting the importance of immune responses in determining susceptibility. Surprisingly, survivors show significantly reduced immune gene expression compared to susceptible frogs, particularly among acquired immune genes, suggesting that mounting acquired immune responses is counterproductive for surviving chytridiomycosis.

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**0676 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

David Savage, Jacob Fetterman, Justin Elchynski, Jennifer Deitloff

*Lock Haven University, Lock Haven, PA, USA*

## Aggression in *Plethodon cinereus* in four Populations from Pennsylvania

Across the range of many species, species characteristics can vary with geographic location. Some characteristics that may different depending on location include morphological features, habitat and prey selection, and behavior. *Plethodon cinereus* has a broad geographic range and is known to display territorial aggression in some locations, such as where they occur in Virginia. However, at other locations, the extent of aggression is reduced from what is observed in Virginia, with some populations not showing territoriality. In this study, we examined the territorial interactions of *Plethodon cinereus* from four populations across Pennsylvania. We tested the hypotheses that (1) populations differed in territorial behaviors and (2) males exhibited greater aggression that females (non-gravid and gravid females examined as separate groups) at these locations. Our results suggest that there is no difference in the behavior between these Pennsylvanian populations or among sexes (male, gravid female, non-gravid female).

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**0469 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Julie Savidge, Martin Kastner, Thomas Seibert

*Colorado State University, Fort Collins, CO, USA,*

**A Novel Climbing Behavior Displayed by the Brown Treesnake (*Boiga irregularis)***

Because of the devastating effect on Guam's native forest birds by non-native Brown Treesnakes (*Boiga irregularis*), we have been studying means for excluding them from avian nesting structures. Published laboratory experiments on climbing behavior of this largely arboreal species suggest that it employs lateral undulation and concertina movements. Additionally, researchers report that with increased slope and diameter of cylinders lacking surface irregularities, Brown Treesnakes are unable to make forward (upward) progress. During our research we noted what we believe to be a previously undescribed mode of locomotion in snakes. When confronted with a vertical, slick, metal cylinder, some Brown Treesnakes formed their body into a ring around the cylinder using their tail as a "slip knot" that could adjust from mid-body to the back of the head. This apparently provides greater grip and allows the snake to gradually wiggle their body up the cylinder. In this flash talk, we show short videos of the behavior, discuss characteristics of snakes employing this method, and discuss its significance.

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**0593 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Alan H. Savitzky

*Utah State University, Logan, UT, USA*

**ASIH and the Prospects for Taxon-focused Professional Organizations**

During its first hundred years, ASIH has been influenced by historical shifts in the focus of biological research, as well as broader trends in global science, publication, and shifting patterns of membership in professional societies. As a member of the society for about half its history, I have observed those shifts as they have affected the ASIH. The transition from print to electronic journal publication has often been identified as a major driver of membership decline. However, changing membership patterns in professional organizations are not limited to scientific societies, nor to organizations that publish periodicals. The causes of shifting membership patterns are more complex, and may include changes in the number of societies individual are willing to join. Furthermore, although many taxon-focused societies are losing members, some process-focused societies are thriving. Membership patterns are further complicated by competition for members among organizations with similar missions. Meanwhile, organismal journals are being challenged by mandates for open access and by the rise of publication metrics, both of which appear to drive stronger manuscripts away from such journals.

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**0227 AES GRUBER AWARD, Balconies J & K, Thursday 7 July 2016**

Jillian Sawyna, Weston Spivia, Kelly Radecki, Deborah Fraser, Christopher Lowe

*California State University, Long Beach, Long Beach, CA, USA*

### Examination of the Potential Association Between Chronic Organochlorine Exposure and Immunotoxicity in the Round Stingray (*Urobatis halleri*)

Chronic organochlorine (OC) exposure has been shown to cause immune impairment in numerous vertebrate species. To determine if local elasmobranchs exhibited a similar effect due to high OC contamination found along the coastal southern California mainland, innate immune function was compared in round stingrays (*U. halleri*) collected from the mainland and Santa Catalina Island, a reference site. Microscopy and flow cytometry were used to assess proliferation and phagocytosis in splenic and peripheral blood leukocytes. Percent phagocytosis, and mean fluorescence index (MFI) were evaluated by quantifying % leukocytes positive for, and relative amounts of ingested fluorescent *E. coli* BioParticles. Total cell proliferation differed between sites, with mainland rays having a higher concentration of cells in whole blood. Splenic mean (± SE) % phagocytosis (24.7 ± 4.98 %) was significantly higher in mainland rays compared to Catalina (9.96 ± 1.18 %). MFI was also greater among the mainland population (2681.74 ± 410.06 and 1197.1 ± 146.97). In blood, mainland rays had a significantly higher % phagocytosis (23.44 ± 2.887 %) compared to Catalina (12.98 ± 1.58 %), yet no difference was found in MFI. ∑PCB and ∑pesticide loads were the most influential factors describing increasing splenic % phagocytosis and MFI, while ∑PCB load alone explained increasing % phagocytosis in blood. Data suggests OC-correlated immunostimulation; however, other site-specific environmental variables may be contributing to the observed effects.

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**0086 Fish Genetics, Salon D, Sunday 10 July 2016**

Jake Schaefer, Brian Kreiser, Stephen Flanagan

*University of Southern Mississippi, Hattiesburg, MS, USA*

### Population genomics of *Fundulus grandis* following the Deepwater Horizon oil spill

The April 2010 Deepwater Horizon incident resulted in the release of a large amount of oil and dispersants into northern Gulf of Mexico ecosystems. Based on impact studies from earlier oil spills, DWH impacts were predicted to be immense, driven by immediate direct mortality or longer term deleterious effects from chronic exposure. Traditional toxicology research on resident species has focused on a variety of responses (e.g. changes in gene expression, growth, development or survivorship) in model organisms, including the Gulf Killifish (*Fundulus grandis*). Studies at the population and

assemblage level have not detected a decrease in post-DWH fish populations, including *F. grandis*. There is, therefore, a disconnect in the scientific literature between published toxicology (predicting dramatic declines) and the assemblage level data (showing no declines). We used next generation sequencing and population genomic tools to test hypotheses about *F. grandis* responses to DWH. We sampled 30-35 individuals from four coastal Mississippi populations: two barrier islands with high oil exposure and two coastal bays with lower exposure. Analysis of >25,000 SNPs will estimate effective populations size and migration rates among the four sites. We specifically test the hypothesis that any of the 4 populations are consistent with a recent population bottleneck or large scale movement in response to oil contamination.

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## 0314 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR

Christopher Schalk[1], Michael Cove[2]

*[1]Southern Research Station, US Forest Service, Nacogdoches, TX, USA, [2]North Carolina State University, Raleigh, NC, USA*

### Emergent patterns between squamate prey and their predators

Globally, squamates (snakes and lizards) are diverse and abundant organisms across various ecosystems. Understanding the relationships between squamates and their predators can provide important insights to evolution of defenses, foraging ecology, and their functional role within their ecosystems. We sought to explore the relationships between the taxonomy and body size between predators and their squamate prey. To gather data on squamate predators, we reviewed the past volumes of Herpetological Review (1967 - 2015) and Herpetology Notes (2008 - 2015), and outside sources when they provided significant contributions (e.g., unreported family of predator). Our database includes over 1,400 squamate predation events represented by 27 lizard families and 10 snake families. Both lizards and snakes were observed being preyed upon more frequently by vertebrates than invertebrates. Taxonomically, lizards had a greater diversity of predators represented by 22 vertebrate orders and 10 invertebrate orders, whereas snake predators were comprised of 19 vertebrate orders and four invertebrate orders. Snakes, lizards, and birds were documented as the most frequent predators of squamates. The predator-prey ratio increased across all predators with increasing body size for all predators, though the slopes differed across predator taxa. The patterns quantified in this study provide a baseline to explore the evolution of defensive strategies across these diverse taxa of both predators and their prey.

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**0313 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Christopher Schalk, Daniel Saenz

*Southern Research Station, US Forest Service, Nacogdoches, TX, USA*

### Dynamics in anuran calling phenology: implications for surveys and monitoring programs

Amphibians exhibit large natural fluctuations in their population dynamics at both the larval and post-metamorphic life stages. Compared to other taxa, amphibians exhibit the strongest to climate change and often exhibit shifts in their breeding phenology. However, many of these studies have focused on few sites or utilize a coarse-grain survey design. We sought to quantify the long-term inter-annual and intra-annual variation in calling phenology in two species of anurans (*Pseudacris crucifer* and *Lithobates clamitans*) using a fine-grained (i.e., daily) survey design. From 2000-2014, we deployed automated recording devices (Song Meters) at eight ponds to monitor nocturnally vocalizing anurans in the piney woods ecoregion of East Texas. Inter-annual comparisons revealed that, on average, there was not a significant difference in date of first call or calling window for each species. However, there was large intra-annual variation in calling metrics across survey sites, which can likely be attributed to the variation in environmental gradients across the breeding ponds. These results suggest that monitoring programs that focus on one or few sites, especially those that share similarities in environmental gradients, will fail to capture the complete picture in calling activity. This is especially important for species that utilize breeding sites that span a number of environmental gradients (e.g., temporary and permanent ponds). Future long-term studies need to design monitoring programs to effectively capture the high intra-annual variability in calling activity and to gain a more accurate understanding on the magnitude of response in changes of calling activity over time.

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**0363 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Rachel Scharer[1], Philip Stevens[2], Gregg Poulakis[1]

*[1]Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, Charlotte Harbor Field Laboratory, Port Charlotte, FL, USA, [2]Fish and Wildlife Research Institute, Florida Fish and Wildlife Conservation Commission, St. Petersburg, FL, USA*

### Not All Nurseries are Created Equal: Differences in Large-scale Habitat Use Patterns between Two Smalltooth Sawfish, *Pristis pectinata*, Nursery Areas

Endangered Smalltooth Sawfish (*Pristis pectinata*) are known to use multiple southwest Florida estuaries during their first 2-3 years of life and understanding region-specific habitat use patterns has become important for effective management. Our research in the Charlotte Harbor estuarine system, was initially focused in the Caloosahatchee River, a highly human-altered river system, and we have now expanded sampling into a more natural area, the Peace River. A total of 238 juveniles ranging from 708 to 2,640 mm

stretch total length were captured, tagged, and released between 2010 and 2015. Electivity analyses showed that sawfish in both rivers had affinities for water <1 m deep, water >24°C, moderate to high dissolved oxygen levels (>4 mg $l^{-1}$), and salinities between 12 and 27. Movements were monitored in main-stem river habitats and non-main-stem habitats (i.e., natural mangrove-lined creeks, semi-natural creeks, seawall-lined canals) using acoustic listening stations. Sawfish used all of the habitats available to them in both rivers, but tended to reside in specific regions of the nurseries. In the Caloosahatchee River, sawfish were usually associated with five hotspots along a 25 river kilometer (rkm) stretch of the river. They moved upriver during dry, low freshwater inflow conditions and downriver during wet, high inflow conditions. In contrast sawfish tended to remain in only a six rkm portion of the Peace River during all freshwater inflow conditions. Possible reasons for these observations relate to differences in geomorphology and freshwater inflow regimes between the rivers.

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**0603 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Vera Schluessel

*Institute of Zoology, University of Bonn, Bonn, Germany*

### Sharks don't just have Sharp Teeth but are also Sharp Thinkers - Cognition in Elasmobranchs

While there has been an upsurge in behavioural studies on fish and even shark cognition in recent years, comparatively few studies have tried to uncover the relevant neuronal substrates involved. Here, learning and memory functions were assessed in bamboo sharks (*Chiloscyllium griseum*) and freshwater stingrays (*Potamotrygon motoro*) on a behavioural and neuronal level. Most behavioural studies were performed as two-alternative forced choice experiments, in which the positive stimulus was reinforced by a food reward. Selected spatial and visual discrimination experiments in sharks were complemented by lesion experiments or immediate-early gene expression studies using egr-1 and c-fos to determine involvement of selected brain structures. Sharks and rays successfully mastered selected object recognition and categorization tasks and showed visual perception of illusionary contours, symmetry, and movement, as well as spatial orientation and memory retention capabilities. Both lesion and gene expression studies in sharks indicate that even in the absence of a neocortex, selected cognitive functions are processed in the telencephalon, with some pallial regions matching potentially homologous areas in other vertebrates where similar functions are being processed. Results of these studies indicate that the here assessed cognitive abilities in bamboo sharks and freshwater stingrays are as well developed as in many other vertebrates, aiding them in activities such as food retrieval, predator avoidance, mate choice and habitat selection.

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**1118 HL, ASIH, SSAR: Eco-Evolutionary Dynamics Symposium, Salon D, Friday 8 July 2016**

Thomas Schoener[1], Jason Kolbe[2], Manuel Leal[3], Jonathan Losos[2], Sebastian Schreiber[1], David Spiller[1]

[1]University of California Davis, Davis, CA, USA, [2]Harvard University, Cambridge, MA, USA, [3]Duke University, Durham, NC, USA

**Eco-evolutionary Aspects of the Lizard *Anolis sagrei* in an Island Metapopulation**

No abstract submitted.

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**0375 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Tiffany Schriever

*Western Michigan University, Kalamazoo, MI, USA*

**Interspecific overlap in trophic niche of larval amphibians in temporary ponds**

Foraging strategy is an important life history trait that determines trophic niche width. Niche variation can occur among individuals of a population, between species, and change throughout development. It is important to understand the significant roles of amphibian larvae in wetland structure and function. In this study, I quantified the isotopic niche and overlap among several species of amphibian larvae throughout their larval development from nine woodland ponds using carbon and nitrogen stable isotopes. I calculated standard Bayesian ellipses from $\delta^{13}C$ and $\delta^{15}N$ values and produced standard ellipse area and ellipse overlap using Stable Isotope Bayesian Ellipse in R (SIBER) functions. I hypothesized that gape-limited active foraging salamander larvae would have narrow isotopic niche widths and low niche overlap and that generalist feeding anuran larvae would have broad niches and high niche overlap. I also hypothesized that niche overlap would be highest during anuran tadpole stages and lowest during metamorphic stages when individuals switch to feeding on invertebrates. I examined the relationship between species richness and isotopic niche widths. Isotopic niches varied in size and overlapped considerably among the anuran species, but less so in salamander larvae. I found some support for the hypothesis that isotopic niches are larger in less species rich ponds. This study took a community approach to quantify the relationship between isotopic niche width and overlap for multiple species from different trophic levels and foraging strategies. Ponds sustain multiple functionally redundant amphibian species that may assist in ecosystem resilience to changing environmental conditions.

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**0390 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Katherine E. Schweiss[1], Jill M. Hendon[2], Nicole M. Phillips[1]

*[1]The University of Southern Mississippi, Hattiesburg, Mississippi, USA, [2]The University of Southern Mississippi Gulf Coast Research Lab, Ocean Springs, Mississippi, USA*

## A simplified approach to genetically sexing elasmobranchs using qualitative PCR

Determining a sex for elasmobranchs is typically done visually, by looking for the presence or absence of male claspers. While this method is easy and reliable, many current research endeavors are based on samples that are not associated with a source animal (*i.e.*, dried fins, sawfish saws), making visual assessments impossible. Having a method to determine or verify sex data for such samples would be a useful tool for increasing the value of the sample and enhancing the resultant assessments. Male heterogamety predominates in elasmobranchs; therefore, males are typically XY and females are XX. The aim of the current study was to develop a multiplex polymerase chain reaction (PCR) to amplify a portion of each of the X and Y chromosome in elasmobranchs. Primers were developed and tested for representative shark and ray species using a qualitative PCR (qPCR) approach. Resultant dissociation peaks are produced during qPCR, where males produce two peaks (corresponding to amplicons for both the X and Y chromosomes) and females produce one peak (corresponding to an amplicon for the X chromosome). Application of qPCR for genetically sexing elasmobranchs is faster and more accurate than the conventional PCR and gel electrophoresis methods commonly employed in sexing other organisms. In addition, this method is more likely to be successful for samples with low quantity or quality DNA.

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**0818 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Gail Schwieterman[1], Karissa Lear[1], Heather Marshall[1], Jack Morris[1], Connor White[2], Robert Hueter[1], Gregory Skomal[3], Nicholas Whitney[1]

*[1]Mote Marine Laboratory, Sarasota, FL, USA, [2]California State University Long Beach, Long Beach, CA, USA, [3]Massachusetts Division of Marine Fisheries, New Bedford, MA, USA*

## Post-Release Mortality of Coastal Sharks in a Commercial Longline Fishery

Estimating post-release mortality rates is essential to understanding the impact of fishing and properly informing management measures. However, logistical difficulties have resulted in relatively few post-release studies, typically with small sample sizes. Here, we quantify post-release mortality of large coastal sharks in the Florida commercial longline fishery using acceleration data loggers (ADLs) to infer mortality. We recorded hook times, capture measures (e.g. animal condition), took blood samples,

and applied ADLs to longline-caught sharks. Between December 2013 and January 2016 we tagged 229 sharks with ADLs with a 90.8% tag recovery rate. Shark species tagged included blacktip (*C. limbatus*), sandbar (*C. plumbeus*), tiger (*Galeocerdo cuvier*), spinner (*C. brevipinna*), bull (*C. leucas*), blacknose (*C. acronotus*), great hammerhead (*Sphyrna mokarran*), scalloped hammerhead (*S. lewini*), and dusky sharks (*C. obscurus*). Species-specific post-release mortality rates ranged from 2.04% (*G. cuvier*) to 75% (*C. brevipinna*). Surviving sharks were monitored for an average of 24.9 ± 22.3 h (mean ± SD), and up to 204.5 h post-release. Mixed modeling of blood stress indicators and capture metrics show several variables significantly correlate with post-release outcome.

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**0882 SSAR SEIBERT SYSTEMATICS & EVOLUTION AWARD, Salon A-C, Friday 8 July 2016**

Peter Scott[1], Travis Glenn[2], Leslie Rissler[3]

*[1]University of Alabama, Tuscaloosa, AL, USA, [2]University of Georgia, Athens, GA, USA, [3]National Science Foundation, Arlington, VA, USA*

**Species Delimitation and Systematics of Musk Turtles (Genus *Sternotherus*)**

Despite being relatively well known, musk turtles (Genus *Sternotherus*) have suffered from a turbulent taxonomic and systematic history, which has resulted in currently unstable species limits, taxonomic designations of populations, and a poorly resolved understanding of interspecific relationships for the genus (particularly in the S. minor complex). Here, dense geographic sampling and ddRADseq methods are combined to sequence ~200 individual turtles at 4000+ genome wide loci to be used for species delimitation and systematic inference within *Sternotherus*. Multiple coalescent-based methods (BFD* in SNAPP and SVDquartets) and concatenation all strongly support an identical taxonomy including the recognition of currently nominate and novel species within *Sternotherus*. However, all methods infer conflicting and differentially supported relationships within the genus. To attempt to resolve systematic relationships, the likelihoods of alternative speciation events and demographic histories within *Sternotherus* are compared using observed and simulated site frequency spectra (SFS). The most likely demographic scenario for speciation in *Sternotherus* infers a nearly-simultaneous speciation event for four of six species, followed by low levels of more recent introgression; both events are concordant with previous geologic hypotheses for diversification within the genus. This work greatly clarifies species limits and relationships within *Sternotherus* and provides a framework by which relatively computationally inexpensive simulations of SFS can resolve systematic relationships for some of the most difficult phylogenetic nodes that may be plagued by rapid diversification, introgression, or both.

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**0963 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Robyn Screen[1], Max Lambert[5], Jennifer McKenzie[4], Greg Pauly[3], Amber Wright[1], H. Bradley Shaffer[2]

*[1]University of Hawaii at Manoa, Honolulu, HI, USA, [2]University of California, Los Angeles, Los Angeles, CA, USA, [3]Natural History Museum of Los Angeles County, Los Angeles, CA, USA, [4]University of Kentucky, Lexington, KY, USA, [5]Yale, New Haven, CT, USA*

## Experimental Reduction of an Invasive Slider Turtle Population Affects the Basking Distribution of a Native Turtle

Red-eared Sliders (*Trachemys scripta elegans*) are one of the world's 100 worst invasive species according to the IUCN, have been released on every continent except Antarctica, and are thought to be competitively dominant to many native turtle species. The Western Pond Turtle (*Emys marmorata*) is California's only species of native turtle and is declining throughout its range. Urban waterways can be valuable habitat for Western Pond Turtles but these habitats are also hotspots for slider introductions. The Arboretum at the University of California, Davis has served as an important study site for understanding the impacts of exotic sliders on native pond turtles. Prior work in this system has shown that these two turtles use basking sites with different features and that the two species are concentrated in different regions of the waterway. Here, we conducted an in situ field experiment where we dramatically reduced the slider population size and monitored turtle basking behavior. In total, we removed 180 sliders, representing over 100 kg of turtle biomass. Our results show that pond turtles no longer basked in one concentrated region of the Arboretum but rather basked relatively evenly throughout the waterway. The remnant slider population became sparser in some regions of the Arboretum but remained concentrated at one end of the waterway. Our removal experiment reveals that manipulating invasive slider populations may have effects on native turtle habitat use. These results may be useful for conservation efforts targeted at native turtle habitat management or invasive slider removal.

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**0011 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

Greg Seegert

*EA Engineering, Science and Technology, Deerfield, IL, USA*

## Evaluation of the Wabash River Fish Community After a Power Plant Shutdown

The Wabash River fish community was sampled by electrofishing and seining in 2011, 2012, and 2013 to determine if it had changed following the shutdown of a nearby power plant. Sampling yielded 87 species including a new species for Illinois. The data collected during 2011-2013 were compared to data collected from the same area in the 1970s and 1980s. ANOVA comparisons found either few changes over time or, if changes were evident, they occurred throughout the study area, not just downstream of

the former power plant site. A variety of ordination and graphical techniques were used to look for changes in overall community structure. These analyses showed that the fish community has changed over time. However, like the ANOVA comparisons, these additional techniques also showed that the changes occurred throughout the study area suggesting that the shutdown of the power plant had little effect on the nearby fish community.

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**1099 Fish Ecology II, Salon A-C, Saturday 9 July 2016**

Fredys F. Segura-Guevara, Ángel L. Martínez-González, Charles W. Olaya-Nieto

*Fishery Biology Research Laboratory-FBRL, Department of Aquatic Sciences, University of Cordoba, Lorica, Cordoba, Colombia*

## Feeding Habits of Moncholo *Hoplias malabaricus* in the Cienaga de Ayapel, Sinu River System

To study the feeding habits of Moncholo *Hoplias malabaricus* in the Cienaga de Ayapel, Sinu River System, we analyzed 349 stomachs of individuals collected between August 2009 and July 2010, with sizes between 25.5 and 40.3 cm total length (TL) and total weight (WT) among 132.0 and 734.0 g. The stomach content was analyzed using the Proportion of empty stomachs, Grade of digestion, Frequency of occurrence, numerical Frequency, Gravimetry and relative importance Index. The Proportion of empty stomachs was high and most of the foods were half digested, identifying five food groups: Fishes, vegetable Rests, Insects, Detritus and Others. Different methods of evaluation of stomach content shows that Fishes were conformed by species like *Andinoacara pulcher*, *Cyphocharax magdalenae*, *Sternopygus* sp., *Plagioscion magdalenae*, *Caquetaia kraussii* and *Oreochromis* sp. and were the most common group (94.6%), the most abundant group (86.2%) and the greatest group composition in weight (97.9%). The relative importance Index indicates that Fishes is a food group of high relative importance and the main food in the Moncholo´s diet, while other food groups are classified as occasional with low relative importance. The results suggest that Moncholo is a carnivorous fish with a piscivorous trend that keeps it´s feeding habits as they grow in the Cienaga de Ayapel.

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**0986 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Fredys F. Segura-Guevara, William Pérez-Doria, Charles W. Olaya-Nieto

*Fishery Biology Research Laboratory-FBRL, Department of Aquatic Sciences, University of Cordoba, Lorica, Cordoba, Colombia*

## Reproductive biology of Mojarra amarilla *Caquetaia kraussii* in the Cienaga de Ayapel, Sinu River System

The reproductive biology of Mojarra amarilla *Caquetaia kraussii* in the Cienaga de Ayapel, Sinu River System between August 2009 and July 2010 was studied. 425 individuals with total length (TL) ranged between 14.0 and 30.0 cm and total weight (TW) ranged between 48.0 and 510 g were collected. The gonads were placed in Gilson solution, the Vazzoler scale was applicated and sexual proportion, sexual maturity index, spawning season, the length at first maturity, oocytes's diameter and fecundity were estimated. 244 females, 115 males and 66 undifferentiated were found, with sexual proportion female: male of 2.1:1 and sexual dimorphism in size, since males reach larger sizes than females. Sexual maturity index indicate that there spawns in October, December, April and July. The length at first maturity was estimated in 19.1, 20.4 and 20.0 cm TL for females, males and combined sexes, respectively, oocytes's average diameter was 1210 □m and average fecundity estimated was 3215 oocytes. The results achieved in this study suggest that Mojarra amarilla in the Cienaga de Ayapel, is a non rheophilous fish whose spawning season extends during the year with partial spawning not associated with the rains, large oocytes and high fecundity.

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**1105 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Fredys F. Segura-Guevara, William Pérez-Doria, Charles W. Olaya-Nieto

*Fishery Biology Research Laboratory-FBRL, Department of Aquatic Sciences, University of Cordoba, Lorica, Cordoba, Colombia*

## Reproductive Ecology of Moncholo *Hoplias malabaricus* in the Cienaga de Ayapel, Colombia

To study the reproductive ecology of Moncholo *Hoplias malabaricus* in the Cienaga de Ayapel, Colombia, 349 individuals were collected between August 2009 and July 2010, with lengths ranging 25.5-40.3 cm of total length (TL) and 132.0-734.0 g of total weight (TW). The gonads were placed in Gilson solution, the Vazzoler scale was applicated and sexual proportion, sexual maturity index, spawning season, the length at first maturity, oocytes's diameter and fecundity were estimated. 274 females, 64 males and 11 individuals undifferentiated were studied, with sexual proportion female: male of 4.3:1. The length at first maturity was estimated in 30.8, 32.3 y 30.8 cm TL for females, males and combined sexes; oocytes's average diameter was 1453 □m and fecundity was estimated in 9107 oocytes by spawning batch. Sexual maturity index shows that the spawning season extends throughout the year. The results achieved in this study suggest that Moncholo in the Cienaga de Ayapel is a fish that has large oocytes, partial

spawning, high fecundity with prolonged spawning season that extends over study period.

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**0289 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Richard Seigel[1], William Saffell[1], Brian Durkin[1], Matt Gutt[1], Anna Savage[2]

*[1]Towson University, Towson, Maryland, USA, [2]University of Central Florida, Orlando, Florida, USA*

### Do Constructed Wetlands Have Higher Rates of *Ranavirus* Infection of Amphibians Compared with Non-constructed sites?

Reports of large-scale die offs of amphibians associated with the emerging pathogen *Ranavirus* have become increasingly common in North America and elsewhere over the past decade. Understanding the distribution and habitat correlates of *Ranavirus*-associated die offs of amphibians is critical for understanding the spread and impact of this pathogen on native amphibians. In this study, we posed a question especially germane to state and federal programs that utilize wetlands restoration as part of mitigation programs; specifically, we wanted to know whether constructed wetlands had a higher rate of *Ranavirus*-associated die offs than seen in non-constructed wetlands. Using a database of over 60 wetlands constructed or modified by the Maryland State Highway Administration, we selected 16-22 of these sites for surveillance of die offs and sampled sites for the presence of *Ranavirus* by DNA assays in both 2014 and 2015. We found that the rate of die offs at our sites was very similar among years (36.4-37.5%), which was similar to the 25-50% rate of die offs seen in non-SHA wetlands in the mid-Atlantic region. DNA testing is still in progress, and will be used to construct a model testing for associations between *Ranavirus* infection and habitat variables that will be of use for land managers.

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**0580 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Jason C. Seitz[1], Jan Jeffrey Hoover[2]

*[1]ANAMAR Environmental Consulting, Inc., Gainesville, FL, USA, [2]US Army Engineer Research and Development Center, Vicksburg, MS, USA*

### Taxonomic Resolution of Sawfish Rostra from a Private Collection

Management and recovery of endangered sawfishes worldwide is challenged by unreliability of species determination. Often, dried rostra (saws) are the only vouchered material available to represent an historical occurrence, yet traditional methods of species identification of rostra (rostral tooth counts) are fallible. We evaluated the utility of rostral morphometric characters on classification of specimens from a private collection of 25 old rostra. All rostra available from collectors and donated by fishers were obtained by a single individual (logistics permitting) so we believe the collection is

representative of sawfishes globally. Rostrum data consisted of: overall length (used to standardize data), standard length, standard width, distal width, gap between right proximal teeth, gap between right distal teeth, number of teeth on each side (used for species assignments). Principal component analysis (PCA) of morphometric characters was informative. PC1 (x-axis) accounted for 74% variance and was associated with 4 variables (loadings = |0.36−0.43|), PC2 (y-axis) amounted for 14% variance and was associated with a single variable (loading = |0.70|). Point clusters were consistent with putative identifications. On PC1, *Anoxypristis cuspidata* (Knifetooth Sawfish) plotted low, *Pristis pectinata* and *P. zijsron* (smalltooth complex) at intermediate values, and *P. microdon* and *P. perotteti* (largetooth complex) at high values. *P. pectinata* and *P. zijsron* were separated from each other along PC2, as were *P. microdon* and *P. perotteti*. Results demonstrate utility of analyzing smaller collections (N < 40) and suggest that pooled data from private collections can characterize phenotypic variation in sawfish interspecifically and intraspecifically.

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**0136 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Jason Seitz[1], John Waters[2]

[1]*ANAMAR Environmental Consulting, Inc., Gainesville, Florida, USA,* [2]*Aquatic Research & Conservation Society, Inc., Little Canada, Minnesota, USA*

## Should Florida really be considered part of the historic range for the endangered Largetooth Sawfish (*Pristis pristis*)?

The U.S. population of the endangered Largetooth Sawfish, *Pristis pristis,* is among those populations with the highest probability of extinction. Identifying areas with valid historical records of this species is therefore critical as these areas may be important to the eventual recovery of the species. The eastern extent of the U.S. range of *P. pristis* is reported to include Florida based on only four historical records purported to be from the state: one from southern Florida based on a dried rostrum held at the American Museum of Natural History (AMNH), one from near Clearwater based on a dried whole specimen seen on display, one each from Salerno and Key West based on dried rostra. Three of these records only presume a local capture location, as the capture or landing of each specimen was not observed by the researcher. The AMNH specimen was only presumed to have been collected during the spring 1910 Tecla expedition to southern Florida but evidence indicates to the contrary. This paper discusses more likely scenarios for the appearance of these dried specimens in Florida and the most plausible scenarios as to the source of the AMNH specimen. Given the dubious nature of the four *P. pristis* accounts purported to be from Florida and the lack of verified vouchered specimens or catches in the state, Florida should be omitted from the range of this species. Texas, or possibly Louisiana, should be considered the eastern-most extent of the species in the United States.

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**0685 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Emily Seubert, Marcus Drymon

*University of South Alabama, Mobile, AL, USA*

### Species and functional biodiversity of apex and mesopredators in the northern Gulf of Mexico

High biodiversity can enhance the resiliency of an ecosystem and hasten the recovery of collapsed populations. Apex and mesopredators often overlap trophic niches, and thus can facilitate the ability of an ecosystem to rebound from a disturbance. To investigate the species and functional diversity of apex and mesopredators across the northern Gulf of Mexico, we plan to analyze catch data from two years of bottom longline surveys conducted in both inshore and offshore waters. Species diversity will be calculated from catch data using standard diversity indices while functional biodiversity will be determined through stable isotope analysis of carbon, nitrogen, and sulfur sampled from two distinct tissue types, white muscle and blood plasma. During the first year of sampling in 2015, 24 bottom longline sets were conducted and 314 individuals from 17 different species were landed. Preliminary results show that overall, offshore sites in Louisiana have the highest diversity while offshore sites in Mississippi contain the lowest diversity. Inshore sites in Alabama had the highest number of species whereas offshore Alabama sites contained the fewest number of species per region. The addition of data collected in 2016 will elucidate the trends from Year 1. Early evidence of high predator diversity across a small spatial scale indicates that the ecosystem may be resilient in the face of environmental disturbances, which are not uncommon in the northern Gulf of Mexico. Investigating the potential for this system to recover from environmental disasters is critical for both preemptive management and post-disaster mitigation strategies.

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**0146 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016**

Thomas Sevick, Jake Schaefer

*The University of Southern Mississippi, Hattiesburg, MS, USA*

### Effect of fragmentation and habitat type on the abundance and diversity of nekton in coastal Mississippi

Coastal wetlands are extremely productive ecosystems that support an abundance of organisms at higher tropic levels. Coastal wetlands also act as important buffers from storms and help protect major cornerstones of coastal economies, such as tourism and fisheries. Despite the clear need for the protection of these habitats, anthropogenic use of coastal wetlands has increased in frequency and intensity, resulting in the fragmentation of once continuous habitats. A central challenge to assessing the impact of marsh fragmentation is the lack of quantitative distribution and abundance data from specific habitat types. This is especially true for species that are not commercially or

recreationally harvested and are, therefore, not regularly monitored by state and federal resource management agencies. This study makes use of quantitative abundance, habitat use, and distribution data for non-harvested marsh nekton collected in oligohaline marshes (salinity 0.5-5ppt) of coastal Mississippi. To assess how nekton assemblages varied by habitat, patch geometry and position in patch (core vs. edge), four sites along coastal Mississippi were sampled in the summers of 2014 and 2015. Nekton were sampled in adjacent patches of submerged aquatic vegetation and emergent vegetation using a 1-m2 throw trap. Marsh patch geometry was quantified, using aerial pictures taken with a GoPro camera secured to the end of a 20ft telescoping pole. Points around the patch were digitized in TPS software and analyzed using R. The results of this study indicate that diversity and abundance of nekton in the Mississippi marshes varies significantly based on habitat type and fragmentation.

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**0990 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Katherine Sgouros, Robert Jadin, Sarah Orlofske

*Northeastern Illinois University, Chicago, Illinois, USA*

## A Revised Molecular Phylogeny Reveals Polyphyly in *Schistura* (Teleostei: Cypriniformes: Nemacheilidae)

With more than 215 presently known species, the genus *Schistura* dominates over the loaches with a vast range of distinct morphologies. Loaches comprise a large portion of the order Cypriniformes with an estimated 1200 species. However, the evolutionary relationships of the majority of loaches remain unresolved. Most species descriptions are based exclusively on morphological data and a limited number of loaches have sequences and placement in molecular phylogenies. This has led to inconsistencies between their taxonomy and evolutionary relationships, as many species have similar environments, life histories, and markings. Because of the great diversity in species and morphology, this research provides a broader understanding of loach taxonomy and phylogenetics while testing the validity of morphological data to infer phylogenetic relationships. A current phylogeny of *Schistura* loaches compiled by the Cypriniformes Tree of Life project indicates this group is polyphyletic. Therefore, it is paramount to include additional species, especially those recently described, into a phylogenetic analysis to obtain a stable taxonomy at the generic level. For this study, we examined the evolutionary relationships of nine members of the genus *Schistura* via mitochondrial gene fragments. Additionally, this research includes several novel species contributing knowledge about the evolutionary history of Asian freshwater fishes. The results of this study confirm polyphyly between *Schistura* and other closely related genera in two large, distinct clades. One clade has a wide Eurasian distribution while the other is limited to Southeast Asia. Lastly, this study opens up new avenues for continued research in nemacheilid evolution.

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**1096 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Brad Shaffer

*UCLA, Los Angeles, CA, USA*

**ASIH in the Genomics Era**

The first pioneering use of modern molecular genetics in evolutionary biology was published in 1966 by Lewontin and Hubby in *Genetics*. The same year, Cei and Erspamer published the first biochemical analysis in the pages of *Copeia*. Ever since, our society and our journal have championed the use of increasingly sophisticated molecular genetic analyses to unravel the phylogeny, population biology, and natural history of amphibians, reptiles, and fishes. Unlike many societies, our molecular geneticists have remained true to the idea that we use molecules to better understand our study organisms, rather than molecular biology in its own right. As we look to the next decade of work, I see an increasingly important role for the expertise in organismal biology that characterizes members of ASIH in applying the tools of genomics research in key research areas ranging from conservation biology to assembling the vertebrate tree of life. We can now assemble a reasonable genome of most vertebrate species for a few thousands of dollars, and the world of comparative, conservation, and landscape genomics is thus a reality. Given our tremendous expertise in the vast majority of vertebrate clades on earth, the members of ASIH are well positioned to take a leadership role in the use of genomics in organismal biology, just as we have for earlier genetic techniques.

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**0775 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Ashley Shaw[1], Bryan Frazier[1], Amanda Barker[2], David Portnoy[2], Doug Adams[3]

*[1]South Carolina Department of Natural Resources, Marine Resources Research Institute, Charleston, SC, USA, [2]Marine Genomics Laboratory, Department of Life Sciences, Harte Research Institute, Texas A&M University-Corpus Christi, Corpus Christi, TX, USA, [3]Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Melbourne, FL, USA*

**Diet analysis of two cryptic Hammerhead species off the Southeastern United States**

Two sympatric species, *Sphyrna lewini*, Scalloped Hammerhead and the recently described *Sphyrna gilberti*, Carolina Hammerhead, inhabit nursery areas as young-of-year along the southeastern United States. As part of ongoing research to determine spatial and temporal distribution of the two species, trophic ecology will also be examined. The diet of Hammerhead species, particularly young-of-year sharks, has not been examined in the waters off of the southeastern United States. This study examines stomach contents as well as stable isotope analyses to determine the dietary habits of the Scalloped and Carolina Hammerheads. Comparisons will be made among and between

Hammerheads from two distinct habitats, Bulls Bay, an estuarine nursery in SC, and Cape Canaveral, a neritic nursery in FL.

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**0231 ASIH STOYE AWARD PHYSIOLOGY & PHYSIOLOGICAL ECOLOGY, SALON A-C, Thursday 7 July 2016**

Tanner Shea, Mason DuBois, Natalie Claunch, Nicolette Murphey, Kiley Rucker, Robert Brewster, Emily Taylor

*California Polytechnic State University, San Luis Obispo, California, USA*

**Testing the oxygen limitation hypothesis for the thermal tolerance of an air-breathing vertebrate**

The physiological mechanisms responsible for thermal tolerance, including the critical thermal maximum (CTmax), in air-breathing organisms remain uncertain despite decades of research on CTmax. We tested the oxygen limitation hypothesis, which states that animals reach their CTmax when the metabolic demand for oxygen at high temperatures exceeds the circulatory system's ability to supply it. Lizards exposed to hypoxic air (6% O2) gaped, panted, and lost their righting response (reached CTmax) at far lower temperatures than lizards exposed to normoxic (21% O2) or hyperoxic (35% O2) air. A greater proportion of lizards in the hyperoxic treatment were able to withstand body temperatures above 44°C than in the normoxic treatment. These data suggest that oxygen limitation plays a mechanistic role in the CTmax of lizards. In addition, oxygen limitation may interact with other effects of high temperatures to stimulate gaping and panting and to interfere with coordinated locomotor ability.

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**0458 General Herpetology, Salon D, Thursday 7 July 2016**

Alexander Shepack, Alessandro Catenazzi

*Southern Illinois University, Carbondale, IL, USA*

**Prevalence of *Batrachochytrium dendrobatidis* in rebounding and remnant amphibian populations**

The global decline of amphibians has captivated scientists and the general public. Although the causes behind the declines are diverse, the amphibian chytrid fungus *Batrachochytrium dendrobatidis* has been implicated in many declines and disappearances in the Americas and Australia. While many species were initially feared extinct, in recent years numerous populations of many species have been discovered. While these populations provide hope for the future of amphibian populations worldwide, the mechanisms behind their survival are still unknown. This study seeks to investigate how these populations have been able to survive or return. Current results indicate that in all studied populations Bd continues to exist in the environment. We have identified Bd in rebounding and remnant populations as well as other members of the amphibian

community; with prevalence varying from 0.3-0.5. Unexpectedly, rebounding populations across sites, while apparently still increasing or maintaining size, have the same Bd prevalence as the rest of the community. These preliminary results suggest that these populations are still facing Bd in the environment and may have evolved resistance to Bd, or coping mechanisms to reduce fatal infections. In the future we will be coupling these results with examinations of the population genetics and intrinsic susceptibility of individuals to understand rapid changes in the host-pathogen system and the possibilities for conservation measures of at risk populations elsewhere.

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**0009 Lightning Talks, Galerie 2, Saturday 9 July 2016**

C. Samantha Sherman[1], Andrew Chin[1], Michelle R. Heupel[2], Colin A. Simpfendorfer[1]

*[1]James Cook University, Townsville, Queensland, Australia, [2]Australian Institute of Marine Science, Townsville, Queensland, Australia*

**Encountering batoids on coral reefs in Malaysian Borneo**

Batoids are emerging as a conservation concern, especially in locations such as South East Asia where fishing pressure is high. In this region, batoids are caught for their meat and skin. Although there is a high diversity of batoids in the region, little is known about their abundances in coral reef ecosystems. The Global FinPrint Project is the first global-scale survey of elasmobranchs in coral reef ecosystems. The project uses baited remote underwater video systems (BRUVS) to determine relative diversity and abundance of coral reef sharks and rays. These data form an important baseline for future studies, and provide data about diversity, abundance and distribution patterns that can inform fisheries and marine park management. In 2015, over 300 BRUVS were set at three sites in Malaysian Borneo in the Tunku Abdul Rahman Park near Kota Kinabalu and in the islands off of Semporna. Preliminary analyses from these Malaysian locations will be presented. Two species were seen most often: the bluespotted maskray (*Neotrygon kuhlii*) and the blue-spotted ribbontailed ray (*Taeniura lymma*). Other species were rarely observed, showing that while there is high diversity, many of those species may be quite rare, or perhaps difficult to sample using BRUVS. A cursory inspection of fish markets and of wholesale websites suggests that the bluespotted maskray and blue-spotted ribbontailed ray are amongst the most common batoid species in local markets.

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**0252 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Chelsey Sherwood, Ginny Adams, Reid Adams

*University of Central Arkansas, Conway, AR, USA*

## Analysis of Historical Theses to Assess Changes in Abundance and Distribution of Cypriniformes in the Saline River, Arkansas

Long-term data sets are important in assessing changes in fish assemblages and population trends of threatened species. The Saline River has not been thoroughly surveyed in 34 years and is a diverse river with 112 known species of fishes, including several species of conservation concern. We compared collections from two historical theses (Reynolds, 1971 and Stackhouse, 1982) to assess changes in abundance and distribution of Cypriniformes over this 11-year period in the Saline River across 20 common sites. In 1982, species richness of Cypriniformes increased to 32 species with the addition of *Macrhybopsis aestivalis, Notropis buchanani, Moxostoma carinatum,* and *Moxostoma duquesnei* compared to 28 species in 1971. *Campostoma pullum* and *Notropis boops* were the most widely distributed species in 1971 occurring at 70% of the sites; however, in 1982 *Cyprinella whipplei* (65%) and *N. boops* (70%) had the highest frequency of occurrence. For both collections, *N. boops* (1971=27%, 1982=33%) and *C. whipplei* (18%, 12%) were the most abundant species across sites with the addition of *Notemigonus crysoleucas* (12%) in 1982. Over the 11 years, there was an increase in frequency of occurrence of some low-gradient, tolerant species: *Lythrurus fumeus* (1971=20%, 1982=60%), *N. crysoleucas* (5%, 30%), and *Opsopoeodus emiliae* (15%, 45%). This trend was most pronounced in uppermost sites of the Saline suggesting fine sediments and/or sluggish flows have increased in these reaches. Beginning spring (2016), sites from historical theses will be sampled using similar techniques to assess changes in fish assemblages relative to changes in land use and in-stream habitat.

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**0485 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Chelsea Shields, James Gelsleichter

*University of North Florida, Jacksonville, Florida, USA*

## Potential Associations between Gonadotropins and Reproduction in Female Stingrays

Follicle Stimulating hormone (FSH) and luteinizing hormone (LH) are glycoproteins that are responsible for regulating gametogenesis and gamete maturation in all vertebrates. However, although these hormones have been detected in some elasmobranchs, no studies have examined temporal associations with reproduction in these fishes. The goal of this study was to examine temporal changes in circulating FSH and LH concentrations in relation to the reproductive cycle of the Atlantic stingray (*Dasyatis sabina*), an elasmobranch species with a well characterized breeding cycle. Plasma

samples were collected from mature female *D. sabina* from all reproductive stages. FSH- and LH-like immunoreactivity was examined using Western Blot. Dot blot analysis was used to obtain semi-quantitative data on hormone concentrations. FSH-like immunoreactivity was observed in female stingrays from all reproductive stages except late pregnancy, when females nourish developing embryos with uterine histotroph. Changes in FSH-like immunoreactivity was determined during other reproductive stages. LH-immunoreactivity was detected in plasma from female stingrays, but results were poor and did not provide a clear understanding of temporal changes in this hormone. Potential associations between gonadotropins and reproduction in female stingrays will be discussed along with preliminary observations on levels of these hormones in male stingrays.

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**0026 Fish Ecology I, Salon A-C, Saturday 9 July 2016**

Robert Shields, Mark Pyron, Mario Minder

*Ball State University, Muncie, IN 47304, USA*

**Effects of Silver Carp on the Wabash River Ecosystem**

Invasive Silver Carp (*Hypophthalmichthys molitrix*) have been abundant in many US rivers for over 20 years. Effects of this invasion include alteration of phytoplankton communities, competition with native fishes, and a potential shift in functional feeding group dominance among large river fishes. The increased dominance of benthic invertivore fishes in the Wabash River after the invasion of Asian carps may be an indication that benthic invertebrate consumers utilize carp feces. We examined long-term Wabash River fish assemblage data to identify relationships among Silver Carp and other fish species. We tested for effects of Asian carp fecal matter on growth and survival of bluntnose minnows (*Pimephales notatus*) and freshwater snails (*Pleurocera* spp) in mesocosm experiments. Ten minnows and 20 snails were added to each of 12 experimental stream mesocosms. Half of the mesocosms received chironomid larvae (*Chironomidae*) as food sources, while the other half received the same mass of Silver Carp fecal matter. Our results provide a more complete understanding of Asian carps in invaded ecosystems.

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**0030 AES GRUBER AWARD, Balconies J & K, Thursday 7 July 2016**

David Shiffman, Neil Hammerschlag

*University of Miami, Miami, FL, USA*

**Intraspecific Variation in the Relative Diet Breadth and Overlap of Coastal Sharks Revealed Through Stable Isotope Analysis**

Determination of the diet and ecosystem role of sharks is a research priority that is important for understanding the potential consequences of population declines.

Interactions between shark species can vary widely, with documented cases of both resource partitioning and significant diet overlap. We used stable isotope analysis to assess the relative diet breadth and overlap between eleven mesopredatory and apex predatory species of sharks in three distinct South Florida coastal habitats, testing whether the ecological interactions between species remained constant. The relative diet breadth and overlap between shark species was not constant between habitats. The diet of some species pairs overlapped almost 100% in one habitat, but didn't overlap at all in other habitats. The species with the widest relative diet breadth varied from one habitat to another, as did the species with the highest trophic level. This intraspecific variation between the diet breadth and diet overlap of shark species suggests that the ecosystem role of a marine predator in one environment cannot be reliably inferred from studies in a different environment, and that habitat-specific studies are required.

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**0058 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

Richard Shine, Michael Crossland, Jayna DeVore, Simon Ducatez, Greg Clarke

*University of Sydney, NSW, Australia*

**Malevolent Tadpoles and Their Rapidly Evolving Weaponry**

Many invasive species exploit disturbed habitats where native taxa are scarce, and the invader's greatest competitors are members of its own species. In response to that pressure, cane toad (*Rhinella marina*) tadpoles eliminate future competitors by producing chemicals with devastating effects on younger conspecifics (eggs and hatchlings). Remarkably, the intensity of this intraspecific competitive mechanism varies dramatically among different populations of cane toads. Production of the suppressor chemical, and sensitivity of the targeted eggs, is highest at the invasion front in Western Australia, intermediate in long-colonised sites in eastern Australia, and minimal in Hawai'i. That diversity plausibly reflects environmental factors that influence the costs and benefits of a chemical "arms race" between successive larval generations. The 80-year invasion of tropical Australia has prompted the rapid evolution of a powerful new mechanism of intraspecific suppression, so far unreported in any other anuran species.

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**0581 HL GRADUATE RESEARCH AWARD, Galerie 2, Thursday 7 July 2016**

Jamie Shinskie, Amber Pitt, Tina Delahunty

*Bloomsburg University, Bloomsburg, PA, USA*

**Influence of Land Cover Change on Eastern Hellbender Occurrence within the Susquehanna River Drainage of Pennsylvania**

Habitat degradation and loss continue to be primary drivers of wildlife population declines and biodiversity loss. Anthropogenic land use along streams alters both

terrestrial and aquatic habitats and detrimentally impacts aquatic species. We examined the influence of reach-scale land cover change on Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*) population persistence and extirpation. We used environmental DNA (eDNA) sampling techniques to reassess previously documented hellbender sites (n=25) within the Susquehanna River drainage in Pennsylvania in order to determine population persistence or extirpation. We assessed land use/land cover change by comparing historical and recent aerial imagery for the study sites. Our results indicated that hellbenders were still present in only 9 of the 25 historical location sites. Extirpations of hellbender populations within the Susquehanna River drainage of Pennsylvania have resulted in range constriction, and extirpations corresponded with land use/land cover change. The results of our study can be used to inform hellbender conservation and reintroduction programs.

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**0260 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Oliver Shipley[1], Emily Tolentino[2], Lucy Howey-Jordan[2], Lance Jordan[2], Edward Brooks[1]

*[1]Shark Research and Conservation Program, The Cape Eleuthera Institute, Eleuthera, Bahamas, [2]Microwave Telemetry Inc, Columbia, Maryland, USA*

## Pop-up satellite archival tags reveal the extent of post-release survivorship and vertical habitat use in a data-deficient, deep-water chondrichthyan, the Cuban dogfish (*Squalus cubensis*)

Pop-up satellite archival tags have proven a valuable method to quantify behavioral modification and the extent of post-release survivorship in large fishes, which are ubiquitously caught in commercial fisheries worldwide. The need to assess these parameters is required within deep-water species, where the effects of fisheries exploitation are exacerbated by extreme *K*-selected life-history traits. We deployed 7 High Rate pop-up satellite archival tags (PSATs) on the data-deficient (IUCN), medium-bodied, deep-sea shark, the Cuban dogfish (*Squalus cubensis*), to investigate how experimental capture may affect susceptibility to post-release mortality. We examined: post-release recovery behavior, subsequent vertical movement, and incidents of predation. Data were retrieved from 6 individuals with deployment durations ranging from 5 to 14 days. Recovery periods (defined by <5m vertical movement between consecutive depth records, once individuals had returned to depth) ranged from 0 to 1.5 days among individuals, suggesting some animals required re-acclimatization before becoming active. Half of the tagged animals were consumed by predators within 24 hours of release during the active phase and after the initial recovery period. The three surviving individuals exhibited clear diel-vertical behavior (ca. 24 hour cycle) such that shallower depths were occupied during the night. Animals occupied depths between 903.8 m and 324.1 m and experienced temperatures between 5.83 to 18.26 °C. PSAT data suggest Cuban dogfish may be highly susceptible to post-release mortality, primarily through predation, after being released from longlines. Depth data also suggest this

species may be highly susceptible to commercial fisheries capture, through movement across a broad depth range.

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**0439 General Herpetology, Galerie 2, Thursday 7 July 2016**

Spencer Siddons, Jeff Wesner, Jacob Kerby

*University of South Dakota, Vermillion, SD, USA*

### Increased species richness reduces pathogen infection risk in amphibians: a meta-analysis

In amphibian communities, the presence of pathogens such as *Batrachochytrium dendrobatidis* (Bd) and trematodes can reduce amphibian biodiversity and negatively alter aquatic ecosystems. Maintaining biodiversity is vital as it can reduce infection risk via the dilution effect. Herein, we report a meta-analysis in which we analyzed the relationship between amphibian richness and infection risk to test the hypothesis that increased amphibian richness reduces the risk of infection by Bd and trematode pathogens. We found that treatments with >1 species reduced risk of infection by 48% on average relative to treatments with 1 species. There was no additional reduction in infection risk among treatments with 2-4 additional species. This suggests that the dilution effect saturates rapidly at relatively low species richness. Our results provide ecologically relevant insight into the dilution effect in amphibian communities, single host-pathogen studies, and the possibility of a positive feedback in which disease-related amphibian declines could make communities more at risk of infection and lead to further declines. We speculate that community composition or species interactions may be the mechanisms behind our results but further studies are needed to fully understand this relationship. These are important findings in light of ongoing amphibian declines as pathogens continue to play a major role.

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**0773 Fish Systematics II, Salon F-H, Saturday 9 July 2016**

Brian Sidlauskas[1], Michael Alfaro[2], Michael Burns[1], Casey Dillman[3], Brant Faircloth[4], Kendra Hoekzema[1], Bruno Melo[5], Mark Sabaj Perez[6], Claudio Oliveira[5], Richard Vari[3]

*[1]Oregon State University, Corvallis, OR, USA, [2]University of California, Los Angeles, CA, USA, [3]Smithsonian Institution, Washington, DC, USA, [4]Louisiana State University, Baton Rouge, LA, USA, [5]Universidade Estadual Paulista, Botucatu, SP, Brazil, [6]Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA*

### Morphological and Macroevolutionary Implications of a Densely Sampled Molecular Phylogeny for Anostomoidea (Characiformes)

Using Sanger sequencing and ultraconserved elements, we reconstruct the phylogeny for 70% of the ecomorphologically diverse characiform fishes in superfamily

Anostomoidea. Comparison with a prior, equally rich morphological reconstruction reveals much congruence, but also significant disagreement on the placement of the headstanders in family Chilodontidae, the position of the morphologically divergent genus *Ichthyoelephas* within Prochilodontidae, and the placement of the superior-mouthed Anostominae within Anostomidae. These novel molecular placements suggest substantial oral jaw shape convergence within Anostomidae, and reinterpret features of the pharyngeal jaws and other systems as homplastic or plesiomorphic for the superfamily rather than synapomorphic for Anostomidae and Chilodontidae. Several characters proposed originally as homoplasies optimize as synapomorphies on the molecular topology, such as the unique hypertrophy of the fourth upper pharyngeal toothplate shared by *Prochilodus* and *Semaprochilodus*. The phylogeny resolves longstanding polytomies resulting from scant or conflicting osteological variation the species-rich genera *Leporinus*, *Cyphocharax* and *Prochilodus*, thereby providing a framework for taxonomic revision and comparative phylogenetic analysis. Phylomorphospace analysis of head and gill arch shape variation reveals initial radiation of all four families into distinct morphospaces regions. Subsequent diversification varies among families,with the ecomorphogically diverse Anostomidae demonstrating particularly high rates of change in oral and pharyngeal jaw shape, and the detrivorous Curimatidae diversifying substantially internally, but not externally. Evolutionary dynamics in Prochilodontidae differ and indicate early fixation of a highly specialized bauplan that apparently allows them to achieve huge body and population sizes but affords little opportunity for subsequent morphological diversification.

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**0006 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Dustin Siegel[1], Yousif Al-Baghdadi[1], Michael Frangello[1], Madison Herrboldt[1], Sam Alvino[1], Stanley Trauth[2], David Sever[2]

*[1]Southeast Missouri State University, Cape Girardeau, MO, USA, [2]Arkansas State University, State University, AR, USA, [3]Southeastern Louisiana University, Hammond, LA, USA*

**"sexual Tears" in a salamander?**

Historical observations detail the possibility of orbital gland involvement in reproduction of spelerpine salamander, particularly *Eurycea*. Orbital glands in *E. longicauda* were assessed for sexual dimorphism and a distinct seasonal secretory cycle that mirrored the reproductive cycle. Orbital glands were found not to be sexually dimorphic in *E. longicauda* and possessed constant secretory activity in males and females throughout the year. Known secondary sexual glands (mental glands, caudal courtship glands, and cloacal glands) were sexually dimorphic between males and females and possessed a secretory cycle that could be correlated with events of the reproductive cycle; i.e., hypertrophy of glands during the mating season. Thus, no evidence was found for orbital gland involvement in reproduction in *E. longicauda*. To this date, only one taxon of salamander, *E. bislineata*, was reported to have orbital glands involved in reproduction through rudimentary gross examination of the head of males

and females. Orbital glands of both male and female *E. longicauda* produce copious lipoproteins throughout the year and these secretions are undoubtedly involved in the prevention of fluid evaporation from the eye and maintenance of a smooth corneal surface as described for lipoprotein secretions in other terrestrial vertebrate lineages.

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**0975 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Priscilla Silva, Maria Malabarba, Luiz Malabarba

*UFRGS, Porto Alegre, RS, Brazil*

## Historical DNA solving taxonomic puzzles: examples in the family Characidae (Teleostei, Characiformes)

Historical DNA is the DNA isolated from ancient samples as subfossil bones, mummies, or museum specimens, which have not been preserved for later DNA analyses. The use of this tool for biodiversity and evolutionary studies has increased due to the development of new techniques in molecular biology, like New Generation Sequencing. The high level of degradation of the DNA obtained from this kind of samples conversely turns traditional sequencing methodologies, like Sanger, less often in use. The use of historical DNA can help to solve taxonomical problems when name-bearing types have no more diagnostic morphological features that allow an accurate identification of the species involved. We were allowed to extract DNA from 53 type specimens stored in collections around the word, which were processed in the molecular biology facilities of the NMNH (Smithsonian Institution). The DNA extraction was conducted in a special clean room, free from any previous fish DNA handling, using commercial kits; whilst PCRs were carried out in an isolated chapel of a different laboratory. From the 53 samples, so far we amplified nine and obtained sequences for COI (Sanger sequencing) from five samples. We got a mean of 120 ng/ul of DNA in the extractions and no correlation between amount of DNA and age of the sample (collecting year) was observed. The sequences indicated taxonomically significant results for the proper recognition of the species *Deuterodon pedri* Eigenmann 1908, *Astyanax rutilus jequitinhonhae* (two syntypes) Steindachner 1877 and *Astyanax eigenmaniorum* Cope 1894.

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Diana Lorena Silva-Garay[1], Ximena Vélez-Zuazo[1], John G. Ramírez[2], Aldo S. Pacheco[3]

*[1]Center for Conservation and Sustainability, Smithsonian Conservation Biology Institute, National Zoological Park, Washington, D.C., USA, [2]Instituto de Ciencias del Mar de Barcelona CSIC-ICM, Barcelona, Spain, [3]CENSOR Laboratory, Instituto de Ciencias Naturales Alexander von Humboldt, Universidad de Antofagasta, Antofagasta, Chile*

## Feeding Partitioning in an Assemblage of Demersal-Neritic Elasmobranchs in the Southeastern Pacific

Elasmobranchs play a regulatory role over prey populations; however, this is less understood for demersal-neritic species, which are facing numerous threats in coastal ecosystems. Dietary studies are a useful tool for understanding species role and their trophic interactions. To this purpose, we investigated the diet from stomach contents of four stingrays (*Dasyatis dipterura, Myliobatis peruvianus, M. chilensis, Urotrygon chilensis*), a guitarfish (*Rhinobatos planiceps*), a shark (*Mustelus mento*), and a chimaera (*Callorhinchus callorhynchus*) collected around an artificial reef along the central coast of Peru from 2012 to 2014. We investigated (1) their diet composition, trophic interactions, trophic level (TL) and niche breadth, and (2) the likely influence of the artificial reef in their feeding dynamics. We used the index of relative importance (IRI%) and PERMANOVA-test to this analysis. All species exhibited a high feeding specialization (Levin<0.3) and dietary separation ($p<0.05$). While stingrays preferred soft bottom polychaetes and pelagic teleost fish ($p>0.09$), the shark and guitarfish fed on crabs ($p>0.06$) and the chimaera consumed mostly mollusks. The species which diet included bivalve mollusks were more associated with the artificial reef, an important hard-bottom food supply for species that feed on hard bottom prey items. The results highlight the relevance of the assemblage predatory activity (mean TL=2.85 ± 0.47) on a broad group of prey taxa and their predation over pelagic and benthic fauna gives insights of their feeding dynamic in this rich upwelling coastal ecosystem.

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**0129 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Colin Simpfendorfer[1], Peter Kyne[2], Tansyn Noble[1], Julie Goldsbury[1], Rose Basiita[1], Rob Lindsay[3], Amos Shields[3], Camillus Perry[4], Dean Jerry[1]

*[1]James Cook University, Townsville, Queensland, Australia, [2]Charles Darwin University, Darwin, Northern Territory, Australia, [3]Malak Malak Ranger Group, Darwin, Northern Territory, Australia, [4]Wudikupildiyerr Ranger Group, Darwin, Northern Territory, Australia*

## Environmental DNA detects Critically Endangered largetooth sawfish in the wild

Environmental DNA (eDNA) is a relatively new tool for the detection of rare, threatened and invasive species in water bodies. In this study we investigated the utility of an eDNA approach in detecting the Critically Endangered largetooth sawfish, *Pristis pristis,* in freshwater habitats in northern Australia. Water samples were collected from a large aquaria mesocosm containing sawfish and other aquatic species, and floodplain waterholes and the main river channel of the Daly River, Northern Territory. Water samples were filtered using a 20 μm nylon filter. DNA was extracted from filters and analysed with PCR using species -specific mitochondrial cytochrome oxidase subunit 1 (COI) primers designed to amplify only largetooth sawfish DNA. PCR products were cleaned and the COI gene sequenced to confirm the species identity. Testing this method using three aquaria, one containing a largetooth sawfish, positively identified sawfish only in the correct aquarium. In the field water samples, seven of eight floodplain waterholes produced a sawfish eDNA PCR product, while eDNA was not detected in the main river channel. Based on gillnet sampling and traditional ecological knowledge, sawfish were known to occur at half of the waterhole and floodplain sites that tested positive for sawfish eDNA. These results demonstrated that an eDNA approach to detecting largeooth sawfish can produce reliable results and can be used as a survey tool to help with conservation efforts for this and other threatened elasmobranchs.

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**0100 ASIH STOYE GENERAL ICHTHYOLOGY AWARD, Galerie 2, Friday 8 July 2016**

Randy Singer, Lawrence Page

*Florida Museum of Natural History/iDigBio, Gainesville, FL, USA*

## Jar Wars: The (data) Source Awakens: Exploring New Ichthyological Frontiers in Specimen-based Research, Education and Outreach

A long long time ago on a natural history collection shelf far far away, a jar of fish is placed on a shelf next to similar species with a label containing precious and irreplaceable data. These specimens collected over hundreds of years and ultimately encased within millions of jars, tanks and boxes in various states of curation await the careful examination by a researcher. In both the past and present these specimens and the data, tissues and photos have been utilized in numerous studies of taxonomy,

phylogenetics, biogeography and ecology. In the advent of better media technology and in an age of rapid digitization of specimens and their data through digitization initiatives like iDigBio, we have only begun to scratch the surface of the usefulness of museum specimens like those housed in ichthyology collections. One specimen can answer dozens of research questions across many disciplines of biology. Some novel and underutilized research questions using fish specimens will be discussed. In addition to research uses of collections, outreach using collections has been largely limited to collection tours, specimen observations and the occasional outreach event hosted by the collection's home institution. In a similar light, creative education and outreach initiatives have begun to surface that require minimal effort for large amounts of impact. As we begin to enter a largely digital era, collections have begun to offer an unmatched service to the scientific community, and we have but to ask in order to unlock its potential.

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**0500 HL GRADUATE RESEARCH AWARD, Galerie 2, Friday 8 July 2016**

Shashwat Sirsi[1], Shailendra Singh[2], Shawn F. McCracken[1], Michael R.J. Forstner[1]

[1]*Department of Biology, Texas State University, San Marcos-78666, Texas, USA,*
[2]*Turtle Survival Alliance-India Program, Lucknow-226021, Uttar Pradesh, India*

## Variation in Reproductive Output of two Endangered Freshwater Turtles (*Batagur* spp.) in North India

The largest known wild population of the endangered Three-striped Roofed Turtle (*Batagur dhongoka*) and last known wild population of the critically endangered Red-crowned Roofed Turtle (*Batagur kachuga*) occur in the Chambal River of North India. Both species are threatened by habitat loss, offtake and accidental drowning in gill nets. Three years of field work (2007, 2008 and 2010) from ongoing population supplementation projects were used to examine annual differences in reproductive output among and within species. Nests were located each year using boat-based surveys and foot patrols. Clutch sizes were enumerated for each nest and egg volumes were calculated for a subset of nests. Generalized linear models were used to determine annual differences in number of nests while ANOVAs were used to test for annual differences in fecundity and egg volume. The number of nests differed significantly for both species - with the greatest number of nests occurring in 2007 and mid-season (nesting season: February to April; peak season: late February through March) across all years. Fecundity also showed a significant annual decline. Available habitat and resource acquisition patterns may affect these differences. Additionally, *B. kachuga* was found to lay significantly larger and fewer eggs than *B. dhongoka*, but within year trends for clutch size imply that two nesting events annually occur in the latter. These data shed some light on these poorly documented species in need of better conservation coverage.

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**1088 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Garrett Sisson, Willem Roosenburg, Shawn Kuchta

*Ohio University, Athens, Ohio, USA*

### When the Rocks are Hotter on the other side of the Fence: Use of Roadside Habitats by Reptiles and Consequences for Mitigation Structures

Roads threaten wildlife populations by destroying and fragmenting habitats, isolating populations, and increasing mortality, among other impacts. Barrier fencing and ecopassages are used to reduce mortality and promote population connectivity, but their effectiveness for reptiles and other small vertebrates remains understudied. We evaluated the effectiveness of barrier fencing and ecopassages for reptiles occurring along a four-lane divided highway in southeastern Ohio. Radio telemetry and capture-mark-recapture on multiple species revealed that snakes trespass the fencing to access habitats located within the right-of-way (ROW). Edge habitat and artificial rocky structures along the roadside may attract snakes because they provide habitat where snakes can thermoregulate and avoid predators. Use of roadside habitat may be intensified if basking habitat in the surrounding landscape is rare or of poor quality. However, if using roadside habitats results in additive mortality from vehicle collisions, higher predation rates, or collection, then these features are ecological traps. Determining whether roadside habitats can have compensatory benefits or function as ecological traps is needed to manage these areas, and inform the design and placement of functional barrier fencing. In 2016 we will compare habitat use and mortality between ROW and forest habitats, and quantify the thermal environment to determine if snakes are using ROW habitats for thermal opportunities unavailable elsewhere within their home ranges.

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**0473 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016**

Phillip Skipwith[1], Paul Oliver[2]

*[1]University of California, Berkeley, Berkeley, CA, USA, [2]Australia National University, Canberra, ACT, Australia*

### Phylogeography of the marbled velvet gecko (*Oedura marmorata*) species complex in the Australian Monsoonal Tropics

The monsoonal tropics of northern Australian has been found to harbor high species diversity as well as numerous short-range endemic lineages. Many of these lineages are tied to important biogeographic barriers including numerous river drainages, limestone escarpments, and tropical regions isolated by extensions of the arid zone. Here, we investigate the phylogeographic patterns of the diplodactylid gecko *Oedura marmorata*. An extensive mtDNA dataset strongly indicates that there are at least seven distinct lineages, including what has been referred to as *O. gemmata*, though inter-clade relationships are poorly resolved. These mitochondrial clades correspond somewhat to

the Daly River drainage, Carpentarian Gap, and Arnhem Plateau. However, preliminary data based on 4,000 ultraconserved elements suggests a different pattern of relationships, though this tree has very limited sampling. Several lineages appear to be closely tied to limestone formations while others seem generalized on karst and vegetation. Morphological diversity is high in this species complex and rupicolous lineages are noted in having longer limbs and flatter heads. However, phenotypic convergence analyses fail to find shared morphological regimes between any *O. marmorata* lineage and other distantly related but ecologically similar dipodactyloids based on external ecomorphology. This species complex illustrates the high genetic and morphologic diversity maintained in the geologically old monsoonal tropics of northern Australia.

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**0407 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Rachel Skubel, Neil Hammerschlag

*University of Miami, Miami, FL, USA*

### Estimates of apex predatory sharks' energetic scope from long-term multi-sensor tags, and applications to climate change

All animals' performance is inherently limited by temperature. Quantifying a species' optimal thermal environment, particularly for ectothermic fish whose body temperature is dictated by that of the surrounding water, is necessary in order to project their behaviors with respect to climate change. Here, we demonstrate a novel application of estimation of pop-up satellite archival tag (PSAT) acceleration data to estimate temperature preferences of apex predatory sharks in the wild, including the longest accelerometry record for any organism to date (378 days). For three tiger sharks (*Galeocerdo cuvier*) and two great hammerhead sharks (*Sphyrna mokarran*), vectorial dynamic body acceleration (a proxy for oxygen consumption) was calculated from acceleration along three axes, and then related to ambient water temperature to approximate scope for oxygen consumption over a temperature range. Tiger sharks, tracked for 31, 22, and 378 days had greatest oxygen consumption in cooler waters (~10-20°C). Great hammerhead sharks, tracked for 8 and 10 days, consistently exploited warm shallow waters. Tiger sharks' scope for oxygen consumption declined sharply between 30 and 31°C, while great hammerhead sharks appeared not to reach waters warm enough to result in a significant decline. These results (a) suggest that tiger sharks spend most of their time in waters warmer than optimal for oxygen consumption, as a possible tradeoff for foraging and reproduction opportunities, and (b) demonstrate the feasibility of using long-term accelerometry records to obtain physiologically relevant estimates of thermal preferences.

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**0890 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Veronica Slobodian[1], Gleidson Figueiredo[2], Janice Muriel-Cunha[2]

*[1]MZUSP- Museu de Zoologia da Universidade de São Paulo, São Paulo, SP, Brazil, [2]UFPA- Universidade Federal do Pará, Bragança, PA, Brazil,*

## Taxonomy of cave and epigean *Pimelodella* species (Siluriformes: Heptapteridae) from Southeastern Brazil

Cavefishes and related surface fishes have been used as models in studies of convergent evolution and phylogeography. However, in order to make solid studies in these matters, the taxonomy decisions must be carefully taken, and the exclusive use of troglomorphic autapomorphies itself has been shown as questionable to delimit species. Concerning the cavefish *Pimelodella kronei* and its related epigean species, *Pimelodella transitoria*, we conducted a morphological study, aiming to determine the validity and delimitation of both species, using external morphology, meristics, osteology, myology and sensory canals information. We found that populations of *P. kronei* of distinct cave sets from the same karstic area (Iporanga, Upper Ribeira de Iguape basin), which are isolated, bear no significant morphological differences. Populations of *P. transitoria* near those caves also bear no consistent morphological differences, but these populations near cave entrances are different from populations found along rivers from Ribeira de Iguape basin. The populations of *Pimelodella* found far from cave entrances and usually identified as *P. transitoria* are, in their turn, indistinguishable from *Pimelodella lateristriga,* that inhabits rivers along the Southeastern Atlantic basins. The differences found between *P. kronei* and *P. transitoria* near cave entrances populations constitute mostly of troglomorphisms. We discuss the possibility of *P. transitoria* being a junior-synonym of *P. kronei*.

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**0495 Herp Conservation, Galerie 3, Saturday 9 July 2016**

Peter Smiley Jr.[1], Mark Jordan[2], Abel Castaneda[2], Robert Gillespie[2], Douglas Smith[3], Kevin King[1]

*[1]USDA-ARS, Columbus, Ohio, USA, [2]Indiana University-Purdue University, Fort Wayne, Indiana, USA, [3]USDA-ARS, West Lafayette, Indiana, USA*

## Conservation Implications of Amphibian Habitat Relationships within Channelized Agricultural Headwater Streams in the Midwestern United States

The widespread use of stream channelization and subsurface tile drainage for removing water from agricultural fields has led to the development of numerous channelized agricultural headwater streams within agricultural watersheds of the Midwestern United States. Channelized agricultural headwater streams have been documented to serve as habitat for amphibians, but information on amphibian habitat relationships within these streams is lacking and needed for developing effective conservation strategies. We quantified instream habitat, water chemistry, and sampled amphibians from seven sites in three channelized streams in Cedar Creek, Indiana in 2008 and 2009

and five sites in five channelized streams in Upper Big Walnut Creek, Ohio in 2009. We conducted an indirect gradient analysis involving the use of Principal Component Analysis and Generalized Linear Mixed Effect Model Analysis to determine which variables had the greatest influence on amphibian community and population structure. Overall, amphibian community and population structure was most strongly correlated with water chemistry rather than instream habitat within channelized agricultural headwater streams in Indiana and Ohio. Ten of 12 amphibian response variables were most strongly correlated with either a water chemistry gradient of nitrate+nitrite and acetochlor or a gradient of total nitrogen and ammonia. Only two amphibian response variables were most strongly correlated with an instream habitat gradient of dissolved oxygen and water depth. Our results suggest that conservation strategies that target reductions of nutrients and herbicides will provide the greatest benefits for amphibians within channelized agricultural headwater streams in the Midwestern United States.

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**0872 HL GRADUATE RESEARCH AWARD, Galerie 2, Friday 8 July 2016**

Sarah A. Smiley-Walters[1], Terence M. Farrell[2], H. Lisle Gibbs[1]

[1]*The Ohio State University, Columbus, Ohio, USA,* [2]*Stetson University, DeLand, Florida, USA*

## Venoms of Pigmy Rattlesnakes (*Sistrurus miliarius*) Show Significant Functional Differences on Prey Mortality

Snake venom composition varies between species, populations, and individuals, yet the functional significance of this variation is poorly understood, especially at the level of individual snakes. Our previous work has shown that pooled venoms from different populations of pigmy rattlesnakes have a slightly different functional response in treefrog prey. In this study, we examined whether venom collected from 32 individual pigmy rattlesnakes (*Sistrurus miliarius*) from 7 different populations differed in its toxicity to a prey species – the brown anole (*Anolis sagrei*). We conducted toxicity tests in which lizards were injected with weight-adjusted dosages (close to the expected LD50) of venom from randomly chosen individual snakes or saline controls. A total of 384 venom-injected lizards and 37 saline-injected controls were used in this study. Lizards were monitored out to 48 hours post-injection. Of the 384 venom-injected lizards, 135 were dead by 48 hours, resulting in a mortality rate of 35.2%. Lizard mortalities were not equally distributed among snakes. The number of kills per snake was bi-modal with some snake venoms being very lethal to lizards while others induced no mortality. Using a logistic regression, lizard mortality was significantly explained by venom concentration (Chi-squared = 81.3, $p<0.001$), population of snake origin (Chi-squared = 41.9, $p<0.001$), and individual snake nested within population (Chi-squared = 113.2, $p<0.001$). This work provides evidence that previously well-documented differences in venom composition between individuals and populations likely have functional consequences for the ability of snakes to capture prey.

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**0530 General Ichthyology II, Balconies J & K, Sunday 10 July 2016**

Amelia Smith[1], James Sulikowski[1], John Mandelman[2], David Rudders[3]

*[1]University of New England, Biddeford, Maine, USA, [2]New England Aquarium, Boston, Massachusetts, USA, [3]Virginia Institute of Marine Science, Gloucester Point, Virginia, USA*

## Stress and discard mortality of *Lophius americanus* in the scallop dredge fishery

Post-release mortality (PRM) studies are considered a primary research priority, particularly for species and fisheries where discard rates are high, and/or for overfished stocks and species of concern. *Lophius americanus,* the most lucrative finfish in New England, constitutes the second highest bycatch species within the scallop dredge fishery. Despite its commercial importance, no data exists on the mortality rates of monkfish for any gear type. Given these shortcomings, our goals were to evaluate the stress and PRM of monkfish captured in scallop dredge gear. This was accomplished by assessing various physical and physiological conditions. To quantify stress levels, blood samples were taken to measure cortisol, lactate, hemoglobin, and hematocrit concentrations. In addition, a series of reflex responses were tested and injury codes, ranging from 1 (uninjured) to 4 (dead), were assigned to each monkfish in order to develop vitality indices. To correlate the aforementioned parameters to discard mortality, monkfish were held in onboard flow-through seawater tanks and all stress indicators were reassessed after a 72-hour holding period. Preliminary results suggest that average cortisol levels increased as assigned injury code (injury 1 = 4.8 ng/ml; injury 3 = 15.7 ng/ml) increased while lactate (injury 1 = 0.9 mmol/L; injury 3 = 0.5 mmol/L), hemoglobin (injury 1 = 2.2 g/dl; injury 3 = 1.4 g/dl) and hematocrit (injury 1 = 12.7%; injury 3 = 10.9%) concentrations were unexpectedly decreased. Analysis of the tank study indicates that 80% of monkfish placed in holding tanks died after 72 hours, regardless of initial vitality index.

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**0540 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Brian J. Smith[1], Christina M. Romagosa[2], Frank J. Mazzotti[1], Mathieu Basille[1], Kristen M. Hart[3]

*[1]University of Florida - FLREC, Davie, FL, USA, [2]University of Florida, Gainesville, FL, USA, [3]US Geological Survey - WARC, Davie, FL, USA*

## Does GPS Technology Help Refine Our Understanding of Invasive Burmese Python Spatial Ecology?

In the last two decades, invasive Burmese pythons (*Python bivitattus*) have spread throughout the Greater Everglades and have severely affected native wildlife. Monitoring and managing their population has proven extremely challenging, and a better understanding of python spatial ecology in the Everglades would improve our ability to remove pythons and mitigate their effects on the ecosystem. GPS technology

could allow for detailed analysis of spatial behavior at a fine temporal resolution, but the application of GPS telemetry in snakes is largely untested. We GPS-tagged 12 wild Burmese pythons in Everglades National Park between July and December 2015, with the tags programmed to attempt a GPS fix every 90-minutes. While preliminary analysis of GPS data showed that 81% of attempted fixes failed (n=4394), we were still able to identify patterns. All pythons exhibited a movement bout every 3-5 weeks, and analysis of selection ratios suggested that pythons positively selected only dry prairie overall, with no difference in habitat selection between daytime and nighttime locations. However, published analyses of VHF data showed that pythons tend to select habitats with dense vegetation, suggesting a potential habitat-driven bias in GPS fix success. Although GPS telemetry has the potential to reveal important patterns of python spatial behavior, such as movement patterns and rates, the potential for habitat-driven bias in GPS relocations must be considered.

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### 0496 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016

David Smith

*Smithsonian Institution, Washington, DC, USA*

**Ichthyology, herpetology, and the world in 1916**

The ASIH was organized in 1916 and held its first meeting in New York at the American Museum of Natural History. What was the world like in those days? If you were a herpetologist or ichthyologist in 1916, what did you know? What did you not know? How did you communicate? How did you get around? Where did you publish your work? In this presentation, I will talk about that first meeting and about the world that those ichthyologists and herpetologists worked and lived in, a very different place from our world today.

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### 0462 AES Conservation & Management II, Balconies L & M, Saturday 9 July 2016

Kelcee Smith[1], Sabrina Taylor[1], William Kelso[1], Michael Kaller[1], John Carlson[2], Dana Bethea[2]

*[1]Louisiana State University, Baton Rouge, LA, USA, [2]NOAA Fisheries Service - Southeast Fisheries Science Center, Panama City, FL, USA*

**Estimating Abundance of Smalltooth Sawfish (*Pristis pectinata*) with Capture-Mark-Recapture Data**

In the United States, the Smalltooth Sawfish (*Pristis pectinata*) is an endangered elasmobranch currently comprising a single population restricted to southwestern Florida. The population has been drastically reduced and fragmented during the 20th century due to overfishing and habitat loss and was listed federally as endangered in

2003. Although habitat use and migration, age and growth, and other life history characteristics have been studied, current abundance remains unknown. Capture-mark-recapture data collected in southwestern Florida from 2009-2015 was used to determine a contemporary census size of juvenile *P. pectinata*. Data were separated into two cohorts (spring/summer & fall/winter) based on length-frequency distribution in order to minimize zeroes in the dataset. Program MARK was used to estimate recapture probabilities and apparent survival from individual capture histories, assuming a closed population. Models with time dependent capture probability and constant recapture probability estimated 181 and 79 individuals in the spring/summer and fall/winter cohorts, respectively. Estimates of population size largely determine risk of extinction in population viability analysis; therefore, historic population estimates will be compared to contemporary estimates of abundance to assess the extent of the population decline and extinction risk, allowing for more direct and effective management, conservation, and recovery efforts for the species.

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## 0983 ASIH STOYE ECOLOGY & ETHOLOGY AWARD, Salon E, Friday 8 July 2016

Thomas Smith

*University of Hawaii at Manoa, Honolulu, HI, USA*

### I Come From the Land Down Under: Ecological Niche Modeling of Hierarchical Spatial Scales to Predict the Range of an Invasive Skink in Hawaii

The delicate skink, *Lampropholis delicata*, represents an example of a successful invasive reptile with a single introduction, from a single source population with limited genetic diversity. All individuals across the main Hawaiian Islands share one haplotype with their introduction source in suburban Brisbane, Australia. The extent of the native range of the species, however spans the entire eastern coast of Australia, and includes 120 haplotypes. The source of the introduction represents a small geographic area with a narrow range of environmental conditions relative to its introduced range in the Hawaiian Islands. Nineteen environmental variables were obtained from BioClim and occurrence records were collected from VertNet for both the native and introduced ranges, and ecological niche models (ENMSs) were constructed using Maxent. Therefore, the objectives of this study were to use population, clade, and entire native distribution environmental data to 1) model whether conditions present at the source population accurately predict the niche of introduced populations and 2) use this prediction to evaluate potential range expansions. This study has implications for the long-term invasion assessment and management strategy of *L. delicata* across the Pacific Basin as well as implications for invasive systems of similar taxa where limited native geographic ranges or single introductions obscure the potential invasibility in a novel environment.

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**0585 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

W. Leo Smith[1], Jennifer Stern[1], Matthew Girard[1], Matthew Davis[2]

[1]*University of Kansas, Lawrence, Kansas, USA,* [2]*Saint Cloud State University, Saint Cloud, Minnesota, USA*

## Phylogenetic and Anatomical Diversity of Venomous Cartilaginous and Ray-Finned Fishes

Venoms and their associated delivery structures have been explored in a diversity of cartilaginous and ray-finned fish clades. Building off new and previously published anatomical studies, we will show the results of a molecular phylogenetic analysis across cartilaginous and ray-finned fishes that hypothesizes at least 18 independent evolutions of this specialization. Likelihood ancestral-states reconstructions of venomous structures indicate that they have evolved four times in extant cartilaginous fishes, once in eels (Anguilliformes), once in catfishes (Siluriformes), and 12 times in spiny-rayed fishes (Acanthomorpha). From our anatomical studies and phylogenetic reconstruction, we show that dorsal spines are the most common envenomed structures (~95% of venomous fish species and 15 independent evolutions). In addition to envenomed spines, fishes have also evolved venomous fangs (2% of venomous fish species, two independent evolutions), cleithral spines (2% of venomous fish species, one independent evolution), and opercular or subopercular spines (1% of venomous fish species, three independent evolutions). The diversity, anatomy, and biology of each venomous clade will be discussed.

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**1028 General Herpetology, Galerie 2, Thursday 7 July 2016**

Itzue Caviedes Solis, Adam Leache

*University of Washington, Seattle, Washington, USA*

## Leap frogging the Mexican Highlands: diversification of the *Plectrohyla bistincta* species complex (Anura: Hylidae)

The geological history of the Mexican highlands has influenced the diversification of the genus *Plectrohyla*. Most of the species are microendemic; however, some widespread species still enclose cryptic diversity with unique levels of gene flow. The present study aims to understand the biogeographical events that influenced the diversification of the *Plectrohyla bistincta* complex across the Mexican highlands. The complex includes the widespread species *P. bistincta*, which is paraphyletic to *P. pentheter* and *P. calthula*. We collected ddRADseq data for 51 individuals from 42 localities along eight mountain systems to identify the number of genetically distinctive populations and cryptic species. The ddRADseq data matrix contained 3,113 loci and 11,484 SNPs. We implemented a k-means clustering algorithm of unlinked SNPs to determine the number of populations, which supported six clusters: four groups within *P. bistincta*, *P. calthula*, and *P. pentheter*. A species tree estimated using SNAPP, a multispecies coalescent model method that uses unlinked bi-allelic markers, does not support the monophyly of *P. bistincta*. For *P.*

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*bistincta* Transvolcanic Belt and Sierra Madre Occidental enclose a distinctive population, and Sierra Mixteca represents a barrier between lineages from Sierra Madre del Sur of Oaxaca and Guerrero. *P. calthula* and *P. pentheter* are restricted to Sierra Mixe and Sierra madre del Sur, respectively. Speciation and population structure in the complex has been determined by geological events, landscape modifications, and climate changes during the Pleistocene. Despite their similarities in morphology and natural history, the Mexican highlands played an important role in lineage diversification in *Plectrohyla.*

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**0232 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Ann Somers, Aerin Benavides, Catherine Matthews

*University of North Carolina at Greensboro, Greensboro, N.C., USA*

**Lassoing Lizards, Trapping Turtles, and Snatching Snakes**

The HERP Project (Herpetology Education in Rural Places & Spaces) developed six curricula for herpetology education in informal science education settings. These curricula, designed for our summer programs called Herpetological Research Experiences (HRE), were developed over a five year period to engage youth from a variety of backgrounds with snakes, lizards, stream amphibians, ephemeral pools, box turtles, and semi-aquatic turtles. Instead of listening to talks, participants in our programs engage in hands-on activities facilitated by scientists and environmental educators to learn how to safely capture wild reptiles and amphibians. Students collect and report morphometric and habitat data and then release the animals safely at the point of capture. Instead of just holding pet-store snakes, as is the tradition in many nature centers, participants learn how to catch wild snakes that might bite. They trap and mark aquatic turtles, lassoed lizards, check cover boards, and track box turtles. The program has been effective in engaging youth with nature and with STEM. Additionally, many of our participants have had limited experience and little affinity with the natural world prior to the HRE. After the HREs, youth's stories overwhelmingly had to do with the novel experience of collecting data on animals in the wild, laced with descriptions of excitement and overcoming fear. The curricula are available for free download.

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**0364 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016**

Julia Sonn, Cori Richards-Zawacki

*Tulane University, New Orleans, LA, USA*

**The Influence of Temperature on Chytridiomycosis In Vivo**

Identifying which environmental features are most influential in the spread and virulence of emerging pathogens can be critical to the prevention of diseases. For example, high temperatures appear to negatively impact the fungal pathogen *Batrachochytrium dendrobatidis* (Bd) and may inhibit the persistence of amphibian chytridiomycosis in certain habitats. We investigated the effects of small differences in host body temperature on pathogenicity of Bd and the outcome of infection in Northern cricket frogs (*Acris crepitans*), a species that is reported to be declining in the northern part of its range. We chose six temperature treatments (11, 14, 17, 20, 23, and 26°C) based on the thermal range of the fungus and analyzed how these treatments affected the course of infection with Bd. Our results will provide insight into the influence of host body temperature on Bd infection, which can be used to model the pathogenicity of chytrid fungus within living amphibian hosts. In addition, to better understand the effects of season and latitude on Bd, we took temperature data from wild cricket frogs and tested them for Bd. We tested the hypotheses that 1) hosts exhibit behavioral thermoregulation and that infected individuals choose warmer microclimates than uninfected individuals and 2) that infection intensity differs with latitude and season. Our results will help predict times and locations during which hosts are unable to reach body temperatures needed to avoid or combat Bd, leaving them susceptible to declines and extinctions.

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**0590 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Conrad Speed[1], Mark Meekan[1], Mike Cappo[2]

[1]*Australian Institute of Marine Science, Perth, Western Australia, Australia,*
[2]*Australian Institute of Marine Science, Townsville, Queensland, Australia*

**Evidence of recovery of shark and ray populations at a remote Marine Reserve in north Western Australia**

There is an ongoing debate about the efficacy of Marine Reserves to protect large and highly mobile organisms. Using Baited Underwater Video Stations (BRUVS) as part of the Global FinPrint Project, we assessed whether elasmobranch abundance and diversity has changed with Marine Reserve enforcement at Ashmore Reef, Western Australia. Ashmore Reef is an emergent continental shelf-edge reef in the Indian Ocean, located 800 km west of Darwin and 140 km south of Indonesia. A Commonwealth Marine Reserve was established in 1983, although historically this area was fished by traditional Indonesian fishers. Illegal fishing has since been observed at Ashmore; however Australian Customs have had an ongoing permanent presence at the reef since 2000. We

compare archival data from a 2004 BRUVS survey with a recent survey in 2016. We deployed over 100 BRUVS during 2016 around the shallow (0-40 m) reef slope and backreef habitats within the Marine Reserve. The shark assemblage was dominated by *Carcharhinus amblyrhynchos* in the current and previous surveys. The current survey showed numerous species that were not observed in 2004, such as: *Galeocerdo cuvier*, *Nebrius ferrugineus*, *Stegostoma fasciatum*, and *Himantura granulata*. Members of the Rhynchobatidae family were also observed more frequently in the current survey. Our results might have been due to a greater extent of spatial sampling in 2016, or seasonal differences in species distribution between the two surveys. We assess how species distribution and abundance varies across habitats, depth, and through time and discuss whether changes to border enforcement have affected elasmobranch populations.

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**0319 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

McKayla Spencer, C.M. Gienger

*Austin Peay State University, Clarksville, TN, USA*

**Metabolic and Thermal Responses to Feeding: Comparing a Semi-aquatic and a Terrestrial *Agkistrodon* Species**

Investigating patterns of energy use by different species gives insight into survivorship and general ecology. Commonly used measures such as Standard Metabolic Rate (SMR) and Specific Dynamic Action (SDA) are especially informative for comparing patterns of energy use among species and in comparing sources of variation in energy use. Cottonmouths (*Agkistrodon piscivorus*) and Copperheads (*Agkistrodon contortrix*) offer a unique situation for comparison of patterns of energy use because of their differing ecologies and diets. Cottonmouths are a semi-aquatic species foraging opportunistically on a variety of prey, while Copperheads are terrestrial and primarily prey on rodents. Data was collected using an open-system respirometer to measure metabolism and a laboratory thermal gradient to measure post-prandial body temperature selection by digesting snakes. We measured standard and post-prandial metabolism of the two species at different temperatures and at different levels of feeding (meal sizes). Analysis is ongoing to compare energy use as a function of physiological and behavioral responses to feeding between two *Agkistrodon* species.

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**0591 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016**

Brenton Spies[1], David Jacobs[1], Camm Swift[2], Ryan Ellingson[1]

*[1]University of California, Los Angeles, Los Angeles, CA, USA, [2]Natural History Museum of Los Angeles, Los Angeles, CA, USA*

### Evolution, Speciation, and Endangerment of the Tidewater Gobies

The endangered closed-estuary specialist goby genus *Eucyclogobius,* the tidewater gobies, is the most locally differentiated vertebrate taxon on the Pacific coast. It is subdivided into regional clades, which are further subdivided into long isolated entities. Clades and subclades exhibit regionally distinct metapopulation processes. In addition, the southernmost clade is deeply divergent with a lineage separation occurring in excess of a million years ago. It is reciprocally monophyletic in nuclear and mitochondrial markers and morphologically distinct in counted lateral line attributes, fin rays, and measured characters as determined by discriminant function analysis as well as rate of development. This distinctive southern entity is currently under review as a new species. The southern tidewater goby is critically endangered, having been reduced to three small lagoonal populations on Camp Pendleton, Northern San Diego County. Captive refuge populations derived from the three remaining populations have recently been established to reduce the risk of extinction associated with the vulnerability to drought and flood. Due to their metapopulation process and subdivision, the Tidewater Gobies are of exceptional scientific interest. We will outline the events that led to range reduction and endangerment of the southern species, current status and management goals, as well as the steps being taken to increase their likelihood of persistence.

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**1007 General Herpetology, Galerie 3, Thursday 7 July 2016**

Kari Spivey, Brian Greene

*Missouri State University, Springfield, MO, USA*

### Variation in venom expenditure in cottonmouths (*Agkistrodon piscivorus*) across prey sizes, prey types, and snake body temperatures

Pit vipers possess a sophisticated venom delivery system enabling them to efficiently disable prey. To avoid retaliatory countermeasures, snakes typically release envenomated prey which are then trailed and consumed after succumbing to venom effects. Successful retrieval of released prey should vary with venom resistance and trail ability of prey types. Rattlesnakes have been suggested to adaptively modify envenomation strategies to compensate for variation in prey susceptibility: adjusting venom expenditure and holding, rather than releasing, prey. Variation in envenomation strategies has been evaluated in a limited number of snake species. We examined the effects of prey size and prey type (mice, lizards, and frogs) on foraging behavior and venom expenditure in a cohort of juvenile cottonmouths. In the prey size experiment snakes injected significantly larger amounts of venom into small mice than in larger size

classes. Venom expenditure did not vary significantly among prey types. However, lizard prey were held significantly more often, and survived significantly longer, than mice. We also evaluated the effect of snake body temperature on foraging response variables across a range of ecologically relevant temperatures (18°C-30°C). Cottonmouths were equally willing to forage across the entire range of body temperature treatments but injected significantly less venom, and held prey significantly more often, at 18°C than at 25 or 30°C. These results are consistent with a thermal constraint on envenomation performance at lower operant temperatures. Overall, our results suggest that cottonmouths modify foraging behavior to compensate for both venom resistance in ectothermic prey and decreased performance at lower temperatures.

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**0962 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Geoffry Spooner[1], Reid Adams[1], Lindsey Lewis[2]

*[1]University of Central Arkansas, Conway, AR, USA, [2]US Fish and Wildlife Service, Conway, AR, USA*

## Upriver Population Characteristics of the Ohio shrimp, *Macrobrachium ohione*, in Arkansas

The Ohio shrimp (*Macrobrachium ohione*) is amphidromous, where marine habitats are required for early juvenile development, but other life stages are able to be completed in freshwater. In the Mississippi River system, upriver adult habitat historically included the Ohio River and Upper Mississippi River, but abundance has reportedly declined, particularly upriver of Louisiana. Migration has been hypothesized to be impacted by dams and channel flow alterations. Current range, abundance, and life history of Ohio shrimp are relatively unknown upriver of Louisiana. During May-October of 2015, 48 Ohio shrimp were trapped in the lower Arkansas River, eight in the White River, two in the St. Francis River system, and 43 in the Arkansas reach of the Mississippi River. These are the first collections indicating tributaries to the Mississippi River in Arkansas are upriver habitat for Ohio Shrimp. Young-of-year females were more abundant than males, but Age-1 females were rarely caught compared to Age-1 males. Our overall upriver sex ratio was 60% male and 40% female, whereas coastal populations tend to be female skewed. Additionally, four Age-1 females were caught in the White River during late June/early July 2015 that had eggs visible between the swimmerets suggesting downriver reproductive migrations by adult females. Ohio shrimp occur in Arkansas habitats greater than 600 river kilometers from the Gulf of Mexico and show patterns suggestive of downriver female migration to complete the amphidromous life cycle.

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**0721 Herp Conservation & Ecology, Galerie 2, Sunday 10 July 2016**

James Spotila[1], Pilar Santidrián Tomillo[2], Gabriela Blanco[3], Nathan Robinson[4], Rotney Piedra[5], Bryan Wallace[6], Vincent Saba[7], Tera Dornfeld[8], Julianne Koval[4], Jennifer Swiggs[4], Pamela Plotkin[9], Richard Reina[10], Anthony Steyermark[11], Frank Paladino[4]

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**27 Years and Counting: Leatherback Turtles, *Dermochelys coriacea*, at Parque Marino Nacional Las Baulas in Costa Rica- Down but not Out!**

We have been measuring the size of the leatherback turtle population at Parque Marino Nacional Las Baulas in Costa Rica since 1988. During that time we have marked 1993 nesting females and produced about 1,132,000 hatchlings from the beach and a hatchery. In 1988 the population was 1504 nesting females. In 2015-2016 the population was 25. That decline was predicted in a population model that we published in 2000. At that time we predicted that there would be about 25 turtles nesting in 2015 even with beach protection, an end to egg poaching and a hatchery. While the park has been partially consolidated and construction of homes and hotels stopped, the population has still declined. The decline still appears to be due to mortality at sea due to fishing activities such as gill nets and longlines along the South American coast. Mortality rates remain about 22%% per year on nesting females and are probably the same on subadult animals. Unless these activities change the population will not survive. The adult population nesting at Las Baulas and Northwest Costa Rica is about 120 nesting females and the East Pacific nesting leatherback population is about 300. While these numbers are very disappointing from a conservation perspective, it is important to note that the population can still recover. Protection of nesting turtles and their beaches provides a continuing supply of hatchlings to the population. If protection can be improved at sea the population can rebound.

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**1092 Fish Ecology I, Salon A-C, Saturday 9 July 2016**

Griffin Srednick, Mark Steele

*California State University, Northridge, Northridge, California, USA*

**Influence of the Structure of an Invasive Alga on the Distribution of Fishes**

In temperate marine environments, the physical structure of algae (e.g., giant kelp) can provide important shelter from predation for juvenile fishes and increased access to

food. Recent variation in local sea surface temperature has led to decreases in giant kelp and increases in the invasive alga *Sargassum horneri* along the southern California coast. The structure provided by *S. horneri* is far different than that of giant kelp (especially the height), as well as many of the native algae. These changes are expected to alter the distribution of fishes throughout the water column. To investigate the effects of these changes, we conducted underwater visual surveys of the fish and algal assemblage at seven sites along the leeward coast of Santa Catalina Island. Transect surveys were performed at three strata: upper-water column, mid-water column, and benthic, to quantify differences in the fish assemblage due to variation in algal structure. The results indicate that the fish assemblage differs among different depth strata and that this difference depends on the type and density of algae present. There were seasonal differences in the fish assemblage among sites due to differences in algal composition and density among seasons. The results of this study indicate that the fish assemblage is influenced by changes in algal structure, and suggests the importance of considering algal identity, structure, and density when attempting to predict fish distribution in a changing marine environment.

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**0567 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Katherine St. Clair, Tasha Metz, David Wells

*Texas A&M University - Galveston Campus, Galveston, TX, USA*

## Stable isotope variability in cownose rays (*Rhinoptera bonasus*) within the northwestern Gulf of Mexico

The trophic ecology of cownose rays (*Rhinoptera bonasus*) has been studied extensively along the Atlantic coast and eastern Gulf of Mexico, but is not well described in the northwestern Gulf of Mexico. Therefore, this study examined spatial and temporal trends in carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotopes along the Texas coast, as well as the influence of size and sex of individuals on stable isotopes by quantifying isotopic niches via Bayesian ellipses created within the R package 'Stable Isotope Bayesian Ellipses in R' (Jackson et al. 2011). Epidermal samples, from the trailing edge of the pectoral fin, were collected for isotopic analysis during in-water entanglement netting surveys conducted along the Texas coast from 2009 – 2012. Isotopic niche size was comparable across Texas bay systems in 2012, with only the lower Laguna Madre (spring) significantly different. However, mean $\delta^{13}C$ and $\delta^{15}N$ signatures varied spatially across bay systems. Isotopic niche size varied seasonally within the lower Laguna Madre, with summer 2012 significantly different than all other sampling periods. Additionally, female mean $\delta^{13}C$ signatures were significantly enriched compared to those of males, indicating female rays are foraging over longer periods of time within inshore habitats. There was also evidence of differential foraging between life history stages, with mean $\delta^{13}C$ signatures of subadults differing significantly from adult rays in Aransas Bay. Future studies should utilize a multi-tissue approach to enable

comparisons of trophic ecology over both short- and long-term timescales, as well as incorporate stomach content analysis to identify prey species consumed.

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**0897 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Daniel Stadtmauer[1], Mark Sabaj[2]

*[1]Yale University, New Haven, CT, USA, [2]The Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA*

### Taxonomic Overview of Mongolian Stone Loaches (Cypriniformes: Nemacheilidae)

Kottelat (2006) reported five nominal valid species of Nemacheilidae (stone loaches) in Mongolia: *Barbatula compressirostris*, *B. dgebuadzei, B. toni, Lefua costata*, and *Triplophysa gundriseri*. He also noted two unnamed species of *Barbatula* from the Selenge Basin, one of which was subsequently described as *B. sawadai* from the Tuul/Yeruu subbasin (Prokofiev 2007). The second unnamed *Barbatula* was from the Eg River, the sole outflow of Lake Hovsgol. Kottelat also noted an unnamed species of *Triplophysa* in the Tuul River (Selenge Dr.). Prokofiev (2007) recognized four *Barbatula* in Mongolia: *B. barbatula toni*, *B. dgebuadzei, B. sawadai,* and *B. golubtsovi* and the lattermost was treated as a questionable synonym of *B. compressirostris* by Kottelat (2006). Over the course of three expeditions to Mongolia in 2006, 2011 and 2012, large series of nemacheilid loaches were collected throughout Mongolia except for its westernmost limits. From those samples, analyses of internal and external morphology have identified three distinct lineages: *Barbatula toni* group, "Barbatula" *sawadai* group, and *Triplophysa* group. Morphotypes within the *Barbatula toni* group are relatively uniform and appear to be conspecific (i.e., *B. dgebuadzei* is a junior synonym of *B. toni*). "Barbatula" *sawadai* is restricted to the Selenge Basin, morphologically uniform, and unlikely related to true *Barbatula*. At least two nominal valid species of *Triplophysa* occur in Mongolia: *T. arnoldii* and *T. gundriseri.* Three potentially undescribed species of *Triplophysa* occur in the rivers draining the Hangay Plateau south into the Gobi desert, west into the Central Depression, and north into the Selenge Basin.

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**0737 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Bruce Stallsmith, Tiffany Bell

*University of Alabama in Huntsville, Huntsville, AL, USA*

### Unusual Female-Biased Sex Ratios in Syntopic Populations of Two Species of *Ulocentra* Darters, *Etheostoma simoterum* and *E. duryi*, in the Flint River of Alabama

*Etheostoma simoterum* (Tennessee Snubnose Darter) and *E. duryi* (Blackside Darter) are similar species in the subgenus *Ulocentra* often found syntopically in stream systems

tributary to the Tennessee River in north Alabama. We made 12 monthly collections of these species from September, 2014, through August, 2015, at a site on the Flint River in Madison County, Alabama. Fish were collected with a four meter long seine along a 300 meter stretch of river characterized by alternating runs and riffles over a substrate that is variously gravel, cobble and boulder. For almost all of these months we have 16 or more adults of both species, typically 30–40 and sometimes as many as 100. Our primary interest was to examine reproductive schedules of the two species to see if there are any significant differences in timing, gonadal maturation, and oocyte number and size. Our initial assumption was that we would find roughly equal numbers of males and females in collections of both species. We found instead that in 11 of 12 monthly collections of *E. simoterum* there was a female skew of as much as 6:1, while *E. duryi* collections were less female skewed with seven months showing a female skew, three months a male skew, and two months with equal numbers. We have not seen or heard of other darter collections with consistent sex ratio skews. We are curious if anyone has seen such sex ratios in any species of darter, and hopefully why this might be.

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**1021 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Nathanael Stanek, Evon Hekkala

*Fordham University, New York, NY, USA*

**Phylogeography of the Forest Hinged Tortoise, *Kinixys erosa***

We examined the phylogeographic differentiation of forest hinged tortoises, *Kinixys erosa*, using sequence fragments from three regions of mitochondrial DNA: 12S rRNA, ND4, and cyt-*b* from archived specimens representing much of the known geographic distribution of the species. Maximum parsimony, maximum likelihood, and haplotype network analysis congruently defined three distinct mitochondrial lineages corresponding to major geographic regions of African rainforest. Most notably, our preliminary results have identified a highly-divergent Congo Basin group. Since the archival tissues available for this study do not represent the full extent of *K. erosa* populations, there is potential for uncovering additional cryptic lineages in other biogeographic regions. To rule out competing explanations for the phylogeography and evolutionary history of *K. erosa*, additional sampling should be directed towards these data gaps. We are optimistic that the conservation of *K. erosa* will be advanced by this and future work that seeks to define significant management units.

CANCELED

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**0792 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Edward Stanley

*Florida Museum of Natural History, Gainesville, Florida, USA*

### Phylogenetic and ecological diversity within the widespread melanistic species *Hemicordylus capensis*

The Cape Fold Mountains (CFM) are a topologically and ecologically diverse range of shale and sandstone formations that run the length and breadth of South Africa's Western Cape Province. Melanism has evolved multiple times in ectotherms of the CFM, invariantly as an adaptation to cold environments. *Hemicordylus capensis* is unique among melanistic lizards from the Western Cape in having a broad distribution, occurring across the entire range, and is seemingly able to tolerate a large range of climatic conditions. In the warm northern extremes of its range, for example, *H.capensis* utilizes specific habitats that allow the lizards to thermoregulate more effectively. Despite receiving attention from ecologists and conservation biologists, the evolutionary history of *Hemicordylus* is poorly known and a phylogenetic assessment of the group is overdue. This study utilizes sequence data from *H. capensis* collected from across the full extent of its range and combines multi-locus molecular phylogenetic analyses with CT-based morphological analysis and ecological niche modeling to identify the extent of populations' genetic, phenotypic and ecological divergence within *H. capensis*. Five major clades were recovered from the phylogenetic analysis, corresponding to four major mountain ranges in the CFM. CT scans of representatives from each clade revealed that the "heat-tolerant" northern forms were morphologically distinct from all the other clades, being much more gracile and poorly armored. Significant breaks in suitable habitat exists between four of the five populations and significant ecological divergence is seen between all populations, suggesting that the group may contain significant amounts of unrecognized species diversity.

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**0224 Herp Morphology & Genetics, Galerie 3, Sunday 10 July 2016**

C. Tristan Stayton

*Bucknell University, Lewisburg, PA, USA*

### What Proportion of Turtle Shell Shape Evolution Can Be Explained by Functional Performance?

The turtle shell is a unique morphological structure that performs a number of functional roles. Most obviously the turtle shell serves as armor to resist forces imposed on the shell by predators. In addition, the shell is a hydrodynamic element that generates drag during swimming, an obstacle to righting when the turtle is overturned, and a structure which exchanges heat with the environment. The shape of a turtle's shell can affect its performance in all of these roles. This study addresses two questions: first, is it possible to integrate performance measures among all these functions to determine optimal shell shapes, or ranges of shell shapes, for various ecological categories of

turtles? Second, what proportion of the variation in shell shape can be explained by reference to performance in these functions? Using engineering optimization principals (including reference to Pareto optimization) and newly-developed comparative techniques, the actual distribution of turtles in shell shape space is compared with predicted optimal ranges. Although the optimal shapes for certain ecological groups generally conform to the observed shell shapes for those groups, there are many exceptions. Surprisingly little variation - only ~30% - is explained by functional performance. Together, these findings point towards the presence of additional and highly influential functional factors affecting shell shape evolution, or towards the action of non-adaptive processes (such as developmental constraints) in the evolution of turtle shell shape. In either case, the results suggest a number of fruitful avenues for future research in understanding the diversification of this fascinating structure.

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**1060 Fish Conservation, Galerie 3, Sunday 10 July 2016**

Clare Steele[1], Vanessa van Heerden[1], Mark Steele[2], Sean Anderson[1]

*[1]California State University, Channel Islands, Camarillo, CA, USA, [2]California State University, Northridge, Northridge, CA, USA*

## Evidence for Human Impacts on Reef Fish Communities on an isolated Oceanic Island

Remote oceanic islands offer an opportunity to study the interaction of human and natural systems in relative isolation. Aitutaki Island (Cook Islands) offers a unique location to observe the coupled dynamics between human systems and coral reefs. Aitutaki is an almost-atoll in the South Pacific that is subject to a variety of synergistic threats, including poor water quality, overfishing, ciguatera, marine debris and climate change. The coral reefs surrounding Aitutaki present a gradient of human influence, with reefs around the inhabited main island suffering the effects of increased turbidity and elevated nutrients from freshwater runoff. We evaluated how reef fish communities differed between reefs near the main island versus those more distant from human influence. Along transects at twelve shallow reef sites, we assessed reef fish abundance and diversity, and evaluated the habitat. Reefs closer to human populations had lower species richness of reef fishes, less coral, and higher densities of macroalgae. Reefs further from the inhabited island had a significantly greater diversity of fishes, as well as higher densities of coral-dependent species, and harvested species such as Lethrinids and Serranids. Coral reefs are a vital marine resource for Cook Islanders, yielding a variety of foods, supporting sustainable tourism and providing coastal protection. Understanding the influence of anthropogenic impacts is an important step in restoring and maintaining the health of these systems.



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**1071 Fish Reproduction, Physiology, & Conservation, Balconies J & K, Sunday 10 July 2016**

Mark Steele, Mia Adreani

*California State University Northridge, CA, USA*

### Effects of temperature on interannual variation in reproduction of three batch-spawning kelp forest fishes

The extent to which reproductive success of fishes varies from year to year is seldom known, even for ecologically and economically important species. We studied the reproductive ecology of three key species in kelp forests in southern California: kelp bass (*Paralabrax clathratus*), California sheephead (*Semicossyphus pulcher*), and señorita (*Oxyjulis californica*) over 7 years that varied widely in temperature regime and included one of the largest El Niño events ever recorded. We tested the general hypothesis that interannual variation in reproductive parameters could be predicted from water temperature. Spawning season duration, spawning frequency, batch fecundity, and total annual reproductive output were measured at 3 large reefs (>70 hectares each). Specifically we tested the hypotheses that in warmer years (1) the onset of reproduction would occur earlier, (2) the reproductive season duration would be longer, (3) total annual reproduction would be higher, but (4) batch fecundity would be unrelated to temperature. Reproduction started earlier in warm years for one species, but not the other two. Contrary to our expectation, the duration of the reproductive season was unrelated to water temperature, and it tended to end earlier in warm years in all three species. Batch fecundity and total reproductive output varied markedly (2-4 fold) among years, but were not related to water temperature. Thus, for this suite of temperate reef species from families with tropical affinities, our expectation that warm years would be better for reproduction was not generally upheld.

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**0070 NIA BEST STUDENT PAPER, Salon A-C, Friday 8 July 2016**

Sarah E. Steele[1], Hernán López-Fernández[2]

[1]*University of Toronto, Toronto, Canada,* [2]*Royal Ontario Museum, Toronto, Canada*

### Examining the Role of Ontogeny and Body Size Evolution in the Diversification of Neotropical Cichlid Fishes

The association between body size diversity and species, morphological and ecological diversity has been explored in fishes yet the role, if any, of body size in fish macroevoutionary divergence is still poorly understood. Changes in body size and shape are ultimately driven by changes in the timing of developmental events. Perturbations of growth rate and duration during ontogenetic development lead to the natural variation in populations that natural selection acts upon and directly determines the variation in traits that we study in adults. Trajectories of species growth (i.e. morphological shape change over age or size) have commonly been studied in vertebrates, yet the macroevolution of ontogenetic information and how ontogenetic

development influences adult variation have rarely been studied. Using geometric morphometrics, we studied the ontogenetic allometry of Neotropical cichlids to determine when the morphological and ecological diversity seen in adult fishes is produced and to describe the patterns of ontogenetic changes over the phylogeny of Neotropical cichlids. Divergence in morphology among species occurs early in ontogeny, with species developing into an adult-like form at early ontogenetic stages followed by relative stasis of morphology and proportional growth. Functionally specialized groups are also highly divergent even in their early ontogenetic stages, suggesting ontogenetic shifts occur rapidly in early development. Understanding the growth of organisms and the variation among individuals across population can aid in understanding the divergence of adult morphology and ecology across species that is so commonly studied in macroevolution.

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**0354 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

John Steffen, Stephen Drozda, Jessica Hultberg

*Penn State Erie, The Behrend College, Erie, PA, USA*

**The effects of carotenoid and food supplementation on Blood Plasma Reactive Oxygen Species levels in Painted Turtles**

Animals use a variety of pigments to color their integument, including pigments known as carotenoids. Carotenoids are photosynthetic pigments in plants that animals must acquire from their diet and play diverse and important roles in photo-protection and free-radical scavenging. As a result, carotenoid-based skin colors are hypothesized to function as honesty-reinforcing mechanisms that underlie the use of colorful ornamental traits in sexual selection. The Painted Turtle (*Chrysemys picta*) has red and yellow patches and stripes on the skin and carapace which are colored by two carotenoids: an apocarotenoid (which generates yellow colors) and astaxanthin (which generates red colors). We performed a two factor lab experiment to investigate the effect of carotenoid access and food amount (i.e., food quantities to facilitate weight maintenance vs weight gain) on Reactive Oxygen Species (ROS) level in blood plasma. ROS levels are known to increase dramatically during times of environmental stress (e.g., UV or heat exposure) and promote tumor development. We found no evidence that male Painted Turtles mediate ROS levels by using carotenoids as free-radical scavengers in the blood. However, we found that weight maintained turtles had significantly higher ROS levels than weight gained individuals suggesting that a) turtles that eat only enough to maintain weight are stressed, or b) turtles that gain weight are gaining anti-oxidant benefits.

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**0491 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Ehlana Stell[2], Glen Parsons[1], Jan Hoover[2]

*[1]University of Mississippi, Oxford, Mississippi, USA, [2]ERDC, Vicksburg, Mississippi, USA*

## Estimating Burst Swim Speeds and Jumping Characteristics of Silver Carp (*Hypophthalmichthys molitrix*) Using Video Analyses and Projectile Physics

Invasive fish species management has long been an issue for consideration in all wildlife and fishery industries. Without management control, invasive species such as the Asian silver carp (*Hypophthalmichthys molitrix*) will continue to exploit already vulnerable habitats disrupting native fisheries and inflicting unknown ecological damage. In this study we used on-line videography to estimate burst swim speeds, horizontal and vertical distance traveled, and angle of exit of silver carp during leaps. Additionally, we tested the hypothesis that carp exit the water at an angle that maximizes distance traveled. Our data show that silver carp reach speeds near 10 body lengths per second which is much higher than previously believed. Carp reach mean heights of 1.93 body lengths and travel a mean distance of 4.76 per leap. Maximum height and distance traveled were 4.58 and 11.5 body lengths, respectively. Our results, while preliminary, suggest the leaping abilities of silver carp may be greater than previously documented. These data may be valuable in the development of control methods to halt or slow the spread of Asian carp. Further investigation is needed particularly regarding the effects of environment on leaping characteristics in this fish.

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**0814 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Anne Stengle[1], Paul Sievert[1], Tom Tyning[2], Alan Richmond[1]

*[1]University of Massachusetts, Amherst, MA, USA, [2]Berkshire Community College, Pittsfield, MA, USA*

## Conserving Snake Species of Greatest Conservation Need Threatened by an Emerging Fungal Skin Disease

Within the past several years, there appears to be an increase of observations of snake species exhibiting facial lesions, leading to many studies as too the cause. Recent work has correlated these facial lesions to fungal species *Ophiodiomyces ophiodiiocola*, also known as snake fungal disease (SFD). These lesions often involve the orbit, pit-organ, or labial region, causing concern for the individuals' survivorship. Following protocols of the New England Timber Rattlesnake (*Crotalus horridus*) research of SFD by Roger Williams Park Zoo (Providence, RI), we currently have a 9 state SWG grant (2014-2015) to investigate effects of SFD on populations. With this study we assess the presence of SFD in all snake species in nine states by submitting biopsies to the National Wildlife Health Center. We're also assessing treatment strategies for severely infected individuals. In addition, the one MA population of Timber Rattlesnakes with the highest report of SFD is currently being radio tracked to assess if there are any

differences between infected and non-infected regarding overwintering, movements, and habitat use. We are currently assessing management strategies of headstarting and captive breeding for populations not only suffering from SFD, but isolation, inbreeding, and increased mortality from road kill, poaching, and intentional killings. Our future project includes introducing a new population in a protected area within the Quabbin Reservoir, in Massachusetts.

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**0452 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Sean Sterrett[1], Todd Dubreuil[2], Evan Grant[2]

*[1]Penn State University, University Park, PA, USA, [2]U.S. Geological Survey, Turners Falls, MA, USA*

## Development of a novel passive integrated transponder (PIT) vertical telemetry system for studying hypogean movements of woodland salamanders (*Plethodon*)

Woodland salamanders (genus *Plethodon*) are the most abundant vertebrate group in Eastern temperate forests, have their center of diversity in the U.S., and have unique roles in ecosystem function. Widespread declines have been recently suggested based on re-visits to historically occupied sites. However, we know that up to 80% of a salamander population is belowground, which means that perceptions of population declines may result from most individuals simply hiding underground with greater frequency in contemporary surveys compared to historic visits. This difficulty in detecting surface-active individuals, combined with their known sensitivity to temperature and moisture, has implications for their conservation. Woodland salamanders are known to make daily and seasonal vertical movements in the forest floor, although no technology exists to quantify these fine scale movements. Here, we report on the development and testing of an antenna and experimental mesocosm system for tracking salamander movements in an environment aimed to mimic forest floor conditions. We monitored the vertical movements of twelve PIT-tagged red-backed salamanders (*P. cinereus*), using this new technique over three months in a laboratory environment. The development of these methods will guide our understanding and broaden our ability to test hypotheses related to salamander microhabitat ecology, which is critical for setting management goals for resource management agencies and predicting true population declines under changing environmental conditions. Based on this successful testing, we are developing field-deployed arrays to observe and map below-ground movements in response to real environmental conditions and at real population densities.

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**0781 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Duane Stevenson, Gerald Hoff, James Orr, Ingrid Spies, Chris Rooper

*NOAA/National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, USA*

### Fishery Interactions with Skate Nursery Areas in the Eastern Bering Sea

Since early 2015, fishery observers in the North Pacific Groundfish and Halibut Observer Program have been receiving training in the identification and sampling of skate egg cases. The goal of this training has been to support an NPRB project examining the unique properties of skate nursery sites in the eastern Bering Sea and the interactions of fisheries with skate egg cases. During the 2015 training year, over 230 observers received training in egg case identification and sampling, and recorded data on over 1000 skate egg cases. A total of 11 skate taxa were identified from egg cases, and over half (58%) of the egg cases were identified as Alaska skate (*Bathyraja parmifera*). Observers scored each egg case as either "viable", meaning it contained an intact egg or embryo in some stage of development, or "non-viable", meaning it was either empty or full of mud. Approximately 33% of the egg cases sampled by observers were classified as viable. Program wide, over 10,000 skate egg cases were encountered by observers. The majority of those egg cases (87%) were encountered on longliners targeting Pacific cod in the Bering Sea. Egg case encounters were concentrated on the outer shelf of the eastern Bering Sea, and over half of all egg cases reported were encountered in the area of Bering Canyon. Data collection for this project will continue through 2017, by which time we hope to have a comprehensive overview of fishery interactions with skate nursery areas in the eastern Bering Sea.

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**1006 NIA II, Galerie 3, Sunday 10 July 2016**

Donald Stewart

*SUNY Coll. Envir. Sci. & For., Syracuse, NY, USA*

### Taxonomic and Conservation Status of *Arapaima mapae*: Data Deficient Fishes in Limited Habitat

Conservation status of all five nominal species of *Arapaima* remain uncertain; these fishes should be considered 'data deficient' based on IUCN criteria. *Arapaima mapae* was described from a 2-m long, dried/stuffed mount. It was collected in 1837 from Lago do Amapá, a coastal lagoon in Brazil north of the Amazon delta. *Arapaima mapae* is distinguished from all other *Arapaima* by a distinctive, horizontally-elongate first lateral-line scale (versus such scales transversely ovate in other *Arapaima*); *A. mapae* is further distinguished from *A. arapaima* by its slender body form, and from *A. arapaima, A. gigas and A. leptosoma* by its slender caudal peduncle (~4% SL vs. ~6% SL in latter three taxa); it is readily distinguished from *A. agassizii* by its relatively larger eye, longer anal-fin base and other characters. Lago do Amapá is one of a series of lagoons along the Brazilian coast between the Amazon mouth and French Guiana (or Guyane) from which

not a single specimen of *Arapaima* has been collected since 1837. A 1949 report from Guyane indicated that *Arapaima* occurred in most of the larger rivers of that country, but recent studies by French biologists failed to find any. Much farther south in the Brazilian state of Bahia, a single *Arapaima* specimen was collected about 1851, but there are no records from that area since then. Implications are that coastal drainages may have limited habitat for *Arapaima,* and such populations may be vulnerable to extirpation. Assessment of conservation status of *A. mapae* is urgently needed.

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**0379 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

Melanie Stiassny[1], Prosanta Chakrabarty[2], Fernando Alda[2]

*[1]American Museum of Natural History, New York, NY, USA, [2]Louisiana State University, Museum of Natural Science, Baton Rouge, LA, USA, [3]Louisiana State University, Museum of Natural Science, Baton Rouge, LA, USA*

## Out of Tanganyika or into Tanganyika? Genome-wide UCE data elucidate the relationships and biogeographic history of the enigmatic lamprologines of the Lower Congo River

The large cichlid tribe Lamprologini numerically dominates inshore fish communities in Lake Tanganyika (LT) and due, in large part, to their ecological, behavioral, and reproductive diversity lamprologines have been subject to extensive field and lab-based study. Unlike the other LT cichlid lineages, lamprologines are represented not just in the lake but also throughout the Congo basin, with a noteworthy concentration of species diversity centered along the lower reaches of the Congo River (LCR). While monophyly of the tribe is strongly supported by both morphological and molecular data, no consensus has yet been reached regarding lamprologine intrarelationships, and in particular the placement of the riverine taxa remains unresolved. Most previous studies have focused on LT species and relied primarily on mtDNA data to resolve their intrarelationships; a strategy driven principally by a noteworthy lack of ncDNA variation in commonly sampled markers. Of the few mtDNA studies that have included one or more riverine taxon, all have them as nested within the lacustrine radiation. A single study utilizing ncDNA (RAG1) suggests an alternative placement with riverine species resolved as sister to the LT radiation. In the present study we investigate the utility of genome-wide UCE data to resolve lamprologine phylogenetics at multiple scales; from the placement of riverine taxa in relation to the lamprologine radiation as a whole, as well as for elucidating species-level relationships and population structuring within and between LCR and upstream Congo River species.

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**1000 General Ichthyology I, Balconies J & K, Sunday 10 July 2016**

Warren Stiles, Carol Johnston

*Auburn University, Auburn, AL, USA*

**Hydrologic Change as a Driver in Fish Assemblage Shifts in Alabama, USA**

Past studies within single watersheds in the Southeast have found that unnatural changes in stream hydrology affect the fish assemblage negatively. With increases in land development and water withdrawals, significant declines in discharge and increases in flashiness have been seen in some Southeastern streams over the past 50 years. In this study, contemporary fish assemblage data collected in the summers of 2013 and 2014 were compared to historic collections in 6 unregulated watersheds across the physiographic regions of Alabama. Using redundancy analysis (RDA) relationships between land cover, hydrologic variation, and stream fish assemblages were investigated. Hydrology was found to have a significant effect on the fish assemblages in 4 of the watersheds. Where hydrologic regimes were found to have been altered, the assemblages were dominated by generalist species and were variable through time. In a watershed on the Talladega National Forest, the fish assemblage was found to be more stable over time than those in more developed watersheds. In another watershed that drains to the Tennessee River, it was found that flashiness had decreased over the past 30 years and this was coincided with stable assemblages that were dominated by a mix of generalists and specialist. Many of the hydrologic changes seen in this study were related to changes in land cover that in some instances led to an increase in flashiness and sometimes a decrease in average discharge. These changes are important to keep in mind for the conservation of the diverse and distinct fish fauna of Alabama.

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**0207 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Andrew Stites[1], Joshua Sherwood[1], Jeremy Tiemann[1], Michael Dreslik[1]

*[1]Illinois Natural History Survey, Champaign, IL, USA, [2]University of Illinois Urbana-Champaign, Champaign, IL, USA*

**Reassessment of Iowa Darter Habitat in Illinois**

The Iowa Darter (*Etheostoma exile*) is a state-threatened fish species inhabiting a limited range in northern Illinois. Historical surveys (from 1901-1995) found Iowa Darters at only 40 sites, with 19 sites being from glacial lakes near the Wisconsin border leading to the conclusion they primarily inhabited glacial lakes. Recent surveys (since 1995) have found *E. exile* at 37 sites, with only 13 of those sites being from glacial lakes. Many of the recent surveys have focused on headwater streams that have had limited to no previous records of fish sampling. The combined findings illustrate the need to evaluate whether populations of Iowa Darters routinely inhabit the headwater streams of northern Illinois. Using the recent collection locations, species distribution models were created to guide future sampling in streams potentially having *E. exile* populations. Models indicated many of the potential locations for *E. exile* are headwater streams with no previous

history fish community sampling. This might be because small streams having predications for occurrence are not routinely sampled by natural resource agencies. With the information we have provided, targeted surveys in areas of high predicted probability will afford assessing the frequency which *E. exile* occupy headwater streams in northern Illinois and determining their local habitat needs.

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**0739 AES GRUBER AWARD, Balconies J & K, Thursday 7 July 2016**

Ashley Stoehr[1], Jeanine Donley[2], Scott Aalbers[3], Doug Syme[4], Chugey Sepulveda[3], Diego Bernal[1]

*[1]University of Massachusetts Dartmouth, Dartmouth, MA, USA, [2]MiraCosta College, Oceanside, CA, USA, [3]Pfleger Institute of Environmental Research, Oceanside, CA, USA, [4]University of Calgary, Calgary, Alberta, Canada*

**Thermal sensitivity of red muscle function in a deep-diving shark**

Amongst pelagic elasmobranchs, bigeye thresher sharks (*Alopias supercilious*) exhibit robust vertical mobility, undertaking routine long-duration dives from the surface (18-20˚C) to beneath the thermocline (5-10˚C). Unlike pelagic fishes capable of regional endothermy (e.g., common thresher sharks, swordfish), the subcutaneous red muscle (RM) morphology of bigeye threshers precludes heat retention and results in large RM temperature fluctuations during prolonged dives. This study used the work loop technique to determine if bigeye thresher RM was impaired at cool temperatures or functioned across naturally-occurring temperatures (8, 16, 24˚C). Bigeye thresher RM did not produce positive power above a presumed tail beat frequency of 0.5 Hz, even when warmed to 24˚C. However, RM produced positive power at 8-24˚C and 0.25-0.5 Hz. The lower thermal sensitivity of bigeye thresher RM suggests that fishes lacking RM endothermy exhibit greater thermal independence. This thermal strategy may provide a cost-effective mechanism to facilitate sustained swimming in disparate thermal environments, but may compromise swimming speeds during prolonged cold exposure.

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**0542 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Jason Strickland[1], Miguel Borja[2], Andrew Mason[1], Darin Rokyta[3], Christopher Parkinson[1]

*[1]University of Central Florida, Orlando, Florida, USA, [2]Universidad Juárez del Estado de Durango, Gómez Palacio, Durango, Mexico, [3]Florida State University, Tallahassee, Florida, USA*

**Convergence within a Species? Venom Evolution in Mojave Rattlesnakes**

Convergent phenotypes typically arise through independent mechanisms in highly divergent taxa due to similar selection pressures. However, recent research indicates

convergence may be common in closely related species when a phenotypic trait, such as venom, is highly adaptive. Rattlesnake venom can be broadly characterized as either hemorrhagic (found in most species) or neurotoxic. Interestingly, in Mojave Rattlesnakes, *Crotalus scutulatus*, the majority have neurotoxic venom which is hypothesized to be ancestral. The exceptions are two populations, one in Arizona and one in Mexico, that are hemorrhagic suggesting convergence. To test this hypothesis, we collected venom and tissue from 120 *C. scutulatus* from throughout their range. We identified individuals of each phenotype as well as eight individuals with a hybrid phenotype and found higher proteomic variation among individuals than previously documented. Neurotoxic and hemotoxic individuals were not phylogenetically distinct indicating gene flow between phenotypes and we determined the two hemorrhagic populations are not closely related but have similar venom. Species distribution models of both phenotypes and of the two populations did not indicate significant differences in range suitability, suggesting environmental variables are not entirely responsible for the venom phenotypes. Based on these data, the venom polymorphism is being maintained in spite of gene flow and without an obvious environmental difference and the two hemorrhagic populations could be a result of convergent changes. Future work will compare venom gland transcriptomes among phenotypes and populations to determine if changes in expression are facilitating the convergence in phenotype.

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**1019 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Tyler Stuck, Shaojie Zhang, Yier Jin, Anna Savage

*University of Central Florida, Orlando, Florida, USA*

### SmartPhrog: A Long-Term, Active Bioacoustic Monitoring Solution Using Raspberry Pi For Frog Population Monitoring

This project aims to develop a bioacoustic monitoring device using a computer system called Raspberry Pi. Raspberry Pi is a low cost, credit-card sized computer that is designed for programming education and ease of use. As a consequence of these design goals, it can be easily modified to fit many different applications. Population demographics can be challenging to assess for cryptic species such as amphibians, but accurate data on population size and activity are critical to determine overall population health. Long term monitoring using acoustics is a viable solution, but often requires sorting through many hours of data manually. The Raspberry Pi's processing capabilities enhance its potential functionality beyond the recording capabilities of current bioacoustic devices and also cost a fraction of the price. Specifically, our "SmartPhrog" will be programmed to change behavior based on what it records. With proper instruction it will be able to determine optimal recording times to save power, take pictures when a frog is within range, and potentially recognize and respond to certain calls. Based on current data sampled with the SmartPhrog prototype that has been transformed using a frequency based principal component analysis, an untrained observer is able to separate and identify frog calls visually. This is the first step towards automatic classification of frog calls. The low cost of this system in applications for

monitoring vocalizing animals make SmartPhrog a strong contender in bioacoustics as a tool for biologists in the future.

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**0898 Fish Conservation & Morphology, Galerie 2, Sunday 10 July 2016**

Kristine Stump[1], Craig Dahlgren[2], Krista Sherman[3], Charles Knapp[1]

*[1]John G. Shedd Aquarium, Chicago, IL, USA, [2]Bahamas National Trust, Nassau, NP, Bahamas, [3]University of Exeter, Exeter, UK*

### Discovery of an Unknown Grouper Spawning Aggregation in The Bahamas Through the Use of Acoustic Telemetry

Globally, many fish species migrate to fish spawning aggregations (FSAs). Temporal and spatial predictability of these migrations and FSA locations make species vulnerable to overfishing, since the majority of a region's adult population may be harvested quickly with minimized effort. Historically, the Nassau Grouper (*Epinephelus striatus*) was an important fishery throughout the Caribbean, but due to FSA overfishing, it is now rare in many reef ecosystems. In The Bahamas, stocks continue to decline despite the implementation of FSA protections. While more Nassau Grouper FSAs have been reported in The Bahamas than any other country, very few have been validated, and the dynamics of migrations to and from these sites is even less understood. We used acoustic telemetry to describe, for the first time, Nassau Grouper migrations along Andros Island, Bahamas, which is bordered by one of the longest barrier reefs in the world. We report the likely extirpation of a historically important FSA and suggest Nassau Grouper are migrating to an unreported spawning location. Synchronous with winter full moons, fish migrated in groups along the barrier reef shelf edge at an average speed of 1.67 km/hr and traveled roundtrip distances of 71.5 km to 260.3 km ($x = 164.5 \pm 65.7$ km, $n = 10$). These results are critical to assessing the efficacy of current management strategies in The Bahamas. Thus far, all known FSAs have been reported to the scientific community by fishermen. Our study represents the first time an FSA has been identified using telemetry.

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**0294 Snake Ecology, Galerie 3, Sunday 10 July 2016**

Eric Suarez[1], Christina Romagosa[1], Carla Dove[2], Bryan Falk[3], Robert Reed[3]

*[1]University of Florida, Gainesville, FL, USA, [2]Smithsonian Institution, Washington, DC, USA, [3]US Geological Survey, Fort Collins, CO, USA*

### Prey species composition and dietary shifts of the Burmese python (*Python molurus bivittatus*) in southern Florida

The impact of invasive species has emerged as a high-priority issue in planning the restoration and conservation of the Greater Everglades Ecosystem. Resource managers in Florida are particularly interested in one of the most direct impacts of the invasive

Burmese python population: what are they eating, and has it changed over time? We identified prey species from the digestive tract contents of 350 pythons collected from 2010 to 2016 using a morphological approach (i.e., using hair, feather, and scale morphology). Digestive tract contents were derived from the southern Everglades, north to Water Conservation Area 3A, and west to Collier County. We found that shifts are occurring over time in diet composition for pythons collected from within Everglades National Park (ENP) boundaries, with birds becoming more prevalent in the diet as compared to data collected before 2008. The percentage of birds found in the python diet north and west of ENP remained near previously reported numbers (~25%). The mammalian component of the diet for pythons collected within the ENP boundaries consisted of primarily rodents (85%). The mammalian component north and west of ENP was more diverse, and rodents were only 45% of the diet. These results suggest spatial and temporal shifts in prey species composition for pythons throughout their range, which supports previous studies showing declining trends for some mammal species throughout the ENP. Dietary shifts in this common invasive species may have implications for ecosystem stability, as well as Everglades restoration.

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**0747 AES Morphology & Reproduction, Balconies L & M, Friday 8 July 2016**

James Sulikowski[1], Carolyn Wheeler[1], Bianca Prohaska[2], Neil Hammerschlag[3]

*[1]University of New England, Biddeford, Maine, USA, [2]Florida State University, Tallahassee, Florida, USA, [3]University of Miami, Miami, Florida, USA*

**Stick it where the sun don't shine: Advances in the non lethal study of elasmobranch reproductive biology for conservation management**

Data on maturity state, gestation period, and fecundity are essential for proper conservation and management of elasmobranchs. Historically, this information has been collected by lethal sampling, an approach that is problematic for threatened and endangered species. Recent studies have demonstrated that non-lethal approaches can be as effective as lethal ones for assessment of the reproductive status of elasmobranchs. Using examples from various species and reproductive modes, this study summarizes our current knowledge of several techniques: 1) analysis of circulating plasma hormones; 2) concentrations of steroid hormones from skeletal muscle tissue; and 3) the use of ultrasonography to discern pregnancy and follicular development and their use as reliable indicators of reproductive status in elasmobranchs.

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**0159 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

Adam P. Summers[1], Kevin Conway[2], Thaddaeus Buser[3]

*[1]University of Washington, Friday Harbor, WA, USA, [2]Texas A&M University, College Station, Texas, USA, [3]Oregon State University, Corvallis, Oregon, USA*

**Scan All the Fishes - Open Source CT data**

Computed tomography scanning with x-rays is an effective technique for visualizing radiodense skeletal tissues. With the addition of contrast techniques, iodine or phosphotungstic acid for example, it is also capable of revealing soft tissue anatomy. CT scanning has been expensive and the reconstructions of specimens a time consuming process that required expensive software. I will report on simple techniques for scanning large numbers of specimens at the same time. The data are then digitally dissected into single specimen scans. An important question to consider when bulk scanning is resolution – it will certainly be less than can be achieved scanning a single specimen. I propose a policy of scanning fishes at a resolution that allows morphometric measurements at higher resolution than traditional 2-d techniques (i.e. calipers, ocular micrometers). The throughput that is possible with a single CT scanner and a single person doing reconstructions is demonstrated at 32 species per day. We expect it is possible for a single person to scan 50 species a day of similarly sized fishes. We are engaged in scanning a specimen of every species of fish. Each species will be scanned at a resolution sufficient for many purposes. Slice data, STL files, PLY files and JPGs of volume and surface renderings are being made available immediately through a open access model. Our first groups of interest are the Cottoids, Gobeisocids, and Blennies. Uploading the data to the web remains a bottleneck. The processes we have developed for rapidly scanning, tracking and returning specimens are also available open access as living documents.

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**0401 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Jenny Sutherland[1, 3], Amber Stedman[1], David Mifsud[2], Maegan Stapleton[2], Edward Roseman[3], Katherine Greenwald[1]

*[1]Eastern Michigan University, Ypsilanti, MI, USA, [2]Herpetological Resource Management, Chelsea, MI, USA, [3]USGS Great Lakes Science Center, Ann Arbor, MI, USA*

**Use of Landcover Data and eDNA to Determine Occupancy of the Mudpuppy (*Necturus maculosus maculosus*) in the St. Clair-Detroit River System**

The Mudpuppy (*Necturus maculosus maculosus*) is a fully aquatic salamander with a range that spans the Great Lakes region. Although this species was once abundant throughout its range, evidence suggests that there have been widespread declines as a result of habitat modification, pollution, and over collection. Land use practices in the St. Clair-Detroit River System (SCDRS) have altered habitat, reducing shelter and breeding

sites for mudpuppies, but information on their current status is lacking. We used trapping records and Geographic Information Systems (GIS) analysis to determine if landcover predicts the presence of mudpuppies along the project area. Additionally, we are investigating the utility of environmental DNA (eDNA) to aid future monitoring efforts. A number of sites along the St. Clair River have recently been restored, providing cover objects suitable for use as mudpuppy nesting habitat. We use eDNA sampling and quantitative PCR (qPCR) to compare mudpuppy presence in restored versus unrestored locations. These data will help prioritize management on a local and range-wide scale, resulting in more successful conservation of this ecologically important species.

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**0780 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Tracey Sutton[1], April Cook[1], Kevin Boswell[2], Heather Bracken-Grissom[2], Sergio deRada[3], Ron Eytan[5], Dante Fenolio[6], Tamara Frank[1], Chuamin Hu[4], Matthew Johnston[1], Heather Judkins[7], Jose Lopez[1], Jon Moore[8], Brad Penta[3], Isabel Romero[4], Mahmood Shivji[1], Michael Vecchione[4], Jay Rooker[5], David Wells[5], Marsh Youngbluth[10]

*[1]Guy Harvey Oceanographic Center, Nova Southeastern University, Dania Beach, FL, USA, [2]Florida International University, North Miami, FL, USA, [3]Naval Research Laboratory at Stennis Space Center, Bay St. Louis, MS, USA, [4]University of South Florida College of Marine Science, St. Petersburg, FL, USA, [5]Texas A&M University Galveston, Galveston, TX, USA, [6]San Antonio Zoo, San Antonio, TX, USA, [7]University of South Florida St. Petersburg, St. Petersburg, FL, USA, [8]Wilkes Honors College, Florida Atlantic University, Jupiter, FL, USA, [9]NOAA NMFS National Systematics Lab, Washington, DC, USA, [10]Harbor Branch Oceanographic Institute at Florida Atlantic University, Ft. Pierce, FL, USA*

## Deep-Pelagic Research in the Gulf of Mexico: the DEEPEND Consortium

The *Deepwater Horizon* oil spill (DWHOS) was unique not only for its volume, but also for its depth of influence (0-1500 m). Variable amounts of hydrocarbons reached the ocean surface and/or seafloor, whereas 100% occurred within the water column. Understanding this pelagic habitat is important because about half of all fish species that occur in the Gulf of Mexico (GoM) spend all or part of their lives in the open ocean. Many mesopelagic and bathypelagic fishes vertically migrate each night to feed in the upper water column and return to deep water during the day. This behavior promotes rapid cycling of natural and anthropogenic material in the water column. Deep-pelagic fishes are prey for gamefishes, seabirds, and marine mammals. Given the steady growth of oil exploration and operations, the likelihood of future spills emphasizes the need to document acute and chronic effects on the pelagic fauna. The GoMRI-funded DEEPEND (Deep-Pelagic Nekton Dynamics) consortium was created for that purpose. DEEPEND is beginning the second of a 3-year program that builds on two intensive NOAA-supported surveys during 2010-11. DEEPEND will focus on short-term and long-term timescales to appraise the dynamic nature of communities using a suite of integrated

approaches. These investigations include: 1) a direct assessment of GoM deep-pelagic community structure including the physical and biological drivers of this structure; 2) a time-series analysis/comparison of biophysical data; 3) a time-series examination of differences in genetic diversity among key species; and 4) a biogeochemical analysis of the effect of DWHOS on pelagic biota.

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**0305 Fish Ecology II, Salon A-C, Saturday 9 July 2016**

Tracey Sutton[1], April Cook[1], Jon Moore[2]

*[1]Guy Harvey Oceanographic Center, Nova Southeastern University, Dania Beach, FL, USA, [2]Wilkes Honors College, Florida Atlantic University, Jupiter, FL, USA*

## Active Linkage of Large Vertebrates and the Deep-Pelagic Fauna of the Oceanic Gulf of Mexico after *Deepwater Horizon*: Vertical Dynamics of the Epipelagic, Mesopelagic and Bathypelagic Ichthyofauna

Large predatory fishes, toothed whales, and smaller cetaceans rely on deep-pelagic nekton as primary or secondary prey. This trophic interaction is mediated by downward and upward vertical migration (e.g., sperm whales and mesopelagic lanternfishes, respectively). This interaction also links particulate-feeding lower trophic levels with top predators in a manner that spans the gamut of depth domains. This is particularly important with respect to a whole-water column disturbance such as the *Deepwater Horizon* oil spill. Here we present highly resolved vertical distribution and migration data collected during a large-scale, NOAA-supported, deep-pelagic (0-1500 m) survey in 2011, along with data collected during ongoing GoMRI-supported DEEPEND consortium surveys. The deep-pelagic nekton community of the Gulf of Mexico is a complex mixture of migrating, non-migrating, and partially migrating assemblages that connect surface waters with depths well in excess of 1000 m. Major patterns of the vertical distribution of 151 species of fishes are summarized and quantified with the goal of highlighting potential vectors of anthropogenic contamination transfer in the deep-pelagial, the Gulf's largest ecosystem. Among the key findings: 1) the epipelagial is truly two ecosystems, depending on time of day; 2) the largest active flux is that of the synchronous migrators, but a large biomass component of the epipelagial at night is contributed by deep-to-very-deep asynchronous migrators; and 3) vertical migration by the bathypelagic fauna is readily apparent. In summary, the deep-pelagic nekton provide an essential intermediate service with respect to ecosystem functioning, efficiently linking lower and higher trophic levels through movement and consumption.

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**0671 Herp Conservation, Galerie 3, Saturday 9 July 2016**

William Sutton[1], Kyle Barrett[2], Cynthia Loftin[3], Phillip deMaynadier[4], Priya Nanjappa[5], Allison Moody[6]

*[1]Tennessee State University, Nashville, TN, USA, [2]Clemson University, Clemson, SC, USA, [3]Maine Cooperative Fish and Wildlife Research Unit, Orono, ME, USA, [4]Maine Department of Inland Fisheries and Wildlife, Bangor, ME, USA, [5]Association of Fish and Wildlife Agencies, Washington, DC, USA, [6]University of Maine, Orono, ME, USA*

## Determining Vulnerability of Priority Amphibian and Reptile Conservation Areas to Climate Change and Urbanization in the Northeastern United States

Climate change represents one of the most complex and globally important ecological stressors. As virtually all ecosystems will face impacts from climate change, it is essential to develop strategies that include pro-active conservation planning measures. The effort to establish Priority Amphibian and Reptile Conservation Areas (PARCAs) was initiated to identify valuable habitat for priority herpetofauna throughout the United States. Implicit in the identification of these habitats includes understanding long-term persistence to ecological stressors. We developed a framework for assessing the long-term vulnerability of proposed PARCAs in the North Atlantic Landscape Conservation Cooperative region to climate change. Our framework determines vulnerability by incorporating exposure (i.e., extent of climate change experienced by a species or locale), sensitivity (i.e., degree to which survival, persistence, or fitness may be impacted), and adaptive capacity (i.e., capacity of a species or locale to cope with climate change). We used a variety of spatially-explicit metrics that included projected temperature change, projected precipitation change, projected landuse change, priority amphibian and reptile species sensitivity, geographic context, and topographic relief to assess vulnerability. We found that projected temperature increases, landscape urbanization, and climatic niche loss of priority herpetofaunal species led to higher landscape vulnerability. Collectively, our efforts provide a science-based structure to assess the long-term vulnerability of these habitats to climate change, which will aid in the allocation of conservation efforts to priority landscapes based on projected climate resiliency.

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**0655 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

William Sutton[1], Michael Osborne[2], Jeff Bailey[3], Thomas Pauley[4]

*[1]Tennessee State University, Nashville, TN, USA, [2]Appalachian State University, Boone, NC, USA, [3]West Virginia Department of Environmental Protection, Charleston, WV, USA, [4]Marshall University, Huntington, WV, USA*

## Landuse Impacts on Stream Salamanders in West Virginia: An Ecoregion-Wide Analysis

Globally, amphibians represent one of the most endangered vertebrate taxa. A variety of stressors, including landscape destruction and landuse change, emerging pathogens, aquatic pollution, and global climate threaten amphibian populations. Salamanders in

the family Plethodontidae represent the only amphibian family where species lack lungs and rely completely on cutaneous respiration. These adaptations increase the vulnerability of these organisms to ecological disturbance, which makes them keen indicators of ecological condition. We evaluated the impacts of landscape disturbance on streamside salamanders at 45 streams in West Virginia over a three-year period. We used a combination of transect and quadrat surveys to survey and capture salamanders. We used both ordination and occupancy modeling approaches to evaluate potential impacts of stream disturbances. We captured over 2500 total adult and larval salamanders representing 9 species throughout the study period. The most commonly captured species included the Northern and Southern Two-lined Salamander (*Eurycea bislineata* and *E. cirrigera*), which tended to be common at most sites. We detected an effect of landscape disturbance on salamander populations and found that both richness and abundance of adult and larval salamanders were significantly lower in degraded streams versus streams of intermediate and reference conditions. A variety of landscape disturbances, including both agricultural and mining operations appear to be the greatest threat to salamanders in streams throughout West Virginia. Collectively, our study defines the greatest threats to stream salamanders throughout the state and also provides an additional evaluation of using salamanders as indicators of aquatic biological condition.

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**0219 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Jennifer Swanson[1], Clay Pierce[2], Erin Muths[3], Kelly Smalling[4], Mark Vandever[3]

*[1]Iowa State University, Ames, IA, USA, [2]U.S. Geological Survey, Iowa Cooperative Fish and Wildlife Research Unit, Iowa State University, Ames, IA, USA, [3]U.S. Geological Survey, Fort Collins Science Center, Fort Collins, CO, USA, [4]U.S. Geological Survey, Lawrenceville, NJ, USA*

## Habitat Use and Pesticide Exposure in Northern Leopard Frogs in Conservation Reserve Enhancement Program Wetlands

Amphibian populations are declining, with habitat alternation due to land use change consistently identified as one of the biggest contributing factors. In agricultural landscapes, habitat loss may interact with other stressors such as environmental contaminants to exacerbate declines. Much of the landscape in northern Iowa has been transformed from a mosaic of seasonal wetlands and grasslands to row crops. In 2001, the Conservation Reserve Enhancement Program (CREP) was created to improve water quality through construction of wetlands positioned on the landscape to catch runoff from tile drainage systems and reduce nutrient effluent. However, these CREP wetlands may provide additional benefits, particularly as wildlife habitat. Our objective was to radio track northern leopard frogs (*Lithobates pipiens*) to record their movement at CREP wetlands and assess the pesticides in which they may come in contact. Although these sites are surrounded by vegetative buffers, they are often located in close proximity to agricultural fields where pesticides and fertilizers are applied. During the summer of 2015 we captured and radio tracked frogs (n=38) at two CREP wetlands in Iowa. Passive

pesticide samplers (PPSs) were placed in locations frequented by frogs to test for presence and concentration of contaminants to which frogs were exposed. Presence and concentrations of pesticides on PPSs were compared to corresponding values found in a subset of frogs that were euthanized after they had been tracked. Frogs moved from their original capture points to a variety of habitats at each site and traveled up to 1,000m during the tracking period.

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**0924 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Meredith Swartwout[1], Philip Vogrinc[1], Joseph Alex Baecher[2], Chelsea Kross[1], John Willson[1]

[1]*University of Arkansas, Fayetteville, AR, USA,* [2]*Eastern Kentucky University, Richmond, KY, USA*

## Growth and Phenotypic Plasticity of *Nerodia sipedon* in Response to Feeding Frequency and Prey Size

Because snakes are gape-limited predators, plasticity in trophic morphology may allow them to modify the sizes of prey that they are able to consume. Evidence suggests that some snakes can alter their head morphology in response to larger prey, but it is unknown whether this effect is mediated by growth rate. To test how prey size and feeding frequency influences head morphology and growth of a common water snake, we randomly assigned 33 lab-born neonate *Nerodia sipedon* to feeding treatments representing a factorial combination of two prey sizes and two feeding frequencies: Big-High (BH), Big-Low (BL), Small-High (SH), Small-Low (SL). Snakes in the BH treatment were offered one sunfish (*Lepomis* sp.) weekly that was 30% of their body mass; BL were offered one sunfish that was 30% of their body mass every other week; SH were offered two sunfish that were each 15% of their body mass weekly; and SL were offered one sunfish that was 15% of their body mass every other week. We photographed snakes at the beginning of the experiment and when they reached 400 mm snout-vent length (SVL) and analyzed images to compare head morphometrics among treatment groups. Snakes in the High treatments (SH and BH) had higher growth rates, while snakes in the Low treatments (BL and SL) had low growth rates. However, due to high variability in head morphology among individuals, we found limited evidence for plastic responses of trophic morphology to prey size or growth rate.

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**0824 Lightning Talks, Galerie 2, Saturday 9 July 2016**

John Swenson, Karen Crow

*San Francisco State University, San Francisco, CA, USA*

### How the Devil Ray Got Its Horns: The Evolution and Development of Cephalic Lobes

Devil rays and their relatives (Family: Myliobatidae) are derived and highly divergent batoids, with some taxa considered the only living vertebrates with three functional paired appendages. The third set of appendages, termed "cephalic lobes", are modifications of the anterior pectoral fin that evolved to assist with feeding as the myliobatids transitioned from a benthic to a more pelagic lifestyle. To investigate the genetic underpinnings of these unique appendages, we collected embryos from the cownose ray (*Rhinoptera bonasus*) and will sequence the transcriptome of developing cephalic lobes for comparison with pectoral fin. Preliminary data indicate previously underappreciated genetic pathways may be responsible for modifying multiple regions of the body in this taxon.

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**0807 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

Shantel Swierc[1], Kim Withers[1], J. Derek Hogan[1], Michael R.J. Fostner[2]

*[1]Texas A&M University- Corpus Christi, Corpus Christi, Texas, USA, [2]Texas State University, San Marcos, Texas, USA*

### Demographics, distribution, and genetic variation in the Texas diamondback terrapin (*Malaclemys terrapin littoralis*) within the Corpus Christi and Aransas bay systems

The goals of this research are to determine the population genetics and population dynamics of the Texas diamondback terrapin (*Malaclemys terrapin littoralis*) within the Nueces/Corpus Christi Bay and Aransas Bay estuaries on the central Texas coast. The genetic data produced by this study can be integrated with previous DNA analyses on Nueces Bay populations and provide needed information for development of management strategies. It will also provide the first genetic data on populations located within Oso Bay (Nueces/Corpus Christi Bay estuary) and Aransas Bay. An understanding of the population genetics from these terrapins will help answer various questions for conservation management in an underrepresented region from bays that are relatively isolated from one another. Terrapins were captured between April 2015 and December 2015. Sex was determined based on morphological characteristics and females were checked for gravidity. Photographs, standard measurements, body condition score, age estimates, physical abnormalities, scute notches and PIT tags were all performed and applied for each individual. Blood samples were drawn from all captured individuals to genetically compare individuals within, and across, these bay

systems using microsatellite DNA analysis. Preliminary captures, sex ratios, and standard measurement data for individual males and females are currently being analyzed, providing insight on the demographics of Texas diamondback terrapins in the study sites. DNA analysis will be performed on a ABI 3730xl DNA Analyzer, utilizing a multiplex PCR strategy involving M13 fluorescent labeled forward primers and the same 12 SSR primers that multiple previous studies have used for this species.

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**0201 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Dominic Swift, David Portnoy

*Texas A&M University-Corpus Christi, Corpus Christi, TX, USA*

### High-throughput Sequencing for Genetic Monitoring and Stock Structure Assessment of Blacktip Sharks (*Carcharhinus limbatus*)

Blacktip sharks (*Carcharhinus limbatus*) are one of the dominant large coastal species landed by commercial and recreational fisheries in the U.S. Atlantic and Gulf of Mexico. Blacktips give birth in nursery areas which are vital for juvenile survival and are considered essential fish habitat. In blacktips and other large coastal sharks, females may show philopatry to these nurseries and this may result in substructure, making these sharks more vulnerable to localized overfishing. Further, nurseries along the U.S. Atlantic and Gulf of Mexico coasts differ in environmental conditions which may lead to localized adaption, important for population viability when the environment is heterogeneous in space and time. We will sample 500-600 young-of-the-year and mature blacktip sharks across the U.S. Atlantic and Gulf of Mexico. We will use double digest restriction-site associated DNA (ddRAD) sequencing to (i) establish baseline genetic monitoring data for blacktips, (ii) provide high-resolution genetic data for blacktip stock assessment, (iii) develop replicable methods for genetic monitoring and stock structure assessment of other shark species. Genomic monitoring will involve estimating the effective number of breeders ($N_b$) and the minimum number of female breeders ($N_{mf}$) at each nursery area, as well as characterizing baseline genetic diversity of the breeding stock. We also will investigate the potential for localized adaptation associated with nurseries and develop fine-scale genetic tags to be used in future mark-and-recapture studies.

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**0864 Fish Behavior & Development, Salon A-C, Sunday 10 July 2016**

Stephen Szedlmayer, Megan McKinzie

*Auburn University, Auburn, Alabama, USA*

### Gray Triggerfish, *Balistes capriscus*, Movement Patterns, Residency, and Mortality on Artificial Reefs in the Northern Gulf of Mexico

Gray triggerfish, *Balistes capriscus*, are ecologically and economically important in the northern Gulf of Mexico, yet little is known on their movement patterns, habitat use and residency to artificial reef structures. In the present study we successfully tagged and acoustically tracked gray triggerfish (N = 22) using the Vemco VR2W Positioning System (VPS). Individual fish were remotely tracked for 8 to 622 d from Oct 2012 through Jul 2015. Gray triggerfish showed diel and seasonal movement patterns, high site fidelity and long term residency to reef sites. Mean ± SD home range (95% KDE) = 3238 ± 3687 $m^2$ and core areas (50% KDE) = 278 ± 331 $m^2$, and were larger during the day than night time periods. Fall home range (mean ± sd = 4966 ± 4713 $m^2$) was significantly greater than spring home range (1950 ± 1587 $m^2$). Tracked individuals remained close to reef structures (mean distance from reef = 46.3 ± 1.3 m) and residency was estimated at 163 d. Several individuals (N = 8) made large-scale directed movements to other nearby reef sites. Three fish returned to their release site after emigration periods of 8 to 200 d. Due to high residency and close proximity to reef structures, gray triggerfish may be highly susceptible to increased fishing mortality.

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**0927 Fish Conservation & Morphology, Galerie 2, Sunday 10 July 2016**

Stephen Szedlmayer, Peter Mudrak

*Auburn University, Auburn, Alabama, USA*

## A Comparison between Conventional and Transmitter Tagged Red Snapper, *Lutjanus campechanus*, to estimate Fishing Mortality in the Northern Gulf of Mexico

Estimates of fishing mortality (*F*) are critical for valid management of red snapper, *Lutjanus campechanus,* in the Gulf of Mexico. To reduce difficulties of fisher non-reporting, unknown tag shedding and tagging artifact mortality with conventional tagging, telemetry methods have been developed. One difficulty with telemetry methods are low sample sizes compared to conventional tagging. The present study applied both conventional tagging (to increase sample size) and telemetry methods (to reduce error inherent with conventional tagging). For telemetry, we used the Vemco VR2W Positioning System to estimate red snapper *F* on artificial reefs in 2015. We released 63 transmitter tagged red snapper on 4 artificial reefs with Vemco VPS receiver arrays. Telemetry methods are unique in that they are entirely independent of fisher reported recaptures. For conventional tagging we release 364 Floy tagged red snapper on 38 artificial reefs at close to 10 tagged fish per reef. Conventional tagging methods are dependent on fisher returns, but we increased the probability of fisher returns by offering $150 rewards for retuned tagged fish. In 2015, telemetry tagged fish showed a high *F* = 0.33 based on fisher reported recaptures. Conventional tagging also showed the same high *F* = 0.33. After applying non-reporting rate (35 %) based on telemetry, estimates increased to *F* = 0.46. Thus telemetry based estimates were validated by conventional tagging methods and indicate that even with low sample sizes they provided accurate estimates, but at the same time can provide critical information that is not attainable with conventional tagging.

**0190 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Elena Tamburin[1], Mauricio Hoyos Padilla Hoyos Padilla[2], Felipe Galván Magaña[1], Sora Kim[3], Alberto Sánchez González[1], Agustín Hernández Herrera[1], José Leonardo Castillo-Geniz[4]

*[1]Instituto Politécnico Nacional. Centro Interdisciplinario de Ciencias Marinas, La Paz, BCS, Mexico, [2]Pelagios-Kakunjá A.C., La Paz, BCS, Mexico, [3]Department of the Geophysical Sciences, Chicago, Illinois, USA, [4]Centro Regional de Investigación Pesquera. Instituto Nacional de la Pesca (INAPESCA), Ensenada, B.C., Mexico*

**Trophic habitat of mako and white shark in a nursery area**

Juveniles of white sharks (*Carcharodon carcharias*) and mako sharks (*Isurus oxyrinchus*) are captured in the artisanal fishery on the western coast of Baja California (B.C.): white sharks as by-catch with bottom gillnets and mako sharks as a target species with gillnets and pelagic longlines. The aim of this research is to study the habitat use of both species using stable isotopes analysis of C and N in muscles tissues, which reflected the diet integrated in a large time scale. Sebastian Vizcaino Bay represents a nursery area in B.C. for both species and Isla Cedros likely represents a new pupping area for white sharks, based on observations and tissue collection (n=2). During 2015, 45 muscle samples were collected in Laguna Manuela (n=30), Bahia Tortugas (n=13) and Isla Cedros (n=2). We observed mako sharks between 67- 196 cm total length (TL) and white sharks between 97-240 cm TL, which represent young of the year and juvenile sharks. The mean isotopic values in muscle were δ13C =-17.3‰ ± 0.3 and δ15N = 18.4‰ ± 0.9 for mako sharks and δ13C = -15.7 ± 0.4 and δ15N = 17.3 ± 0.9 for white sharks. In addition, smaller individuals have greater nitrogen isotope values, which could be due to maternal contributions or foraging in 15N-enriched environments. The isotopic niche for white and mako sharks do not overlap suggesting that sharks are not sharing feeding resources. Mako sharks of different age and sex classes showed a similar habitat use (δ13C) and segregation between neonates and juveniles.

CANCELED

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**0664 ASIH STOYE AWARD GENETICS, DEVELOPMENT, & MORPHOLOGY, Salon F-H, Friday 8 July 2016**

Milton Tan, Jonathan Armbruster

*Auburn University, Auburn, AL, USA*

**Transcriptome Evolution of Paedomorphic Cyprinidae**

The relationship between functional genomic evolution and evolution of extreme phenotypes is of major interest in evolutionary biology. Cypriniformes includes multiple genera of paedomorphic taxa, such as *Paedocypris*, *Sundadanio*, and *Danionella*, representing some of the world's smallest vertebrates. Previous phylogenomic investigation demonstrated these taxa do not form a clade, and thus there have been

multiple, independent transitions to paedomorphism. To study the relationship of phenotypic convergence in paedomorphic taxa and functional genomic evolution, we sequenced transcriptomes of *Paedocypris*, *Sundadanio*, and *Danionella* and compared their transcriptome sequences to publically available cypriniform transcriptomes. We first inferred the phylogeny of Cypriniformes using transcriptomic data. We then explored the relationship of transcriptomic sequence evolution with the evolution of paedomorphism, and tested for shifts in the level of selection specific to paedomorphic taxa relative to other cypriniforms in functional genes across the transcriptome.

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**0547 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

Kevin Tang

*University of Michigan–Flint, Flint, MI, USA*

**Systematics of Damselfishes**

The family Pomacentridae is a widespread and species-rich group, forming a major component of the world's reef communities. Over 250 damselfish species, representing all 29 pomacentrid genera, were examined for this study. Over 100 acanthomorph species were also included for analysis. Sequence data from mitochondrial (12S, 16S, ATPase 8/6, cytochrome b, cytochrome c oxidase I) and nuclear (histone 3, recombination activating gene 1, and tmo-4c4) genes were used for the phylogenetic analyses. The results of these analyses found support for the monophyly of the family as well as the monophyly of many previously recognized groups, corroborating other recent molecular phylogenies of this family. These relationships, particularly their implications for the classification and taxonomy of Pomacentridae, will be discussed.

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**0728 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

Juliette Tariel[2], Gary Longo[1], Giacomo Bernardi[1]

*[1]UC Santa Cruz, Santa Cruz, CA, USA, [2]Ecole Normale Supérieure de Lyon, Lyon, France*

**Tempo and Mode of Speciation in *Holacanthus* Angelfishes Based on RADseq Markers**

In this study we estimated the timing of speciation events in a group of angelfishes using 1186 RADseq markers corresponding to 94,880 base pairs. The genus *Holacanthus* comprises seven species, including two clades of Panama trans-Isthmian geminates, which diverged approximately 3-3.5 Mya. These clades diversified within the tropical Eastern Pacific (TEP, three species) and tropical Western Atlantic (TWA, two species), which our data suggest to have occurred within the past 1.5 My in both ocean basins, but may have proceeded via different mechanisms. In the TEP, speciation is likely to have followed a peripatric pathway, while in the TWA, sister species are currently

partially sympatric, thus raising the possibility of sympatric speciation. This study highlights the use of RADseq markers for estimating both divergence times and modes of speciation at a 1-3 My timescale.

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**0466 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Christopher Taylor

*University of Texas Rio Grande Valley, Edinburg, TX, USA*

### The spatial scale of similarity and patterns of homogenization and differentiation in Chihuahuan Desert riverine fish assemblages

Desert aquatic ecosystems around the world are declining in water quantity, quality and native species diversity. Fish assemblages in these ecosystems are increasingly becoming homogenized, although the degree of homogenization is dependent on the magnitude and direction of change following extirpation and colonization events and the spatial scale of observation. The frequency of species loss and gain, the identity of those species, and the regional extent of these changes interact with historical patterns of species diversity and environmental change, and determine resulting patterns. We examined the spatial scale of similarity for fish assemblages in the highly modified Rio Grande basin in the Chihuahuan desert of West Texas using a well-documented historical data set and recent collections that provided a paired analytical design across 29 localities spanning approximately 30 years of time. Results indicated that homogenization and differentiation occurred, but these patterns depended on the spatial resolution of comparison. The greatest changes were found between stream reaches within a sub-basin. The Rio Grande sub-basin showed strong convergence between upstream and downstream reaches that corresponded to declining water quality and quantity from the Rio Conchos in Mexico. The Pecos River sub-basin showed strong differentiation between upstream and downstream reaches that was associated with a strong shift in geomorphology. Assemblage similarities within specific river reaches of each sub-basin were variable in their degree of historical change, which was largely dependent on anthropogenic modification to the flow regime change and variability in the success of invasive species.

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**0946 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Emily Taylor

*California Polytechnic State University, San Luis Obispo, CA, USA*

### What's behind the critical thermal maximum?

The critical thermal maximum (CTmax) is a commonly used measure of thermal tolerance in ectotherms. It is defined as the temperature at which they lose coordinated locomotor function. The physiological mechanism responsible for the CTmax is largely

unknown in air-breathing ectotherms. Recent studies in my lab have tested the oxygen limitation hypothesis, which suggests that the CTmax is reached when metabolic demand for oxygen exceeds the cardiovascular system's ability to supply it. I will briefly discuss the results of these studies and describe current studies underway to further test the hypothesis, which so far is being strongly supported in our studies on *Sceloporus* lizards.

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**0238 AES Physiology, Paleontology, & Collections, Balconies L & M, Friday 8 July 2016**

Jordan Taylor, Gavin Naylor

*College of Charleston, Charleston, SC, USA*

**A Morphometric approach for assessing the Elasmobranch Fishes from the Late Eocene of South Carolina**

Isolated chondrichthyan teeth are the most abundant vertebrate fossils represented in the fossil record, and are widely distributed along the southeastern United States. The coastal plain in South Carolina contains an abundance of chondrichthyan remains from the Eocene epoch. It is distinguishable from other epochs by the presence of distinct, calcareous nannofossil assemblages and levels of dissolved carbon. The Eocene lasted from 55.8 to 33.9 million years ago and is characterized by accelerated global cooling, changes in ocean circulation, and a drop in global temperature of about 2°C. The effects of this climatic transition on fauna diversity have been observed in the calcareous nannofossil assemblage, but have yet to be observed in vertebrate macrofauna, specifically elasmobranchs. The present study aims to identify the diversity and distribution of the elasmobranch fauna using isolated teeth found in the Parkers Ferry formation (33.239068° N, -80.425665°W), which represents a period of cooling in South Carolina. Many extant sharks can be identified on the basis of tooth morphology, which has been typically qualitative in nature. This sorting "technique" has led to taxonomic problems in the fossil record, because there are several patterns of heterodonty that influence tooth shape. In this study, a geometric morphometric technique will be applied to extant and fossil teeth as a quantitative approach to identify the elasmobranch taxa from the late Eocene. The results of the present study will provide a reliable and unbiased method to identifying sharks' teeth.

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**0388 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Julie Taylor, Matthew Lattanzio

*Christopher Newport University, Newport News, Virginia, USA*

**Blue Gets the Boulder, but Yellow is Bolder: Territorial Dynamics of a Color Polymorphic Lizard**

Social dynamics in territorial species reflect the outcome of interactions between multiple traits, including dominance and boldness, yet these traits are often treated independently. For example, in ornate tree lizards (*Urosaurus ornatus*), males differing in dewlap color diverge in social dominance: whereas blue males are aggressive and always territorial, yellow males usually exhibit a less-aggressive satellite behavioral tactic. However, in habitats with fewer available microhabitats, yellow males defend territories and increase in relative abundance, despite still losing to blue males in controlled dominance experiments. These observations suggest that consideration of social dominance alone may be insufficient to explain *U. ornatus'* territorial dynamics in the wild. In this study we tested how both dominance and boldness contribute to the outcome of territorial disputes in tree lizards. We recorded the territory-use behavior of blue and yellow male tree lizards (entered in pairs) in the lab. At the end of each trial, we approached each male and recorded whether it fled (shy) or not (bold) in response to our approach. Our results support previous findings for *U. ornatus*; namely, dominant blue males occupied the higher-quality territory more often than yellow males. However, when approached by a simulated predator, blue males were more likely to flee than yellow males. Thus, while blue males are more dominant, yellow males may be bolder. In conclusion, although social dominance may drive initial territory acquisition patterns among competing males, asymmetries in their boldness behavior may perturb the nature of these patterns across environments.

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**0392 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

William Ternes, Matthew Lattanzio

*Christopher Newport University, Newport News, Virginia, USA*

**Trophic Niche Variation in a Widespread Lizard**

A growing body of evidence supports that dietary differentiation among populations may contribute to the ecological success of widespread taxa. However, the degree that populations vary in foraging tactics (i.e., generalist versus specialist with respect to resource availability) and prey selection (i.e., variation in trophic level) remains poorly understood. Here we will evaluate the degree of dietary divergence among 17 populations of the ornate tree lizard (*Urosaurus ornatus*), and characterize the

mechanism(s) contributing to observed inter-population differences in diet. At each population we captured 10 lizards with a noose-pole, recorded their body size, and collected a tissue sample for stable isotope analysis of their carbon and nitrogen content. At each site of capture, we also estimated the percent vegetation cover. We will use our stable isotope data to describe each population's diet and test whether populations diverge in foraging tactics (carbon), prey selection (nitrogen), or both. Preliminary analyses from a subset of our populations support that *U. ornatus* populations vary in diet selection ($P<0.05$), and do not generalize on available resources ($P>0.05$). Currently, we are in the process of analyzing our remaining data. If populations occupy distinct ecological roles in terms of their diet, then this would suggest ecological heterogeneity among populations plays a role in the ability of widespread species to occupy diverse microhabitats. In this manner, we will provide key insights into the factors contributing to and the nature of diet variation in a widespread taxon.

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**1073 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Kimberly Terrell[1], Daniel Breaux[2], Shelley Stiaes[2]

*[1]Memphis Zoo, Memphis, TN, USA, [2]Southeast Louisiana Refuge Complex, US Fish and Wildlife Service, Lacombe, LA*

## High Incidence of Snake Mortality at Bayou Sauvage National Wildlife Refuge (New Orleans, LA)

Bayou Sauvage National Wildlife Refuge (NWR) is located entirely within the city limits of New Orleans and is considered the nation's largest urban wildlife refuge. It encompasses ~24,000 acres of intermediate and brackish marsh, as well as ~200 acres of forested lands on low ridges. The refuge is highly impacted by anthropogenic development. It is located in an area of high industrial/petrochemical activity and is intersected by a major interstate. In early 2006, wetlands along the eastern edge of the refuge were developed into a landfill to accept 2.6 million tons of residential debris from Hurricane Katrina. We conducted a herpetological inventory of Bayou Sauvage NWR from Jan - Dec 2015, funded by the US Fish and Wildlife Service. We detected 27 amphibian and reptile species, including 10 snake species. Dead or moribund snakes were encountered throughout the year, including *Agkistrodon piscivorus, Coluber constrictor, Farancia abacura, Lampropeltis nigra, Liodytes rigida, Nerodia cyclopion, and Thamnophis proximus*. In many cases, no gross abnormalities were observed. Freshly-dead carcasses of three species were submitted to the National Wildlife Health Center for necropsy. Severe internal infections were identified in *T. proximus* and *F. abacura*, but the cause of death was undetermined in six necropsied *L. rigida*. Chemical or thermal skin burns were observed in the *T. proximus* carcass and in a live *C. constrictor* (not collected). Additional tests for environmental contaminants are ongoing. There is an urgent need to identify and mitigate the causes of mortality, disease susceptibility, and skin abnormalities in this population.

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**0053 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Christopher Thawley, Tracy Langkilde

*Penn State University, University Park, PA, USA*

### Invasive Fire Ant (*Solenopsis invicta*) Predation of Eastern Fence Lizard (*Sceloporus undulatus*) Eggs

Invasive species are a threat to biodiversity, and understanding their impacts on native ecosystems is a research priority. Red imported fire ants (*Solenopsis invicta*) are invasive in the southeastern United States and have multiple effects on a variety of native species. In some species, particular life stages, including juveniles and eggs, may be especially vulnerable to fire ants, but research on these impacts has been limited. Fire ants occupy microhabitats used for nesting by Eastern Fence Lizards (*Sceloporus undulatus*) across much of their range. We examined the extent of fire ant predation on fence lizard eggs by constructing artificial nests at a fire ant-invaded location and monitoring them for predation for up to 20 days. During this period, 24% of nests were predated by fire ants, and survival curves suggest 61% of nests may be vulnerable to fire ant predation over the entire incubation period. Distance of nests to the nearest fire ant mound and canopy cover above nests were not significant predictors of predation, indicating that nest site choice by fence lizards may not be able to avert fire ant predation. Invasive fire ants likely represent a novel level of predation pressure on many species, and these effects should be accounted for in management and conservation strategies.

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**0923 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Cheryl Theile, Terry Grande

*Loyola University Chicago, Chicago, IL, USA*

### Developmental Changes in Lower Jaw Functional Morphology of North American Esocids

Northern Pike (*Esox lucius*) and Muskellunge (*Esox masquinongy*) are two closely related fishes within the order Esociformes. Their geographical distributions overlap in North America and they are known to compete for resources in many localities. While both are voracious ambush predators later in life, Muskellunge appears to transition to a piscivorous diet sooner than Northern Pike. The development of Northern Pike and Muskellunge was examined to study how changes in the functional morphology of the lower jaw might be correlated to the timing of their diet shifts. The theoretical mechanical advantage (MA) for jaw opening and closing was calculated using ontological measurements of cleared and stained hatchery specimens (330.25 to 1,577.5 hours post fertilization). In addition, the effective mechanical advantage (EMA) was for stained and dissected specimens (960.75 to 2131.25 hours post fertilization) for two subsections of the abductor mandibulae muscle, A2 and A3. Preliminary data for Northern Pike and Muskellunge suggest shifting MA for jaw opening and closing is

correlated to age and size. Both species display a decrease in MA for jaw opening. However, MA for jaw closing increased with age for both species. The timing of these changes in MA are similar in both species and occur once the yolk sac is fully consumed but before their ontogenetic diet shifts. In addition, EMA was lower than MA for each muscle subsection, while both MA and EMA was lower for A3 than for A2. EMA did not change significantly over the time period studied for either muscle section.

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**0265 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Alex A Thomas, Peter A Zani

*University of Wisconsin - Stevens Point, Stevens Point, WI, USA*

**Experimental Test of Overwinter Site Selection by Ectotherms Based on Thermal and Spatial Cues: Side-blotched Lizards Prefer Smaller Crevices over Warmer Sites**

Winter site selection by ectotherms is often complex and the factors influencing this process are not yet fully understood. In many reptilian species microhabitat temperature appears to influence overwintering site selection, but the importance of spatial cues cannot be ruled out. To clarify the role of thermal and spatial cues, we independently tested how temperature and crevice size affects overwintering site selection of side-blotched lizards in the lab. Winter-acclimated lizards were allowed crevice selection in an artificial hibernaculum (winter habitat) in which heat and space were altered separately. This allowed us to test gradients of heat (~5–15 °C), or space (6, 13, or 19 mm-tall crevices), or both. Experiments were preformed i) with a heat gradient, but without a space gradient, ii) without a heat gradient, but with a space gradient, and iii) with both heat and space gradients. The results of this experiment show that thermal or spatial cues by themselves may influence site selection, but when both heat and space gradients are available, lizards prefer smaller crevices over warmer sites. These results indicate that for overwintering ectotherms, crevice size may be more influential than temperature for site selection.

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**0534 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Meagan Thomas, Alanna Horton, Michael Dorcas

*Davidson College, Davidson, North Carolina, USA*

**Predicting Total Body Length of Incomplete Rattlesnake Skeletons Through X-ray Technology and Vertebral Measurements**

The Eastern diamondback rattlesnake (*Crotalus adamanteus*) is the largest species of rattlesnake in the world, with adults typically reaching lengths of 1.2-1.5 m (4-5 ft).

Although there are reports of individuals up to 2.4 m (7.8 ft), physical evidence (e.g. museum specimens, skins, scalable photographs) is limited for individuals over 2.1 m (7 ft). In this study we used museum specimens (skeletal and preserved) to develop a model that would allow determination of body length from skeletal remains of *C. adamanteus*. We X-rayed 15 preserved known-length specimens of varying size and measured the pre- and post- zygapophyseal articular facets of the largest vertebra for each specimen. We used these data to develop body length estimates for three partially complete *C. adamanteus* skeletons with highly variable vertebral size (largest vertebra of each specimen measured 14.16, 16.60, 27.04 mm long). We discuss our findings and how they relate to what is currently known about *C. adamanteus* body size and natural history. Studies such as this are important for developing new techniques which can further our understanding of the natural history of extinct, rare, or understudied organisms that are difficult to acquire in nature, but are available through museums or other similar collections.

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## 0690 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H, Thursday 7 July 2016

Andréa T. Thomaz[1], Mark R. Christie[2], L. Lacey Knowles[1]

*[1]University of Michigan, Ann Arbor, MI, USA, [2]Purdue University, West Lafayette, IN, USA*

### Riverscape genetics: modeling genomic expectations to test hypotheses about river network architecture as drivers of evolutionary dynamics in aquatic populations

It is widely recognized that physical landscapes can shape genetic variation within and between populations. However, it is not well understood how riverscapes, with their complex architectures, affect patterns of neutral genetic diversity. Using a spatially explicit agent-based modeling (ABM), we evaluate the genetic consequences of dendritic river shapes on local population structure. We disentangle the relative contribution of specific river properties to observed patterns of genetic variation by evaluating how different branching architectures and downstream flow regimes affect the genetic structure of populations within rivers. Irrespective of the river length, our results illustrate that the extent of river branching, confluence position, and asymmetric downstream migration dictate patterns of genetic variation in riverine populations. Comparisons between simple and highly branched rivers show a 20-fold increase in the overall genetic diversity and a 7-fold increase in the genetic differentiation between local populations. Given that most rivers have complex architectures, our findings highlight the importance of incorporating riverscape information into evolutionary models of aquatic species to disentangle neutral divergence caused by river architecture from adaptive processes. Also, the high genetic differentiation observed in complex architectures could help explain why riverine fishes represent a disproportionately large amount of global vertebrate diversity. In addition to exploring the genetic consequences of the riverscape theoretically, the framework is also useful for addressing how different

aspects of river architecture might impact observed patterns of genetic variation in empirical systems; in this case, tests of hypotheses about genomic variation in the tetra *Mimagoniates microlepis* (Characidae) from southern Brazil.

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**0427 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Andrew Thompson[1], Andrew Furness[2], Guillermo Orti[1]

[1]*The George Washington University, Washington D.C., USA,* [2]*University of California, Irvine, Irvine, California, USA*

**Phylo-transcriptomics of Annual Killifishes**

Annualism or seasonality is hypothesized to have evolved multiple times in Aplocheiloid killifishes (Cyprinodontiformes). These are fishes that live in ephemeral bodies of water subject to seasonal desiccation. When the pools dry up, adults bury their eggs in the soil, and embryos enter diapause stages and tolerate desiccation until the rains return**.** Once the rains return, they are then able to hatch. The phylogeny of this group has never been inferred with "big data" and many interrelationships in this clade are undetermined. Here, the phylogeny is inferred with orthologous genes of nearly 30 transcriptomes of aplocheiloid killifishes from most annual and non-annual lineages. This phylogeny is the foundation for future comparative work on the evolution of annualism in this group of organisms.

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**0423 Fish Genetics, Salon D, Sunday 10 July 2016**

Andrew Thompson[1], Jason Podrabsky[2], Guillermo Orti[1]

[1]*The George Washington University, Washington, D.C., USA,* [2]*Portland State University, Portland, Oregon, USA*

**The Tanscriptomics of Delayed Hatching and Desiccation Tolerance in the Non-Annual Killifish *Aplocheilus lineatus***

Annual killifish (Cyprinodontiformes: Aplocheiloidei) are known for their seasonality and their ability to inhabit temporary or ephemeral environments, which are subject to desiccation. Embryos undergo a diapause stage in the pre-hatching stage and they can also tolerate desiccation. This is a convergent trait that has evolved multiple times in this suborder of fishes. However, all related non-annual species also have embryos that possess the ability to tolerate desiccation and delay their hatching in a way that is similar to annual species. To explore the evolution of annualism and investigate the intermediate phenotype of non-annual fishes, replicated transcriptomes were sequenced for water-incubated pre-hatching and air-incubated delayed hatching embryos of the non-annual fish *Aplocheilus lineatus.* Hundreds of candidate genes involved in delayed hatching and desiccation tolerance have been identified. Results are compared to other transcriptomic studies of diapause and desiccation tolerance in cyprinodontiform fishes.

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**0490 General Ichthyology II, Balconies J & K, Sunday 10 July 2016**

Kenneth Thompson

*Lock Haven University of Pennsylvania, Lock Haven, Pennsylvania, USA*

### Karyotypes of Two Species of Sculpin (*Cottus*) and their Hybrid in Central Pennsylvania with a Discussion of Chromosomal Evolution in the Cottidae

Specimens of *Cottus cognatus*, *C. bairdi* and their hybrids were collected from the West Branch of the Susquehanna River in Lycoming and Clinton Counties in Central Pennsylvania. Air dried, C-metaphase chromosome preparations were produced from gill epithelium. Diploid counts (2N) of 48 were determined for all three of these. Diploid counts for 19 specimens of *C. cognatus*, (nine males and nine females), eight specimens of *C. bairdi* (three males and five females) and seven hybrids (two males and five females) were determined. A total of 372 spreads were counted, 237 (63.7%) were determined to have 2N counts of 48 chromosomes. Metaphase spreads with 2N=48 were considered to be complete diploid sets and these were measured and classified by type (metacentric, submetacentric or subtelocentric/telocentric). It was found that there were eight bi-armed (msm) and 40 uni-armed (stt) chromosomes. The chromosome formulae (2N/NF) for all three were thus determined to be 48/56. Karyotypes for 34 species in 16 genera are known for the family Cottidae. Twenty-four (70.6%) have 2N values of 46 - 48. Ten (14.5%) of the 69 species in the genus *Cottus* have been karyotyped and nine of these (90.0%) have 2N=48. Eight of these (80.0%) have NF values of 56 - 58 indicating the conservative nature of chromosomal evolution within this genus.

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**0209 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016**

Michelle E. Thompson, Maureen A. Donnelly

*Florida International University, Miami, FL, USA*

### Recovery of Amphibian Communities in Regenerating Forest: Two Case Studies in Riparian and Upland Habitats of Secondary Forest, Costa Rica

The extensive degradation of natural systems caused by anthropogenic activities is a pressing global conservation concern. There is hope that some of the negative impacts caused by forest loss such as reduction of ecosystem services and loss of biodiversity may be offset by the regeneration of altered landscapes to secondary forests. However, the value of secondary forests to fauna is poorly understood. In our study, we examined the differences in species richness among riparian and upland habitats in a chronosequence of secondary forest in two tropical lowland wet forest regions of Costa Rica. We found that riparian habitats maintain high species diversity in modified habitats and early successional stages of forests. In harsh landscapes, such as those

generated as a result of land-use change, riparian zones may be especially crucial to maintaining amphibian populations by serving as a refuge for a variety of species.

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**0592 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Mike Thompson

*University of Sydney, Sydney, NSW, Australia*

**Eggs and Live Birth: A Retrospective and Prospective Look at the Evolution of Viviparity in Reptiles**

The 100th anniversary of ASIH is a terrific milestone and it is timely to reflect on the next 100 years. The evolution of viviparity has been the major focus of my research career. From the seminal paper by Packard, Tracy and Roth in 1977, the field developed in a number of ways, from understanding the selective pressure leading to the evolution of live birth to the morphology and ontogeny of placental development, with squamate reptiles playing a major role in those studies. In last 40 years, methodological advances have pushed our studies further than we ever imagined. First, major advances in imaging technology and rapid development of sophisticated molecular techniques now allow us to address many new questions. We now combine the morphology of placental development, especially in skinks, and next generation sequencing to understand both the function and the evolution of gestational structures. The hunt for "the" gene for viviparity proved naïve and we now know that all of the same genes present in oviparous species are also present in viviparous species, but their timing and level of expression varies. The evolution of viviparity from oviparity seemingly involves 100s of genes, making it extremely complex. Many fields of biology, viviparity included, had firm roots in studies of reptiles, but they are now developing as broader evolutionary questions where reptiles act as a model. Consequently, many of us now use multiple models to address our questions (for me that includes marsupials and fishes), although our passions remain with reptiles.

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**0951 Herp Biogeography, Phylogeography, & Systematics, Salon E, Saturday 9 July 2016**

Robert Thomson[1], Phillip Spinks[2], Bradley Shaffer[2], Anthony Barley[1]

*[1]University of Hawaii, Honolulu, Hawaii, USA, [2]University of California, Los Angeles, California, USA*

**Phylogeny of the Map Turtles (*Graptemys*)**

The emydid turtle genus *Graptemys* primarily inhabits large river systems that are drainages of the Gulf of Mexico. The species shows strong endemism, with each major system typically supporting one or two species within the genus. This radiation appears to have occurred both rapidly and recently, which has made phylogenetic resolution

within the clade difficult. Here we present a well sampled molecular phylogeny comprising all species and subspecies recognized in the genus. We recover a well resolved phylogeny that is congruent with the presumed biogeographic history of the group. We also find a complicated history within the false map turtle complex, a group that contains several morphologically similar species, which may be due to incomplete lineage sorting, hybridization, or a combination of these factors. To further elucidate this history, we present preliminary results on a follow-up population genetic study comprising many thousands of SNP markers for several hundred individuals.

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**0677 Fish Genetics, Salon D, Sunday 10 July 2016**

Jeremy Tiemann[1], Trent Thomas[2], John Epifanio[1], Wendy Schelsky[1]

*[1]Illinois Natural History Survey, Champaign, IL, USA, [2]Illinois Department of Natural Resources, Gibson City, IL, USA*

## The Redspotted Sunfish Saga: From statewide surveys to genetic analyses, captive propagation, and reintroduction efforts

The Redspotted Sunfish (*Lepomis miniatus*) occurs in clear, slow-flowing, well-vegetated streams and backwater lakes from the Illinois River basin south through the Mississippi River Valley. The range of *L. miniatus* in Illinois has been greatly reduced since the pre-1908 collections of Forbes and Richardson. Our surveys of known historical collection sites and other promising sites with favorable habitat in the mid-2000s suggested that only two populations now exist in the state – one in the Saline River basin (Ohio River drainage) and one in the Sangamon River basin (Illinois River drainage). Subsequent to our surveys, *L. miniatus* was designated as a state-endangered species in Illinois. Decimation of the species was probably the result of the drainage of swamps and bottomland lakes, loss of aquatic vegetation, and the general deterioration of water quality. We established a Redspotted Sunfish recovery team and established goals that included propagating the fish and releasing young-of-year (YOY) into restored Illinois River backwater lakes. From 2008-2010, *L. miniatus* was collected from Fish Creek (Sangamon River basin) and stocked into nursery ponds. Approximately 8,500 YOY were released into the 72-acre Fish Preserve Lake, a protected waterbody at Emiquon Nature Preserve near the Sangamon – Illinois confluence. These individuals spawned the following summer, allowing us to expand our stocking efforts by translocating the fish to five additional suitable waters in the region. Testing of the F2 generation suggested we were able to maintain the genetic diversity of this population of *L. miniatus*.

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**0241 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Thomas TinHan, R.J. David Wells

*Texas A&M University at Galveston, Galveston, Texas, USA*

**Feeding Ecology of Juvenile Bull Sharks in the Northwest Gulf of Mexico**

Estuaries along the Gulf coast provide valuable nursery habitat for juveniles of several species of elasmobranchs (e.g. Bull Sharks), but questions remain as to how young sharks exploit resources along the marine-freshwater continuum. In this study, we examine spatial and temporal patterns in the feeding ecology of juvenile (<210 cm total length) Bull Sharks in estuaries along the Texas coast. Juvenile sharks (N = 142) were collected opportunistically from five estuarine complexes along the Texas coast over a two-year period. Stomach contents from all individuals were identified to the lowest possible taxon, and four metrics of dietary composition were calculated: 1) percent number, 2) percent weight, 3) percent frequency of occurrence, and 4) index of relative importance (IRI and % IRI) as an omnibus metric of dietary composition. Stomach contents were dominated by teleost prey, particularly drums/croakers (45% IRI), mullets (25% IRI), and catfishes (13% IRI), and taxonomic contributions to dietary composition were consistent across multiple metrics. Stable isotopes of carbon (δ13C), nitrogen (δ15N) and sulfur (δ34S) obtained from epaxial tissue of juvenile sharks were used to infer trophic position and sources of organic matter in Bull Shark diets. In addition, we examined differences in feeding ecology among sharks from distinct estuarine complexes, and the shifts in diet or trophic position occurring with respect to season or ontogeny. Here we present the results of these analyses and discuss the role Bull Sharks may play in the trophic connectivity of Texas nearshore systems.

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**0093 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Brian Todd[1], Justin Nowakowski[1], Steven Whitfield[2], Evan Eskew[1], Michelle Thompson[3], Jonathan Rose[1], Benjamin Caraballo[4], Jacob Kerby[5], Maureen Donnelly[3]

*[1]UC Davis, Davis, CA, USA, [2]Zoo Miami, Miami, FL, USA, [3]Florida International University, Miami, FL, USA, [4]Renaissance Charter High School for Innovation, New York, NY, USA, [5]University of South Dakota, Vermillion, SD, USA*

**Variation in Host Thermal Tolerances Explains Patterns of *Batrachochytrium dendrobatidis* Infection in Amphibians**

The fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*) has caused the greatest known wildlife pandemic to date, infecting over 500 amphibian species. Although many species develop disease as a result of infection and suffer from consequent mortality, others persist despite infection or avoid infection altogether. Our understanding of factors shaping differences in chytridiomycosis susceptibility among amphibians remains incomplete, limiting our ability to effectively predict infection and disease risk. Here, we introduce a conceptual model that explains differential susceptibility of ectothermic

hosts to a generalist pathogen. Our model predicts that, given a conducive environment, infection risk will be lower for amphibian host species whose thermal tolerances exceed that of the *Bd* pathogen. We tested this prediction with a global database of *Bd* infection prevalence records representing 11,435 assays from 53 species across five continents. We supplemented this global database with infection data we collected in Costa Rica for 16 additional species. Host species with higher thermal tolerances had lower *Bd* infection prevalence than did species with lower thermal tolerances. The relationship between host thermal tolerance and infection prevalence was generalizable across multiple amphibian families and spatial scales, and depended on environmental context, but host thermal tolerance was always the single best predictor of infection risk. Our study is the first to show how variation in thermal tolerance among host species underlies differential disease susceptibility. Given parallels in other disease systems, tolerance mismatches between host and pathogen may broadly shape disease risk among many ectotherm hosts besieged by host-generalist pathogens.

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**1054 ASIH STOYE AWARD CONSERVATION, Salon F-H, Friday 8 July 2016**

Erin Toffemier, H. Bradley Shaffer

*University of California, Los Angeles, Los Angeles, CA, USA*

### Metapopulation dynamics of the critically endangered Santa Barbara Distinct Population Segment of the California tiger salamander, *Ambystoma californiense*

The Santa Barbara county population of the California tiger salamander, *Ambystoma californiense*, is recognized as a Distinct Population Segment (DPS) under the Federal Endangered Species Act (2000) and is one of the most endangered salamanders in the United States. The entire range of this lineage is contained in a 30 by 40 km region in northern Santa Barbara County, virtually all of which is in privately owned. Current recovery and management efforts focus on six geographically isolated metapopulations with the goals of maintaining and developing suitable habitat to support population growth and connectivity among breeding ponds. However, our understanding of current and historical movement patterns is extremely limited. Using both existing microsatellite data and newer genomic level target capture markers, we examined the genetic connectivity and effective population sizes of 23 breeding ponds across the metapopulations sampled from 1986 to 2001. Preliminary analyses show that there is strong genetic subdivision both among metapopulations and among breeding sites within these metapopulations, suggesting a history of restricted gene flow and local differentiation. These results indicate that metapopulations may not be interchangeable, and that local, on-site conservation methods may be called for, even in a geographically restricted species.

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**0649 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Samantha Tomczewski[1], Gary S. Casper[2], John D. Peterson[1]

*[1]University of Wisconsin - Platteville, Platteville, Wisconsin, USA, [2]University of Wisconsin - Milwaukee Field Station, Saukville, Wisconsin, USA*

## Comparing Survey Techniques for Monitoring Wisconsin's Endangered Cricket Frog

Manual calling surveys have historically been the method of choice for monitoring frog populations. During these surveys researchers travel to wetlands and listen for frog species following a standard protocol. These surveys can be time intensive and occur late into the evening. Additionally, incorrect detections, observer differences, logistics, and safety and environmental factors can constrain data collection in manual surveys. The development of automated recording systems and their accompanying software can offer a solution to some of the drawbacks of manual calling surveys. In our study we used a combination of manual calling surveys and automated recording systems to monitor three populations of the state Endangered Blanchard's Cricket Frog (*Acris blanchardi*) at 3 sites in Grant County Wisconsin. Results from manual calling surveys done by novice observers were compared to the audio playback of recordings from the same time. During manual calling surveys, observers made an error of omission 7% of time compared to zero commission errors in the audio playback. Current DNR management guidelines for this species involve assessing populations via manual calling surveys. Our data suggest that automated recording systems have several advantages over manual calling surveys. Our results may lead to improved guidelines for monitoring this species, especially as regards increasing sample sizes for statistical analysis, thereby improving the conservation of this imperiled species.

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**0735 Turtle Ecology, Salon A-C, Sunday 10 July 2016**

Pilar Santidrián Tomillo[1], Meritxell Genovart[1], Frank Paladino[2], James Spotila[3], Daniel Oro[1]

*[1]Institut Mediterrani d' Estudis Avançats, IMEDEA (CSIC-UIB), Esporles, Spain, [2]Indiana Perdue University Fort Wayne University, Fort Wayne/Indiana, USA, [3]Drexel University, Philadelphia, PA, USA*

## Temperature-dependent sex determination (TSD) is linked to temperature-dependent embryo mortality in sea turtles

Sea turtles have temperature-dependent sex determination (TSD) and high temperatures in the nest reduce hatching success and emergence of hatchlings. We modeled the effect of increasing nest temperature on a critically endangered population of leatherback turtles (*Dermochelys coriacea*) and assessed the relationship between TSD and temperature-dependent hatchling output. Our results showed that TSD is advantageous for sea turtle populations when temperatures rise to the levels that increase their embryo mortality. Populations compensate for the increased mortality of hatchlings by

increasing production of female hatchlings and therefore, future fecundity. This mechanism seems advantageous under fluctuating environments but it may become ineffective under climate change, as temperatures are projected to rise over the levels that produce 100% female hatchlings and cause death.

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**0248 AES Morphology & Reproduction, Balconies L & M, Friday 8 July 2016**

Taketeru Tomita[1], Chip Cotton[2], Minoru Toda[3]

*[1]Okinawa Churashima Research Center, Motobu, Okinawa, Japan, [2]Florida State University Coastal and Marine Laboratory, St. Teresa, FL, USA, [3]Okinawa Churaumi Aquarium, Motobu, Okinawa, Japan*

## Gas diffusion model indicates that oxygen diffusion through uterine wall is insufficient to sustain dogfish embryo

Unlike mammals or some "placental viviparous" sharks, most viviparous elasmobranchs lack connection with the mother, and thus, the embryos must acquire oxygen from the surrounding uterine fluid for a period ranging from several months to more than a year. However, the mechanisms underlying oxygen delivery and uptake in elasmobranchs remain largely unknown. Diagnostic sonography performed on a captive Japanese dogfish (*Squalus japonicus*) at the Okinawa Churaumi Aquarium demonstrated that a late-stage embryo used buccal movement to pump uterine fluid, suggesting that the embryo acquires oxygen from uterine fluid via gill ventilation. A previous study hypothesized that embryonic respiration in aplacental elasmobranchs depends on oxygen supplied by the uterine wall. To test this hypothesis, the rate of oxygen supply from the uterus was estimated by applying a "gas diffusion model" to the uterine wall of two dogfish species (*Squalus* cf. *mitsukurii* and *Squalus cubensis*). Our model calculations suggested that the supply of oxygen via diffusion through the uterine wall contributes less than 15-30% of the total oxygen demand of late-stage embryos, indicating that uterine wall is not the main source of oxygen for embryonic respiration. Previously, some authors have suggested that pregnant dogfish intermittently exchange uterine fluid with external seawater during late gestation. Thus, late-stage embryos may acquire oxygen primarily from uterine seawater introduced from the external environment.

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**0629 HL GRADUATE RESEARCH AWARD, Galerie 2, Thursday 7 July 2016**

João Tonini[1], Karen Beard[2], Rodrigo Ferreira[3], Walter Jetz[4], R. Alexander Pyron[1]

*[1]The George Washington University, Washington, DC, USA, [2]Utah State University, Logan, UT, USA, [3]Universidade Vila Velha, Vila Velha, ES, Brazil, [4]Yale University, New Haven, CT, USA*

## Fully-sampled phylogenies of squamates reveal evolutionary patterns in threat status

Macroevolutionary rates of diversification and anthropogenic extinction risk differ vastly throughout the Tree of Life. This results in a highly heterogeneous distribution of evolutionary distinctiveness (ED) and threat status among species. We examine the phylogenetic distribution of ED and threat status for squamates (amphisbaenians, lizards, and snakes) using fully-sampled phylogenies containing 9,574 species and expert-based estimates of threat status for ~4,000 species. We ask whether threatened species are more closely related than would be expected by chance and whether high-risk species represent a disproportionate amount of total evolutionary history. We found currently-assessed threat status to be phylogenetically clustered at broad level in Squamata, suggesting it is critical to assess extinction risks for close relatives of threatened lineages. Our findings show no association between threat status and ED, suggesting that future extinctions may not result in a disproportionate loss of evolutionary history. Lizards in degraded tropical regions (e.g., Madagascar, India, Australia, and the West Indies) seem to be at particular risk. A low number of threatened high-ED species in areas like the Amazon, Borneo, and Papua New Guinea may be due to a dearth of adequate risk assessments. It seems we have not yet reached a tipping point of extinction risk affecting a majority of species; 63% of the assessed species are not threatened and 56% are Least Concern. Nonetheless, our results show that immediate efforts should focus on geckos, iguanas, and chamaeleons, representing 67% of high-ED threatened species and 57% of unassessed high-ED lineages.

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**0633 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

João Tonini[1], Karen Beard[2], Rodrigo Ferreira[3], Walter Jetz[4], R. Alexander Pyron[1]

*[1]The George Washington University, Washington, DC, USA, [2]Utah State University, Logan, UT, USA, [3]Universidade de Vila Velha, Vila Velha, ES, Brazil, [4]Yale University, New Haven, CT, USA*

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**0921 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Luke Tornabene[1], D. Ross Robertson[2], James Van Tassell[3], Carole Baldwin[1]

*[1]National Museum of Natural History: Smithsonian Institution, Washington, DC, USA, [2]Smithsonian Tropical Research Institute, Balboa, Panama, [3]American Museum of Natural History, New York, NY, USA*

## A cache of new gobies (Gobiiformes: Gobiidae) from mesophotic reefs in the Caribbean discovered by manned submersibles

The Smithsonian's Deep Reef Observation Project (DROP) has reinvigorated the exploration of mesophotic and other deep-reefs in the Caribbean. Through the use of Substation Curacao's manned submersible *Curasub*, along with its tender vessel the *R/V Chapman*, DROP has discovered a cache of undescribed fish biodiversity from reefs below traditional scuba diving depths (~150-1000 ft). Many of the new species discovered by DROP belong to the family Gobiidae (gobies), the most diverse family of marine fishes in the world. Here we present an overview of the different gobiid taxa found on deep reefs in the Caribbean, including several species and genera that have been recently described as well as many other taxa that await formal description.

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**0668 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Josiah Townsend[1], Kayla Weinfurther[1], Ileana Luque-Montes[1], Thomas Firneno[1], James Austin[2]

[1]*Indiana University of Pennsylvania, Indiana, Pennsylvania, USA,* [2]*University of Florida, Gainesville, Florida, USA*

**Underestimated diversity in Mesoamerican true frogs (Family Ranidae)**

True frogs (Family Ranidae) are a taxonomically and ecologically diverse radiation of with New World distributions reaching from Alaska to the Amazon. The taxonomy of ranids has historically been underestimated, particularly in reference to leopard frogs (*Rana pipiens* complex). In Mesoamerica, our understanding of species-level diversity in these ubiquitous frogs is poor, and lacks a well-resolved phylogenetic hypothesis to guide species delimitation. Recognized taxa include *Rana brownorum* (low and moderate elevations along Caribbean versant of northern Mesoamerica), R. forreri (low elevations along Pacific versant), *R. macroglossa* (western Nuclear Central American highlands), *R. maculata* (Nuclear Central American highlands), *R. taylori* (low and moderate elevations along Caribbean versant of southern Mesoamerica), and *R. warszewitschii* (humid lowlands southern Mesoamerica). We sampled for over 200 Mesoamerican ranids representing six recognized species, and used DNA sequence data from three mitochondrial (12S, 16S, and COI) and four nuclear (BDNF, RAG1, Rhodopsin, and Seventh in Absentia) gene regions to estimate a new phylogeny. Our results suggest at there are at least eight unconfirmed candidate species in Central America, in addition to the six named taxa, with multiple cryptic lineages concealed within *Rana brownorum*, *R. maculata*, and *R. warszewitschii*. The taxonomy of both R. forreri and R. macroglossa also require additional attention. These results provide the phylogenetic backbone to support further work to delimit these candidate taxa and evaluate species boundaries in areas of potential sympatry and parapatry.

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**0952 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Claire Tracy, Kerry Cobb, Rafe Brown

*University of Kansas, Lawrence, Kansas, USA*

**Identification of Unknown Tadpoles from the Philippines**

With amphibian declines currently plaguing biodiverse regions around the planet, there is a need to focus further research on areas like the Philippines — regions that can utilize improved biological surveys to fuel conservation efforts. The lack of recent research including information on tadpoles, and the benefits that this information can have on biological assessments, conservation efforts, and phylogenetic relationships, puts a need for further descriptions and identifications of poorly studied amphibian larvae. A paper delimiting Philippine anuran species via tadpole descriptions, and including identification of those that have yet to be described, will greatly increase our current

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level of knowledge on the tadpoles in the Philippines. Standard Phenol-Chloroform extraction protocol was used followed by PCR to amplify the target region of the 16s rRNA locus. The amplified product was then sequenced using Sanger Sequencing by Beckman Coulter Genomics, and homologous sequences obtained from the National Center for Biotechnology (NCBI) nucleotide database using the Basic Local Alignment Search Tool (BLAST). By sequencing unknown tadpole specimens in the Herpetology collection at the University of Kansas, I was able to correctly identify these tadpoles and allow for further descriptions that can make a substantial contribution to the literature for both basic and applied science. It is anticipated that this contribution will form both a fundamental contribution to larval biology of Philippine amphibians—and also make practical, useful contribution for species identification, which should have an applied value for management purposes.

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**0065 Turtle Ecology, Salon A-C, Sunday 10 July 2016**

Stan Trauth[1], Dustin Siegel[2], Malcolm McCallum[3], David Jamieson[4], Anthony Holt[5], Joy Trauth[1], Hilary Hicks[1], Jonathan Stanley[1], Jonathan Elston[1], John Kelly[1], Johnny Konvalina[1]

*[1]Arkansas State University, Jonesboro, AR, USA, [2]Southeast Missouri State University, Cape Girardeau, MO, USA, [3]Scientific Investigator's Alliance, Holden, MO, USA, [4]Crowder College-Cassville, Cassville, MO, USA, [5]University of Arkansas Community College at Morrilton, Morrilton, AR, USA*

## Long-term Monitoring and Recovery of a Population of Alligator Snapping Turtles, *Macrochelys temminckii* (Testudines: Chelydridae), from a Northeastern Arkansas Stream

We conducted a mark and release study of the alligator snapping turtles, *Macrochelys temminckii*, on Salado Creek (Independence Co., Arkansas) during 10 trapping seasons, which spanned a 20-year period (1995 - 2015). We trapped a total of 163 alligator snapping turtles during 416 trap nights; we also recorded a total of 35 recaptures during this study. The catch per unit effort (CPUE) averaged slightly greater than 0.24 (317 trap nights) during the first 4 years (1995-1998), showed an increase to 0.64 by 2001 (only 14 trap nights), and then dramatically increased during the final 5 years to average 0.92 (85 trap nights). The population size estimates during the early period of the study (1995-2001) ranged from 20 alligator snappers in 1995 to as many as 88 snappers in 1998, whereas the population size estimates from 2011-2015 ranged from 105 snappers in 2011 to as many as 282 snappers in 2015. The male turtles recaptured had a higher average growth rate than females. These data, however, should be used with caution as age was not known. Most of the 22 recaptured alligator snapping turtles exhibited some degree of site fidelity. Within our sample, recaptured males grew faster on average than females or juveniles in both straight carapace length and mass. Both CPUE and Jolly-Seber approaches demonstrate that this population benefitted from removal of fishing pressure, thus leading to an increase in abundance of alligator snapping turtles in the lower ~5 km of the creek.

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**0862 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016**

Joel Trexler[1], William Loftus[2]

*[1]Florida International University, North Miami, FL, USA, [2]Aquatic Research & Communication, LLC, Vero Beach, FL, USA*

**Thirty years of bird food in the Everglades: Monitoring key links in the food web of an iconic ecosystem**

We are conducting a long-term study of aquatic animals in the Everglades that was started in the late 1970's. In the early 1990's we expanded the study from three sites in Everglades National Park to 20 sites over two drainages in the Park and in state-owned lands to the north. The goals of this study have been to gather information on fish and macroinvertebrates that indicate status of ecosystem function and particularly support key apex predators, especially wading birds. By the 1990's it was concluded that wading bird nesting success had declined because of food limitation during the nesting season, leading to the hypothesis that poorly planned water management failed to support aquatic animal production and seasonal concentration that historically coincided with the bird's nesting season. The long-term data gathered have been used to assess management actions as part of the Comprehensive Everglades Restoration Plan and contribute to a biannual report for the US Congress on the status of restoration efforts. This project is currently funded by the US National Park Service, though state and other Federal agencies contributed funding for the original expansion of the work outside of the National Park. The study design uses random sampling at fixed plots, which has generated time-series data yielding adequate statistical power to detect effects of importance for management. Recent uses of the project have been to develop models for evaluation of alternative restoration plans and climate change scenarios, and to track the invasion of non-native species.

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**1047 Fish Behavior & Development, Salon A-C, Sunday 10 July 2016**

Timothy C. Tricas, Kelly S. Boyle

*University of Hawai'i at Manoa, Honolulu, HI, USA*

**Evolutionary Patterns of Sound Production in Coral Reef Butterflyfishes (Chaetodontidae)**

Fish produce context-specific sounds during social communication, but evolutionary patterns of sound production are poorly known for most taxa. Butterflyfishes (family Chaetodontidae) are prominent members of coral reefs and use a diversity of acoustic behaviors during social communication. At least two sound production mechanisms exist in the bannerfish clade, and additional mechanisms exist in the *Chaetodon* clade which is distinguished by anterior swim bladder horns and the laterophysic connection.

Some *Chaetodon* species share the head bob acoustic behavior with *Forcipiger flavissimus*, which along with other sounds in the 100–1000 Hz spectrum, are likely adequate to stimulate the ear, swim bladder or LC of a receiver fish. In contrast, only *Chaetodon* species produced the tail slap sound, which involves a 1–30 Hz infrasound pulse that can stimulate the receiver's ear or lateral line at close distances, but not the swim bladder or its horns. Reconstructions of ancestral character states appear equivocal for the head bob and divergent for the tail slap acoustic behaviors. Independent contrast analysis indicates a correlation between sound duration and stimulus intensity characters within the family. The intensities of the tail slap and body pulse sounds in *Chaetodon* and the head bob sound in *Forcipiger* are correlated with body length, thus they provide honest acoustic signals of size. Future studies on fish acoustic communication should investigate low frequency and infrasound acoustic fields to understand the integrated function of the ear and lateral line, and their evolutionary patterns in acoustic communication.

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**0486 Fish Systematics II, Salon F-H, Saturday 9 July 2016**

Michael Tringali[1], Brandon Barthel[1], John Knight[2]

[1]*Florida Fish and Wildlife Commission, Saint Petersburg, FL, USA,* [2]*Florida Fish and Wildlife Commission, Holt, FL, USA*

**An Undescribed species of *Micropterus* in Florida and Southeastern Alabama**

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An undescribed species of the genus *Micropterus* has been discovered in coastal plain drainages of the Florida panhandle and southeastern Alabama. Taxonomically this species occurs within the *M. punctulatus* species group, which otherwise consists of *M. punctulatus*, *M. treculii*, and *M. henshalli*. It is monophyletic within the genus in phylogenetic reconstructions based on mitochondrial and nuclear-intron sequences, respectively, and is diagnosable with respect to all recognized members of *Micropterus* by multiple molecular autapomorphies. It is phylogenetically positioned such that failure to elevate it would require synonymizing other *M. punctulatus* group members. Its distinctiveness has been further corroborated by morphological-based canonical discriminant analyses, logistic regression, and, to lesser degree, recursive partitioning. Morphological and molecular analyses also elucidated another novel population of *Micropterus* inhabiting the coastal drainages in Mississippi. Specimens from this region, which are phylogenetically and morphologically distinct from the undescribed species, were thought to be intergrades of *M. punctulatus* × *M. henshalli*. However, the intergrade hypothesis is an oversimplification of its complex evolutionary dynamics and its taxonomic position within the genus remains uncertain.

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**0916 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Kelcie Troutman, Renata Platenberg

*University of the Virgin Islands, St Thomas, U.S. Virgin Islands*

**Call Recognition of Virgin Islands Frogs using Bioacoustic Analysis Software**

Frog populations are declining globally and there is a critical need to rapidly identify changes in population distribution, activity patterns, and community composition, and to correlate these changes with potential influences to direct management actions. Frogs in the Virgin Islands can be effectively surveyed using acoustic methods; each species has a unique call that can be recognized by trained personnel even across distances of hundreds of meters. We conducted an experimental synoptic survey using a citizen science model where community members submitted cell phone recordings collected during a specific time window, along with a screenshot of their location coordinates. We received over 300 2-minute recordings from across the US and British Virgin Islands. Using bioacoustic analysis software, the call structures for each frog species were isolated to allow automatic classification; species IDs were verified aurally. From the recordings, we identified three native (*Eleutherodactylus antillensis*, *E. cochranae*, and *Leptodactylus albilabris*) and two non-native (*E. coqui* and *Osteopilus septentrionalis*) species, while an additional two species (*E. lentus* and *Rhinella marina*) remained undetected. The recording locations have been mapped and will be used to spatially analyze patterns in frog distributions. Although the learning curve for this effort has been steep, this combination of bioacoustics and citizen science offers a promising method for rapidly collecting data for amphibian community monitoring.

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**0965 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016**

Derek B. Tucker[1], S. Blair Hedges[2], Guarino R. Colli[3], R. Alexander Pyron[4], Jack W. Sites, Jr.[1]

*[1]Brigham Young University, Provo, UT, USA, [2]Temple University, Philadelphia, PA, USA, [3]Universidade de Brasilia, Brasilia, DF, Brazil, [4]The George Washington University, Washington, DC, USA*

**A Fossil-Calibrated Time Tree of Teiid Lizards and Historical Biogeography of the West Indian *Ameiva* (Teiidae: Squamata)**

The West Indian *Ameiva* (N = 21) are a radiation of teiid lizards with a distribution across the Greater Antilles, Lesser Antilles, and Bahamas, with the remaining species in the genus occupying diverse habitats in South America. We propose to test hypotheses of the historical biogeography of the group. To accomplish this goal, we use a combination of NextGen sequence data (316 nuclear loci) and the mitochondrial ND2 gene to reconstruct phylogenetic relationships, estimate divergence times, and conduct ancestral area estimations. Our results support previous studies of *Ameiva* showing a single radiation to the Caribbean islands consisting of four species groups. A fossil-

calibrated time-tree estimates that West Indian *Ameiva* diverged from its sister group 27–23 MYA and diversification within the group has taken place over the last 12–10 MYA. If contemporary ocean currents are not considered in the analyses, the ancestor of Caribbean *Ameiva* likely began diversification in Cuba or the Bahamas. Animals from here also colonized Jamaica and Hispaniola with a long distance dispersal event to Puerto Rico. Subsequently, the Lesser Antilles were colonized from the Puerto Rican ancestor. If the probability of dispersal is reduced against ocean currents, the ancestor of the group likely dispersed from South America to Dominica with subsequent dispersal to Hispaniola. Both of these groups (Domica and Hispaniola) then dispersed to nearby islands with the Domica group colonizing Puerto Rico and the remaining Lesser Antilles while the Hispaniola group colonized the remaining Greater Antilles (except for Puerto Rico) and the Bahamas.

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**1037 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Cassandra Turinske[1], Michael Pauers[0]

*[1]UW-Waukesha, Waukesha, WI, USA, [2]Milwaukee Public Museum, Milwaukee, WI, USA, [3]UW-Milwaukee School of Freshwater Science, Milwaukee, WI, USA*

## Morphological Variation among Wisconsin Populations of the Orangespotted Sunfish (*Lepomis humilis*)

While studies of intraspecific morphological variation in centrarchid sunfishes are fairly common, these studies are often focused on a select few species of the genus *Lepomis*. Nonetheless, many species of *Lepomis* have been overlooked, including the Orangespotted Sunfish, *Lepomis humilis*. As a first attempt to explore the possibility of intraspecific variation in *L. humilis*, examined morphological variation among nine Wisconsin populations of this species. While we found no morphometric variation among these populations, we did find one, from Lake Belle View in Dane County, which had an unusually low number of lateral line scales; these scales were also larger than those found in the other populations. To the best of our knowledge, this is the first demonstration of any kind of morphological variation among populations of *L. humilis*; a fruitful second step would be to expand the geographical range of these comparisons.

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**0374 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

A.J. Turner, William Ludt, Prosanta Chakrabarty

*Louisiana State University, Baton Rouge, LA, USA*

### Molecular phylogeny of threadfin breams (Nemipteridae), with comments on their habitat transitions to and from coral reefs

Fishes in the family Nemipteridae, also referred to as threadfin or whiptail breams, are carnivorous fishes inhabiting shallow, continental habitats. They are widely distributed throughout tropical and subtropical waters in the Indo-West Pacific and are important for artisanal and commercial fisheries in the region. Approximately 67 species are currently described and placed within five genera, which exhibit strikingly different ecologies. Fishes in *Nemipterus* and *Parascolopsis* generally occur over sandy or muddy bottoms and consume benthic invertebrates, while species of *Pentapodus, Scolopsis,* and the monotypic *Scaevius* occur near coral reefs. Although they are widely distributed throughout many habitat types across their range, life history information on many species is poorly studied and phylogenetic relationships among genera remain unresolved. At present, less than ten species have been included in phylogenetic analyses. Here we present the most inclusive dataset of nemipterid fishes to date by including approximately half of the described species diversity in the family, and representatives from all genera. Using a combination of mitochondrial and nuclear loci, we demonstrate the monophyly of this group with both maximum likelihood and Bayesian approaches. Furthermore, the relationships among different genera are discussed, along with historical transitions between reef and non-reef habitats. With this dataset, Nemipteridae has the potential to become a new model system for investigating how transitions to coral reef habitat influence speciation in marine fishes.

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**0647 Fish Ecology I, Salon A-C, Saturday 9 July 2016**

Thomas Turner

*University of New Mexico, Albuquerque, New Mexico, USA*

### Stable Isotopes and museum specimens offer new insights into ecological processes over centuries of environmental change

Natural history collections offer vast resources and deep time series for stable isotope analysis (SIA). In turn, SIA offers insights into ecosystem processes that shape biodiversity. The highest value of museum holdings may be to establish baseline conditions to evaluate ecosystem and food web processes over the last century. This is notable because this time period is marked by unprecedented landscape transformation and climate change. Using river systems as an example, I explore several scenarios of how isotopic techniques and museum specimens can be used to evaluate effects of river flow homogenization, invasive species, and water extraction. A recently developed analytical framework places isotopic ratios into niche modeling context that opens up

new possibilities for process-oriented analysis of species distribution and abundance. Constraints involve the effects of museum preservatives and temporal and spatial depth of museum sampling events. Incorporation of isotope ratios into natural history collections databases could enhance interpretation and utility immeasurably.

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## 0193 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016

Annalee Tutterow[1], Shannon Pittman[1], Gabrielle Graeter[2], Michael Dorcas[1]

*[1]Davidson College, Davidson, NC, USA, [2]North Carolina Wildlife Resources Commission, Raleigh, NC, USA*

### The State of North Carolina Bog Turtle Populations: Assessing Bog Turtle Population Demography and Landscape Factors Affecting Their Persistence

Turtles are among the most vulnerable vertebrate group to declines, extirpations, and extinctions, especially those species with specific habitat requirements. The bog turtle (*Glyptemys muhlenbergii*) occupies small bogs, fens, and wet meadows in the eastern United States and is listed as federally threatened. We used a long-term mark-recapture dataset and applied a Cormack-Jolly-Seber model to calculate annual adult, sex-specific, and juvenile survival for intensively-sampled bog turtle populations in North Carolina. We found that adult survivorship remained constant over time for all populations, but was relatively low (0.869-0.942) when compared to the 0.96 adult survival estimate documented for northern bog turtle populations. We also analyzed landscape-level factors potentially affecting North Carolina bog turtle populations across multiple spatial scales (500-3000 m). We evaluated the impact of landscape conditions on turtle densities (range 4-224 turtles/ha) for the eight most intensively-sampled populations and considered the distribution of eleven bog turtle wetlands within a broader spatial context. We found that percent forest cover and wetland connectivity at the highest spatial scale (3000 m) were the only significant predictors of bog turtle densities in North Carolina. Our studies indicate that North Carolina bog turtle populations are likely declining and that without stronger protection measures, including the mitigation of large-scale effects, local and regional extirpations of the species may occur.

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**0907 SSAR SEIBERT PHYSIOLOGY & MORPHOLOGY, Galerie 3, Friday 8 July 2016**

Catherine Tylan[1], Kiara Camacho[1], Sean Graham[2], Mark Herr[1], Jermayne Jones[1], Gail McCormick[1], Melissa O'Brien[1], Jennifer Tennessen[1], Christopher Thawley[1], Tracy Langkilde[1]

*[1]Department of Biology, The Pennsylvania State University, University Park, PA, USA, [2]Department of Biology, Sul Ross State University, Alpine, TX, USA*

### Collecting baseline corticosterone samples in reptiles and amphibians: is under 3 minutes good enough?

There is growing interest in the use of glucocorticoid (GC) stress-relevant hormones as a way to understand how wild animals interact with their environment. The best medium for obtaining recent information about GC levels is blood, as the earliest changes in GC concentrations occur in blood plasma. Unfortunately, it is stressful to capture, restrain, and obtain blood from wild animals. As the hypothalamic-pituitary-adrenal axis requires some time to respond to a stressor with increased GC concentrations, the prevailing assumption is that blood taken within three minutes of capture should not yet be affected by the stress of capture, and thus reflect a true baseline level of GCs. This has been tested and confirmed in numerous laboratory rodents and birds, but there has been minimal work done in wild reptiles and amphibians. Here we compiled data collected from three species of wild caught reptiles (cottonmouths, rattlesnakes, and eastern fence lizards) and one species of laboratory acclimated amphibian (wood frogs). Blood samples to measure baseline GC concentrations (corticosterone, CORT) in these animals were taken between 1 and 13 minutes after first disturbing the animal, depending on the species. We used a nonparametric change point analysis test to determine if there was a statistically significant change point in the concentrations of CORT in samples taken after longer duration of captivity stress. We will present our findings and discuss the implications of the potential similarities and differences in character between the stress physiology of endotherms and ectotherms.

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**0988 HL, ASIH, SSAR: Eco-Evolutionary Dynamics Symposium, Salon D, Friday 8 July 2016**

Mark Urban

*University of Connecticut, Storrs, CT, USA*

### Do Eco-evolutionary Dynamics Promote Resilience of Amphibian Communities to Climate Change?

Understanding the resilience of natural systems to climate change is necessary to predict and ameliorate future impacts on biodiversity and ecosystem dynamics. In particular, we cannot accurately understand climate change risks to particular species and communities without understanding the interacting contributions of ecological and evolutionary resilience. Yet, most research fails to address one or more of these

fundamental forms of resilience, and these gaps currently limit our ability to predict ecological responses with accuracy. Here I evaluate evidence for both ecological and evolutionary resilience in spotted salamanders (*Ambystoma maculatum*) and wood frogs (*Rana sylvatica*) to the climate-fueled expansion of the marbled salamander (*Ambystoma opacum*), an apex predator in temporary ponds. Results demonstrate that the apex predator substantially affected community and ecosystem properties in whole-pond manipulations. Experiments show that both spotted salamanders and wood frogs have adapted to the predator at fine scales. These adaptations could increase the resilience of some but not all ecological properties of ponds. Also evolution might not occur quickly enough relative to the rate of climate change. Also, populations located outside of the current marbled salamander range are adapted to other selection regimes that could interfere with these dynamics. Understanding the full complexity of both ecological and evolutionary responses will often be necessary to predict climate change responses with accuracy.

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**0321 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Robin Van Meter[1], Donna Glinski[2], Matthew Henderson[3], Tom Purucker[3]

*[1]Washington College, Chestertown, MD, USA, [2]Oak Ridge Institute of Science & Education, Oak Ridge, TN, USA, [3]US Environmental Protection Agency, Athens, GA, USA*

## Soil organic matter content effects on dermal pesticide bioconcentration in American toads (*Bufo americanus*)

Pesticides have been implicated as a major factor in global amphibian declines and may pose great risk to terrestrial phase amphibians moving to and from breeding ponds on agricultural landscapes. Dermal uptake from soil is known to occur in amphibians, but predicting pesticide availability and bioconcentration across soil types is not well understood. This study was designed to compare uptake of five current-use pesticides (imidacloprid, atrazine, triadimefon, fipronil, pendimethalin) in American toads (*Bufo americanus*) from exposure on soils with significant organic matter (OM) content differences (14.1 % = high OM and 3.1% = low OM). We placed toads on high or low OM soil after applying individual current use pesticides on the soil surface for an 8-hour exposure duration. Whole body tissue homogenates and soils were extracted and analyzed using LC-MS to determine pesticide tissue and soil concentration, as well as bioconcentration factor in toads. Tissue concentrations were greater on the low OM soil than the high OM soil across all pesticides (average±SE; 1.23ppm±0.35 and 0.78ppm±0.23, respectively), and bioconcentration was significantly higher for toads on the low OM soil (ANCOVA $p = 0.002$). Soil organic matter is known to play a significant role in mobility of pesticides and bioavailability to living organisms. The potential for pesticide accumulation in amphibians moving throughout agricultural landscapes may be greater and should be considered in conservation and policy efforts.

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**0806 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Alex Van Nynatten[1], Devin Bloom[2], Belinda Chang[1], Nathan Lovejoy[3]

*[1]University of Toronto, Toronto, Ontario, Canada, [2]Western Michigan University, Kalamazoo, Michigan, USA, [3]University of Toronto Scarborough, Scarborough, Ontario, Canada*

**Visual Evolution in Marine Derived Amazonian Fishes**

Incursions of marine water into South America during the Miocene prompted colonization of freshwater habitats by ancestrally marine species, and present a unique opportunity to study the molecular evolution of adaptations to varying environments. Freshwater and marine environments are distinct in both spectra and average intensities of available light. Higher concentrations of organic material and suspended particulate matter red-shift the underwater visual environment of large freshwater rivers. We have identified increased rates of molecular evolution in rhodopsin, the protein component of the photosensitive pigment in the eye expressed in the dim-light sensitive rod cells, in lineages of marine derived Amazonian fishes. Using likelihood-based comparative sequence analyses, we found evidence for positive selection in the rhodopsin of freshwater inhabiting lineages at sites known to be important for aspects of rhodopsin function such as spectral tuning. Differences are also observed between marine and freshwater lineages at known red-shifting sites, shifting the sensitivity of this pigment towards wavelengths of light more predominant in freshwater rivers. Our results suggest that an increased rate of rhodopsin evolution was driven by diversification into freshwater habitats, thereby constituting a rare example of molecular evolution mirroring large-scale palaeogeographical events.

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**0812 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Alex Van Nynatten[1], Devin Bloom[2], Belinda Chang[1], Nathan Lovejoy[3]

*[1]University of Toronto, Toronto, Ontario, Canada, [2]Western Michigan University, Kalamazoo, Michigan, USA, [3]University of Toronto Scarborough, Scarborough, Ontario, Canada*

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**0691 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

Maurits van Zinnicq Bergmann[1], Tristan Guttridge[1], Mark Bond[2], Samuel Gruber[1], Yannis Papastamatiou[2]

*[1]Bimini Biological Field Station, South Bimini, Bahamas, [2]Florida International University, Miami, Florida, USA*

## Movement Networks and Habitat Preferences of a Multi-Species Elasmobranch Assemblage in Bimini, Bahamas

Describing the ecological role of a species is contingent upon a holistic understanding of the relationships between animal movement, physical environment, and interactions with con-/heterospecifics. Such interactions define the structure and dynamics of populations and communities. How large predators influence these processes in marine systems, however, remains poorly understood. Here, a combination of passive acoustic telemetry, baited remote underwater video system (BRUVS) and fixed environmental data loggers in an island system in Bimini, The Bahamas, to identify physical (water temperature, depth) and biological drivers (competition, prey availability) of movement, habitat and space use, habitat specificity and spatial hotspots of lemon *Negaprion brevirostris* (*n*=14), great hammerhead *Sphyrna mokarran* (*n*=20), tiger *Galeocerdo cuvier* (*n*=12), nurse *Ginglymostoma cirratum* (*n*=14), bull *Carcharhinus leucas* (*n*=7), blacktip *C. limbatus* (*n*=7), Caribbean reef *C. perezi* sharks (*n*=6), and southern stingray *Dasyatis americana* (*n*=6). A multi-habitat acoustic array monitored localized movements and residencies, while a data share collaboration of acoustic arrays monitored long-distance movements. BRUV surveys assessed relative abundance and distribution of elasmobranch and prey species for each habitat type that were representative of the Bimini array. Preliminary results revealed singular and diverse habitat use (Caribbean reef and nurse/great hammerhead, respectively), spatial hotspots and concentrated movements (around coral reefs/deep-water drop-off), numerous (trans-national boundary) migrations (nurse, lemon, hammerhead) and long-term, seasonal site fidelity. The creation of mechanistic home range models, through quantification of elasmobranch habitat associations and movement networks, will be vital to delineate key areas for protection and predict home range size and the impacts of anthropogenic perturbations.

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**1078 General Herpetology, Balconies L & M, Sunday 10 July 2016**

John Vanek[1], Russell Burke[2]

[1]*Southern Illinois University, Carbondale, IL, USA,* [2]*Hofstra University, Hempstead, NY, USA*

## Behavioral Ecology of Dwarfed Eastern Hog-nosed Snakes (*Heterodon platirhinos*) on a Barrier Island

We studied the behavioral ecology of Eastern Hog-nosed Snakes (*Heterodon platirhinos*) on a New York barrier island (~1800 ha) that reach smaller maximum sizes than mainland populations. Snakes on the island only have access to a single prey species (*Anaxyrus fowleri*), occur in large numbers (n >180 marked) with high densities (>4 snakes/ha), and lack color polymorphism that is characteristic of the species. We used radio-telemetry (n = 12), visual encounter surveys, and trapping to analyze the home range, habitat selection, and activity periods of this unique population. We found that dwarfed Eastern Hog-nosed Snakes utilize small home ranges, and that males (100% MCP = 40.6 ha ± 8.9) have significantly larger home ranges than females (100% MCP = 12.0 ha ± 9.4) home range sizes. Dwarfed Eastern Hog-nosed Snakes utilized open habitat with low canopy cover, but unlike other studies they also exhibited high use of Common Reed (*Phragmites australis*) dominated wetlands. Visual encounter surveys were male biased and revealed bimodal seasonal activity, with peaks in the spring and fall corresponding to the breeding seasons. Trapping was female biased, and remained successful during the summer, when concurrent visual encounter surveys were of diminished utility. Our success trapping (n = 52 unique individuals captured) suggests that this combination of survey techniques can be used very successfully, particularly in the northeastern United States where the species is of regional concern.

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**0304 ASIH STOYE AWARD GENERAL HERPETOLOGY, Salon F-H, Friday 8 July 2016**

Mariana Vasconcellos[1], Guarino Colli[2], Miguel Rodrigues[3], David Cannatella[1]

[1]*The University of Texas, Austin, Texas, USA,* [2]*Universidade de Brasilia, Brasilia, DF, Brazil,* [3]*Universidade de São Paulo, São Paulo, SP, Brazil*

## Historical Climate Change Shapes Population Structure and Genomic Divergence of Treefrogs in the Neotropical Cerrado Savanna

Although the impact of Pleistocene glacial cycles was once dismissed in tropical regions, increasing evidence suggests that tropical organisms were greatly affected by Pleistocene climatic fluctuations resulting in distributional shifts. The genetic consequences of such responses to past climate change are just now being uncovered in several regions. Using genome-wide SNPs and mitochondrial DNA, combined with species distribution models across the late Quaternary until the present, we evaluate the effect of paleoclimatic shifts on the present genetic structure and population differentiation of *Hypsiboas lundii*, a treefrog endemic to the South American Cerrado

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savanna. Our results show a recent and strong genetic divergence across the Cerrado landscape from west to east that does not seem congruent with any current physical barrier to gene flow. Isolation by distance explains much of the population differentiation in *H. lundii*, but we also find substantial support for the role of past climatic changes when controlling for the geographic distance among populations. Areas of more stable climatic conditions allowing population persistence since the Pleistocene appear to have played a strong role establishing the present genetic structure of this treefrog. This pattern is consistent with a model of isolation by instability, highlighting the strong effects of Pleistocene climatic shifts on tropical savannas.

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**0576 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Victoria Elena Vásquez, David A Ebert

*Moss Landing Marine Laboratories, Moss Landing, CA, USA*

**'IT'S HAMMERTIME!': Uncovering the Secrets of an Iconic Shark with Citizen Science**

Hammerhead sharks (*Sphyrna spp.*) are distinctive, and rather iconic, among shark species, with their "hammer-shaped" head. Two species are known to occur in the Northeast Pacific off southern California; the Scalloped (*Sphyrna lewini*) and Smooth (*S. zygaena*). Of these two species, the Smooth Hammerhead is the more temperate occurring species and is not uncommon off southern California. However, the extent of its occurrence is poorly known. The Scalloped Hammerhead is less common to rare in this area, typically only observed during warm water years usually associated with El Niño events. In recent years the use of mobile devices and through social media the general public and media has captured and informally documented images of Hammerhead Sharks, prompting interest from the public. The public's perception is that they are increasing in abundance. Therefore, in an effort to better document and identify the Hammerhead species involved, a citizen science project was initiated in 2014 called 'Hammertime'. Information is gathered through a web-based survey designed and monitored by the Pacific Shark Research Center. Basic, or more detailed, observational information, such as date and time of sightings, can be entered through a portal. Data collected overtime will allow researchers to evaluate long-term trends. This knowledge is of particular importance for Smooth and Scalloped Hammerhead Sharks since little is known about their use of Southern California waters. A better understanding of abundance, distribution and seasonality of Hammerhead Sharks in Southern California waters will help to better inform conservation and fishery management practices.

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**0868 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Jeremy Vaudo[1], Bradley Wetherbee[2], Jessica Harvey[3], Alexandra Prebble[1], Keith Bruni[2], Mark Corcoran[1], Matt Potenski[1], Guy Harvey[1], Mahmood Shivji[1]

*[1]Guy Harvey Research Institute, Nova Southeastern University, Dania Beach, FL, USA, [2]University of Rhode Island, Kingston, RI, USA, [3]Cayman Islands Department of Environment, George Town, Grand Cayman, Cayman Islands*

## Characterization and monitoring of one of the world's most valuable ecotourism animals, the southern stingray, *Dasyatis americana*, at Stingray City, Grand Cayman

Marine wildlife-oriented ecotourism often involves the provisioning of animals to increase the reliability of human-animal interactions. While these practices may increase the enjoyment of tourists, the long-term effects on wildlife are often unclear. The Stingray City Sandbar (SCS), Grand Cayman, is a location where southern stingrays, *Dasyatis americana*, are provisioned for ecotourism, resulting in behavioral and physiological changes. Recently, tourist operators have claimed that the number of stingrays at SCS has decreased substantially, however, there has never been a formal survey of stingrays at SCS. We examined over 13 years of southern stingray tagging data and enacted a structured census of the SCS aggregation to provide a formal characterization of the aggregation, establish a baseline for future monitoring, and provide some basic biological information on southern stingrays. Mature females dominated the SCS aggregation across years, and confirming operator fears, the size of the SCS declined between 2008 and 2012 from >100 to ~60 stingrays. Since 2012, stingray numbers have increased and appear to have stabilized at ~90 stingrays, which is still lower than historical levels. Females tended to be recaptured over much longer periods of time than males, with ~20% of recaptured females present for 10+ years, while male recaptures typically occurred within 3 years. As a result, there was more consistency of females over time, while males turned over more quickly. Our results suggest the SCS aggregation is highly dependent on recruitment from the general population and highlight the importance of regular monitoring for successful management of ecotourism activities.

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**0211 ASIH STOYE GENERAL ICHTHYOLOGY AWARD, Galerie 2, Friday 8 July 2016**

Diego F B Vaz, Eric J Hilton

*Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia, USA*

## The caudal-fin skeleton of Batrachoidiformes (Teleostei: Percomorphacea) and its implications for the systematics of the order

The caudal-fin skeleton is a primary data source for studies of the systematics of fishes, with characters from it being proposed as synapomorphies at many levels of

organization. Batrachoidiformes is recognized as a monophyletic group, although the interrelationships among the genera and species are not entirely clear. Similarly, the relationships of this order to other percomorph fishes are not well established. The distinctive caudal skeleton of Batrachoidiformes has not been throughouly studied and the characters from this complex are poorly represented in recent phylogenetic analyses. This analysis of the caudal-fin skeleton of Batrachodiformes, based on cleared and stained specimens representing the diversity of the order, emphasized the detection of intraspecific variation to better recognize morphological characters of possible phylogenetic significance. There is a high level of intraspecific variation, especially in the shape of the epurals and the margin of the parhypural flange. However, the parhypural articulates with the haemal spine of PU2 in two distinct patterns: 1) tightly with the haemal spine through a straight edge (e.g., *Opsanus tau*, *Thalassophryne maculosa*, *Allenbatrachus reticulatus*), and 2) loosely through an acute stay (e.g., *Aphos porosus*, *Porichthys porosissimus*). The support for the caudal-fin rays by the epurals also has two conditions: 1) the anteriormost epural supporting one or two procurrent caudal-fin rays (e.g. *Halobatrachus didactylus, Batrachoides pacifici*) and 2) the anteriormost epural not supporting any caudal-fin ray (e.g. *Poricthys plectrodon*, *Daector dowi*, *Amphichthys cryptocentrus*). The implications of these and other characters on interpreting the phylogenetic relationships within Batrachoidiformes will be discussed.

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**1004 General Ichthyology II, Balconies J & K, Sunday 10 July 2016**

Page E. Vick[1], Mark S. Peterson[1], William T. Slack[2], Paul O. Grammer[1]

[1]*University of Southern Mississippi, Department of Coastal Sciences, Ocean Springs, MS, USA,* [2]*U.S. Army Corps of Engineers Research and Development Center, Vicksburg, MS, USA*

## Are there differences in critical habitat use between western and eastern Gulf Sturgeon (*Acipenser oxyrinchus desotoi*) population segments on Ship Island, Mississippi Sound, north-central Gulf of Mexico?

Federally-mandated critical habitat was designated for Gulf Sturgeon (GS) in 2003 across the species range including the Mississippi barrier islands. Earlier research showed that Ship Island (SI) provides critical overwintering habitat for members of the western population segment (WPS), and our preliminary research indicates members of the eastern population segment (EPS) also use SI. We used acoustic telemetry data to generate conservative estimates of travel time, travel distance, and travel rate for individual WPS and EPS members by drainage. The SI four year acoustic array (2011-2015) detected 60 acoustically-tagged GS (89.9-195 cm FL); 26 were EPS with the majority from the Blackwater River (FL) whereas 30 were WPS, representing the Pearl (MS/LA) and Pascagoula (MS) rivers. Fish residency averaged 33 days for EPS and 37 days for WPS annually, with WPS fish arriving in late October and leaving in early March and EPS fish arriving in mid-November and leaving in early April. Although arrival and departure times differed, annual residency (~6 mo) was about the same for both population segments. Conservative travel distances to SI from EPS ranged from 185

to 276 km whereas WPS ranged from 32 to 53 km. In one case, a Blackwater fish traveled from SI to its drainage within 11 days averaging 17 km/d; however, most travel between SI and natal drainages is about 1 km/d for both EPS and WPS. Arrival and departure of WPS was earlier than EPS suggesting either faster swimming speeds or earlier departure for natal drainages.

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**1013 AES Genetics, Genomics, Biogeography, & Systematics, Balconies J & K, Saturday 9 July 2016**

Eduardo Villalobos[1], Héctor Espinosa[1], Paulo Brito[3], Jesús Alvarado[2]

*[1]Instituto de Biología, UNAM, Ciudad de México, Mexico, [2]Instituto de Geologia, UNAM, Ciudad de México, Mexico, [3]Universidade do Estado do Rio de Janeiro, Rio de Janeiro, Brazil*

## Morphological analysis of the genus *Zapteryx* (Rhinobatidae: Batoidea) and its phylogenetic implications

The genus *Zapteryx* is composed of three species, which are distributed in the coasts of the American continent: in the Pacific side *Z. exasperata* and *Z. xyster* and in the Atlantic coast *Z. brevirostris*. This genus poorly studied from the phylogenetic perspective and its phylogenetic relations with other members of the family Rhinobatidae (*Aptychotrema*, *Rhinobatos* and *Trygonorrhina*) are uncertain. Using a parsimony phylogenetic analysis with chondroskeleton characters, the present study seeks to determine the phylogenetic topology of the genus *Zapteryx* and its phylogenetic relations with the family Rhinobatidae. The phylogenetic analysis included several species from the guitar fishes sensu (Compagno, 1977) and five fossil species of guitar fishes from de Upper Cretaceous. The character review was made via dissections or using images from x-rays and tomographys from specimens kept in the Colección Nacional de Peces, del Instituto de Biología UNAM, the Colección Nacional de Paleontología del Instituto de Geología UNAM, the Ichthyology Collection of the University of the State of Rio du Janeiro and from bibliographical reviews. The matrix for the phylogenetic analysis was elaborated using the program WINCLADA and analyzed using the algorithms of TBR and Ratchet in the program TNT. The results of these analyses show that the genus *Zapteryx* has not immediate phylogenetic affiliations with the genus *Rhinobatos* and *Aptychotrema* and that the family Rhinobatidae could be divided in at least two taxonomic entities of the same hierarchy.

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**0601 ASIH STOYE AWARD GENERAL ICHTHYOLOGY, SALON F-H, Thursday 7 July 2016**

Kirill Vinnikov

*University of Hawaii at Manoa, Honolulu, Hawai'i, USA*

### Complete Phylogeny of the Righteye Flounders (Teleostei: Pleuronectidae) Provides the New Evidence for Vicariant Speciation Event after the Bering Strait Opening

The family Pleuronectidae is a group of righteye flounders with 62 currently described species. Ten occur exclusively in the Northern Atlantic and the others live in the Northern Pacific, with a few polar species that can be found in both regions. A recent phylogenetic study of bony fishes provided the first molecular time estimate for the origin of Pleuronectidae at <25 mya (Betancur-R et al., 2013), which contradicts the fossil evidence for pleuronectids from the early Oligocene deposits. Moreover, those deposits have been found in several regions in Europe and in Japan, suggesting conflicting hypotheses for the geographic origin of the family. In the present study, I propose the first complete phylogeny of Pleuronectidae reconstructed from the Bayesian analysis of two mitochondrial and three nuclear genes. The phylogenetic tree was used to estimate the ancestral states of osteological characters commonly applied in pleuronectid fossil identification. Then, a set of 23 known pleuronectid fossils was thoroughly reanalyzed, discarding all the specimens with uncertain taxonomy and dating. The remained fossils were used for node calibration under the UCLN clock model and the birth-death prior in BEAST. Based on the calibrated phylogeny, the origin of Pleuronectidae is estimated to be between 38-50 mya. According to that estimate, Atlantic species had begun to diverge independently from the Pacific species starting around 5 mya, which corresponds with the time of the Bering Strait's first opening. Thus, this study provides new insights into the origin of the righteye flounders in the Northern Atlantic by vicariant speciation.

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**0707 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Elizabeth Vinyard[1], Walter Bubley[2], Bryan Frazier[2], Marcus Drymon[3], Jim Gelsleichter[4]

*[1]The Graduate School at the University of Charleston, South Carolina, Charleston, SC, USA, [2]South Carolina Department of Natural Resources, Charleston, SC, USA, [3]University of South Alabama, Mobile, AL, USA, [4]University of North Florida, Jacksonville, FL, USA*

### Age, growth, and maturation of the Finetooth Shark, *Carcharhinus isodon*, in coastal waters of the western North Atlantic Ocean

Age, growth, and maturity was examined for Finetooth Sharks, *Carcharhinus isodon*, in coastal waters of the western North Atlantic Ocean (WNA) from Winyah Bay, South Carolina to Cape Canaveral, Florida. Vertebrae from 190 males and 217 females were aged, and the maximum observed age for males and females was 21.9 years and 22.3

years, respectively. Sizes ranged from 376 mm to 1174 mm FL for males and 380 mm to 1282 mm FL for females. Significant differences were detected between the sexes necessitating sex-specific von Bertalanffy growth models. These models yielded the following equations: $L_t = 1141$ mm FL - $(1 - e^{-0.279(t-(-1.857))})$ for males and $L_t = 1257$ mm FL - $(1 - e^{-0.197(t-(-2.335))})$ for females. Median length ($L_{50}$) and age ($A_{50}$) where 50% of the population is mature were 999 mm FL for males and 1041 mm FL for females corresponding to 6.4 years and 6.9 years, respectively. Significant differences in growth were detected between the current study and previously published parameters for the WNA. The current study found greater observed maximum ages, $A_{50}$, $t_0$, and $L_0$ for both sexes and greater $L_{50}$ for females. Both sexes were found to have lower $L_\infty$ parameters and males displayed lower $L_{50}$ and lower k compared to the previous study. Previously no significant differences were detected in growth models from the WNA and Gulf of Mexico (GOM); however, results from the current study as well as reproductive, tagging and genetic studies suggest separate stocks in the WNA and GOM.

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**0488 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Stacey Virtue-Hilborn, Mark Steele

*California State University, Northridge, Northridge, CA, USA*

## Bay Pipefish Abundance, Distribution and Ecological Function in Southern California Eelgrass Beds

As a result of human population pressures, seagrasses have experienced rapid environmental changes and large scale losses over that last 20 years. These losses directly threaten the survival of organisms like the bay pipefish (*Syngnathus leptorhynchus*), which is highly specialized to seagrass environments and unlikely to survive outside of them. The bay pipefish is an abundant microcarnivore and may be affecting the trophic structure of these beds but it has not been well studied. Through seasonal surveys as well as caged experiments in the field, the distribution, abundance and ecological role of the bay pipefish in the trophic system of seagrasses was assessed in order to understand how to better protect these fragile marine ecosystems and the organisms that inhabit them. Seasonal surveys were conducted to confirm that pipefish abundance and distribution stay constant throughout the year (regardless of temperature and eelgrass density changes) unlike other fish and invertebrate species that inhabit these nursery habitats temporarily. Caged experiments in the field concluded that the bay pipefish may be having an effect on the density of crustacean algal grazers in this system. Preliminary results suggest that the loss of these grazers are resulting in either immense algal growth on eelgrass blades or community structure change as other grazers, including mollusks, increase in density in these areas. Further analysis on the ecological function of the bay pipefish in these habitats could provide meaningful information needed to better understand how to protect a fish that is dependent on this fragile marine ecosystem.

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**0575 HL: Social Behavior in Reptiles Symposium, Salon E, Saturday 9 July 2016**

Richard Vogt[1], Camila Ferrara[2], Virginia Bernardes[1]

[1]*Instituto Nacional de Pesquisas da AmazÇonia, Amazonas, Brazil,* [2]*Wildlife Conservation Society-Brazil, Amazonas, Brazil*

### Communication and Social Life of the Giant South American River Turtle (*Podocnemis expansa*)

Most turtles do not appear to have much of a social life apart from courting and copulating, and a few territorial disputes among males, however we have found that the Giant South American River Turtle has a much more complex social life and dynamic vocal repertoire beginning while still in the egg. Over 25 years studying a population of this species in the Brazilian Amazon in the Rio Trombetas has shown *Podocnemis expansa* to be one of the most social species of turtles in the world: 1) communication with siblings while still in the egg, in the nest, scampering across the beach, entering the river and migrating with adult females; 2) group migratory behavior of adults from the flooding forests where they feed to the nesting beaches, group basking on the nesting beach, communal nesting, aggregation of females waiting for their young to hatch, communicating with hatchlings vocally, leading their hatchlings to the flooded forests to feed. We documented that many of these activities are synchronized by vocalizations. Through the use of hydrophones and microphones in the nest, sonic, vhf, and satellite transmitters as well as Crittercams attached to the carapaces of females and 1000s of pit tagged hatchlings we have confidently described post natal maternal care and other attributes suggesting group selection. These turtles use both visual and auditory signals to communicate, although they do not wag their tails like a dog when they come to greet you it is apparent that they also recognize individual humans besides individual conspecifics.

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**0529 NIA II, Galerie 3, Sunday 10 July 2016**

Joseph Waddell, William Crampton

*University of Central Florida, Orlando, Florida, USA*

### Condition-dependent Electric Signaling in a Community of the Gymnotiform Knifefish *Brachyhypopomus* from the Upper Amazon

*Brachyhypopomus* generate pulsed electric organ discharges (EODs), and exhibit notable interspecific and intraspecific waveform diversity. Many studies have shown that these electric signals play a significant role in both mate attraction and intrasexual competition. Here, we summarize evidence for condition dependent signaling in a community of nine species of *Brachyhypopomus* from terra firme stream and floodplain

lake habitats in the Upper Amazon. To best characterize signaling status in a natural social environment, we recorded head-to-tail EOD waveforms in the field at night, during peak hours of activity, within two minutes of capture (before the onset of most melanocortin-mediated EOD modulation). We investigated the correlation between overall body condition and calibrated EOD amplitude by correcting for covariance between EOD amplitude, body length, and body mass (utilizing residuals from log-normalized regressions). Our results show considerable variation in the correlation between body condition and size-adjusted EOD amplitude among species and sexes, and also seasonally. We found that condition dependence is strongest during the breeding season and largely restricted to species with EODs consisting of one or two phases. We also found that individuals with caudal filament damage exhibit reduced EOD amplitude, and/or considerably altered EOD waveform shape: both of which may impact sexual selection. Species with one or two EOD phases exhibited higher rates of caudal filament damage (ca. 20-40% of individuals) when compared to species with more than two phases (ca. 10-25%). Across all species, we found that males exhibited higher rates of caudal filament damage than females.

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**0930 General Herpetology, Galerie 2, Saturday 9 July 2016**

Hardin Waddle, Brad Glorioso

*U.S. Geological Survey, Lafayette, LA, USA*

**Site Occupancy Characteristics of the Gulf Coast Waterdog (*Necturus beyeri*)**

The Gulf Coast Waterdog (*Necturus beyeri*) is a neotenic salamander known primarily from sandy spring-fed streams along the Gulf Coastal Plain of Texas, Louisiana, and Mississippi. In Louisiana, the current distribution of the species is not well known. Likewise, there is little specific information on the characteristics of sites that may explain occupancy and abundance of waterdogs. We sampled for waterdogs using minnow traps along Bayou Lacombe in southeastern Louisiana at 25 sites from the headwaters to where the stream widens and slows. Using hierarchical models of abundance from repeat count data we determined that waterdog abundance within Bayou Lacombe was positively related to lower turbidity and higher pH. In southwestern Louisiana, we conducted an occupancy study to better determine the characteristics of sites that are occupied by waterdogs. Sites were chosen at random from a database of stream crossings in the known range of the species in the region. Each site was trapped for two consecutive weeks during the active season for the species. Stream characteristics such as width, bottom substrate, pH, and turbidity were measured at the study sites. Additional characteristics about the streams including drainage area and impervious surface estimates were derived from GIS information. A hierarchical occupancy model will indicate the relative importance of these factors for occurrence of waterdogs. Similar analyses for Lesser Siren (*Siren intermedia*) and Three-toed Amphiuma (*Amphiuma tridactylum*) also caught during the study reveal the apparent habitat differences among these three aquatic salamanders in the coastal plain.

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**0165 ASIH: ASIH at 100 Symposium, Salon D, Saturday 9 July 2016**

Marvalee H Wake

*University of California, Berkeley, Berkeley, CA, USA*

**ASIH At Crossroads**

Scientific societies are at crossroads—how can they advance their missions, increase membership, invigorate their journals, and integrate their science with 21st century techniques, questions, problems, and social concerns, given the precipitous changes in the practice of science, and the public's regard for it? The American Society of Ichthyologists and Herpetologists has a long history of achievement, but we cannot rest on our laurels. Our journal is important, and our meetings offer rich science that includes everything from passion about taxa to a broadly-based scientific repertoire that represents all of the dimensions of the hierarchy of biological organization, often integrative of several of them. But how can ASIH sustain these attributes? How can it be sure that its approach to organismal biology, which most of us believe is essential to major questions in several areas (e. g., conservation, evolutionary biology, development, behavior, ecology, etc.), has a significant place at the table where funding and policy decisions are made? We have the potential to make that happen, but we must develop an agenda that has specific goals, and that outlines the means to meet those goals. It should be part of our legacy to today's students, and those who will follow them. ASIH is poised to provide major scientific leadership!

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**0753 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Paddy Walker, Irene Kingma

*Dutch Elasmobranch Society, Amsterdam, The Netherlands*

**Baseline Study for Underpinning of the Management of Sharks and Rays in the Dutch Caribbean**

In August 2015 the *Save our Sharks* project was launched in the Netherlands and the Dutch Caribbean. This is a 3 year campaign which aims to stop the decline of sharks and rays in the Dutch Caribbean. During the project dedicated research, stakeholder involvement and participatory development of management measures should ultimately lead to better protection of the elasmobranchs around the islands. The project will focus on: education on the importance of sharks in the marine ecosystem; working with local fishermen to find solutions workable solutions to stop shark (by)catches; working with government to realise effective management and control of shark populations; and enhancing the scientific knowledge needed for conservation and management. In this talk we will present the first results of the project, including baseline studies carried out around the islands of Saba and St Maarten using Baited Remote Underwater Videos (BRUVs) and tagging studies carried out using acoustic

tags. The results will be put into the context of broader conservation and management measures and the need for international collaboration.

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**0982 SSAR SEIBERT AWARD ECOLOGY, Galerie 3, Thursday 7 July 2016**

Danielle Walkup, Wade Ryberg, Toby Hibbitts, Lee Fitzgerald

*Texas A&M University, College Station, TX, USA*

**Survivorship of the Dunes Sagebrush Lizard (*Sceloporus arenicolus*) in disturbed and undisturbed habitat**

Fragmentation and habitat disturbance are predicted to cause population declines in habitat specialists. *Sceloporus arenicolus* (dunes sagebrush lizard) is a habitat specialist, endemic to the Mescalero-Monahans Sandhills of West Texas and southeastern New Mexico. With heavy oil and gas development occurring throughout its range, habitat fragmentation is an ongoing concern for the persistence of this species. We carried out a four-year mark-recapture study to quantify demography and movements of *S. arenicolus*. Two "super-grids" of pitfall traps were used to sample large landscapes in undisturbed and disturbed habitat. *Sceloporus arenicolus* was the third most common lizard species captured, with 549 individuals captured in the undisturbed site and 179 in the disturbed site. We modeled apparent survival and detection probability as a function of time, grid, and sex using Cormack-Jolly-Seber models in Program MARK. Top models showed apparent survival was a function of time, and detection probability was best modeled as an additive function of grid and time. There were no differences in survivorship between the two landscapes, but the population size was much smaller in the disturbed site. These results are interesting, because previous work demonstrated that disturbance has a negative effect on *S. arenicolus* population size and persistence and it was clear in this study that the habitat in the disturbed area supports fewer *S. arenicolus* than in the undisturbed site. The reasons are complex and dependent upon site history, current site condition, and stochastic population fluctuations at the two sites.

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**0467 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Ellie Wallace

*University of Wisconsin-Stevens Point, Stevens Point, WI, USA*

**Blood-Lactate Level Response to Potentially Stressful Activities Due to Physical Exertion in Three Endemic South African Small-Bodied Shysharks (Scyliorhinidae: Chondrichthyes)**

Angling exposes sharks to physical exhaustion and other types of stress. One of the many shark groups upon which angling has relatively unknown effects is the shysharks

(F: Scyliorhinidae), endemic to the coast of South Africa, including the Puffadder Shyshark (*Haploblepharus edwardsii*), Dark Shyshark (*H. pictus*) and the Leopard Catshark (*Poroderma pantherinum*). Working with the RecFishSA program at the South African Shark Conservancy (SASC), I gathered and evaluated lactate levels in wild-caught shysharks experiencing voluntary stressors like actively foraging, involuntary stressors such as simulated angling by chasing, and also the effects of short recovery periods. I additionally defined and quantified several shark behaviors in video footage while the sharks were being subjected to chasing or foraging stimuli. These behaviors were indicative of physical exertion (i.e., line changes and tail whips), "psychological" stress (i.e., turning, circling, head raises, and suspensions), and interest (i.e., stimulus approaches). I hypothesized that blood lactate levels correlate with physical exertion and "psychological" stress in response to the two stimuli. There were no whole-blood lactate level differences among the species or sexes. Whole-blood lactate levels were higher in sharks experiencing chasing stimuli compared to foraging stimuli ($p<0.0001$). The two behaviors indicative of physical exertion were positively correlated with blood lactate levels (p-values < 0.001). None of the behaviors indicative of "psychological" stress or interest significantly correlated with blood lactate levels. These data suggest that, in shysharks, blood lactate is primarily influenced by increased anaerobic metabolism during physical exertion rather than "psychological" stress.

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**0912 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Susan Walls[1], Katherine O'Donnell[1], William Barichivich[1], Joseph Reinman[2], Terry Peacock[2], Greg Titus[2], Jonathan Chandler[2]

*[1]US Geological Survey, Wetland and Aquatic Research Center, Gainesville, FL, USA, [2]US Fish & Wildlife Service, St. Marks National Wildlife Refuge, St. Marks, FL, USA*

## Taking Action: Management and Recovery of Imperiled Flatwoods Salamanders at St. Marks National Wildlife Refuge, FL

Flatwoods salamanders (*Ambystoma cingulatum* and *A. bishopi*) historically occurred throughout the Coastal Plain of the southeastern U.S., but have declined by nearly 90% in recent years. St. Marks National Wildlife Refuge (SMNWR) in Florida is one of two remaining "strongholds" for *A. cingulatum*. Refuge land managers must decide how to restore and manage both aquatic and terrestrial habitats at SMNWR to maximize population persistence. We used structured decision making to develop a long-term approach to management and recovery of *A. cingulatum* at SMNWR. We also determined short-term actions needed to keep *A. cingulatum* on the landscape long enough to take advantage of improved future habitat conditions - an interim "emergency response." We used an adaptive management framework to address our habitat-related decision problem with state-dependent decisions, monitoring, and updating actions. For our emergency response, we decided to rear larvae to metamorphosis in mesocosms at SMNWR. We are actively engaged in conducting frequent growing season prescribed burns to restore upland and wetland habitat on the refuge, and have begun long-term monitoring of all known populations. In 2015, we set

up cattle-watering tanks in which to head start larvae and, thus, boost survival to metamorphosis. SMNWR is committed to restoration of *A. cingulatum* habitat, coupled with head-starting larvae to boost survival, as means to stop and reverse this species' decline. Partnerships with state and other federal agencies are enhancing our ability to address complex challenges in conservation and management of this imperiled species.

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**1053 Fish Ecology II, Salon A-C, Saturday 9 July 2016**

Christoph Walser[1], Sarah Walsh[1], Matthew Campbell[2], Helen Neville[3]

*[1]The College of Idaho, Caldwell, Idaho, USA, [2]Idaho Department of Fish and Game, Eagle, Idaho, USA, [3]Trout Unlimited, Boise, Idaho, USA*

## Distribution and movement of Columbia River redband trout, *Oncorhynchus mykiss gairdneri*, in an intermittent southern Idaho stream

The Columbia River redband trout (*Oncorhynchus mykiss gairdneri*) is native to the Columbia River Basin east of the Cascades. Throughout the region, the genetic structure of many redband trout populations has been influenced by introgression with hatchery stocks and by isolation due to migration barriers. Dry Creek is a small tributary of the Boise River and is characterized by large seasonal fluctuations in temperature and flow. The objective of our research was to describe trout distribution and movement patterns and evaluate the potential effects of a road culvert on trout movement. During the summer of 2015, stream reaches throughout the watershed were surveyed for redband trout. Fish were collected via electrofishing and fin clips were taken from 243 individuals. Genetic analyses of fin clips were carried out at the Idaho Department of Fish and Game (IDFG), Fish Genetics Laboratory in Eagle, Idaho. Each fish was genotyped at 186 single nucleotide polymorphisms (SNPs). Genetic analyses using the program Colony identified 24 trout families (defined as three or more full-siblings). No full siblings were observed on opposite sides of the culvert. Most families were located above the culvert but one family of young of year fish was found below the culvert—providing the first evidence that trout use the lower reaches of Dry Creek for spawning. Mean distance of trout within families was 424-m. Given the recent establishment of a conservation easement for upper Dry Creek, the results of this study will assist efforts to design an effective watershed management plan.

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**0756 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Stephen Walsh[1], Frank Ribeiro[2], Lucía Rapp Py-Daniel[3]

*[1]U.S. Geological Survey, Gainesville, Florida, USA, [2]Universidade Federal do Oeste do Pará, Santarém, Brazil, [3]Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil*

## Revision of the South American Catfish Genus *Ageneiosus* (Siluriformes: Auchenipteridae)

The Neotropical family Auchenipteridae, commonly known as driftwood catfishes, currently includes about 118 species in 23 genera. The family is widely distributed throughout South America and includes two subfamilies, the Auchenipterinae (73 species) and Centromochlinae (45 species). *Ageneiosus* (barbelless or bottlenose catfishes) is the second most species-rich genus of the family and has been the subject of considerable study since Linnaeus (1766) described the first species (as *Silurus inermis*). Taxonomy of the *Ageneiosus* clade has been confounded by nomenclatural problems as well as cryptic and sexually dimorphic morphological features. Based on a comprehensive study of morphological variation, examination of type material, original descriptions, and other available evidence, we revise the genus *Ageneiosus* and recognize 13 valid species, four of which are described as new: *A. apiaka*, *A. intrusus*, *A. levis*, and *A. lineatus*, all from the Amazon River basin. *Ageneiosus* differs from the closely related genus *Tympanopleura* in having the gas bladder reduced and ossified, with the exception of *A. pardalis*, the only member of the genus that includes trans-Andean populations. *Ageneiosus inermis* reaches the largest body size of any species (> 45 cm), has the widest distribution, and is exploited for food in some regions. The center of diversity of *Ageneiosus* is in the Amazon basin (*A. ucayalensis* and other fork-tailed species). Additionally, there are species endemic to the Orinoco basin (*A. magoi*) and Paraná-Paraguay basin (*A. militaris*). *Ageneiosus* is absent from the São Francisco basin but occurs in a few coastal drainages of Suriname and Guyana.

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**0660 ASIH STOYE GENERAL ICHTHYOLOGY AWARD, Galerie 2, Friday 8 July 2016**

Brandon Waltz, Kory Evans

*University of Louisiana at Lafayette, Lafayette, LA, USA*

## Morphological and Molecular Variation in *Eigenmannia macrops* (Boulenger, 1897): A single widespread species or a cryptic species complex?

Neotropical fishes constitute the most species-rich continental ichthyofauna on Earth, and as in all biotas, evolutionary analyses and reliable measures of species richness depend on accurate alpha taxonomy. Because many species concepts ultimately come down to the presence of distinct gaps, it is necessary to understand the nature of variation as the basis for correct species delimiatation. Here we examine morphological and genetic variation in the *Eigenmannia macrops* group (Sternopygidae, Gymnotiformes), a geographically widespread but phenotypically conserved taxon

inhabiting both black and white water rivers throughout the Amazon, Orinoco, and Guianas region. We used geometric morphometric, osteological, and molecular genetic analyses to resolve a robust hypothesis of species-level taxa. We took homologous landmark data from 60 specimens spanning a large portion of the species distribution, followed by the implementation of a principle components analysis and Procrustes ANOVA. A minimum of four specimens per population were cleared and stained for osteological analysis, and 16 tissue samples were subjected to DNA extraction and amplification for phylogenetic and phylogeographic analyses across the Amazon and Orinoco river basins. Bayesian species delimitation under the multispecies coalescent model was implemented to test species limits and interrelationships. Two distinct morphotypes were recovered from the geometric morphometric analyses, each found in distinct water types. Snout length, eye diameter, head length, and head depth load most heavily on PC1 and PC2. Results of comparative osteology and molecular analyses suggest the existence of undescribed species in the genus.

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## 0587 HL: Social Behavior in Reptiles Symposium, Salon E, Saturday 9 July 2016

Erik Wapstra[1], Tobias Uller[2], Geoff While[1]

[1]*University of Tasmania, Tasmania, Australia,* [2]*University of Lund, Lund, Sweden*

### The evolutionary ecology of family living in lizards

Family groups form the basis of social organisation across a wide range of organisms. Understanding the factors responsible for the evolutionary origins and diversification of family living has ~~been a major challenge for biologists. Lizards offer~~ a valuable system in this context because they provide us with a window into the very early stages of family life. Here I will report on a unique group of Australian lizards, the Egernia group, which provide a particularly ~~useful system in this context. One of the~~ most striking features of the Egernia group is that they include highly social lizards that form stable family groups. While some species are largely solitary, in others males and females form long-term pair-bonds sometimes holding territories where juveniles can remain with their parents. In the most extreme cases this can lead to large communal groups of up to 30 related individuals, including non-breeding adults who stay within their parent's social group. The huge diversity in family structure across the Egernia group make them the idea model system to connect processes occurring across levels of biological organisation (from individuals to populations to species) and ultimately provide novel insights into the evolutionary origins of family life.

CANCELED

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**0261 General Herpetology, Balconies L & M, Sunday 10 July 2016**

Jonathan Warner[1], Xander Combrink[1], Jan Myburgh[2], Colleen Downs[1]

*[1]School of Life Sciences, University of KwaZulu-Natal, Pietermaritzburg, KwaZulu-Natal, South Africa, [2]Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, Pretoria, Gauteng, South Africa*

## Blood Lead Concentrations in Nile Crocodiles (*Crocodylus niloticus*) from South Africa

Crocodilians are apex, generalist predators that utilize both aquatic and terrestrial habitats, thereby exposing them to a potentially wide range of environmental contaminants. We collected blood from 34 free-ranging Nile crocodiles (*Crocodylus niloticus*) at three separate South African populations in order to analyze their blood lead concentrations (BPb). Concentrations ranged from below detectability (< 3 µg/dL, n = 8) to 960 µg/dL for an adult male at the Lake St Lucia Estuary. Blood lead concentrations averaged 8.15 µg/dL (SD = 7.47) for females and 98.10 µg/dL (SD = 217.42) for males. Eighteen individuals (53%) had elevated BPbs (≥ 10 µg/dL). Crocodiles had higher BPbs at Lake St Lucia than at Ndumo Game Reserve or Kosi Bay, which we attribute to lead sinker ingestion during normal gastrolith acquisition. No clinical effects of lead toxicosis were observed in these crocodiles, even though the highest concentration (960 µg/dL) we report represents the most elevated BPb recorded to date for a free-ranging vertebrate. Although we suggest adult Nile crocodiles are likely tolerant of elevated Pb body burdens, experimental studies on other crocodilian species suggest the BPb levels reported here may have harmful or fatal effects to egg development and hatchling health. In light of recent Nile crocodile nesting declines in South Africa we urge further BPb monitoring and ecotoxicology research on reproductive females and embryos.

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**0674 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Mel Warren[1], Brooks Burr[2]

*[1]Southern Research Station, USDA Forest Service, Oxford, MS, USA, [2]Southern Illinois University, Carbondale, IL, USA*

## Freshwater Fishes of North America: Update 2016

Over 1,200 native freshwater fish species occur on the North American continent, composing the largest temperate, freshwater fish fauna on Earth. The importance of freshwater fishes in North American ecosystem function, their direct value economically and as providers of ecological services, and the increasing need to conserve this fauna cannot be over emphasized. In the last 30 years, major scientific advances have been made for these fishes across disciplines of systematics, genetics, physiology, behavior, ecology, and conservation. These advances, however, are marked by increased specialization and resulting fragmentation of knowledge about the diverse North American fish fauna. Our book is the first-ever published, fully-illustrated multi-volume work synthesizing the diversity, natural history, ecology, and biology of 52 families of

North American freshwater fishes (including several marine families with species occurring in fresh water). The coverage includes all of Canada, the coterminous United States, and Mexico (south to about the Isthmus of Tehuantepec). Chapter authors are synthesizing information on a set of standard topic areas for each family (see outline). Our emphasis is on near-comprehensive synthesis of existing information on freshwater fishes in North America. The book also covers non-taxonomic topics including evolution and ecology of fish assemblages, mating behavior, foreign fishes, fishes as models for scientific studies, and conservation overviews. Currently, 87 contributors are engaged in the book. Volume 1 was published by Johns Hopkins University Press in 2014. Volume 2 is slated for publication in 2017 and Volume 3 in 2018.

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**0910 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Brooke Washburn, David Eisenhour

*Morehead State University, Morehead, Kentucky, USA*

## A Northern Fish in a Southern Land: Conservation Status of Trout-Perch (*Percopsis omiscomaycus*) in Tygart's Creek and Lewis County, Kentucky

The Trout-Perch, *Percopsis omiscomaycus,* is a fish species widely distributed in northern North America, extending south to northeast Kentucky. This study's purpose is to document the species' current distribution and population status in Kentucky and to identify habitat variables associated with the present occurrence of Trout-Perch. We investigated five drainages, Cabin Creek, Quicks Run, Salt Lick Creek, Kinniconick Creek, and Tygart's Creek, in three Kentucky counties, Lewis, Greenup, and Carter. The Lewis County sites and tributaries of Tygart's Creek were surveyed for Trout-Perch using a semi-quantitative protocol to assess Trout-Perch abundance by seining all pools in a 200-300 m stream reach; habitat data were also taken from these sites. Additional sites in the mainstem of Tygart's Creek were sampled qualitatively. We detected Trout-Perch at 5 of 22 sites in Lewis County, all in the Quicks Run and Salt Lick Creek watersheds. In Tygart's Creek tributaries we detected Trout-Perch at 4 of 15 sites, three of which are new locality records. However, Trout-Perch were detected in only 1 of 7 Tygart's mainstem sites and were not detected in the Cabin Creek or Kinniconick Creek watersheds, which indicates Trout-Perch have declined in those watersheds when viewed alongside historical data. In sites with Trout-Perch present, Trout-Perch were associated with fine substrates, woody debris, and deep pools. Even when locally abundant, this species has a rather clumped distribution, making it difficult to detect; in Tygart's Creek tributaries, detection probability (p) of Trout-Perch was one of the lowest (0.243) of eleven pool-inhabiting species (range 0.239-1.00).

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**0667 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Mao Watanabe, Keisuke Furumitsu, Yu Umezawa, Naoki Yagishita, Atsuko Yamaguchi

*Nagasaki University, Nagasaki, Nagasaki, Japan*

## Stable isotope and stomach contents analyses of *Aetobatus narutobiei* to clarify its feeding ecology and foraging impact on bivalve fisheries in Ariake Bay

The naru eagle ray *Aetobatus narutobiei*, inhabiting the southwestern coastal areas of Japan, has increased in numbers since 1990s. *A. narutobiei* feeds on bivalves and is considered to be responsible for the decrease in bivalve catches in coastal areas such as Ariake Bay. Our previous studies showed that *A. narutobiei* is a seasonal resident of Ariake Bay, however, detailed information on the feeding ecology and foraging impact of this species on bivalve fisheries, including bivalve cultures, is limited. In the present study, *A. narutobiei* (n = 188) were collected from Ariake Bay. Recognizable stomach contents were analyzed based on the mean weight percentage of each prey item. Muscle tissue samples of *A. narutobiei* and mollusk samples identified as prey items were analyzed for carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotopes. The main prey items identified by stomach contents analysis were bivalves such as *Scapharca kagoshimensiss*, *Crassostrea gigas*, and *Ruditapes philippinarum*. There was no significant difference in isotopes between sexes and among months; however, significant differences were found among size classes for both $\delta^{13}C$ and $\delta^{15}N$. The results of isotope analysis suggested that *Scapharca kagoshimensiss* accounts for the largest proportion of the *A. narutobiei* diet. Moreover, comparative analysis of the stable isotopes in *Scapharca kagoshimensisss* collected from cultured and wild areas showed that *A. narutobiei* likely feeds predominantly on the wild *Scapharca kagoshimensisss*. This study demonstrates the possibility of using stable isotope analysis as a tool to determine both the feeding ecology and foraging impact of a predator species on bivalve cultures.

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**0718 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Heather Waye, Zach Smith

*University of Minnesota Morris, Morris, MN, USA*

## Tiger salamander larval density and aquatic invertebrate communities in the prairie potholes of West-Central Minnesota

Tiger salamanders are a common inhabitant of aquatic habitats across much of North America. Despite their abundance, we know relatively little about their life history in the Prairie Pothole Region. Given the global interest in the health of amphibian species, we should be particularly interested in the environmental factors that influence survival and reproduction. We have recorded changes in larval Eastern Tiger Salamander (*Ambystoma tigrinum*) capture rates between years in certain ponds in west-central Minnesota. There are many factors that could affect larval survival rate, including

availability and quality of food. The goal of this study is to examine prairie pond aquatic invertebrate communities in relation to tiger salamander population density. Three ponds were each sampled in June and August of 2015. Salamander density was estimated using the number of captures per trap-night, and aquatic invertebrates were sampled at each trap site using standardized sweeps. Invertebrates collected from the ponds and from salamander stomach contents were counted and identified to family. Salamander larvae density varied between ponds by an order of magnitude and June capture rates were more than double those in August. Pond invertebrates were similar between sites in June, but not in August. Salamander stomach samples were also similar in June, while differences in contents in August reflect variation in salamander size more than invertebrate availability. Major differences in invertebrate communities and/or larval diets between the ponds may point us in the direction needed to explore the variation in salamander reproductive success in seemingly similar pond habitats.

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**0768 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Alison Webb, Lori Neuman-Lee, Eleanor Watson, Susannah French

*Utah State University, Logan, UT, USA*

**Timecourse of the immune response in non-model organisms, *Thamnophis elegans* and *Iguana iguana***

The time it takes for an animal's immune system to respond to and clear an infection is influenced by many factors and can ultimately affect disease resistance and survival. Studies of the time-course of an immune response and the relationship between immune components in non-model organism are limited, but necessary for understanding the immune system in an ecological context. This study uses two non-model reptiles to assess the relationship between innate and immune components following a primary injection with sheep red blood cells (SRBC's) and changes in immune response between primary and secondary injections of SRBC's. To assess the time-course of the immune response, bacterial killing capacity, hemolysis, hemagglutination, and differential leukocyte counts were measured at days 0, 4, 8, 12, and 19 following both the primary and secondary injection. Bacterial killing capacity, hemolysis, and hemagglutination increased significantly following both primary and secondary injections. Of these variables, only hemagglutination increased significantly more following the secondary injection than the primary injection, suggesting some role of acquired immunity in these organisms.

CANCELED

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**0258 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: EVOLUTION, GENETICS, & SYSTEMATICS**

Johanna Wegener[1], Adam Moreno[2], Jessica Atutubo[1], Jessica Pita-Aquino[3], Jason Kolbe[1]

*[1]University of Rhode Island, Kingston, RI, USA, [2]Brown University, Providence, RI, USA, [3]University of Puerto Rico, San Juan, PR, Puerto Rico*

## Genetic evidence of hybridization between the native green anole (*Anolis carolinensis*) and the invasive Cuban green anole (*A. porcatus*)

*Anolis carolinensis*, the only native anole in the United States, is closely related to *A. porcatus*, a naturalized species introduced to Florida from its native range in Cuba. The two species are morphologically and ecologically similar and the presence of *A. porcatus* in Miami is known from only mtDNA haplotypes. We genotyped six microsatellite loci and one mtDNA marker (ND2) to test for hybridization between *A. carolinensis* and *A. porcatus* in Miami. We genotyped 116 individuals from the potential hybrid zone in Miami and reference populations from *A. carolinensis* and *A. porcatus*. Results from a Bayesian cluster analysis reveal that the Miami population forms a distinct genetic cluster and individuals from this population share a high proportion of alleles with both the *A. carolinensis* reference population and *A. porcatus* from Cuba. We found both *A. carolinensis* and *A. porcatus* mtDNA haplotypes in the hybrid population and several individuals show a mismatch between nuclear microsatellite genotypes and mtDNA haplotypes. This reciprocal mismatch pattern is characteristic of hybrid populations. Hybridization may present a concern for the conservation of *A. carolinensis* since introgression can threaten the integrity of this native species.

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**0371 AES GRUBER AWARD, Balconies J & K, Thursday 7 July 2016**

Ornella Celine Weideli[1,4], Yannis Papastamatiou[2], Mahmood Shivji[3], Michael Heithaus[2], Rainer von Brandis[4], Serge Planes[1]

*[1]CRIOBE USR3278-EPHE-CNRS-UPVD, Perpignan, France, [2]Florida International University (FIU), North Miami, FL, USA, [3]Save Our Seas Shark Research Center (SOSSRC) NOVA University, Dania Beach, FL, USA, [4]Save Our Seas Foundation D'Arros Research Centre (SOSF-DRC), D'Arros Island, Seychelles*

## Resource Partitioning and Competition in a Mutually Used Shark Nursery

Traditional theoretical approaches predict that resource partitioning is crucial to the coexistence of ecologically and morphologically similar species, as it minimizes competition among sympatric species. This partitioning may occur through divergence in resource use or through differences in spatial and temporal habitat use. Coastal reef sharks often use lagoons as nursery areas for their young, where inter-specific competition may be particularly high. At St. Joseph Atoll, Seychelles, two sympatric

juvenile shark species, the sicklefin lemon shark, *Negaprion acutidens*, and the blacktip reef shark, *Carchahinus melanopterus*, use shallow flats as a communal nursery. Both shark species are viviparous with no maternal care, therefore inexperienced and opportunistic behaviour is assumed to lead to niche overlaps and competition. Investigation of competition within shark nurseries at fine spatial scales are lacking, despite its importance for coastal nursery management. We investigated spatial and temporal niche partitioning using active tracking. We quantified dietary overlap using visual and molecular analysis of stomach contents (DNA barcoding), and analysis of stable isotopes (SIA) of red blood and plasma tissues. Preliminary results show various degrees of spatial and trophic segregation between the two species. If niche partition results through the avoidance of competition, or if it is shaped by species-specific food or habitat preferences, remains to be proven.

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**0948 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Chava Weitzman[1], Franziska Sandmeier[2], C. Richard Tracy[1]

*[1]University of Nevada, Reno, Reno, Nevada, USA, [2]Lindenwood University - Belleville, Belleville, Illinois, USA*

## Presence and diversity of *Mycoplasma agassizii* in the threatened *Gopherus agassizii*

In 1990, the Mojave desert tortoise (*Gopherus agassizii*) was listed as threatened under the Endangered Species Act, partly due to the threat of an upper respiratory tract disease (URTD) that some feel has caused population declines. The bacterium *Mycoplasma agassizii* is a known cause of URTD, and in the last two decades, URTD has been extensively studied in the Mojave desert tortoise. There are still many gaps in our knowledge of this disease, and not much is known about the bacterium, *M. agassizii*, itself–its virulence, its strain diversity, its ecology, or its prevalence in local tortoise populations. We have sampled nasal mucus from tortoises across the Mojave Desert. Here, we quantify spatially-explicit prevalence of *M. agassizii*, haplotype diversity of three genetic markers, and the relationship between tortoise encounter rate (as a proxy for density) and pathogen presence. This pathogen is found in all tortoise genotypes, although some sample sites had higher levels of prevalence than others. In three genetic markers of the pathogen–16S rRNA, 16-23S intergenic spacer, and rpoB–we found very little nucleotide diversity. Though *M. agassizii* is prevalent across the tortoise distribution, we do not know whether these levels are predictably stable across time. Our analyses suggest both new hypotheses about the host-pathogen relationship and ways in which tortoise populations may be managed.

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**0584 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Hannah Weller[1], Mark Westneat[1], Caleb McMahan[2]

[1]*University of Chicago, Chicago, IL, USA,* [2]*Field Museum of Natural History, Chicago, IL, USA*

## Dirt-sifting Devilfish: Diversity and Convergence of Winnowing Morphologies in Geophagine Cichlids

Winnowing, a substrate-sifting foraging strategy common in geophagine cichlds, is often assumed to be a stereotyped behavior similar to that of the distantly related surfperches (Embiotocidae), despite morphological and genetic diversity within the clade. Many geophagines possess an epibranchial lobe (EBL), a pharyngeal structure of unknown function that may be advantageous in feeding or mouthbrooding. With this study, we aim to investigate (1) whether winnowing is truly a stereotyped behavior comparable to that of embiotocids; (2) how morphological diversity within the clade scales with putative winnowing propensity, and (3) how, if at all, the mysterious EBL may be related to winnowing diversity. Winnowing behavior was characterized with high-speed video of *Satanoperca daemon*, and cranial and EBL morphology was analyzed in 18 species across 12 genera using PCA. We found that winnowing occurs in three distinct phases: strike, substrate is acquired through oral suction; winnowing, substrate and food are separated in the oral cavity and substrate ejected through the operculum; and oral ejection, large particulates are ejected through the mouth. While the first and last stages are fairly stereotyped, winnowing itself was found to be highly dynamic. PCA suggests a particular winnowing morphospace exploited differentially by particular morphologies. We also found a surprising amount of diversity in the EBL, which may function to filter out particulates of a certain size or density, optimizing winnowing efficiency at the cost of a more generalized feeding morphology.

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**1091 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Allison Wells[1], Gary S. Casper[2], John Peterson[1]

[1]*University of Wisconsin-Platteville, Platteville, WI, USA,* [2]*UWM Field Station, Saukville, WI, USA*

## Inter-observer Detection Error in Cricket Frog Auditory Surveys

Blanchard's Cricket Frog (*Acris blanchardi*) is declining throughout the northern part of its range and is Endangered in Wisconsin. It is currently only known from the southwest corner of the state. In order to monitor Wisconsin Cricket Frog populations, auditory surveys are traditionally conducted during the species' breeding period from May through August, by visiting wetland sites after dark to listen for and quantify frog calls. A possible alternative to this survey method is the use of automated recording systems (ARS) to collect acoustic samples rather than utilizing a human surveyor. In this study, ARS were utilized to obtain Cricket Frog call data at a focal site in southwest Wisconsin. One expert and 16 novice surveyors quantified presence/absence and calling intensity

from recordings. Inter-observer agreement between expert and novice observers was generally high for species that call throughout much of the summer. Species displayed daily and seasonal calling patterns similar to previous studies. Specifically, anurans called more after sunset and species called more at different times throughout the season. Our data suggest that ARS are an effective method for collecting acoustic samples that can be used for monitoring calling behavior of this species. We address the potential for improving monitoring of this species by this method.

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**0090 AES Ecology & Behavior II, Balconies J & K, Saturday 9 July 2016**

David Wells[1], Natalie Spear[1], Michael Kinney[2], Suzanne Kohin[3]

[1]*Texas A&M University, Galveston, TX, USA,* [2]*Ocean Associates, La Jolla, CA, USA,* [3]*Southwest Fisheries Science Center, La Jolla, CA, USA*

## Application of Chemical Tags to Age Validation Studies of Sharks in the Northeastern Pacific Ocean

Accurate age and growth models provide some of the most important biological parameters needed for stock assessment and fishery management. However, assumptions regarding band pair deposition rates used for age and growth models are often made without direct validation studies. As such, the purpose of this research was to validate vertebral band pair counts for three pelagic shark species in the northeastern Pacific Ocean. Species included shortfin mako (*Isurus oxyrinchus*), blue (*Prionace glauca*), and common thresher (*Alopias vulpinus*) sharks. Oxytetracycline (OTC) labeled vertebrae from each species were obtained from tag-recapture activities and used to determine centrum band pair deposition rates. Count results from band pairs distal to OTC marks indicate species- and life stage-specific band pair deposition rates for the three species investigated. Shortfin mako in this region exhibit biannual band pair deposition as juveniles (< 200 cm fork length, FL); males shift to annual deposition rates at or near sexual maturity. In contrast, both blue and common thresher sharks appear to exhibit annual deposition rates over the juvenile and adult sizes examined. Given the uncertainty surrounding band pair deposition rates of shark vertebrae and the differences among species, life stages, and regions, it's important to continue validating the age and growth of sharks to ensure the most accurate biological parameters are being used to manage these ecologically and economically important predators.

CANCELED

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**0738 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Monique Welten[1], Moya Meredith Smith[3], Charlie Underwood[4], Zerina Johanson[2]

*[1]University of Bristol, Bristol, UK, [2]Natural History Museum, London, UK, [3]King's College, London, UK, [4]Birkbeck University of London, London, UK*

## Teeth inside and outside the mouth: an X_CT analysis of topographic relationships in sawshark and sawfish dentitions (Elasmobranchii; Chondrichthyes)

The origin and evolution of teeth is still under debate, with competing hypotheses seeking to explain their evolutionary origins. Teeth and tooth-like structures, odontodes, are present both externally (skin denticles, scales) and internally (oropharyngeal teeth). Sharks and rays have been studied intensively to address evolutionary origins of teeth, since their dermal scales show great similarity to their oral teeth. According to the ‘'Outside in'' theory, teeth evolved from skin denticles after the ancestral mouth cavity evolved by invagination of the skin. The 'Inside out'' hypothesis however, suggests that teeth evolved independently from skin denticles. Tooth-like structures are also found on the elongate ‘saw' in three chondrichthyan groups: the sawfish, the fossil Scelorhynchidae; and the sawsharks. These ‘'teeth'' differ from oral teeth and skin denticles, presenting a challenge in understanding their morphology and patterning, and relation to either skin denticles or oral teeth. We used Computed Tomography to study growth and replacement patterns of ‘'saw -teeth'' in embryos, adults and fossils of these groups, to compare with their skin denticles and jaw teeth. Our results showed that in the sawfish ‘'saw-teeth'' are of equal size and retained during life. By contrast, in sawsharks, the ‘'saw-teeth'' are of various sizes; and are replaced irregularly, but in a size-specific manner. Strikingly, saw-teeth in the fossil sawfish *Sclerorhynchus* show many similarities in morphology to those of sawsharks, despite the lack of close phylogenetic relationships. We conclude that the saw ‘'teeth'' are specialized skin denticles, functioning as feeding and prey-obtaining structures.

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**0318 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Alexander Wendt, Jamie Roberts

*Georgia Southern University, Statesboro, GA, USA*

## Population Genetic Structure and Dispersal of the Reticulated Flatwoods Salamanders (*Ambystoma bishopi*) on Eglin Air Force Base

Determining how landscape connectivity affects the distribution and abundance of species is vital for conservation efforts. The reticulated flatwoods salamander (*Ambystoma bishopi*) is an endangered pond-breeding species restricted to pine flatwoods habitats of Georgia and Florida. Some of the most extensive remaining habitat occurs on

Eglin Air Force Base in Okaloosa County, Florida. We characterized variation of 12 microsatellite DNA loci among larval salamanders at 12 ponds on Eglin. Our objectives were to 1) delineate population genetic structure, 2) estimate dispersal rates among ponds, and 3) estimate the effective numbers of breeders contributing to each pond. We found an expected pattern of isolation-by-distance, with nearby groups of ponds showing higher connectivity and distant comparisons showing greater genetic differentiation. Connectivity also was reduced by anthropogenic landscape features such as roads and impervious surfaces as well as invasive vegetative overgrowth. Effective population sizes at ponds were small at most ponds, suggesting that few breeders contribute to a typical cohort. These findings will assist the Air Force with implementing effective habitat management measures on Eglin.

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**1031 Fish Conservation, Galerie 3, Sunday 10 July 2016**

Julia Wester

*University of Miami, Coral Gables, FL, USA*

**Opportunities in Hands-on Shark Outreach and Education**

Experiential education and outreach programs can have valuable impacts on pro-environmental attitudes and behaviors as well as self-efficacy and interest in science. The Shark Research and Conservation Program at the University of Miami, is a research laboratory that has created an education program combining classroom talks with hands-on experiences engaging students in collecting real data in the field for ongoing shark research studies. The session will discuss this program and will cover the results of an ongoing study evaluating the impacts of these experiences on students' knowledge, attitudes, and behaviors toward sharks, science, and ocean conservation. The study combines a before and after survey design with student focus groups onboard the research vessels to provide a thorough and nuanced picture of how students are affected by their experiences and educational content. The findings highlight important lessons for several critical areas of modern marine science education, including strategies for conducting outreach around species with complex cultural representations such as sharks and the differential impacts of experiential education on underrepresented communities in STEM. Finally, barriers and opportunities for developing these kinds of collaborative educational experiences between universities and high schools will be considered.

CANCELED

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**0636 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

Aundrea Westfall[1], Melissa Miller[1], Christopher Murray[2], Bryan Falk[3], Robert Reed[3], Lindsey Garner[4], Frank Mazzotti[4], Craig Guyer[1], Christina Romagosa[5]

*[1]Auburn University, Auburn, AL, USA, [2]Southeastern Louisiana University, Hammond, LA, USA, [3]US Geological Survey, Fort Collins, CO, USA, [4]University of Florida Research and Education Center, Davie, FL, USA, [5]University of Florida, Gainesville, FL, USA*

## Morphological Plasticity of a Non-Native Parasite in Novel Snake Hosts

When a non-indigenous species (NIS) establishes in its introduced range, it can bring parasites capable of infecting native taxa. Parasites co-introduced with NIS may overcome the obstacles of infecting novel hosts in their invaded range by exhibiting phenotypic plasticity among hosts. Burmese pythons (*Python molurus bivittatus*) are well established in southern Florida and have introduced a lung parasite (*Raillietiella orientalis*) found within python's native range in Southeast Asia. Spillover of *R. orientalis* from pythons to native snakes has occurred, with two families and six genera of snakes infected in Florida. The mechanism through which *R. orientalis* infects such diverse taxa has not been explored. We utilized geometric morphometrics to evaluate the morphological plasticity of *R. orientalis* among infected south Florida snakes and pythons to investigate the parasites ability to infect a diverse array of novel snake taxa. A Procrustes ANOVA revealed significant variation in *R. orientalis* head shape ($F_{3, 64}$ = 2.27, P < 0.0001) according to host taxa. Variation was not attributable to centroid size ($F_4$ = 2.16, P = 0.09). *Raillietiella orientalis* from semi-aquatic and aquatic native snakes exhibited the greatest morphological similarity. Morphological analyses of *R. orientalis* recovered from invasive pythons, native pitvipers, and terrestrial snakes each exhibited distinct groupings. Our results suggest *R. orientalis* exhibit significantly different morphology based upon host species infected. Additionally, we provide evidence of host-specific parasite head shape plasticity, an ability that may facilitate infection in a wide array of novel reptilian host species.

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**0700 Fish Systematics I, Salon F-H, Saturday 9 July 2016**

Mark Westneat

*University of Chicago, Chicago, IL, USA*

## Evolutionary history and global biogeographic patterns of reef fishes using all-species phylogenetic trees

Building large-scale phylogenies with all known species in various reef fish groups is now possible using a molecular backbone and a morphological trait matrix in tandem. All-species phylogenetic trees are presented for the Labridae (including the scarines and odacines), Chaetodontidae, and Pomacentridae. Anatomical characters play a key role in clade support and in placing rare taxa into the tree topology. The high resolution,

species-level topologies for the three iconic reef fish families are used as a framework for mapping the evolutionary diversification of function and enhancing our understanding of biomechanical convergence in these groups. Finally, reconstructing global biogeographic patterns in the three families across major biogeographic provinces and from temperate to tropical seascapes show that these often sympatric fish groups show alternative patterns of phylogenetic dispersion history.

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**0397 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD ICHTHYOLOGY**

Courtney A. Weyand, Kyle R. Piller

*Southeastern Louisiana University, Hammond, Louisiana, USA*

**Phylogeography of the Rosyside Dace (*Clinostomus funduloides*)**

The genus *Clinostomus* (Teleostei:Cyprinidae) is an understudied genus of fishes in the order Cypriniformes. *Clinostomus* has a large geographic range occupying much of eastern North America. Currently, two species are recognized within *Clinostomus*: *C. funduloides* and *C. elongatus*. A previous morphological study recognized three subspecies within *C. funduloides*: *C. f. funduloides, C. f. estor*, and one undescribed subspecies, but these have not been universally recognized. Given the broad distribution and disjunct geographic range of this genus, a phylogenetic assessment of *Clinostomus* is needed to further resolve the taxonomic diversity within this genus. In particular, we focused on assessing diversity within *C. funduloides*. Multiple tissue samples of *C. funduloides* were obtained across the range. Sequence data was obtained from multiple mitochondrial and nuclear loci. Data were analyzed using Bayesian phylogenetic methods and constraint tree searches to investigate the diversity and phylogenetic relationships within the genus. Results of this study will give insight on the phylogenetic relationships, genetic differentiation, and taxonomic status of the populations within *C. funduloides*.

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**0007 AES GRUBER AWARD, Balconies J & K, Thursday 7 July 2016**

John Whalen, Jim Gelsleichter

*University of North Florida, Jacksonville, FL, USA*

**Multibiomarker evaluation of pollutant effects in Atlantic stingray (*Dasyatis sabina*) populations in Florida's St. Johns River**

The goal of this study was to examine the potential health effects of polychlorinated biphenyl (PCB) and polycyclic aromatic hydrocarbon (PAH) exposure on Atlantic stingray populations in Florida's St. Johns River (SJR). Special emphasis was placed on identifying PAH- and/or PCB-related effects in stingrays from areas of the lower SJR basin that have been shown to possess elevated levels of these compounds, as well as

characterizing baseline levels of pollutant exposure in other areas that may be subjected to dredging in the near future, potentially resuspending contaminated sediments and increasing pollutant associated effects. To accomplish this, we measured PCB and PAH biomarker levels in *D. sabina* collected from contaminated sites and reference locations. We specifically examined the biomarkers cytochrome P4501a1 (CYP1a1), a Phase I detoxification enzyme; glutathione-S-transferase (GST), a Phase II detoxification enzyme; fluorescent aromatic compounds (FACs), PAH bile metabolites; lipid peroxidation (LPO), cell membrane damage; and thyroid epithelial height (TEH), an assessment of endocrine disruption-induced hypothyroidism. Enzymatic activity of CYP1a1 and GST was measured using the EROD assay and a GST Assay Kit, while LPO was measured with an OxiSelect TBARS Assay Kit. FACs were measured using fixed wavelength fluorescence and TEH was analyzed histologically. Biomarker levels of individuals collected from contaminated sites were compared to individuals collected from reference sites. The data suggest that pollutant biomarker levels in SJR *D. sabina* did not differ significantly from those measured in individuals from reference locations. However, the close proximity of high biomarker levels to known contaminated areas suggests continuous exposure.

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**0350 AES Physiology, Paleontology, & Collections, Balconies L & M, Friday 8 July 2016**

Catharine J. Wheaton[1], Andrew N. Evans[2], John M. Rimoldi[3], Rama S. V. Gadepalli[3], Bobbi R. O'Hara[4], Natalie D. Mylniczenko[1]

*[1]Animals, Science and Environment, Disney's Animal Kingdom® and The SEAS with Nemo and Friends®, Lake Buena Vista, FL, 32830, USA, [2]Department of Coastal Sciences, University of Southern Mississippi, Ocean Springs, MS 39564, USA, [3]Department of Medicinal Chemistry, University of Mississippi, University, MS 38677, USA, [4]Research and Development, Arbor Assays L.L.C., Ann Arbor, MI, 48108, USA*

## Development and Preliminary Validation of a Monoclonal Antibody for Enzyme Immunoassay of the Steroid 1α-hydroxycorticosterone in Selected Elasmobranch Species

Measurement of 1α-hydroxycorticosterone (1αOH-B), the putative primary stress and ionoregulatory hormone for shark and ray species has been of significant biological interest and a major scientific challenge for over 50 years. Previous research relied on measurements using techniques such as thin-layer chromatography, ultraviolet absorption spectra, or high-performance liquid chromatography of incubates from interrenal glands or large volumes of blood, often pooled from multiple individuals. Although commercial enzyme immunoassays (EIA) are available for corticosterone, those tested exhibit only low relative cross-reactivity to 1αOH-B (3-5%). To improve measurement of 1αOH-B, we developed a monoclonal antibody using a synthesized 1αOH-B derivative for testing in a double-antibody EIA system. Relative displacements of cross-reactant compounds showed good sensitivity for 1αOH-B and 11-dehydrocorticosterone with low reactivity to related steroids including corticosterone.

Adjustment of incubation times and titration of the antibody and conjugate concentrations increased sensitivity of the EIA for 1αOH-B (range 4-12 ng/ml, 90% binding). Banked serum and plasma samples from selected elasmobranch species managed at The SEAS with Nemo and Friends® were used to validate sample treatment and extraction protocols to optimize measurement of 1αOH-B in <1 ml of sample. Improved measurement of 1αOH-B in sharks and rays will be important for many aspects of collection, transport, medical treatment, and aquaria and conservation management of these charismatic and ecologically important species.

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**0613 ASIH: Lessons From, and Visions For Symposium, Salon D, Sunday 10 July 2016**

Kit Wheeler[1], Mary Freeman[2], Phillip Bumpers[1], Megan Hagler[1], Byron Freeman[3], Seth Wenger[1]

*[1]River Basin Center & Odum School of Ecology, UGA, Athens, GA, USA, [2]USGS Patuxent Wildlife Research Center, Athens, GA, USA, [3]Georgia Museum of Natural History & Odum School of Ecology, UGA, Athens, GA, USA*

**Rates Add Meaning to Long-term Monitoring Data**

Ecologists commonly use long-term datasets to correlate environmental drivers with changes in community states, such as species richness or dominance by particular taxa. However, communities may arrive at the same state through differing processes, such as local extirpation as opposed to failure of species to colonize following an extreme event. An alternative approach is to explicitly estimate demographic process rates (extirpation, colonization, population growth) in relation to time or environmental covariates. This allows us to test hypotheses of actual mechanisms driving observed changes in community states. Here, we illustrate application of this process-based analytical approach using 20 years of annual surveys of shoal-dwelling fishes at multiple sites in the Conasauga River basin, GA. Our preliminary results showed substantial temporal variability among species in persistence (0.29-0.90) and colonization (0.24-0.89) rates and indicated population declines of some taxa. A comparative analysis of similar, long-term monitoring data for shoals in the nearby Etowah River basin suggested observed declines were restricted to the Conasauga River. By estimating process rates for multiple species simultaneously, we could more precisely infer trends for rare fishes for which it is otherwise difficult to distinguish non-detection from true absences. We suggest that process-based rates analyses provide a complementary framework for testing alternative hypothesized environmental drivers and for building predictive models of community change.

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**0863 AES GRUBER AWARD, Balconies J & K, Friday 8 July 2016**

Connor White[1], Kady Lyon[1], Kevin Weng[3], Chuck Winkler[2], Salvador Jorgensen[3], John O'Sullivan[3]

*[1]California State University Long Beach, Long Beach, CA, USA, [2]Southern California Marine Institute, Terminal Island, CA, USA, [3]Monterey Bay Aquarium, Monterey, CA, USA*

## Movement of Juvenile White Sharks in Southern California: Predicting Future Nursery Habitat

The white shark, *Carcharodon carcharias*, is an apex predator with a circumglobal distribution and a low intrinsic growth rate that is listed as vulnerable by the IUCN. While considerable information is known for adults, there is limited information on the movements, environments, and distributions of juvenile white sharks (JWS). Understanding this life stage is important as JWS experience considerable overlap with human activities and juveniles often have the highest mortality of any life stage. In an effort to quantify JWS movements and understand their distribution in the Southern California Bight, JWS were captured and outfitted with satellite transmitters (SPOT tags: n=20). There was a large amount of variability in number of geopositions rendered (Class 0-3: 645 locations; mean: 36, range: 0-130), with individuals having a higher probability of detection later in the day (1700-2000). Some individuals (n=9) displayed movements south of the United States border into Baja California, Mexico. A generalized linear model with a binomial distribution was used as a resource selection function to predict presence of individuals based on depth, distance to shoreline, and daily sea surface temperature (SST). Sharks were found to significantly select shallow habitats (<2500 m) close to land (<50km) at temperatures between 15.6 and 24.3C. The model predicts sharks to move to Baja California during winter and a higher probability of JWS in southern California during El Niño years.

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**0892 Amphibian Ecology & General Herpetology, Salon F-H, Sunday 10 July 2016**

Elijah White, Joseph Pechmann

*Western Carolina University, Cullowhee, North Carolina, USA*

## Life Cycles of a Facultatively Paedomorphic Salamander at High Elevation

Facultatively paedomorphic salamanders, including the mole salamander (*Ambystoma talpoideum*), respond to environmental conditions experienced as a larva by either metamorphosing into a terrestrial subadult or maturing in the aquatic environment as a paedomorph. There are two proposed selective mechanisms for the maintenance of paedomorphosis in salamanders: (1) "paedomorph advantage" (PA), in which a favorable aquatic habitat allows greater fitness than the terrestrial habitat and (2) "best of a bad lot" (BBL), in which paedomorphosis maximizes fitness in a growth-limiting environment by forgoing metamorphosis thereby allowing reproduction during the first

breeding season. Paedomorphosis has been studied extensively in *A. talpoideum* in the coastal plain ecoregion, but the different environmental conditions at high elevations may affect breeding phenology and life cycles. This project characterizes the breeding phenology and seeks to determine which mechanism (PA or BBL) maintains paedomorphosis in high-elevation populations of *A. talpoideum* in the Nantahala Mountains of North Carolina. Field surveys revealed that high-elevation *A. talpoideum* populations are majority paedomorphic and breed from October-April as compared to September-March in Atlantic coastal plain populations. A mesocosm experiment found that water temperature did not affect growth rate, but growth was density dependent. All individuals remained paedomorphic or larval during their first breeding season, and those that metamorphosed the following spring attained a large body size prior to the metamorphosis event. This evidence supports the BBL hypothesis that maintenance of paedomorphosis in these high-elevation populations is a default strategy in a growth-limiting environment and that metamorphosis is favored when sufficient growth occurs.

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**1114 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Jared White[1], Michael Husak[2]

*[1]Midwestern State University, Wichita Falls, Texas, USA, [2]Cameron University, Lawton, Oklahoma, USA*

### New County Records and Range Expansion of the Mediterranean Gecko *(Hemidactylus turcicus)* in Oklahoma and Kansas

Prior to 2011, the introduced Mediterranean gecko (*Hemidactylus turcicus*) was known from 11 of Oklahoma's 77 counties. Following the discovery of a small breeding population in the city of Lawton, Comanche County, Oklahoma in 2011, I began surveys to determine the extent of *H. turcicus* established in Oklahoma and Kansas. Here we add 3 new county records to Kansas and 29 new county records to Oklahoma's previously described distribution.

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**0301 General Ichthyology II, Balconies J & K, Sunday 10 July 2016**

Macaulay White[1], J. Derek Hogan[1], Luke Tornabene[2], Frank Pezold[1]

*[1]Texas A&M University - Corpus Christi, Corpus Christi, Texas, USA, [2]Smithsonian, Washington D.C., USA*

### Pelagic Larval Duration and Amphidromy Not Linked to Endemism in *Stiphodon* Gobies

Sicydiine gobies are a diverse group of freshwater fishes characterized by a unique life history and morphological features that allow them to inhabit oceanic island streams throughout tropical and sub-tropical regions. Larval dispersal is achieved by an

amphidromous life history in which adults live and spawn in fresh water and larvae develop at sea. Sicydiine gobies often account for the majority of freshwater ichthyofauna in island streams, and many are endemic to particular regions. The subfamily Sicydiinae currently consists of nine genera of which the genus *Stiphodon* exhibits the most diversity and is widespread throughout the western Pacific. Many species of *Stiphodon* have very large distributional ranges, while others are more restricted. Dispersal plays a large role in the distribution of species, greater dispersal capabilities can lead to larger range sizes and vice versa. Variations in the number of individuals migrating to the sea may influence the dispersal capabilities, as well as the duration of time that larvae spend at sea. Variation in these traits may influence the geographic range size for a given species. To test these hypotheses, we counted daily growth rings from otoliths to determine the pelagic larval duration and used otolith chemistry to determine migratory behaviors of different *Stiphodon* species exhibiting different range sizes.

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**0928 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Mary White[1], Mark Merchant[2]

[1]*Southeastern Louisiana University, Hammond, LA, USA,* [2]*McNeese State University, Lake Charles, LA, USA*

**Innate Immune System Genes of Crocodilians**

Crocodilians have potent antimicrobial activity in their blood and tissue, attributed in large part to their serum complement proteins and other components of the innate immune system. Our previous work shows that crocodilians have two very different genes for complement C3, a vital component of complement activation. Birds and mammals have only a single C3 gene, and although snakes have multiple C3 genes, they encode very similar proteins. Among vertebrates, only fish are known to have such diverse C3 genes, and it was hypothesized that the diversity expanded the recognition repertoire of the innate immune system. Our current work continues investigation of the innate immunity of crocodilians, focusing on expression of the different complement C3 genes and other genes that may bolster the innate immune system.

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**0418 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Matthew White, Jenna Riemenschneider, Hannah Mohr

*Ohio University, Athens, OH, USA*

**Genetic Differentiation of the Least Brook Lamprey in the Mississippi Embayment**

The Least Brook lamprey is a non-parasitic species with a broad distribution in the eastern US. It displays limited variation in morphology and life history but is known to

display considerable genetic differentiation among populations throughout its range. Notable is the variation observed among populations located along the Mississippi Embayment, particularly the Obion, Forked Deer, Hatchie, and Yazoo drainages. Samples of Least brook lamprey from additional streams in this region (Loosahatchie, Big Black, Bayou Pierre, Buffalo) were sequenced at two mitochondrial genes (Control region, ND3) for comparison to the larger data set. Consistent with previous work each population had a unique haplotype. Considerable variation (3-7% sequence divergence) was observed among populations in this region. The phylogeny observed confirmed the distinctiveness of the Hatchie River population. This pattern is consistent with that shown by the Least madtom (*Noturus hidebrandi*) suggesting a common history, likely a Hatchie/Tennessee River connection. In addition to variation among unique sequences these populations exhibited considerable variation in the sequence and number of tandem repeats in the mitochondrial Control Region. A major change in repeat structure was observed in populations south of the Yazoo River. The Hatchie River population and likely those found in several other streams (e.g., Obion) reflect undescribed species. Additional surveys should be undertaken to determine if other species demonstrate differentiation in the Hatchie drainage.

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**0330 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Stacia White[1], Katy Duke[2], Paula Carlson[3], Alan Henningsen[4], Katherine Hunter[5], Richard Preziosi[5], Jennifer Rountree[5], Graham Hill[2], John Fitzpatrick[6]

*[1]Ripley's Aquariums, Inc., Myrtle Beach, SC, USA, [2]The Deep, Hull, East Yorkshire, UK, [3]Dallas World Aquarium, Dallas, TX, USA, [4]National Aquarium, Baltimore, MD, USA, [5]The University of Manchester, Manchester, UK, [6]Stockholm University, Stockholm, Sweden*

## Making Connections for Sawfish: The Role of Public Aquaria in Sawfish Biology and Conservation

Aquaria are important partners in sawfish science and conservation. Important messages are communicated to millions of aquarium visitors by providing face – to - face encounters with living sawfish in a unique educational setting. The global decline of sawfishes is increasing the need for conservation of fragile coastal habitats. Public aquaria can build on these connections, to promote conservation solutions. Collaboration across many disciplines is vital for successful conservation of sawfishes, and aquaria can contribute alongside with academic institutions, conservation organizations, field research groups, government agencies and the local populations. All stakeholders can benefit from information exchange, and the implementation of knowledge on sawfish biology, ecology, and conservation. The IUCN Shark Specialist Group's Global Strategy for Sawfish Conservation provides a framework for collaborative sawfish conservation, including opportunities for aquaria to participate in conservation education, research and public awareness. The Association of Zoos and Aquariums' (AZA) Species Survival Plan and the European Association of Zoos and Aquaria (EAZA) Studbook, population management programs for pristids, provide

member facilities a forum in which to share important data collected about their animals, and work collaboratively on sawfish husbandry, research and conservation. Current research at The Deep is developing non-invasive methods of DNA collection from elasmobranch species in collaboration with the University of Manchester. These methods have produced usable quantities of material for DNA analysis which the way forward for the establishment of a central identification DNA database of captive *Pristis* as proposed in the IUCN Strategy. These programs provide additional platforms for communication and collaboration with other stakeholders to promote sawfish science and conservation. Although the focus is on how aquaria have and can contribute to sawfish research and conservation, the greatest opportunity and need is for future collaboration with aquaria worldwide and other important stakeholders through existing as well as new programs and strategies.

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**0037 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

William White[1], Sharon Appleyard[1], Leontine Baje[2], Benthly Sabub[2]

*[1]CSIRO National Research Collections Australia, Hobart, Australia, [2]National Fisheries Authority, Port Moresby, Papua New Guinea*

**Preliminary Investigation into Sawfish Catches in Papua New Guinea**

During a larger project on the shark and ray fisheries of Papua New Guinea which commenced in 2014, records of sawfish catches were collated and anecdotal information from fishers collected. Tissue samples, photographs and morphometric measurements from dried rostra and/or fins were taken from any sawfish observed during artisanal surveys. Also, an observer program on prawn trawlers in the Gulf of Papua collected data and samples from any sawfish captures. All four species known to occur in the area (*Anoxypristis cuspidata, Pristis clavata, P. pristis* and *P. zijsron*) were recorded in the fishery catches. *Anoxypristis cuspidata* was by far the most abundant species caught. Most records were from the Gulf of Papua but records also taken from Manus, Rabaul and Bougainville. The difficulties in collecting such data in Papua New Guinea and the best way to continue acquiring good data and providing capacity building tools are discussed.

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**0670 Amphibian Reproduction & Herp Conservation, Galerie 3, Saturday 9 July 2016**

Steven Whitfield[1], Jacob Kerby[3], Juan Abarca[2], Gilbert Alvarado[4]

*[1]Zoo Miami, Miami, FL, USA, [2]Universidad de Costa Rica, San Pedro, Costa Rica, [3]University of South Dakota, Vermillion, SD, USA, [4]Universidade de São Paulo, São Paulo, Brazil*

## Enigmatic survival follows enigmatic amphibian decline - A turning point for amphibian conservation?

Amphibian chytridiomycosis (caused by the pathogen *Batrachochytrium dendrobatidis*, "Bd") is an emerging fungal disease associated with apparent extinctions of perhaps more than 200 amphibian species. However, many amphibian species long presumed extinct have been recently rediscovered, and these rediscoveries are difficult to reconcile with the prevailing paradigm that an amphibian mass extinction has already transpired. Here, we synthesize information on amphibian rediscoveries, and present a new conceptual framework to classify rediscoveries that will improve clarity concerning mechanisms for host-pathogen co-existence relevant for efforts to mitigate Bd. We distinguish among four phenomena in rediscovery of amphibian populations. First, many rare amphibian species have been rediscovered after decades unseen by scientists, but are unrelated to chytridiomycosis. Second, some "relict populations" from chytridiomycosis-susceptible species exist in environmental refugia from chytridiomycosis (environments that are hostile for survival or growth of Bd). Third, recolonization of upland sites from lowland refugia is a second form of recovery, and is widespread, but is not typical of the most severely threatened amphibian species or those presumed extinct. Finally, several species of amphibians highly sensitive to chytridiomycosis have populations surviving within ideal habitat for Bd yet persist with some unexplained resistance or tolerance to chytridiomycosis – the enigmatic survivors of amphibian extinctions. Enigmatic survival may result from evolutionary responses of hosts or pathogens, or shifts in the host community or community composition of the amphibian skin microbiome. Research on enigmatic survivors may inform strategies to mitigate wildlife emerging infectious diseases, including amphibian chytridiomycosis among others.

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**0092 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; AES CARRIER AWARD**

Nicholas Whitney[1], Karissa Lear[1], Lindsay Gaskins[1], Adrian Gleiss[2]

*[1]Behavioral Ecology and Physiology Program, Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, FL 34236, USA, [2]Centre for Fish and Fisheries Research, Murdoch University, 90 South Street, WA 6150, Australia*

## The effects of temperature and swimming speed on the metabolic rate of the nurse shark (*Ginglymostoma cirratum*, Bonaterre)

Sharks and other top predators have a substantial impact on their ecosystems through trophically mediated effects, and understanding the scope of this impact is essential to forming an accurate picture of energy flow within an ecosystem. One of the most important factors to consider when assessing a predator's impact is metabolic rate, which is dependent on a number of environmental, physiological, and anatomical characteristics. Standard (SMR) and routine metabolic rates (RMR) and swimming dynamics of the nurse shark (*Ginglymostoma cirratum*, Bonaterre) were assessed using a static respirometer over two experimental temperatures (23 and 30 °C). The metabolic rates measured here represent the lowest reported for any shark species to date. Mean (± SD) SMRs at 23 °C and 30 °C were 36 ± 8 and 60 ± 17 mg $O_2$ $kg^{-1}$ $h^{-1}$, and mean RMRs were 95 ± 15 and 138 ± 21 mg $O_2$ $kg^{-1}$ $h^{-1}$, respectively. The $Q_{10}$ for SMR was 2.42 between 23 and 30 °C. Minimum cost of transport ($COT_{min}$) at 23 °C was 68 mg $O_2$ $kg^{-1}$ $km^{-1}$, where swimming speed was 0.33 BL $s^{-1}$. The $COT_{min}$ increased to 81 mg $O_2$ $kg^{-1}$ $km^{-1}$at 30 °C, where swimming speed was 0.44 BL $s^{-1}$. The proportional cost of activity was greater compared to other elasmobranchs, and nearly twice that of most ram ventilating shark species. These results highlight the sedentary nature of nurse sharks and suggest that they are energetically suited for a minimally active lifestyle.

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**0560 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Jeff Whitty[1], James Keleher[1], Adrian Gleiss[1], Brendan Ebner[2], Colin Simpfendorfer[3], David Morgan[1]

*[1]Murdoch University, Perth, Western Australia, Australia, [2]CSIRO, Atherton, Queensland, Australia, [3]James Cook University, Townsville, Queensland, Australia*

## Heterogeneous habitat use of the critically endangered largetooth sawfish (*Pristis pristis*) in a riverine nursery

Understanding the habit use and selection of a species is important for identifying environments and resources that it is dependent upon. However, these subjects can be complex and often involve a balance of multiple abiotic and biotic rewards and risks. This study used acoustic monitoring to assess the movements of 32 juvenile largetooth sawfish (*Pristis pristis*) in association with various abiotic and biotic variables in the Fitzroy River, Western Australia between 2008 and 2015, in order to determine which

nursery habitats and resources are important to this critically endangered species. *Pristis pristis* demonstrated an affinity for deep-water runs and pools with high concentrations of large woody debris in the day-time, when activity was lowest, and for shallow-water habitats, such as glides, in the night-time, when movement and distance travelled significantly increased. Depth selection changed in response to the time of day, with individuals occupying deeper depths in the day-time and shallower depths in the night-time, moving between these depths in accordance with light intensity, regardless of the habitat type. Mean hourly depth of *P. pristis* also decreased through the dry season as temperatures increased and river stage height decreased. These results highlight that habitat use and selection of juvenile *P. pristis* are not static and that the species uses a range of riverine microhabitats. Given the threatened status of *P. pristis*, these habitats, which are largely unprotected in Australia, need to be strategically managed to promote juvenile survivorship and conservation of this species.

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**0917 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; STORER AWARD HERPETOLOGY**

K.H. Wild, B. Bedal, C.M. Gienger

*Austin Peay State University, Clarksville, TN, USA*

**External Parasites Influence Locomotor Performance of Male Eastern Fence Lizards (*Sceloporus undulatus*)**

External parasites are common on wildlife and humans that inhabit forested areas. These ectoparasites may have a variable impact on the host species, from minimal effects to negative effects, that can alter the hosts physiology and potentially lead to influencing its overall health. Our objective is to quantify the effect of parasites (*Dermacentor variabilis*, American Dog tick and *Amblyomma americanum,* Lone Star tick) on male *S. undulatus* locomotor performance, a trait that is linked to health of an individual and ultimately important for survival. *Sceloporus undulatus* is relatively common throughout the eastern U.S., and parasite load varies considerably among populations. We compared locomotor performance of lizards with attached ticks to lizards without ticks. We measured locomotor performance in two ways: maximum sprint speed and 2-meter run speed. Lizards with ticks had significantly lower maximum sprint speed and 2-meter run speed in comparison to lizards where ticks were absent.

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**0292 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Tonya Wiley-Lescher[1], Adam Brame[2]

*[1]Haven Worth Consulting, Palmetto, Florida, USA, [2]NOAA Fisheries Service Southeast Regional Office Protected Resources Division, St. Petersburg, Florida, USA*

## Endangered Species Act Five-year Review and Recovery Plan Updates for US Smalltooth Sawfish, *Pristis pectinata*

The United States distinct population segment (DPS) of smalltooth sawfish (*Pristis pectinata*) was classified as Endangered under the US Endangered Species Act (ESA) in 2003. A recovery plan for the US DPS of smalltooth sawfish was published in 2009 detailing goals and actions necessary to meet identified recovery criteria. To monitor recovery efforts and ongoing threats to the species, the ESA requires the status of the species be assessed through regular 5-year reviews. The first review was completed in 2010 and, based on criteria established in the recovery plan, determined the species still warranted protections afforded by an Endangered classification. Recently a second ESA 5-year review was commenced and will determine if the listing classification of Endangered under the ESA is still appropriate. Changes to the recovery plan, including revised recovery goals and criteria, are also underway. Updating the plan, and the recovery criteria it contains, will help scientists and managers work toward restoring the sawfish population in the US to the point where it is a secure part of its ecosystem and protections under the ESA are no longer needed. Results of the second 5-year review and updated recovery plan will be presented.

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**0015 General Ichthyology II, Balconies J & K, Sunday 10 July 2016**

Philip Willink[1], Gregory Jacobs[2], Dimitry Gorsky[3], Zy Biesinger[3], Andrew Kough[1]

*[1]Shedd Aquarium, Chicago, IL, USA, [2]US Fish & Wildlife - NFC, Lamar, PA, USA, [3]US Fish & Wildlife - LGL, Basom, NY, USA*

## Activity patterns of Lake Sturgeon (*Acipenser fulvescens*) in Lakes Erie and Ontario using Pop-off Archival Satellite Tags

Little is known about lake sturgeon (*Acipenser fulvescens*) movement and migration behavior in Lakes Erie and Ontario. In contrast to conventional survey methods, archival tags allow the ability to record habitat variables, movement, and location throughout the year. The objective of this study was to characterize movement behavior of lake sturgeon in response to time and habitat variables during and after the spring spawning period. Pop-off Archival Satellite Tags (PSAT tags) were attached to 23 lake sturgeon in Buffalo Harbor, Lake Erie and 22 lake sturgeon in the Lower Niagara River, Lake Ontario during spring, 2014. PSAT tags measure location, depth, temperature, and activity until a programmed release date. After release, tags float to the surface where they communicate their data via satellite or may be recovered and their data downloaded directly. We evaluated migration behavior and positional accuracy of tag

data on a daily time step. We then evaluated variation in tag acceleration and orientation across depth, temperature, and time to infer movement patterns. Migration patterns were difficult to assess as lake sturgeon tended to migrate relatively short distances during tag deployment. However, we do find patterns in the variation of lake sturgeon activity across environmental covariates.

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**0279 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Stuart Willis

*Texas A&M University-Corpus Christi, Corpus Christi, TX, USA*

## Integrating disparate genetic data reveals a complex phylogeographic history and no resolution for species delimitation in the Amazon peacock bass cichlid *Cichla pinima* (Perciformes: Cichlidae) species complex

Species are often treated as fundamental units in biology, and their discovery and relationships are the principle goals of systematics. However, the delimitation of species is often ambiguous, and many forms of molecular data are often brought to bear on the question. Here we integrated analyses of genetic data from 11 microsatellites, mtDNA sequences, and sequences of 17 unlinked nuclear genes of 134 fishes from the *Cichla pinima* species complex. Four species were described from this complex, but later molecular analyses discovered two primary genetic clusters, neither of which corresponded well to the four described species. Our integration of these data with additional nuclear sequences showed that the complex exhibits a significant population structure, with moderate to high genetic divergence between most populations. Species delimitation under the multispecies coalescent supported the recognition of three species, with core distributions in the 1) Tapajós and Jari Rivers, 2) Trombetas, Nhamundá, and eastern tributaries of the Madeira River, and 3) the upper Uatumã River. However, approximate Bayesian computation favored models that included admixture in the lower Amazon between the Tapajós and Trombetas lineages. Continuous phylogeographic modeling also suggested that the two mitochondrial lineages (Tapajós vs. Trombetas+Uatumã), which are polyphyletic with respect to other *Cichla* clade A species, expanded recently from 'refugia' in the Tapajós and Madeira Rivers. These data are consistent with a hypothesis of sister populations that experienced significant isolation, followed by extensive range expansion and secondary contact, and now exhibit an elaborate meta-population structure characterized by moderate isolation.

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**0277 Fish Genetics, Salon D, Sunday 10 July 2016**

Stuart Willis, Jonathan Puritz, David Portnoy, John Gold

*Texas A&M University-Corpus Christi, Corpus Christi, TX, USA*

### Low genomic divergence among King Mackerel (*Scomberomorus cavalla*) in northern temperate waters of the western Atlantic Ocean revealed by ddRAD sequencing

King mackerel is a migratory, coastal pelagic scombrid fish native to the Western Atlantic Ocean, including the Gulf of Mexico (Gulf). The species is highly targeted commercially in southern winter fisheries, and recreationally in northern summer fisheries. Demographic and otolith shape and microchemistry studies have identified distinct migratory groups along the U.S. Atlantic coast and in the northern Gulf, and it has been suggested that eastern and western migratory groups may exist in the northern Gulf as well. However, previous tagging studies have indicated little fidelity to migratory routes, and genetic studies have found few significant differences between migratory groups. We employed data from a reduced representation genomic library to test the hypothesis that migratory groups could be discriminated genetically. We surveyed a filtered set of over 1,000 haplotyped loci among king mackerel sampled from seven localities, six from the U.S. Atlantic and Gulf coasts and one from Campeche Bay (Mexico) in the southern Gulf. We found no evidence of genetic heterogeneity among localities, regions, or migratory groups (mean global $G_{ST}$'' of <0.001) and observed only a low probability in assigning individuals back to migratory group or region. The sample from Campeche Bay could not be distinguished from those in U.S. territorial waters. No significant $F_{ST}$ 'outlier loci' were identified after rigorous filtering. We hypothesize that high migration rates and large effective population sizes have precluded divergence among king mackerel in the northern part of its contemporary range.

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**1014 Herp Conservation, Galerie 2, Sunday 10 July 2016**

John Willson[1], Shannon Pittman[2], Tracey Tuberville[3], Jeffrey Beane[4], Michael Dorcas[2]

*[1]University of Arkansas, Fayetteville, AR, USA, [2]Davidson College, Davidson, NC, USA, [3]University of Georgia Savannah River Ecology Lab, Aiken, SC, USA, [4]North Carolina State Museum of Natural Sciences, Raleigh, NC, USA*

### A Novel Approach to Estimating Density of Secretive Terrestrial Snakes

Accurate estimates of population density and individual detection probability are critical components of effective wildlife conservation and management. However, many snake species are so secretive that their density cannot be determined using traditional methods such as mark-recapture. Thus, the status of populations of most terrestrial snake species remains completely unknown, presenting a substantial obstacle to wildlife inventory or management plans. Here we develop a novel simulation-based technique for estimating density of secretive snakes that combines behavioral observations of

snake road crossing behavior (crossing speed), effort-corrected road survey data, and simulation-based analysis of spatial movement patterns derived from radiotelemetry, without relying on mark-recapture. Specifically, we use radiotelemetry data to parameterize individual-based movement models that estimate the frequency with which individual snakes cross roads and use information on survey vehicle speed and snake crossing speed to determine the probability of detecting a snake, given that it crosses the road transect during a survey. Snake encounter frequencies during systematic road surveys can then be interpreted in light of detection probabilities and simulation model results to estimate snake densities and to assess various factors likely to affect encounter rates. We demonstrate the applicability of this approach to a variety of rare, secretive, or poorly understood species through a case example of the imperiled Southern Hognose Snake (*Heterodon simus*) in the North Carolina sandhills.

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**0657 Poster Session I, Acadia/Bissonet, Friday 8 July 2016; SSAR VICTOR HUTCHISON STUDENT POSTER AWARD: ECOLOGY, NATURAL HISTORY, DISTRIBUTION, & BEHAVIOR**

Audrey Wilson, Steve Johnson

*University of Florida, Gainesville, FL, USA*

**Habitat Use of Invasive Cane Toads (*Rhinella marina*) in Florida**

Cane toads (*Rhinella marina*) were accidentally introduced to Florida through the pet trade in the 1950s. They are now common in disturbed habitat throughout much of south and central Florida, and are particularly prevalent in residential areas. However, there are few records of cane toads in natural areas in Florida. It is unclear if the lack of records in undisturbed habitat indicates a true absence or if it results from insufficient sampling effort. We deployed thirty-eight autonomous recording units (ARUs) in four natural areas and nearby neighborhoods to identify cane toads calling in summer and fall 2015. We scanned recordings with Song Scope software using an automated recognizer, and then manually to focus on periods of heavy rain. Cane toads were not detected in any of the natural habitats, though they were recorded calling at four of five residential sampling locations. Although two of the four sites experienced abnormally low rainfall, other species called regularly. Species frequently heard calling in natural areas included southern toads (*Anaxyrus terrestris*), oak toads (*Anaxyrus quercicus*), Cuban tree frogs (*Osteopilus septentrionalis*), green tree frogs (*Hyla cinerea*) and eastern narrowmouth toads (*Gastrophryne carolinensis*). Additional ARUs will be deployed spring 2016 to examine cane toad presence along a disturbance gradient.

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**0778 Lightning Talks, Galerie 2, Saturday 9 July 2016**

Thomas Wilson, Brad Reynolds, Margaret Dempsey, Alexandra Korshun, Ashton Mitchell, Erin Shrenker, Richard Schwartz, Team Salamander

*University of Tennessee at Chattanooga, Chattanooga, TN/SEUSA, USA*

### The Development and Implementation of a Natural Science Living and Learning Community and a Case for Hands-On Herpetology Utilizing the Biological Field Stations at UT-Chattanooga

The University of Tennessee at Chattanooga (UTC) is a regional metropolitan university that is exploring new and exciting ways to better engage and prepare students for careers. Pedagogically speaking, the traditional approach of paring lectures and laboratories is not always effective when compared to research approaches utilizing problem-based learning with design process thinking. The latter has received some traction at UTC and is a dynamic way to prepare students for productive careers in science. Our Natural Science Living and Learning Community (NSLLC) will be a residentially based research opportunity that focuses on a particular aspect of natural science. In 2004, UTC officials began drafting a plan to acquire properties to be used as biological field stations (BFS) so that faculty could better engage students in education, research, outreach and conservation. UTC's BFS are pivotal for this NSLLC because they provide the frame work for students to better understand wildlife-habitat relationships in urban systems. By using existing elements of the curricula and university infrastructure, we have devised a plan to integrate the BFS into a four semester curriculum so that students can gain hands-on experience in scientific research. The NSLLC will be tied to the current research being performed at the BFS because it provides an excellent jump-off platform that dovetails flawless within a realistic problem based learning environment. In closing, the NSLLC will build capacity for undergraduate research, facilitate partnerships among community stakeholders, and foster active yet collaborative learning by studying the urban ecology of the Chattanooga area.

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**0290 HL GRADUATE RESEARCH AWARD, Galerie 2, Friday 8 July 2016**

Kristin Winchell[1], Elizabeth Carlen[2], Liam Revell[1]

*[1]University of Massachusetts Boston, Boston, MA, USA, [2]Fordham University, New York, NY, USA*

### Urban Habitat Partitioning by Two Common Species of Puerto Rican Anoles

Ecology and evolution of herpetofauna in urban areas is an important aspect of global change. Urbanization leads to significant habitat modification and species differ in their ability to utilize and adapt to human-altered landscapes. In Puerto Rico, *Anolis cristatellus* is abundant in urban areas where it frequently utilizes manmade substrates. Our previous work demonstrated that this urban habitat use is correlated with phenotypic shifts in fitness-related traits. Yet not all species present in urban areas

utilize anthropogenic habitat extensively. *Anolis stratulus* is frequently found in urban areas across Puerto Rico but rarely utilizes manmade substrates. We quantified differences in habitat use for these two species to better understand partitioning of urban habitat. We found that *A. cristatellus* and *A. stratulus* discriminately utilized different portions of the habitat. Specifically, *A. stratulus* chose patchy, remnant natural habitat such as trees and shrubs while *A. cristatellus* used anthropogenic habitat such as buildings and fences with high frequency. Aspects of the observed habitat discrimination are similar to patterns in natural sympatric populations: *A. stratulus* perched higher than *A. cristatellus*, preferring sites with lower temperatures and greater canopy cover. However, the use of manmade substrates by *A. cristatellus* and not *A. stratulus* reduces niche overlap. The avoidance of manmade substrates by *A. stratulus* may reduce inter-specific predation and competition or may reflect less flexible habitat requirements. Our results have implications for long-term persistence of these species in urban habitats and suggest loss of natural habitat elements may lead to non-random species extirpations as urbanization intensifies.

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**0507 SSAR SEIBERT AWARD CONSERVATION, Galerie 3, Friday 8 July 2016**

Stephanie Winton[1], Christine Bishop[2], Karl Larsen[1]

*[1]Thompson Rivers University, Kamloops, British Columbia, Canada, [2]Environment and Climate Change Canada, Delta, British Columbia, Canada*

## Assessing the Relationship between Habitat Temperature and Rattlesnake Road Mortality

Road mortality poses a severe threat to many wildlife species, and effective mitigation requires a fundamental understanding of why animals occupy roads in the first place. Research has recognized that snakes are particularly susceptible to roadkill due to distinct life history traits, even being shown to have a preference for road habitat in some cases. However, little research has attempted to identify the driving factors behind snake occurrences on roads. As ectotherms at the northern extent of their range in British Columbia, western rattlesnakes (*Crotalus oreganus*) exhibit behavior that is highly influenced by the need to thermoregulate, and paved roads likely offer preferential habitat at certain times of the day or season compared to the surrounding shrub-steppe. We are examining a population of western rattlesnakes through mark-recapture and radio-telemetry work. Regular road and habitat surveys are conducted throughout the active season with concurrent monitoring of environmental conditions such as substrate temperatures. The goal of this research is to identify predictors of snake behavior relating to road thermodynamics, as well as quantify overall roadkill impacts on the population. Preliminary analysis indicates that there is a positive relationship between road temperature and the presence of rattlesnakes on roads, although the combination of multiple factors is being explored. It is anticipated that this research will reveal important movement corridors and roadkill 'hot-spots' as well as identify conditions associated with incidence of roadkill. Being able to predict when, where and for how

long snakes are occupying roadside habitat will contribute to successful mitigation measures.

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**0953 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Van Wishingrad, Anthony Barley, Robert Thomson, Amber Wright

*University of Hawaii, Honolulu, Hawaii, USA*

**Evidence-based threat assessment: lessons from California herpetofauna**

Mitigating threats to species of conservation concern requires accurately determining causes of decline. While many studies have assessed common threats across taxa, little attention has been paid to the standards for evidence used to determine threats. We used reptiles and amphibians in California, USA as a case study for determining both the threats causing imperilment and the evidence used to support identification of threats. We reviewed the original listing documents and relevant literature for all taxa that are endangered, threatened, or special concern at the state and/or federal level (64 taxa). For each cited threat we scored whether evidence existed for that threat from observational or experimental data, and whether that evidence was replicated across space, time, or research groups. Threats supported only by expert opinion were scored as lacking formal evidence. Overall, the most commonly cited threats were habitat degradation (92% of taxa affected), climate change (72%) and introduced species (50%). We identified 186 combinations of threat and taxon, and in over half of these cases (54%) there was no empirical evidence for the threat. When evidence was available, it was usually from observational data only (54/85 cases with evidence), and a quarter of cases with empirical evidence were unreplicated (22/85). The call for evidence-based conservation has been growing, with an emphasis on decision-making regarding alternative interventions. Our analysis shows that little evidence is contributing to identifying threats in the first place, potentially leading to inefficient conservation actions. Our analysis highlights key research gaps for conservation of California herpetofauna.

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**0599 ASIH STOYE AWARD CONSERVATION, SALON E, Thursday 7 July 2016**

Calvin Won, Larry Allen

*California State University, Northridge, Northridge, California, USA*

**Moonlit Summer Love: Exploring the lunar effect on spatial patterns of spawning Barred Sand Bass**

Spawning aggregations are essential to commercial and recreational fish harvest. Predictability of aggregations in both time and space allows for plentiful yield with relatively low fishing effort. However, this places certain species at risk of overharvest.

The Barred Sand Bass (*Paralabrax nebulifer*), a resident California species, has been exhibiting the characteristics of an aggregation-based fishery that is on the verge of collapse, as annual catch estimates have declined by more than 90% within a 10-year period. Population declines of aggregation-based fisheries have a tendency of going unnoticed, as fishery-dependent stock assessments do not generally account for spatial or temporal variability. Spatial variability and behavior of many fish species is mediated by physical environmental factors. This study aims to investigate the spatial tendencies of Barred Sand Bass spawning aggregations in relation to lunar periodicity. Lunar phase-dependent transect surveys were performed using active acoustic technology (BioSonics® DT-X split beam echosounder, 206 kHz) during the summer of 2014 spawning season. These data revealed a possible lunar-dependent depth pattern, as Barred Sand Bass were detected over shallower environments during new moon events and over deeper environments during full moon events. This pattern may be related to variations in water column illumination, which has previously been shown to alter the schooling behaviors of the Northern Anchovy (*Engraulis mordax*), a common prey species to the piscivorous Barred Sand Bass.

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**1116 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Dustin Wood[1], Erika Nowak[2], Randy Jennings[5], Bruce Christman[5], Iain Emmons[2], Jeff Servoss[4], Amy Vandergast[1]

*[1]U.S. Geological Survey, San Diego, CA, USA, [2]Northern Arizona University, Flagstaff, AZ, USA, [3]U. S. Geological Survey, Flagstaff, AZ, USA, [4]U.S. Fish and Wildlife Service, Tucson, AZ, USA, [5]Western New Mexico University, Silver City, NM, USA*

**Genetic Connectivity of Mexican and Narrow-headed gartersnakes across the major US watersheds using genome-wide SNP data**

The Northern Mexican Gartersnake (*Thamnophis eques megalops*) and the Narrow-headed Gartersnake (*Thamnophis rufipunctatus*) are highly aquatic species inhabiting the major perennial watersheds throughout central and southern Arizona, western New Mexico, and Mexico. Although historically common and widespread throughout their range, remaining populations in the United States are largely disjunct and isolated from one another and from populations in Mexico, suggesting that gene flow is nonexistent or impeded. Given the fragmented state of the remaining populations, it is critical to understand the genetic structure and diversity of existing populations to ensure long-term viability. We used data from hundreds of independent nuclear markers (Single Nucleotide Polymorphisms) to (1) determine whether there is significant genetic structure among watersheds, (2) assess the levels of genetic diversity and gene flow dynamics within and among watersheds, (3) and identify suitable source populations for potential re-establishment efforts. In both species we found evidence for strong genetic partitioning both within and among watershed and multiple genetic clusters within each species. Using comparisons of genetic diversity and effective population size estimates, we discuss how patterns of genetic diversity can inform conservation management decisions and the recovery planning efforts for both species.

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**0470 Fish Ecology I, Salon A-C, Saturday 9 July 2016**

Kirsten Work, Melissa Gibbs

*Stetson University, DeLand, FL, USA*

### How effective is discharge management on maintaining Florida spring fish assemblage structure?

Over the past forty years, Florida springs have been increasingly impacted by reductions in water quantity and quality and by invasions of exotic species. Those springs near high population densities have been disproportionately impacted. Volusia Blue Spring is a first magnitude spring (> 100 mgd/day) and a major manatee refuge in Central Florida and its springshed is almost entirely municipal. The St. Johns River Water Management District adopted a Minimum Flow Regime (MFR) in 2007 to provide an administrative means for maintaining discharge and the ecological health of the spring. This study was part of the periodic evaluation of the ecological integrity of the spring for the MFR and its purpose was to determine whether there were relationships between discharge and stage, water quality, and biological parameters. Over the course of one year, we assessed (among other parameters) fish density and diversity monthly with seine and snorkel counts. We evaluated spatial, seasonal, and annual changes in the assemblages and compared the data collected in 2014-2015 to data collected in 2007-2008 and in 2001-2003. Low discharge combined with high stage and salinity in 2014-2015 produced a fish population with a lower density and diversity than in previous years. As a result of the strong relationships between variation in discharge and an array of chemical and biological characteristics of the spring, we suggest that maintaining the historical discharge rate is important for preserving the ecological integrity of Volusia Blue Spring.

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**1016 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Amber Wright

*University of Hawaii at Manoa, Honolulu, HI, USA*

### Competition in Novel Lizard Communities: *Anolis* vs. *Phelsuma* in Hawaii

Novel communities are increasingly being formed by factors such as climate change and species introductions. Predicting the outcome of interactions in novel communities is of paramount practical importance, and also addresses fundamental questions in ecology about community assembly. The arboreal, diurnal lizard fauna of Hawaii is comprised of the ecologically similar but distantly related anoles and day geckoes, providing an ideal study system for predicting the outcome of novel species interactions. The two anoles (*A. carolinensis* and *A. sagrei*) have a well-documented competitive interaction: where they co-occur they partition habitat, and *A. carolinensis* abundance declines. Therefore, I can use the traits of the anoles and their expected competitive outcome as a

reference to predict how the novel player, *P. laticauda*, fits into the community. Here I report preliminary data on functional trait variation, observational data from the field, and data from experimentally assembled communities. When alone, any of the three species can be abundant, but in sympatry only one is abundant. *A. carolinensis* is still abundant and uses lower perches in sites recently colonized by either of the other species compared to sites with longer co-occurrence. In 10 m x 10 m experimental enclosures, interactions between the two anoles are consistent with previous studies. Interactions between *Phelsuma* and the anoles seems to depend on whether 1 or 2 anole species are present: *P. laticauda* perches much higher in the presence of both species compared to all other combinations. These results suggest that these taxa are indeed competing in Hawaii.

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**1067 Herp Ecology, Salon F-H, Sunday 10 July 2016**

Amber Wright[1], Gregory Pauly[2], Anthony Barley[1], Robert Thomson[1]

*[1]University of Hawaii at Manoa, Honolulu, HI, USA, [2]Natural History Museum of Los Angeles County, Los Angeles, CA, USA*

**Historical Resurveys of Lizard Communities in the Mojave Desert**

In seminal work on lizard ecology, Eric Pianka surveyed distribution, abundance, and species traits of flatland, Mojave Desert lizard communities in the 1960s. This work combined with surveys by Benjamin Banta during the same period resulted in the collection of over 3,500 specimens. Since then, this region has experienced increased development and a warming climate, with such trends expected to continue into the future. We resurveyed 5 of these historical sites to determine changes in lizard communities over the last 50 years. We found slight changes in species richness at most sites. For the two most common lizards, *Aspidoscelis tigris* and *Uta stansburiana*, for which historical abundance data were available, we found decreases in abundance at most sites. Future work will expand to resurveys of the full transect of Pianka localities in the Sonoran and Great Basin deserts, and analysis of trait variation over time. Our resurvey will provide an important benchmark for future studies of environmental change in the Mojave Desert.

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**0610 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Barbara Wueringer[1], Teagan Marzullo[1], Vera Schluessel[2]

*[1]Sharks And Rays Australia, Bungalow, Queensland, Australia, [2]University of Bonn, Institute of Zoology, Bonn, Germany*

**Sawfish research in Queensland, Australia**

For four species of sawfish, i.e. the green sawfish *Pristis zijsron*, the dwarf sawfish *Pristis clavata,* the freshwater sawfish *P. pristis* and the narrow sawfish *Anoxypristis cuspidata*,

the waters of Northern Australia are likely to represent their last global stronghold. The organization Sharks And Rays Australia is currently undertaking a project assessing the distribution and abundance of these four sawfish species in Northern Queensland, focusing on Far North Queensland, the Cape York region and the coastline of the Gulf of Carpenteria. The region north of Cairns is only sparsely populated by approximately 28,000 people. A large percentage of the 2500 km coastline and rivers are believed to be an important habitat for sawfish. The aim of Sharks and Rays Australia will be to determine the status quo and review the limitations of the current knowledge on the occurrences of sawfish within this region. The methods of our study, including a tagging study, collaborations with local indigenous rangers and the involvement of the public, will be presented together with preliminary results and future aims for the expansion of this study.

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**1062 AES Morphology & Reproduction, Balconies L & M, Friday 8 July 2016**

Jennifer Wyffels, Linda M. Penfold

*South-East Zoo Alliance for Reproduction & Conservation, Yulee, FL, USA*

## Comparative Morphology of Shark Sperm Using Light and Electron Microscopy

Elasmobranch spermatozoa studied so far are characterized by a conical acrosome, helical nucleus, long mitochondria-rich midpiece, and helical tail. Semen was collected from 5 sharks (*Carcharias taurus, Chiloscyllium plagiosum, Chiloscyllium punctatum, Mustelus canis*, and *Carcharhinus limbatus*) for comparative light and scanning and transmission electron microscopy. Spermatozoa had a species-specific number of gyres or twists (*C. plagiosum* 32, *C. taurus* 17, *M. canis* 11, and *C. limbatus* 5) that continued into part of the midpiece for *C. plagiosum*, *C. punctatum,* and *M. canis*. The midpiece was composed of glycogen granules and mitochondria with concentric cristae. A cytoplasmic sleeve, analogous to the cytoplasmic droplet of other vertebrates, was located at the junction of the midpiece and flagellum and was shed via movement down the flagellum over time after semen collection. For all species the flagellum contained two ovoid longitudinal columns adjacent to the axoneme at doublets 3 and 8. In contrast to the other sharks, the nucleus of *C. limbatus* underwent changes with cell death that manifested as foci of nuclear expansion from DNA decondensation. *C. punctatum* and *C. plagiosum* spermatozoa were observed to be capable of both forward and backward motility. Reverse motility for spermatozoa is a remarkable feature not reported for other species.

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**0835 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Amy Yackel Adams[1], Bjorn Lardner[2], Elden Holldorf[3], Justine Kaseman[3], Lea' Bonewell[1], Rod Adams[4], Adam Knox[1], Michelle Collier[1], Bryan Falk[1], Emma Hanslowe[1], Julie Savidge[2], Robert Reed[1]

*[1]U.S. Geological Survey, Fort Collins, CO, USA, [2]Colorado State University, Fort Collins, CO, USA, [3]Cherokee Services Group, Fort Collins, CO, USA, [4]Front Range Community College, Fort Collins, CO, USA*

## Camera Traps as a Tool in Reptile Research

Advances in trail camera technology, coupled with decreasing costs, have led to a dramatic increase in camera trap use in wildlife research. There is immense potential for camera traps to deliver new data types. In our invasive reptile research program, we use cameras to understand tegu brumation behavior, species presence, and snake activity around mouse-baited traps. We report on the use of trail cameras to record behaviors of invasive brown treesnakes around conventionally-used snake traps on Guam. Our results provide circadian rhythm information and trap-entry rates of snakes that approach traps. Camera trap use, while extremely challenging in field settings for reptiles, can provide important information on reptile biology as well as control-tool efficacy for invasive reptiles.

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**0816 Herp Conservation, Galerie 2, Sunday 10 July 2016**

Amy Yackel Adams[1], Bjorn Lardner[2], Gordon Rodda[3], Julie Savidge[2], Robert Reed[1]

*[1]U.S. Geological Survey, Fort Collins, CO, USA, [2]Colorado State University, Fort Collins, CO, USA, [3]U.S. Geological Survey Emeritus, Hesperus, CO, USA*

## Can Detectability of Brown Treesnakes Reveal its Ability to Predict When it is Worth Foraging?

Invasive Brown Treesnakes (*Boiga irregularis*) have caused extinction or extirpation of many native vertebrates on Guam, a U.S. territory in the western Pacific Ocean. We study control, containment, and detection of this species. One of the primary objectives of our research is to obtain comprehensive estimates of snake detection probability—a parameter of paramount interest for optimizing invasive species management. In a 5-ha enclosure, we used mark-recapture and nocturnal visual searches to evaluate detection determinants that reflect (1) human ability to detect an active snake (e.g., wind, rain, searcher) and (2) differences in snake activity (e.g., sex, size, body condition, prey, and an individual's recent detection history). Snake size affected individual detection in a predictable manner, but also interacted in a novel way with our sighting rates of prey: small snakes were more detectable on nights when their gecko prey were frequently sighted, whereas large snakes were more detectable on nights when their rat prey were frequently sighted. Nightly gecko and rat sighting rates were not correlated. We suspect that the snakes cannot sense the activity of prey species directly, but likely use proxies

(e.g., high humidity, dark of moon, etc.) that they have come to associate with good hunting. However, our modeling of known proxies suggests the existence of additional unidentified factors. Knowledge of modulators of snake activity and their covariates can be useful for not only enhancing the precision and reducing the bias of monitoring and control activities, but also for exploring ecological questions.

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**0228 SSAR SEIBERT ECOLOGY AWARD, Galerie 2, Friday 8 July 2016**

Katharine Yagi[1], David Green[2]

*[1]Department of Natural Resource Science, McGill University, Montreal, Quebec, Canada, [2]Redpath Museum, McGill University, Montreal, Quebec, Canada*

**Mechanisms of Density-Dependent Dispersal in Juvenile Fowler's toads, *Anaxyrus fowleri***

Dispersal is a necessary process for any species living in a fragmented landscape, but it is unknown precisely how body size is related to dispersal. If displacement is in some way size-dependent, then by manipulating larval density conditions to produce juvenile toads of varying sizes in the same adult habitat, we should see a correlation between displacement and body size among individuals. To address this, we reared Fowler's toad tadpoles in eight density treatments in artificial ponds located in the Long Point National Wildlife Area. After about two weeks post-metamorphosis, we measured toadlet body length and relative leg length and released individuals into the adult habitat. Toadlets were recaptured in the terrestrial landscape the following spring and identified using photographs of their dorsal spot patterns. Displacement rate was measured using the linear distance between the initial release coordinates and the coordinates of their first recapture the following season, divided by the number of active season days in between each encounter. We hypothesized that if larger toads have more energy stores to move longer distances at a faster rate, then we should find a positive relationship between body size and relative displacement rate. Similarly, if longer legged animals jump proportionally longer distances than those with shorter legs, relative leg length should positively correlate with relative displacement rate. The results show that relative leg length is a better predictor for relative displacement rate than body length, suggesting that tadpole density may influence dispersal indirectly, by influencing leg length of toadlets.

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**0596 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Naoki Yagishita[1], Takahiro Kusaka[2], Hara Koujirou[1], Keisuke Furumitsu[1], Shinji Uehara[3], Yuta Yagi[3], Atsuko Yamaguchi[1]

*[1]Graduate School of Fisheries and Environmental Sciences, Nagasaki University, Nagasaki, Japan, [2]Graduate School of Agriculture, Kinki University, Nara, Japan, [3]Japan Sea National Fisheries Research Institute, Niigata, Japan*

## Microsatellite DNA analysis of population structure of a Japanese common skate *Dipturus* cf. *kwangtungensis* in Japan

A Japanese common skate *Dipturus* cf. *kwangtungensis* is distributed in the coast of Japan from Hokkaido southward to Kyushu, the East China Sea, Korean Peninsula, and Taiwan, inhabiting depth of 20 to 320 m. The populations around Japan of the species are indicated to be structured by mitochondrial DNA analyses. We investigated population structure of *D*. cf. *kwangtungensis* based on polymorphism of microsatellite (simple sequence repeat: SSR). Samples of *D*. cf. *kwangtungensis* were collected from the Pacific Ocean (northern part of Honshu), the Sea of Japan (Niigata and Kyoto Prefs.), the East China Sea (Goto Islands and Danjo-gunto Islands). Polymerase chain reactions were carried out to amplify four SSR loci (LERI21, 34, 44, 50; El Nagar et al. 2010). The number of alleles per SSR locus within samples varied from 2 to 13 with a mean of 5.5. The *H*o ranged from 0.182 to 0.909 with a mean of 0.611, and the *H*e ranged from 0.385 to 0.939 with a mean of 0.703. The pairwise *F*st values between northern part of Honshu and each of the other four geographic populations were high (0.157□0.252) and significant after Bonferroni correction ($P < 0.001$), while the values between each of the geographic populations in the Sea of Japan and the East China Sea were low (from -0.026 to 0.013) and not significant ($P > 0.05$). The genetic differentiation was suggested between population in the Pacific Ocean and the group containing populations in the Sea of Japan and the East China Sea.

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**0654 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Atsuko Yamaguchi, Kojiro Hara, Noriko Omori, Keisuke Furumitsu

*Nagasaki University, Nagasaki, Japan*

## Two hammerhead sharks, *Sphyrna lewini* and *S. zygaena* in Ariake Bay, Japan: size and age composition, feeding habits, and migration

Hammerhead sharks of the genus *Sphyrna* play an important role as predators in ecosystems. However, very few studies exist on the species of *Sphyrna* in Japan, including Ariake Bay, the largest bay in Kyushu. Here, we report the assessment of biological and behavioral aspects of two hammerhead sharks, *S. lewini* and *S. zygaena*, such as age composition, feeding habits, and migration, based on the specimens collected in Ariake Bay from 2006 to 2016. *S. lewini* specimens collected were 429-3290 mm in total length (TL) with aged 0-33; however, specimens aged 2-8 were not collected. *S. zygaena* specimens collected were 548-1590 mm TL; however, specimens of mature

animals were not collected. The stomach contents of both species comprised primarily teleosts, cephalopods, and crustaceans. Of those, teleosts were predominant; the two *Sphyrna* spp. were therefore considered to feed primarily on teleosts in Ariake Bay. The investigation of movement and migration revealed that small *S. zygaena* individuals enter the bay incidentally. In contrast, *S. lewini* was considered to visit the bay to breed in early summer and leave after giving birth and mating. Juvenile *S. lewini* appeared to move to the open sea in autumn after inhabiting the shallow areas of the bay through the summer. We estimate that they inhabit the open sea and do not return to the bay until they reach sexual maturity. Ariake Bay was thus regarded as playing an important role as a nursery ground for *S. lewini*.

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**0308 Fish Systematics II, Salon F-H, Saturday 9 July 2016**

Lei Yang, Gavin Naylor

*College of Charleston, Charleston, SC, USA*

**Mitogenome Sequencing and the Tree of Life of Chondrichthyan Fishes**

The present study is aimed at resolving the phylogenetic relationships among chondrichthyan fishes based on the largest taxon sampling to date and the mitogenome sequences. A preliminary Neighbor-Joining tree was estimated from mitochondrial ND2 sequences derived from more than 12,000 tissue samples collected as part of a NSF funded Tree of Life project. Representative samples of lineages identified as distinct in the Neighbor-Joining analysis were subsequently subjected to library preparation. Cross-species gene capture of nuclear genes and the mitogenome were then performed separately using three different sets of specially designed RNA baits (one for nuclear genes, two for mitogenomes). Captured genes of pooled samples were then sequenced on an Illumina MiSeq. Only results from mitogenome sequences are shown here. Partitioned Maximum Likelihood searches and bootstrap analyses were performed for the concatenated dataset of the protein-coding genes of the mitogenome sequences obtained. Most nodes were resolved with high bootstrap support in the tree. Topology of the tree was compared with those from previous studies and relationships among major lineages of sharks and batoids were discussed. Molecular dating based on multiple well-characterized chondrichthyan fossils and diversification analyses were performed.

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**0341 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Toshikazu Yano[1], Seiji Ohshimo[2], Minoru Kanaiwa[3], Tsutomu Hattori[1], Masa-aki Fukuwaka[4], Toru Nagasawa[5], Sho Tanaka[6]

*[1]Tohoku National Fisheries Research Institute, Japan Fisheries Research and Education Agency, Aomori, Japan, [2]National Research Institute of Far Seas Fisheries, Japan Fisheries Research and Education Agency, Shizuoka, Japan, [3]Tokyo University of Agriculture, Hokkaido, Japan, [4]Seikai National Fisheries Research Institute, Japan Fisheries Research and Education Agency, Nagasaki, Japan, [5]Hokkaido National Fisheries Research Institute, Japan Fisheries Research and Education Agency, Hokkaido, Japan, [6]Tokai University, Shizuoka, Japan*

## Estimation of Spatial Distribution of North Pacific Spiny Dogfish *Squalus suckleyi* using Generalized Additive Models

The distribution of North Pacific spiny dogfish *Squalus suckleyi* is not well known in the whole North Pacific, in particular around Japan. Our objective is to demonstrate the dogfish habitat in the North Pacific and to evaluate the effect of sea surface temperature (SST) and prey availability. A total of 14,893 gillnet operations were conducted in the North Pacific from 1972–2011 and the presence/absence of dogfish in each gillnet were analyzed by the generalized additive models with a binomial error distribution. Our results supported the previous study that the probability of dogfish presence was highest around the Gulf of Alaska and presented the following new findings; (1) the area with a high probability of presence also exists off Japan, (2) the distribution is continuous between two areas. Though the waters in the Tsugaru Strait has been considered as a primary habitat area for this species, our results showed that the area with higher probability located in the Sea of Japan off Hokkaido Island than the Tsugaru Strait. The spiny dogfish probability of the presence was high ranging 6 to 12 °C in SST, and the probability was higher if the prey co-exist. These results indicate that the factors both distribution of prey species and SST affect to the dogfish habitat, and the evaluating the habitat of this species could be available for rational management.

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**0340 AES Sawfishes Symposium, Salon E, Sunday 10 July 2016**

Kara Yopak[1], Barbara Wueringer[2], Kirk Feindel[3], Shaun Collin[1]

*[1]University of Western Australia, Crawley, WA, Australia, [2]Sharks And Rays Australia, Bungalow, Qld, Australia, [3]Center for Microscopy Characterisation and Analysis, UWA, Crawley, WA, Australia*

## What you Saw Isn't always What you Get: Patterns of Brain Organization in Sawfishes

Broad variability has been documented within cartilaginous fishes regarding the size and complexity of the brain and its major components (olfactory bulbs, telencephalon, diencephalon, mesencephalon, cerebellum and medulla). This variability is often

associated with habitat or specific behavior patterns, even in phylogenetically unrelated species that share certain lifestyle characteristics. However, few studies to date have examined the brain in species that have convergently evolved morphological specializations, such as the protruded "saw" rostrum of sawfishes and sawsharks, which is used for detecting and/or manipulating prey. This study examined the brains of four species of sawfishes, including representatives from the *Anoxypristis* and *Pristis* genera, in comparison to the sawshark *Pristiophorus cirratus* and an existing dataset of approximately 100 other chondrichthyan species, which differed with respect to their phylogeny and ecology. Brains were assessed in these critically endangered species using magnetic resonance imaging (MRI), which allowed for non-invasive interrogation of the organization of the central nervous system and the quantification of different brain regions. Results show dramatic differences in both relative brain size and brain morphology between sawfishes and sawsharks, which reflect their phylogenetic and ecological divergence. Of particular note is the variation in size and complexity of the corpus cerebellum, a region of the brain thought to be responsible for executing fast and efficient movement in these ancient predators. Results support the assertion that the saw-like rostrum may serve different functions in these two divergent taxa and that their brain organization may reflect a range of behavioral and ecological specializations.

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**0498 Herp Morphology & Genetics, Galerie 3, Sunday 10 July 2016**

Bruce Young, Dawei Han

*Kirksville College of Osteopathic Medicine, Kirksville, MO, USA*

**The dynamic middle ear of the water monitor lizard (*Varanus salvator*)**

Many reptiles have internally-coupled ears in which the two eardrums, or tympana, are linked by relatively large open passageways through the skull. This morphology produces novel sound localization cues arising from both the timing and amplitude of tympanic activation. Which of these two cues a reptile uses is determined, in part, by the fundamental frequency (or tension) of the tympanic membrane. Anatomical investigations of the water monitor lizard (*Varanus salvator*) revealed a small skeletal muscle capable of tensing the tympanum, as well as a band of elastic tissue bordering one edge of the tympanum. Experimental analyses using muscle stimulation and laser doppler vibrometry demonstrate that contraction of the muscle is associated with displacement of the tympanum, and that this displacement alters how the eardrum responds to presented tones. Monitor lizards actively alter the air pressure between the tympana by regulating the contractile state of hypobranchial muscles. Experimental analyses reveal that pressurizing the inter-tympanic connection results in displacement of the tympana and changes how the membrane responds to presented tones. The monitor lizards can actively modulate, through skeletal muscle, the tension (and thus fundamental frequency) of the tympana, which will determine the relative levels of the temporal and amplitude cues available for sound localization. This represents a novel form of modulating the auditory system, as it is mechanical not neural, and based on the middle ear not the inner ear.

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**0800 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Nadege Zaghdoudi-Allan[1], Mark Roberts[2], Andrew Coleman[3], Fernando Manzano-Cervantes[4], Irma Galván[4], Kathryn Levasseur[2], Laura Kiehner[5]

*[1]Center of Marine Sciences (CCMAR), Faro, Portugal, [2]University of South Carolina, Columbia, South Carolina, USA, [3]Birmingham Audubon, Birmingham, Alabama, USA, [4]Vida Milenaria, A.C., Tecolutla, Veracruz, Mexico, [5]Tecolutla Turtle Preservation Project, Pennsylvania, USA*

**Preliminary characterization of a poorly understood nesting population of the critically endangered Kemp's ridley sea turtle**

Once nearly extinct, Kemp's ridley sea turtles have made an impressive comeback. Despite this, it remains the most endangered of all sea turtles, and the total impact of the 2011 oil spill on the species is still unclear. Currently, most conservation efforts are centered around Rancho Nuevo (RN), MX and Padre Island, US; however, efforts to protect important additional beaches are one of the priorities of the NMFS Bi-National Recovery Plan for the species. A comparatively poorly understood nesting population at Tecolutla, Veracruz (~ 330km S of RN) represents a potentially important nesting beach due to its relatively large nesting population size and the possibility that it is isolated from the RN nesting population. Additionally, temperature controlled hatchling sex ratios produced at Tecolutla could be different from those produced at RN - as they are in other marine turtle species separated by a similar distance. Dispersal models indicate that local currents promote the successful pelagic recruitment of Kemp's ridley hatchlings from Tecoluta as effectively as from RN, further stressing the need to characterize this population. A Mexican NGO has conducted surveys for a number of years that focus on counting and protective relocation of nests. In 2014 a study was initiated to characterize the nesting beach (beach profile and sediment grain size analyses), establish nest temperature profiles, estimate genetic diversity, characterize the morphology of nesting turtles, and develop a rigorous tagging program. Here we present nesting history at Tecolutla from 2000-present as well as initial results of the recent study.

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**0049 Poster Session I, Acadia/Bissonet, Friday 8 July 2016**

Ilena Zanella, Andrés López

*Misión Tiburón, Guanacaste, Costa Rica*

**Identification and Protection of Critical Habitats for Scalloped Hammerhead Shark (*Sphyrna lewini*), in Golfo Dulce, Costa Rica**

The scalloped hammerhead shark, *Sphyrna lewini*, is threatened by human activities. In 2008 the IUCN Red List classified as Endangered, and in 2013 it was included on the CITES Appendix II list. Neonates and juveniles live in nursery areas located in coastal

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waters, where nutrient waters provide food and protection from predators. The adults migrate to open waters, returning to nursery areas for mating and pupping. Scientific study is needed to identify nursery areas and provide evidence-based recommendations for the development of successful conservation management plans. Fisheries-dependent biological data was gathered for *S. lewini* during artisanal fishing trips between May 2010 and May 2011 in Golfo Dulce. Catch per unit effort (CPUE) throughout the year was also estimated from catch data. We sampled a total of 315 sharks. Mean total length was estimated at 74.3±17.4cm. Total length and relative abundance of S. lewini had opposite tendencies, with the smallest TL recorded during July-August, when CPUE was highest. Based on the fisheries dependent data from on board observations, three aggregations sites were selected to deploy acoustic receivers and tag ten hammerhead sharks. Between June 2011 and July 2012, the receivers recorded almost 40.000 detections. All the sharks tagged were reported, showing daily movements between receivers. Our field research during this project has identified critical habitats within Golfo Dulce, and acted to improve the management plans for their protection. Through our efforts we have discovered the first evidence of a biological connection for *S. lewini* between critical coastal habitats and Cocos Island.

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**0894 AES Ecology & Behavior I, Balconies L & M, Thursday 7 July 2016**

Patricia Zarate, Carlos Montenegro, Daniel Devia

*Instituto de Fomento Pesquero, Valparaiso, Chile*

**Preliminary results on the horizontal and vertical movements of *Lamna nasus* in the South East Pacific**

Spatial dynamics are poorly understood for pelagic sharks despite the decline of many species due to overfishing. For many species with low population abundances, however, little progress has been made in identifying space use patterns. Porbeagle sharks *Lamna nasus* stocks from North and Southwest Atlantic Ocean and Mediterranean Sea have severely declined in population size resulting in the listing of this species in CITES' Apendix II. In the South East Pacific Ocean, particularly in Chilean waters, porbeagles are the third most common species incidentally caught by swordfish fisheries in Chile. Here we described the movements, diving behavior and habitats (vertical thermal) occupied by a juvenile female porbeagle in the Southeast Pacific Ocean using pop-up satellite-linked archival transmitters (PSATs). The shark named "Violeta" was tagged on November 2015 and tracked for 90 days. Violeta displayed a clear southward movement of approximately 1500 km after being tagged off Coquimbo in the north coast of Chile (36° latitude). Shark occupied a broad vertical depth range (0 - 552 m) and water temperatures (8° - 19 °C). This study described for the first time the diving behavior and habitats occupied by porbeagle sharks in this region of the Pacific Ocean.

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**0171 Poster Session II, Acadia/Bissonet, Saturday 9 July 2016**

Jeffrey Zeyl, Carol Johnston

*Auburn University, Auburn, AL, USA*

## Comparative and developmental patterns of amphibious auditory function in salamanders

Early amphibious tetrapods lacked tympanic ears, which restricted the detection of air-borne sounds to low frequencies and high intensities. In these taxa, aquatic hearing adaptations could have pre-equipped aerial function, depending on the extent of acoustic transmission between air and unspecialized tissues. Salamanders lack tympanic middle ears, but may use sound-induced lung vibrations to detect aquatic sound pressure. Therefore, they could be useful models for the functional constraints and evolutionary responses of the early tetrapod auditory system to the aquatic-terrestrial boundary. We collected amphibious auditory evoked potential audiograms in five phylogenetically and ecologically distinct salamanders (*Amphiuma means*, *Notophthalmus viridescens*, *Ambystoma talpoideum*, *Eurycea cirrigera*, and *Plethodon glutinosus*) to: (1) assess the diversity of auditory carryover across media, and (2) examine whether terrestrial niche and metamorphosis are associated with higher aerial sensitivity. Relative to its aquatic audiogram, aerial sensitivity of *A. means* was maximized at 100 Hz, but constrained at higher frequencies. In contrast, *A. talpoideum* and *E. cirrigera* showed best aquatic-aerial sensitivity carryover at 400-500 Hz, while auditory thresholds in *N. viridescens* were shifted uniformly across frequencies. Aerial thresholds of terrestrial *P. glutinosus* were similar to paedomorphic *A. talpoideum* and adult *E. cirrigera*, but lower than *N. viridescens* and *A. means*. Metamorphosis was not associated with higher aerial sensitivity in *N. viridescens* or *A. talpoideum*. The results fail to support significant specialization of the salamander ear for terrestrial auditory function. Additionally, aerial performance is contingent on aquatic performance, but to varying degrees for different species.

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**0909 Fish Morphology & Biogeography, Salon A-C, Sunday 10 July 2016**

Nicholas Zielinski, Ian Bollinger, Ryan Lavoie, Julianne Rawson, Jeff Eble

*University of West Florida, Pensacola, Florida, USA*

## The Black Triggerfish (*Melichthys niger*): A Circumtropical Species or Species Complex?

There are more than 15,000 known species of marine fishes, yet only 284 are believed to be truly circumtropical. Of these, nearly all (83%) are either pelagic and highly migratory as adults or inhabit the bathypelagic zone where few barriers to dispersal exist. The ability to maintain genetic connectivity and high similarity across major marine biogeographic provinces (Atlantic, Indo-Pacific and East Pacific) is rare among reef fishes. Only 2% of circumtropical fish are reef associated and depend on a pelagic larval stage as a means of dispersal. *Melichthys niger*, the black triggerfish, is a reef fish

found commonly across the tropics. The purpose of this study is to address whether *M. niger* is truly a circumtropical species or a species complex through a comparative genetic survey. Mitochondrial (CO1 and d-loop) and nuclear (S7-1) loci in 250 individuals from 17 globally distributed sites were analyzed. Results indicate high genetic connectivity throughout the range of *M. niger*, including ongoing or recent gene flow between the Indian and Atlantic Oceans, and throughout the closely-associated islands of the East Indian and West Pacific Oceans (Indo-Pacific region). The lack of deep-genetic subdivision and apparent high gene flow indicates *M. niger* is an exceptional disperser, with the relatively unique ability among reef fishes to maintain genetic connectivity between sites separated by tens of thousands of kilometers.

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## 0646 ASIH STOYE AWARD ECOLOGY & ETHOLOGY, SALON D, Thursday 7 July 2016

Erin Zylstra[1], Robert Steidl[1], Don Swann[2], Blake Hossack[3]

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### Population Dynamics and Dispersal of Canyon Treefrogs in Desert Mountain Canyons

Understanding the biotic and abiotic factors that govern variation in demography is essential for conservation and management of amphibians, many of which have declined in response to a broad array of anthropogenic activities. Canyon treefrogs (*Hyla arenicolor*) inhabit arid canyons in the Sky Island region of southern Arizona, environments where the amount of surface water is highly dynamic and predicted to decrease with climate change. We used visual encounter (n = 56-74 surveys at each of 5 sites) and mark-recapture surveys (n ≥ 10 surveys/site) to characterize demography and movements of treefrogs in 2014-2015. Counts of adult (range = 0-695 frogs/survey) and juvenile (0-736) treefrogs varied markedly over time, reflecting seasonal variation in both abundance and surface activity. Treefrogs reproduced in both spring and summer, but recruitment varied with availability of surface water and failed during spring when pools dried before the onset of monsoon rains. We marked >1800 adult and subadult frogs; of those individuals recaptured, most were observed < 30 m from their original capture location. Movements > 100 m along drainages or between canyons were rare, comprising < 6% of movements. Apparent monthly survival varied seasonally and was highest during winter (>0.90) and lowest during summer (<0.50), indicating that most frogs live < 1 year after reaching subadult stages. Low rates of adult survival suggest that persistence of treefrog populations depends on high rates of recruitment, immigration, or both in these dynamic environments. Reductions in surface water and hydrologic connectivity will likely increase risk of local extinction.

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