

Animal Markets and Zoonotic Disease in United Arab Emirates

COUNTRY SUMMARY: UNITED ARAB EMIRATES

CULTURAL CONTEXT

Enormous, rapid economic growth has transformed the emirates. Abu Dhabi and Dubai are major airline and transit hubs. Dubai has branded and invested in itself as a tax haven—a place where wealthy, international tourists can taste and see, unhampered by the conservative values of neighboring Emirates and countries. In this environment, social media platforms are used to illegally trade in exotic animals, and celebrities and influencers who engage in the trade use wild animals to grow their online followings. Live animal imports to the UAE have continued to rise over recent decades; in 2021 the UAE was importing approximately 90% of its food needs, relying on imported cows and sheep to meet increasing demand for meat and dairy products in a warming climate that is rapidly desertifying, limiting domestic production of animals. The UAE is facing profound and questions of food supply, particularly regarding livestock production and meat consumption. Emirati authorities are aiming to double local production of food in the near future. Tremendous change is imminent and urgently required to secure food and water supply in the region.

ANIMAL MARKETS

Demand for live animal imports has a significant impact on the shape of the global marketplace. Slaughter takes place in formal slaughterhouses or on roadside slabs, though there are significant and increasing efforts to reduce unregulated slaughter. The UAE is a major destination and international hub—both airports and seaports—through which huge numbers of people, livestock, pets, and legally and illegally traded wildlife move. The role of the UAE as a transit hub situates it at the center of the international exotic pet trade, and critically in terms of zoonotic disease concern, is itself a final destination for exotic pets from South America (primarily birds), and from all over the African and Asian continents.

DRIVERS OF ZONOTIC DISEASE RISKS

Extraordinary wealth and consumption patterns of UAE consumers exacerbate the risk of zoonotic disease. Despite prohibitions, large, diverse quantities of wild animals are kept as exotic pets, interacting closely with humans and other animals, and often being displayed on social media. Wildlife captured from the horn of Africa or Southeast Asia are kept in private zoos and manageries by wealthy Emiratis, driving zoonotic risk upstream in the supply chain. An extensive live import trade in livestock, held in dense quantities in transit and after arrival, can also contribute to the risk of zoonoses. Informal and unregulated slaughter, carried out with few safety precautions, represents a potential flashpoint for spillover. This practice is driven in part by the Muslim requirement of halal certification for animal products, prizing

animals from local and only recently regulated Ezba, and a long-standing reverence for Bedouin traditions. Other traditional forms of animal use, such as those involving falcons and camels, also pose risks.

RISK MITIGATION AND RELEVANT CHALLENGES

While the UAE prohibits exotic pet ownership, these regulations are rarely enforced, particularly with respect to wealthy individuals. In terms of the wildlife trade, the UAE has undertaken many steps to ensure that its national legislation is up to date and capable of implementing CITES at a national level; however, here too exceptions are sometimes made on behalf of elites and other high-ranking families. In addition, the sheer volume of traffic moving through Dubai, especially connecting international flights, makes screening and monitoring of passengers and baggage extremely challenging. Loopholes in existing UAE laws that prohibit, for example, hunting of endangered houbara, ungulates, primates, and indeed all manner of wildlife, pose serious risks of zoonotic spillover. According to Emirati officials, food security challenges are being addressed alongside increased investments and infrastructure in food safety and biosecurity. For example, across all seven emirates, the UAE is reportedly increasing the capacity of testing laboratories to enhance food safety in line with the highest international standards.

AUTHORS

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OVERVIEW OF APPROACH

Our approach for researching animal markets in the United Arab Emirates (UAE) began with the same process we used for all of these case studies: starting in early 2020, we reached out via email to nonprofit and nongovernmental organizations, academic institutions, and official government bodies in the UAE, informed them of the scope of the project and requested assistance in completing the UAE's case study as fulsomely as possible. In most instances when reaching out to these groups and individuals in the UAE, we received no response at all; sometimes, we were told that we must refer back to the Ministry of Climate Change and the Environment, which we attempted multiple times, without response. Despite our repeated email attempts, we were not able by this method to secure any official interviews or gather any information, e.g., data, about animal markets and/or zoonotic disease in the UAE. Instead, we proceeded by conducting an independent review of existing literature and media, and interviewed several individuals with knowledge of animal markets in the region, most of whom have requested to remain anonymous. This research was conducted remotely from the US when COVID precluded safe travel to the UAE itself.

For these reasons, the case study of animal markets, supply chains, zoonotic disease risk, and existing regulations and reforms in the UAE will look a little different from those of other countries in this report. Some of the information is incomplete, as we were not always able independently to fill the gaps with existing data or information; further, several of our sources (i.e., interviews) will be cited anonymously. In each of these cases, we took steps to verify the credentials of the individuals we spoke with; in all cases they are respected and published in their respective fields of study. As with any research or interview, wherever possible, each interviewee provided evidence we believed sufficient to support their statements and experiences. Further, we shared information across and among anonymous sources to verify the consistency of observations and reports. Based on this process, we believe the information provided and included in this case study is accurate.

INTRODUCTION

The UAE is a federation of seven emirates covering some 89,000 square kilometers in Western Asia and at the eastern end of the Arabian Peninsula, sharing land borders with Oman and Saudi Arabia and maritime borders along the Persian Gulf with Qatar and Iran. The seven emirates include Abu Dhabi, Ajman, Dubai, Fujairah, Ras Al Khaimah, Sharjah, and Umm Al Quwain; each is governed by a Sheikh who together form the Federal Supreme Council.¹ The Council is the highest constitutional authority, has the highest legislative and executive authority, and draws up general policies and approves federal legislation. The seven emirates vary in size, and their roles and functions in the federation depend upon factors such as population, area and degree of development. Abu Dhabi is the nation's capital and Dubai, its most densely populated city, is an international hub. In 2013 the population of the UAE was 9.2 million, of which 1.4 million were Emirati citizens and 7.8 million expatriates.² The population was estimated to have grown to 10 million by 2021.³

The UAE's main nineteenth- and twentieth-century economic activity—pearl-harvesting in the Arabian Gulf—collapsed with the manufacturing of cultured pearls. Massive oil deposits were discovered in the UAE region, however, and export began in the 1960s, with some 2 million barrels a day exported currently.⁴ This discovery of oil and its production utterly changed the economic situation of the country, which modernized rapidly in subsequent decades, diversifying its economy to include trade, finance, tourism, infrastructure investment in telecommunications and information technology and construction. The rapid rate of growth required skilled foreign professionals. In 1990, the Muslim population of the UAE stood at 1.62 million, is now 3.58 million and is expected to rise to 4.98 million by 2030.⁵ UAE citizens (Emiratis) represent only one-fifth of the population, which also includes a significant migrant workforce of Iranians, Filipinos, South Asians, Europeans, Americans, and other Arab nationalities.⁶

In terms of Muslim practice, this “melting pot” of Muslim citizenry together with a religiously diverse expatriate workforce and their families has resulted in social divergence, such that large metropolitan cities, particularly Dubai, where many expatriates reside, are outwardly liberal, whereas other urban and more rural areas are visibly more religiously conservative. Other aspects of life, such as political and legal systems are naturally governed by ruling Emirati classes and are based on Islamic principles and Emirati personal lifestyle is largely faith-based, concealed and intensely private.⁷

1. “United Arab Emirates,” Wikipedia, updated October 28, 2023, https://en.wikipedia.org/wiki/United_Arab_Emirates.
2. “United Arab Emirates,” Wikipedia, updated October 28, 2023, https://en.wikipedia.org/wiki/United_Arab_Emirates.
3. Binsal Abdulkader, “UAE Upgrades Food-Testing Labs to Enhance Food Safety: Minister,” Emirates News Agency (WAM), September 23, 2020, <http://www.wam.ae/en/details/1395302871905>.
4. Simeon Kaitibie, Munshi Masudul Haq, and Manitra A. Rakotoarisoa, “Analysis of Food Imports in a Highly Import Dependent Economy,” *Review of Middle East Economics and Finance* 13, no. 2 (2017): 20160033, <https://ideas.repec.org/a/bpj/rmeecf/v13y2017i2p12n2.html>.
5. Kasim Randeree, “Challenges in Halal Food Ecosystems: The Case of the United Arab Emirates,” *British Food Journal* 121, no. 5 (2019): 1154–67, <https://doi.org/10.1108/BFJ-08-2018-0515>.
6. Kasim Randeree, “Challenges in Halal Food Ecosystems: The Case of the United Arab Emirates,” *British Food Journal* 121, no. 5 (2019): 1154–67, <https://doi.org/10.1108/BFJ-08-2018-0515>.
7. Kasim Randeree, “Challenges in Halal Food Ecosystems: The Case of the United Arab Emirates,” *British Food Journal* 121, no. 5 (2019): 1154–67, <https://doi.org/10.1108/BFJ-08-2018-0515>.

Enormous and rapid economic growth within the UAE has transformed the culture and demographics of the emirates; important to this case study in regard to legal and illegal wildlife trafficking (a major risk factor for zoonotic disease spillover), Abu Dhabi and Dubai are now also major airline hubs. The UAE economy also relies upon and supports vigorous regional and international tourism, which has been impacted by the current zoonotic pandemic.⁸ COVID-19 is estimated to have reduced tourism to the UAE by roughly 2 to 7 percent of GDP.⁹ The hotel, restaurant and institutional sector suffered significantly from the pandemic, and they account for the majority of import demand.

Critically, the UAE is situated in a region that is particularly vulnerable to the effects of climate change, especially desertification patterns. Already nearly two-thirds of those residing in the Middle East lack sufficient renewable water resources for sustainable production of crops. Over 80% of water use in the region is used for agriculture versus some 4% used for industrial purposes.¹⁰ In fact, due to its arid climate and increasingly minimal precipitation, the UAE is simply inhospitable to most traditional agriculture, and is heavily dependent on imported food for the vast majority of its caloric intake.¹¹ As of 2021, the UAE was importing approximately 90% of its needs.¹² Live animal imports to the UAE have continued to rise over recent decades, as the region relies on imported cows and sheep from Australia and Brazil, for example, to meet increasing demand for meat and dairy products in a warming climate that is rapidly desertifying.¹³ Paying (financially and politically) to import live animals allows the UAE and other Middle Eastern countries to skip the water-intensive process of raising them from birth (a single dairy cow, for example, consumes 3-50+ gallons of water each day), opting instead to feed them cheaply in the last six months before they're slaughtered.¹⁴ This demand for live animal imports has a significant impact on the shape of the global marketplace.¹⁵ For example, when Australia enacted a three-month ban on live animal exports to the Middle East in the wake of outcries regarding animal welfare, other countries such as India, Pakistan, and Iran stepped up their own exports to Middle Eastern countries like Qatar, the UAE, and Kuwait.¹⁶

Even as the desert region grapples with increasingly erratic weather patterns, urbanization, population growth, and high rates of consumption of resource-intensive foods from imported livestock,

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8. P. S. Soorae et al., "A Survey in the Trade in Wildlife as Pets in the United Arab Emirates," *TRAFFIC Bulletin* 22, no. 1 (2008): 41–6, https://www.traffic.org/site/assets/files/2984/traffic_pub_bulletin_22_1.pdf.
 9. Mohamed Hamza, Rana Tarraf, and Lucas Blaustein, "Poultry and Products Annual: United Arab Emirates," United States Department of Agriculture Foreign Agricultural Service, October 14, 2021, https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Poultry%20and%20Products%20Annual_Dubai_United%20Arab%20Emirates_09-01-2021.pdf.
 10. Chloe Bernadaux, "Agricultural Technology in the Middle East: Sowing the Seeds of the Future," Middle East Institute, May 19, 2021, <https://www.mei.edu/publications/agricultural-technology-middle-east-sowing-seeds-future>.
 11. Mohamed Hamza, Rana Tarraf, and Lucas Blaustein, "Poultry and Products Annual: United Arab Emirates," United States Department of Agriculture Foreign Agricultural Service, October 14, 2021, https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Poultry%20and%20Products%20Annual_Dubai_United%20Arab%20Emirates_09-01-2021.pdf.
 12. Paul Wallace, Verity Ratcliffe, and Manus Cranny, "UAE to Grow More Food in the Desert as Pandemic Disrupts Imports," *Bloomberg*, April 8, 2021, <https://www.bloomberg.com/news/articles/2021-04-08/uae-to-grow-more-food-in-the-desert-as-pandemic-disrupts-imports>.
 13. Ruth Michaelson and Bibi van der Zee, "How the Middle East's Water Shortage Drives Demand for Live Animal Imports," *The Guardian*, January 23, 2020, <https://www.theguardian.com/environment/2020/jan/23/how-the-middle-easts-water-shortage-drives-demand-for-live-animal-imports>.
 14. Ruth Michaelson and Bibi van der Zee, "How the Middle East's Water Shortage Drives Demand for Live Animal Imports," *The Guardian*, January 23, 2020, <https://www.theguardian.com/environment/2020/jan/23/how-the-middle-easts-water-shortage-drives-demand-for-live-animal-imports>.
 15. Ruth Michaelson and Bibi van der Zee, "How the Middle East's Water Shortage Drives Demand for Live Animal Imports," *The Guardian*, January 23, 2020, <https://www.theguardian.com/environment/2020/jan/23/how-the-middle-easts-water-shortage-drives-demand-for-live-animal-imports>.
 16. Ruth Michaelson and Bibi van der Zee, "How the Middle East's Water Shortage Drives Demand for Live Animal Imports," *The Guardian*, January 23, 2020, <https://www.theguardian.com/environment/2020/jan/23/how-the-middle-easts-water-shortage-drives-demand-for-live-animal-imports>.

Emirati authorities are aiming to *double* local production of food in the near future.¹⁷ At the same time, the entire Middle East region, including the UAE, is also experiencing a high urbanization rate, and the regional population is projected to increase by over 300 million by 2050.¹⁸ As such, and given its extraordinary wealth and increasing, resource-intensive, and disproportionate consumption patterns¹⁹ (i.e., for meat), the UAE is facing profound and fundamental questions of food supply, particularly regarding livestock production and meat consumption. In short, it is very obvious that climate change combined with the COVID-19 pandemic have intensified food insecurity in countries like the UAE.²⁰ According to one group of policy analysts, “The situation is growing increasingly dire and is only poised to get worse with the continuing environmental degradation linked to climate change.”²¹ According to one very highly positioned individual we spoke with, government officials in the UAE are very aware that “the import of live animals could stop at any time,” and due to any one of a handful of reasons. Short-term fixes for this systemic and increasingly urgent problem are not likely to be effective.²²

Mariam Almhieri, the Minister of State for Food and Water Security at the time of writing, says the UAE is looking at increasing its domestic production some 30%–40% over the next decade,²³ strategies include growing rice in the desert, importing dairy cows, and investing heavily in high-tech agricultural research such as making food in space and other extreme climates.²⁴ According to Almhieri, the coronavirus pandemic only clarified authorities’ already poignant understanding that dependency on global food supplies “is not a good thing.”²⁵ The UAE aims to enhance food security in the country such that by 2051, it would reach the world’s number-one ranking in the Global Food Security Index.²⁶

Studies on food insecurity indicate that to protect against future shortages, the UAE needs new and diverse sources of meat imports, such as from other Arab and African markets.²⁷ Amid climate change, the coronavirus pandemic, and outrage regarding animal welfare in live imports, consumer consciousness in halal food certification is on the rise, leading to worries about the integrity of halal systems and supply chains.²⁸

The UAE is not alone. There are massive and increasing efforts to promote sustainable

17. Mohamed Hamza, Rana Tarraf, and Lucas Blaustein, “Poultry and Products Annual: United Arab Emirates,” United States Department of Agriculture Foreign Agricultural Service, October 14, 2021, https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Poultry%20and%20Products%20Annual_Dubai_United%20Arab%20Emirates_09-01-2021.pdf.

18. Chloe Bernadaux, “Agricultural Technology in the Middle East: Sowing the Seeds of the Future,” Middle East Institute, May 19, 2021, <https://www.mei.edu/publications/agricultural-technology-middle-east-sowing-seeds-future>.

19. Chloe Bernadaux, “Agricultural Technology in the Middle East: Sowing the Seeds of the Future,” Middle East Institute, May 19, 2021, <https://www.mei.edu/publications/agricultural-technology-middle-east-sowing-seeds-future>.

20. Chloe Bernadaux, “Agricultural Technology in the Middle East: Sowing the Seeds of the Future,” Middle East Institute, May 19, 2021, <https://www.mei.edu/publications/agricultural-technology-middle-east-sowing-seeds-future>.

21. Chloe Bernadaux, “Agricultural Technology in the Middle East: Sowing the Seeds of the Future,” Middle East Institute, May 19, 2021, <https://www.mei.edu/publications/agricultural-technology-middle-east-sowing-seeds-future>.

22. Chloe Bernadaux, “Agricultural Technology in the Middle East: Sowing the Seeds of the Future,” Middle East Institute, May 19, 2021, <https://www.mei.edu/publications/agricultural-technology-middle-east-sowing-seeds-future>.

23. Paul Wallace, Verity Ratcliffe, and Manus Cranny, “UAE to Grow More Food in the Desert as Pandemic Disrupts Imports,” Bloomberg, April 8, 2021, <https://www.bloomberg.com/news/articles/2021-04-08/uae-to-grow-more-food-in-the-desert-as-pandemic-disrupts-imports>.

24. Paul Wallace, Verity Ratcliffe, and Manus Cranny, “UAE to Grow More Food in the Desert as Pandemic Disrupts Imports,” Bloomberg, April 8, 2021, <https://www.bloomberg.com/news/articles/2021-04-08/uae-to-grow-more-food-in-the-desert-as-pandemic-disrupts-imports>.

25. Paul Wallace, Verity Ratcliffe, and Manus Cranny, “UAE to Grow More Food in the Desert as Pandemic Disrupts Imports,” Bloomberg, April 8, 2021, <https://www.bloomberg.com/news/articles/2021-04-08/uae-to-grow-more-food-in-the-desert-as-pandemic-disrupts-imports>.

26. “ADAFSA and ADIO Grow Abu Dhabi’s Agricultural Sector with Five New Projects Worth AED 75 Million,” Abu Dhabi Agriculture and Food Safety Authority, June 25, 2020, <http://www.adafsa.gov.ae/English/MediaCenter/News/Pages/2562020.aspx>

27. Gureni Lukwaro, “UAE Meat Consumption Above Global Average,” The National, May 22, 2010, <https://www.thenationalnews.com/business/uae-meat-consumption-above-global-average-1.481556>.

28. Gureni Lukwaro, “UAE Meat Consumption Above Global Average,” The National, May 22, 2010, <https://www.thenationalnews.com/business/uae-meat-consumption-above-global-average-1.481556>.

agriculture across the Gulf Cooperation Council (GCC), where all countries are particularly vulnerable to accelerated desertification and water scarcity. Millions of dollars of investment in agritech, for example, follow unsuccessful attempts to increase agricultural production by way of hugely expensive irrigation subsidies (as in Saudi Arabia as early as the 1970s), i.e., failed unsustainable agricultural practices. Importantly in terms of a shifting understanding of where and how a nation draws its borders amid resource scarcity, and how animals are raised, traded, and sold across these borders, another aspect of the GCC's agricultural strategies for ensuring food security involves purchase of fertile farmland and pursuit of agricultural investments in Africa.²⁹ Non-oil trade between the UAE and Africa was over \$7 billion in 2016, primarily driven by increasing food production exports from the African continent to the UAE.³⁰ UAE purchase and use of land on the African continent has both curious and compelling bearing on zoonotic disease risk in (and around) the UAE, because these purchased or borrowed tracts of land also often involve legal and illegal UAE hunting, trading, and movement of wildlife across borders, both into and out of the UAE.

The extraordinary wealth and consumption patterns of UAE consumers is exacerbating this already dismal situation. Currently, residents of the UAE with a high per-capita income and predilection for spending a lot of money on food indeed spend most of their food income on meat and poultry. Tourism—international travelers seeking the high-end cuisine of Abu Dhabi and Dubai—also contributes to an above-average meat consumption rate.³¹ Meat was already a significant feature in traditional diets of the region, and combined with economic and social change in recent decades, the prevalence of overweight and obese residents is increasing (associated with urbanization and wealth).³² Due to a number of factors, including sedentary leisure, energy-dense fast foods replacing traditional foods, and low fruit and vegetable intake, in 2009–2010, 65% of adult women, 28% of male adolescents, 40% of female adolescents, 25% of male children, and 41% of female children were overweight or obese.³³

In other words, tremendous change is both imminent and urgently required in how the UAE secures its food supply, and perhaps what fundamentally that food supply comprises.

As imports and domestic agricultural innovation increase, the Ministry of Climate Change and Environment (MOCCA) is planning and investing heavily in enhancing food security in the UAE in many ways, such as by supporting local food production, and by increasing food imports as well as import markets.³⁴ Without setting precise targets, the MOCCA's aim is to increase food diversity and ensure local food production sustainability, quantity, and quality while protecting the environment.³⁵ This will entail new legislation, promotion of sustainable food cultivation, new sales channels for local products,

29. Chloe Bernadoux, "Agricultural Technology in the Middle East: Sowing the Seeds of the Future," Middle East Institute, May 19, 2021, <https://www.mei.edu/publications/agricultural-technology-middle-east-sowing-seeds-future>.

30. Chloe Bernadoux, "Agricultural Technology in the Middle East: Sowing the Seeds of the Future," Middle East Institute, May 19, 2021, <https://www.mei.edu/publications/agricultural-technology-middle-east-sowing-seeds-future>.

31. Chloe Bernadoux, "Agricultural Technology in the Middle East: Sowing the Seeds of the Future," Middle East Institute, May 19, 2021, <https://www.mei.edu/publications/agricultural-technology-middle-east-sowing-seeds-future>.

32. Shu Wen Ng et al., "Nutrition Transition in the United Arab Emirates (UAE)," *European Journal of Clinical Nutrition* 65, no. 12 (2011): 1328–37, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3304306/>.

33. Shu Wen Ng et al., "Nutrition Transition in the United Arab Emirates (UAE)," *European Journal of Clinical Nutrition* 65, no. 12 (2011): 1328–37, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3304306/>.

34. "UAE Upgrades Food-Testing Labs to Enhance Food Safety: Minister," *Middle East Business*, September 23, 2020, <https://mebusiness.ae/ar/news/show/57598>.

35. "UAE Upgrades Food-Testing Labs to Enhance Food Safety: Minister," *Middle East Business*, September 23, 2020, <https://mebusiness.ae/ar/news/show/57598>.

subsidies for farmers and fishermen, encouraging subsistence farmers (on small, only recently officially registered family farms called ezba), and increasing international cooperation, research and development.³⁶

One strategy among MOCCAIE efforts to increase food security is of particular note regarding zoonotic risk, which could be heightened by increasing the movement and rearing of animals within and across UAE borders. In general, the MOCCAIE is initiating many changes to encourage agricultural entrepreneurship and growth. For example, to increase local agricultural production and streamline the food supply chain, the MOCCAIE has reduced fees for 44 of its services by as much as 50 per cent; this will presumably minimize the burden of investing in the food sector and boost business expansion. Fees have been similarly reduced for livestock import and export, horse imports, falcon imports and exports, pet imports, veterinary products and companies, animal consignments, fertilizer and pesticide trade, agricultural consignments, and the practice of specialized professions and activities related to agricultural production.³⁷ More specifically, the cost has been reduced by 50% or more to be issued or to renew a license to open a veterinary product company or livestock farm (cut from Dh5,000 to Dh2,000).³⁸ At the time of writing, the fees for releasing consignments of reptiles and “select other species” are down from Dh100 to Dh10 per animal.³⁹ Import permit costs have been reduced from Dh300 to Dh100 for broodstock and larvae, live animals and birds, hatching eggs, and veterinary products.⁴⁰ The fee for a CITES certificate to import, export, or re-export falcons has been lowered from Dh300 to Dh75 per bird; the fee to release a falcon consignment at UAE borders has been cut from Dh200 to Dh50 per bird. Similarly, release of sheep, goat, cow, and buffalo consignments ranging from Dh100 to Dh200 per animal, has been completely waived to boost local livestock production and import new strains for breeding. Complimentary services have also been introduced, including accreditation of disinfectants, veterinarian equipment and supplies, animal care supplies, approval of vet raw material for import, issue of falcon identification rings, and services pertaining to the registration, transfer, and cancellation of the ownership of CITES-listed species.⁴¹

According to Emirati officials, all of these changes are being introduced alongside increased investments and infrastructure in food safety and biosecurity. For example, across all seven emirates, the UAE is reportedly increasing the capacity of testing laboratories to enhance food safety in line with the highest international standards.⁴² For example, together the Abu Dhabi Investment Office and the Abu Dhabi Agriculture and Food Safety Authority have created a series of investment projects totaling AED 1 billion to boost the private sector’s ability to increase food security and sustainable agriculture in

36. “UAE Upgrades Food-Testing Labs to Enhance Food Safety: Minister,” Middle East Business, September 23, 2020, <https://mebusiness.ae/ar/news/show/57598>.

37. Riaz S, “UAE Ministry Cuts Agricultural Service Fees,” Gulf Time News, April 29, 2021, <https://gulftimenews.com/2021/04/29/uae-ministry-cuts-agricultural-service-fees/>.

38. Riaz S, “UAE Ministry Cuts Agricultural Service Fees,” Gulf Time News, April 29, 2021, <https://gulftimenews.com/2021/04/29/uae-ministry-cuts-agricultural-service-fees/>.

39. Riaz S, “UAE Ministry Cuts Agricultural Service Fees,” Gulf Time News, April 29, 2021, <https://gulftimenews.com/2021/04/29/uae-ministry-cuts-agricultural-service-fees/>.

40. Riaz S, “UAE Ministry Cuts Agricultural Service Fees,” Gulf Time News, April 29, 2021, <https://gulftimenews.com/2021/04/29/uae-ministry-cuts-agricultural-service-fees/>.

41. Riaz S, “UAE Ministry Cuts Agricultural Service Fees,” Gulf Time News, April 29, 2021, <https://gulftimenews.com/2021/04/29/uae-ministry-cuts-agricultural-service-fees/>.

42. UAE Upgrades Food-Testing Labs to Enhance Food Safety: Minister,” Middle East Business, September 23, 2020, <https://mebusiness.ae/ar/news/show/57598>.

Abu Dhabi.⁴³ The investments include awards to four companies and a veterinary clinic to develop Abu Dhabi's rapidly growing agricultural value chain.⁴⁴ One project involves establishing a research-based farm that includes a poultry processing facility and a research laboratory for producing and testing animal feed in order to reduce animal mortality.⁴⁵ Another project will develop Roqiaat Veterinary Center, in Al-Qou'a, Al Ain, to service some 200 farms and camel races, including a laboratory to enhance biosecurity and high-level veterinary services for livestock.⁴⁶ In Al Khatim, the "Zahrat Al-Tayeb Livestock Market" is being developed, an integrated market that will include stores, a veterinary clinic, slaughterhouse, auction platform, and other facilities. All of these projects are intended to also address climate change challenges, and to make Abu Dhabi a leading global center for agricultural innovation in deserts.⁴⁷

While not risky per se, increasing the numbers and extent of animal-based agriculture while facilitating overseas investment and waiving entrepreneurial fees in animal markets could be problematic, and it at least merits attention. Just for example, because of their relatively low resource requirements, poultry farms comprise more than 70% of agricultural production in the Emirate of Abu Dhabi.⁴⁸ Indeed, the poultry industry is greatly valued for its role in helping the UAE achieve greater food security.⁴⁹ 2021 UAE poultry production was forecast to increase to 56,000 metric tons due to higher demand for locally produced chicken meat products and increasing government support.⁵⁰ But, as described in greater detail below, the proximity of poultry farms with captive breeding of wild bird and mammal species, and the high number of migratory birds in the region together pose a significant risk of zoonotic disease spillover and merit additional study, surveillance, and national and perhaps international information sharing and planning.

ZOONOTIC DISEASE IN THE UAE AND GCC REGION

Because of its major international hubs—both airports and seaports—through which huge numbers of people, livestock, pets, and legally and illegally traded wildlife move, the risk of introduction and emergence of zoonoses in the UAE is significant.⁵¹ Generally, this is well known, and a fairly fulsome report of the UAE's strengths, weaknesses, and ability to respond to zoonotic infection can be reviewed [here](#).

43. "ADAFSA and ADIO Grow Abu Dhabi's Agricultural Sector with Five New Projects Worth AED 75 Million," Abu Dhabi Agriculture and Food Safety Authority, June 25, 2020, <http://www.adafsa.gov.ae/English/MediaCenter/News/Pages/2562020.aspx>.

44. "ADAFSA and ADIO Grow Abu Dhabi's Agricultural Sector with Five New Projects Worth AED 75 Million," Abu Dhabi Agriculture and Food Safety Authority, June 25, 2020, <http://www.adafsa.gov.ae/English/MediaCenter/News/Pages/2562020.aspx>.

45. "ADAFSA and ADIO Grow Abu Dhabi's Agricultural Sector with Five New Projects Worth AED 75 Million," Abu Dhabi Agriculture and Food Safety Authority, June 25, 2020, <http://www.adafsa.gov.ae/English/MediaCenter/News/Pages/2562020.aspx>.

46. "ADAFSA and ADIO Grow Abu Dhabi's Agricultural Sector with Five New Projects Worth AED 75 Million," Abu Dhabi Agriculture and Food Safety Authority, June 25, 2020, <http://www.adafsa.gov.ae/English/MediaCenter/News/Pages/2562020.aspx>.

47. "ADAFSA and ADIO Grow Abu Dhabi's Agricultural Sector with Five New Projects Worth AED 75 Million," Abu Dhabi Agriculture and Food Safety Authority, June 25, 2020, <http://www.adafsa.gov.ae/English/MediaCenter/News/Pages/2562020.aspx>.

48. Mohamed Hamza, Rana Tarraf, and Lucas Blaustein, "Poultry and Products Annual: United Arab Emirates," United States Department of Agriculture Foreign Agricultural Service, October 14, 2021, https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Poultry%20and%20Products%20Annual_Dubai_United%20Arab%20Emirates_09-01-2021.pdf.

49. Mohamed Hamza, Rana Tarraf, and Lucas Blaustein, "Poultry and Products Annual: United Arab Emirates," United States Department of Agriculture Foreign Agricultural Service, October 14, 2021, https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Poultry%20and%20Products%20Annual_Dubai_United%20Arab%20Emirates_09-01-2021.pdf.

50. Mohamed Hamza, Rana Tarraf, and Lucas Blaustein, "Poultry and Products Annual: United Arab Emirates," United States Department of Agriculture Foreign Agricultural Service, October 14, 2021, https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Poultry%20and%20Products%20Annual_Dubai_United%20Arab%20Emirates_09-01-2021.pdf.

51. John Hopkins Bloomberg School of Public Health, Global Health Security Index 2019 (Washington DC: Nuclear Threat Initiative (NTI), 2019), <https://www.ghsindex.org/wp-content/uploads/2019/10/2019-Global-Health-Security-Index.pdf>.

According to the World Health Organization, “The UAE has demonstrated its ability to identify a potential public health emergency of international concern and file a report within 24 hours; the same applies to reporting relevant zoonotic diseases to the World Organization for Animal Health.” Prompted by the impacts of COVID-19, the MOCCA began working anew to minimize the risk of zoonotic disease transmission; it reports, including animal market and slaughterhouse inspection, gap analysis, and recommendations for corrective action, wherever problems and risk areas are observed.⁵²

In 2023, in advance of the December Climate COP28 hosted in the UAE, The Ministry of Health and Prevention (MoHAP) and the Ministry of Climate Change and Environment collaborated with the WHO Regional Office for the Eastern Mediterranean to address a One Health approach to “combat” zoonotic disease. According to regional news media, workshops in Abu Dhabi were designed to emphasize communication, cooperation, and coordination across organizations and government sectors involved in human, animal, and environmental health.⁵³

There are a number of already identified zoonotic diseases of concern in the UAE, which this case study notes and tracks particularly. MERS-CoV and Crimean Congo Hemorrhagic Fever outbreaks have recently proved critical challenges at the human-animal interface in the UAE.⁵⁴ According to the World Health Organization, other emerging and re-emerging zoonoses that are either newly arising or are rapidly increasing in incidence and/or geographical range include Rift Valley Fever, SARS, pandemic influenza H1N1 2009, Yellow Fever, Avian Influenza (H5N1) and H7n, West Nile Virus and MERS-CoV.⁵⁵ The Eastern Mediterranean Region covered by WHO is especially vulnerable to zoonotic infections because of the number of people living closely with animals and the volume of international trade (including massive livestock movement for live imports).⁵⁶

The UAE itself has identified the following priority zoonoses: CCHF, rabies, and RVF.⁵⁷ It does not list MERS-CoV among its priority zoonoses; despite what the scientific literature (described in greater detail and cited below) seem to suggest, the UAE “does not believe that MERS-CoV has the potential to become a public health emergency of international concern.”⁵⁸

In July of 2023, the UAE notified WHO of a case of MERS-CoV in a 28-year-old male with no history of direct or indirect contact with dromedaries, goats, or sheep. No secondary cases were detected (after monitoring over 100 contacts). This was the first MERS-CoV infection reported since November 2021. The patient suffered severe disease without having had any exposure to camels, camel products, or other MERS-CoV cases; genomic analysis is underway to help identify any genetic evolution of

52. “UAE Upgrades Food-Testing Labs to Enhance Food Safety: Minister,” Middle East Business, September 23, 2020, <https://mebusiness.ae/ar/news/show/57598>.

53. “UAE Health Workers Ramp Up Fight Against Zoonotic Diseases,” Gulf News, January 22, 2023, <https://gulfnews.com/uae/uae-health-workers-ramp-up-fight-against-zoonotic-diseases-1.93285577>.

54. Ihab Habib and Zainab Alshehhi, “Zoonotic Disease Management and Infection Control Practices Among Veterinarians in the United Arab Emirates,” *Veterinary Sciences* 8, no. 5 (2021): 82, <https://pubmed.ncbi.nlm.nih.gov/34065032/>.

55. “Zoonotic Disease: Emerging Public Health Threats in the Region,” Organisation Mondiale de la Santé (WHO): Région Méditerranée Orientale, accessed October 30, 2023, <https://www.emro.who.int/fr/about-who/rc61/zoonotic-diseases.html>.

56. “Zoonotic Disease: Emerging Public Health Threats in the Region,” Organisation Mondiale de la Santé (WHO): Région Méditerranée Orientale, accessed October 30, 2023, <https://www.emro.who.int/fr/about-who/rc61/zoonotic-diseases.html>.

57. John Hopkins Bloomberg School of Public Health, *Global Health Security Index 2019* (Washington DC: Nuclear Threat Initiative (NTI), 2019), <https://www.ghsindex.org/wp-content/uploads/2019/10/2019-Global-Health-Security-Index.pdf>.

58. John Hopkins Bloomberg School of Public Health, *Global Health Security Index 2019* (Washington DC: Nuclear Threat Initiative (NTI), 2019), <https://www.ghsindex.org/wp-content/uploads/2019/10/2019-Global-Health-Security-Index.pdf>.

the virus.⁵⁹

Mpox was also reported in the UAE in May of 2022.^{60 61} According to MoHAP, the UAE’s health system “is fully prepared to handle the spread of [mpox],” and that it is “proactively investigating and closely monitoring any suspect cases.”⁶²

The health sector in the UAE is administered by different authorities. At the federal level, two authorities administer the health sector: The Ministry of Health and Prevention (MoHAP) (responsible for regulating the public health sector) and the Emirates Health Authority (responsible for service delivery). At the emirate level, there are also two entities: The Abu Dhabi Health Authority (HAAD) and the Dubai Health Authority (DAH).⁶³

RELATIONSHIPS WITH ANIMALS AND THEIR IMPACT ON RISK OF ZOOBOTIC DISEASE EMERGENCE AND TRANSMISSION

In terms of the relationships with animals that bear on zoonotic disease emergence and transmission in the UAE, this case study examines several cultural dynamics:

- UAE as major international travel destination and transit hub;
- Rapidly increasing wealth and associated consumption of animal products;
- An obsession with both exotic pets and social media;
- The Muslim requirement of halal certification for animal products, and
- A long-standing reverence for Bedouin traditions, such as those involving falcons and camels.

The UAE is a major destination and international hub for wildlife trafficking. As revealed in the literature and by other case studies in this report, commercial flights to smuggle wildlife means a growing risk of highly transmissible and potentially deadly diseases. Some attribute the increasing volume to trafficking in the UAE area to a combination of financial means and lack of government commitment.⁶⁴ According to several of our sources, exceptions made to enforcement of extant legislation on behalf of elites or high-ranking families creates space and wiggle room for widespread failure to regulate. In addition, the sheer volume of traffic moving through Dubai, for example, especially connecting international flights, makes screening and monitoring of passengers and baggage extremely challenging.

According to Kinda Jabi from IFAW in Dubai, “About 90 million passengers pass through Dubai

59. “Middle East Respiratory Syndrome: United Arab Emirates,” World Health Organization, July 24, 2023, <https://www.who.int/emergencies/disease-outbreak-news/item/2023-DON478>.

60. Pragya D. Yadav et al., “First Two Cases of Monkeypox Virus Infection in Travellers Returned from UAE to India, July 2022,” *Journal of Infection* 85, no. 5 (2022): e145–8, <https://pubmed.ncbi.nlm.nih.gov/35963550/>

61. Nguyen Thanh Dung et al., “Monkeypox Virus Infection in 2 Female Travelers Returning to Vietnam from Dubai, United Arab Emirates, 2022,” *Emerging Infectious Diseases* 29, no. 4 (2023): 778–81, https://wwwnc.cdc.gov/eid/article/29/4/22-1835_article.

62. “MoHAP: UAE Health System Fully Prepared to Deal With Monkeypox,” United Arab Emirates Ministry of Health & Prevention, May 22, 2022, <https://mohap.gov.ae/en/media-center/news/22/5/2022/mohap-uae-health-system-fully-prepared-to-deal-with-monkeypox>.

63. “MoHAP: UAE Health System Fully Prepared to Deal With Monkeypox,” United Arab Emirates Ministry of Health & Prevention, May 22, 2022, <https://mohap.gov.ae/en/media-center/news/22/5/2022/mohap-uae-health-system-fully-prepared-to-deal-with-monkeypox>.

64. Nadine El Sayed, “Middle East Major Hub for Wildlife Trafficking,” *Nature Middle East*, September 26, 2018, <https://www.natureasia.com/en/nmiddleeast/article/10.1038/nmiddleeast.2018.120>.

airport every year, so it's expected that wildlife traders would use Dubai as a transit point on their way from Africa to Asia."⁶⁵ Middle Eastern airports are prominent for trafficking ivory, rhinoceros' horns, and pangolins for traditional medicines and meat. Dubai International Airport is also a primary transit hub for birds and reptiles moving from Africa to Asia, and it has also reported ivory seizures.⁶⁶

Wildlife traffickers are highly dependent on commercial air transportation systems, and as a transit hub, the UAE in the Middle East plays an outsized role.⁶⁷ Indeed, a 2018 report called "In Plane Sight" found that between 2009 and 2018, 117 trafficking cases were recorded at UAE airports (behind 387 in China and 150 in Thailand), and says the UAE (alongside Kenya) is the primary transit center for moving wildlife between Africa and Asia.⁶⁸ Birds are the most commonly seized wildlife,⁶⁹ and as detailed below, they pose some of the highest risk of transmitting and recombining zoonotic viruses.

The role of the UAE as a transit hub also situates it at the center of the international exotic pet trade, though critically, in terms of zoonotic disease concern, the country is itself a final destination for exotic pets from South America (primarily birds), and all over the African and Asian continents. While great cats—especially cheetahs—are particularly coveted and not a high-risk species in terms of zoonotic spillover, primates are of steady and increasing interest among exotic pet owners, and all species of exotic pets tend to be intermixed with other species and dwelling alongside humans in private homes.

Traditionally, pets have been sold in pet markets that sell domestic and exotic species, but particularly after a 2017 UAE law that prohibits individuals from owning, trading, or transporting dangerous or exotic animals, pet stores have been shifting to high-end malls. In a recent survey, when asked whether they were familiar with CITES and the species it covers, 60% responded affirmatively compared to 40% who were unaware of CITES, though "there was a general understanding that certain species had to be traded with special permission or permits."⁷⁰ The customers are primarily UAE citizens and the expat community.⁷¹

One of our sources who has been tracking the exotic pet trade for years confirmed that pet stores have changed.

I heard about a gorilla that was enroute to Dubai from Niger, and was given names of dealers that might be involved. I was given and went to the address and it was a totally new kind of shopping mall—a square building, all pet shops. A pet shop super market center. Many, if not all, there were said to be involved in the [illegal] wildlife trade as well. It was a totally new set up which I had not seen before in such a concentrated manner.

65. Nick Webster, "Dubai at Heart of Countering Global Animal Trafficking, Report Finds," *The National*, August 20, 2018, <https://www.thenationalnews.com/uae/dubai-at-heart-of-countering-global-animal-trafficking-report-finds-1.761970>.

66. Nadine El Sayed, "Middle East Major Hub for Wildlife Trafficking," *Nature Middle East*, September 26, 2018, <https://www.natureasia.com/en/nmiddleeast/article/10.1038/nmiddleeast.2018.120>.

67. Mary Utermohlen and Patrick Baine, *In Plane Sight: Wildlife Trafficking in the Air Transport Sector* (Cambridge: TRAFFIC, 2018), https://www.traffic.org/site/assets/files/10858/in_plane_sight.pdf.

68. Nick Webster, "Dubai at Heart of Countering Global Animal Trafficking, Report Finds," *The National*, August 20, 2018, <https://www.thenationalnews.com/uae/dubai-at-heart-of-countering-global-animal-trafficking-report-finds-1.761970>.

69. Nick Webster, "Dubai at Heart of Countering Global Animal Trafficking, Report Finds," *The National*, August 20, 2018, <https://www.thenationalnews.com/uae/dubai-at-heart-of-countering-global-animal-trafficking-report-finds-1.761970>.

70. P. S. Soorae et al., "A Survey in the Trade in Wildlife as Pets in the United Arab Emirates," *TRAFFIC Bulletin* 22, no. 1 (2008): 41–6, https://www.traffic.org/site/assets/files/2984/traffic_pub_bulletin_22_1.pdf.

71. P. S. Soorae et al., "A Survey in the Trade in Wildlife as Pets in the United Arab Emirates," *TRAFFIC Bulletin* 22, no. 1 (2008): 41–6, https://www.traffic.org/site/assets/files/2984/traffic_pub_bulletin_22_1.pdf.

Pet store and animal market changes elsewhere in the UAE are consistent with this report. For example, in response both to the new 2017 law and in keeping with government promises to make changes in the interest of biosecurity, public health, and animal welfare, a well-known pet/livestock market in Sharjah has been transformed. According to the previous source:

It's a straight long building, with 40 to 50 cube-type shops. In the old days, the front doors were all open so you could walk in and get pictures/video of whatever they had in terms of birds or mammals. Nothing high profile was visible but there were plenty of small primates. But now, on my last visit about two months ago, they all keep their doors locked, you have to knock on the door, and they won't let you in if you don't look like a potential buyer. It's gone more underground. I was once there and talked to somebody about buying an orangutan and they brought out a big thick book in Russian, an encyclopedia of wildlife, and he said you can choose whatever you want, we'll get it for you. I filmed that. I've been involved in an investigation in Armenia where we got, looking into chimps there, including bonobos, and were given by Armenian authorities not export permits but invoices for primates from Dubai, and that was enough to let them out of Dubai and into Armenia to this quite well-known dealer and from there into Russia. [It's] very clear that the CITES aspect is not very organized and controlled.

So the legal and illegal exotic pet trade were, until recently, more visibly connected even at the point of sale. Since the 2017 law prohibiting exotic pet ownership (with some exceptions) was issued, legal and illegal exotic pet ownership have separated themselves to some extent. Important to note, however, and as detailed further below, the legal exotic pet trade in many cases enables illegal pet trade, and in terms of zoonotic disease, viruses make no distinction between, for example, captive-bred or wild prey for raptors like falcons. According to extant literature and described below, legal, captive-bred and wild houbara (among the most common birds on the market, but also endangered prey for falcons) are just as susceptible to highly pathogenic bird flu viruses as are the falcons themselves. Even so, the illegal exotic pet trade has indeed retreated somewhat into shadow, which is an unfortunate turn of events given the transparency and communication required not only among the Emirates but globally if zoonotic disease is to be prevented and/or mitigated. Per the source above:

Now these private animal dealers have their own facilities (probably registered as private zoos to justify the number of exotics) where they stock a lot of rejected stuff. If [an exotic pet owner] doesn't want something anymore, he trades it back to the animal dealer who provides something new in return, something young and cute. I visited one of these facilities once and they had everything: hyenas, cheetahs, ligers, monkeys, and the two guys who ran this facility, when I went back two years later and tried to visit again, they shouted at me to leave and said this all belongs to [royal family member]; if you have any questions go to [them]. These are basically backyard facilities where incoming stuff is kept for potential buyers, or if people want to get rid of animals and ask are you willing to take my lion, tiger,

cheetah, they'll say yes and they won't pay for it but they'll pick it up. There is nowhere else to take these no-longer-wanted animals. At the Dubai Zoo they've posted a sign that says: "Any animal dropped on our doorstep will be destroyed." So you surrender an animal to a private dealer, and there's probably a butchery of them. It's likely lion bones are sold as tiger bones because no one can tell the difference. Those skeletons will find a market. You could sell tiger skins to China.

Research indicates that the proportion of species involved in the legal trade includes 51% birds, 37% reptiles, 7% invertebrates, 3% mammals, and 2% fish. Pet stores are stocked with some animals that come from overseas breeders with more expensive animals and others come from "less reputable breeders" or from ranching quotas and are offered at lower prices,⁷² which is also of zoonotic concern if (and is possible if not likely) animals among these less reputable breeders are kept in crowded and/or stressful conditions. Domesticated species commonly seen include chickens, turkeys, ducks, pigeons, and quail.⁷³ Significantly, because of the possibility of passing on disease, especially if captured in the wild or bred without strict adherence to and awareness of biosecurity risks, these species of poultry are primary food sources for pet falcons. In fact, the UAE has made many Ministerial Decrees prohibiting the importing of various birds and their products due to the risk of the spread of avian influenza. The resulting difficulty in obtaining import clearance for some bird species and the increasing number of countries from which bird imports have been banned has rendered an increase in reptile and marine species.⁷⁴ However, as indicated elsewhere in this case study, the illegal bird trade is enormous, thriving, and poses many significant health risks.

In general, the UAE has undertaken many steps to ensure that its national legislation is up to date and capable of implementing CITES at a national level.⁷⁵ The UAE is a signatory to CITES, and has been since 1990. There are two CITES management authorities—one for Abu Dhabi and the other for the northern emirates. There is one federally designated Scientific Authority—the Environment Agency-Abu Dhabi—in the emirate of Abu Dhabi.⁷⁶ However, it's widely reported that legislation is not enforced.

If you have money it is possible to pay people off so you don't get caught trafficking these cats or fueling the trade itself...Animals are rarely confiscated from the very rich...It would be good if the penalties were stronger. Don't go after the guy who is catching the animals in the wild and trying to feed his family but the traders who are buying them. If you get rid of the middle man you will help destroy the market. That begins with proper enforcement of international law. It has to be stronger than it is.⁷⁷

72. P. S. Soorae et al., "A Survey in the Trade in Wildlife as Pets in the United Arab Emirates," TRAFFIC Bulletin 22, no. 1 (2008): 41–6, https://www.traffic.org/site/assets/files/2984/traffic_pub_bulletin_22_1.pdf.

73. P. S. Soorae et al., "A Survey in the Trade in Wildlife as Pets in the United Arab Emirates," TRAFFIC Bulletin 22, no. 1 (2008): 41–6, https://www.traffic.org/site/assets/files/2984/traffic_pub_bulletin_22_1.pdf.

74. P. S. Soorae et al., "A Survey in the Trade in Wildlife as Pets in the United Arab Emirates," TRAFFIC Bulletin 22, no. 1 (2008): 41–6, https://www.traffic.org/site/assets/files/2984/traffic_pub_bulletin_22_1.pdf.

75. P. S. Soorae et al., "A Survey in the Trade in Wildlife as Pets in the United Arab Emirates," TRAFFIC Bulletin 22, no. 1 (2008): 41–6, https://www.traffic.org/site/assets/files/2984/traffic_pub_bulletin_22_1.pdf.

76. P. S. Soorae et al., "A Survey in the Trade in Wildlife as Pets in the United Arab Emirates," TRAFFIC Bulletin 22, no. 1 (2008): 41–6, https://www.traffic.org/site/assets/files/2984/traffic_pub_bulletin_22_1.pdf.

77. Nick Webster, "Cut Out the Middle Man in Exotic Animal Trade to Kill Market, Expert Says," The National, October 18, 2017, <https://www.thenationalnews.com/uae/cut-out-the-middle-man-in-exotic-animal-trade-to-kill-market-expert-says-1.668270>.

According to one of our sources, many of these trafficked wild animals end up staying in the UAE as pets, while others eventually go farther east, for example, to Armenia, Russia, and Ukraine. The great cats, especially cheetahs, are highly desirable, they said, but more recently (with a higher risk of spreading zoonotic disease), primates—especially great apes—are being trafficked. We found this claim supported elsewhere. After enactment of the 2017 law, Dubai Safari has been providing sanctuary to exotic pets as part of an amnesty. Pets they have received include chimpanzees and baboons that were held illegally in private homes across the UAE.⁷⁸ Said an official at Dubai Safari: “We’ve had a lot of monkeys handed in, roughly 20, mainly baboons and macaques. They were being held in private homes, and were getting too big for people to manage.”

Another source reported increasing numbers of orangutans in private zoos in Dubai, and that marmosets (very small monkeys) are very frequent. The species are mixed together, this source said—hyenas, big cats, monkeys, birds, lions, in an apartment and in cages next to each other. “A person might have a monkey in one hand and a tiger cub in another, and there are people coming in to get pictures taken with them, and animals coming and going out.” The animals are moved around the country and into the Emirates from Saudi Arabia in car trunks, the source told us, but “sometimes just in the main part of the car crawling around—you can see it plainly in the city. One guy in Saudi Arabia has even set up a transport service, selling pets from his car. Before going out he publishes a picture on Instagram with his routes.”

In addition to receiving primates in amnesty, the aforementioned official interviewed at Dubai Safari also reported: “A lot of exotic birds have been given to us. We had a flood of macaws and toucans that came in at once, there must have been a recent shipment onto the black market.”⁷⁹ According to a single report, at least 70% of birds taken to Dubai Safari at that time had chlamydia—an indication of the spread of infection and infection prevalence among such birds—and were most likely to have come from South America. The fact of such travel and the probable conditions in which the birds were transported are likely behind the high infection rate. That same year, i.e., after enactment of the 2017 law, some 400 ornamental birds protected by CITES were taken from a trader near the Sharjah animal market. It is obvious these animals have not received adequate veterinary care and have been poorly tended; some adult birds have serious health problems. There is head-tossing and thumb-sucking among recovered primates, and lions have been declawed.⁸⁰ Cheetahs, jaguars, and leopards have also been declawed and the teeth filed down. As far as primates are concerned, there are many slow lorises (a protected species) kept as pets.

According to one source, this state of affairs is because of the number of “vet hacks” proliferating across the UAE.

78. Nick Webster, “Exclusive: Overweight and Inbred, Banned Exotic Animals are Handed Over to Dubai Safari Under Amnesty,” *The National*, May 20, 2018, <https://www.thenationalnews.com/uae/exclusive-overweight-and-inbred-banned-exotic-animals-are-handed-over-to-dubai-safari-under-amnesty-1.731743#:-:text=Too%20big%20for%20owners%20to,introduction%20of%20anti%2Dtrafficking%20laws&text=Exotic%20pets%20including%20chimps%2C%20baboons,as%20part%20of%20an%20amnesty>.

79. Nick Webster, “Exclusive: Overweight and Inbred, Banned Exotic Animals are Handed Over to Dubai Safari Under Amnesty,” *The National*, May 20, 2018, <https://www.thenationalnews.com/uae/exclusive-overweight-and-inbred-banned-exotic-animals-are-handed-over-to-dubai-safari-under-amnesty-1.731743#:-:text=Too%20big%20for%20owners%20to,introduction%20of%20anti%2Dtrafficking%20laws&text=Exotic%20pets%20including%20chimps%2C%20baboons,as%20part%20of%20an%20amnesty>.

80. Nick Webster, “Exclusive: Overweight and Inbred, Banned Exotic Animals are Handed Over to Dubai Safari Under Amnesty,” *The National*, May 20, 2018, <https://www.thenationalnews.com/uae/exclusive-overweight-and-inbred-banned-exotic-animals-are-handed-over-to-dubai-safari-under-amnesty-1.731743#:-:text=Too%20big%20for%20owners%20to,introduction%20of%20anti%2Dtrafficking%20laws&text=Exotic%20pets%20including%20chimps%2C%20baboons,as%20part%20of%20an%20amnesty>.

Vets have an oath to care for any animal, but they are also required to report illegal activity. So many exotic pet owners aren't really looking for vaccines or official vet care, but things like declawing, getting teeth filed down—quick ways to make the pet more tame. So there are vet hacks who will do that. The UAE is trying to crack down on this. The “vet hacks” are part of the same network of traders and pet owners. You don't know how to take care of these animals and someone sees opportunity to profit off pretending to be a vet. I've seen pictures of animals with their paws partially cut off from poor declawing. There also have been videos of owners of these animals giving advice, veterinarian advice, on YouTube. Frankly, they're pretty much wrong.

Indeed, though the Ministry of Climate Change and Environment (MOCCA) did not point to any particular extant problems with unlicensed veterinarians, another new 2017 UAE law is aimed at regulating the field of veterinary medicine and support services in line with best practices and international standards. The law imposes fines of US\$2,722 to \$54,450 for an unlicensed veterinarian/practice owner, and illegal practitioners can be imprisoned for at least a year.⁸¹ The aim of the law is three-fold:

1. Regulating the ownership, possession, trading, and breeding of dangerous animals.
2. Protecting humans and other animals from the harm of dangerous animals and the transmission of their diseases and their causes to them and to other animals.
3. Ensuring that the animals are receiving good care.⁸²

On the subject of questionable veterinary activity, one source reported: “There is a well-known Tanzania[n] vet who provides the [high-ranking families] everything they want, has links to all the dealers. If someone wants something, it will arrive. This Tanzanian vet is a typical one—a colleague of mine said he was trained in Russia, but he doesn't speak Russian. If he has a Russian vet certificate, so how did he get this certification?”

There exists in the literature one study that aimed to assess zoonotic disease management and infection control practices among clearly established and certified veterinarians in the UAE. The survey included 110 individuals and results were as follows:

- Reported hand hygiene, sharps management, barrier or isolation practices, and personal choices for PPE in common practice scenarios varied among practitioners.
- The majority (>75%) of vets in all practice types reported always washing their hands before eating, drinking, or smoking at work.
- 19% and 10% of large and small animal vets, respectively, indicated they sterilized and reused disposable needles.

81. “UAE Cracks Down on Unlicensed Veterinarians,” *Today's Veterinary Business*, October 9, 2017, <https://todaysveterinarybusiness.com/uae-cracks-unlicensed-veterinarians/>.

82. Khalifa Bin Zayed Al Nahyan, “Regulating the Possession of Dangerous Animals,” Federal Law No. 22, December 12, 2016, amended by Cabinet Decision no. 721/2017, December 5, 2017, <https://web.archive.org/web/20201209111912/https://www.moccae.gov.ae/assets/download/ea834864/L22-16%20Eng.pdf>.

- Vets among all practices indicated high rates (75% to 80%) of recapping needles before disposal.
- When handling an animal suspected of having a zoonotic disease, most (90%) of small animal vets reported always using practices such as isolating the animal and removing outerwear before contact with other animals.
- About half (55%) of large animal respondents reported always isolating the animal or sterilizing all equipment used on the animal of concern.
- Fewer than half of large animal (35%) and mixed practice (44%) vets indicated they would always limit human contact with the animal of concern.
- All of the small animal respondents reported full compliance with PPE while performing surgery and necropsy.
- Among large animal vets, 44% reported not using respiratory or eye protection when aiding with parturition or handling conception products. (Failure to use PPE when handling blood samples was the second most common noncompliant practice among large animal [39%] and mixed practice vets [41%.])⁸³

The study reveals significant need for ongoing education among UAE veterinarians, including increased awareness of risk of zoonotic disease exposure and how to manage such risk.

To date there is no research in the literature that explores the relationship between zoonotic disease risk management perception and infection control practices in the UAE.⁸⁴ MERS-CoV and Crimean Congo Hemorrhagic Fever have shown “a critical challenge arising at the human-animal interface in the UAE” and some of the practices revealed by the study are unacceptable.

Surveillance data for sheep, goats, and camels are sparse in the UAE, researchers note, but they suggest there may be a significant animal reservoir of *Brucella* infection, so they cite brucellosis as an occupation risk for farmers, veterinary surgeons, and employees in the meatpacking business. Small droplets or aerosols of body fluids can be released during all related processing and procedures and pose risks for zoonotic diseases exposure.⁸⁵

The study concludes that “vets who do not consider PPE in their routine work are compromising their duty of care to adopt work practices that do not expose themselves, their supporting team and others to avoidable risk of zoonotic diseases.”⁸⁶

In general, where more strict legislation and enforcement around the care for and trade of exotic pets may not be helpful or possible, raising awareness about the harm caused by the exotic pet industry—including risk of spreading zoonotic disease—may be key. And a major component of public awareness must tackle the impact of social media on the wildlife trade in the Middle East.⁸⁷

83. Ihab Habib and Zainab Alshehhi, “Zoonotic Disease Management and Infection Control Practices Among Veterinarians in the United Arab Emirates,” *Veterinary Sciences* 8, no. 5 (2021): 82, <https://pubmed.ncbi.nlm.nih.gov/34065032/>.

84. Ihab Habib and Zainab Alshehhi, “Zoonotic Disease Management and Infection Control Practices Among Veterinarians in the United Arab Emirates,” *Veterinary Sciences* 8, no. 5 (2021): 82, <https://pubmed.ncbi.nlm.nih.gov/34065032/>.

85. Ihab Habib and Zainab Alshehhi, “Zoonotic Disease Management and Infection Control Practices Among Veterinarians in the United Arab Emirates,” *Veterinary Sciences* 8, no. 5 (2021): 82, <https://pubmed.ncbi.nlm.nih.gov/34065032/>.

86. Ihab Habib and Zainab Alshehhi, “Zoonotic Disease Management and Infection Control Practices Among Veterinarians in the United Arab Emirates,” *Veterinary Sciences* 8, no. 5 (2021): 82, <https://pubmed.ncbi.nlm.nih.gov/34065032/>.

87. Nadine El Sayed, “Middle East Major Hub for Wildlife Trafficking,” *Nature Middle East*, September 26, 2018, <https://www.natureasia.com/en/nmiddleeast/article/10.1038/nmiddleeast.2018.120>.

SOCIAL MEDIA

Without the oil of Abu Dhabi, the more liberal Dubai has branded and invested in itself as a tax haven and a place where wealthy, international tourists can taste and see, unhampered by the conservative values of neighboring Emirates and countries.⁸⁸ Per The Guardian journalist Ruth Michaelson, Dubai is “[b]uilt on the illusion of unlimited indulgence”⁸⁹ and is a global hub of “influencer culture”—a “magnet for social media stars desperate to tweak their image in what has become the ideal Instagram city.” Michaelson writes:

This city, powered by the overlap of aesthetics and a desire to make money, holds an irresistible appeal for Instagram itself. The social network has its Middle Eastern headquarters in Dubai, with that of parent company Facebook. Dubai-based head of communications Nada Enan tells me, “Instagram is a platform that inspires people, and this is manifested in this city.” Data from the Global Web Index shows that generation Z now rely on influencers for information almost as much as the brands they represent, and 69% of all internet users in the UAE use Instagram, far outstripping the UK at 53%.⁹⁰

Influencers comprise a measurable and critical component of the tourism industry in Dubai, which comprised 11.5% of GDP in 2019.⁹¹ The abstract ambition to become an ideal Instagram city, as it were, is fed by an entire industry of business people advising luxury brands and would-be celebrities about how to boost follower counts.⁹² One proven way to do so is to post photos of yourself cuddling with, wrestling with, cohabiting with, casually and elegantly posing with in an expensive room, or leading upon a leash various species of dangerous wildlife, particularly great cats and primates. Even independently of high-risk species such as primates, there is significant risk of emergence and transmission of zoonotic disease along the supply chain that brings many forms of wildlife—including birds—from the Horn of Africa to Saudi Arabia, where wholesalers sell them legally and illegally in the UAE, as described in greater detail below.

It is known and well-documented that social media platforms are used to illegally trade in exotic animals.⁹³ By now, so is a direct link between celebrities and influencers who engage in the trade, and who are using wild animals as props by posting images of themselves with, say, a cheetah cub, or a full grown tiger on a leash.

Exotic animals are used as status symbols in the UAE. By posing and tagging their posts

88. Ruth Michaelson, “In This World, Social Media is Everything: How Dubai Became the Planet’s Influencer Capital,” The Guardian, April 17, 2021, <https://www.theguardian.com/world/2021/apr/17/in-this-world-social-media-is-everything-how-dubai-became-the-planets-influencer-capital>.

89. Ruth Michaelson, “In This World, Social Media is Everything: How Dubai Became the Planet’s Influencer Capital,” The Guardian, April 17, 2021, <https://www.theguardian.com/world/2021/apr/17/in-this-world-social-media-is-everything-how-dubai-became-the-planets-influencer-capital>.

90. Ruth Michaelson, “In This World, Social Media is Everything: How Dubai Became the Planet’s Influencer Capital,” The Guardian, April 17, 2021, <https://www.theguardian.com/world/2021/apr/17/in-this-world-social-media-is-everything-how-dubai-became-the-planets-influencer-capital>.

91. Julien Hirschinger et al., “Exposure Assessment for Avian Influenza and Newcastle Disease Viruses from Peridomestic Wild Birds in a Conservation Breeding Site in the United Arab Emirates,” *Transboundary and Emerging Diseases* 69, no. 4 (2022): 2361–72, <https://pubmed.ncbi.nlm.nih.gov/34333870/>.

92. Julien Hirschinger et al., “Exposure Assessment for Avian Influenza and Newcastle Disease Viruses from Peridomestic Wild Birds in a Conservation Breeding Site in the United Arab Emirates,” *Transboundary and Emerging Diseases* 69, no. 4 (2022): 2361–72, <https://pubmed.ncbi.nlm.nih.gov/34333870/>.

93. Foeke Postma, “How Instagram Celebrities Promote Dubai’s Underground Animal Trade,” *Bellingcat*, February 8, 2021, <https://www.bellingcat.com/news/mena/2021/02/08/how-instagram-celebrities-promote-dubais-underground-animal-trade/#:~:text=By%20posing%20with%20lion%20and,a%20pet%20in%20private%20homes>.

accordingly, celebrities connect with a vast network of individuals in the online trade in exotic animals, and they advertise this network (and themselves) to millions of followers. As one journalist, Foeke Postma, has recently documented, some of these wild animals are moved around from home to home and celebrity to celebrity for photo shoots, then end up as pets in private homes.⁹⁴ It is a multi-million dollar industry and, writes Postma:

Rappers, movie stars, business magnates, TV-presenters, models, vloggers and even a fugitive criminal have all posted images of themselves posing with them. But there's a problem — these same pets can be traced back to a small group of anonymous individuals who may be engaged in illegally leasing out, and perhaps even selling, exotic animals.⁹⁵

As with most aspects of celebrity culture, social media is big business in the UAE. Any influencer who is paid for their work in the UAE has to obtain a license and/or pay thousands of dollars to work with an official influencer agency; visitors and/or foreign influencers are expected to follow government rules for social media⁹⁶—and importantly, where image is everything and social media is everything—there isn't much room for mis-steps. In some instances, the government employs influencers directly.⁹⁷ “The result,” writes Michaelson, “is a torrent of positivity, an online world where glamour and achievement are the only acceptable forms of communication.”⁹⁸ It was noted, however, in an interview with a high-ranking individual, that increasingly—at least in some quarters—it is understood that contributing to the exotic pet wildlife trade, particularly in the wake of the pandemic, does not reflect positively upon the UAE, or upon those celebrities and influencers who continue to pose with these animals. “Our team has recognised a change in behaviour online; more people are calling out exotic pet owners and more are aware of the negative impacts of owning a dangerous animal, to the individual keeping it, the community around it and the wild where the animal comes from,” explained Elsayed Mohamed, Regional Director for the Middle East and North Africa for the International Fund for Animal Welfare (IFAW).⁹⁹ To take photos with these wild animals is no longer seen as entirely “cool” to do, even if it garners a lot of “likes,” and it is slowly but surely becoming less beneficial for celebrities to continue this practice, especially from Western countries.

Raising awareness about how destructive these practices are—and in terms of spreading disease, how dangerous—has already begun a shift away from boasting with such posted images, which ultimately signals that a person is part of a problem. As some of our sources acknowledge (and

94. Foeke Postma, “How Instagram Celebrities Promote Dubai’s Underground Animal Trade,” *Bellingcat*, February 8, 2021, <https://www.bellingcat.com/news/mena/2021/02/08/how-instagram-celebrities-promote-dubais-underground-animal-trade#:~:text=By%20posing%20with%20lion%20and,a%20pet%20in%20private%20homes>.

95. Foeke Postma, “How Instagram Celebrities Promote Dubai’s Underground Animal Trade,” *Bellingcat*, February 8, 2021, <https://www.bellingcat.com/news/mena/2021/02/08/how-instagram-celebrities-promote-dubais-underground-animal-trade#:~:text=By%20posing%20with%20lion%20and,a%20pet%20in%20private%20homes>.

96. Foeke Postma, “How Instagram Celebrities Promote Dubai’s Underground Animal Trade,” *Bellingcat*, February 8, 2021, <https://www.bellingcat.com/news/mena/2021/02/08/how-instagram-celebrities-promote-dubais-underground-animal-trade#:~:text=By%20posing%20with%20lion%20and,a%20pet%20in%20private%20homes>.

97. Ruth Michaelson, “‘In This World, Social Media is Everything’: How Dubai Became the Planet’s Influencer Capital,” *The Guardian*, April 17, 2021, <https://www.theguardian.com/world/2021/apr/17/in-this-world-social-media-is-everything-how-dubai-became-the-planets-influencer-capital>.

98. Ruth Michaelson, “‘In This World, Social Media is Everything’: How Dubai Became the Planet’s Influencer Capital,” *The Guardian*, April 17, 2021, <https://www.theguardian.com/world/2021/apr/17/in-this-world-social-media-is-everything-how-dubai-became-the-planets-influencer-capital>.

99. Foeke Postma, “How Instagram Celebrities Promote Dubai’s Underground Animal Trade,” *Bellingcat*, February 8, 2021, <https://www.bellingcat.com/news/mena/2021/02/08/how-instagram-celebrities-promote-dubais-underground-animal-trade#:~:text=By%20posing%20with%20lion%20and,a%20pet%20in%20private%20homes>.

which partly explains their desire to remain anonymous), in the UAE—particularly in Dubai—bad publicity can have a meaningful negative effect on GDP.¹⁰⁰ “It is in part for this reason that governments don’t respond well to being embarrassed publicly,” one source explained. “It’s better to share things behind closed doors, because then the government might shut out [the people perpetrating wildlife crimes] and not interact with them anymore.” A second source agreed. “There are a lot of wealthy and influential people involved in this questionably legal, questionably ethical pet ownership, and nobody wants to put the spotlight on these powerful people.” A third source said on the topic: “Nobody dares to talk about it, nobody documents it, they all know it’s risky to expose any of these big shots in any formal way.” What is behind it all, and its imitation by thousands of Emirati and expats of the UAE’s wealthy and influential exotic pet owners, even among those who would not become influencers or make money from the illegal trade? A couple of blunt, if simplified, responses we received: “The gathering of ‘likes’ is destroying us,” and “Obsession with social media is killing animals and people.”

Two individuals we spoke with stated very clearly that Facebook/Meta plays a powerful and destructive role in the trade by disingenuously claiming an inability to regulate illegal wildlife trafficking via social media. Said one source: “I feel like there’s an easy technical solution that isn’t being used. In my mind I draw the comparison to childhood sexual abuse material—you can’t post it on social media. If you have certain hashtags or words, violence and terrorism also will get removed. I can’t explain why this wouldn’t happen for the wildlife trade. The technical solution must already be there. We have to rely instead on cultural change and public awareness.” Another individual was more blunt: “[Facebook/Meta] is killing animals. It is killing people. It really does have a central role in the supply chain. I was at a meeting at Interpol, where [Facebook/Meta] claimed it was just so difficult to monitor. In fact they’re not doing anything. [Facebook/Meta] is like the corrupt cop. He gets paid to allow the thief to commit the crime.”

SUPPLY CHAIN OF EXOTIC PETS

According to one source with decades of study in the field and first-hand experience on the African continent and in the Middle East, this is how the exotic pet supply chain works:

A mother cheetah hides her cubs when she goes out hunting. Nomadic farmers or people from villages will go and take them by hand from their hiding places and are put into baskets, canisters, cardboard boxes. They’re tied to prevent escape, including cheetah cubs as young as two weeks old, bound by the legs. The animals are kept in these containers, or in a hole in the ground, until a buyer is found; the buyer is usually the exporter. This individual will buy several cheetahs and other animals. Some of them die. Cheetahs are very susceptible to deformation and neurological disorders related to poor nutrition. Many of them die before they get too far along. Nothing happens to those that die along the way. Their skin at that point doesn’t have any economic value. Dead cubs are just a business loss. That’s why so many are taken, because so many

100. Ruth Michaelson, “In This World, Social Media is Everything’: How Dubai Became the Planet’s Influencer Capital,” *The Guardian*, April 17, 2021, <https://www.theguardian.com/world/2021/apr/17/in-this-world-social-media-is-everything-how-dubai-became-the-planets-influencer-capital>.

of them die. The cheetahs are taken from the wild in the horn of Africa. They move through northern Somaliland, by boat, and need to get from Yemen to Saudi Arabia, then to Syria, Jordan, but mostly to the UAE and Kuwait. Along with the cheetahs—which don't represent a great risk of zoonotic diseases—are gazelles and birds of prey, which do represent a great risk. We've seen eagles, owls, vultures...we know there is drug trafficking, alcohol, weapons, and human trafficking involved as well. All of these things are transported together. The stakeholders are immigrants in Yemen from Somaliland, Somali people living in Somaliland, and people in Ethiopia, mainly of Somali origin.

All of these animals, people, weapons, etc. are thrown into boats called dhows, which are 20 or 30 feet long—they're very common in that part of the world. They're middle-sized boats and can go through shallow waters, I understand, because these boats of course don't use official ports. They might land on beaches.

They [the animals] basically all end up in Saudi Arabia. There are a couple cases where they go through Oman. Saudis are the main [wholesalers]. So once they cross the border into Saudi Arabia, usually by truck or by foot, the traders or middlemen sell them to Saudi wholesalers. The animals might stay there for a while until they find buyers. They might be kept on a farm—I've seen videos of cheetah cubs for example that seem to be on sand, outside in a kind of farm environment, but I've also seen them in houses, playing with kids. They keep them wherever they can. In the past they were in the markets, but that's become risky. Usually cheetahs, which are extremely susceptible to disease, are kept with other animals. Stray cats, lions, parrots, and reptiles are also huge. They mix them and think it's cute.

The supply chain for primates is more complicated, this same source reports, as they come in from Asia and Africa. "From Africa, there are gorillas, chimps, and bonobos—from Ghana, from the Congo, the DRC, from Mali...mostly central and west Africa. They're usually taken through different countries—there's a huge risk of zoonotic diseases there—these primates are also pets in the Emirates." The other route for primates being trafficked into the UAE, this source describes, is from Asia, usually out of Thailand, Malaysia, or Indonesia, including orangutans, gibbons, and slow lorises. They're usually flown in from those countries into Oman or directly to the Emirates.

The problem of course is that the Emirates enacted a law that bans private ownership of wild animals—there is that law. The key word is that it's private ownership. In some cases that I'm aware of, the government issued licenses to people that already had these animals, legalized the ownership, and these people registered as zoos. And they are small zoos. But they're definitely not displayed—they charge people to come pet them, play with them, take pictures with them. Also the royals have all these animals. So I think that's why there's a lack of political will to do anything in the Emirates. Of course they're all members and parties to CITES. The trade in these animals is illegal,

but they basically don't admit that there is a problem. They say they have it under control. Notwithstanding, the onset of the COVID pandemic seems to have given rise to illegal exotic pet demand in the UAE, at least in terms of cheetahs and great apes.

Some exotic pet owners think they're saving or rescuing sick or sad animals with nowhere else to go—and it is in fact the case that many of them have nowhere to go. “Some say they love animals and I think they do,” a source told us. “They think they're saving these animals from a worse fate, the animals advertised look unhealthy or sick, and so animal lovers will buy them. Females seem to often buy them for this reason. For men, they want to put their hand inside the tiger's mouth and share that picture, it makes them seem tough.”

The private zoos or menageries include multiple species mixed together in peoples' homes and don't seem to be subjected to inspections. It's not uncommon to see in pictures children playing with baby chimps or gibbons. “The animals become part of their family. You'll see the primates and parrots in the living room, then a bunch of guys doing their thing posing with a dangerous-looking animal like a great cat—all kinds of interactions. But if they survive to adulthood, especially primates, they become really dangerous.”

Those who run these zoos and who trade and traffic the animals do make some money, but it's not really about exploiting wildlife to reach a different/higher scale of wealth, one source reported. “What you get is status on social media and certain social circle connections. You can be proud of being in touch with celebrities who are posing with your animals. Or you can put your exotic animal inside of your nice car and drive around.”

In terms of the money laundering involved, a local collector might get \$80 for a cheetah cub, for example. The price goes up depending on the number of middlemen. An exporter might sell the cub for \$2000. “Locally, as a foreigner,” one source told us, “I was once offered a cheetah for \$15,000. The price for cheetahs is determined by how tame or wild it is (less expensive), anywhere from \$5,000 to \$7,000 to \$30,000 or more.”

Primates that come from Asia, central and west Africa have to be put on airplanes. According to one source, traffickers find a way of smuggling them on commercial airlines by hiding them among legal animals, or by hiding them in containers that say: washing machine or TV. “Then they drug the animal so it will sleep. On commercial airlines they're in suitcases or on a person's body—for example, one woman pretended to be pregnant and she was holding an orangutan. As a last resource, a [high-ranking family's] private plane might be sent to fetch primates and other exotic pets from Asia or central and west Africa.”

“In Plane Sight” confirmed our source's claim. “Between 2009 and 2017, the majority of mammal instances destined for the Middle East originated in Thailand, Indonesia, Tanzania, and Mozambique, and were destined for Iran, Kuwait, Qatar, and the UAE. At least 75% of these instances contained live animals (tiger cubs, slow lorises, pythons, orangutans, Javan gibbons, etc.) moved in luggage and destined for the region's thriving exotic pet trade.”¹⁰¹

The animals are then advertised online. “Social media is a major threat to the survival of these animals,” one source told us. “Facebook, Instagram, Snapchat, TikTok, and WhatsApp are all used. I

101. Mary Utermohlen and Patrick Baine, *In Plane Sight: Wildlife Trafficking in the Air Transport Sector* (Cambridge: TRAFFIC, 2018), https://www.traffic.org/site/assets/files/10858/in_plane_sight.pdf.

have a source that is a buyer who gets the offers for the animals. They're adapting with changing social media platforms. They change the way they are advertising—used to be they would put up pictures of animals for sale, put up prices, they were very open. Tame or healthy, the ad might say, all kinds of detail. Lately, traffickers have started putting words on pictures or on a video—just holding up a sign—so these posts can no longer be searched with a hashtag. Just a picture of an animal with the species name, maybe just a phone number, and when someone inquires, they communicate privately on WhatsApp, or Snapchat. It's very difficult and onerous to track."

We spoke with an individual who has studied wildlife trafficking patterns and behaviors for years, concentrating on high profile "flagship species" and big importers across the African continent, including the Middle East. They said:

These are elite clientele. If so and so has a white tiger then so and so wants a blue tiger or a red tiger. There's a competition, a lot of the trade operates along these levels. You want to show these creatures off. They're dangerous, and if you have them then you prove that you're above the law, that you're of a certain status socially. If you're getting away with it, you must have that status. A lot of dealers take advantage of this, knowing they're taking practically no risk. Quite often, they're provided with private jets; there's a private airport where there's no immigration or customs, and they can simply load chimps and gorillas with no inspection because the airport is just for the elite. The UAE was once suspended from CITES for the same scenario, but has been readmitted, and basically nothing has changed. No one really takes new laws too seriously.

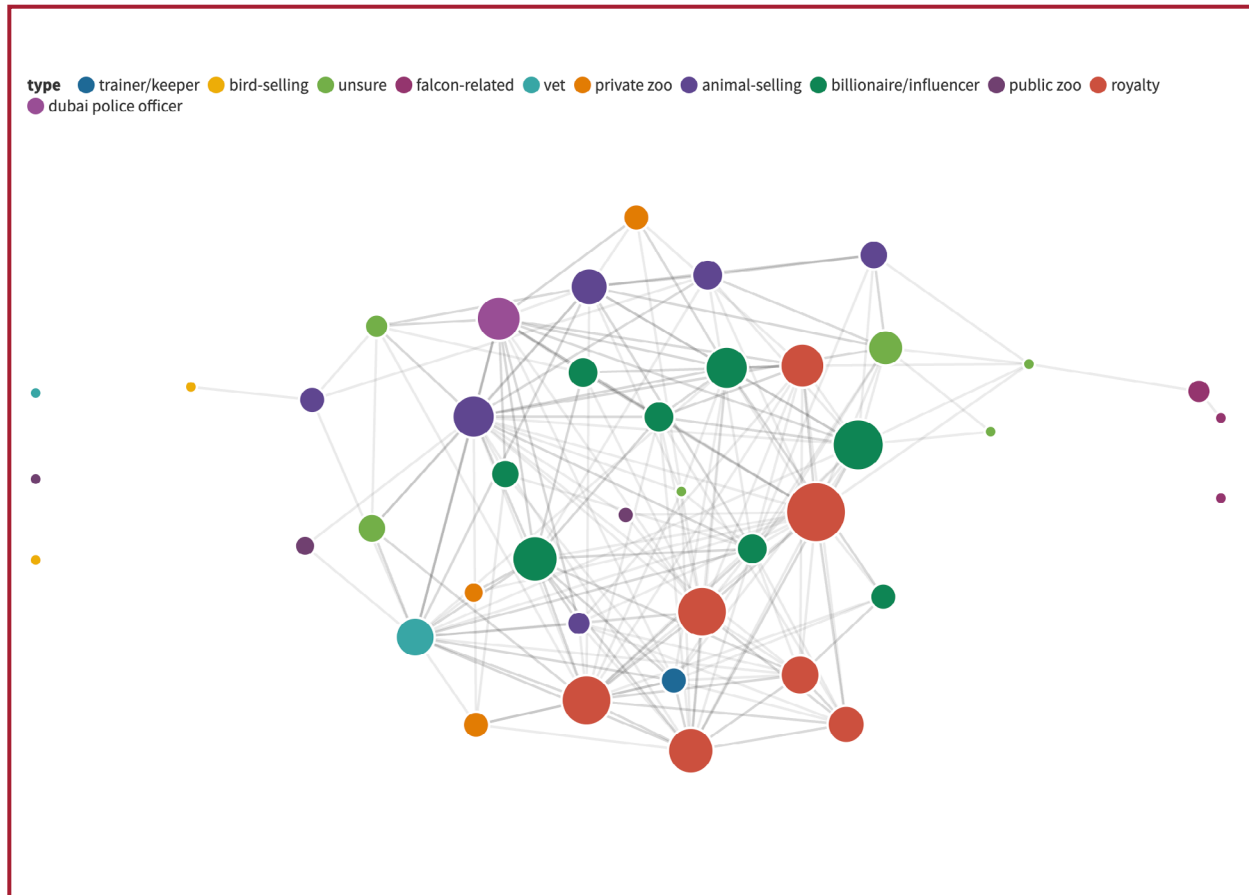
According to this source, gorillas and chimps are easy to identify, so it isn't difficult to know their origin, and there are only so many around on the market at any given time, making it relatively easy to pinpoint "who's behind it all." For example, "there's a dealer in India who regularly supplies orangutans. On his [Facebook/Meta] page, he's bringing baby orangutans from Indonesia to anybody who wants them." But the movement of primates from the wild via airplane to wealthy pet owners in the UAE doesn't stop here. "The other issue is, these animals grow up, become difficult and problematic." The animals change hands again and again.

This same source spoke of a colleague who is continually having chimpanzees "donated/dumped on him," and has informed the municipality he will not accept anymore. According to our source, there are likely 100 chimpanzees in Dubai or in the UAE on any given day held in private by celebrities.

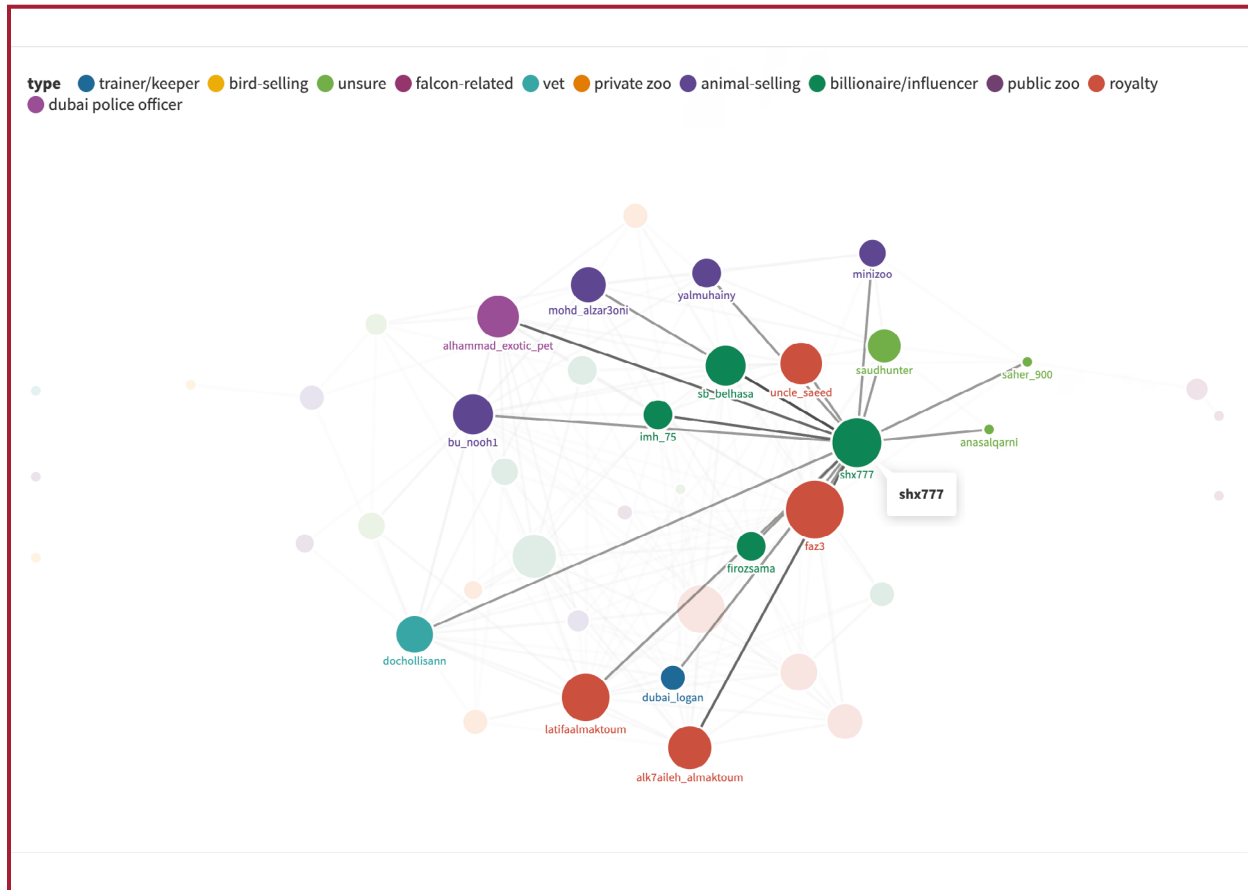
And vets know exactly what's going on; they treat the animals but don't rock the boats. No expat in the UAE is going to stick his neck out, though someone might tell you something over a beer. Overall, they know if anything is leaked back to them, they're kicked out or even get serious problems while being kicked out. It's that kind of environment. It's not easy to get information.

However, it is not too difficult to track the social media accounts of major players (as Postma has done), and this source, above, contributed the "key Instagram" accounts they follow in tracking the illegal

wildlife trade from the Horn of Africa through Saudi Arabia, for example, where wholesalers purchase them and sell them up to the UAE. We used these accounts along with accounts we watched and tracked ourselves to create the following graphic:



The graphic indicates the size of the accounts following and how each account is connected to the others.



One of these accounts belongs to the captain of a ship that runs between Saudi Arabia and the Horn of Africa, this source pointed out. Another is a border guard between Saudi Arabia and Yemen. “And all the other seller accounts we’ve found on Instagram, they’re following these individuals.”

An anonymous source agreed with Postma, who writes: “By pointing out the connections between Instagram photoshoots and this trade, fans and followers may make such posts less attractive, and help protect threatened wildlife populations.” To this, our source added: “Every time you see a post of a wild animal with thousands of likes and comments—any time you like or make a comment, you’re encouraging the whole dynamic.”

The international wildlife trade is a multi-billion-dollar industry and the live pet trade is a significant part of it. Importantly, the live and exotic pet trade is expected to grow globally with increasing affluence.¹⁰² While there may be economic opportunity in the pet trade, even when legal, it obviously poses major health and biosecurity risks—the coronavirus pandemic is just one very current example of the danger and devastation posed by zoonotic disease transmission.¹⁰³ As it grows, the exotic pet trade has increasingly expanded online among social media platforms that are difficult but not impossible to monitor and track. For now, there is limited enforcement on Facebook/Meta, for example, and one’s ability to monitor and track the trade there means it has not yet shifted to the dark web.¹⁰⁴

102. Alisa Davies et al., “Live Wild Bird Exports from West Africa: Insights into Recent Trade from Monitoring Social Media,” *Bird Conservation International* 32, no. 4 (2022): 559–72, <https://ora.ox.ac.uk/objects/uuid:1487bbf0-0997-4f14-8f84-55b5e00654cd>.

103. Alisa Davies et al., “Live Wild Bird Exports from West Africa: Insights into Recent Trade from Monitoring Social Media,” *Bird Conservation International* 32, no. 4 (2022): 559–72, <https://ora.ox.ac.uk/objects/uuid:1487bbf0-0997-4f14-8f84-55b5e00654cd>.

104. Alisa Davies et al., “Live Wild Bird Exports from West Africa: Insights into Recent Trade from Monitoring Social Media,” *Bird Conservation International* 32, no. 4 (2022): 559–72, <https://ora.ox.ac.uk/objects/uuid:1487bbf0-0997-4f14-8f84-55b5e00654cd>.

Not only individuals, but the UAE's private zoos, too, have social media accounts. One of our sources told us:

Anyone can go visit. I've been to one of them. There's a guy I've followed for years on Instagram. For whatever reason, it turned out he was going to buy two cheetahs from a woman who keeps rescuing them. So I went to see his farm/zoo. He had two lions, two tigers, two hyena cubs, and dogs, mastiffs. Their drinking water came from the ground, and I told this man, "That's salt water. You can't feed salt water to your animals." He said he didn't know. I told him he wasn't taking proper care of them. Enclosures were horrible. Maybe because of salt water, his lion had already killed two lionesses. Had a tigress that was in terrible physical shape from being bred several times per year. Hyenas were deformed already from lack of calcium. Captive-bred and wild-caught animals are mixed together. At this end, it's not so much a criminal network as a group of misled people.

BIRDS

The UAE has been notorious for bird trafficking by air in the world since 2009, both due to the country's importance as a transit hub and the significant Emirati demand for protected falcons and other bird species (e.g., macaws, grey parrots, and love birds).¹⁰⁵ The trade spans legal and semi-legal trade and purely illegal activity. It is a murky industry and the ambiguity provides a lot of space for illegal activity; where the activity is illegal, the activity is cloaked, and where the activity is cloaked, the risks of zoonotic disease emergence, recombination, transmission, and spillover remain largely unknown and/or unshared.

The UAE is a major destination for captive-bred parrots from South Africa, which is a huge producer and exporter of parrots. According to CITES-reported figures, in 2020, imports into the UAE from South Africa involved over 11,000 parrots from 80 different species. Significant numbers of parrots and other live birds are also imported from other countries in the Middle East, Europe, and South America. Parrots arriving from these regions include those sourced in the wild and bred in captivity. In 2020, over 1,200 wild-sourced parrots of 15 species were reported as imports from Suriname. Although parrots dominate the trade, the live bird trade includes other non-parrot CITES- and non-CITES-listed species. Those who study the trade reported to us that most parrots arrive by plane, using both commercial airlines and secondary airports. Usually when the UAE is a hub, a source told us, the destinations are other Middle Eastern countries, or South and East Asia, including India, Pakistan, and Bangladesh. The legal trade is used to introduce illegal activity. For example, according to this source, who has spent years studying CITES data and patterns in the trade:

- There is misdeclaration of parrot species as non-CITES species on paperwork.
- Mammals are being mixed with bird species and shipped or transported together.

105. Mary Utermohlen and Patrick Baine, *In Plane Sight: Wildlife Trafficking in the Air Transport Sector* (Cambridge: TRAFFIC, 2018), https://www.traffic.org/site/assets/files/10858/in_plane_sight.pdf.

- People responsible for inspecting imports of wildlife are unable to differentiate species to determine if the paperwork matches the birds in the containers.
- Traffickers may seek to disguise CITES Appendix I-listed parrots as other species, for example, by using a fine green mesh netting on containers of gray parrots to make them appear as “green parrots.”¹⁰⁶ This is a finding arising from investigations into the trade in Bangladesh. Similar practices may occur in the UAE, but we don’t have evidence of this.
- You can find permits for species that have already gone extinct—so nothing will be flagged when someone working for CITES types the extinct species’ name into a database.

When reporting issues like these to CITES authorities in various countries, this individual says, sometimes there is no response, and sometimes a statement of “we won’t issue any more permits like this”—but it’s hard to know if the research and reporting has any direct impact on CITES officials. And according to this same source, birds and other high-risk species (in terms of zoonotic disease emergence and transmission) are trafficked together; they cite a recent example of chimpanzees seized with African gray parrots, though this did not involve the UAE. Of further potential zoonotic significance, influenza virus strains have been isolated from different bird species over the last 10 years in UAE, including chickens, falcons, houbara bustards, quail, tone curlews, plovers, doves, and pheasants.¹⁰⁷ Unpublished data from the UAE reports that between 2009 and 2014, 49 strains of H1N1 were isolated from sick human patients.¹⁰⁸ Below, further detail is provided from the literature that establishes clear connections between virus strains in poultry, water fowl, wild and captive-bred prey along with migratory birds, raptors (both wild and kept as pets), and ungulates (sheep, gazelles, camels, goats) raised on small/private farms.

The same aforementioned source describes the supply chain for moving trafficked birds from Africa into and/or through the UAE in this way:

Generally, you have middlemen based in major cities, who have all the connections. They have teams of people they work with in rural areas. They’ll receive an order, make a sale, and might receive an advance, for, say, 500 African Gray Parrots. They’ll have their rural people go out and aggregate in a holding facility until the 500 are reached. Communities might get some kind of payment for traffic/trapping teams to come in, but generally, it’s professional teams who do the trapping. The 500 birds are then moved on to a regional, then national hub as they make their way to the destination, such as the UAE. There, wildlife importers/exporters, like brokers, are connecting with potential importers in final destinations in Bangladesh. These individuals might not ever touch the birds, but they know how to arrange all the permits. For Grey parrots there’s a trade in adult birds and a trade in chicks—taking young birds from a nest. The chicks are potentially more valuable, because they can be habituated to people to make better pets. Young birds taken from the

106. Rowan O. Martin et al., “Tricks of the Trade: Legal Trade Used to Conceal Endangered African Grey Parrots on Commercial Flights,” *Oryx* 53, no. 2 (2019): 213, <https://www.cambridge.org/core/journals/oryx/article/tricks-of-the-trade-legal-trade-used-to-conceal-endangered-african-grey-parrots-on-commercial-flights/5EA97E0F69096A53F2ED06FC70B157CB>.

107. Ulrich Wernery, “Zoonoses in the Arabian Peninsula,” *Saudi Medical Journal* 35, no. 12 (2014): 1455–62, <https://pubmed.ncbi.nlm.nih.gov/25491209/>.

108. Ulrich Wernery, “Zoonoses in the Arabian Peninsula,” *Saudi Medical Journal* 35, no. 12 (2014): 1455–62, <https://pubmed.ncbi.nlm.nih.gov/25491209/>.

wild can be passed off as captive-bred if they are fitted with a ‘closed’ steel leg ring, which are used by captive breeding operations to mark chicks legitimately bred in captivity. The other way is to catch adult birds. These birds are sociable creatures, so trappers can use a lure bird, tame and tied to a tree or the ground, to draw other birds in. Trappers use a sticky ‘glue’ on branches and palm fronds to catch the birds. The primary “flight” feathers of captured adult birds are then cut off. This is a strong indicator later in the supply chain that the birds have been wild-caught. Tail feathers may also be removed because tail feathers can be sold locally—they’re beautiful, scarlet tail feathers. The birds are then put into small baskets made out of palm leaves or wood, transported by bus or back of a bike to a holding room, in a building.

Many birds die during the capture, transport, and holding phase and the birds that are left are the hardy ones, which go on a plane. After that, levels of mortality are much lower. In the regional holding facilities, birds of the same species from different areas can be held together with new ones coming in to reach the desired number, the sick or weaker ones dying among them as the number increases. When the desired number of “hardened” birds is reached, they will be exported by plane.

There are relatively few people in this trade, so they exercise a lot of power and trust each other. The birds are treated in poor and shocking ways. Small things could be done to take better care of them, and I don’t really understand why it doesn’t happen; they’re worth a lot of money. Depending on the country and local laws, the individuals gathering birds may be issued with local permits to conduct trapping activities, etc. To some extent they’ll follow the rules, and they can also get around them.

Birds may die due to stress, dehydration, malnutrition, or disease. It is common for seized birds to have intestinal parasites, which likely spread among the birds due to the poor sanitary conditions. Food may be placed on the floor, under perches, on which birds defecate—there’s a lot of mortality at that stage. In some cases, thousands of birds of dozens of different species are held together in small confined spaces with little ventilation and under very stressful conditions. Some of the exporting countries have reported outbreaks of highly pathogenic avian influenza in wild birds, so it’s bonkers that any country would consider importing or trading in birds this way.

A recent study by the World Parrot Trust aimed to monitor social media to draw inferences about international trade in live birds from West Africa; it is consistent with the supply-chain description above and finds that the scope of transport and trafficking described by the anonymous source above potentially spans every continent. The group surveyed 427 social-media posts, including trade-related content from 2016 to 2020 on a popular social-media platform, to identify which species were promoted, their trade routes, and potential conservation and biosecurity risks. The social media posts featured a

broad taxonomic diversity of birds, including 83 species from 26 avian families; nine of the species have been observed to carry infectious disease of risk to livestock and humans. The researchers found that “social media posts are facilitating connections with potential buyers across the globe. Trade-related engagement was particularly directed from countries in the Middle East and South Asia, notably India, which has strong domestic restrictions on the importation of wild birds.”¹⁰⁹

There is an increase in affluence in the Middle East and Asia driving demand for exotic pets, researchers said, and additional study is needed in order to identify the risks to biodiversity and humans posed by new trade patterns. The group analyzed social media posts featuring West African birds from previously known bird traders over a four-year period to gain insights into patterns of trade and analyzed information on trade routes from post images and text to understand the role of social media in the trade. Researchers identified a total of 427 relevant posts and positively recorded 721 species identifications, including 26 families, 51 genera and 83 species (in 69 cases, species could not be determined with certainty).¹¹⁰ The study demonstrates that exporters in the region have adopted social media to promote trade, with tremendous potential implications for conservation, animal welfare, and biosecurity, as several species are threatened and/or documented vectors of infectious diseases.¹¹¹ In the social media posts monitored, birds were frequently housed in conditions that could promote the development and spread of disease and recombination of viruses, further confirming reports of the anonymous source above, including multiple species densely packed in one room, exported while possibly carrying infectious pathogens that have been picked up while in transit, which risks introducing diseases both to importing and transit countries.¹¹² In another study, when screening for parrot Beak and Feather Disease Virus (BFDV), to their surprise researchers found two different strains until then unknown to wild parrots in the part of the world they were screening, suggesting that the parrots were being infected during the trade.¹¹³ While not known to have zoonotic potential, the transmission of BFDV suggests viral infections are transmitted during trade, and there is significant potential for disease transfer between and among species.¹¹⁴

The noted patterns of interaction and bird movements in this study demonstrate the enormous potential of social media to enable wildlife traffickers in connecting with buyers in multiple countries.¹¹⁵ The study reports that humans in 56 countries across every continent interacted with posts featuring West African birds and used social media to make enquiries about trade. In terms of the potential for spreading highly pathogenic zoonotic disease, the implications are staggering. As the researchers conclude: “This lays bare the extraordinary power of social media platforms to both facilitate and regulate

109. Alisa Davies et al., “Live Wild Bird Exports from West Africa: Insights into Recent Trade from Monitoring Social Media,” *Bird Conservation International* 32, no. 4 (2022): 559–72, <https://ora.ox.ac.uk/objects/uuid:1487bbf0-0997-4f14-8f84-55b5e00654cd>.

110. Alisa Davies et al., “Live Wild Bird Exports from West Africa: Insights into Recent Trade from Monitoring Social Media,” *Bird Conservation International* 32, no. 4 (2022): 559–72, <https://ora.ox.ac.uk/objects/uuid:1487bbf0-0997-4f14-8f84-55b5e00654cd>.

111. Alisa Davies et al., “Live Wild Bird Exports from West Africa: Insights into Recent Trade from Monitoring Social Media,” *Bird Conservation International* 32, no. 4 (2022): 559–72, <https://ora.ox.ac.uk/objects/uuid:1487bbf0-0997-4f14-8f84-55b5e00654cd>.

112. Alisa Davies et al., “Live Wild Bird Exports from West Africa: Insights into Recent Trade from Monitoring Social Media,” *Bird Conservation International* 32, no. 4 (2022): 559–72, <https://ora.ox.ac.uk/objects/uuid:1487bbf0-0997-4f14-8f84-55b5e00654cd>.

113. Alisa Davies et al., “Live Wild Bird Exports from West Africa: Insights into Recent Trade from Monitoring Social Media,” *Bird Conservation International* 32, no. 4 (2022): 559–72, <https://ora.ox.ac.uk/objects/uuid:1487bbf0-0997-4f14-8f84-55b5e00654cd>.

114. Alisa Davies et al., “Live Wild Bird Exports from West Africa: Insights into Recent Trade from Monitoring Social Media,” *Bird Conservation International* 32, no. 4 (2022): 559–72, <https://ora.ox.ac.uk/objects/uuid:1487bbf0-0997-4f14-8f84-55b5e00654cd>.

115. Alisa Davies et al., “Live Wild Bird Exports from West Africa: Insights into Recent Trade from Monitoring Social Media,” *Bird Conservation International* 32, no. 4 (2022): 559–72, <https://ora.ox.ac.uk/objects/uuid:1487bbf0-0997-4f14-8f84-55b5e00654cd>.

wildlife trade and raises questions about where responsibility rests for ensuring online trade does not exacerbate the risks the wildlife trade poses to biodiversity, people, and the economy.”¹¹⁶

Airlines have a major role to play in initiating change, and the current intermixing of species on commercial and private jets—not only multiple species of birds but also trafficking them together with and to hide other high-risk species such as primates, as noted above—increases the risk of transmission and recombination of zoonotic viruses. Moreover, research is consistent with the above reports that CITES controls can be easily manipulated in service of the illegal transport of wildlife. It is likely that officially reported trafficking cases and seizures to date in Dubai, for example, are just the tip of the iceberg in terms of the volume wildlife traffic passing through the airport.¹¹⁷ Conservationist Patricia Tricorache, at the time working for Cheetah Conservation International, said of the report, “In Plane Sight”:

Having worked for 13 years on the illegal cheetah trade along with other species, this study confirms my data in that many animals introduced into the Gulf arrive by air...Many primates are arriving from Asia, including orangutans, slow loris and gibbons, and then primates from Africa such as chimpanzees as well as birds and reptiles...The Gulf seems to be a favored transit route for wildlife products, but mostly as a final destination for live animals. The fact that so many wildlife products get through without being seized indicates either security personnel are not doing their job, or corruption is at work; it’s known that high-level wildlife traffickers use airlines and airports, where paid facilitators ensure that baggage with illicit products will get through. The trend in increased wildlife seizures in airports reflects increased wildlife trafficking...¹¹⁸

“In Plane Sight” iterated the same:

The dearth of live animal seizures in the region, despite the well-known practice in certain Middle Eastern countries of keeping exotic pets as status symbols, may suggest one of the following: that Middle Eastern air seizures of mammals are not publicly released or getting much publicity, that most Middle Eastern customs and enforcement agencies are turning a blind eye to illegal live animal imports, or that many mammal species that are protected elsewhere and banned from trade do not receive the same level of protection in the Middle East. Regardless, the high number of mammal seizures made en route to the Middle East, paired with the low number of seizures on arrival in the region, suggests that most mammal air trafficking into the Middle East goes undetected.¹¹⁹

116. Alisa Davies et al., “Live Wild Bird Exports from West Africa: Insights into Recent Trade from Monitoring Social Media,” *Bird Conservation International* 32, no. 4 (2022): 559–72, <https://ora.ox.ac.uk/objects/uuid:1487bbf0-0997-4f14-8f84-55b5e00654cd>.

117. Nick Webster, “Dubai at Heart of Countering Global Animal Trafficking, Report Finds,” *The National*, August 20, 2018, <https://www.thenationalnews.com/uae/dubai-at-heart-of-countering-global-animal-trafficking-report-finds-1.761970>.

118. Nick Webster, “Dubai at Heart of Countering Global Animal Trafficking, Report Finds,” *The National*, August 20, 2018, <https://www.thenationalnews.com/uae/dubai-at-heart-of-countering-global-animal-trafficking-report-finds-1.761970>.

119. Mary Utermohlen and Patrick Baine, *In Plane Sight: Wildlife Trafficking in the Air Transport Sector* (Cambridge: TRAFFIC, 2018), https://www.traffic.org/site/assets/files/10858/in_plane_sight.pdf.

In fact, common transit hubs such as the Dubai airport are less likely to be able to screen high numbers of passengers, luggage, and shipments between connecting flights, and worse, they may not be reported or even tracked in the first place. According to conservationist Tricorache:

I have information that Muscat airport is used as a transit route from animals from Asia into the GCC. There is a dearth of live animal seizures in the region, despite the well-known practice in certain Middle Eastern countries of keeping exotic pets as status symbols. This may suggest Middle East air seizures of mammals are not publicly released.¹²⁰

Etihad Airways, Qatar Airways, and Emirates have publicly promised to support anti-trafficking campaigns and are attempting to publicize both the inhumane treatment of animals and the criminal networks that are strengthened by trafficking them.^{121 122} However, when we reached out to executives at Etihad Airways for information on their promising initiatives, including employee awareness education on wildlife trafficking detection and reporting, we did not receive any response. Among the country's highest risk of zoonotic spillover, the legal and illegal raptor trade (related to the longstanding tradition of falconry) in the region means that Qatar Airways, Etihad Airways, and Emirates permit raptors in the main cabins of the aircraft; this makes regulating illegal bird trafficking more difficult, to say nothing of the risk of disease, particularly when these falcons have been hunting wild birds in foreign countries. As revealed by the summary of the literature below, wild (and even captive-bred) prey is at risk of highly pathogenic avian flu strains, which additional studies document can be passed on to falcons who are hunting and/or feeding on these birds. Emirates states that "Animals are not permitted in the cabin of Emirates flights, with the exception of falcons between Dubai and certain destinations in Pakistan, and Guide Dogs for the Blind." Etihad Airways states that all falcons seated in the main cabin must come with all the necessary documentation, likely including each bird's own passport. Gulf News reported that between 2002 and 2013, more than 28,000 falcons were issued passports to combat the illicit falcon trade.¹²³

And this brings us to the breathtaking, ancient tradition of falconry in the UAE, and its own regulatory relationship to CITES and existing UAE laws. As it is currently practiced, this deeply revered and hugely important tradition, alongside its beauty and cultural significance, has enormous implications for the emergence, transmission, and spillover of zoonotic disease.

120. Nick Webster, "Dubai at Heart of Countering Global Animal Trafficking, Report Finds," *The National*, August 20, 2018, <https://www.thenationalnews.com/uae/dubai-at-heart-of-countering-global-animal-trafficking-report-finds-1.761970>.

121. Nick Webster, "Dubai at Heart of Countering Global Animal Trafficking, Report Finds," *The National*, August 20, 2018, <https://www.thenationalnews.com/uae/dubai-at-heart-of-countering-global-animal-trafficking-report-finds-1.761970>.

122. Nadine El Sayed, "Middle East Major Hub for Wildlife Trafficking," *Nature Middle East*, September 26, 2018, <https://www.natureasia.com/en/nmiddleeast/article/10.1038/nmiddleeast.2018.120>.

123. Mary Utermohlen and Patrick Baine, *In Plane Sight: Wildlife Trafficking in the Air Transport Sector* (Cambridge: TRAFFIC, 2018), https://www.traffic.org/site/assets/files/10858/in_plane_sight.pdf.

FALCONRY

In the UAE, falcon ownership is skyrocketing. The bird has become a high-priced status symbol, not just among Emiratis, but wealthy expats as well.¹²⁴ Like many pets in the UAE, falcons—expensive as they are—serve as status symbols. At worst, one might see people walking with their falcons around high-end malls in the UAE “just to show them off.” The price of a gyr-peregrine once cost \$10,000 and now goes for double, while “pure gyrs” cost more than \$60,000.¹²⁵ According to one source, among the truly elite in the Middle East, a coveted bloodline can produce a falcon worth a million dollars.

For most, falconry is a family hobby, though trainers are “deathly serious about their falcons.”¹²⁶ “Let me tell you something,” one trainer told journalist Harrison Jacobs at Business Insider, “If my falcon and my son both got sick at the same time, I would have my driver take my son to the hospital, and I would drive my falcon to the animal hospital myself. That’s how important that bird is to me.”¹²⁷

In a training area, pigeon carcasses are thrown around the ground, and typically these pigeons, quail, and chicken comprise the training falcons’ diet.¹²⁸ Per Jacobs: “...one of the workers was methodically cutting through live pigeon after live pigeon, chopping the heads off, plucking the feathers and then cutting them into little morsels that he tossed into a bag for other workers to feed the falcons.” Both before and after such training, “it is not uncommon for cities like Dubai or Abu Dhabi to hire falconers to let loose their birds in the city to cull the pigeon population.”¹²⁹

However, one major source of zoonotic concern is that falcons that are let loose in cities to prey upon potentially infected wild and captive-bred birds are not regularly monitored or tested for disease when traveling via airplane to other countries for purposes of falconry—a common practice. Though we reached out to the well-known falcon hospital in Abu Dhabi for data, information, and either confirmation or otherwise, we were told they could not assist us.

One of our sources, as part of long-term research into how CITES permits work in the UAE, reported the following:

I went to the airport’s CITES authorities to question how it all works with CITES permits, and found that in the basement/entrance hall there is a computer section and you actually fill in your own permits—you do everything yourself, in fact, and, someone else signs it remotely. Nobody really controls anything. When I asked (I’d never seen any other country

124. Harrison Jacobs, “I Woke Up at Dawn to Follow a Top Falconer Training the Fastest Creatures on Earth to Compete for \$7 Million in Prizes, and Found the Middle East’s Oldest Pastime Grisly and Thrilling,” Business Insider, January 16, 2019, <https://www.businessinsider.com/middle-east-falcons-uae-training-2019-1#:~:text=In%20the%20UAE%20falconers%20train,to%20fancy%20European%20sports%20cars>.

125. Harrison Jacobs, “I Woke Up at Dawn to Follow a Top Falconer Training the Fastest Creatures on Earth to Compete for \$7 Million in Prizes, and Found the Middle East’s Oldest Pastime Grisly and Thrilling,” Business Insider, January 16, 2019, <https://www.businessinsider.com/middle-east-falcons-uae-training-2019-1#:~:text=In%20the%20UAE%20falconers%20train,to%20fancy%20European%20sports%20cars>.

126. Harrison Jacobs, “I Woke Up at Dawn to Follow a Top Falconer Training the Fastest Creatures on Earth to Compete for \$7 Million in Prizes, and Found the Middle East’s Oldest Pastime Grisly and Thrilling,” Business Insider, January 16, 2019, <https://www.businessinsider.com/middle-east-falcons-uae-training-2019-1#:~:text=In%20the%20UAE%20falconers%20train,to%20fancy%20European%20sports%20cars>.

127. Harrison Jacobs, “I Woke Up at Dawn to Follow a Top Falconer Training the Fastest Creatures on Earth to Compete for \$7 Million in Prizes, and Found the Middle East’s Oldest Pastime Grisly and Thrilling,” Business Insider, January 16, 2019, <https://www.businessinsider.com/middle-east-falcons-uae-training-2019-1#:~:text=In%20the%20UAE%20falconers%20train,to%20fancy%20European%20sports%20cars>.

128. Harrison Jacobs, “I Woke Up at Dawn to Follow a Top Falconer Training the Fastest Creatures on Earth to Compete for \$7 Million in Prizes, and Found the Middle East’s Oldest Pastime Grisly and Thrilling,” Business Insider, January 16, 2019, <https://www.businessinsider.com/middle-east-falcons-uae-training-2019-1#:~:text=In%20the%20UAE%20falconers%20train,to%20fancy%20European%20sports%20cars>.

129. Harrison Jacobs, “I Woke Up at Dawn to Follow a Top Falconer Training the Fastest Creatures on Earth to Compete for \$7 Million in Prizes, and Found the Middle East’s Oldest Pastime Grisly and Thrilling,” Business Insider, January 16, 2019, <https://www.businessinsider.com/middle-east-falcons-uae-training-2019-1#:~:text=In%20the%20UAE%20falconers%20train,to%20fancy%20European%20sports%20cars>.

do this), I was told that so many were traveling with their falcons on their hunts, and flying on private jets, so paperwork has to be done fast. Everything comes back basically approved through the computer, and off they go. Falcon business is why CITES permits have streamlined to the point of being meaningless.

This source is referring to a new registration scheme introduced in the UAE for owners of birds of prey, locally known as the Falcon Passport. Because of the birds' frequent cross-border movements for falconry, a certificate of ownership was developed in accordance with CITES Resolution 10.20: Frequent Cross-Border Movements of Personally Owned Animals. The process involves an initial registration process to confirm the legality of the individual bird of prey, but once this is complete, a Falcon Passport is issued allowing for multiple cross-border movements of individual birds without the burden of issuing CITES permits for each trip. Some countries don't recognize these travel documents, and in these cases, CITES permits are issued. This streamlined process is very troubling in terms of the zoonotic disease risk, particularly when taken in combination with these birds traveling in the main cabin of airplanes—both private and commercial—after having hunted wild birds that studies have shown are infected with highly pathogenic viruses, and which are passed into falcons in the process.

Indeed, hunting practices in the UAE, both via falcons and other modes (explored further below) are of serious zoonotic significance. Years ago, before guns and cars entered the hunting equation, Emirati would practice falconry with their camels.¹³⁰ Back then, hunting was a matter of survival in the desert—of procuring food—and had profound cultural implications related to storytelling and peacemaking.¹³¹ Some hunting grounds, for example in Abu Dhabi's Western Region, are trying to revive the old traditional ways of falconry. The hunting grounds are open to anyone, fenced off inside a nature preserve protected by the Abu Dhabi Environmental Agency. "The hunting grounds are inside Al Marzoum, a 933-square-kilometer nature reserve protected by the Environment Agency - Abu Dhabi (EAD)," said Dr. Shaikha Al Dhaheri, executive director of terrestrial and marine biodiversity at EAD. The hunting area itself is 200 square kilometers populated with houbara bustards from the National Avian Research Centre, which is also a risk factor. Hunting wild houbara bustards is illegal, but captive-bred houbara are stocked on the hunting ground, beginning with the release of 80 when the center was established.¹³²

The practice is now widespread and an example of trying to balance hunting and conservation; the reserve is managed by Abu Dhabi's Ministry of Climate Change and Environment. Rabbits, houbara bustards, and karawan are either bred on-site or bought from other government-regulated breeders and then released into the desert, where wild animals, including deer, also roam across 200 square kilometers.¹³³ In 2018, over 1,300 people visited the hunting ground, both from the UAE and neighboring Gulf states, and they could rent SUVs or camels. If a visitor doesn't have their own falcon, they go out

130. Silvia Radan, "Try Falcon Hunting the Traditional Way," Khaleej Times, updated February 27, 2016, <https://www.khaleejtimes.com/uae/try-falcon-hunting-the-traditional-way>.

131. Silvia Radan, "Try Falcon Hunting the Traditional Way," Khaleej Times, updated February 27, 2016, <https://www.khaleejtimes.com/uae/try-falcon-hunting-the-traditional-way>.

132. Silvia Radan, "Try Falcon Hunting the Traditional Way," Khaleej Times, updated February 27, 2016, <https://www.khaleejtimes.com/uae/try-falcon-hunting-the-traditional-way>.

133. Ulrich Wernery, "Zoonoses in the Arabian Peninsula," Saudi Medical Journal 35, no. 12 (2014): 1455–62, <https://pubmed.ncbi.nlm.nih.gov/25491209/>.

with guides and trainers who do.¹³⁴

Falconry, the birds, and the traditions and skills passed down through generations are both revered and very expensive, ranging from ten to hundreds of thousands of dollars, and a falcon is considered a cherished pet, even a family member, who lives (as most pets in the UAE do) alongside humans in their homes. One source told us, on the subject of zoonotic disease spreading via falconry, that the tradition and practice itself will never end, but that “when disease starts taking out million-dollar birds, people may finally start to pay attention to the risk.”

A 2011 study highlights the risk. For the first time, researchers reproduced natural infection in falcons via feeding on infected prey. The results demonstrated that gyr-saker hybrid falcons are highly susceptible to H5N1 HPAI virus infection and may play a significant role in the spreading of HPAI and LPAI viruses. Gallinaceous poultry are considered to be highly susceptible, whereas waterfowl have long been recognized as natural reservoirs, although they may show variable morbidity depending on the infective viral strain.¹³⁵ According to the study, “The use of avian prey species in falconry husbandry and wildlife rehabilitation facilities could put valuable birds of prey and humans at risk and, therefore, this practice should be closely monitored.”¹³⁶ The study also indicates that while in the past, HPAI viruses have rarely been discovered in birds of prey, recent H5N1 outbreaks have revealed a growing number of infected birds of prey, probably as a result of sampling and diagnostic improvements.¹³⁷

It is well known that migration of infected wild birds is one of the mechanisms in the spreading of AI viruses, thus many falcon species may contribute to the movement of both HPAI and LPAI viruses within, or between countries. Wild birds of prey are at an increased risk of acquiring AI viruses because they regularly feed on avian carcasses and diseased avian prey. In falconry, birds of prey are kept in captivity and come into close contact with humans. Although there is still no direct evidence of virus transmission from falcons to humans, birds of prey could represent a bridging species for AI viruses and, consequently, the practice of falconry may pose an enhanced risk of transmission to humans and poultry.

Researchers reported that the infectious dose the falcons were exposed to via feeding was comparable to doses wild falcons would be exposed to when feeding on infected wild prey, and also similar to clinically admitted falcons in wildlife rehabilitation centers and among falcons raised for sport.¹³⁸ The study concludes that:

- Infected falcons shedding AI virus could represent a risk for humans and other valuable bird species when admitted to wildlife rehabilitation centers or during shipping in the falconry trade.

134. Dean Irvine, “Desert Hunting with the Falcons of Abu Dhabi,” CNN, December 13, 2019, <https://www.cnn.com/travel/article/falcon-hunting-abu-dhabi/index.html>.

135. Kateri Bertran et al., “Highly (H5N1) and Low (H7N2) Pathogenic Avian Influenza Virus Infection in Falcons Via Nasochoanal Route and Ingestion of Experimentally Infected Prey,” PLoS ONE 7, no. 3 (2012): e32107, <https://pubmed.ncbi.nlm.nih.gov/22427819/>.

136. Kateri Bertran et al., “Highly (H5N1) and Low (H7N2) Pathogenic Avian Influenza Virus Infection in Falcons Via Nasochoanal Route and Ingestion of Experimentally Infected Prey,” PLoS ONE 7, no. 3 (2012): e32107, <https://pubmed.ncbi.nlm.nih.gov/22427819/>.

137. Kateri Bertran et al., “Highly (H5N1) and Low (H7N2) Pathogenic Avian Influenza Virus Infection in Falcons Via Nasochoanal Route and Ingestion of Experimentally Infected Prey,” PLoS ONE 7, no. 3 (2012): e32107, <https://pubmed.ncbi.nlm.nih.gov/22427819/>.

138. Kateri Bertran et al., “Highly (H5N1) and Low (H7N2) Pathogenic Avian Influenza Virus Infection in Falcons Via Nasochoanal Route and Ingestion of Experimentally Infected Prey,” PLoS ONE 7, no. 3 (2012): e32107, <https://pubmed.ncbi.nlm.nih.gov/22427819/>.

- The species, whether wild or in captivity, should be included in passive surveillance programs in order to prevent transmission risk to humans and other wild bird species, and to minimize the threat of spreading disease, particularly of HPAI viruses within and among countries via the animal trade or natural movements.¹³⁹

Another recent study shows that houbara—a bird coveted by falconers for its purported aphrodisiac qualities—can also be infected by HPAIV H5N1. Unintentionally, an outbreak of HPAIV H5N1 in 2009 was introduced into Saudi Arabia via houbara intended for falconry sport. It was not possible to assess how these houbara became infected, but researchers presume they were infected during transit, as these birds are illegally transported in poor conditions, including intermixing of multiple bird species.¹⁴⁰

In this study, 93% of the houbara and 62.5% of the falcons that came into contact with the birds died. These falcons were in contact with the houbara bustards at the outbreak sites or were fed with carcasses of houbara bustards from the infected group.¹⁴¹ Until this study, there had been no reports of HPAIV in houbara bustards in the literature.¹⁴² Typically, wild houbara bustards are trapped in countries such as Pakistan, Iran, and Afghanistan and illegally exported to Middle East countries where they are used by falconers to train their falcons.¹⁴³

Birds of prey are at higher risk for infection of highly pathogenic avian influenza viruses because they feed on avian carcasses, including diseased avian carcasses, and prey. Being migratory, both the birds of prey and the prey cover extensive territories within and across national borders. “In this respect,” researchers conclude, “birds of prey represent a bridging species and may pose a risk of transmitting a virus to humans or to other captive avian species, including poultry.”¹⁴⁴ They add:

Although it is obvious that birds of prey can be infected with HPAI viruses, the pathogenic potential in these species remains unclear. Free-ranging birds frequently suffer from other concurrent diseases or starvation, and captive birds undergo stressful periods due to rearing conditions or training. These situations may immunocompromise the birds, leading to vulnerability. However, their potential to shed virus after infection, which is important to virus transmission, potentially also to humans, remains unclear.

These researchers demonstrated that falcons are highly susceptible to HPAI viruses; all non-vaccinated birds exposed died after five days, though clinical signs were “mild and indicated only by a reduced food intake, which is not considered very obvious as falcons do not typically eat every day.

139. Kateri Bertran et al., “Highly (H5N1) and Low (H7N2) Pathogenic Avian Influenza Virus Infection in Falcons Via Nasochoanal Route and Ingestion of Experimentally Infected Prey,” *PLoS ONE* 7, no. 3 (2012): e32107, <https://pubmed.ncbi.nlm.nih.gov/22427819/>.

140. Owais Ahmed Khan et al., “Isolation and Identification of Highly Pathogenic Avian Influenza H5N1 Virus from Houbara Bustards (*Chlamydotis undulata macqueenii*) and Contact Falcons,” *Avian Pathology* 38, no. 1 (2009): 35–9, <https://pubmed.ncbi.nlm.nih.gov/19130352/>.

141. Owais Ahmed Khan et al., “Isolation and Identification of Highly Pathogenic Avian Influenza H5N1 Virus from Houbara Bustards (*Chlamydotis undulata macqueenii*) and Contact Falcons,” *Avian Pathology* 38, no. 1 (2009): 35–9, <https://pubmed.ncbi.nlm.nih.gov/19130352/>.

142. Owais Ahmed Khan et al., “Isolation and Identification of Highly Pathogenic Avian Influenza H5N1 Virus from Houbara Bustards (*Chlamydotis undulata macqueenii*) and Contact Falcons,” *Avian Pathology* 38, no. 1 (2009): 35–9, <https://pubmed.ncbi.nlm.nih.gov/19130352/>.

143. Owais Ahmed Khan et al., “Isolation and Identification of Highly Pathogenic Avian Influenza H5N1 Virus from Houbara Bustards (*Chlamydotis undulata macqueenii*) and Contact Falcons,” *Avian Pathology* 38, no. 1 (2009): 35–9, <https://pubmed.ncbi.nlm.nih.gov/19130352/>.

144. Michael Lierz et al., “Protection and Virus Shedding of Falcons Vaccinated Against Highly Pathogenic Avian Influenza A Virus (H5N1),” *Emerging Infectious Diseases* 13, no. 11 (2007): 1667–74, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3375792/>.

Signs will not be seen in free-ranging birds and may be overlooked in captive animals.”¹⁴⁵ Ultimately, the researchers concluded that falcons can be protected by vaccine, but that using vaccines in this capacity will require “an appropriate surveillance program that includes use of serologic testing, PCR, and sentinel birds.”¹⁴⁶

In Dubai, an additional study reported and investigated a 2014 outbreak of HPAIV H5N1 among falcons kept for hunting and other wild species bred as falcon prey, and found that the outbreak was likely related to intercontinental westward spread of the viruses from unknown sources in Asia, preceding outbreaks in Nigeria and other West African countries.¹⁴⁷ The gyr-falcons and hybrids of gyr and peregrine had likely returned from hunting trips in central Asian countries where they encountered free-ranging houbara. Moreover, the viruses detected in Dubai were characterized by 23 “aa” substitution mutations, which have been predicted to correlate with enhanced virulence in mice.¹⁴⁸ These scientists conclude:

The observed high geographical mobility of certain HPAIV H5 lineage of Asian origin should be both an incentive and a warning to continue and to arrange for new internationally concerted and intensified AIV surveillance programmes in poultry and wild bird populations. Hunting falcons and bred prey populations should essentially be included in such programs.

A 2018 study discovered and sequenced four deltacoronaviruses from birds in the Middle East, revealing interspecies “jumping with recombination” as a possible mechanism not only for avian-to-avian but also avian-to-mammalian transmission.¹⁴⁹ Prompted by the emergence of MERS-CoV and exploring the diversity of deltacoronaviruses in animals in the Middle East, researchers tested fecal samples from 1,356 mammals and birds in Dubai.¹⁵⁰ The literature reports:

During an attempt to explore the diversity of deltacoronaviruses among mammals and birds in Dubai, four novel deltacoronaviruses were detected in fecal samples from eight birds of four different species: FalCoV UAE-HKU27 from a falcon, HouCoV UAE-HKU28 from a houbara bustard, PiCoV UAE-HKU29 from a pigeon, and QuaCoV UAE-HKU30 from five quails. Genome analysis revealed evidence of recent interspecies transmission between falcons and their prey, houbara bustards and pigeons, possibly along the food chain, as well as avian-to-swine transmission. Recombination, which is known to occur

145. Michael Lierz et al., “Protection and Virus Shedding of Falcons Vaccinated Against Highly Pathogenic Avian Influenza A Virus (H5N1),” *Emerging Infectious Diseases* 13, no. 11 (2007): 1667–74, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3375792/>.

146. Michael Lierz et al., “Protection and Virus Shedding of Falcons Vaccinated Against Highly Pathogenic Avian Influenza A Virus (H5N1),” *Emerging Infectious Diseases* 13, no. 11 (2007): 1667–74, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3375792/>.

147. Mahmoud M. Naguib et al., “Outbreaks of Highly Pathogenic Avian Influenza H5N1 Clade 2.3.2.1c in Hunting Falcons and Kept Wild Birds in Dubai Implicate Intercontinental Virus Spread,” *Journal of General Virology* 96, no. 11 (2015): 3212–22, <https://pubmed.ncbi.nlm.nih.gov/26350163/>.

148. Mahmoud M. Naguib et al., “Outbreaks of Highly Pathogenic Avian Influenza H5N1 Clade 2.3.2.1c in Hunting Falcons and Kept Wild Birds in Dubai Implicate Intercontinental Virus Spread,” *Journal of General Virology* 96, no. 11 (2015): 3212–22, <https://pubmed.ncbi.nlm.nih.gov/26350163/>.

149. Susanna K. P. Lau et al., “Discovery and Sequence Analysis of Four Deltacoronaviruses from Birds in the Middle East Reveal Interspecies Jumping with Recombination as a Potential Mechanism for Avian-to-Avian and Avian-to-Mammalian Transmission,” *Journal of Virology* 92, no. 15 (2018): e00265-18, <https://pubmed.ncbi.nlm.nih.gov/29769348/>.

150. Susanna K. P. Lau et al., “Discovery and Sequence Analysis of Four Deltacoronaviruses from Birds in the Middle East Reveal Interspecies Jumping with Recombination as a Potential Mechanism for Avian-to-Avian and Avian-to-Mammalian Transmission,” *Journal of Virology* 92, no. 15 (2018): e00265-18, <https://pubmed.ncbi.nlm.nih.gov/29769348/>.

frequently in some coronaviruses, was also common among these deltacoronaviruses and occurred predominantly at the spike region. Such recombination, involving the receptor binding protein, may contribute to the emergence of new viruses capable of infecting new hosts. Birds in the Middle East are hosts for diverse deltacoronaviruses with potential for interspecies transmission.¹⁵¹

In other words, because of flocking and traveling over long distances, birds—reservoirs of major emerging viruses (e.g., avian influenza viruses)—can spread emerging viruses efficiently among themselves, to other animals, and to humans. Birds in the Middle East are also hosts to a diversity of deltacoronaviruses.¹⁵²

The intermixing of wild birds, captive-bred birds, and falcons center around the aforementioned houbara bustard, which falconers train their birds to hunt because they believe that the meat possesses aphrodisiac qualities. Bird meat is sold at high prices, despite the banning of such controversial practices in some countries.¹⁵³ Unsurprisingly, houbara populations drastically declined in recent decades because of such overhunting, alongside habitat degradation and poaching (Hingrat et al., 2007). In response, houbara captive-breeding programs have been steadily and increasingly implemented in North Africa, the Middle East, and Central Asia, including within the UAE, so the size of captive flocks has been growing, from hundreds of initial founder stock to thousands of adult breeders who produce some 20,000 juveniles annually.¹⁵⁴

The large-scale captive breeding of wild endangered species pose unprecedented challenges, especially in maintaining a high level of biosecurity while preserving a high-quality management of every captive individual. However, these programs also offer opportunities to study and gather epidemiological and physiopathological information on infectious diseases.¹⁵⁵

Another important study provides for the first time the epidemiological description of repeated pox disease outbreaks among captive-bred houbara over several years and across different sites, including in Morocco and the UAE—and this despite the high vaccination and biosecurity levels among the birds.¹⁵⁶ At both sites, the following biosecurity measures were applied:

- Epidemiological units defined according to fate (breeder versus future released individual) and disease sensitivity of birds (juveniles versus adults);

151. Susanna K. P. Lau et al., “Discovery and Sequence Analysis of Four Deltacoronaviruses from Birds in the Middle East Reveal Interspecies Jumping with Recombination as a Potential Mechanism for Avian-to-Avian and Avian-to-Mammalian Transmission,” *Journal of Virology* 92, no. 15 (2018): e00265-18, <https://pubmed.ncbi.nlm.nih.gov/29769348/>.

152. Susanna K. P. Lau et al., “Discovery and Sequence Analysis of Four Deltacoronaviruses from Birds in the Middle East Reveal Interspecies Jumping with Recombination as a Potential Mechanism for Avian-to-Avian and Avian-to-Mammalian Transmission,” *Journal of Virology* 92, no. 15 (2018): e00265-18, <https://pubmed.ncbi.nlm.nih.gov/29769348/>.

153. Susanna K. P. Lau et al., “Discovery and Sequence Analysis of Four Deltacoronaviruses from Birds in the Middle East Reveal Interspecies Jumping with Recombination as a Potential Mechanism for Avian-to-Avian and Avian-to-Mammalian Transmission,” *Journal of Virology* 92, no. 15 (2018): e00265-18, <https://pubmed.ncbi.nlm.nih.gov/29769348/>.

154. G. Le Loc'h et al., “Outbreaks of Pox Disease Due to Canarypox-Like and Fowlpox-Like Viruses in Large-Scale Houbara Bustard Captive-Breeding Programmes, in Morocco and the United Arab Emirates,” *Transboundary and Emerging Diseases* 63, no. 6 (2016): e187–96, <https://pubmed.ncbi.nlm.nih.gov/25651753/>.

155. G. Le Loc'h et al., “Outbreaks of Pox Disease Due to Canarypox-Like and Fowlpox-Like Viruses in Large-Scale Houbara Bustard Captive-Breeding Programmes, in Morocco and the United Arab Emirates,” *Transboundary and Emerging Diseases* 63, no. 6 (2016): e187–96, <https://pubmed.ncbi.nlm.nih.gov/25651753/>.

156. G. Le Loc'h et al., “Outbreaks of Pox Disease Due to Canarypox-Like and Fowlpox-Like Viruses in Large-Scale Houbara Bustard Captive-Breeding Programmes, in Morocco and the United Arab Emirates,” *Transboundary and Emerging Diseases* 63, no. 6 (2016): e187–96, <https://pubmed.ncbi.nlm.nih.gov/25651753/>.

- Sanitary measures implemented per unit: barriers (changing room, disinfectant mats for vehicles and staff, etc.) at interfaces, both outdoors and between each epidemiological unit; staff and equipment dedicated to each unit; one-way management;
- Cleaning, disinfection, and pest control regularly applied;
- Facility access to wild birds controlled;
- Birds housed in individual cages or in small groups in large aviaries;
- Medical management includes a daily control of every bird and isolating and treating each infected bird.¹⁵⁷

Hundreds of technicians worked to guarantee good individual bird care. Even so, the study found that pox cases broke out during more than half of the year (88% of the year in Morocco, 61% in the UAE), and that seasonal increase of the incidence of infection took place every year.¹⁵⁸ Exposure to vectors—increasingly difficult to control given climate change—may be attributed to the infection spread. Importantly, many poultry farms and private collections of exotic birds of unknown biosecurity levels are nearby—six poultry farms are located between six and 12 kilometers from one of the houbara captive-breeding projects. The sites also attract wild birds such as sparrows and pigeons. Researchers also found the houbara to be sensitive to a wide diversity of APV strains, especially FWPV-like viruses, and state that this finding is of particular concern.

In this particular study, four additional novel deltacoronaviruses were detected in fecal samples from falcons, houbara bustards, pigeons, and quails in Dubai. Researchers in this study also conclude that the interspecies transmission of these coronavirus species is likely a result of the predator-and-prey relationship. In fact, the researchers say, recent interspecies jumping events were observed in the deltacoronaviruses among falcons, houbara bustards, and pigeons, very probably a result of predator-and-prey relationships along the food chain. “Continuous surveillance studies on birds in the Middle East and other regions will help to better understand the viral and host diversity of deltacoronaviruses and their potential for emergence in mammals.”¹⁵⁹

A research project conducted at the National Avian Research Center, a captive-bred houbara project in the UAE, focused on evaluating risks associated with poultry farms being exposed to wild birds. The study revealed that captive houbara had a “relatively high risk of being exposed to pathogens by wild birds,” even if housed in netted aviaries to protect them from direct contact with wild birds. Holes in the nets, improper door seals, and human mistakes all allow for wild birds such as sparrows to get inside for food and water, both directly contacting the houbara and contaminating food and water.¹⁶⁰ The researchers conclude:

157. G. Le Loc'h et al., “Outbreaks of Pox Disease Due to Canarypox-Like and Fowlpox-Like Viruses in Large-Scale Houbara Bustard Captive-Breeding Programmes, in Morocco and the United Arab Emirates,” *Transboundary and Emerging Diseases* 63, no. 6 (2016): e187–96, <https://pubmed.ncbi.nlm.nih.gov/25651753/>.

158. G. Le Loc'h et al., “Outbreaks of Pox Disease Due to Canarypox-Like and Fowlpox-Like Viruses in Large-Scale Houbara Bustard Captive-Breeding Programmes, in Morocco and the United Arab Emirates,” *Transboundary and Emerging Diseases* 63, no. 6 (2016): e187–96, <https://pubmed.ncbi.nlm.nih.gov/25651753/>.

159. Susanna K. P. Lau et al., “Discovery and Sequence Analysis of Four Deltacoronaviruses from Birds in the Middle East Reveal Interspecies Jumping with Recombination as a Potential Mechanism for Avian-to-Avian and Avian-to-Mammalian Transmission,” *Journal of Virology* 92, no. 15 (2018): e00265-18, <https://pubmed.ncbi.nlm.nih.gov/29769348/>.

160. Julien Hirschinger et al., “Exposure Assessment for Avian Influenza and Newcastle Disease Viruses from Peridomestic Wild Birds in a Conservation Breeding Site in the United Arab Emirates,” *Transboundary and Emerging Diseases* 69, no. 4 (2022): 2361–72, <https://pubmed.ncbi.nlm.nih.gov/34333870/>.

These results also confirm the importance of known pathways of exposure for outdoor poultry (direct contacts and feces-contaminated water) and reaffirm the need to implement sanitary measures to limit exposure of captive birds to wild birds...They also highlight the need for further research dedicated to the pathogens circulating in the Middle East and to the role of poultry farms as a reservoir of pathogens for wild birds.¹⁶¹

UNGULATES

Ungulates—wild, captive-bred, and livestock—in UAE ungulate facilities have also been subject to a recent study, though broadly speaking, such research remains limited; researchers on this project between 2014 and 2015 claim to be the first.¹⁶² They aimed in part to describe biosecurity measures in ungulate facilities in the UAE, but report that the overall number of captive wild ungulates is difficult to assess as there is no registration system in place or enforced in the UAE with regard to the possession of wildlife.¹⁶³ Captive-bred and wild ungulates tend to be in animal collections owned by elite families, and these can exceed 30,000 animals in a single location. Between October 2014 and May 2015, biosecurity questionnaire data were collected in the Emirates of Abu Dhabi, Dubai, Ras Al Khaimah, Fujairah, Ajman, Umm al Quwain and Sharjah from 14 wildlife collections, 30 livestock farms, and 15 mixed (wildlife and livestock) farms. Groups studied—all within the UAE—were defined as “livestock” (farms or ezbas including sheep, goats, cows, and camels), “wildlife collection” (with at least one wild ungulate species, such as gazelles or oryx), and “both” (a combination of wildlife and livestock).

Researchers found statistically different biosecurity measures across these groups, and looked at the following:

- Awareness of biosecurity
- Pest control plan
- Isolation of sick animals
- Disease-screening program
- Fencing system
- Buffer zone
- Distance to other farms (at least 500 meters)

Most of the ezbas were at that time unregistered (the UAE is now requiring registration of all ezbas or small private farms) and skewed toward a score of “0,” or no biosecurity. These farms are managed with the help of poorly qualified workers, are located in small numbers in desert areas, or can be aggregated in the hundreds in areas specifically designated for this kind of facility. In the study, researchers found one ezba overseeing 50–200 ruminants and with zero biosecurity measures. These

161. Julien Hirschinger et al., “Exposure Assessment for Avian Influenza and Newcastle Disease Viruses from Peridomestic Wild Birds in a Conservation Breeding Site in the United Arab Emirates,” *Transboundary and Emerging Diseases* 69, no. 4 (2022): 2361–72, <https://pubmed.ncbi.nlm.nih.gov/34333870/>.

162. AL Chaber and C Saegerman, “Biosecurity Measures Applied in the United Arab Emirates: A Comparative Study Between Livestock and Wildlife Sectors,” *Transboundary and Emerging Diseases* 64, no. 4 (2017): 1184–90, <https://pubmed.ncbi.nlm.nih.gov/26961479/>.

163. AL Chaber and C Saegerman, “Biosecurity Measures Applied in the United Arab Emirates: A Comparative Study Between Livestock and Wildlife Sectors,” *Transboundary and Emerging Diseases* 64, no. 4 (2017): 1184–90, <https://pubmed.ncbi.nlm.nih.gov/26961479/>.

animals are transported in-country to local markets for Ramadan, Eid, and other festivities. Researchers concluded that “this group represents a very high risk of spreading disease to any other farms in their vicinity” and that in wildlife and livestock sectors, almost all biosecurity measures need significant improvement.¹⁶⁴ Most of the wildlife-only “farms” are owned by high-ranking, wealthy families and better managed, but the number and species were not reported because of it being “politically sensitive.”¹⁶⁵ Furthermore, despite better disease screening, these wild animals are being “brought from all over the world” (the number of animals brought in from the Horn of Africa is 10 times greater than intraregional trade), so this might be the source of new and emerging diseases, including potentially zoonotic diseases. Among these wildlife collections, diseases screened for and methods used for screening were left up to the veterinarian or manager.¹⁶⁶ All three groups needed improvement in properly enforcing quarantine amid continual arrival of new animals, and the quarantine enclosures themselves needed improvement. Food was often stored out in the open, which attracts pests and pathogen vectors. According to this group of researchers: “Although free-roaming wildlife is often seen as the source of contagious diseases, human activities and disrespect of biosecurity measures are enhancing disease transmission and thus should be the central pillar of actions regarding disease control and prevention.”¹⁶⁷

A 2020 paper analyzes three episodes of foot and mouth disease among captive-bred oryx in a wild ungulate breeding facility east of Abu Dhabi.¹⁶⁸ As a result of habitat degradation, competition with livestock, hunting, and civil unrest, the once plentiful scimitar-horned oryx was brought to extinction in the wild during the 20th century and the species now relies on captive breeding. In addition to trophy hunting ranches in Texas, a great number of the world’s scimitar-horned oryx reside in the UAE. A complex of hundreds of ezbas was 3900 meters east of the studied breeding facility. In the facility were:

- 7931 Indian black-buck antelope in 13 pens;
- 3894 scimitar-horned oryx in 11 pens;
- 1300 reem gazelles in four pens;
- 258 mountain gazelles and Indian gazelles in five pens;
- 11 urial sheep in one pen; and
- 4 Arabian oryx in one pen.¹⁶⁹

None of the animals were vaccinated or screened for foot-and-mouth disease. While not a disease of zoonotic concern, this study is of interest because researchers attribute these three viral

164. AL Chaber and C Saegerman, “Biosecurity Measures Applied in the United Arab Emirates: A Comparative Study Between Livestock and Wildlife Sectors,” *Transboundary and Emerging Diseases* 64, no. 4 (2017): 1184–90, <https://pubmed.ncbi.nlm.nih.gov/26961479/>.

165. AL Chaber and C Saegerman, “Biosecurity Measures Applied in the United Arab Emirates: A Comparative Study Between Livestock and Wildlife Sectors,” *Transboundary and Emerging Diseases* 64, no. 4 (2017): 1184–90, <https://pubmed.ncbi.nlm.nih.gov/26961479/>.

166. AL Chaber and C Saegerman, “Biosecurity Measures Applied in the United Arab Emirates: A Comparative Study Between Livestock and Wildlife Sectors,” *Transboundary and Emerging Diseases* 64, no. 4 (2017): 1184–90, <https://pubmed.ncbi.nlm.nih.gov/26961479/>.

167. AL Chaber and C Saegerman, “Biosecurity Measures Applied in the United Arab Emirates: A Comparative Study Between Livestock and Wildlife Sectors,” *Transboundary and Emerging Diseases* 64, no. 4 (2017): 1184–90, <https://pubmed.ncbi.nlm.nih.gov/26961479/>.

168. Louis Lignereux et al., “Foot-and-mouth Disease Outbreaks in Captive Scimitar-horned Oryx (*Oryx dammah*),” *Transboundary and Emerging Diseases* 67 (2020): 1716–24, <https://orbi.uliege.be/bitstream/2268/258334/1/tbed.13502.pdf>.

169. Louis Lignereux et al., “Foot-and-mouth Disease Outbreaks in Captive Scimitar-horned Oryx (*Oryx dammah*),” *Transboundary and Emerging Diseases* 67 (2020): 1716–24, <https://orbi.uliege.be/bitstream/2268/258334/1/tbed.13502.pdf>.

outbreaks to hundreds of sand gazelles that moved in during 2012 and 2013 (i.e., wild animals mixed among captive-bred animals), and proximity to roadways where livestock transit and ezbas.¹⁷⁰

CAMELS

Camels are ungulates of particular interest in the UAE, both because of their centuries-long connection with humans of the region, and also because of the Middle East Respiratory Syndrome coronavirus (MERS-CoV), first identified in Saudi Arabia in 2012.¹⁷¹ MERS-CoV is a zoonotic virus and a major reservoir for spillover.¹⁷² The United Arab Emirates has reported several outbreaks of MERS-CoV and has so far had the third highest number of confirmed human cases, second to Saudi Arabia and South Korea. Previous testing of 7803 camels from February to March 2014 from zoos, public escorts, slaughterhouses, and the borders with Saudi Arabia and Oman performed in the Emirate of Abu Dhabi showed that the highest MERS-CoV positivity rate among camels was seen at slaughterhouses, 8.25%. In Abu Dhabi between 2013 and 2014, six clusters of human-to-human transmission were also identified. Studies have demonstrated the relationship of the virus in camels and the introduction of the virus in humans. In February 2015, a German traveler was infected with MERS-CoV after visiting a market and died from the infection. Because MERS-CoV cases and outbreaks seem to arise from multiple and ongoing zoonotic transmissions, researchers emphasize the need for large-scale sequencing efforts to understand the diversity of MERS-CoV virus strains; their analysis demonstrates that livestock markets “may actively participate in the spread of MERS-CoV among camels and/or humans.” In multiple studies, the diversity of MERS-CoV strains in humans is “mirrored in the camel population... [supporting] the hypothesis that some human MERS-CoV infections are a result of multiple independent transmissions from camels.¹⁷³ MERS-CoV seropositivity is not fully understood and some data describe more MERS-CoV variants among camels than in humans, suggesting that only a subset of these variants can be transmitted to and replicated in humans.¹⁷⁴ Many studies and analyses suggest camel exposure is associated with MERS-CoV, but in fact “the exact mechanisms of transmission are not fully understood.”¹⁷⁵ Some findings suggest that the prevalence of human MERS-CoV infection has been underestimated in settings with camels, such as markets, slaughterhouses,¹⁷⁶ and presumably among racing camels that are bred and raised locally on ezbas. Human-to-human transmission of MERS seems to occur most often in healthcare settings. The data and evidence currently available are not sufficient “to

170. Louis Lignereux et al., “Foot-and-mouth Disease Outbreaks in Captive Scimitar-horned Oryx (*Oryx dammah*),” *Transboundary and Emerging Diseases* 67 (2020): 1716–24, <https://orbi.uliege.be/bitstream/2268/258334/1/tbed.13502.pdf>.

171. “Live-camel Handlers at Higher Risk for MERS-CoV Infection,” Healio, April 24, 2019, <https://www.healio.com/news/infectious-disease/20190423/livecamel-handlers-at-higher-risk-for-merscov-infection>.

172. “Live-camel Handlers at Higher Risk for MERS-CoV Infection,” Healio, April 24, 2019, <https://www.healio.com/news/infectious-disease/20190423/livecamel-handlers-at-higher-risk-for-merscov-infection>.

173. “Live-camel Handlers at Higher Risk for MERS-CoV Infection,” Healio, April 24, 2019, <https://www.healio.com/news/infectious-disease/20190423/livecamel-handlers-at-higher-risk-for-merscov-infection>.

174. Ahmed Khudhair et al., “Risk Factors for MERS-CoV Seropositivity Among Animal Market and Slaughterhouse Workers, Abu Dhabi, United Arab Emirates, 2014–2017,” *Emerging Infectious Diseases* 25, no. 5 (2019): 927–35, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6478233/>.

175. Ahmed Khudhair et al., “Risk Factors for MERS-CoV Seropositivity Among Animal Market and Slaughterhouse Workers, Abu Dhabi, United Arab Emirates, 2014–2017,” *Emerging Infectious Diseases* 25, no. 5 (2019): 927–35, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6478233/>.

176. Ahmed Khudhair et al., “Risk Factors for MERS-CoV Seropositivity Among Animal Market and Slaughterhouse Workers, Abu Dhabi, United Arab Emirates, 2014–2017,” *Emerging Infectious Diseases* 25, no. 5 (2019): 927–35, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6478233/>.

conclusively state that asymptomatic patients play an appreciable role in MERS transmission.”¹⁷⁷ There are large knowledge gaps about this zoonotic virus. Community cases are still reported, and importantly, a “small but consistent proportion of MERS cases have no camel, healthcare, or MERS-CoV exposure.”¹⁷⁸

Amid climate change on the Arabian Peninsula, the increasing dependence on animal products for milk and meat, and the urgent need for food security in the UAE, the hardiness of camels in desert areas makes them an important protein source. In the UAE, they are also the center of camel-racing sports. According to one source we spoke with, camels from within the UAE are prized over imported camels, but as other studies highlighted in this case study indicate, the ungulates raised in more rural, isolated regions of the Emirates pose serious biosecurity and biosafety risks. In an effort to regulate it, the UAE government is encouraging a movement from rural desert farms to urban settings,¹⁷⁹ but this, too—their abundance and increased concentration—comes with risk of disease emergence and transmission.¹⁸⁰

HUNTING GROUNDS ABROAD

Particularly given studies like those summarized above, loopholes in existing UAE laws that prohibit, for example, hunting of endangered houbara, ungulates, primates, and indeed all manner of wildlife, pose serious risks of zoonotic spillover. Of late, for example, mainstream media has repeatedly raised the question of why high-ranking Middle Eastern individuals have been allowed to hunt houbara in Pakistan. In June 2021, Pakistan issued special permits to an elite group to hunt houbara bustard during the 2020–2021 hunting season—“secretive and controversial private hunting expeditions” that reportedly date back decades despite Pakistan’s Supreme Court ban on the killing of the houbara bustard (an order that was later reversed).¹⁸¹ Large areas of hunting ground in Pakistan are provided to elites from the UAE, Saudi Arabia, and other Gulf countries, who come hunting the birds with their falcons.¹⁸² Media coverage is prohibited, and the scale of the hunts is unknown. After 2006, permits were issued to elites to allow the hunting of 100 bustards each in a given area during a 10-day safari. Reportedly, however, these elites are known to kill far more bustards; in one reported instance, they killed up to 2000 a day.¹⁸³

The fact of these trips is well documented in mainstream media, as are questions about UAE land acquisitions—for hunting and other recreation—in Tanzania. As wealth mounted in the UAE, businessmen started to buy concessions in East Africa to cater to wealthy UAE tourists and Emirati.

177. Marie E. Killerby et al., “Middle East Respiratory Syndrome Coronavirus Transmission,” *Emerging Infectious Diseases* 26, no. 2 (2020): 191–8, <https://pubmed.ncbi.nlm.nih.gov/31961300/>.

178. Marie E. Killerby et al., “Middle East Respiratory Syndrome Coronavirus Transmission,” *Emerging Infectious Diseases* 26, no. 2 (2020): 191–8, <https://pubmed.ncbi.nlm.nih.gov/31961300/>.

179. Nick Leech, “Welcome to Abu Dhabi’s Agricultural Future,” *The National*, May 8, 2013, <https://www.thenationalnews.com/uae/welcome-to-abu-dhabi-s-agricultural-future-1.305831>.

180. Sophie Zhu, Dawn Zimmerman, and Sharon L. Deem, “A Review of Zoonotic Pathogens of Dromedary Camels,” *Ecohealth* 16, no. 2 (2019): 356–77, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7087575/>.

181. Rahel Philipose, “Explained: Why Does Pakistan Allow Arab Royalty to Hunt Vulnerable Houbara Bustard?” *The Indian Express*, January 22, 2021, <https://indianexpress.com/article/explained/explained-pakistan-houbara-bustard-hunting-arab-royals-7144982/#:~:text=Why%20does%20Pakistan%20allow%20Arab%20royalty%20to%20hunt%20the%20houbara,country's%20relations%20with%20Gulf%20nations>.

182. Rahel Philipose, “Explained: Why Does Pakistan Allow Arab Royalty to Hunt Vulnerable Houbara Bustard?” *The Indian Express*, January 22, 2021, <https://indianexpress.com/article/explained/explained-pakistan-houbara-bustard-hunting-arab-royals-7144982/#:~:text=Why%20does%20Pakistan%20allow%20Arab%20royalty%20to%20hunt%20the%20houbara,country's%20relations%20with%20Gulf%20nations>.

183. Rahel Philipose, “Explained: Why Does Pakistan Allow Arab Royalty to Hunt Vulnerable Houbara Bustard?” *The Indian Express*, January 22, 2021, <https://indianexpress.com/article/explained/explained-pakistan-houbara-bustard-hunting-arab-royals-7144982/#:~:text=Why%20does%20Pakistan%20allow%20Arab%20royalty%20to%20hunt%20the%20houbara,country's%20relations%20with%20Gulf%20nations>.

Tanzania was one of their first stops. In 1992, the Ortelo Business Co. began flying clients to the Loliondo area near Serengeti National Park in Tanzania, where visitors hunted freely on over 50,000 acres, returning with planes full of the animals they killed.¹⁸⁴ 111 tribal people have been displaced and/or killed, and though some of the land acquisition has been allowed under the aegis of wildlife or wildland conservation, the flora and fauna in this particular region of Tanzania have been decimated according to multiple reports and blogs by independent activists and nongovernmental and nonprofit organizations. According to one of our sources:

Yes, the UAE has runways and hunting grounds in Loliondo. The story is the same throughout Africa and extends into South Sudan where they also have runways. It started with falconry, going out and living in deserts with falcons, and now it's extended to hunting. They pay people off. It's outright corruption. A lot of capturing of animals shipped back in cargo aircraft, not just killing and hunting but hunting from cars—they don't stick to any rules or regulations. They know their money can buy anything. It's corruption in a major way. The Boma Plateau in Sudan, on the border with Ethiopia, also has a huge runaway—someone I know who saw it was told it was “an Arab hunting operation.” They fly in with their C47, hunt, set up camp, do whatever they please. There's more than just one. They're looking for countries with poor governments where corruption works. Loliondo got more attention—more sensitive area. They also fly out live animals. They fly in and out whatever and whoever they want, because they don't have to fly through any kind of customs. In fact the airport in Dubai has a private section just for the [high-ranking families], where everyone flies in and out without customs or immigration. They can smuggle anything in. For example, flying in gorillas from Congo. If the merchandise is valuable enough—and gorillas are \$250,000 a piece, they'll send a private jet that lands at a private airport—everything is handled on this level. For anyone of lower status, you have the more standard trafficking.

The political and business machinations behind this are beyond the scope of this case study, but are nonetheless important to note because such dealings allow for completely unmonitored movement of both dead and live animals of potential zoonotic concern without any oversight, data gathering or regulatory enforcement.

According to one of our sources, since 2019, a Kuwaiti-registered Airbus has been seen and photographed at the international airport in Hargeisa, Somaliland. It is said that the owner has land northeast of Hargeisa, in the Shiikh area, where he goes hunting, although this activity is banned in the country. Witnesses have reported hearing animal noises coming out of the aircraft, which might indicate that he is also taking live animals back to Kuwait.

184. Joshua Hammer, “Last Days of the Masai?” *Conde Nast Traveler*, October 19, 2010. <https://www.cntraveler.com/stories/2010-10-19/last-days-of-the-masai>

LIVE IMPORTS

Behind the enormous and increasing number of live imports of cows and sheep into the UAE, there are many complex questions regarding what it means and entails, and who is responsible for ensuring that consumed meat and processed meat products are “halal.” Broadly speaking, halal is an Arabic term that signifies “permissible” according to shari’ah, or Islamic law, and its increasingly mainstream usage has come to indicate what is allowed per Muslim dietary law, particularly in the sourcing and slaughter of meat and poultry.¹⁸⁵ Very briefly, according to this law animals should be slaughtered by a Muslim who speaks the name of Allah as they kill the animal, using only Islamic methods (Zabiha) that kill the animal without pain, removing all blood from the carcass with humane handling and minimizing animal suffering.¹⁸⁶ Processes for ensuring and understanding of what ensures an animal product is halal vary widely across cultures and geographies.

The powerful and longstanding cultural importance of consuming only halal animal products is potentially quite important when considering zoonotic disease emergence and transmission, because the process of raising, transporting, and slaughtering live imports includes many touchpoints that can increase risk of disease. The cramped and filthy conditions in which animals are shipped from Australia or Brazil to the UAE are well-documented and have at times made the live import industry reel in response to outrage from animal activists and sympathizers. In the UAE, the number of imports and the amount of slaughter are particularly high in the context of holy days when millions of goats and sheep are slaughtered in the country, and according to halal requirements. Without direct assistance from the MOCCAE, it is difficult to find data for the total number of animals slaughtered during a single Eid Al Adha in any given year. Each year, hundreds of thousands of goats and sheep are sacrificed at the Abu Dhabi Public Slaughterhouse so Muslims can feast with their families and donate a portion to the poor.¹⁸⁷

In 2020, a single abattoir in Abu Dhabi would slaughter approximately 20,000 animals¹⁸⁸; between 2018 and 2019, the total number of slaughtered animals was expected to increase by 60% in Dubai markets from 170,000 animals to 300,000.¹⁸⁹ In 2019, each public abattoir in Abu Dhabi was expected to receive nearly 8,000 sacrificial animals for slaughter on the first day of Eid Al Adha, the civic body has announced.¹⁹⁰ Live animal exports to the Middle East, generally, have risen steadily over the past two decades, particularly from Europe. Trade to Egypt, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, and Saudi Arabia has risen steeply over the last fifteen years. From 2016 to 2017, for example, Turkey went from importing \$600 million worth of live animals to \$1.2 billion.¹⁹¹

185. Kasim Randeree, “Challenges in Halal Food Ecosystems: The Case of the United Arab Emirates,” *British Food Journal* 121, no. 5 (2019): 1154–67, <https://doi.org/10.1108/BFJ-08-2018-0515>.

186. John Ireland and Soha Abdollah Rajabzadeh, “UAE Consumer Concerns About Halal Products,” *Journal of Islamic Marketing* 2, no 3 (2011): 274–83, <https://doi.org/10.1108/17590831111164796>.

187. Haneen Dajani, “Eid Al Adha 2020: Muslims Turn to Online Orders for Meat Deliveries,” *The National*, July 29, 2020, <https://www.thenationalnews.com/uae/heritage/eid-al-adha-2020-muslims-turn-to-online-orders-for-meat-deliveries-1.1056481>.

188. Haneen Dajani, “Eid Al Adha 2020: Muslims Turn to Online Orders for Meat Deliveries,” *The National*, July 29, 2020, <https://www.thenationalnews.com/uae/heritage/eid-al-adha-2020-muslims-turn-to-online-orders-for-meat-deliveries-1.1056481>.

189. “Livestock Prices High in Dubai Ahead of Eid Al Adha,” *Hiiraan Online*, August 19, 2018, https://www.hiiraan.com/news4/2018/aug/159641/livestock_prices_high_in_dubai_ahead_of_eid_al_adha.aspx.

190. Ismail Sebugwaawo, “8,000 Animals Expected to Be Slaughtered in UAE on Day 1 Eid Al Adha,” *The Free Library*, accessed November 2, 2023, <https://www.thefreelibrary.com/8%2C000+animals+expected+to+be+slaughtered+in+UAE+on+Day+1+of+Eid+Al...+a0593891812>.

191. Haneen Dajani, “Eid Al Adha 2020: Muslims Turn to Online Orders for Meat Deliveries,” *The National*, July 29, 2020, <https://www.thenationalnews.com/uae/heritage/eid-al-adha-2020-muslims-turn-to-online-orders-for-meat-deliveries-1.1056481>.

Globalization and an emerging middle- and upper-middle-class among Muslims in the West and Arabian Gulf have made halal certification a force that is reshaping the global marketplace.¹⁹² In the UAE, having live animal imports means that an animal can be slaughtered in a halal way, and at least until the current pandemic and corresponding “drive-thru” slaughter facilities, live animal imports meant that halal slaughter could be *witnessed* and prayed over by the people purchasing and ultimately consuming the meat. But fundamentally, why countries such as the UAE seek to import live animals is not entirely clear. The researchers conclude:

As this research found that virtually all Muslim consumers in the UAE feel “great concern” that some product categories might not be halal, these fears represent a failure of the system. People should be able to trust the wholesomeness of the food they consume yet UAE Muslim consumers trust neither fresh nor manufactured products. On the other hand, these fears offer a great opportunity to firms, brands, and institutions that are perceived as trustworthy, as these actors can charge consumers for the assurance they lack and seek.¹⁹³

In fact, since 2021, in the wake of supply-chain and food security anxieties piqued by COVID-19 and climate change, the MOCCAE has certified 25 new slaughterhouses in 12 countries as halal, bringing the total number of accredited slaughterhouses outside the country to 182,¹⁹⁴ signaling that frozen or chilled imports (already slaughtered) from these countries would satisfy shari’ah law—one of many signs that government officials in the UAE recognize and are systematically addressing biosecurity issues associated with raising, selling, slaughtering, and consuming livestock, and that the current scale of live imports may not remain feasible, for a variety of reasons ranging from political to environmental. Importantly, to the extent that assessing risk of zoonotic disease emergence involves the same, halal meat production and supply is not only a matter of slaughtering animals in a ritualistic manner, but also a matter of holistically considering the animal’s life and death: animals must be raised on halal feed and financial investment that is also shari’ah-compliant. So the halal supply chain involves monitoring of food ingredients, traceability, cross contamination issues with non-halal foods and supply chain integrity. And according to a recently concluded and long-term study, Muslim consumers have reservations regarding the halal “integrity” of products imported specifically from non-Muslim countries, such as raw meat imports from Australia and Brazil. In total, 86.5 percent of surveyed respondents in the UAE felt “great concern” that at least one category of commonly purchased food items were not halal.¹⁹⁵ In terms of halal food sourcing and consumption, Muslim consumers are becoming progressively more environmentally astute, increasingly concerned over the source of ingredients, and ever more mindful of their personal health. Generally, the study suggests that the UAE’s halal “ecosystem” is well developed for its size and population density, but compared with other countries, it faces more challenges addressing consumer

192. Kasim Randeree, “Challenges in Halal Food Ecosystems: The Case of the United Arab Emirates,” *British Food Journal* 121, no. 5 (2019): 1154–67, <https://doi.org/10.1108/BFJ-08-2018-0515>.

193. John Ireland and Soha Abdollah Rajabzadeh, “UAE Consumer Concerns About Halal Products,” *Journal of Islamic Marketing* 2, no 3 (2011): 274–83, <https://doi.org/10.1108/17590831111164796>.

194. “Ministry of Climate Change and Environment Accredits 25 New Slaughterhouses in 12 Countries During H1 2021,” ZAWYA, July 7, 2021, https://www.zawya.com/uae/en/legal/story/Ministry_of_Climate_Change_and_Environment_accredits_25_new_slaughterhouses_in_12_countries_during_H1_2021-WAM20210707135122580/.

195. Kasim Randeree, “Challenges in Halal Food Ecosystems: The Case of the United Arab Emirates,” *British Food Journal* 121, no. 5 (2019): 1154–67, <https://doi.org/10.1108/BFJ-08-2018-0515>.

concerns because of how diverse the UAE population is, and how diverse its demand is for a variety of foods.¹⁹⁶

Climate change and rapidly accelerating desertification mean that in pursuit of food security, the UAE must face the reality of how resource-intensive and possibly short-term the “solution” of importing animals may be. Thus, the UAE must ensure not only diverse sources of frozen and chilled animal products, but also diverse sources of halal certified frozen and chilled animal products. Increasingly, the UAE will depend upon imported frozen and chilled products from a multitude of halal-certified slaughterhouses abroad, but consumer confidence in this may not be very high. Can the demand for meat be met by lab-grown meat? Is that considered halal? Is scalability even possible? Live imports and in-country slaughter and/or living in close proximity with a limited number of livestock that the UAE’s small geographic region can support—both entail an increasingly apparent and researched risk of zoonotic disease emergence and transmission, and they will have to be carefully and systematically surveilled. It is likely for this reason that the UAE is updating its live animal markets, automating slaughterhouses, cracking down on “roaming butchers,” and mandating registration of small “off-grid” family farms called ezbas, where the literature suggests livestock could be among the UAE’s highest risk areas in terms of zoonotic disease emergence and spillover.

The UAE has recently widely publicized an example of what seems to be its ideal live import process:

The first shipment of some 4,500 Holstein cows, one of the best breeds for milk production, have arrived at the Khalifa Port from the Republic of Uruguay.

The shipment was sent through ZAIN 1 specifically designed for shipping livestock between continents, on the directives of the leadership of the UAE to enhance food security in the country. The import of the Holstein breed is done within a record time of fewer than 40 days from the date of the import to the arrival of the shipment at the Khalifa Port, where federal, local governments and international companies joined forces to receive the shipment. These included the Ministry of Climate Change and Environment, Food Security Office, Abu Dhabi Ports, Khalifa Port, General Command of Abu Dhabi Police, Gladinor Co., Mira International Shipping Co. under the supervision and management of Emirates Future Co. and Al Ain Farms. This shipment is the first of the scheduled shipments, and many more will follow in the upcoming period. They are the beginning of an ambitious launch for the largest dairy cattle breeding project in the UAE to enhance food security locally. Speaking on the occasion, Mariam Hareb Almheiri, Minister of State for Food Security, said, “The UAE has a strong and flexible food system and can cope with all current and future changes. The wise leadership devotes the utmost importance to increasing local food production, by enhancing cooperation and partnerships with various relevant local and global entities within the framework of the National Food Security Strategy, aimed at increasing possible local production via technology. The arrival of the first Holstein breeds

196. Kasim Randeree, “Challenges in Halal Food Ecosystems: The Case of the United Arab Emirates,” *British Food Journal* 121, no. 5 (2019): 1154–67, <https://doi.org/10.1108/BFJ-08-2018-0515>.

shipment is a perfect step in strengthening the country's efforts to enhance local production and place it in all UAE markets." Emirates Future Co. had completed the import after verifying that all health requirements were fulfilled and laboratory tests for livestock were carried out based on the instructions of the Ministry of Climate Change and Environment. The company, in cooperation with partners, also studied the health reports of the World Organisation for Animal Health, OIE, in all countries, and ensured that the epidemiological situation of the coronavirus does not affect the safety and timing of import of the living livestock. The cows were also transported through an integrated fleet of transport trucks intended for transporting livestock to the port in Uruguay, while they were received at shipping and follow-up points at the port, and then they shipped onto ZAIN 1. The cows were distributed to the barns designated for them on the ship with safety standards followed and OIE requirements for transporting livestock fulfilled. After completing the shipment of the cows and issuing the necessary reports to start the stage of maritime shipping, the ship headed to Abu Dhabi. On arrival, the cows were examined by the specialised veterinarian to make sure that there were no pathological symptoms, the necessary samples were taken and sent to the laboratory for the cows to be quarantined for the prescribed period. They would be released once the results were declared ensuring their safety. In terms of completing the veterinary examination, the ministry has adopted various rapid examinations of some diseases and provided quick release services if the safety of the shipments is confirmed. During the current global circumstances, the government has proved its worthiness and the effectiveness of its strategy in taking all necessary measures to achieve food security within the country in various food fields and sectors and ensuring the continuity of supply even during emergency conditions.¹⁹⁷

The importance of halal certification, however, and a recent case in which horse meat was detected in beef products in Europe, may provide a window into gaps in a less desirable supply chain. In the wake of the scandal, Spinneys, a major grocery store chain in the UAE, tried to assure customers that its highest priority is high food-safety standards. Spinney's has the approval of two international food-safety bodies and only imports beef from Australia and New Zealand, and the cuts are shipped to the UAE before they are processed and packaged. Spinneys says its fresh meat supply chain has 100 percent traceability—a single cut of beef can be traced back to the slaughterhouse or origin and even to the individual animal's veterinary records. Representatives from Géant, Carrefour, and Al Maya in the Dubai Marina have less food safety security; though their frozen beef products have halal stamps, and most have been manufactured or packaged in the UAE, a representative for JRT Global, a food trade and distribution company that delivers food to the Emirates, says that while suppliers bringing in meat from factories need halal certification, "the only way to check it is by checking the processes in place at the factories. The factory could do a good job while the check is going on, but the minute you leave you don't know what you are doing. We can never be 100 percent sure." Dubai Municipality has established a list of halal-approved slaughterhouses—a list that is expanding rapidly as the UAE attempts to diversify its food

197. "4,500 Holstein Cows Arrive in Abu Dhabi to Enhance Food Security," Saudi Gazette, July 5, 2020, <https://saudigazette.com.sa/article/595137>.

sources—and containers are to be inspected before leaving Dubai Port. However, not every container is inspected—they are sampled at random. JRT Global isn't taking chances; the company once imported chilled beef, pork, and lamb from the US, Brazil, and Ireland, but stopped in the wake of the horse meat scandal.¹⁹⁸ According to the same article in which this was reported:

Another supplier who did not want to be named claims consumers cannot always be 100 percent sure what food they are eating. He says some UAE industry members combine different lines of beef to cut costs, such as mixing Indian beef with Brazilian beef or Pakistani beef with Australian meat. “It’s very hard for the end consumer to find this out,” he says. “You should buy a whole cut of meat and let them cut it in front of you. Don’t buy chopped meat because unless it is tested there is no way of knowing.”¹⁹⁹

SLAUGHTERHOUSES

In 2018, the following case study was reported:

A 30-year-old migrant worker from Kerala who was an abattoir worker in the Middle East was diagnosed to have CCHF infection in a hospital in UAE on the third week of November 2018 and was treated with ribavirin. After a few days of treatment, a second PCR was done, and the result was positive for CCHF viral RNA. The following day, he requested discharge and traveled to Kerala, India. As he was suffering from nausea, headache and abdominal discomfort; he was admitted to a tertiary care center in central Kerala on the day of arrival and kept under isolation. Strict adherence to standard contact precaution was undertaken by health-care workers and patient caregivers. The district health authorities were informed, and a rapid response team was constituted. Contact-tracing activity was initiated by the Community Medicine Department. Communications were sent to the airport authorities to trace potential contacts. A networked online surveillance system was set up. All patient movements were mapped for contact identification. Persons considered to have had significant exposure were listed as contacts into an online contact listing form using Google Sheets. A total of 27 contacts were identified. Among these, 24 were health-care workers in the tertiary health center, 2 were travel contacts, and 1 was a relative. Most of the health-care workers were unaware of the mode of spread of CCHF as it was the first time that such a case was reported in Kerala.²⁰⁰

Crimean-Congo hemorrhagic fever is a zoonotic virus and emerging infectious disease that is asymptomatic in infected animals, but has a 30%–50% fatality rate in humans. Its prevalence ranges

198. Mitya Underwood, “As Horse Meat Stalks Europe, UAE Confident It Has No Beef with Standards,” *The National*, February 12, 2013, <https://www.thenationalnews.com/lifestyle/wellbeing/as-horse-meat-stalks-europe-uae-confident-it-has-no-beef-with-standards-1.298575>.

199. Mitya Underwood, “As Horse Meat Stalks Europe, UAE Confident It Has No Beef with Standards,” *The National*, February 12, 2013, <https://www.thenationalnews.com/lifestyle/wellbeing/as-horse-meat-stalks-europe-uae-confident-it-has-no-beef-with-standards-1.298575>.

200. Ronnie Thomas et al., “Contact Tracing for an Imported Case of Crimean-Congo Hemorrhagic Fever: Experience from a Tertiary Care Center in Kerala, South India,” *Indian Journal of Community Medicine* 44, no. 3 (2019): 285–7, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6776958/>.

widely, including Africa, the Middle East, Central Asia, and Eastern Europe. Outbreaks constitute a threat to public health services because of the epidemic potential, high case fatality rate, potential for nosocomial outbreaks, and difficulties in treatment and prevention; there is no safe and effective vaccine for either humans or animals.²⁰¹

In the interest of minimizing zoonotic disease risk amid continuing waves of COVID-19, as well as to ensure halal certification as it continues to import live animals, the UAE is increasingly regulating and redesigning live animal markets at ports, along with “automated slaughterhouses” that process roughly 240 livestock per hour.²⁰² The new Sharjah market is an example. The Sharjah Livestock Market is situated in an area of some 170,000 square meters, and includes:

- 141 shops for selling sheep in their barns
- 26 stores for selling livestock
- 12 shops for selling camels
- 74 shops for selling poultry
- A slaughterhouse for livestock
- A slaughterhouse for poultry
- 44 stores that sell fodder
- 34 multi-use shops
- 32 nursery shops
- An auction yard for selling livestock
- A mosque with a capacity for 386 worshippers
- Multiple service facilities and green spaces
- An administrative building to manage the market
- A laboratory that includes modern laboratory equipment and equipment
- Veterinary clinics that include surgery rooms, X-Ray rooms, and examination rooms and care incubators

The market was designed and built according to internationally approved standards, with a focus on the elements of hygiene and public health.

CONCLUSIONS AND RECOMMENDATIONS

As summarized in this case study, from what is apparent in the literature and from interviews and mainstream media even without nongovernmental or governmental assistance from the UAE itself, it is clear that there are several areas of significant zoonotic concerns in and among animal markets in the UAE. In fact, all major risk factors associated with the emergence, transmission, recombination, and spillover of zoonotic diseases have been observed in its pet trade (both legal and illegal), live imports and livestock markets, captive breeding facilities, and hunting practices, including falconry and illegal wildlife

201. Ronnie Thomas et al., “Contact Tracing for an Imported Case of Crimean-Congo Hemorrhagic Fever: Experience from a Tertiary Care Center in Kerala, South India,” *Indian Journal of Community Medicine* 44, no. 3 (2019): 285–7, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6776958/>.

202. For more information on Abu Dhabi municipality’s new automated slaughterhouse, see: <https://www.youtube.com/watch?v=qCuuJ-uSKKI>.

hunting—both internally among the Emirates and internationally, spanning all continents. These variables that drive zoonotic risk—all noted in the case study above—include: the health of the animals²⁰³ (welfare conditions and stress, hygiene and sanitation measures in place, access to vet care etc.) and how those animals are stored and transported (intensity of confinement,²⁰⁴ length and mode of travel, conditions regarding how the animals are housed or shipped). Risk is also a function of the types of pathogens²⁰⁵ that the animals carry²⁰⁶ and by the behaviors and biology of the species carrying them (their genetic diversity,²⁰⁷ their relatedness to humans, whether the animals are alive or dead, and how likely they are to interact closely with other animals or with humans).

The UAE has a strong, functional system of surveillance for priority diseases and syndromes. However, since event-based surveillance is relatively new, it is not yet systematically implemented in the country and will require training of all stakeholders. Systematic reporting with a dedicated team for data analysis and risk assessment is in place at both district and Emirate level. UAE also has a dynamic surveillance system in place for priority diseases where clinical diagnosis for suspected cases is utilized for reporting. An electronic notifiable infectious disease reporting system is in place in Abu Dhabi and Dubai, although it is currently only used for human health. Opportunities exist to unify the national electronic surveillance system.²⁰⁸

UAE has demonstrated its ability to identify a potential public health emergency of international concern and file a report within 24 hours; the same applies to reporting relevant zoonotic diseases to the World Organization for Animal Health.²⁰⁹

An advanced education system and an evolving workforce strategy exists for the development of staff in the public health sector. This strategy needs to be more regularly reviewed, updated, and consistently implemented, and it should be expanded to cover the entire public health workforce. Multidisciplinary human resource capacity is available at different levels of the public health system, although this capacity depends on professionals from overseas with a high turnover of expats, which remains a challenge.²¹⁰

Strategies and plans exist to mobilize resources from national and intermediate levels to support local responses, and a national public health emergency preparedness and response plan is in place. The national risk profile and resources are regularly assessed and supported by legislation and policymakers' commitment. Dedicated and trained emergency operations staff can activate a response within 2 hours. Roles and responsibilities are clearly defined, and case management, patient referrals,

203. Mhairi Sutherland et al., "Stress-Induced Immunomodulation in Low and High Reactive Sheep," *Animals* 9, no. 3 (2019): 104, <https://doi.org/10.3390/ani9030104>.

204. Boris I. Pavlin, Lisa M. Schloegel, L. M., and Peter Daszak, "Risk of Importing Zoonotic Diseases Through Wildlife Trade, United States," *Emerging Infectious Diseases* 15, no. 11 (2009): 1721–26, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2857234/>.

205. Mark E. J. Woolhouse et al., "Assessing the Epidemic Potential of RNA and DNA Viruses," *Emerging Infectious Diseases* 22, no. 12 (2016): 2037–44, <https://doi.org/10.3201/eid2212.160123>.

206. Madeleine Dietrich et al., *Assessing Risk Factors for Viral Disease Emergence Within the Wildlife Trade* (Gland: WWF, 2020).

207. Stephen J. O'Brien and James F. Evermann, "Interactive Influence of Infectious Disease and Genetic Diversity in Natural Populations," *Trends in Ecology & Evolution* 3, no. 10 (1988): 254–9, [https://doi.org/10.1016/0169-5347\(88\)90058-4](https://doi.org/10.1016/0169-5347(88)90058-4).

208. World Health Organization, *Joint External Evaluation of IHR Core Capacities of the United Arab Emirates: Mission Report : 19–23 March 2017* (Geneva: WHO, 2017), <https://iris.who.int/bitstream/handle/10665/259456/WHO-WHE-CPI-REP-2017.57-eng.pdf?sequence=1&isAllowed=y>.

209. World Health Organization, *Joint External Evaluation of IHR Core Capacities of the United Arab Emirates: Mission Report : 19–23 March 2017* (Geneva: WHO, 2017), <https://iris.who.int/bitstream/handle/10665/259456/WHO-WHE-CPI-REP-2017.57-eng.pdf?sequence=1&isAllowed=y>.

210. World Health Organization, *Joint External Evaluation of IHR Core Capacities of the United Arab Emirates: Mission Report : 19–23 March 2017* (Geneva: WHO, 2017), <https://iris.who.int/bitstream/handle/10665/259456/WHO-WHE-CPI-REP-2017.57-eng.pdf?sequence=1&isAllowed=y>.

and transportation of potentially infected patients are well-implemented.²¹¹ Strong collaboration between the public health and security sectors and the legal system in the country allows the public health sector to call for the support of the security sector.²¹²

What seem to be the greatest risks of emergent zoonotic diseases and their transmission and spillover in the UAE extend beyond the country's traditional borders:

- Legal and illegal hunting and the transportation of live and dead animals from other countries into the UAE, including falconry and captive breeding of raptor prey and ungulates
- Flight patterns, flocking behavior, and migratory patterns of wild birds
- Major international airports that are transit hubs for international wildlife trafficking
- An online exotic pet trade that connects buyers from all over the world with sellers and traffickers based in or near the UAE
- Dependence on live imports that bring enormous and increasing numbers of animals into the country from great distances, multiple countries, and in confinement and under very stressful conditions

As such, and according to the WHO, there is an urgent need for veterinarians and medical scientists to cooperate and communicate openly across these traditional boundaries in the Arabian Peninsula, sharing information about disease risks, mitigation, prevention, and outbreaks. This is obviously not the case currently, as the difficulty in gathering information and data for this particular case study clearly demonstrates. National and international surveillance strategies for rapid disease detection would need to be nuanced and resilient to detect changes and continually initiate preventive and control measures. Another important step is the establishment of a rapid information system between the responsible ministries of each country as well as the establishment of highly efficient quarantine and veterinarian lab facilities in each of the GCC countries. The Mediterranean and Middle East Region are known as an important area for concentration of zoonoses; therefore, the WHO has established in 1979 a Mediterranean Zoonoses Control Center operating from Athens. This control center should widen its scope in the future and include all countries of the region.²¹³

There is likewise an urgent need for increased public awareness campaigns communicating the risk of zoonotic diseases from animals illegally imported into the country. As a start, WHO encourages the UAE to coordinate, cooperate, and communicate about zoonotic disease risks and issues among key stakeholders in animal production, animal health, and public health sectors throughout the Emirates as well as countries involved in the supply chain of all animals. As can be seen in this case study, because of the UAE's dependence on imports and role as a hub and transit for legal and illegal wildlife trafficking, doing so truly merits global cooperation and transparency—i.e., a One Health approach.

Another identified challenge is the implementation of a unified health policy (in all sectors) for priority zoonoses throughout the Emirates. Infrastructure and the types of labor differ across Emirates,

211. World Health Organization, Joint External Evaluation of IHR Core Capacities of the United Arab Emirates: Mission Report : 19–23 March 2017 (Geneva: WHO, 2017), <https://iris.who.int/bitstream/handle/10665/259456/WHO-WHE-CPI-REP-2017.57-eng.pdf?sequence=1&isAllowed=y>.

212. World Health Organization, Joint External Evaluation of IHR Core Capacities of the United Arab Emirates: Mission Report : 19–23 March 2017 (Geneva: WHO, 2017), <https://iris.who.int/bitstream/handle/10665/259456/WHO-WHE-CPI-REP-2017.57-eng.pdf?sequence=1&isAllowed=y>.

213. Ulrich Wernery, "Zoonoses in the Arabian Peninsula," *Saudi Medical Journal* 35, no. 12 (2014): 1455–62, <https://pubmed.ncbi.nlm.nih.gov/25491209/>.

and all need to meet international standards. Notable challenges for the UAE are the skyrocketing number of travelers and goods by air and sea, the shortage of trained workers in animal health systems, and increasing demand in view of the growth of and accelerating consumption amid urgent resource shortages.²¹⁴

214. Ulrich Wernery, "Zoonoses in the Arabian Peninsula," *Saudi Medical Journal* 35, no. 12 (2014): 1455–62, <https://pubmed.ncbi.nlm.nih.gov/25491209/>.