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A systematic map of illegal wildlife trade literature:

global trends, distributions, and patterns

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Wildlife has been used as a commodity and traded globally by humans for millennia, driven by a diverse series of motivations. However, when unregulated and unsustainable, this use and trade can result in far-reaching negative consequences for wildlife. Despite the implementation of laws, rules, and regulations to try and minimize these effects, trade in violation of these legal frameworks persists, constituting the illegal wildlife trade (IWT). Past research on IWT has largely been limited either taxonomically, geographically, methodologically, or thematically. As such, there has been limited efforts to fully constitute the scope and scale of research on IWT. This thesis aims to address these limitations through a comprehensive and broad-scale systematic literature map of IWT, investigating the temporal trends and geographic scope of published literature on IWT, as well as investigating the taxonomic focus and geographic biases and gaps within this literature.

Primary data for this research was collected through a systematic literature review, with 1973 records screened, 676 full-text articles assessed for eligibility, and 566 articles published between 1979 and 2024 included in the qualitative synthesis. Data collected from the systematic literature review, alongside species spatial habitat range data from the IUCN Red List and BirdLife International was used to create a systematic map of the current extent of knowledge of IWT by means of a series of charts and maps. To best contextualize the spatial representativeness of the results synthesized from the literature, a baseline of all wildlife affected by use and trade was created and used to approximate the spatial representation, per country, of each applicable taxon (i.e. kingdom and class). Spatial patterns of literature representation were highlighted through the spatial autocorrelation method of Local Moran's I.

Results showed an increasing trend in IWT literature over time, with a geographic scope that includes most countries globally, though certain countries received a disproportionate focus compared to others. Taxonomic biases were evident in the literature, with a focus towards animals, particularly mammals, birds, and reptiles, while literature was limited for plants, fungus, and other animal classes like amphibians. Geographic clusters of statistically significant over- and under-representation in the literature were found for the animal and plant kingdoms, as well as for mammals and reptiles. Only clusters of over-representation were found for birds, while no clusters were observed for amphibians. It was also shown that despite the complexity, patterns in trade routes and wildlife product types exist for the classes of animal species well-represented in the literature, though a large amount of knowledge of IWT trade routes remains incomplete.

The results highlight the need for continued research into the taxonomic groups found within a limited quantity of published research, like plants and fungi, but also within the taxonomic classes of animals outside of the terrestrial vertebrates and ray-finned fish. Geographically, across all taxonomic groups, further research of IWT within countries and regions entirely missing or under-represented in the literature is needed. Additionally, domestic trade routes and incomplete trade route knowledge of IWT should be investigated further. Limitations in data collection and processing methodologies are discussed along with the inherent limitations of research into IWT due to its illicit and clandestine nature, specially alongside the changes and decentralization of IWT marketplaces. Overall, our findings call for more comprehensive and unbiased understanding of all aspects of IWT to better inform conservation and enforcement efforts globally.

Avainsanat – Nyckelord – Keywords
Illegal Wildlife Trade, Systematic Map, Systematic Literature Review, Biodiversity, Conservation, Use and Trade

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List of Terms, Acronyms, and Initialisms

CITES – Convention on International Trade in Endangered Species of Wild Fauna and Flora

ESS – Ecosystem Services

EU-TWIX – Europe Trade in Wildlife Information Exchange

IUCN – International Union for Conservation of Nature

IWT – Illegal Wildlife Trade

LEMIS – Law Enforcement Management Information System

PRISMA – Preferred Reporting Items for Systematic Reviews and Meta-Analyses

TCM – Traditional Chinese Medicine

UN – United Nations

WTP – Wildlife Trade Portal

1 Introduction

Wildlife trade pertains to the notion of the sale or exchange of wild animals, plants, and fungi by people (Broad et al., 2002; Hinsley et al., 2024). Globally, the International Union for Conservation of Nature Red List of Threatened Species (IUCN Red List) identifies almost 39000 wildlife species as affected by use and trade (The IUCN Red List of Threatened Species Version 2024-1, 2024). Spanning back millennia, wildlife through trade has been utilized both functionally to provide materials, medicine, food and labour, as well as symbolically through status and religion (van Uhm, 2016), though the main modern motivations for the trade and consumption of wildlife include experiential, social, functional, financial, and spiritual (Thomas-Walters et al., 2021).

All global regions are involved in the wildlife trade, with variations in flora and fauna availability often dictating a regional primary taxonomic association (UNODC, 2016). The supply chain for trade in wildlife products, across countries, is understood to be made up of source (supply), transit, and destination (demand) countries, though this is not limited to international trade as one country can serve as multiple components within the supply chain (UNODC, 2022). This trade is also not uniformly distributed, as certain species and regions endure the largest effects of this trade (Liew et al., 2021; UNODC, 2016). This has led to devastating results on wildlife species populations with terrestrial populations experiencing a near 62% decline in abundance, due at least in part to this trade (Morton et al., 2021).

Laws to regulate regional and domestic wildlife trade began coming into effect by the 1910s in some of the most biodiverse (megadiverse) countries worldwide, including Brazil, China, and Indonesia (Petrossian et al., 2024; ‘t Sas-Rolfes et al., 2019). While these national laws were typically well defined for domestic wildlife trade, there were often legal gaps in the legislation that failed to define rules and regulations when it came to international wildlife trade, the importation of wildlife protected in a source country but unprotected in a different destination country (UNODC, 2016). As such, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was developed between global parties “to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species” (CITES, 2022). Wildlife trade performed in violation of these local, national

and international laws and regulations is therefore illegal. This constitutes the subsection of wildlife trade that composes the illegal wildlife trade (IWT) industry (Turner & Usher, 2021), which includes “the illegal trade, smuggling, poaching, capture, or collection of endangered species, protected wildlife (including animals or plants that are subject to harvest quotas and regulated by permits), derivatives, or products thereof” (South & Wyatt, 2011).

IWT continues to increase in scope and scale alongside the increases in human population and emerging economies within developing countries (D’Cruze & Macdonald, 2016), and is estimated in value at between US$7 and $23 billion per year (Mozer & Prost, 2023; TRAFFIC, 2024; United Nations Environment Programme, 2016) though the exact value remains highly contested (Tow et al., 2021). As a proportion of all wildlife trade globally, seized shipments of IWT increased between 2017 - 2021 alongside an increase in the value of the seized products, despite an overall reduction in the total number of seizures across the same period (UNODC, 2024). These seizures can occur at any step along trade routes, like supply chains, including the country of origin (supply), countries of transit, or the country of destination (demand) (UNODC, 2022, 2024).

Due to the volume and veracity of this trade as well as the emergence of online marketplaces, there has been a limited ability for research to determine the scope and scale of IWT globally (‘t Sas-Rolfes et al., 2019). IWT is also a highly complex and dynamic globalized problem which necessitates the application of multi-disciplinary approaches to begin understanding some of its key underlying drivers (Fukushima et al., 2021; Mozer & Prost, 2023). Historically, IWT has been primarily limited to physical marketplaces, where most illegal trade was limited to a few key centralized locations (Siriwat, 2020). However, over the past few decades, the emergence of the internet and online marketplaces has transformed the ways in which IWT can occur (Lavorgna, 2014). This global expansion and decentralization of IWT has negatively impacted the ability of authorities, both locally and globally, to enact adequate enforcement measures (Fukushima et al., 2021; Global Initiative Against Transnational Organized Crime, 2024).

Furthermore, there exist certain biases and gaps, both geographically and taxonomically within the literature surrounding IWT. Most publicly available information on IWT comes from a select number of seizure databases, many of which

are geographically biased as they only report information from a single country or are overly broad in their reporting and require careful interpretation for use in data analysis (Hinsley et al., 2024; Hu et al., 2024). Literature on and data collection of IWT also tends to be biased towards charismatic animal species, like *Loxodonta spp.* (elephants) and *Rhinocerotidae spp.* (rhinoceros) (Macdonald et al., 2021; Siriwat, 2020). Non-charismatic species, while receiving less attention than their charismatic counterparts, have the additional challenge of being more difficult to identify and distinguish between different species especially when dealing with derivative products. This leads to a large amount of literature dedicated to identification methods for these species, such as shark, ray, and *Elasmobranchii spp.* (chimera fins) for example (Alvarenga et al., 2024; Holmes et al., 2009; Murillo Rengifo et al., 2024). At a greater taxonomic level, research on, and funding for animal conservation greatly outnumbers that of plants (Adamo et al., 2022; Siriwat, 2020), while fungi are almost entirely absent (Bashyal & Roberts, 2024; Gonçalves et al., 2021; Oyanedel et al., 2022).

This research aims to investigate:

(i) What are the temporal trends and geographic distributions of and within the literature on IWT?

(ii) What is the taxonomic focus and their associated countries in the literature on IWT, and to what extent does the literature reflect the global geographic distribution of wildlife potentially affected by IWT?

(iii) What species are most prominently reported in the literature on IWT, and what are their associated flows of wildlife products?

2 Background

2.1 Wildlife use and trade

Food has always been a requirement for human survival with wildlife products being a key nutritional staple in diets all the way back to our hunter gatherer days (Phillips, 2015). Agriculture would eventually develop and become standard practice around 10,000 years ago, with animal husbandry following (Phillips, 2015). Animal products provide humans with basic needs including clothing and food, while live animals provide functional labour for work and transportation (van Uhm, 2016), engraining wildlife trade as an important aspect of human development (Broad et al., 2002).

"Wildlife trade involves live animals and plants, or a diverse range of products needed or prized by humans" (Nijman, 2010). Wildlife has been used as a commodity for millennia, being traded globally stemming back to ancient Egyptian times around 3500 to 500 BCE (van Uhm, 2016). Like independent settled regions before them, Egyptians developed their own versions animal-centred mythology (Phillips, 2015; van Uhm, 2018). Gods were often anthropomorphized figures, in which key species were chosen based on their qualities and considered sacred (van Uhm, 2018). Mythology, religion and spirituality were not exclusive with their exhibition of animals as status symbols at this time, as the use of exotic species and tamed non-domesticated animals were common with the elite of Egypt and subsequent notable societies (van Uhm, 2016, 2018). Overtime the wildlife trade has continuously evolved, "ranging from live animals and ornamental plants to a vast array of wildlife products … Fish and other food products, exotic leather goods, musical instruments, timber, tourist curios and medicines and other wildlife commodities" (Broad et al., 2002).

Recent technological developments have facilitated a shift in wildlife trade onto online platforms, including websites, online marketplaces, and social media platforms (Lavorgna, 2014; Rinne et al., 2023). This shift has not only decentralized much of the wildlife trade that once primarily occurred in select physical marketplaces but also increased the accessibility of wildlife trade while allowing both buyers and sellers to remain anonymous while doing so (Harrison et al., 2016; Lavorgna, 2014).

2.2 Drivers of wildlife use and trade

Driving all wildlife use and trade is a framework comprising several key motivators for humans to consume wildlife products, including experiential, social, functional, financial, and spiritual (Thomas-Walters et al., 2021).

Personal success and pride stemming from satisfying personal needs was observed through interviews with South African hunters who noted a sense of achievement as a resulting outcome of the experience (Radder & Bech-Larsen, 2008). This along with other experiential motivators that include recreational and sensorial experiences are based on human desire for hedonism (Thomas-Walters et al., 2021). Further examples of this can be found demonstrated in the collection of orchids for aesthetic beauty (Mackenzie & Yates, 2016), or with the collection of songbirds based on the quality of their singing and beauty (Fernandes-Ferreira et al., 2012).

Wildlife products have historically been traded because of the pertinence they play when it comes to enacting traditional religious and cultural practices (Alves et al., 2012; Green et al., 2022; van Uhm, 2016). This can include the purchasing of wildlife products pertaining to various species because of their effects within magico-religious practices in Brazil (Alves et al., 2012), as well as the collection of *Protium attenuatum* (Lansan tree) exudate for use as incense in religious ceremonies and to ward off evil spirits in Saint Lucia (Daltry et al., 2015). Certain plants and animals may be considered sacred or protected, and effectively conserved through traditional belief systems, as is the case with sacred groves and traditional forests of the Yoruba in Nigeria (Berkes, 2013). Motivations for wildlife trade can also vary across geographies for the same species or product, such as the trade of slow and slender lorises where Cambodian trade is primarily motivated by their use in traditional medicine compared to Indonesia where they are more commonly kept as pets due to their own localized set of myths (Nekaris et al., 2010). Religion and spirituality in this regard are often also interlinked with cultural practices (Thomas-Walters et al., 2021), but are also sometimes linked to functional motivations, namely medicine, through the practice of ethnopharmacology (Williams & Whiting, 2016).

Relating back to humans' initial uses for animals and animal products are their functional provisions (van Uhm, 2016), including nutrition, medicine, material, and labour (Thomas-Walters et al., 2021). On a global scale wildlife products are traded

constantly for the provision of feeding people and other animals as is required for survival (Hinsley et al., 2024; van Uhm, 2016). In rural populations, wild animals are often caught for their nutritional value where they can be a vital source for fats and nutrients (D'Cruze et al., 2021; Hinsley et al., 2024). Fish through fisheries makes up most of the global animal-based food trade (Broad et al., 2002), with the value of globally traded fish alone having increased from US$40 billion to $180 billion between 1996 and 2018 (A. C. Hughes, 2021). Use of plants and animal products in medicines has been an important component of medicines historically, and continues to be relevant to this day, both regarding modern and traditional medicine practices (A. C. Hughes, 2021; Lev, 2003; van Uhm, 2016; Williams & Whiting, 2016). Medicinal plants which contain active ingredients are highly sought after in both modern and traditional medicine for their effects, though they may be indiscriminately harvested alongside other non-medicinal plants and sold in mass (Okigbo et al., 2008). Traditional medicine practices remain popular globally, with global trade in traditional medicine products being worth US$60 billion annually and trade value in China alone having been expected to reach US$123 billion by 2023 (A. C. Hughes, 2021). This large demand for traditional medicines, especially traditional Chinese medicines, brings with it a demand for several high-profile animal products like those from rhinoceros, Pholidota spp. (pangolins), *Ursidae spp.* (bears), and Reptilia spp. (reptiles) (Chan et al., 2024), many of which have legal protections both locally and internationally (Broad et al., 2002; Cheung et al., 2018). Animal products have well documented uses as functional materials for art, décor, jewellery, fashion, and furniture (UNODC, 2016), such as reptile skin which is often used as leather in the fashion industry (Natusch & Lyons, 2014) or with cacti as pigment (Senanayaka et al., 2024).

Social motivators, including reputations, social influence, and relationships, are based social relationships and the human desire to form or strengthen them (Thomas-Walters et al., 2021). Animals have long been collected by humans as companions as far back as recorded history goes (Bush et al., 2014; van Uhm, 2016). Despite certain animal species having been domesticated for this purpose, there remains a large demand for wild-caught or exotic pets (Bush et al., 2014; UNODC, 2016). Social motivations can also be linked to experiential motivation, as is the case with the large demand for songbirds and parrots (Fernandes-Ferreira et al., 2012; Mackenzie & Yates, 2016; UNODC, 2016). Additionally social motivations are often

linked to financial motivations where expensive or rare wildlife products are used to convey wealth and status as a means of social influence or impression (Thomas-Walters et al., 2021), such as in places like Vietnam (Shairp et al., 2016) and China (Ribeiro et al., 2020).

As previously mentioned, the IWT market is estimated in value at between US$7 and $23 billion per year (Mozer & Prost, 2023; TRAFFIC, 2024; United Nations Environment Programme, 2016). This value is spread unevenly across the entire illicit supply chain however, with each of the supply, transport/intermediary, and demand/consumer stages of IWT with their own financial value, key actors and motivations (Basu, 2014; ‘t Sas-Rolfes et al., 2019). As wildlife or wildlife products progress through the supply chain, their value increases significantly while subsequently, the incomes generated by actors at each stage also increases accordingly (UNODC, 2020). This is because of both the increase in coordination costs as well as transactional risk the further into the supply chain one is (Basu, 2014). The supply side consists of harvesters, farmers, and poachers who collect wildlife or wildlife products through various means (Basu, 2014; ‘t Sas-Rolfes et al., 2019). These activities are typically performed to generate income in poorer areas without alternative means of supporting livelihoods, or as an opportunistic way to generate some additional income (South & Wyatt, 2011; Thomas-Walters et al., 2021; UNODC, 2016). Transporters/intermediaries concerns those who smuggle and physically transport wildlife and/or wildlife either domestically or internationally, bridging the gap between the supplier and the demand/consumer, (Basu, 2014; ‘t Sas-Rolfes et al., 2019). Like suppliers before, transporters/intermediaries are financially motivated to generate income from the illicit activity (UNODC, 2020). While consumers may be driven by one of the other primary drivers of IWT (experiential, social, functional, or spiritual), it may also be the case they are driven financially, either for immediate or future profits through the commodification of wildlife or wildlife products (Thomas-Walters et al., 2021; UNODC, 2020). This commodification can work in conjunction with the other drivers, such as an increase in value of wildlife and wildlife products based on their experiential or social value such as the songbird trade where birds are valued based on the quality of their singing and beauty (Fernandes-Ferreira et al., 2012).

2.3 Regulating wildlife trade

The overuse and exploitation of wildlife brought with it the need for rules and regulations surrounding its acquisition and trade. There was growing public concern over the disappearance of key species in notable areas and the complete extinction of others, which led to the creation of national parks such as Kruger National Park in South Africa (van Uhm, 2016). This also led to the creation of agreements on wildlife trade between western countries (van Uhm, 2016). Laws regulating wildlife use and trade typically have to do with a concern for animal health and welfare (Cooper & Rosser, 2002). This establishes a general understanding of which flora and fauna can be extracted from the natural environment for use and trade at the regional or national level, and those which are protected under these laws. Subsequently there are also laws at the international level which regulate the trade of these protected species (Cooper & Rosser, 2002).

Despite this, there remained incongruencies at the international level when it came to the legality of certain wildlife trade. Wildlife products or species may be allowed to be traded in the destination country while banned from being traded in the supply country, leading to an opaque market for wildlife trade (UNODC, 2016). To account for this, an international trade agreement for wildlife was required through the creation of CITES (Cooper & Rosser, 2002; van Uhm, 2016).

CITES “is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species.” (CITES, 2022). Entering into force in 1975, CITES currently has 184 global parties (as of 2024) and allows for the integration of wildlife trade reporting and regulation between parties signed to the convention (CITES, 2022; Cooper & Rosser, 2002; van Uhm, 2016). More pertinently, CITES regulates limitations on the trade of specific species between signatories based on a series of appendices maintained by the treaty (Table 1), with each appendix determining the level of protection afforded to each species (CITES, 2024).

Table 1: The CITES appendices.

Appendix	Definition
Appendix I	"species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances."
Appendix II	"species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival."
Appendix III	"species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade."

As Appendix I species are both threatened with extinction as well as significant exploitation through use and trade, the trade restrictions applicable are the most severe. The trade restrictions on the subsequent appendices are less severe but are still limiting because of their considerable reporting and approval requirements. There can be geographical differences in where a species appears in CITES appendices. For example, *Loxodonta africana* (African elephant) is listed in Appendix I globally except for Botswana, Namibia, Zimbabwe, and South Africa where it is listed in Appendix II because of higher species populations in those countries (Lawson & Vines, 2014). It should also be noted that CITES regulations do not overrule local laws and regulations. Early 2016 had all pangolin species listed in Appendix II, however species with geographic origins in Asian countries all had zero export quotas from their source countries, meaning that all wild-sourced products and specimens were effectively banned from being traded (United Nations Environment Programme, 2016). Since 2016 though, all pangolin species have been moved to Appendix I.

More recently adopted in December of 2022, The Kunming-Montreal Global Biodiversity Framework is modern global framework that builds on the United Nations (UN) sustainable development goals to "reach the global vision of a world living in harmony with nature by 2050" (CBD Secretariat, 2024b). Target 5 of the framework, "Ensure Sustainable, Safe and Legal Harvesting and Trade of Wild Species" aims to:

> Ensure that the use, harvesting and trade of wild species is sustainable, safe and legal, preventing overexploitation, minimizing impacts on non-target species and ecosystems, and reducing the risk of pathogen spillover, applying the ecosystem approach, while respecting and protecting customary

sustainable use by indigenous peoples and local communities (CBD Secretariat, 2024a).

Trade of wildlife in violation of these laws, rules, and regulations, whether they be regional, national, or international, is ultimately what defines IWT.

2.4 Outcomes of IWT

The outcomes resulting from IWT are vast and result in a large interconnected series of impacts, broadly falling under the categories of environmental (e.g. population decline, extinction, and invasive species), human (e.g. zoonosis and the loss of ecosystem services (ESS)), and economic (e.g. loss from tourism, loss of natural resources, and loss from ESS) (Mozer & Prost, 2023).

Many species affected by IWT have been pushed to a critical IUCN conservation status due to human use and trade, including IWT (Ceballos et al., 2020). With use comes overuse, often succumbing to the 'tragedy of the commons' where a common resource is overused in the short-term leading to the decimation over the long-term (Hardin, 1968; Pires & Moreto, 2011). Overexploitation of charismatic species including elephants, *Panthera leo* (lions), and *Hippopotamus amphibius* (hippopotamus') caused their disappearances in Roman and Greek times (van Uhm, 2016). Similarly, text from ancient Greece discusses the disappearance of animals from places of past abundance like the total disappearance of *Panthera pardus* (leopards) and *Hyaenidae spp*. (hyenas), while "bears, [*Lynx spp*. (lynxes)], [*Canis lupus* (wolves)] and [*Canidae spp*. (jackals)] were limited to the mountains" (Cabeza et al., 2024; J. D. Hughes, 2003). The clearing of forests for increased agricultural production and trade has led to a decrease in wildlife populations as well as *Insecta spp*. (insect) biodiversity (Raven & Wagner, 2021; van Uhm, 2016), while modern growth in wildlife trade has caused a reduction in *Cetacea spp*. (whale) populations around the Norwegian territory of Svalbard due to demand for baleen and lubrication oils (van Uhm, 2016). *Cactaceae spp*. (Cacti), with their multi-purpose use as food and medicine as well as their popularity as ornaments has left a high proportion of their species at risk of extinction (Goettsch et al., 2015). Given that IWT is unregulated and operates in exclusion of the law, there are often several health and safety concerns for the specific wildlife involved in the trade, for example *Psittacus*

erithacus (African grey parrots) have a mortality rate typically between 60-66% but up to 90% for individuals being transported as part of IWT (Mozer & Prost, 2023).

It is also the case that this overuse and exploitation has several compounding effects which continually reduce biodiversity (Cooper & Rosser, 2002). Reductions in biodiversity when it comes to the loss of key predator species can result in a harmful increase in prey species, both fauna and flora which further harm the ecosystem (Costanza et al., 1997; UNODC, 2024). Invasive species can arise from the abandonment of exotic species, particularly those kept as wild pets in areas outside of their native range (Lockwood et al., 2019; Wyatt et al., 2022). Without natural predators, these invasive alien species decimate the local ecosystems further compounding biodiversity losses (Butchart et al., 2010).

Zoonosis, or zoonotic pathogens are infectious diseases which have originated in vertebrate wildlife and been transmitted to humans (Taylor et al., 2001; World Health Organization, 2020). Zoonosis is not exclusively caused by IWT, or wildlife trade for that matter, but the rate of occurrence is considerably increased through these activities (Chomel et al., 2007; Karesh et al., 2005). Research suggests that the outbreak of COVID-19 was likely facilitated through IWT in wildlife markets (Ceballos et al., 2020; UNODC, 2020, 2024; Wyatt et al., 2022). COVID-19, alongside many other zoonotic diseases like SARS, HIV and Ebola continues to be a globally significant cause of human illness and death (Chomel et al., 2007; Karesh et al., 2005; Wyatt et al., 2022). Ecosystem services (ESS) are the goods and services that humans receive from a functioning ecosystem, including for example food, water supply and regulation, biological control that are required for human survival (Costanza et al., 1997). With the reduction of biodiversity and extinction of wildlife species comes with it the reduction or breakdown of these ESS (Cardinale et al., 2012; Ceballos et al., 2020).

Zoonosis drives considerable economic losses, as well as being able to cause significant disruptions to global travel, logistics, and domestic security. All told the COVID-19 pandemic is likely to have cost between US$5.8 and $8.8 trillion, with some estimates upwards of US$15.8 trillion (Dobson et al., 2020; Wyatt et al., 2022), as well as causing disruptions globally like those previously stated (Wyatt et al., 2022). The supply of wildlife and wildlife products for IWT through activities like poaching often causes damage to humans and human communities alongside the

affected wildlife. For example, the over-poaching of charismatic species such as rhinos, lions, and *Panthera tigris* (tigers) from key areas limits both the financial viability of the poaching activity and subsequent financial activities related to those species (i.e. ecotourism) (Mozer & Prost, 2023; UNODC, 2022). The breakdown of key ESS due to IWT is estimated to cost US$15 million yearly, though this estimate is likely undervalued as most ESS have not had formal values associated with them (Mozer & Prost, 2023).

It cannot be stated however that the outcomes of IWT are purely negative, especially on the human side. Given the social, functional, and spiritual drivers of IWT there are inherent benefits for many of the people and communities that participate in the trade. Poverty is a large factor that drives people to participate in the IWT, providing a means for employment, livelihoods, and a source of income in regions where these opportunities are limited (United Nations Environment Programme, 2016). The Daasanach community of Northern Kenya uses skins for their traditional coming-of-age ceremony, including those of *Acinonyx jubatus* (Cheetah) and Leopard. As participation in this ceremony is the only way for men to acquire the status of elder, becoming a true and respected member of the Daasanach community, halting it could result in the loss of important cultural heritage (Torrents-Ticó et al., 2023). Additionally, within the Congo Basin, bushmeat (from forest mammals) provides the bulk of daily recommended protein intake for four out of the five countries in that region. To withdraw from all bushmeat consumption would heavily impact those countries unable to produce adequate protein by other means, likely leading to an increase in regional food insecurity and malnutrition (Fa et al., 2003).

2.5 Challenges in understanding IWT

2.5.1 Proxy data

Unlike the legal wildlife trade, IWT is inherently more difficult to study because of its illegality. The clandestine nature required of IWT actors and trade networks limits the ability of data collection (Hu et al., 2024; Macdonald et al., 2021; ‘t Sas-Rolfes et al., 2019). As such, proxy data is utilized to provide some understanding of the scope and scale of IWT (Esmail et al., 2020). The limited data that is available tends to come from a limited number of seizure databases (Hinsley et al., 2024; Hu et al., 2024).

Seizure databases can range in scope and scale including international like the CITES Trade Database and the Traffic International Wildlife Trade Portal (WTP) and, down to the more regional and federal scales like the U.S. Fish and Wildlife Service Law Enforcement Management Information System (LEMIS) or the Europe Trade in Wildlife Information Exchange (EU-TWIX) (Stringham et al., 2021).

The WTP, while also openly accessible and global scale (Stringham et al., 2021), sources its data from other open data sources like news articles and press releases which ends up creating a taxonomic bias towards charismatic species (Jiao & Lee, 2022; Stringham et al., 2021; Svensson et al., 2023). Smaller scale seizure databases like LEMIS and EU-TWIX benefit from more detailed and taxonomically comprehensive data (Arroyo-Quiroz & Wyatt, 2019; Stringham et al., 2021), but are not openly accessible geographically limited (D'Cruze & Macdonald, 2016; Stringham et al., 2021). Though across all seizure databases there remains the inherent limitations of the data available which is limited to movements of wildlife and wildlife products which were unable to evade authorities (Hitchens & Blakeslee, 2020; Hu et al., 2024; Macdonald et al., 2021; Smith et al., 2017; 't Sas-Rolfes et al., 2019), and hindered by species-level taxonomic identification by authorities that leads to missing or inaccurate information (Gomez, Kala, et al., 2023; Hinsley et al., 2018; Khanwilkar et al., 2022; Petrossian et al., 2016; Smith et al., 2017; Tow et al., 2021).

The CITES Trade Database is more unique than other similar databases as it is both openly accessible and global scale (D'Cruze & Macdonald, 2016; Stringham et al., 2021), but reports on a limited amount of illegal and domestic trade as its primary purpose is to document legal, international trade (Bager Olsen et al., 2021; Beastall et al., 2016; Jiao & Lee, 2022; Stringham et al., 2021; Tricorache et al., 2018) Other limitations include poor, inconsistent, and mismatched trade reporting as well as wide scale absent data (Bashyal et al., 2023; Beastall et al., 2016; D'Cruze & Macdonald, 2016; Gomez, Kala, et al., 2023; Hinsley et al., 2018; Khanwilkar et al., 2022; Li & Jiang, 2014), and taxonomic restrictions to just those species listed within the CITES appendices (Arroyo-Quiroz & Wyatt, 2019; Bager Olsen et al., 2021; Jiao & Lee, 2022).

According to the UNODC World WISE Database, key wildlife species most seized based on an aggregation of standard values include rosewood, elephants, pangolins, rhinoceros, reptiles, Acipenseridae spp. (sturgeon), Panthera spp. (big cats), Cnidaria

spp. (corals), Psittaciformes spp. (parrots), agarwood, Aves spp. (raptors), Testudines spp. (tortoises, fresh water, and marine turtles), and Anguilliformes spp. (eels) (UNODC, 2020). Though it has been estimated that seizure data accounts for less than 10% of all IWT (Esmail et al., 2020), with the aforementioned limitations and weaknesses that further obscure our understanding of the full scope and scale of IWT.

Other common methods for the identification of IWT include analysis on the consumer side of trade through market analysis, both physical and online. Physical market analysis involves visitations to physical marketplaces to conduct surveys on the wildlife and wildlife products available for sale (Ghorbani et al., 2014; Kasper et al., 2020; Nijman & Shepherd, 2015; Shiping et al., 2006). These surveys can provide needed insight into both the domestic and international IWT as well as to help characterize consumer demand preferences, market prices, and trade dynamics (Gaubert et al., 2024; Gomez & Min Sheng, 2024; Uddin et al., 2024), but are geographically limited. Online market analysis represents a relatively new form of marketplace analysis which comes alongside the emergence of decentralized online marketplaces (Lavorgna, 2014). Like physical market analysis, online market analysis can provide both domestic and international scale trade information (Fukushima et al., 2021; Lavorgna, 2014) and is able to help characterize consumer demand preferences, market prices, and trade dynamics (Fukushima et al., 2021; Global Initiative Against Transnational Organized Crime, 2024). However, unlike physical markets, analysis of online markets can be performed on a broader range of marketplaces at one time through automated detection and web scraping methods (Fukushima et al., 2021; Harrison et al., 2016; Rinne et al., 2023).

Limitations for both sets of market analysis remain. The clandestine nature of IWT actors remains an issue for both sets of markets (Barber-Meyer, 2010; UNODC, 2020), which can take the form of sellers hiding certain wildlife products in physical markets and requiring the use intermediaries (Nijman et al., 2019), or the use of private groups and forums as online markets (Grimwood et al., 2024). The similar issue of taxonomic identification, as well as issues of product authentication also arise in both sets of markets (Feddema et al., 2020; Fukushima et al., 2021; Leupen et al., 2022; Phelps & Webb, 2015; Stringham et al., 2023; van Uhm & Zhang, 2022). To address these challenges and improve the understanding of IWT dynamics,

researchers often turn to robust methodological approaches for data collection and analysis (Nijman et al., 2022; Siriwat & Nijman, 2020).

2.5.2 Research methods

At a fundamental level, the ability to perform any kind of analysis first requires some form of data collection, which can include primary or secondary data (Sandelowski, 2000). One such method of secondary data collection is the systematic literature review which is a way of systematically identifying, selecting, and collecting data based on a prior explicitly formulated question (Moher et al., 2009). Data collected through the literature review process can then be analysed (at least in part) through a meta-analysis (Moher et al., 2009). This data analysis primarily consists of either qualitative or quantitative methods, or a combination of the two with the use of mixed-methods (Sandelowski, 2000).

Qualitative methods are those used to explore or describe the data, which in the context of IWT can include the identification of geographic areas or taxonomic groups which have been identified as being involved in IWT (see Abdullah et al., 2024; Boratto et al., 2024; Gomez & Min Sheng, 2024; Kalra et al., 2024). Quantitative methods are those used to explore measurements or quantities within the data, which in the context of IWT can include the frequency of geographic areas or taxonomic groups (see Abdullah et al., 2024; Boratto et al., 2024; Gomez & Min Sheng, 2024; Kalra et al., 2024) which have be identified as being involved in IWT, but can also include distributions (see Haq et al., 2023; Machado et al., 2018; Massingham et al., 2023), flows (see Gomez, Toropov, et al., 2023; Gondhali & Petrossian, 2023; Uddin et al., 2023), biases and gaps (see Alvarenga et al., 2024; Fukushima et al., 2020; Pitogo & Saavedra, 2024) in the data.

Exploratory spatial data analysis through the identification of biases and gaps is a form of quantitative cluster analysis (Sandelowski, 2000). Cluster analysis is a statistical technique which spatially identifies groups of areas consisting of either homogenous or distinctive features (Sandelowski, 2000), and can be used to help describe the presence spatial autocorrelation (Fávero et al., 2023). Spatial autocorrelation refers to the analysis of spatial patterns of a studied phenomenon, and the tendency for adjacent spatial observations to be like each other (Getis, 2008). This can be done as a measure of a whole (global) or by identifying local areas of

contiguous homogenous or distinctive features (Fotheringham, 1997). Moran's index was one of the first measures of spatial autocorrelation developed, which compares the similarities of features and their associated values that are in proximity to one another (Moran, 1950).

There has been a limited amount of research in the past which aimed to investigate trends and distributions of IWT with a systematic literature review, especially on a broader scale. This research has either taken place by using a crime, corruption, or criminology perspective on a broad scale (Anagnostou & Doberstein, 2022; Pires & Moreto, 2016), or by constraining the scope of IWT, either geographically (Luong, 2022) or taxonomically (Panek et al., 2021). Other systematic literature reviews have been done taxonomically constrained examining the effects of wildlife trade on iconic species, but not exclusively looking at illegal trade (Hiller & 't Sas-Rolfes, 2025). Analysis methods in these studies using data from the literature review process have included qualitative, quantitative, and mixed-methods of data analysis, including a descriptive analysis of included literature (see Anagnostou & Doberstein, 2022; Luong, 2022; Panek et al., 2021), taxonomic assessments (see Anagnostou & Doberstein, 2022; Luong, 2022; Pires & Moreto, 2016), systematic mapping (see Anagnostou & Doberstein, 2022; Luong, 2022; Panek et al., 2021), research convergences (see Anagnostou & Doberstein, 2022; Luong, 2022; Panek et al., 2021; Pires & Moreto, 2016), and categorical clustering, though not spatially (see Panek et al., 2021).

While valuable, these studies have either narrowed their focus thematically or applied specific disciplinary lenses. As such, there remains a need for a comprehensive and broad-scale systematic literature review on IWT without the restrictions of a geographic, taxonomic, or disciplinary frame. This review aims to synthesize the existing literature across disciplines and taxa to better understand and characterize the global landscape of IWT research.

3 Methodology

The full workflow for this thesis can be found visualized within Figure 1. The workflow was conducted using a combination of Excel (Version 2501), GeoDa (Version 1.22.0.4) (Anselin et al., 2006), QGIS (Version 3.28 LTR) (Open Source Geospatial Foundation Project, 2025), and Python 3 (Version 3.12) via JupyterLab (Version 4.2.1-1), including the Pandas (Version 2.2.3) (The pandas development team, 2024), Matplotlib (Version 3.10.1) (The Matplotlib Development Team, 2025), NumPy (Version 2.2.0) (Harris et al., 2020), and Requests (Version 2.32.3) (Reitz, 2025) Python libraries. Data pre-processing was done using Excel and Python, while data processing and visualization was done using QGIS, Python, and GeoDa. Source code is available at https://github.com/riley-kemp/thesis.

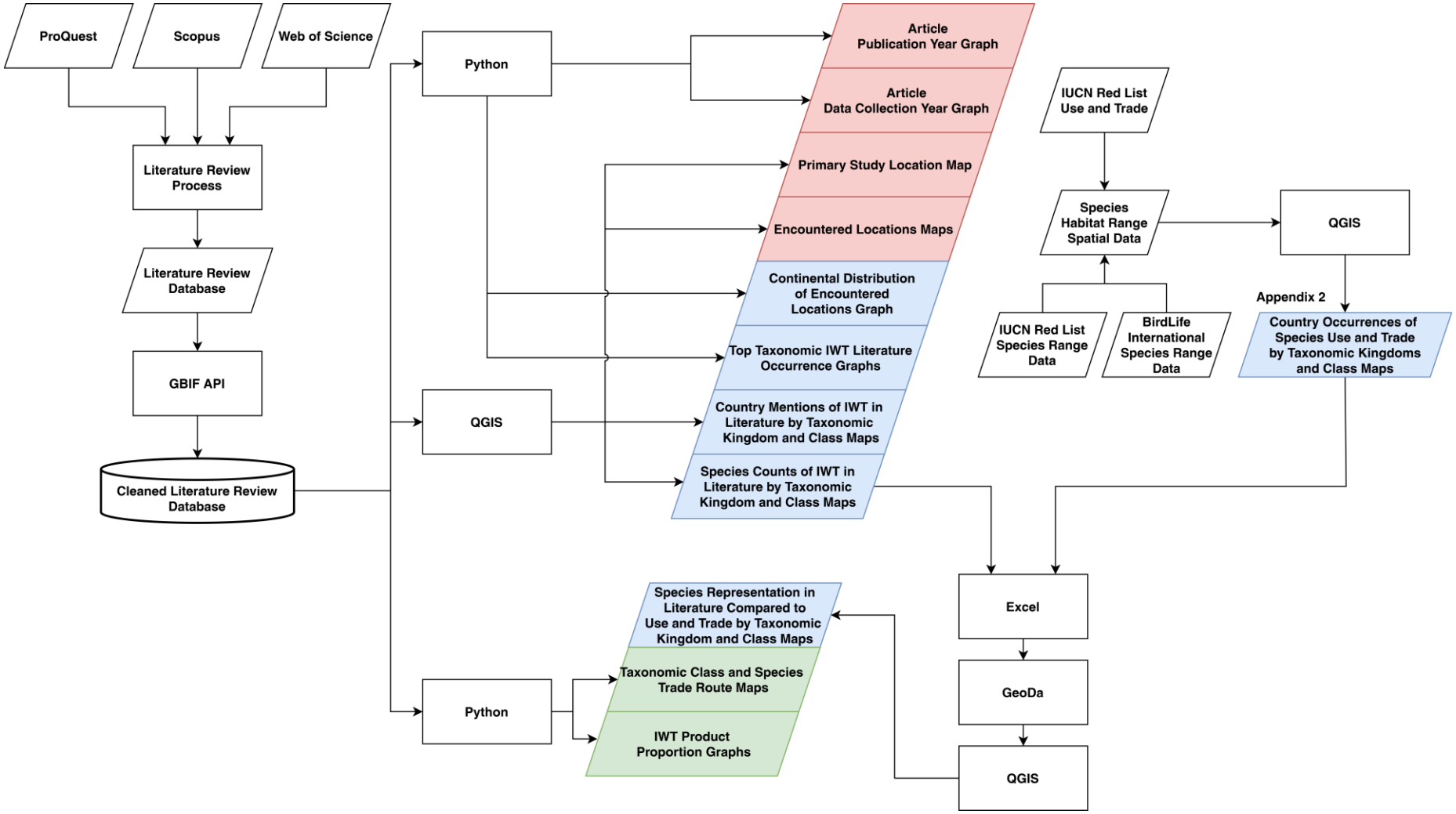

Figure 1: Flow chart displaying the data collection, preparation, and visualization workflow.

3.1 Data collection

3.1.1 Primary data collection: systematic literature review

Primary data for this thesis was collected through a systematic literature review that followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (see Moher et al., 2009).

IWT inherently consists of three components: “illegal”, “wildlife”, and “trade”. As such, three sets of queries were utilized to retrieve articles which fully pertained to IWT (Table 2).

Table 2: Keyword search strings.

Keyword	Search String
Illegal	"black market" OR "black-market" OR "illegal" OR "crime" OR "illicit" OR "illegitimate" OR "banned" OR "ban" OR "criminal" OR "prohibited" OR "unsustainable"
Wildlife	"wildlife" OR "animal" OR "mammal" OR "plant" OR “fungi" OR "fish" OR "bird" OR "avian" OR "reptile" OR "marine" OR "ornamental" OR "timber" OR "orchid" OR "species" OR "bushmeat" OR "wild meat" OR "endangered" OR "threatened"
Trade	"commerce" OR "trade" OR "trading" OR "purchase" OR "purchasing" OR "transaction" OR "traffic" OR "trafficking" OR "sale"

The review was based on queries from three abstract and citation databases: Scopus (https://www.scopus.com/), Web of Science (https://www.webofscience.com/) and ProQuest (https://www.proquest.com/). Due to the limitations of the search functionality of each database, a custom query was created for each database which combined each of the keyword search strings with the “AND” operator to ensure each aspect of IWT was included in the search results (Table 3).

Table 3: Database search strings.

Database	Search String
Scopus	(TITLE-ABS-KEY("wildlife" OR "animal" OR "mammal" OR "plant" OR "fungi" OR "fish" OR "bird" OR "avian" OR "reptile" OR "marine" OR "ornamental" OR "timber" OR "orchid" OR "species" OR "bushmeat" OR "wild meat" OR "endangered" OR "threatened") AND TITLE-ABS-KEY("commerce" OR "trade" OR "trading" OR "purchase" OR "purchasing" OR "transaction" OR "traffic" OR "trafficking" OR "sale") AND TITLE-ABS-KEY("black market" OR "black-market" OR "illegal" OR "crime" OR "illicit" OR "illegitimate" OR "banned" OR "ban" OR "criminal" OR "prohibited" OR "unsustainable"))
Web of Science	ALL=("wildlife" OR "animal" OR "mammal" OR "plant" OR "fungi" OR "fish" OR "bird" OR "avian" OR "reptile" OR "marine" OR "ornamental" OR "timber" OR "orchid" OR "species" OR "bushmeat" OR "wild meat" OR "endangered" OR "threatened") AND ALL=("commerce" OR "trade" OR "trading" OR "purchase" OR "purchasing" OR "transaction" OR "traffic" OR "trafficking" OR "sale") AND ALL=("black market" OR "black-market" OR "illegal" OR "crime" OR "illicit" OR "illegitimate" OR "banned" OR "ban" OR "criminal" OR "prohibited" OR "unsustainable")
ProQuest	noft("wildlife" OR "animal" OR "mammal" OR "plant" OR “fungi" OR "fish" OR "bird" OR "avian" OR "reptile" OR "marine" OR "ornamental" OR "timber" OR "orchid" OR "species" OR "bushmeat" OR "wild meat" OR "endangered" OR "threatened") AND noft("commerce" OR "trade" OR "trading" OR "purchase" OR "purchasing" OR "transaction" OR "traffic" OR "trafficking" OR "sale") AND noft("black market" OR "black-market" OR "illegal" OR "crime" OR "illicit" OR "illegitimate" OR "banned" OR "ban" OR "criminal" OR "prohibited" OR "unsustainable")

Selected articles were required to have a focus on IWT, where the trade was understood by the authors to be illegal and related to wildlife or wildlife derivatives, including animals, plants, fungi, or some combination of these. The included articles consisted of both published research and grey literature, with a publication date criterion up to and including June 10th, 2024. Included articles were written in English, Portuguese, Spanish, Italian, or Russian, with Google Translate (https://translate.google.com/) utilized to translate these articles into English when applicable.

Articles were excluded when they had no or limited relevance to IWT, such as those that only mentioned IWT in an isolated or limited capacity. This included genetic and forensic studies that focused only on testing methodologies. Article types apart from published research and grey literature were also excluded, including biographical items, corrections/corrigendum, items about an individual, poetry, and anonymous documents that could not be verified for accuracy.

All articles following the removal of duplicates and an initial screening which met the literature inclusion criteria were subject to the PRISMA guidelines for the reporting of systematic reviews (Figure 2). All available abstracts were screened for relevancy towards the study topic (N=1973), where outright irrelevant publications were excluded (n=1297). The remaining full-text articles (N=676) were reviewed and assessed, where any articles meeting the exclusion criteria were deemed ineligible and removed from the qualitative synthesis (n=110). All remaining articles were included in the qualitative synthesis (N=566) (Appendix 1: Table 7).

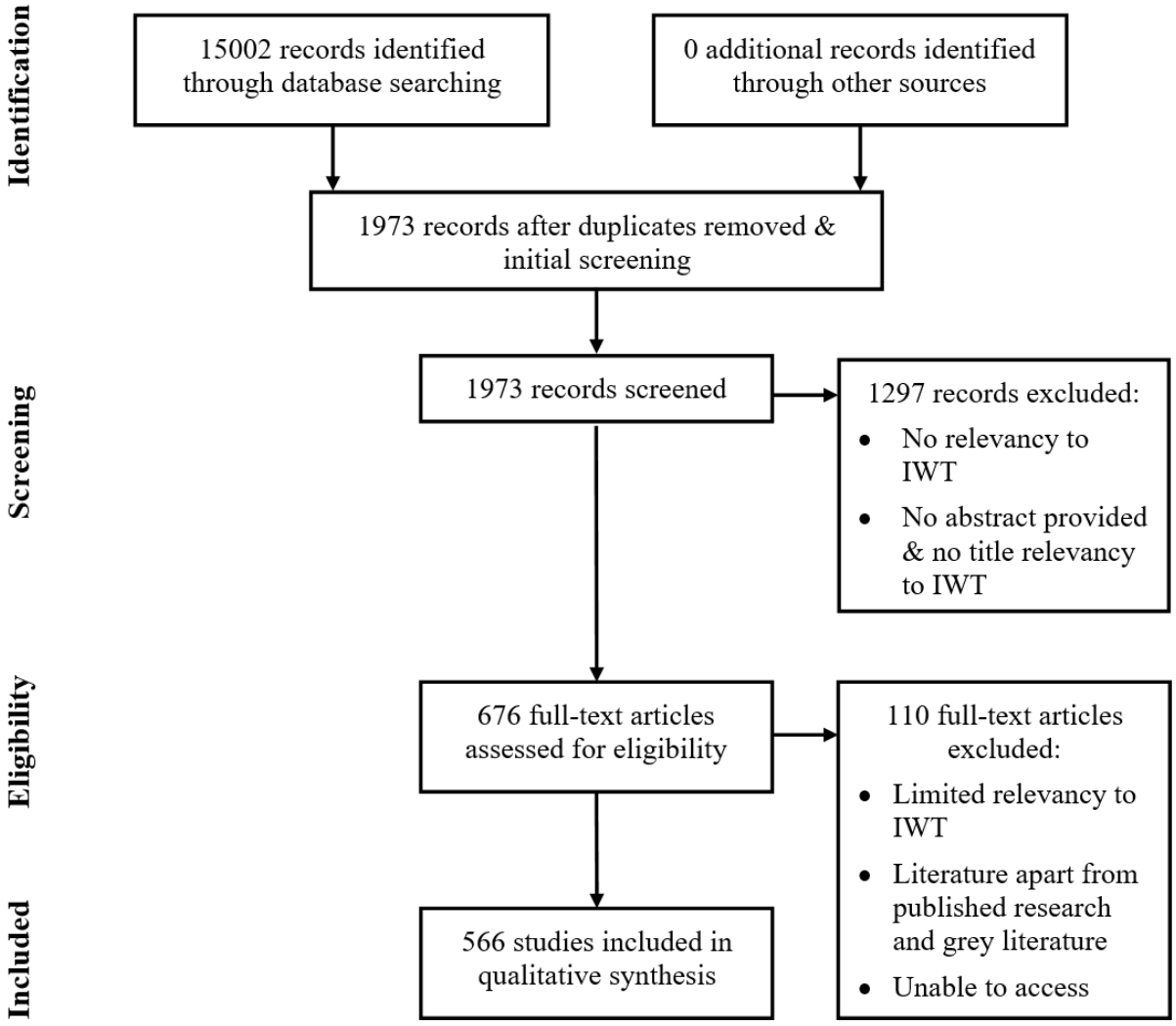

Figure 2: PRISMA Flowchart summarizing the literature review process (adapted from Moher et al., 2009).

All articles included in the qualitative synthesis (N=566) had their relevant information manually extracted and entered into a spreadsheet. For each article, a series of categorical variables were extracted based upon the text provided, including both the main publication and any accessible supplemental or supplementary

information (Table 4). Variables were selected based on their relevance to prior IWT research methodologies, including descriptive analysis, taxonomic assessments, and research convergences. Variable data was extracted verbatim where possible, with some careful interpretation occasionally required. Data that could not be confidently interpreted were omitted.

Table 4: Literature review variables.

Category	Variable Name	Variable Description	Variable Example
Bibliographic	Label	Unique identifier per article	Van.Der.Grijp2007341
	Publication Year	Year the article was published	2007
Taxonomic	Kingdom	Taxonomic rank of kingdom	Animalia
	Class	Taxonomic rank of class	Mammalia
	Class (Common Name)	Common name for the taxonomic rank of class	Mammals
	Species	Taxonomic rank of species	Physeter macrocephalus
	Species (Common Name)	Common name for the taxonomic rank of species	Sperm Whale
Study Information	Continent	Continent(s) for which illegal wildlife trade is focused on in the article	Oceania
	Country	Countries(s) for which illegal wildlife trade is focused on in the article	Fiji, Tonga
	Year of Data Collection	Year(s) for which data on the illegal wildlife trade has been collected	2003
Trade Routes	Trade Route Type	Classification for an observed illegal wildlife trade route	International
	Supply Continent	Continent for which illegal wildlife trade is observed to be supplied from	Oceania
	Supply Country	Country for which illegal wildlife trade is observed to be supplied from	Fiji
	Transit Continent	Continent[s] for which illegal wildlife trade is observed to be transited through	Oceania
	Transit Country	Country/countries for which illegal wildlife trade is observed to be transited through	Tonga
	Demand/Consumer Continent	Continent for which illegal wildlife trade is observed to be supplied to	North America
	Demand/Consumer Country	Country for which illegal wildlife trade is observed to be supplied to	United States
Wildlife Products	Wildlife Product	The illegally traded wildlife product	Derivative
	Wildlife Product Type	A product category for which the illegally traded wildlife product belongs to	Teeth

3.1.2 Additional data collection

For visualization purposes, species-level spatial data for terrestrial vertebrate species was gathered from two sources: the IUCN Red List (*The IUCN Red List of Threatened Species Version 2024-1*, 2024) as well as BirdLife International (BirdLife International and Handbook of the Birds of the World, 2022).

Wildlife silhouettes were obtained from PhyloPic (Keesey, 2025).

A list of all Animal and Plant species affected by use and trade, as deemed by a series of search criteria was obtained from the IUCN Red List (*The IUCN Red List of Threatened Species Version 2024-1*, 2024) (Table 5).

Table 5: IUCN Red List Use and Trade search criteria.

Search Filter	**Filter Values**
Red List Category	CR – Critically Endangered
	DD – Data Deficient
	EN – Endangered
	LC or LR/lc – Least Concern
	NT or LR/nt – Near Threatened
	VU - Vulnerable
Use and Trade	Food - human
	Food - animal
	Medicine - human & veterinary
	Poisons
	Manufacturing chemicals
	Other chemicals
	Fuels
	Fibre
	Construction or structural materials
	Wearing apparel, accessories
	Other household goods
	Handicrafts, jewellery, etc.
	Pets/display animals, horticulture
	Sport hunting/specimen collecting
	Other (free text)
Systems	Terrestrial
Include	Species

3.2 Data preparation

Due to the nature of manual data entry, it was necessary to take a second pass over the literature review database to ensure that the database was well-defined and free from any errors and mistakes. This process included verifying that the bibliographic and study information was fully complete, as well as harmonizing taxonomic, trade route, and wildlife product data entries.

As taxonomic classifications are modified and refined over time, there was a need to ensure that all the recorded taxonomic information was up to date. To achieve this, the Global Biodiversity Information Facility API (GBIF Secretariat, 2023) was used to update and standardize any out-of-date taxonomies, as well as to complete any missing taxonomic rank information. Further taxonomic standardization was performed by shortening any trinomial taxonomic species to a binomial form, and summarizing any wildlife listed only by a common or generic name to the lowest taxonomic level possible (e.g. Geckos, Lizards, and Snakes would be summarized to the order Squamata).

3.3 Data analysis and visualization

For each subsequent analysis and visualization step, all variables were extracted from the literature review database outlined in Table 4 unless otherwise specified.

3.3.1 Temporal trends and geographic distributions of and within the literature on IWT

To investigate the temporal trends of literature on IWT, publication date and data collection variables across all articles were summarized and visualized using Python.

To investigate the geographical distribution of IWT research, a subset of study information and trade route variables including primary study locations and encountered locations for all articles was created.

Primary study locations refer to the main country (or countries) that authors identified as the focus of their research. Encountered study locations are those countries involved within the broader IWT supply chain which the authors have observed in relation to the primary study locations. Illegal wildlife and wildlife products originate in encountered supply locations and may be transported through

encountered transit locations, ultimately reaching their destinations as encountered demand locations.

The subset of data was pivoted to provide counts for each primary and encountered study location and visualized in QGIS as separate proportional symbol maps. A continental-scale breakdown of the encountered study locations was visualized using Python.

3.3.2 Taxonomic focus and their associated countries in the literature on IWT, and the extent that the literature reflects the global distribution of wildlife potentially affected by IWT

To investigate the most studied taxa involved in IWT, a subset of taxonomic variables was created. Two counts for each non-species taxonomic rank were created (i.e., kingdom and class), the frequency of each taxon at the lowest available taxonomic rank within the articles, and the number of articles which the taxon was observed. Since species was the lowest available taxonomic rank recorded, the two aggregation methods became identical so only one count was utilized. All counts were visualized using Python.

While the limited number of plant observations in the literature made it possible to analyse geographic patterns at the kingdom level, the same cannot be said for animals. As such animals were studied via a proxy of the top four terrestrial classes observed in the literature, amphibians, birds, mammals, and reptiles. Only a single geographic instance of fungus was observed and was not included in the visualized kingdom level analysis.

To investigate spatial trends of IWT occurrences studied in the literature, a series of global maps were created for each of the kingdoms of animals and plants, and the four taxonomic classes which make up the kingdom of animals. A subset of taxonomic variables and encountered locations was created and pivoted to create a list of countries and an associated count of articles observing IWT occurrences for each applicable taxon. Each count was visualized in QGIS as a proportional symbol map.

Because the primary data collected for this systematic map was gathered with a systematic literature review, the results presented ran the risk of conflating the

spatial extent of research on IWT with the actual extent of IWT itself. As previously discussed, much of the data sourced for published research on IWT comes from proxy sources like seizure databases or is based off observational research that is limited by the clandestine nature of illicit activities. To best address this, the creation of a synthesized baseline of all wildlife affected by use and trade was done to help contextualize the results presented from the literature.

For this reason, two proportions were calculated for each taxon at the country level. The first proportion compared the number of species noted as illegally traded in each country to the global total, based on the literature review data. The second proportion compared the number of species noted being affected by use and trade in each country to the global total, based on species range data. Data for the second proportion was created by summarizing the count of habitat ranges for species affected by use and trade, per country, for each applicable taxon. Both proportions were logarithmically scaled, and a ratio was taken between them to create a new continuous variable. Countries with a value close to -1 were relatively underrepresented in the literature for that taxon, while countries with a value close to 1 were relatively overrepresented in the literature. This variable allowed for a means of contextualizing the results of the systematic map, highlighting the potential spatial over- and under-representation of wildlife from the literature.

To analyse spatial patterns of the representation of wildlife in the literature, the local spatial autocorrelation method of Local Moran's I was calculated for countries belonging to each applicable taxon using GeoDa. Local Moran’s I tests for the similarities of features and their values in proximity to one another. Local Moran's I results are generated by GeoDa as a series of classes representing statistically significant features. Spatial clusters are classified as either High-High (H-H) meaning areas of high representation, or Low-Low (L-L) meaning areas of low representation, while spatial outliers are classified as either Low-High (L-H) or High-Low (H-L). This research aims to study spatial over- and underrepresentation of taxonomic groups in the literature, so only spatial clusters were considered. In the case of this study, global countries with literature representation for each taxonomic group are the features, and proximity was calculated using Queen contiguity weights across one order of continuity. The use of Queen contiguity weights meant that countries were considered in proximity to each other if they shared at least one edge or vertex, while

one order of continuity meant that proximity was limited to immediate neighbouring countries only.

The logarithmically scaled representation value for each taxonomic group was visualized in QGIS as a choropleth map, with any potential spatial clusters (H-H and L-L) overlaid.

3.3.3 The species most prominently reported in the literature on IWT, and their associated flows of wildlife products

To provide a better understanding of the global context of the most studied species, species-specific global maps were created for a subset of species that were mentioned in 10 or more articles. Limiting this research to well-represented species from the literature both highlights the taxonomical biases present in the research and ensures that the results are meaningful and representative of widespread research.

Trade route segments, domestic trade routes, and incomplete trade route locations were parsed and counted for each species, with all resulting data generalized at the taxonomic rank of class for visualization purposes. For each taxonomic class aggregation and species, a map was created showing habitat ranges, IWT encountered countries, and trade routes. To create the breakdown of IWT product types, a count of each product category was created and visualized using Python.

4 Results

4.1 Temporal trends and geographic distributions of and within the literature on IWT

4.1.1 Temporal trends in IWT literature across taxonomic kingdoms

The publication years of the articles were heavily skewed towards the mid-2010s and into the 2020s, with a similar number of articles published within the 2020s (n=279) than all the years prior to this decade (n=287) (Figure 3a). The earliest article was published in 1979, while 2023 was the year with the highest number of publications (n=79). Similarly, data collection for these articles also experienced an increase over time. The earliest data collection year was 1969, with 2014 being the year with the largest amount of data collection (n=126) (Figure 3b).

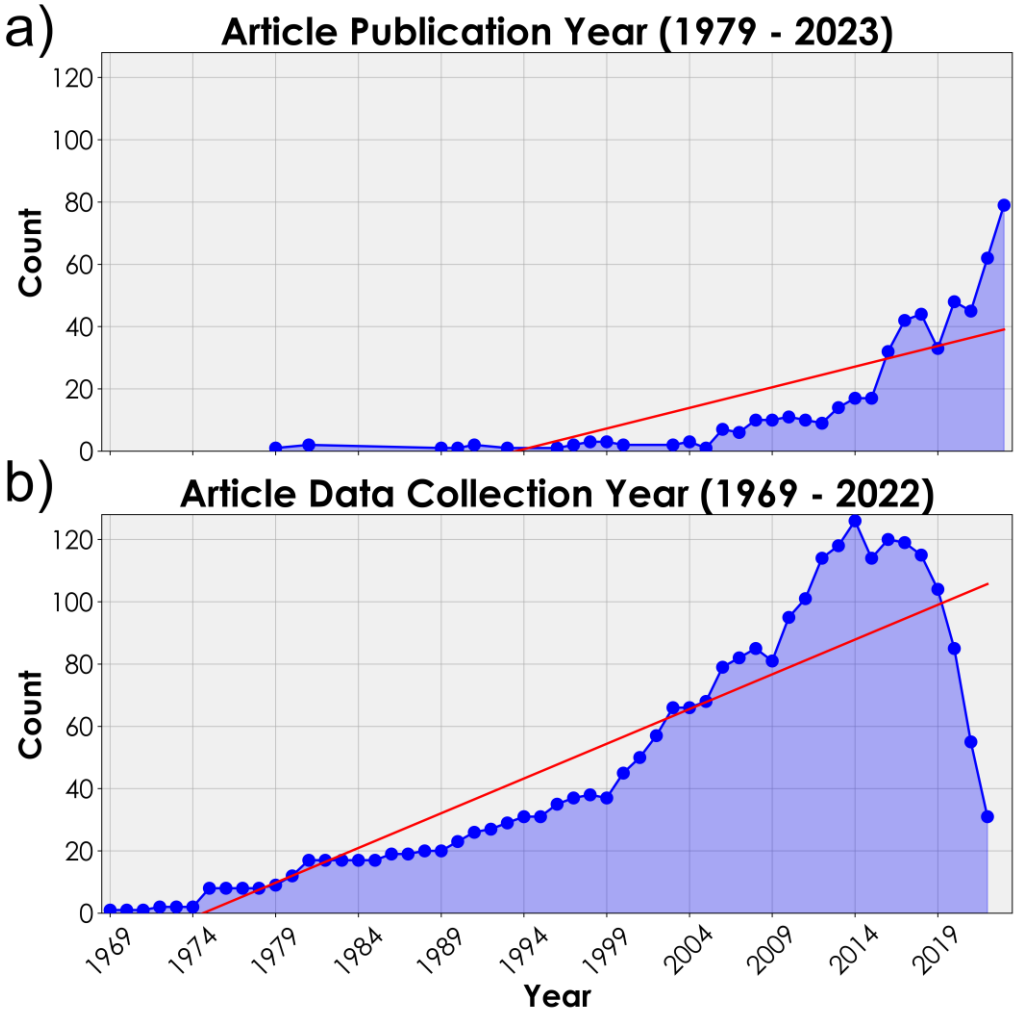

Figure 3: Literature review articles across all full years: a) Count of articles published by year, b) Count of data collection years of articles.

4.1.2 Primary study locations of IWT literature

Full tables of primary study locations can be found in Appendix 2: Geographic data tables, specifically Table 8 and Table 9.

At the continental level, Asia was the most studied continent (43%, n=214), followed by South America (17%, n=86), Africa (14%, n=69), North America (13%, n=65), Europe (10%, n=51), and Oceania (2%, n=11). As some articles had multiple primary study locations, it should also be noted that the numerical total here exceeds the total number of articles selected for the study.

At the country level, China was the most studied country (n=44), followed by Brazil n=42), Indonesia (n=41), United States (n=32), and Vietnam (n=21) (Figure 4).

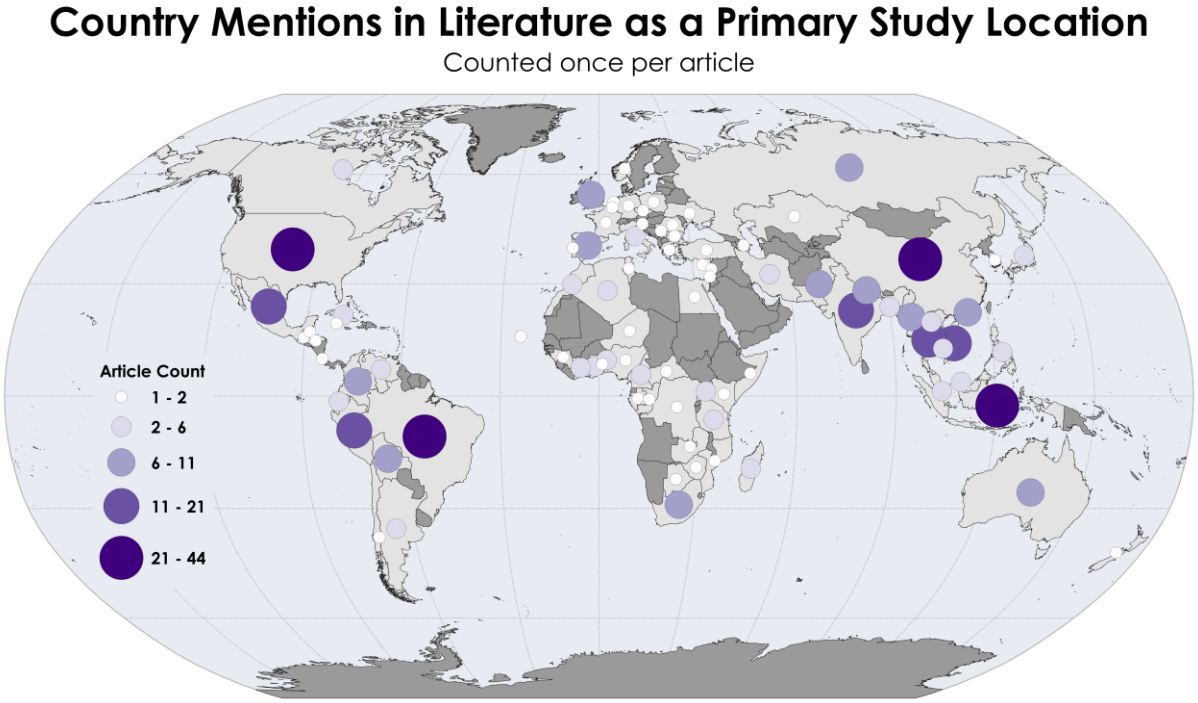

Figure 4: Primary study locations from the literature. All subsequent maps are presented in the Robinson projection (ESRI:54030). A lighter and smaller symbol indicates a lower number of observations while a larger and darker symbol indicates a higher number of observations.

4.1.3 The geographical distribution within IWT literature: encountered supply, transit and demand locations

Full tables of encountered locations can be found in Appendix 2: Geographic data tables, specifically Table 10 and Table 11.

Observing the encountered supply component of IWT at the continental level, Asia was the most frequently identified supply continent (44%, n=453), followed by Africa (22%, n=232), South America (13%, n=133), North America (9%, n=98), Europe (9%, n=94), and Oceania (2%, n=22). At the country level, Indonesia was the most identified supply country (n=71), followed by China (n=55), Brazil (n=51), Vietnam (n=38), and Mexico (n=33) (Figure 5a).

When observing the encountered transit component of IWT at the continental level, Asia was the most frequently identified transit continent (46%, n=125), followed by Africa (21%, n=58), Europe (17%, n=46), North America (8%, n=23), South America (4%, n=11), and Oceania (3%, n=9). At the country level, Vietnam was the most identified transit country (n=14), followed by the United States (n=12), Hong Kong (SAR) (n=11), and Malaysia, Thailand, and Uganda (n=9) (Figure 5b).

When observing the encountered demand component of IWT at the continental level, Asia was the most frequently identified destination continent (56%, n=532), followed by Europe (14%, n=129), North America (10%, n=95), South America (9%, n=88), Africa (8%, n=78), and Oceania (2%, n=20). At the country level, China was the most identified demand country (n=130), followed by the United States (n=59), Vietnam (n=50), Indonesia (n=47), and Hong Kong (SAR) (n=45) (Figure 5c).

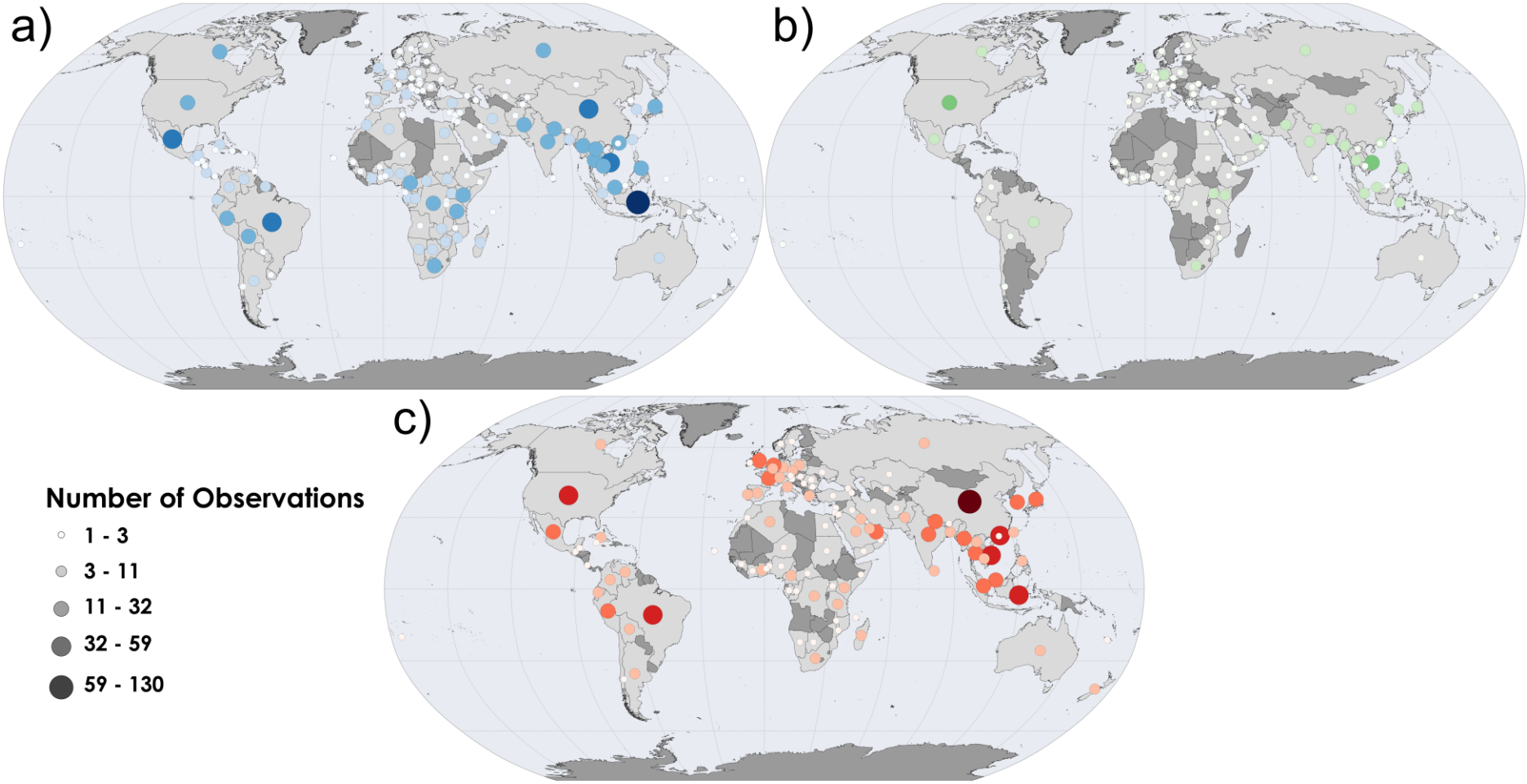

Figure 5: Encountered locations in the literature. a) encountered supply locations, b) encountered transit locations, c) encountered demand locations.

Across all encountered locations, a total of 160 countries were mentioned in the literature.

When summarizing the proportions of encountered study locations at the continental level, Africa (63%), South America (57%), North America (45%) and Oceania (43%) were mainly involved with encountered supply locations, while Asia (48%) and Europe (48%) were mainly involved with encountered demand locations (Figure 6).

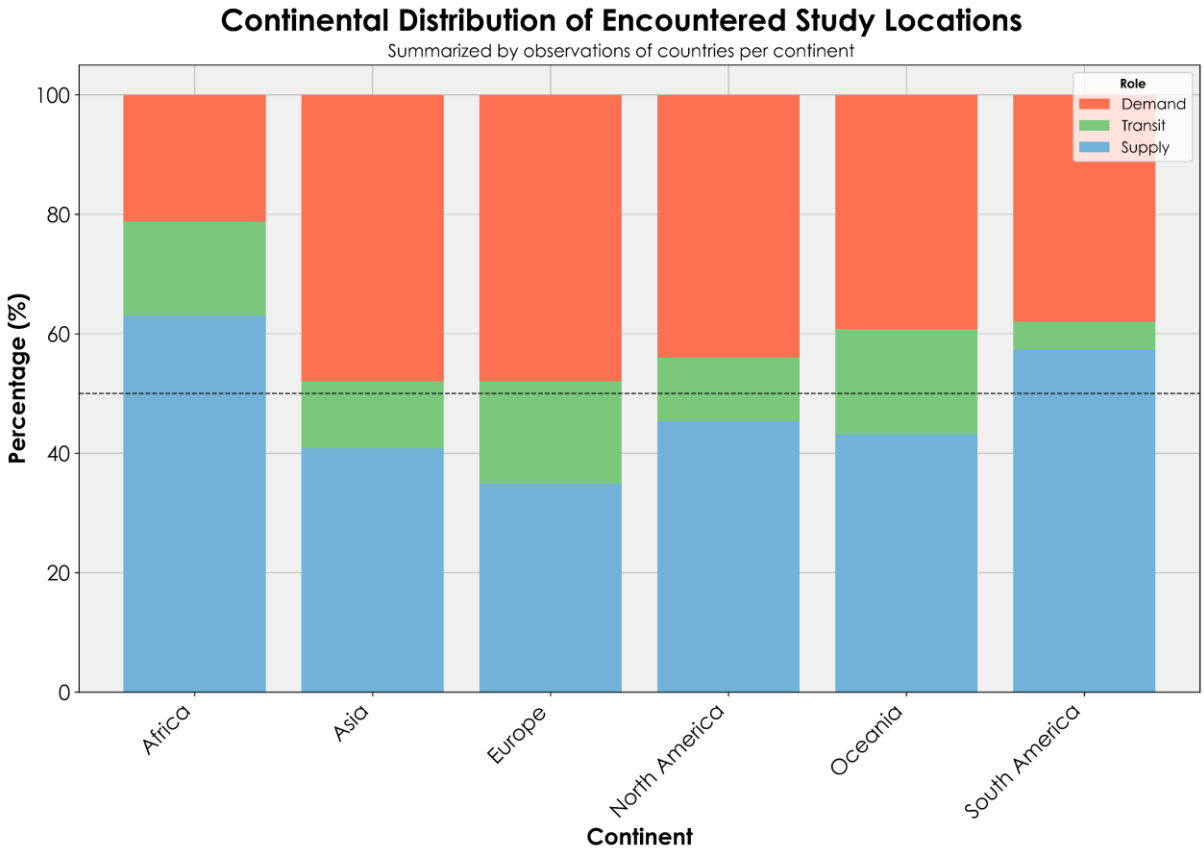

Figure 6: Continental distribution of encountered study locations.

4.2 Taxonomic focus and their associated countries in the literature on IWT, and the extent that the literature reflects the global distribution of wildlife potentially affected by IWT

4.2.1 Focus and representativeness of research on the most studied wildlife at the taxonomic rank of kingdom

Full tables of geographic results presented in this section can be found in Appendix 2: Geographic data tables.

When summarized at the taxonomic rank of kingdom, *Animalia* were the most mentioned group across all articles, followed by *Plantae* (Plants) and *Fungi* (Fungus) (Figure 7).

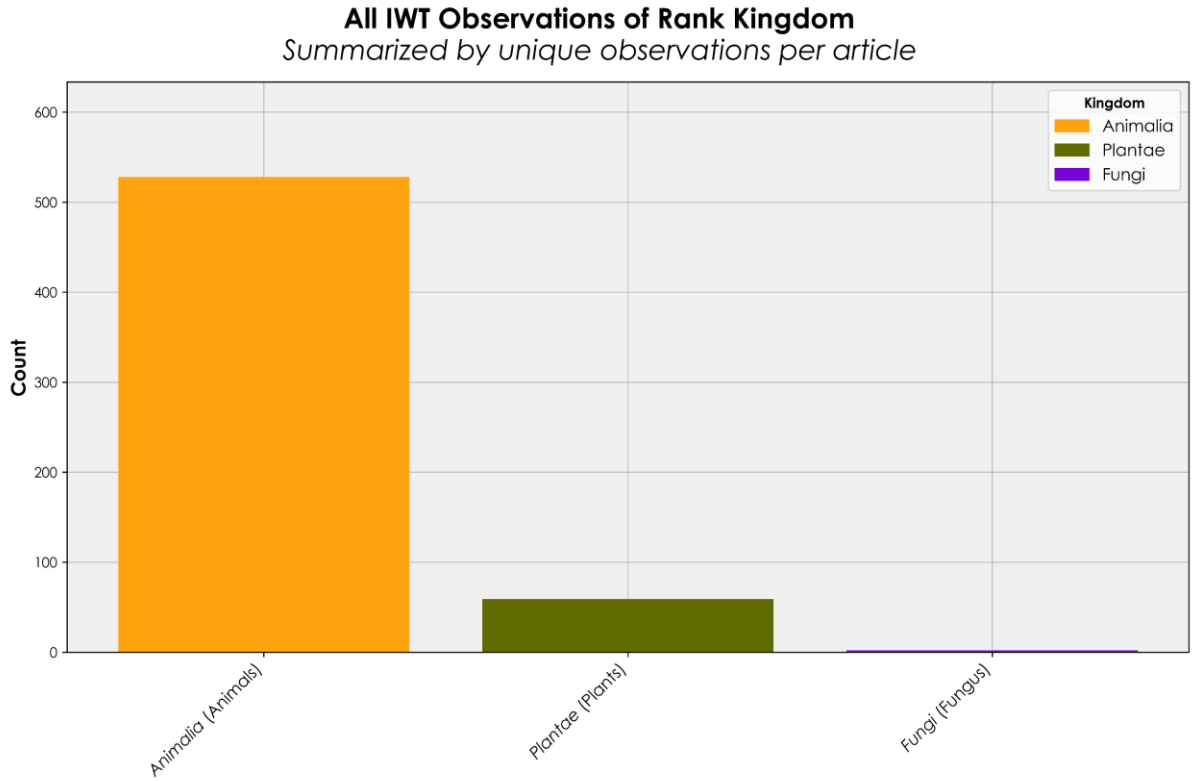

Figure 7: IWT observations of rank kingdom summarized by unique mentions per article.

Not included within the subsequent kingdom-level figures is a single instance of a fungus observed as illegally traded in the country of Bhutan.

IWT mentions per country in the literature

At the continental level, Asia had the highest number of animal-based observations in articles (49%, n=751), followed by Africa (17%, n=258) and Europe (13%, n=200), while Oceania had the least (2%, n=33). At the country level, China had the highest number of animal-based observations in articles (n=148), followed by Vietnam (n=77) and the United States (n=69) (Figure 8a).

Plants had the highest number of continental observations in Asia (49%, n=49), followed by North America (16%, n=16), Europe (14%, n=14), Africa (11%, n=11), South America (7%, n=7), and Oceania (2%, n=2). At the country level, China had the highest number of plant-based observations in articles (n=9), followed by both Mexico and the United States (n=8) (Figure 8b).

There are some similarities in the ranking of continents between animals and plants, with Asia having the highest and Oceania having the lowest number of observations in both. While there are some similarities between countries with the most observations within each taxonomic kingdom in articles (China and the United States), the number of plant observations are lower compared to animal observations in all countries except for Turkey, Azerbaijan, and Cyprus (Figure 8).

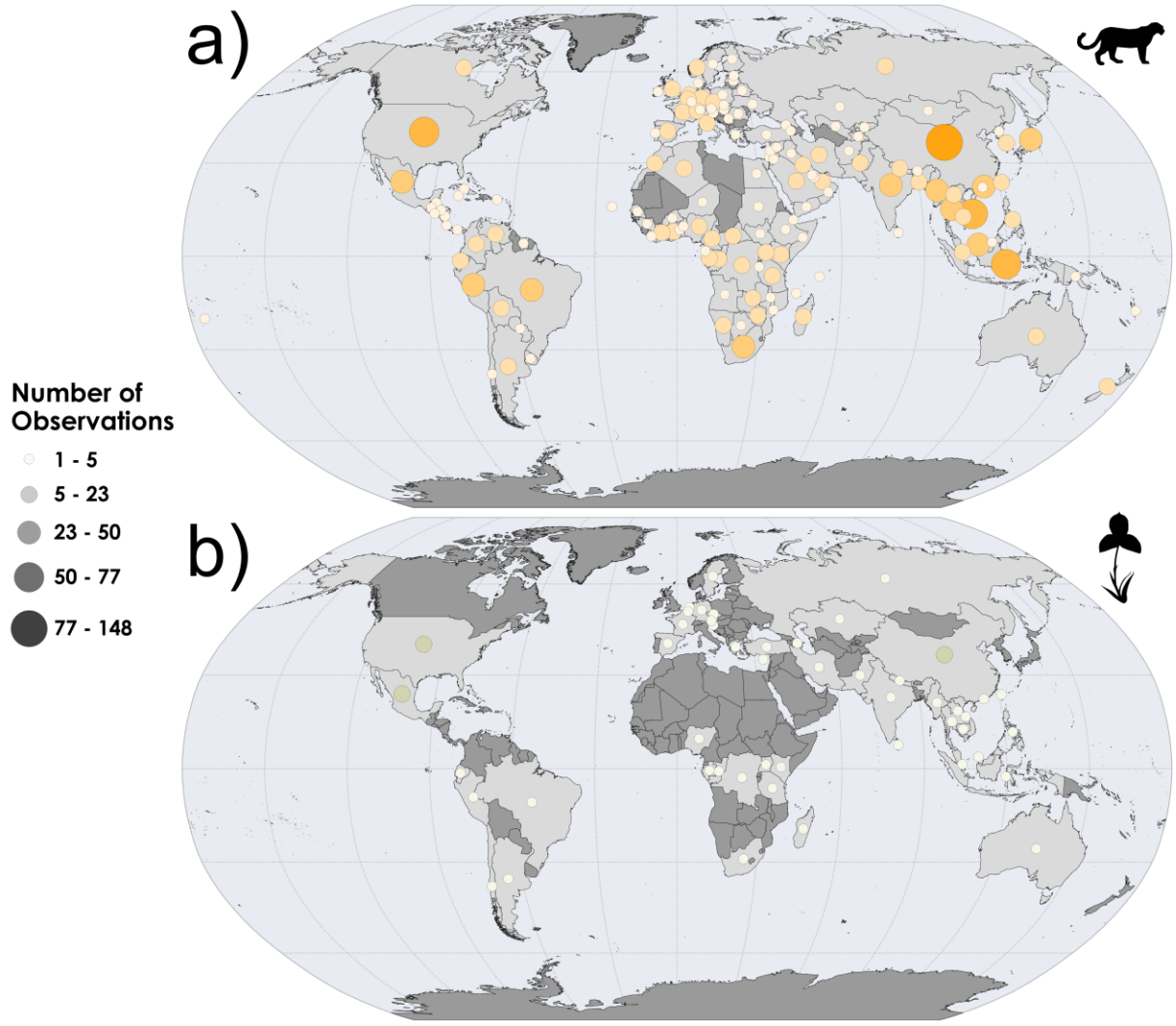

Figure 8: Observations of IWT per country in the literature of a) Animals, b) Plants.

Number of species mentioned in the literature as being illegally traded, per country

At the continental level, Asia had the highest number of animal-based observations of species in articles (44%, n=1427), followed by South America (28%, n=916), North America (12%, n=381), Africa (7%, n=234), and Europe (7%, n=219), while Oceania had the least (3%, n=103). At the country level, Brazil had the highest number of animal-based observations in articles (n=450), followed by China (n=243) and Indonesia (n=214) (Figure 9a).

Plants the highest number of observations continentally in Asia (45%, n=183), followed by North America (23%, n=93), Oceania (18%, n=72), Europe (8%, n=32), and Africa (4%, n=16), while South America had the least (2%, n=7). At the country

level, Nepal had the highest number of plant-based observations in articles (n=89), followed by Mexico (n=88) and Australia (n=72) (Figure 9b).

Asia ranking first and North America contained in the top three ranks are about the only continental similarities between the taxonomic kingdoms, with no overlapping rankings of countries in the top three. Similar to the article counts above, the number of animal species exceeded the number of plant species observed in all countries, except in the cases of Nepal, Iran, Czechia/Czech Republic, and Azerbaijan (Figure 9).

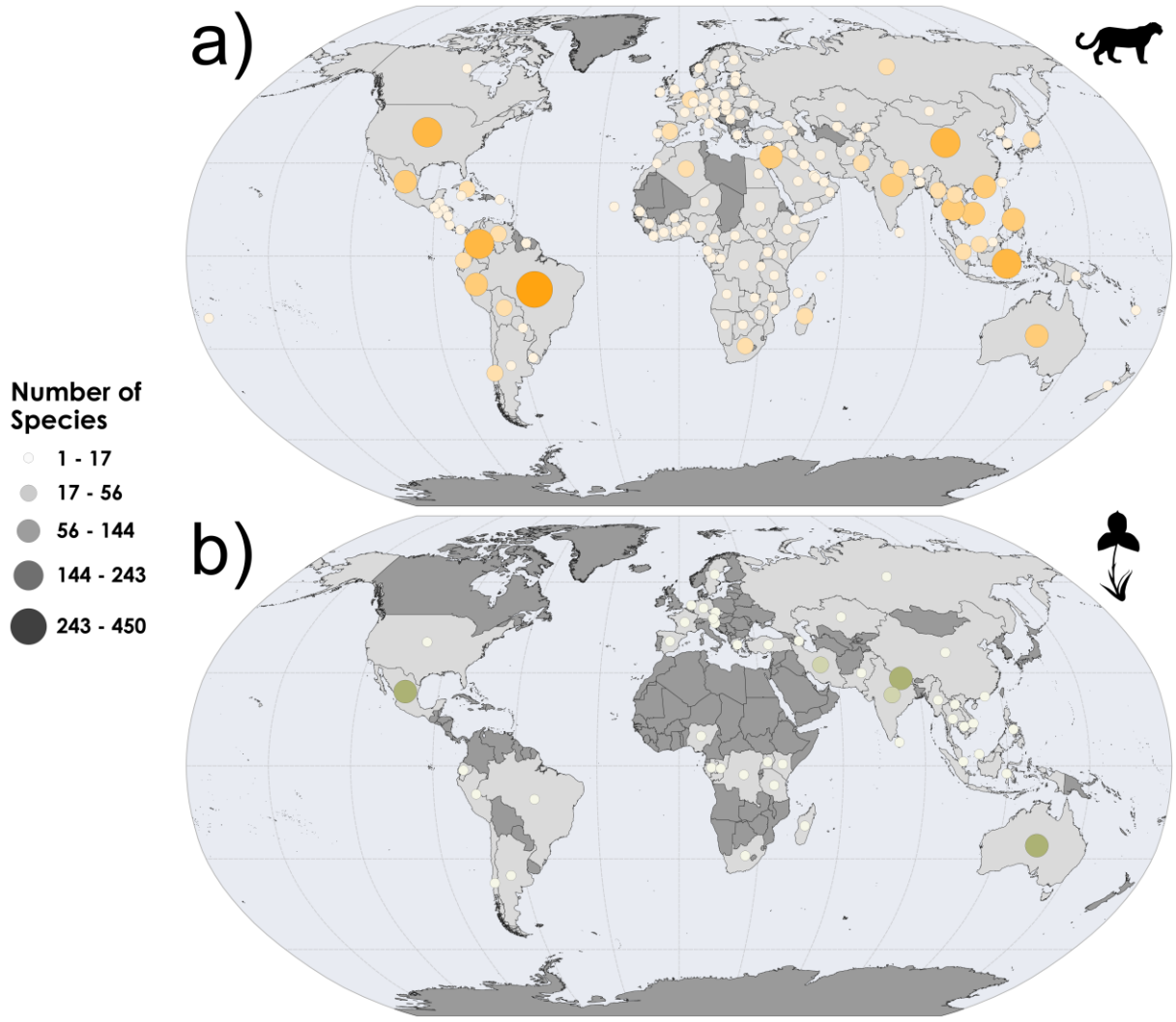

Figure 9: Number of species observed in the literature as being illegally traded, per country for a) Animals, b) Plants.

Spatial representativeness and associated patterns of the literature relative to all wildlife potentially affected by IWT

When comparing the count of animal species observed as illegally traded (Figure 9a) to global patterns of animal species potentially affected by illegal trade (through use and trade) (Appendix 2: Figure 18a), some continental patterns can be observed in the balanced to overrepresentation in North America, Southern and Eastern Asia, and Oceania, with a mix of all representations in South America (Figure 10a). Conversely, balanced to underrepresentation can be observed across much of Central America, Europe, and Africa (Figure 10a). Three significant clusters of underrepresentation in the literature can be seen observed for the animal species in western and central Africa, as well as in central Asia, while multiple clusters of overrepresentation in the literature can be observed in North America, South America, central Europe, northern Africa, and much of southern and south-eastern Asia (Figure 10a).

When comparing the count of plant species observed as illegally traded (Figure 9b) to global patterns of plant species potentially affected by illegal trade (through use and trade) (Appendix 2: Figure 18b), much of the world is largely either underrepresented not represented in the literature, excluding Nepal as the only country strongly overrepresented in the literature, with Mexico, Iran, India, and Australia all also slightly overrepresented (Figure 10b). Statistically significant clusters of underrepresentation in the literature can be seen observed for plants in South America, while a statistically significant cluster of overrepresentation in the literature can be seen in southern Asia (Figure 10b).

Comparatively between countries with both animal and plant representation, animal representation was higher in most countries (80%, n=35) compared to plant representation (20%, n=9), while globally there are more countries missing all representations of plants compared to animals (Figure 10). Similarities in statistically significant clusters between kingdoms are limited to just those overrepresented clusters containing both India and Nepal (Figure 10).

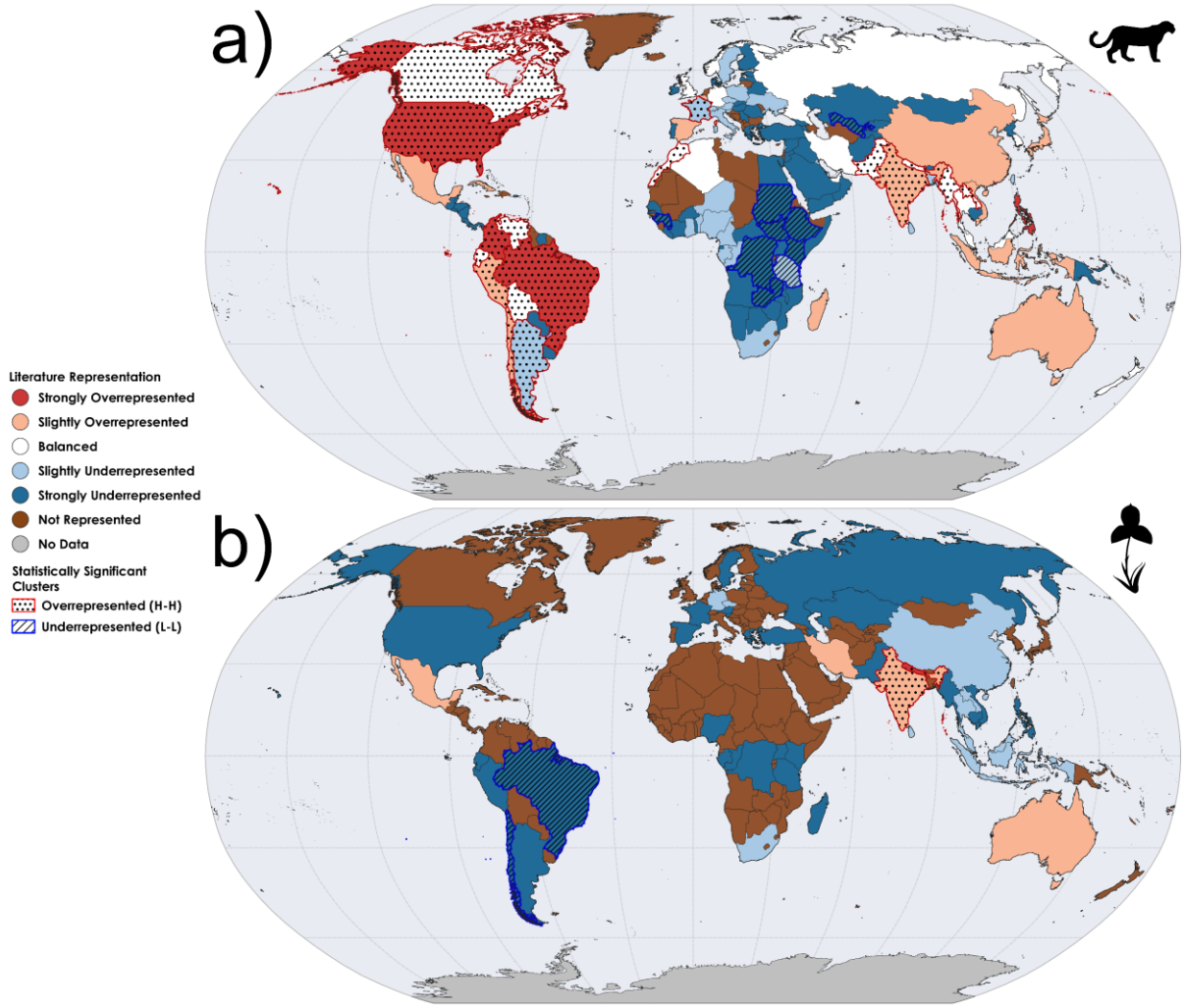

Figure 10: Species representation in the literature compared to those potentially affected by IWT (through use and trade), with statistically significant clusters highlighted for a) Animals, b) Plants.

4.2.2 Focus and representativeness of research on the most studied wildlife at the taxonomic rank of class

Full tables of geographic results presented in this section can be found in Appendix 2: Geographic data tables.

Mammalia (Mammals) were the class observed across the largest number of articles, followed by *Aves* (Birds) and *Reptilia* (Reptiles) (Figure 11).

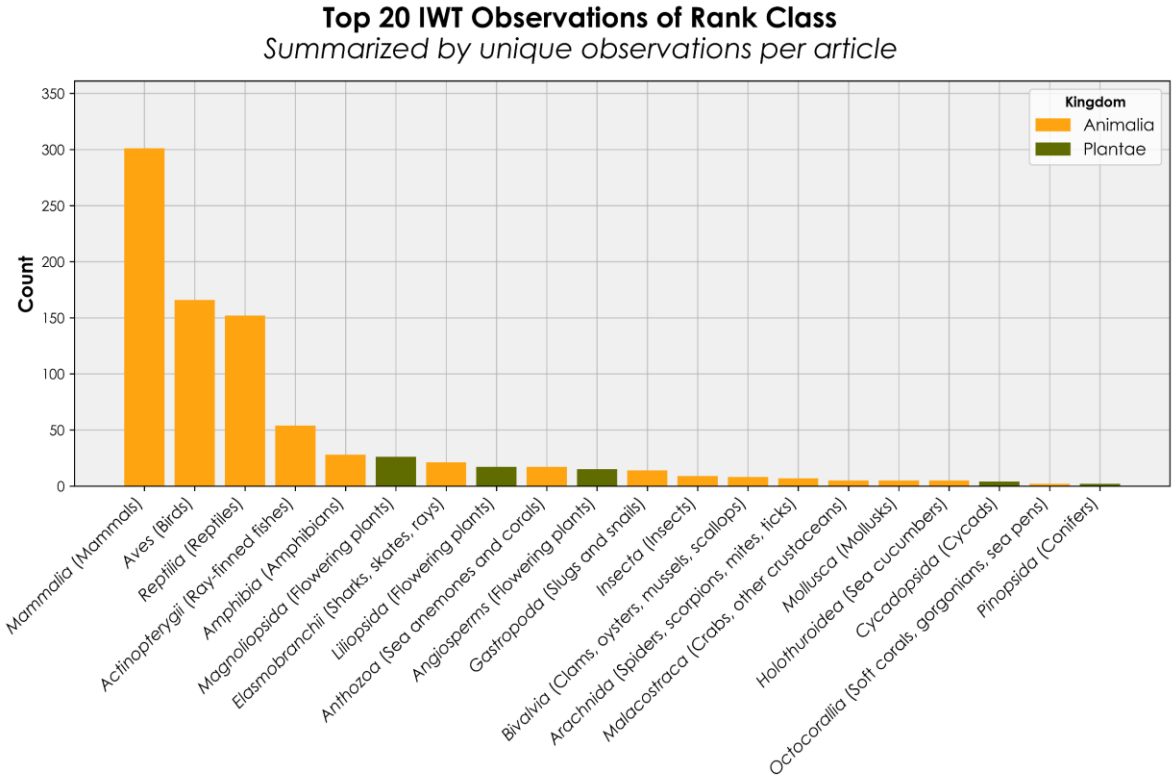

Figure 11: IWT observations of rank class, summarized by unique mentions per article.

IWT mentions per country in the literature

Observations of illegally traded amphibians were the lowest of all terrestrial vertebrate classes within the literature. Both Asia and South America were the continents with the largest proportion of illegally traded amphibian observations (27%, n=8), followed by Europe (23%, n=7), North America (17%, n=5), and Oceania (7%, n=2), while Africa had no observations at all. At the country level Peru had the highest number of observations (n=3), while China, Mexico, Japan, Australia, Brazil, Netherlands, and Colombia all had the second highest (n=2) (Figure 12a).

Continental observations of illegally traded birds were the largest in Asia (45%, n=101), followed by South America (20%, n=44), North America (14%, n=31), Europe (13%, n=29), and Africa (8%, n=17), while Oceania had the least (1%, n=2). At the country level Brazil had the highest number of observations (n=20), followed by both China and Indonesia (n=18) (Figure 12b).

Observations of illegally traded mammals were the highest of all terrestrial vertebrate classes in the literature. Continental observations of mammals were the largest in Asia (49%, n=485), followed by Africa (22%, n=221), Europe (13%, n=124), North America (7%, n=73), and South America (6%, n=64), while Oceania had the least (1%, n=19). At the country level China had the highest number of observations (n=97), followed by Vietnam (n=52) and the United States (n=34) (Figure 12c).

Continental observations of illegally traded reptiles were the largest in Asia (55%, n=157), followed by Europe (14%, n=40), North America (14%, n=39), Africa and South America (7%, n=20), while Oceania had the least (3%, n=10). At the country level China had the highest number of observations (n=31), followed by the United States (n=21) and Indonesia (n=18) (Figure 12d).

Asia ranking first or being tied for first is about the only continental similarity across all the taxonomic classes, while Oceania ranked the lowest in three of the four classes (excluding amphibians). At the country level, similarities include China raking within the top three of all the classes, while the Brazil, Indonesia, and the United States were ranked in two of the four classes.

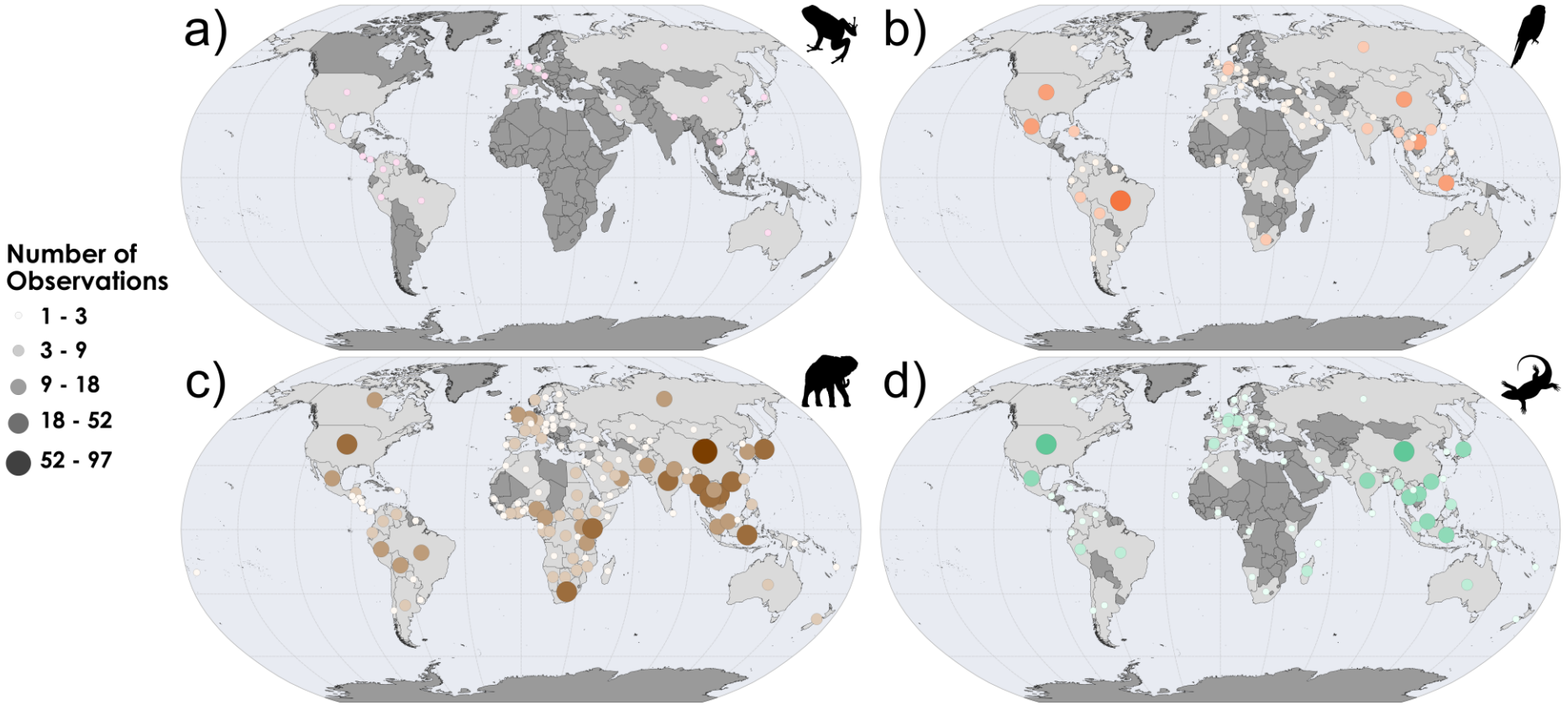

Figure 12: IWT observations per country in the literature of a) Amphibians, b) Birds, c) Mammals, d) Reptiles.

Number of species mentioned in the literature as being illegally traded, per country

Continental observations of amphibian species were the largest in South America (62%, n=43), followed by Europe (16%, n=11), Asia (13%, n=9), North America (7%, n=5), and Oceania (1%, n=1), while Africa did not have any. At the country level Brazil had the highest number of amphibian species observed (n=37), followed by Russia (n=6), and Colombia (n=4) (Figure 13a).

Continental observations of bird species were the largest in South America (43%, n=628), followed by Asia (38%, n=556), North America (10%, n=151), Europe (5%, n=70), Africa (2%, n=34), and Oceania (1%, n=8). At the country level Brazil had the highest number of bird species observed (n=358), followed by Indonesia (n=150), and Colombia (n=96) (Figure 13b).

Continental observations of mammal species were the largest in Asia (47%, n=457), followed by Africa (18%, n=179), South America (15%, n=151), Europe (11%, n=106), North America (7%, n=71), and Oceania (1%, n=12). At the country level China had the highest number of mammal species observed (n=68), followed by Colombia (n=52), and India and Nepal (n=41) (Figure 13c).

Continental observations of reptile species were the largest in Asia (51%, n=405), followed by North America (20%, n=154), South America (12%, n=94), Oceania (10%, n=82), Europe (4%, n=32), and Africa (3%, n=21). At the country level the United States had the highest number of reptile species observed (n=119), followed by China (n=97), and Australia (n=79) (Figure 13d).

Asia and South America each had two of the highest proportion of species observed across the taxonomic classes, while Oceania ranked last in three of the four proportions. Likewise, Colombia ranked in the top three for three of the four taxonomic classes, while China and Brazil ranked in the top three twice.

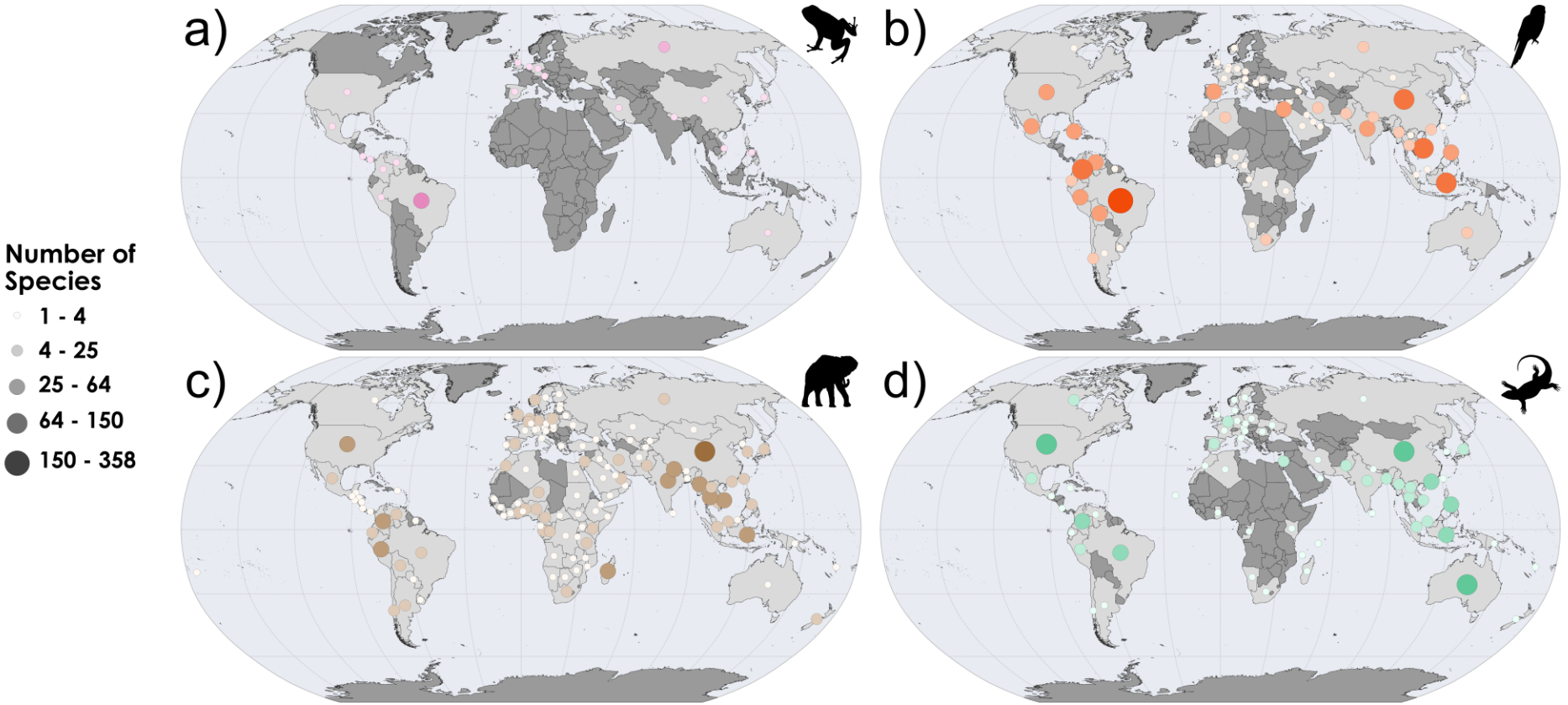

Figure 13: Number of species observed in the literature as being illegally traded, per country for a) Amphibians, b) Birds, c) Mammals, d) Reptiles.

Spatial representativeness and associated patterns of the literature relative to all wildlife potentially affected by IWT

When comparing literature observations of amphibian species being illegally traded (Figure 13a) to global patterns of amphibian species potentially affected by illegal trade through all use and trade (Appendix 3: Figure 19a), nearly all of the countries appearing in the literature fall into the literature overrepresentation categories excluding China which is balanced, though for most of the countries globally there was no representation in the literature (Figure 14a). No statistically significant over- or underrepresented clusters of countries occur in the literature representation of amphibian species (Figure 14a).

When comparing literature observations of bird species being illegally traded (Figure 13b) to global patterns of bird species potentially affected by illegal trade through all use and trade (Appendix 3: Figure 19b), of the countries represented in the literature, much of the world appeared underrepresented (Figure 14b). This may be due to the high number of bird species with both range data available and that are potentially affected by illegal trade through use and trade. Of the overrepresented countries, Brazil were the only ones strongly overrepresented while Cuba, Spain, Vietnam, and Indonesia were slightly overrepresented (Figure 14b). One statistically significant cluster of overrepresentation in the literature was observed in South America while there were no statistically significant clusters of underrepresentation (Figure 14b).

When comparing literature observations of mammal species being illegally traded (Figure 13c) to global patterns of mammal species potentially affected by illegal trade through all use and trade (Appendix 3: Figure 19c), much of North and South America as well as Europe, Asia, and Oceania fell between balanced and overrepresented in the literature (Figure 14c). While much of Africa was between balanced and underrepresented, some countries in Northern Africa were slightly overrepresented, with Madagascar as the only strongly overrepresented country in the continent (Figure 14c). New Zealand stands out in this case as having had no native mammal species potentially affected by use and trade despite having an observed instance of a mammal species being illegally traded in the country (Figure 14c). Two significant clusters of underrepresentation in the literature were seen observed for mammals in western and central-southern Africa, while multiple significant clusters of overrepresentation in the literature were seen in western South

America, central-western Europe, as well as much in central and south-eastern Asia (Figure 14c).

When comparing literature observations of reptile species (Figure 13d) to global patterns of reptile species potentially affected by illegal trade through all use and trade (Appendix 3: Figure 19d), all of continental North America (excluding Central America), along with much of South America, Western Europe, and Eastern and Southern Asia were overrepresented in the literature (Figure 14d). Conversely, much of eastern Europe, central Asia, and nearly all of Africa were not represented in the literature with only a few sporadic countries being balanced (Figure 14d). Only one significant cluster of underrepresentation in the literature was observed for reptiles in southern Africa, while two significant clusters of overrepresentation were observed North America and central Europe (Figure 14d).

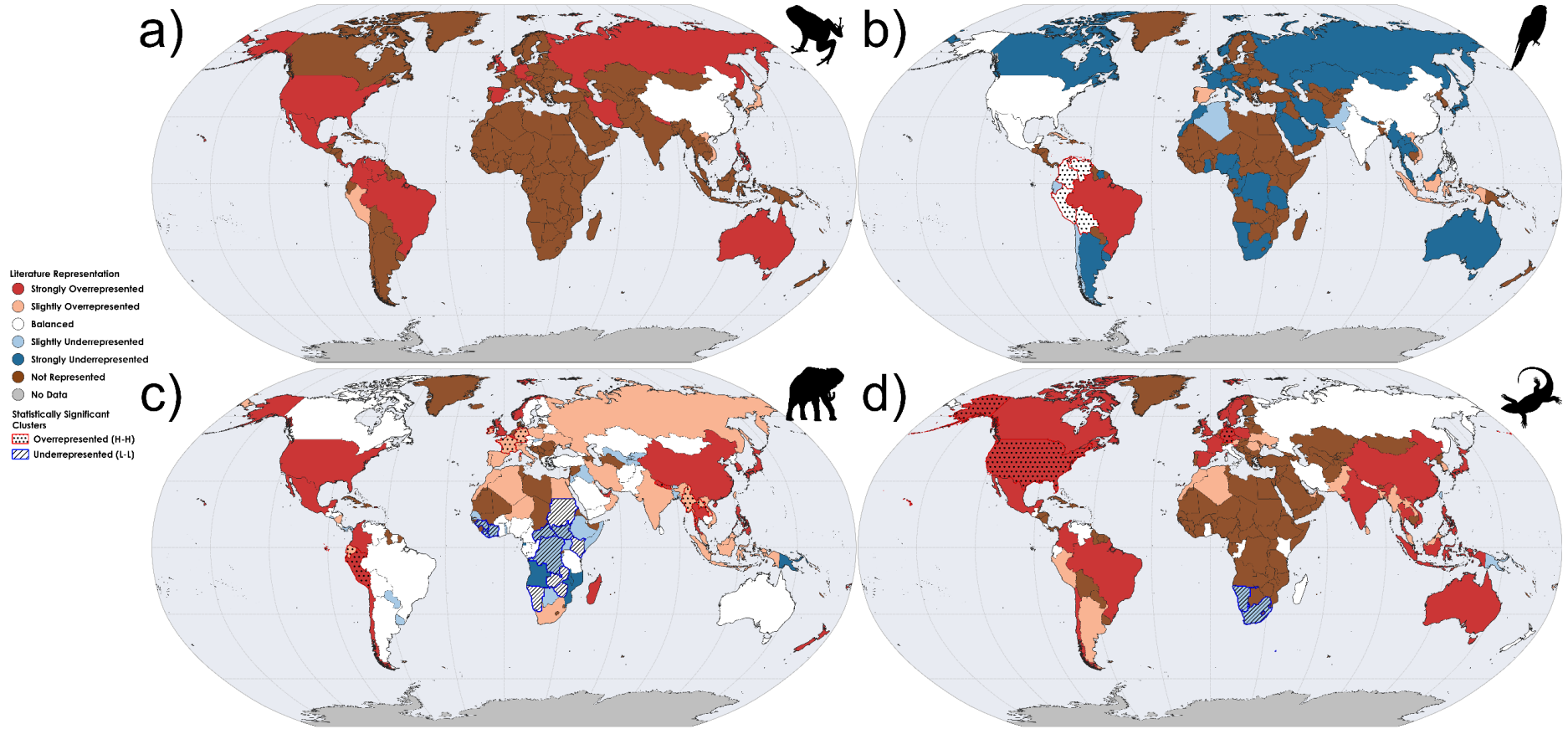

Figure 14: Species representation in the literature compared to those potentially affected by IWT (through use and trade), with statistically significant clusters highlighted for a) Amphibians, b) Birds, c) Mammals, d) Reptiles.

4.3 The species most prominently reported in the literature on IWT, and their associated flows of wildlife products

4.3.1 Focus of research on the most studied wildlife at the taxonomic rank of species

When summarized at the taxonomic rank of species there is no longer the inclusion of the taxonomic kingdom of Plantae, as well both aggregation methods become identical (Figure 15). *Panthera tigris* (Tiger) was the most observed species in the articles, followed by *Panthera pardus* (Leopard) and *Psittacus erithacus* (Grey parrot) (Figure 15).

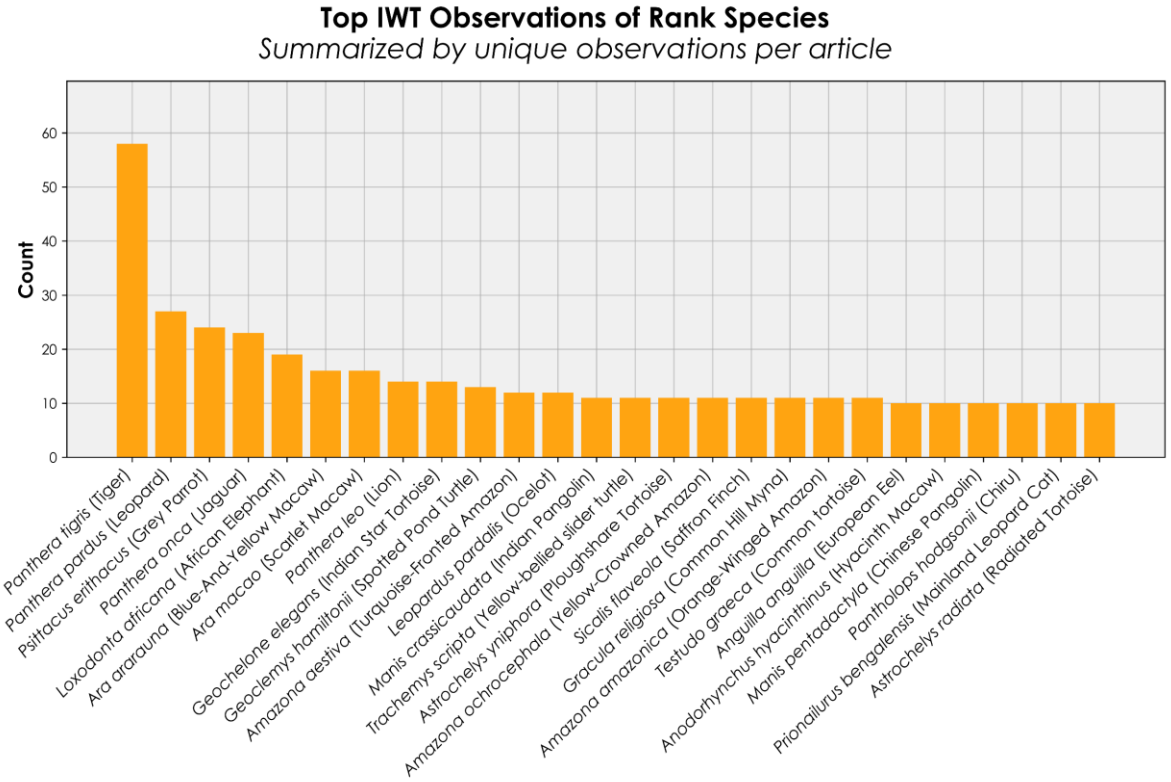

Figure 15: IWT observations of rank species, summarized by unique mentions per article.

4.3.2 Observed IWT trade routes and products

A total of 26 species were identified as illegally traded across 10 or more articles in Figure 15 above. Of these 26 species, 24 had species range data available from the IUCN Red List (Table 6). As such, within Appendix 4: IWT trade routes of frequently observed species in the literature are global maps of those species, with each map containing the species native habitat range, as well as international, domestic, and incomplete (partial) IWT trade routes as identified in the literature review as well as a proportion of the available product types for each species (Appendix 4: Figure 20 - Figure 43).

Species of the class *Reptilia* (Reptiles) (n=4) had the highest proportion of countries involved in illegal trade compared to their native species ranges, where each species had more countries observed within the IWT than countries in their native ranges (for those species with spatial data available), compared to only certain species of *Mammalia* (Mammals) (n=10) and *Aves* (Birds) (n=9) where this occurred (Table 6).

Table 6: Species observed across 10 or more articles (n=24).

Scientific Name	**Common Name**	**Class**	**Count of Articles Observed in**	**Count of Countries Encountered in Articles**	**Count of Countries in Species Native Range**
Panthera tigris	Tiger	*Mammalia*	58	36	12
Panthera pardus	Leopard	*Mammalia*	27	28	59
Psittacus erithacus	Grey Parrot	*Aves*	24	18	16
Panthera onca	Jaguar	*Mammalia*	23	22	18
Loxodonta africana	African Elephant	*Mammalia*	19	26	23
Ara ararauna	Blue-And-Yellow Macaw	*Aves*	16	11	10
Ara macao	Scarlet Macaw	*Aves*	16	13	16
Panthera leo	Lion	*Mammalia*	14	18	27
Geochelone elegans	Indian Star Tortoise	*Reptilia*	14	15	3
Geoclemys hamiltonii	Spotted Pond Turtle	*Reptilia*	13	16	5
Amazona aestiva	Turquoise-Fronted Amazon	*Aves*	12	5	4
Leopardus pardalis	Ocelot	*Mammalia*	12	17	20
Amazona amazonica	Orange-Winged Amazon	*Aves*	11	7	10
Amazona ochrocephala	Yellow-Crowned Amazon	*Aves*	11	7	11
Gracula religiosa	Common Hill Myna	*Aves*	11	6	16
Sicalis flaveola	Saffron Finch	*Aves*	11	2	10
Manis crassicaudata	Indian Pangolin	*Mammalia*	11	10	6
Astrochelys yniphora	Ploughshare Tortoise	*Reptilia*	11	15	1
Anguilla anguilla	European Eel	*Actinopterygii*	10	18	65

Scientific Name	Common Name	Class	Count of Articles Observed in	Count of Countries Encountered in Articles	Count of Countries in Species Native Range
Anodorhynchus hyacinthinus	Hyacinth Macaw	*Aves*	10	8	3
Manis pentadactyla	Chinese Pangolin	*Mammalia*	10	16	11
Pantholops hodgsonii	Chiru	*Mammalia*	10	16	2
Prionailurus bengalensis	Mainland Leopard Cat	*Mammalia*	10	5	20
Astrochelys radiata	Radiated Tortoise	*Reptilia*	10	10	1

Across all the taxonomic classes identified in Table 6, some form of illegal wildlife trade was observed within the native habitat range (Figure 16). Only ray-finned fishes, with its single species lacked observations of illegal domestic trade (Figure 16c). However, all other classes had some form of illegal trade observed. This included both incomplete and international trade routes, with at least one international trade route originating from a country found within the applicable native species ranges as well as incomplete trade routes occurring outside of the native range (Figure 16). For all classes except for ray-finned fishes, there were observations of illegal domestic trade in countries located outside of the native range (Figure 16a, b, d). Additionally for the classes of ray-finned fishes and reptiles, there were observations of illegal international trade between two countries outside of the native range without an additional link to a country within the native range (Figure 16c, d). Though, at the species level this phenomena was observed for certain species of the classes birds and mammals including *Ara ararauna* (Blue-and-yellow macaw) (Appendix 4: Figure 25), *Loxodonta Africana* (African elephant) (Appendix 4: Figure 33), *Manis Crassicaudata* (Indian pangolin) (Appendix 4: Figure 34), *Manis Pentadactyla* (Chinese pangolin) (Appendix 4: Figure 35), *Panthera Tigris* (Tiger) (Appendix 4: Figure 39), and *Psittacus Erithacus* (Grey parrot) (Appendix 4: Figure 42).

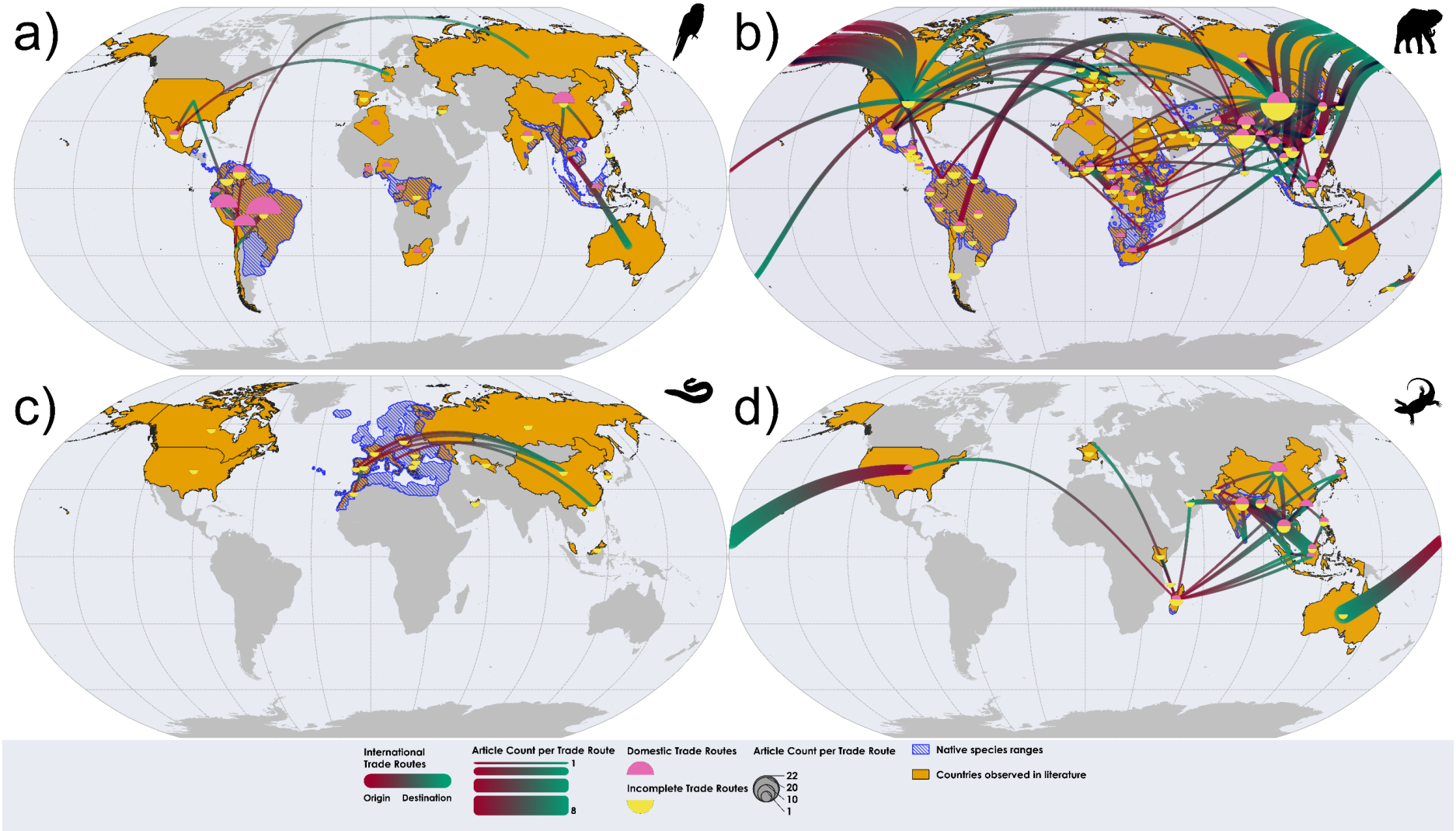

Figure 16: Species habitat ranges, global IWT trade routes, country occurrences, and product types for the most traded species of a) Birds, b) Mammals, c) Ray-finned fish, d) Reptiles. Symbology of the trade routes is scaled in size proportional to the count of articles they were observed in.

The main proportions of product types observed illegally traded can be broken down into trends by each of the individual taxonomic classes. For mammals, a higher proportion of illegal trade was observed with dead animals/animal derivatives as opposed to live animals (Figure 17b), while for the single Ray-finned fish, birds, and reptiles, the converse was true (Figure 17 a, c, d). These trends also held true at the species level for all the taxonomic classes, except for the Chinese pangolin where there was a higher proportion of illegal trade with live animals as opposed to dead animals/animal derivatives (Appendix 4: Figure 35).

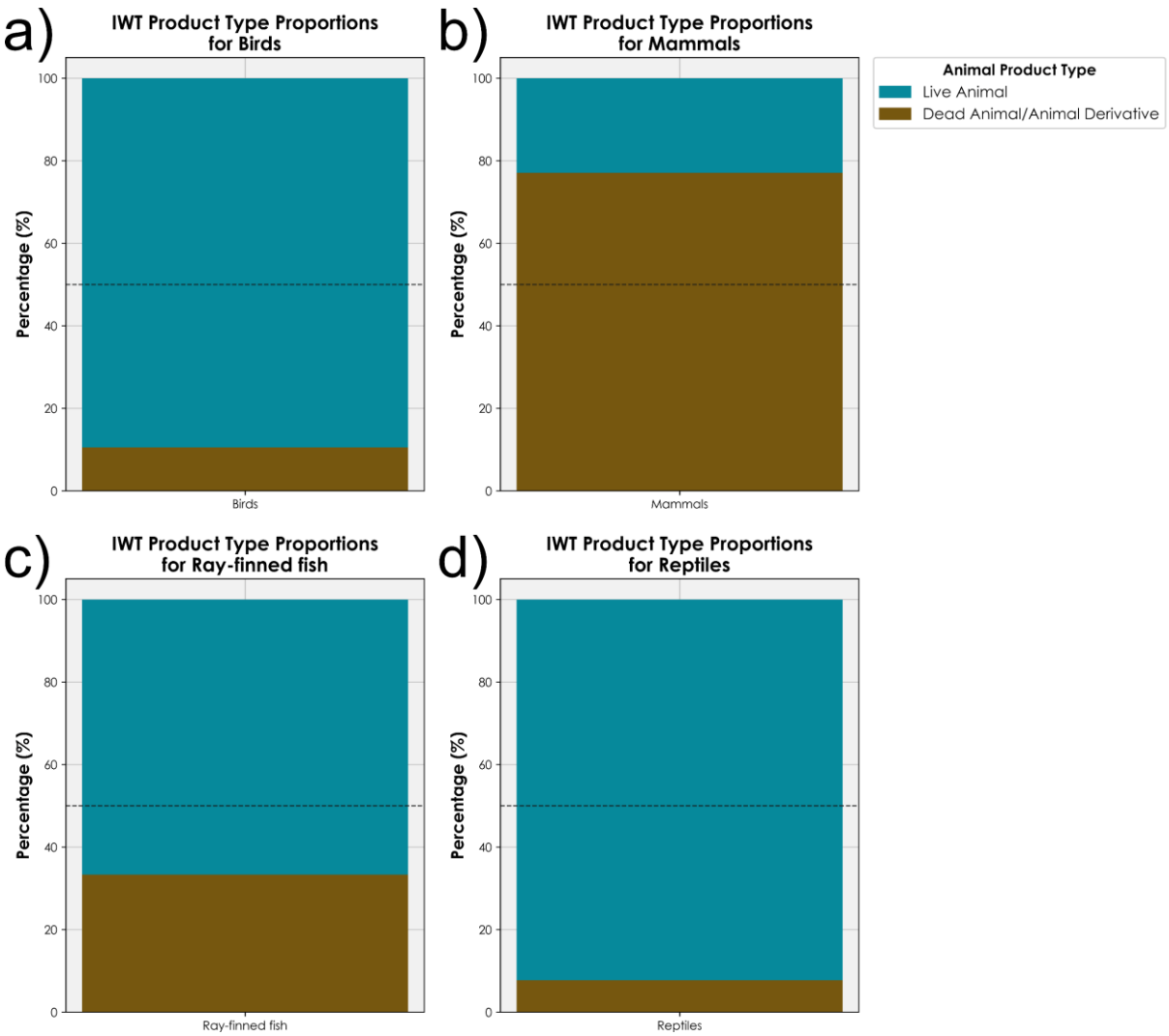

Figure 17: Product types observed for the most illegally traded species of a) Birds, b) Mammals, c) Ray-finned fish, d) Reptiles.

5 Discussion

5.1 A growth in IWT research over time

There has been an increase in research being performed about IWT across taxonomic kingdoms over time, demonstrated both by the increases in the number of publications, and the lagging but similar increase in data collection over time (Figure 3). The number of articles published increased in six of the ten most recent full years, with each increase representing a new annual high in the publication count.

There are various potential reasons for this ongoing increase in IWT literature. Research has shown that on the global scale, biodiversity loss has not only continued but has been increasing in recent years (Cardinale et al., 2012). This increase is occurring despite the development of international policies, agreements, and frameworks over the same period aimed at reducing this biodiversity loss (Cardinale et al., 2012; Petrossian et al., 2024).

Though, it is the case that many countries including those with the highest levels of wildlife product consumption have only recently introduced legislation to address and reduce demand for illegal wildlife (UNODC, 2022). The onset of the COVID-19 pandemic and the early connections of the disease being potentially zoonotic in origin also brought with it increased attention to IWT, to the public but also specifically to lawmakers (Ceballos et al., 2020; Hinsley et al., 2024; Hu et al., 2024; Siriwat & Nijman, 2020; Wyatt et al., 2022). Increases in performance of analytical software and rapid development of artificial intelligence and machine learning tools has enhanced the ability to detect patterns and gaps in collected data, which has aided both research and enforcement efforts alike (UNODC, 2022).

The increase in published research also coincides with the indication of increases in both the scope and scale of IWT alongside increases in human population and emerging economies within developing countries (D'Cruze & Macdonald, 2016). Similarly, it is also occurring at a time when IWT is becoming increasingly decentralized through the emergence of online marketplaces ('t Sas-Rolfes et al., 2019).

Future research on the temporal trends of IWT research should explore how the geographic distribution and taxonomic coverage of said research have evolved over

time. This can include how the emergence of online marketplaces has changed the possibilities for IWT research but also taking advantage of tools which utilize machine learning and artificial intelligence to full effect.

5.2 IWT impacts wildlife globally, but research is geographically concentrated

Research on, and observations of IWT have taken place in most countries globally.

Similarities exist in both the extent and quantity of literature observations between the primary and encountered study locations. Primary study locations are comprehensive across continental North and South America, and throughout most of Asia, while gaps in the research can be seen in northern and eastern Europe, throughout Africa, central Asia, and across many island nations (Figure 4). Each primary study location occurs in at least one of the encountered study location components (either supply, transit, or demand). Of the top five primary study locations, each occurred within at least one of the top five encountered study locations, with China occurring in supply and demand, Brazil occurring in supply, Indonesia occurring in supply and demand, the United States occurring in transit and demand, and Vietnam occurring in supply and demand. It is also the case that four of the top five primary study locations (excluding Vietnam) are megadiverse countries, or those hosting the largest amount of biodiversity (Petrossian et al., 2024).

The data also shows continental-level trends across the trade route components. While all continents have IWT occurrences reported for each of the three trade route components, there is a majority trade route component observed in each continent. Additionally, countries from Asia make up at least three of the top five countries mentioned across all primary and encountered location counts.

Biases in the occurrences of primary and encountered study locations were largely expected due to the indications in previous research, in part because most of the publicly available information on IWT comes from a select few sources including seizure databases (Hinsley et al., 2024; Hu et al., 2024). Many of these seizure databases are often more representative of higher-income, western countries and their primary trading partners, largely due to better detection and reporting capabilities for illegally traded wildlife and wildlife products but also because of their

higher overall trade volumes (Hinsley et al., 2024; Hu et al., 2024; ‘t Sas-Rolfes et al., 2019).

There is an additional western influence, at least within the criminology perspective with which IWT falls under, where minimal attention provided to crimes outside of the western or northern world because of the influence of western governments, enforcement organization, NGOs, and institutions which fund and perform this type of research (van Uhm, 2016). A large variability also exists between governments regarding the support for research of IWT, with certain nations less open and not collaborative with researchers and institutions out of concern that their policies, laws, and systems may be criticized (UNODC, 2022). The gap in research outside of the purview of western institutions creates a geographic blind spot of certain regions and risks an inference that IWT only occurs in those regions where it is studied (van Uhm, 2016). Funding for this type of research is also not uniform within individual countries either, as variations in funding of research can be observed at the sub-national level (see Alvarenga et al., 2024).

A western bias can also be seen represented within the design of this study. Article results from the three abstract and citation databases for this study consisted of those primarily, though not exclusively written in the English language. A non-insignificant number of results were excluded outright because they did not meet the language inclusion criteria. While not conclusive, this language limitation does potentially limit the general applicability of the findings of this research (see Petrossian et al., 2024).

The increased quantity of published IWT research in recent years, as observed in section 4.1, also coincides with a reduction in the overall number of IWT seizures (UNODC, 2024). Additionally, the ongoing decentralization of IWT through online marketplaces has limited the ability of authorities to enact adequate enforcement measures (Fukushima et al., 2021; Global Initiative Against Transnational Organized Crime, 2024).

Together these factors limit the quality and availability of new data used to analyse the evolution of trends in IWT while also reinforcing the geographic biases found in the source data. The overrepresentation of certain geographic regions can directly cause the underrepresentation of others, risking a conflation that IWT does not occur in those underrepresented regions or creating a skewed understanding of global IWT

dynamics. This then runs the risk of potential global gaps in wildlife conservation for those regions underrepresented in the literature, but also the exclusion of those regions in global policy aimed at combating biodiversity loss and IWT (Esmail et al., 2020).

Future research on the geographic trends of IWT should consider these geographic biases in seizure databases and look towards improving data collection methods in low-income countries. Additionally, further research into online marketplaces could allow for a better understanding of the evolving nature of IWT, particularly its decentralization.

5.3 Geographic biases in animal-centric research: overlooking plants and fungi

Literature on IWT is overwhelmingly focused on members of the taxonomic kingdom of animals, where this preference for animals can be seen across all the studied taxonomic levels (Figure 7, Figure 11, Figure 15). This aligns with past research which highlights the underrepresentation of plants and fungus in both IWT literature and within wildlife conservation efforts (Adamo et al., 2022; Bashyal & Roberts, 2024; Gonçalves et al., 2021; Oyanedel et al., 2022; Siriwat, 2020).

The limited research on plants is geographically reinforced by the vast underrepresentation of plant species by country in the literature review (Figure 10b). The most common plants being researched were those belonging to taxonomic classes of flowering plants, which include species of cactus, along with ferns and tree classes like cycads and conifers. The limited literature written about the illegal trade of plants tends to focus on timber, orchids, and cactuses, aligning with the results of this study (Siriwat, 2020). Flowering plants, like orchids, are often targeted for novel reasons, typically the aesthetic beauty which they provide which is valued as a collector or showcase type item (Goettsch et al., 2015; Siriwat, 2020), while several tree species are targeted for both functional and aesthetic purposes (Goettsch et al., 2015).

While the literature on IWT overwhelmingly focuses on animals, a large portion of that is made up of literature on mammals, birds, and reptiles, which along with amphibians, make up the grouping of taxonomic classes known as terrestrial

vertebrates. The highest intensities of both country and species mentioned in the literature across all these terrestrial vertebrate classes tend to be shared with those countries which make up the most mentioned primary study locations (Figure 4, Figure 12, Figure 13), which also tend to include the megadiverse countries of the world (Petrossian et al., 2024). These areas then also unsurprisingly almost always balanced or over-represented in their literature representation for all the terrestrial vertebrate classes (Figure 14). Amphibians were largely not represented in the literature, and those few countries which did appear mostly consisted of overrepresentation in literature per country (Figure 14a).

One prevailing geographic trend can be seen across all the terrestrial vertebrate classes of the near universal underrepresentation or missing representation of countries from Africa in the literature, and the occurrence of statistically significant clusters of underrepresentation found within Africa (Figure 10, Figure 14). This underrepresentation also aligns with the research gaps presented in section 5.2 which outlines the western bias of primary and encountered study locations in the literature.

Building upon the results identified in section 4.1.2, seizures make up the primary data source for literature written about IWT. It is then no surprise that all the most mentioned species in the literature are those belonging to the most commonly seized taxonomic groups (UNODC, 2022). Like plants, there is a focus on animal species which are generally aesthetically pleasing such as parrots and songbirds, alongside large charismatic mammals, large or distinctive reptiles, and those mammals commonly utilized in traditional medicine (Figure 15). Past research has shown this to be the case with literature and data collection on IWT tending to be biased towards charismatic animal species (Macdonald et al., 2021; Siriwat, 2020).

Seizures of wildlife products require both the knowledge and skills to detect and identify illegally traded wildlife and wildlife products, which is easier done with those aesthetically pleasing, distinctive, and charismatic animal species (Hinsley et al., 2024; UNODC, 2020, 2024). There are often large volumes of trade in wildlife species, such as many fish and plant species which are not easily identifiable and are subject to large quantities of unidentified trade where potential illegal trade remains unobstructed and unreported (Alvarenga et al., 2024; Holmes et al., 2009; Murillo Rengifo et al., 2024; Siriwat, 2020; UNODC, 2016). Similar identification limitations

can similarly be extended to research involving physical and online market visits and analysis.

Future research should aim to address the geographic research gaps outlined throughout Africa, central Asia, South America, and across many island nations. It should also put additional focus on species within the taxonomic kingdoms of plants and fungus, as well as putting additional focus on the less traditionally appealing, distinctive, and charismatic wildlife species.

5.4 Complex IWT trade routes: knowledge gaps and product specificity

The identified trade routes across all the taxonomic classes studied reveal a complex and interconnected system of IWT (Figure 16). Despite having just one additional species included within the class aggregation, there is a distinct jump in extent, complexity, and quantity of illegal trade routes when comparing birds (n=9) (Figure 16a) to mammals (n=10) (Figure 16b).

Building upon the results of sections 5.2 and 5.3, interpretations of these results need to account for not only the geographic biases found within wildlife product seizure data, but also the kinds of IWT these databases report on (Hinsley et al., 2024; Hu et al., 2024). Seizures typically occur within the context of international trade but can occur at any point along the trade route (supply, transit, or demand) (UNODC, 2022). As an example, one of the largest countries reporting on seizures, but also one of the largest countries trading goods globally is the United States (Hinsley et al., 2024; Tow et al., 2021; UNODC, 2024), a country also occurring within the top primary study locations found in this literature review (Figure 4). IWT trade involving the United States can be observed in some capacity across all the taxonomic class trade route maps (Figure 16). This also includes significant quantities of illegal international trade between the United States and other countries, where neither country is contained within the native species ranges of the class of species being traded.

The over-reliance on seizure data needs to be extended to the interpretation of the other trade route types as well. All taxonomic classes had some amount of illegal and domestic trade reported in the literature, excluding the class *Actinopterygii* (Ray-finned fishes) which did not report any illegal domestic trade (Figure 16). Because domestic trade is not contained within these seizure databases, records and

observations need to be performed on a case-by-case basis, typically through snowball sampling methods like market observations, media reports, or interviews with key actors or enforcement agencies (Hu et al., 2024; Siriwat, 2020; van Uhm, 2016). These kinds of reporting also can sometimes lead to fuzzy or incomplete data, both as they require species-level interpretation from authors or enforcement agents as discussed in section 5.3, but also can lack information about the actual origin the traded wildlife (Macdonald et al., 2021; Siriwat, 2020; UNODC, 2016) as can be seen in the widespread illegal incomplete trade observed across the studied taxonomic classes (Figure 16).

These factors highlight the need for further research to connect the missing links within IWT. These missing links include trade between countries within species native ranges and those countries outside the native ranges, trade to those countries with only incomplete trade route data available, as well as increased consideration for domestic trade routes.

There are also general trends in the product types being illegally traded when summarized at the class level. Higher proportions of live animals for those species of birds and reptiles can likely be explained by their popularity in the exotic pet trade (Bush et al., 2014; Mozer & Prost, 2023), though there is still a large market for reptile derivatives for use aesthetically (Mozer & Prost, 2023). While conversely, higher proportions of dead or animal derivatives for mammals is likely because of their popularity for consumption as bushmeat or use in traditional medicine (D'Cruze et al., 2021; Mozer & Prost, 2023; United Nations Environment Programme, 2016), their functional uses like clothing (D'Cruze et al., 2021; South & Wyatt, 2011), and as status symbols such as trophies (Lawson & Vines, 2014; UNODC, 2016), though there is still a demand for live mammals as exotic pets as well (Bush et al., 2014; Mozer & Prost, 2023).

Future research should look further into these trends of IWT product types, particularly in a geographic context to help aid with species identification techniques.

5.5 Study limitations and conclusion

This work examined the current breath of published literature available on IWT, identifying both geographic and taxonomic biases in the literature that are reinforced by the limitations of the most popular publicly available IWT data sources.

This study has several potential limitations. Concessions had to be made when it came to the initial selection criteria for the inclusion of literature in the study, like those of the language criteria but also with publication type restrictions that may have inadvertently excluded valuable insights. There were also issues with accessing certain articles published by journals that the university does not subscribe to, leading to even more potentially missed information. Finally, as observed in Figure 3, the amount of literature published about IWT has been increasing overtime. While a publication date criterion must be set for practical purposes, there is likely a significant amount of literature that has been published since that criterion.

Several aspects of the data entry process for the literature review could be improved upon. Quite a bit of time was spent on my part fixing a lot of the data I manually recorded, due to a variety of factors. There are several features within Excel which I had used to try and speed up the data entry process, which includes using many of the “Get & Transform Data” tools available. These automated tools are not perfect, and have several limitations based on the formatting of data made available in articles. Better quality control techniques and general foresight on my part should have been exhibited to reduce the number of errors introduced at this stage. Despite the limitations of the language selection criteria limitations outlined in section 5.2, the translation of non-English articles to English created additional issues when it came to understanding author context, as well as mistranslations of certain scientific terminology such as taxonomic nomenclature.

The formatting of my data collection excel table led to issues when it came to certain data analysis and visualization steps. Previous systematic literature reviews have outlined a series of data collection methods which I did not implement, including the use of coding sheets and data extraction protocols for Excel-based data collection (see Hiller & ’t Sas-Rolfes, 2025), the use of alternative or relational database software like NVivo 12 (see Luong, 2022). Better identification methods on my part could have been implemented for recording the data sources of IWT observations found within

the included articles, with an added data level identifier (e.g. first party, second party, etc.).

A better understanding of research outcomes and scope of the systematic mapping would be beneficial before undertaking the literature review process. The data collection process through the variables I chose ended up being overly broad, and contained a considerable number of variables which did not end up being included in the literature map. More time could have been dedicated to deepening the level of data collected for the variables which did end up being utilized (e.g. identifying sub-national regions of observed IWT).

My interpretation of observations and data presented in articles was perhaps overly cautious at times. Many statements of IWT in the literature lacked explicit taxonomic or geographic information or used broad statements to refer to IWT in a general sense. These issues of broad data reporting have been brought up in past systematic literature review articles about IWT as well (Anagnostou & Doberstein, 2022). Each of the component terms of IWT (illegal, wildlife, and trade) all have a long list of synonyms or equivalent terms as demonstrated in the keyword search strings of Table 2. Based on individual author writing styles and this series of IWT identification key words, it was difficult at times to determine if an author was discussing illegal wildlife trade, or the broader wildlife trade. Careful interpretations of observed IWT locations and trade route types were also required based on the primary data sources utilized in each individual article. These trade route interpretation limitations can be seen affecting the results presented in Figure 16 with the substantial number of incomplete trade route points.

There is also a slight methodological issue when it comes to the spatial over- and under-representation of plant and animal species in the literature. While the first proportion calculated includes species from all encountered study locations (supply, transit, and demand), the second proportion is derived from species' native ranges and thus only reflects the encountered supply component. This then requires a careful interpretation of the resulting data visualized in the maps but provides the best possible data synthesis that could be completed in the time frame I had available.

Finally, there is the larger inherent issue when it comes to the covert nature of IWT. The research performed in this study can only assess the extent, biases, and gaps in the knowledge of IWT, not of IWT itself. It is not able to be representative of the actual extent of IWT due to the primary and proxy data source limitations outlined in section 5.4. Taxonomic and geographic biases in the research are also likely only further amplified in this research because of the limited number of data sources utilized within the literature, meaning the same source data has likely been recorded by me in the literature review process multiple times across a series of articles included in the analysis. Attempting to understand the true extent and scale of IWT would require the synthesis of literature data with other external data, something I had hoped to accomplish with this research but was unable to due to time constrains.

Despite these limitations, trends were observed in both geographic literature representation, as well as with trade routes and product types across the most studied taxonomic classes. IWT remains an ongoing and pertinent issue which requires continued research moving forward. More effort in research should be placed on data collection in the regions identified as under-represented in this work, research regarding the IWT of non-charismatic animals, plants, and fungi, as well as research to better understand the dynamics of domestic IWT. Future research should also investigate the feasibility of synthesizing IWT proxy data with other data sources to better represent the true scope and scale of IWT. With this, a more comprehensive and unbiased understanding of all aspects of IWT could better inform conservation and enforcement efforts to ensure biodiversity remains intact, globally.

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References

Abdullah, A., Ardiansyah, A., Balestri, M., Campera, M., Chavez, J., Dewi, T., Fourage, A., Hankinson, E. L., Hedger, K., Leupen, B., Manson, S., Morcatty, T. Q., Nekaris, K. A. I., Nijman, V., Pereyra, P. E. R., Sintya, E., Svensson, M. S., & Xie, M. (2024). Parrot Trade and the Potential Risk of Psittacosis as a Zoonotic Disease in Indonesian Bird Markets. *Birds*, *5*(1), 137–154. https://doi.org/10.3390/birds5010010

Adamo, M., Sousa, R., Wipf, S., Correia, R. A., Lumia, A., Mucciarelli, M., & Mammola, S. (2022). Dimension and impact of biases in funding for species and habitat conservation. *Biological Conservation*, *272*, 109636. https://doi.org/10.1016/j.biocon.2022.109636

Alvarenga, M., Bunholi, I. V., de Brito, G. R., Siqueira, M. V. B. M., Domingues, R. R., Charvet, P., Foresti, F., Solé-Cava, A. M., & da Cruz, V. P. (2024). Fifteen years of elasmobranchs trade unveiled by DNA tools: Lessons for enhanced monitoring and conservation actions. *Biological Conservation*, *292*, 110543. https://doi.org/10.1016/j.biocon.2024.110543

Alves, R. R. N., Rosa, I. L., Léo Neto, N. A., & Voeks, R. (2012). Animals for the Gods: Magical and Religious Faunal Use and Trade in Brazil. *Human Ecology*, *40*(5), 751–780. https://doi.org/10.1007/s10745-012-9516-1

Anagnostou, M., & Doberstein, B. (2022). Illegal wildlife trade and other organised crime: A scoping review. *Ambio*, *51*(7), 1615–1631. https://doi.org/10.1007/s13280-021-01675-y

Anselin, L., Syabri, I., & Kho, Y. (2006). GeoDa: An Introduction to Spatial Data Analysis. *Geographical Analysis*, *38*(1), 5–22. https://doi.org/10.1111/j.0016-7363.2005.00671.x

Arroyo-Quiroz, I., & Wyatt, T. (2019). Wildlife trafficking between the European union and Mexico. *International Journal for Crime, Justice and Social Democracy*, *8*(3), 23–37. https://doi.org/10.5204/ijcjsd.v8i3.1243

Bager Olsen, M. T., Geldmann, J., Harfoot, M., Tittensor, D. P., Price, B., Sinovas, P., Nowak, K., Sanders, N. J., & Burgess, N. D. (2021). Thirty-six years of legal and illegal wildlife trade entering the USA. *ORYX*, *55*(3), 432–441. https://doi.org/10.1017/S0030605319000541

Barber-Meyer, S. M. (2010). Dealing with the Clandestine Nature of Wildlife-Trade Market Surveys. *Conservation Biology*, *24*(4), 918–923. http://www.jstor.org/stable/40864190

Bashyal, R., Paudel, K., Hinsley, A., & Phelps, J. (2023). Making sense of domestic wildlife and CITES legislation: The example of Nepal's orchids. *Biological Conservation*, *280*. https://doi.org/10.1016/j.biocon.2023.109951

Bashyal, R., & Roberts, D. L. (2024). A systematic survey of online trade in the caterpillar fungus *Ophiocordyceps sinensis*. *Oryx*, *58*(1), 29–37. https://doi.org/10.1017/S003060532300131X

Basu, G. (2014). Concealment, corruption, and evasion: a transaction cost and case analysis of illicit supply chain activity. *Journal of Transportation Security*, *7*(3), 209–226. https://doi.org/10.1007/s12198-014-0140-8

Beastall, C., Shepherd, C. R., Hadiprakarsa, Y., & Martyr, D. (2016). Trade in the Helmeted Hornbill Rhinoplax vigil: The "ivory hornbill." *Bird Conservation International*, *26*(2), 137–146. https://doi.org/10.1017/S0959270916000010

Berkes, F. (2013). Religious Traditions and Biodiversity. In *Encyclopedia of Biodiversity* (pp. 380–388). Elsevier. https://doi.org/10.1016/B978-0-12-384719-5.00122-2

BirdLife International and Handbook of the Birds of the World. (2022). *Bird species distribution maps of the world. Version 2022.2*. http://datazone.birdlife.org/species/requestdis

Boratto, R., Porter, A. A., & Shepherd, C. R. (2024). Canada's role in global wildlife trade: Research trends and next steps. In *European Journal of Wildlife Research* (Vol. 70, Issue 1). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/s10344-023-01763-2

Broad, S., Mulliken, T., & Roe, D. (2002). The nature and extent of legal and illegal trade in wildlife. In S. Oldfield (Ed.), *The trade in wildlife. Regulation for conservation*. (pp. 3–22). Routledge. https://doi.org/10.4324/9781849773935

Bush, E. R., Baker, S. E., & Macdonald, D. W. (2014). Global Trade in Exotic Pets 2006–2012. *Conservation Biology*, *28*(3), 663–676. https://doi.org/10.1111/cobi.12240

Butchart, S. H. M., Walpole, M., Collen, B., van Strien, A., Scharlemann, J. P. W., Almond, R. E. A., Baillie, J. E. M., Bomhard, B., Brown, C., Bruno, J., Carpenter, K. E., Carr, G. M., Chanson, J., Chenery, A. M., Csirke, J., Davidson, N. C.,

Dentener, F., Foster, M., Galli, A., … Watson, R. (2010). Global Biodiversity: Indicators of Recent Declines. *Science*, *328*(5982), 1164–1168. https://doi.org/10.1126/science.1187512

Cabeza, M., Torrents-Ticó, M., Viranta, S., & Werdelin, L. (2024). The hyena story: from ancient fossils to folktales and witchcraft. *Annales Zoologici Fennici*, *61*(1). https://doi.org/10.5735/086.061.0125

Cardinale, B. J., Duffy, J. E., Gonzalez, A., Hooper, D. U., Perrings, C., Venail, P., Narwani, A., Mace, G. M., Tilman, D., Wardle, D. A., Kinzig, A. P., Daily, G. C., Loreau, M., Grace, J. B., Larigauderie, A., Srivastava, D. S., & Naeem, S. (2012). Biodiversity loss and its impact on humanity. *Nature*, *486*(7401), 59–67. https://doi.org/10.1038/nature11148

CBD Secretariat. (2024a). *2030 Targets (with Guidance Notes)*. https://www.cbd.int/gbf/targets

CBD Secretariat. (2024b, January 10). *GBF Home*. https://www.cbd.int/gbf

Ceballos, G., Ehrlich, P. R., & Raven, P. H. (2020). Vertebrates on the brink as indicators of biological annihilation and the sixth mass extinction. *Proceedings of the National Academy of Sciences*, *117*(24), 13596–13602. https://doi.org/10.1073/pnas.1922686117

Chan, J. Y. S., Nijman, V., & Shepherd, C. R. (2024). The trade of tokay geckos Gekko gecko in retail pharmaceutical outlets in Hong Kong. *European Journal of Wildlife Research*, *70*(1), 10. https://doi.org/10.1007/s10344-023-01762-3

Cheung, H., Mazerolle, L., Possingham, H. P., & Biggs, D. (2018). Medicinal Use and Legalized Trade of Rhinoceros Horn From the Perspective of Traditional Chinese Medicine Practitioners in Hong Kong. *Tropical Conservation Science*, *11*, 1940082918787428. https://doi.org/10.1177/1940082918787428

Chomel, B. B., Belotto, A., & Meslin, F.-X. (2007). Wildlife, Exotic Pets, and Emerging Zoonoses1. *Emerging Infectious Diseases*, *13*(1), 6–11. https://doi.org/10.3201/eid1301.060480

CITES. (2022). *What is CITES?* https://cites.org/eng/disc/what.php

CITES. (2024, May 25). *Appendices I, II and III*. https://cites.org/sites/default/files/eng/app/2024/E-Appendices-2024-05-25.pdf

Cooper, M. E., & Rosser, A. M. (2002). International regulation of wildlife trade: relevant legislation and organisations. *Revue Scientifique et Technique de l'OIE*, *21*(1), 103–123. https://doi.org/10.20506/rst.21.1.1329

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R. V., Paruelo, J., Raskin, R. G., Sutton, P., & van den Belt, M. (1997). The value of the world's ecosystem services and natural capital. *Nature*, *387*(6630), 253–260. https://doi.org/10.1038/387253a0

Daltry, J. C., Prospere, A., Toussaint, A., Gengelbach, J., & Morton, M. N. (2015). Making business scents: how to harvest incense sustainably from the globally threatened lansan tree *Protium attenuatum*. *Oryx*, *49*(3), 431–441. https://doi.org/10.1017/S003060531400115X

D'Cruze, N., Galarza, F. E. R., Broche, O., El Bizri, H. R., Megson, S., Elwin, A., Machado, F. C., Norrey, J., Coulthard, E., & Megson, D. (2021). Characterizing trade at the largest wildlife market of Amazonian Peru. *Global Ecology and Conservation*, *28*, e01631. https://doi.org/10.1016/j.gecco.2021.e01631

D'Cruze, N., & Macdonald, D. W. (2016). A review of global trends in CITES live wildlife confiscations. *Nature Conservation*, *15*, 47–63. https://doi.org/10.3897/natureconservation.15.10005

Dobson, A. P., Pimm, S. L., Hannah, L., Kaufman, L., Ahumada, J. A., Ando, A. W., Bernstein, A., Busch, J., Daszak, P., Engelmann, J., Kinnaird, M. F., Li, B. V., Loch-Temzelides, T., Lovejoy, T., Nowak, K., Roehrdanz, P. R., & Vale, M. M. (2020). Ecology and economics for pandemic prevention. *Science*, *369*(6502), 379–381. https://doi.org/10.1126/science.abc3189

Esmail, N., Wintle, B. C., t Sas-Rolfes, M., Athanas, A., Beale, C. M., Bending, Z., Dai, R., Fabinyi, M., Gluszek, S., Haenlein, C., Harrington, L. A., Hinsley, A., Kariuki, K., Lam, J., Markus, M., Paudel, K., Shukhova, S., Sutherland, W. J., Verissimo, D., … Milner-Gulland, E. J. (2020). Emerging illegal wildlife trade issues: A global horizon scan. *Conservation Letters*, *13*(4). https://doi.org/10.1111/conl.12715

Fa, J. E., Currie, D., & Meeuwig, J. (2003). Bushmeat and food security in the Congo Basin: linkages between wildlife and people's future. *Environmental Conservation*, *30*(1), 71–78. https://doi.org/10.1017/S0376892903000067

Fávero, L. P., Belfiore, P., & de Freitas Souza, R. (2023). Exploratory spatial analysis. In *Data Science, Analytics and Machine Learning with R* (pp. 521–547). Elsevier. https://doi.org/10.1016/B978-0-12-824271-1.00014-7

Feddema, K., Harrigan, P., Nekaris, K. A. I., & Maghrifani, D. (2020). Consumer engagement behaviors in the online wildlife trade: Implications for conservationists. *Psychology and Marketing*, *37*(12), 1755–1770. https://doi.org/10.1002/mar.21423

Fernandes-Ferreira, H., Mendonça, S. V., Albano, C., Ferreira, F. S., & Alves, R. R. N. (2012). Hunting, use and conservation of birds in Northeast Brazil. *Biodiversity and Conservation*, *21*(1), 221–244. https://doi.org/10.1007/s10531-011-0179-9

Fotheringham, A. S. (1997). Trends in quantitative methods I: stressing the local. *Progress in Human Geography*, *21*(1), 88–96. https://doi.org/10.1191/030913297676693207

Fukushima, C. S., Mammola, S., & Cardoso, P. (2020). Global wildlife trade permeates the Tree of Life. *Biological Conservation*, *247*, 108503. https://doi.org/10.1016/j.biocon.2020.108503

Fukushima, C. S., Tricorache, P., Toomes, A., Stringham, O. C., Rivera-Téllez, E., Ripple, W. J., Peters, G., Orenstein, R. I., Morcatty, T. Q., Longhorn, S. J., Lee, C., Kumschick, S., de Freitas, M. A., Duffy, R. V., Davies, A., Cheung, H., Cheyne, S. M., Bouhuys, J., Barreiros, J. P., … Cardoso, P. (2021). Challenges and perspectives on tackling illegal or unsustainable wildlife trade. *Biological Conservation*, *263*, 109342. https://doi.org/10.1016/j.biocon.2021.109342

Gaubert, P., Djagoun, C. A. M. S., Missoup, A. D., Ales, N., Amougou, C. V., Dipita, A. D., Djagoun, J., Gossé, K. J., Koffi, C. E., N'Goran, E. M., Noma, Y. N., Zanvo, S., Tindo, M., Antunes, A., & Gonedelé-Bi, S. (2024). Vendors' perceptions on the bushmeat trade dynamics across West and central Africa during the COVID-19 pandemic: Lessons learned on sanitary measures and awareness campaigns. *Environmental Science and Policy*, *152*. https://doi.org/10.1016/j.envsci.2023.103649

GBIF Secretariat. (2023). *GBIF Backbone Taxonomy*. *Checklist dataset*. https://doi.org/10.15468/39omei

Getis, A. (2008). A History of the Concept of Spatial Autocorrelation: A Geographer's Perspective. *Geographical Analysis*, *40*(3), 297–309. https://doi.org/10.1111/j.1538-4632.2008.00727.x

Ghorbani, A., Gravendeel, B., Naghibi, F., & de Boer, H. (2014). Wild orchid tuber collection in Iran: A wake-up call for conservation. *Biodiversity and Conservation*, *23*(11), 2749–2760. https://doi.org/10.1007/s10531-014-0746-y

Global Initiative Against Transnational Organized Crime. (2024). *Monitoring Online Illegal Wildlife Trade: Setting the Stage: Past, Current and Future Efforts*. https://globalinitiative.net/wp-content/uploads/2024/06/Monitoring-online-illegal-wildlife-trade-Setting-the-stage-EcoSolve-GI-TOC-June-2024.pdf

Goettsch, B., Hilton-Taylor, C., Cruz-Piñón, G., Duffy, J. P., Frances, A., Hernández, H. M., Inger, R., Pollock, C., Schipper, J., Superina, M., Taylor, N. P., Tognelli, M., Abba, A. M., Arias, S., Arreola-Nava, H. J., Baker, M. A., Bárcenas, R. T., Barrios, D., Braun, P., … Gaston, K. J. (2015). High proportion of cactus species threatened with extinction. *Nature Plants*, *1*(10), 15142. https://doi.org/10.1038/nplants.2015.142

Gomez, L., Kala, B., & Shepherd, C. R. (2023). Bear trade in Poland: an analysis of legal and illegal international trade from 2000 to 2021. *European Journal of Wildlife Research*, *69*(6). https://doi.org/10.1007/s10344-023-01737-4

Gomez, L., & Min Sheng, K. (2024). The Trade of Porcupines in Malaysia With International Trade Links. *Tropical Conservation Science*, *17*. https://doi.org/10.1177/19400829241236311

Gomez, L., Toropov, P., & Shepherd, C. R. (2023). Bears in the Russian Far East illegally exploited for meat, medicine and trophies. *Tropical Conservation Science*, *16*. https://doi.org/10.1177/19400829231191061

Gonçalves, S. C., Haelewaters, D., Furci, G., & Mueller, G. M. (2021). Include all fungi in biodiversity goals. *Science*, *373*(6553), 403–403. https://doi.org/10.1126/science.abk1312

Gondhali, U., & Petrossian, G. A. (2023). Hidden in plain sight: Investigating the illegal trade of medical products derived from the spiny-tailed lizard (Uromastyx spp.) through the surface web. *Forensic Science International: Animals and Environments*, *4*. https://doi.org/10.1016/j.fsiae.2023.100072

Green, J., Hankinson, P., de Waal, L., Coulthard, E., Norrey, J., Megson, D., & D'Cruze, N. (2022). Wildlife Trade for Belief-Based Use: Insights From Traditional Healers in South Africa. *Frontiers in Ecology and Evolution*, *10*. https://doi.org/10.3389/fevo.2022.906398

Grimwood, E. I., Menner, J. K., & Marsden, S. J. (2024). Comparisons of songbirds on sale across online and physical markets in Indonesia. In *Biodiversity and Conservation* (Vol. 33, Issue 5, pp. 1591–1604). Springer Science and Business Media B.V. https://doi.org/10.1007/s10531-024-02825-w

Haq, R. U., Abdulabad, A., Asghar, S., & Szabo, J. K. (2023). Clicks and comments: Representation of wildlife crime in Pakistan in social media posts. *Global Ecology and Conservation*, *43*. https://doi.org/10.1016/j.gecco.2023.e02473

Hardin, G. (1968). The Tragedy of the Commons. *Science*, *162*(3859), 1243–1248. https://doi.org/10.1126/science.162.3859.1243

Harris, C. R., Millman, K. J., van der Walt, S. J., Gommers, R., Virtanen, P., Cournapeau, D., Wieser, E., Taylor, J., Berg, S., Smith, N. J., Kern, R., Picus, M., Hoyer, S., van Kerkwijk, M. H., Brett, M., Haldane, A., del Río, J. F., Wiebe, M., Peterson, P., … Oliphant, T. E. (2020). Array programming with NumPy. *Nature*, *585*(7825), 357–362. https://doi.org/10.1038/s41586-020-2649-2

Harrison, J. R., Roberts, D. L., & Hernandez-Castro, J. (2016). Assessing the extent and nature of wildlife trade on the dark web. *Conservation Biology*, *30*(4), 900–904. https://doi.org/10.1111/cobi.12707

Hiller, C., & ’t Sas-Rolfes, M. (2025). Systematic review of the impact of restrictive wildlife trade measures on conservation of iconic species in southern Africa. *Conservation Biology*, *39*(1). https://doi.org/10.1111/cobi.14262

Hinsley, A., De Boer, H. J., Fay, M. F., Gale, S. W., Gardiner, L. M., Gunasekara, R. S., Kumar, P., Masters, S., Metusala, D., Roberts, D. L., Veldman, S., Wong, S., & Phelps, J. (2018). A review of the trade in orchids and its implications for conservation. In *Indonesia Botanical Journal of the Linnean Society* (Vol. 186). https://academic.oup.com/botlinnean/article/186/4/435/4736317

Hinsley, A., Hughes, A., & Margulies, J. (2024). Creating a more inclusive approach to wildlife trade management. *Conservation Biology*, *38*(5). https://doi.org/10.1111/cobi.14360

Hitchens, R. T., & Blakeslee, A. M. H. (2020). Trends in illegal wildlife trade: Analyzing personal baggage seizure data in the Pacific Northwest. *PLoS ONE*, *15*(6). https://doi.org/10.1371/journal.pone.0234197

Holmes, B. H., Steinke, D., & Ward, R. D. (2009). Identification of shark and ray fins using DNA barcoding. *Fisheries Research*, *95*(2–3), 280–288. https://doi.org/10.1016/j.fishres.2008.09.036

Hu, S., Liang, Z., Liang, D., Liu, Y., Zhong, J., Wei, Q., & Lee, T. M. (2024). Quantifying species biases among multidata sources on illegal wildlife trade and its implications for conservation. *Conservation Biology*, *38*(5). https://doi.org/10.1111/cobi.14351

Hughes, A. C. (2021). Wildlife trade. *Current Biology*, *31*(19), R1218–R1224. https://doi.org/10.1016/j.cub.2021.08.056

Hughes, J. D. (2003). Europe as Consumer of Exotic Biodiversity: Greek and Roman times. *Landscape Research*, *28*(1), 21–31. https://doi.org/10.1080/01426390306535

Jiao, Y., & Lee, T. M. (2022). The global magnitude and implications of legal and illegal wildlife trade in China. *ORYX*, *56*(3), 404–411. https://doi.org/10.1017/S0030605320000800

Kalra, S., Davies, A., Martin, R. O., & Poonia, A. (2024). Insights from the media into the bird trade in India: an analysis of reported seizures. *ORYX*, *58*(1), 69–77. https://doi.org/10.1017/S0030605322001594

Karesh, W. B., Cook, R. A., Bennett, E. L., & Newcomb, J. (2005). Wildlife Trade and Global Disease Emergence. *Emerging Infectious Diseases*, *11*(7), 1000–1002. https://doi.org/10.3201/eid1107.050194

Kasper, K., Schweikhard, J., Lehmann, M., Ebert, C. L., Erbe, P., Wayakone, S., Nguyen, T. Q., Le, M. D., & Ziegler, T. (2020). The extent of the illegal trade with terrestrial vertebrates in markets and households in Khammouane Province, Lao PDR. *Nature Conservation*, *41*, 25–45. https://doi.org/10.3897/NATURECONSERVATION.41.51888

Keesey, T. M. (2025). *PhyloPic*. https://www.phylopic.org/

Khanwilkar, S., Sosnowski, M., & Guynup, S. (2022). Patterns of illegal and legal tiger parts entering the United States over a decade (2003–2012). *Conservation Science and Practice*, *4*(3). https://doi.org/10.1111/csp2.622

Lavorgna, A. (2014). Wildlife trafficking in the Internet age. *Crime Science*, *3*(1), 5. https://doi.org/10.1186/s40163-014-0005-2

Lawson, K., & Vines, A. (2014). *Global Impacts of the Illegal Wildlife Trade: The Costs of Crime, Insecurity and Institutional Erosion*. https://www.chathamhouse.org/sites/default/files/public/Research/Africa/0214Wildlife.pdf

Leupen, B. T. C., Gomez, L., Nguyen, M. D. T., Shepherde, L., & Shepherd, C. R. (2022). A Brief Overview of the Online Bird Trade in Vietnam. *Asian Journal of Conservation Biology*, *11*(2), 176–188. https://doi.org/10.53562/ajcb.71823

Lev, E. (2003). Traditional healing with animals (zootherapy): medieval to present-day Levantine practice. *Journal of Ethnopharmacology*, *85*(1), 107–118. https://doi.org/10.1016/S0378-8741(02)00377-X

Li, L., & Jiang, Z. (2014). International trade of CITES listed bird species in China. *PLoS ONE*, *9*(2). https://doi.org/10.1371/journal.pone.0085012

Liew, J. H., Kho, Z. Y., Lim, R. B. H., Dingle, C., Bonebrake, T. C., Sung, Y. H., & Dudgeon, D. (2021). International socioeconomic inequality drives trade patterns in the global wildlife market. *Science Advances*, *7*(19). https://doi.org/10.1126/sciadv.abf7679

Lockwood, J. L., Welbourne, D. J., Romagosa, C. M., Cassey, P., Mandrak, N. E., Strecker, A., Leung, B., Stringham, O. C., Udell, B., Episcopio-Sturgeon, D. J., Tlusty, M. F., Sinclair, J., Springborn, M. R., Pienaar, E. F., Rhyne, A. L., & Keller, R. (2019). When pets become pests: the role of the exotic pet trade in producing invasive vertebrate animals. *Frontiers in Ecology and the Environment*, *17*(6), 323–330. https://doi.org/10.1002/fee.2059

Luong, H. T. (2022). Understanding the Illegal Wildlife Trade in Vietnam: A Systematic Literature Review. *Laws*, *11*(4), 64. https://doi.org/10.3390/laws11040064

Macdonald, D. W., Harrington, L. A., Moorhouse, T. P., & D'Cruze, N. (2021). Trading Animal Lives: Ten Tricky Issues on the Road to Protecting Commodified Wild Animals. *BioScience*, *71*(8), 846–860. https://doi.org/10.1093/biosci/biab035

Machado, G., Thulke, H.-H., Ito, S., D-s, Y., K-h, C., S-k, H., H-e, K., & J-y, P. (2018). *Data-driven risk assessment of the incursion of African swine fever virus via pig products brought illegally into South Korea by travelers based on the temporal relationship between outbreaks in China*. https://wahis.woah.org/

Mackenzie, S., & Yates, D. (2016). Collectors on illicit collecting: Higher loyalties and other techniques of neutralization in the unlawful collecting of rare and precious orchids and antiquities. *Theoretical Criminology*, *20*(3), 340–357. https://doi.org/10.1177/1362480615607625

Massingham, E., Meijaard, E., Ancrenaz, M., Mika, D., Sherman, J., Santika, T., Pradipta, L., Possingham, H. P., & Dean, A. J. (2023). Killing of orangutans in Kalimantan - Community perspectives on incidence and drivers. *Conservation Science and Practice*, *5*(11). https://doi.org/10.1111/csp2.13025

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine*, *6*(7), e1000097. https://doi.org/10.1371/journal.pmed.1000097

Moran, P. A. P. (1950). Notes on Continuous Stochastic Phenomena. *Biometrika*, *37*(1/2), 17. https://doi.org/10.2307/2332142

Morton, O., Scheffers, B. R., Haugaasen, T., & Edwards, D. P. (2021). Impacts of wildlife trade on terrestrial biodiversity. *Nature Ecology & Evolution*, *5*(4), 540–548. https://doi.org/10.1038/s41559-021-01399-y

Mozer, A., & Prost, S. (2023). An introduction to illegal wildlife trade and its effects on biodiversity and society. *Forensic Science International: Animals and Environments*, *3*, 100064. https://doi.org/10.1016/j.fsiae.2023.100064

Murillo Rengifo, N., Choy, C. P. P., Gowidjaja, J. A. P., Urera, M. Q., Kibat, C., Nott, D. J., & Wainwright, B. J. (2024). Determining the species composition of the shark fin trade in Singapore: a globally significant Southeast Asian market. *Reviews in Fish Biology and Fisheries*, *34*(3), 1101–1112. https://doi.org/10.1007/s11160-024-09861-3

Natusch, D., & Lyons, J. (2014). Assessment of python breeding farms supplying the international high-end leather industry. In *Occasional Paper of the IUCN Species Survival Commission* (Issue 50). https://portals.iucn.org/library/node/43337

Nekaris, K. A. I., Shepherd, C. R., Starr, C. R., & Nijman, V. (2010). Exploring cultural drivers for wildlife trade via an ethnoprimatological approach: a case study of slender and slow lorises (*Loris* and *Nycticebus*) in South and Southeast Asia. *American Journal of Primatology*, *72*(10), 877–886. https://doi.org/10.1002/ajp.20842

Nijman, V. (2010). An overview of international wildlife trade from Southeast Asia. *Biodiversity and Conservation*, *19*(4), 1101–1114. https://doi.org/10.1007/s10531-009-9758-4

Nijman, V., Ardiansyah, A., Langgeng, A., Hendrik, R., Hedger, K., Foreman, G., Morcatty, T. Q., Siriwat, P., van Balen, S. (Bas), Eaton, J. A., Shepherd, C. R.,

Gomez, L., Imron, M. A., & Nekaris, K. A. I. (2022). Illegal Wildlife Trade in Traditional Markets, on Instagram and Facebook: Raptors as a Case Study. *Birds*, *3*(1), 99–116. https://doi.org/10.3390/birds3010008

Nijman, V., Morcatty, T., Smith, J. H., Atoussi, S., Shepherd, C. R., Siriwat, P., Nekaris, K. A.-I., & Bergin, D. (2019). Illegal wildlife trade – surveying open animal markets and online platforms to understand the poaching of wild cats. *Biodiversity*, *20*(1), 58–61. https://doi.org/10.1080/14888386.2019.1568915

Nijman, V., & Shepherd, C. R. (2015). Analysis of a decade of trade of tortoises and freshwater turtles in Bangkok, Thailand. *Biodiversity and Conservation*, *24*(2), 309–318. https://doi.org/10.1007/s10531-014-0809-0

Okigbo, R. N., Eme, U. E., & Ogbogu, S. (2008). Biodiversity and conservation of medicinal and aromatic plants in Africa. *Biotechnology and Molecular Biology Reviews*, *3*(6), 127–134.

Open Source Geospatial Foundation Project. (2025). *QGIS Geographic Information System*. http://qgis.org/

Oyanedel, R., Hinsley, A., Dentinger, B. T. M., Milner-Gulland, E. J., & Furci, G. (2022). A way forward for wild fungi in international sustainability policy. *Conservation Letters*, *15*(4). https://doi.org/10.1111/conl.12882

Panek, V., Johanisova, L., & Mauerhofer, V. (2021). Jaguars substituting Tigers? Results from a Systematic Literature Review on Illegal Wildlife Trade. *Accelerating the Progress towards the 2030 SDGs in Times of Crisis :* , 224–259. http://urn.kb.se/resolve?urn=urn:nbn:se:miun:diva-43604

Petrossian, G. A., Elwin, A., Sosnowski, M., Nunphong, T., Chiang, H.-T., Riungu, J. K., & D'Cruze, N. (2024). A synthesis of wild animal-related trade laws in some of the world's most biodiverse countries. *Journal of Environmental Management*, *354*, 120141. https://doi.org/10.1016/j.jenvman.2024.120141

Petrossian, G. A., Pires, S. F., & van Uhm, D. P. (2016). An overview of seized illegal wildlife entering the United States. *Global Crime*, *17*(2), 181–201. https://doi.org/10.1080/17440572.2016.1152548

Phelps, J., & Webb, E. L. (2015). "Invisible" wildlife trades: Southeast Asia's undocumented illegal trade in wild ornamental plants. *Biological Conservation*, *186*, 296–305. https://doi.org/10.1016/j.biocon.2015.03.030

Phillips, C. J. C. (2015). *The Animal Trade*. CABI Publishing. https://doi.org/10.1079/9781780643137.0000

Pires, S. F., & Moreto, W. D. (2011). Preventing Wildlife Crimes: Solutions That Can Overcome the 'Tragedy of the Commons.' *European Journal on Criminal Policy and Research*, *17*(2), 101–123. https://doi.org/10.1007/s10610-011-9141-3

Pires, S. F., & Moreto, W. D. (2016). The Illegal Wildlife Trade. In *Oxford Handbooks Online: Criminology and Criminal Justice*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199935383.013.161

Pitogo, K. M. E., & Saavedra, A. J. L. (2024). Orchid trade at the source: Epiphytic species with conspicuous flowers in low-elevation forests are more locally collected in a Philippine key biodiversity area. *Biotropica*, *56*(4). https://doi.org/10.1111/btp.13336

Radder, L., & Bech-Larsen, T. (2008). Hunters' Motivations and Values: A South African Perspective. *Human Dimensions of Wildlife*, *13*(4), 252–262. https://doi.org/10.1080/10871200801986739

Raven, P. H., & Wagner, D. L. (2021). Agricultural intensification and climate change are rapidly decreasing insect biodiversity. *Proceedings of the National Academy of Sciences*, *118*(2). https://doi.org/10.1073/pnas.2002548117

Reitz, K. (2025). *Requests* (2.32.3). https://docs.python-requests.org/en/latest/dev/authors/

Ribeiro, J., Bingre, P., Strubbe, D., & Reino, L. (2020). Coronavirus: why a permanent ban on wildlife trade might not work in China. *Nature*, *578*(7794), 217–217. https://doi.org/10.1038/d41586-020-00377-x

Rinne, J., Kulkarni, R., Soriano-Redondo, A., Correia, R., & Di Minin, E. (2023). Using automated content analysis to monitor global online trade in endemic reptile species. *Diversity and Distributions*. https://doi.org/10.1111/ddi.13771

Sandelowski, M. (2000). Combining Qualitative and Quantitative Sampling, Data Collection, and Analysis Techniques in Mixed-Method Studies. *Research in Nursing & Health*, *23*(3), 246–255. https://doi.org/https://doi.org/10.1002/1098-240X(200006)23:3<246::AID-NUR9>3.0.CO;2-H

Senanayaka, S. G. M. S. D., Senanayake, G., & Ratnayake, R. M. C. S. (2024). Propagation and management of ornamental and commercial cacti– a review. *The Journal of Horticultural Science and Biotechnology*, *99*(3), 267–288. https://doi.org/10.1080/14620316.2023.2298987

Shairp, R., Veríssimo, D., Fraser, I., Challender, D., & MacMillan, D. (2016). Understanding Urban Demand for Wild Meat in Vietnam: Implications for Conservation Actions. *PLOS ONE*, *11*(1), e0134787. https://doi.org/10.1371/journal.pone.0134787

Shiping, G., Jichao, W., Haitao, S., Riheng, S., & Rumei, X. (2006). Illegal trade and conservation requirements of freshwater turtles in Nanmao, Hainan Province, China. In *ORYX* (Vol. 40, Issue 3, pp. 331–336). https://doi.org/10.1017/S0030605306000949

Siriwat, P. (2020). *Wildlife Trade in the Digital Age: The Role of the Internet in Monitoring the Trade in Wild Plants and Animals in Thailand*. Oxford Brookes University.

Siriwat, P., & Nijman, V. (2020). Wildlife trade shifts from brick-and-mortar markets to virtual marketplaces: A case study of birds of prey trade in Thailand. *Journal of Asia-Pacific Biodiversity*, *13*(3), 454–461. https://doi.org/10.1016/j.japb.2020.03.012

Smith, K. M., Zambrana-Torrelio, C., White, A., Asmussen, M., Machalaba, C., Kennedy, S., Lopez, K., Wolf, T. M., Daszak, P., Travis, D. A., & Karesh, W. B. (2017). Summarizing US Wildlife Trade with an Eye Toward Assessing the Risk of Infectious Disease Introduction. *EcoHealth*, *14*(1), 29–39. https://doi.org/10.1007/s10393-017-1211-7

South, N., & Wyatt, T. (2011). Comparing Illicit Trades in Wildlife and Drugs: An Exploratory Study. *Deviant Behavior*, *32*(6), 538–561. https://doi.org/10.1080/01639625.2010.483162

Stringham, O. C., Maher, J., Lassaline, C. R., Wood, L., Moncayo, S., Toomes, A., Heinrich, S., Watters, F., Drake, C., Chekunov, S., Hill, K. G. W., Decary-Hetu, D., Mitchell, L., Ross, J. V., & Cassey, P. (2023). The dark web trades wildlife, but mostly for use as drugs. *People and Nature*, *5*(3), 999–1009. https://doi.org/10.1002/pan3.10469

Stringham, O. C., Moncayo, S., Thomas, E., Heinrich, S., Toomes, A., Maher, J., Hill, K. G. W., Mitchell, L., Ross, J. V., Shepherd, C. R., & Cassey, P. (2021). Dataset of seized wildlife and their intended uses. *Data in Brief*, *39*, 107531. https://doi.org/10.1016/j.dib.2021.107531

Svensson, M. S., Nijman, V., & Shepherd, C. R. (2023). Insights into the primate trade into the European Union and the United Kingdom. *European Journal of Wildlife Research*, *69*(3). https://doi.org/10.1007/s10344-023-01681-3

't Sas-Rolfes, M., Challender, D. W. S., Hinsley, A., Veríssimo, D., & Milner-Gulland, E. J. (2019). Illegal Wildlife Trade: Scale, Processes, and Governance. *Annual Review of Environment and Resources*, *44*(1), 201–228. https://doi.org/10.1146/annurev-environ-101718-033253

Taylor, L. H., Latham, S. M., & woolhouse, M. E. J. (2001). Risk factors for human disease emergence. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, *356*(1411), 983–989. https://doi.org/10.1098/rstb.2001.0888

The IUCN Red List of Threatened Species Version 2024-1. (2024). IUCN. https://www.iucnredlist.org

The Matplotlib Development Team. (2025). *Matplotlib: Visualization with Python*. Zenodo. https://doi.org/10.5281/zenodo.14940554

The pandas development team. (2024). *pandas-dev/pandas: Pandas*. Zenodo. https://doi.org/10.5281/zenodo.13819579

Thomas-Walters, L., Hinsley, A., Bergin, D., Burgess, G., Doughty, H., Eppel, S., MacFarlane, D., Meijer, W., Lee, T. M., Phelps, J., Smith, R. J., Wan, A. K. Y., & Veríssimo, D. (2021). Motivations for the use and consumption of wildlife products. *Conservation Biology*, *35*(2), 483–491. https://doi.org/10.1111/cobi.13578

Torrents-Ticó, M., Fernández-Llamazares, Á., Burgas, D., Nasak, J. G., & Cabeza, M. (2023). Biocultural conflicts: understanding complex interconnections between a traditional ceremony and threatened carnivores in north Kenya. *Oryx*, *57*(4), 435–444. https://doi.org/10.1017/S0030605322000035

Tow, J. H., Symes, W. S., & Carrasco, L. R. (2021). Economic value of illegal wildlife trade entering the USA. *PLOS ONE*, *16*(10), e0258523. https://doi.org/10.1371/journal.pone.0258523

TRAFFIC. (2024). *Illegal Wildlife Trade Enhancing Responses to Wildlife Crime and Illegal Trade*. https://www.traffic.org/about-us/illegal-wildlife-trade/

Tricorache, P., Nowell, K., Wirth, G., Mitchell, N., Boast, L. K., & Marker, L. (2018). Pets and Pelts: Understanding and Combating Poaching and Trafficking in Cheetahs. In *Cheetahs: Biology and Conservation: Biodiversity of the World:*

Conservation from Genes to Landscapes (pp. 191–205). Elsevier. https://doi.org/10.1016/B978-0-12-804088-1.00014-9

Turner, D., & Usher, helen. (2021). *Preventing Illegal Wildlife Trade: Guidelines for the Travel & Tourism Sector on the Integration of the WTTC Declaration on Illegal Wildlife Trade and Zero Tolerance Policy*.

Uddin, N., Enoch, S., Harihar, A., Pickles, R. S. A., & Hughes, A. C. (2023). Tigers at a crossroads: Shedding light on the role of Bangladesh in the illegal trade of this iconic big cat. *Conservation Science and Practice*, *5*(7). https://doi.org/10.1111/csp2.12952

Uddin, N., Islam, A., Akhter, T., Ara, T., Hossain, D., Fullstone, C., Enoch, S., & Hughes, A. C. (2024). Exploring market-based wildlife trade dynamics in Bangladesh. *ORYX*, *58*(1), 56–68. https://doi.org/10.1017/S0030605322001077

United Nations Environment Programme. (2016). *The Rise of Environmental Crime – A Growing Threat To Natural Resources Peace, Development And Security*. United Nations. https://doi.org/10.18356/cdadb0eb-en

UNODC. (2016). *World Wildlife Crime Report: Trafficking in protected species, 2016*.

UNODC. (2020). *World Wildlife Crime Report: Trafficking in protected species, 2020*.

UNODC. (2022). *Wildlife and Forest Crime Analytic Toolkit - Second Edition*.

UNODC. (2024). *World Wildlife Crime Report 2024: Trafficking in Protected Species*. https://www.unodc.org/documents/data-and-analysis/wildlife/2024/Wildlife2024_Final.pdf

van Uhm, D. P. (2016). The Illegal Wildlife Trade. Inside the World of Poachers, Smugglers and Traders. In D. Siegel (Ed.), *The Illegal Wildlife Trade: Inside the World of Poachers, Smugglers and Traders*. Springer International Publishing. https://doi.org/10.1007/978-3-319-42129-2_1

van Uhm, D. P. (2018). The social construction of the value of wildlife: A green cultural criminological perspective. *Theoretical Criminology*, *22*(3), 384–401. https://doi.org/10.1177/1362480618787170

van Uhm, D. P., & Zhang, M. (2022). Illegal wildlife trade in two special economic zones in Laos: Underground–open-sale fluctuations in the Golden Triangle borderlands. *Frontiers in Conservation Science*, *3*. https://doi.org/10.3389/fcosc.2022.1030378

Williams, V. L., & Whiting, M. J. (2016). A picture of health? Animal use and the Faraday traditional medicine market, South Africa. *Journal of Ethnopharmacology*, *179*, 265–273. https://doi.org/10.1016/j.jep.2015.12.024

World Health Organization. (2020). *Zoonoses*. World Health Organization (WHO). https://www.who.int/news-room/fact-sheets/detail/zoonoses

Wyatt, T., Maher, J., Allen, D., Clarke, N., & Rook, D. (2022). The welfare of wildlife: an interdisciplinary analysis of harm in the legal and illegal wildlife trades and possible ways forward. *Crime, Law and Social Change*, *77*(1), 69–89. https://doi.org/10.1007/s10611-021-09984-9

Appendices

Appendix 1: List of articles included in the systematic literature review qualitative synthesis

Table 7: All full-text articles included in the qualitative synthesis

Article Title	Author(s)
A Brief Overview of the Online Bird Trade in Vietnam	Leupen and Boyd T. C. and Gomez and Lalita and Nguyen and Minh D. T. and Shepherd and Loretta and Shepherd and Chris R.
A Case Study of the Online Trade of CITES-Listed Chelonians in Hong Kong	Wong, Rebecca W Y, Lee, Chee Yan, Cheung, Hubert, Lam, Jack Y K, Tang, Cecile
A comparison of seizures of illegal wildlife between the US and the EU: Implications for prevention	van Uhm and Daan P. and Pires and Stephen F. and Sosnowski and Monique and Petrossian and
A criminal justice response to address the illegal trade of wildlife in Indonesia	Adhiasto, Dwi N., Exploitasia, Indra, Giyanto, Fahlapie, Patih, Johnsen, Pekki, Andriansyah, M Irfan, Hafizoh, Nur, Setyorini, Yunita D, Mardiah, Sofi, Ulfah Mardhiah, and Linkie, Matthew
A forensically validated genetic toolkit for the species and lineage identification of the highly trafficked shingleback lizard (Tiliqua rugosa)	Brown, A. O., Ueland, M., Stuart, B. H., and Frankham, G. J.
A framework for investigating illegal wildlife trade on social media with machine learning	Enrico Di Minin and Fink and Christoph and Hiippala and Tuomo and Tenkanen and Henrikki
A Green Criminological Exploration of Illegal Wildlife Trade in Vietnam	Cao Ngoc and Anh and Wyatt and Tanya
A literature synthesis of actions to tackle illegal parrot trade	Sánchez-Mercado and Ada and Ferrer-Paris and José R. and Rodríguez and Jon Paul and Tella and José L.
A new look at the Himalayan fur trade	Heinen and Joel T. and Leisure and Blair
A novel application of mark-recapture to examine behaviour associated with the online trade in elephant ivory	Yeo and Lydia M and McCrea and Rachel S and Roberts and David L
A pioneering method to identify bovine horn trophy: A combined morphometric and DNA-based approach in wildlife forensics	Vipin, Sharma V., Sharma C. P., Goyal S. P., Stevens H., and Gupta S. K.
A prescription for conservation: Strengthening Japan's role in curbing the illegal international trade of bear bile for medicinal use	Lewis and Melissa G. and Takahashi and Mitsuhiko A.
A price on their heads? Assessing foreign demand as a driver of hornbill hunting in Cameroon	Su, S., Guetse, F., and Arcilla, N.
A rapid assessment of the illegal otter trade in Vietnam	Gomez, Lalita, and Nguyen, Minh D. T.
A review of global trends in CITES live wildlife confiscations	D'Cruze and Neil and Macdonald and David W

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A review of the trade in orchids and its implications for conservation	Hinsley and Amy and de Boer and Hugo J and Fay and Michael F and Gale and Stephan W and Gardiner and Lauren M and Gunasekara and Rajasinghe S and Kumar and Pankaj and Masters and Susanne and Metusala and Destario and Roberts and David L and Veldman and Sarina and Wong and Shan and Phelps and Jacob
A Review on the Ecology, Conservation and Current Research Priorities of Indian Pangolins Manis crassicaudata in South Asia with Special Emphasis to India	Gayen, D., Bhattacharya, T., Banerjee, S., Chatterjee, A., and Chaudhuri, S.
A scoping review of live wildlife trade in markets worldwide	Altherr and Sandra
A shot in the dark for conservation: Evidence of illegal commerce in endemic and threatened species of elasmobranch at a public fish market in southern Brazil	Vanessa Paes da Cruz, Aisni Mayumi Corrêa de Lima Adachi, Giovana da Silva Ribeiro, de Oliveira, Pablo Henrique, de Oliveira, Cláudio, Rinaldo Oriano Junior, Renato Hajenius Achê de Freitas, Foresti, Fausto
A Social Network Analysis of Large-Scale Wildlife Seizures Made at US Ports of Entry	Pires, Stephen F., Thomson, Ryan W., Petrossian, Gohar A., and Sosnowski, Monique C.
A star attraction: The illegal trade in Indian Star Tortoises	D'Cruze and Neil and Singh and Bhagat and Morrison and Thomas and SchmidtBurbach and Jan and Macdonald and David W and Mookerjee and Aniruddha
A succinct view of wildlife crimes in West Bengal and their conservation	Roy, D., and Kumar, V.
A Survey of African Grey Parrots (Psittacus erithacus) Trade and Trafficking in	Eniang and EA and Akpan and CE and Eniang and ME
A Survey of Diseases in Different Species of Wild, Captive, and Illegally Traded Birds in Brazil	Lacerda, M. D. C., Santos, W. H. D., Lopes, M. C., Fonseca, C. S., de Carvalho, M. P. N., Martins, N. R. D., and Ecco, R.
A survey on trade in wildlife parts in the Northern Region of Ghana	Dery, George, Imoro, A. Ziblim, and Dzitse, Selasi
A systematic survey of online trade in the caterpillar fungus Ophiocordyceps sinensis	Bashyal, R., and Roberts, D. L.
A systematic survey of online trade: Trade in Saiga antelope horn on Russianlanguage websites	Roberts and David L. and Mun and Katya and MilnerGulland, E.J.
A systematic survey of the online trade in elephant ivory in Singapore before and after a domestic trade ban	Yeo, H. H. T., Ng, S. J. W., Lee, J. S. R., Soh, M. C. K., Wong, A. M. S., Loo, A. H. B., and Er, K. B. H.
A ticking time bomb: Is the illegal pet trade a pathway for the establishment of corn snake (Elaphe guttata) populations in Australia?	McFadden and Michael S. and Topham and Philip and Harlow and Peter S.
Addressing Illegal Transnational Trade of Totoaba and Its Role in the Possible Extinction of the Vaquita	Boilevin, V., Crosta, A., and Hennige, S. J.
Advancing interdisciplinary science for disrupting wildlife trafficking networks	Gore, Meredith L., Griffin, Emily, Dilkina, Bistra, Ferber, Aaron, Griffis, Stanley E., Keskin, Burcu B., and Macdonald, John

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Amphibian illegal pet trade and a possible new case of an invasive exotic species in Brazil	Máximo and Isabel M. and Brandão and Reuber A. and Ruggeri and Joice and Toledo and Luís Felipe
An analysis of illegal wildlife trade with the aid of social media and prevention strategies	Roy, D., and Kumar, V.
An assessment of avian species sold in the South African pet trade	Shivambu, Tinyiko C., Shivambu, Ndivhuwo, and Downs, Colleen T.
An assessment of illegal capuchin monkey trade in Bahia State, Brazil; [Avaliação do comércio ilegal de macacos-prego na Bahia, Brasil]	do Nascimento and Rafaela Almeida and Schiavetti and Alexandre and Montaño and Romari Alejandra Martinez
An Ethical Matrix for the Reintroduction of Trafficked Primates: A Platyrrhine Case Study	Hernández-Cruz, G., Ferreira, R. G., Mendl, M., Rooney, N. J., and Mullan, S.
An examination of the import of live reptiles from Indonesia by the United States from 2000 to 2015	Janssen, Jordi, Gomez, and Lalita
An introduction to illegal wildlife trade and its effects on biodiversity and society	Mozer A. and Prost S.
An open door for illegal trade: Online sale of Strombocactus disciformis (Cactaceae)	Olmos-Lau and Vania R. and Mandujano and María C.
An overview of international wildlife trade from Southeast Asia	Nijman and Vincent
An overview of seized illegal wildlife entering the United States	Petrossian and Gohar A and Pires and Stephen F and van Uhm and Daan P
Analysis of a decade of trade of tortoises and freshwater turtles in Bangkok, Thailand	Nijman and Vincent and Shepherd and Chris R
Analysis of trade in endemic Javan hill partridges over the last quarter of a century period	Nijman and Vincent
Animal origins of SARS Coronavirus: Possible links with the international trade in small carnivores	Bell and Diana J. and Roberton and Scott and Hunter and Paul R.
Animal sales from Wuhan wet markets immediately prior to the COVID-19 pandemic	Xiao, Xiao, Newman, Chris, Buesching, Christina D, Macdonald, David W, Zhao-Min, Zhou
Animal Trafficking and Trade: Abuse and Species Injustice	Sollund and Ragnhild
Another inconvenient truth: The failure of enforcement systems to save charismatic species	Bennett and Elizabeth L.
Anthropogenic Threats to Crocodiles, and the Level and Sociodemographic Determinants of their Utilization in Lower River Tana Basin, Kenya	Mosse, M. N., Odadi, W. O., and Kibue, G. W.
Applying systems thinking to inform studies of wildlife trade in primates	Roe, D. and Cooney, R. and Dublin, H. and Challender, D. and Biggs, D. and Skinner, D. and Abensperg-Traun, M. and Ahlers, N. and Melisch, R. and Murphree, M.

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Are tortoises and freshwater turtles still traded illegally as pets in Singapore?	Goh and Ter Yang and O'Riordan and Ruth M
Assessing consumer trends and illegal activity by monitoring the online wildlife trade	Sung, Yik-Hei, and Fong, Jonathan J.
Assessing illegal trade networks of two species of pangolins through a questionnaire survey in Nepal	Phuyal N., Sadadev B. M., Khulal R., Bhatt R., Bajagain S., Raut N., and Dhami B.
Assessing the Illegal Bear Trade in Myanmar Through Conversations With Poachers: Topology, Perceptions, and Trade Links to China	Nijman and Vincent and Oo and Htun and Shwe and Nay Myo
Assessing the illegal hunting of native wildlife in China	Liang, Dan, Giam, Xingli, Hu, Sifan, Ma, Liang, and Wilcove, David S.
Assessing the risk of invasion of species in the pet trade in Brazil	da Rosa, Clarissa Alves, Zenni, Rafael, Ziller, Silvia R., Curi, Nelson de Almeida, and Passamani, Marcelo
Assessing the trade of Chinese Hwamei Garrulax canorus in the USA	Nelson, S. Sunny, and Shepherd, Chris R.
Assessment of the international illicit wildlife trade in the critically endangered Malagasy tortoise species Astrochelys yniphora and Astrochelys radiata	Schwarz, Dennis, Newton, David, Ratzimbazafy, Cynthia
Attitudes toward consumption and conservation of tigers in China	Cooney and Rosie and Jepson and Paul
Automatic detection of potentially illegal online sales of elephant ivory via data mining	Hernandez-Castro and Julio and Roberts and David L
Batrachochytrium dendrobatidis in confiscated Telmatobius in Lima, Peru	Zevallos and Samanta and Elías and Roberto K. and Berenguel and Raúl A. and Weaver and Thomas J. and Reading and Richard P.
Bear trade in Poland: an analysis of legal and illegal international trade from 2000 to 2021	Gomez, Lalita, Kala, Borys, and Shepherd, Chris R.
Bear trade in the Czech Republic: an analysis of legal and illegal international trade from 2005 to 2020	Shepherd, Chris R, Kufnerová Jitka, Cajthaml Tomáš, Frouzová Jaroslava, Gomez, Lalita
Bear with me: Understanding motivations for bear farming in Vietnam	Green, J., Schmidt-Burbach, J., Kukreja, K., and Guillon, E.
Bearing all Down Under: the role of Australasian countries in the illegal bear trade	Cassey, Phillip, Gomez, Lalita, Heinrich, Sarah, Garcia-Diaz, Pablo, Stoner, Sarah, Shepherd, Chris R.
Bearly on the radar – an analysis of seizures of bears in Indonesia	Gomez and Lalita and Shepherd and Chris R
Behind the Ivory Trade Shutdown in China	Permata and Inda Mustika and Wahyuni and Elsi
Belgian actions to stop illegal trade in Endangered wild biota	Wachtel and Paul S.
Bolder steps to fight global wildlife illegal trade	Lopes and Ricardo Jorge and Juliana Machado Ferreira and Nadia Moraes-Barros

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Booming trade in mammoth ivory may be bad news for elephants	Price and Michael
Building sustainability into the Belt and Road Initiative's Traditional Chinese Medicine trade	Hinsley, Amy, Milner-Gulland, E. J., Cooney, Rosie, Timoshyna, Anastasiya, Ruan, Xiangdong, Lee, Tien Ming
Building Trust and Honouring Agreements in the Supply of Protected Wildlife Products1	Wong, R. W. Y.
Can bans stimulate wildlife trade?	Rivalan and Philippe and Delmas and Virginie and Angulo and Elena and Bull and Leigh S. and Hall and Richard J. and Courchamp and Franck and Rosser and Alison M. and Leader-Williams and Nigel
Canada's role in global wildlife trade: Research trends and next steps	Boratto, R., Porter, A. A., and Shepherd, C. R.
Chain of commercialization of Podocnemis spp. turtles (Testudines: Podocnemididae) in the Purus River, Amazon basin, Brazil: Current status and perspectives	Pantoja-Lima and Jackson and Aride and Paulo H.R. and de Oliveira and Adriano T. and Félix-Silva and Daniely and Pezzuti and Juarez C.B. and Rebêlo and George H.
Changes in the primate trade in indonesian wildlife markets over a 25-year period: Fewer apes and langurs, more macaques, and slow lorises	Nijman and Vincent and Spaan and Denise and Rode-Margono and Eva Johanna and Wirdateti and Nekaris, K A I
Characteristics of, and uncertainties about, illegal jaguar trade in Belize and Guatemala	Melissa Arias, Amy Hinsley, and E. J. Milner-Gulland
China: Engage the public to stop bear trafficking	Yuan and Zhengrong and Han and Yingying and Weng and Qiang
China's lust for jaguar fangs imperils big cats	Fraser and Barbara
China's online parrot trade: Generation length and body mass determine sales volume via price	Yin and RuYi and Ye and YunChun and Newman and Chris and Buesching and Christina D. and Macdonald and David W. and Luo and Yi and Zhou and ZhaoMin
Chinese wildlife trafficking networks along the silk road	Van Uhm and Daan
CITES and the international trade in wildlife	Stahl, J. and De Meulenaer, T.
Clinical haematology, biochemistry profiles and erythrocytic morphometry of confiscated Sunda pangolins (Manis javanica) in the Centre for Rehabilitation and Quarantine of Confiscated Animals, Wildlife and Alien Species, Thailand	Yindee M., Thomas W., Wajjawalku W., Wongsawang W., Income N., Horpiencharoen W., Bangkaew N., Kosaruk W., Thepapichaikul W., Manatchaiworakul W., Pattanarangsan R., and Ketpun D.
Clouded in mystery: the global trade in clouded leopards	D'cruze and Neil and Macdonald and David W
Code word usage in the online ivory trade across four European Union member states	Alfino, Sara, Roberts, David L
Collection and trade of wild-harvested orchids in Nepal	Subedi and Abishkar and Kunwar and Bimal and Choi and Young and Dai and Yuntao and van Andel and Tinde and Chaudhary and Ram P and de Boer and Hugo J and Gravendeel and Barbara

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Combating rhino horn trafficking: The need to disrupt criminal networks	Brookes, V.J. and Wismandanu, O. and Sudarnika, E. and Roby, J.A. and Hayes, L. and Ward, M.P. and Basri, C. and Wibawa, H. and Davis, J. and Indrawan, D. and Manyweathers, J. and Nugroho, W.S. and Windria, S. and Hernandez-Jover, M.
Combating transnational organized crime by linking multiple large ivory seizures to the same dealer	Wasser and Samuel K. and Torkelson and Amy and Winters and Misa and Horeaux and Yves and Tucker and Sean and Otiende and Moses Y. and Sitam and Frankie A. T. and Buckleton and John and Weir and Bruce S.
Community-Based Approaches to Tackling Illegal Wildlife Trade—What Works and How Is It Measured?	Wilson-Holt O. and Roe D.
Comparisons of songbirds on sale across online and physical markets in Indonesia	Grimwood, E. I., Menner, J. K., and Marsden, S. J.
Complex interactions between commercial and noncommercial drivers of illegal trade for a threatened felid	Arias, M, Hinsley, A, P Nogales-Ascarrunz, P J Carvajal-Bacarreza, Negroes, N, Glikman, J A, EJ Milner-Gulland
Conflicting Outlooks? The Endurance of Popular Cosmology in Modern China and Its Impact on Illegal Wildlife Trade	Bruun and Ole
Conservation genetics of the white-bellied pangolin in West Africa: A story of lineage admixture, declining demography, and wide sourcing by urban bushmeat markets	Gossé, K. J., Gonedelé-Bi, S., Dufour, S., Danquah, E., and Gaubert, P.
Conservation-related knowledge, interactions, and attitudes of local people toward Grey Crowned-Cranes (Balearica regulorum) in Tanzania	Amulike, B. B., Griffin, C. R., and Fuller, T. K.
Consumer engagement behaviors in the online wildlife trade: Implications for conservationists	Feddema and Kim and Harrigan and Paul and K Anne Isola Nekaris and Maghrifani and Dila
Consumption of wildlife-origin products by local residents at the largest wildlife market of Amazonian Peru: is there scope for demand reduction?	Moorhouse T. P., Elwin A., Perez-Peña P. E., Perez D., Solis S., Zari L., and D'Cruze N. C.
Cool cats and communities: Exploring the challenges and successes of community-based approaches to protecting felids from the illegal wildlife trade	Green, A. R., Anagnostou, M., Harris, N. C., and Allred, S. B.
Covid-19 wake-up call for exotic pet trade	No authors listed
Cracking down on illegal wildlife trade	Holden and Constance
Crime gone wild: The dangers of the international illegal wildlife trade	Xie and Kevin
Crime script analysis of the illegal sales of spiny-tailed lizards on YouTube	Gondhali, U., Merzon, A., Nunphong, T., Lo, T. Y., Liu, Y. H., and Petrossian, G. A.
CSI wildlife: How science is helping detectives to track down poaching and illegal trade in wildlife	Gristwood and Adam

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Current wildlife crime (Indian scenario): major challenges and prevention approaches	Rana, Ajay Kumar, and Kumar, Nishant
Delegitimizing Ivory: The Case for an Ivory Trade Ban Treaty	Adams and Rachelle
Deliberate by-catch of the caspian seal and the development of illegal wildlife trade (IWT) in dagestan, Russia: A socio-economic approach	Ermolin and Ilya
Demand for forest elephant ivory in Japan	Nishihara and Tomoaki
Demand reduction campaigns could reduce the domestic trade in illegal wildlife in Peru	Moorhouse, T. P., Elwin, A., and D'Cruze, N. C.
Detecting illegal wildlife trafficking via real time tomography 3D Xray imaging and automated algorithms	Pirotta and Vanessa and Shen and Kaikai and Liu and Sheldon and Phan and Ha Tran Hong and O'Brien and Justine K. and Meagher and Phoebe and Mitchell and Jessica and Willis and Joel and Morton and Ed
Determinants and drivers of wildlife trafficking: A qualitative analysis in Uganda	Kassa, Saba, Baez-Camargo, Claudia, Costa, Jacopo, Lugolobi, Robert
Diagnostic overview of the illegal trade in primates and law enforcement in Peru	Shanee and Noga and Mendoza, A Patricia and Shanee and Sam
Disentangling the Legal and Illegal Wildlife Trade-Insights from Indonesian Wildlife Market Surveys	Nijman and Vincent and Morcatty and Thais Q. Q. and Feddema and Kim and Campera and Marco and Nekaris, K. A. I.
Disguising Elephant Ivory as Other Materials in the Online Trade	Venturini Sofia and Roberts and David L
Dissecting the Illegal Ivory Trade: An Analysis of Ivory Seizures Data	Underwood and Fiona M and Burn and Robert W and Milliken and Tom
Distribution and illegal killing of the Endangered Indian pangolin Manis crassicaudata on the Potohar Plateau, Pakistan	Mahmood, Tariq, Akrim, Faraz, Irshad, Nausheen, Hussain, Riaz, Fatima, Hira, Andleeb, Shaista, Aihetasham, and Ayesha
Distribution, population estimation, and awareness of the indigenous community for the Indian pangolin (Manis crassicaudata) in the Kohat District, Pakistan	Mahmood T., Ullah A., Khalid A., Akrim F., Nadeem M. S., Irshad N., and Ahmad T.
Diversity and prevalence of zoonotic infections at the animal-human interface of primate trafficking in Peru	Mendoza, A. P., Muñoz-Maceda, A., Ghersi, B. M., Puente, M. D. L., Zariquiey, C., Cavero, N., Murillo, Y., Sebastian, M., Ibañez, Y., Parker, P. G., Perez, A., Uhart, M., Robinson, J., Olson, S. H., and Rosenbaum, M. H.
DNA barcode reveals occurrence of threatened species and hidden diversity on Teleost fish trade in the Coastal Amazon	Santana P., Martins T., Lutz Í., Miranda J., da Silva R., Mesquita D., Martins R., Veneza I., Vallinoto M., Sampaio I., and Evangelista-Gomes G.
DNA Barcoding Identifies Illegal Parrot Trade	Gonçalves and Priscila F M and Oliveira-Marques and Adriana R and Matsumoto and Tania E and Miyaki and Cristina Y

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DNA barcoding reveals endangered and protected elasmobranchs in Tanzanian fish markets	Rumisha C., Simwanza R. J., Nehemia A., Mdegela R. H., and Kochzius M.
DNA metabarcoding of orchid-derived products reveals widespread illegal orchid trade	de Boer, Hugo J., Ghorbani, Abdolbaset, Manzanilla, Vincent, Raclariu, Ancuta-Cristina, Kreziou, Anna, Ounjai, Sarawut, Osathanunkul, Maslin, and Gravendeel, Barbara
DNA recovery and analysis from helmeted hornbill (Rhinoplax vigil) casques and its potential application in wildlife law enforcement	Ouitavon K., McEwing R., Penchart K., and Sri-aksorn K., Chimchome V.
DNA-based identification reveals illegal trade of threatened shark species in a global elasmobranch conservation hotspot	Feitosa and Leonardo Manir and Ana Paula Barbosa Martins and Giarrizzo and Tommaso and Macedo and Wagner and Iann Leonardo Monteiro and Gemaque and Romário and Silva Nunes and Jorge Luiz and Gomes and Fernanda and Schneider and Horácio and Sampaio and Iracilda and Souza and Rosália and Sales and João Bráulio and Rodrigues-Filho and Luís Fernando and Tchaicka, Ligia and Carvalho-Costa and Luís Fernando
Do communities understand the impacts of unlawful bushmeat hunting and trade? Insights from villagers bordering Western Nyerere National Park Tanzania	Foya Y. R., Mgeni C. P., Kadigi R. M. J., Kimaro M. H., and Hassan S. N.
"Do you know where I can buy ivory?": The illegal sale of worked ivory products in Hong Kong	Wong and Rebecca WY
Documenting and tackling the illegal wildlife trade: change and continuity over 40 years	Milner-Gulland, E J
Dolphins, Love and Enchantment: Tracing the Use of Cetacean Products in Brazil	Siciliano and Salvatore and Viana and Maria C and EminLima and Renata and Bonvicino and Cibele R
Dragons in our midst: Phyloforensics of illegally traded Southeast Asian monitor lizards	Welton, Luke J., Siler, Cameron D., Linkem, Glades W., Diesmos, Arvin C., Diesmos, Mae L., Sy, Emerson, Brown, Rafe M.
Drivers and spatial patterns of avian defaunation in tropical forests	Ferreiro-Arias, I., Santini, L., Sagar, H. S. S. C., Richard-Hansen, C., Guilbert, E., Forget, P. M., van Kuijk, M., Scabin, A. B., Peres, C. A., Revilla, E., and Benítez-López, A.
Drivers of snow leopard poaching and trade in Pakistan and implications for management	Din, Jaffar Ud, Bari, Fathul, Ali, Hussain, Rehman, Ejaz ur, Adli, Durriyyah Sharifah Hasan, Abdullah, Nurul Ashikin, Norma-Rashid, Yusoff, Kabir, Muhammad, Hameed, Shoaib, Nawaz, Doost Ali, Nawaz, Muhammad Ali
Dying for love: Illegal international trade in hummingbird love charms	Trail and Pepper W
Dynamics of illegal wildlife trade in Indonesian markets over two decades, illustrated by trade in Sunda Leopard Cats	Nijman and Vincent and Ardiansyah and Ahmad and Bergin and Daniel and Birot, Hélène and Brown and Ella and Langgeng and Abdullah and Morcatty and Thais and Spaan and Denise and

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	Siriwat and Penthai and Imron and Muhammad Ali and Nekaris, K Anne-Isola
Economic value of illegal wildlife trade entering the USA	Jia Hao Tow, Symes, William S, Luis Roman Carrasco
Effect of CITES Appendix I listing on illegal pangolin trade as gauged from seizure reports in Indonesia	Nijman, Vincent
Effective law enforcement in Ghana reduces elephant poaching and illegal ivory trade	Martin, Esmond
Effects of regional economics on the online sale of protected parrots and turtles in China	Yun-Chun Ye and Wen-Hua Yu and Newman and Chris and Buesching and Christina D and Ya-li Xu and Xiao and Xiao and Macdonald and David W and Zhao-Min Zhou
Elephant ivory trade in China: Trends and drivers	Gao and Yufang and Clark and Susan G.
Elephant ivory, rhino horn, pangolin and helmeted hornbill products for sale at the Myanmar–Thailand–China border	Vigne and Lucy and Nijman and Vincent
Elephant meat and ivory trade in central Africa	Stiles and Daniel
Elephant Poaching and Ivory Trafficking as a Threat to the Peace	Peters and Anne
Elephant poaching and the ivory trade: The impact of demand reduction and enforcement efforts by China from 2005-2017	Zhou and Xuehong and Wang and Qiang and Zhang and Wei and Jin and Yu and Wang and Zhen and Chai and Zheng and Zhou and Zhiqiang and Cui and Xiaofeng and MacMillan and Douglas C.
Elephants, Ivory, and Trade	Wasser and Samuel and Poole and Joyce and Lee and Phyllis and Lindsay and Keith and Dobson and Andrew and Hart and John and Iain and Douglas-Hamilton and Wittemyer and George and Granli and Petter and Morgan and Bethan and Gunn and Jody and Alberts and Susan and Beyers and Rene and Chiyo and Patrick and Croze and Harvey and Estes and Richard and Gobush and Kathleen and Joram and Ponjoli and Kikoti and Alfred and Kingdon and Jonathan and King and Lucy and Macdonald and David and Moss and Cynthia and Mutayoba and Benezeth and Njumbi and Steve and Omondi and Patrick and Nowak and Katarzyna
Emerging trends of the illegal wildlife trade in Mesoamerica	Gluszek, Sarah, Ariano-Sánchez, Daniel, Cremona, Patricia, Goyenechea, Alejandra, Luque Vergara, Darío Antonio, Mcloughlin, Lee, Morales, Alejandro, Adrian Reuter Cortes, Javier Rodríguez Fonseca, Radachowsky, Jeremy, Knight, Andrew
Endangered species: Illegal lemur trade grows in Madagascar	Reuter and Kim E. and Lafleur and Marni and Clarke and Tara A.
Enforcement seizures reveal large-scale illegal trade in India's tortoises and freshwater turtles	Mendiratta, Uttara, Sheel, Vallari, and Singh, Shailendra

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Estimating the extent and structure of trade in horticultural orchids via social media	Hinsley and Amy and Lee and Tamsin E and Harrison and Joseph R and Roberts and David L
Estimating the Extent of CITES Noncompliance among Traders and End-Consumers; Lessons from the Global Orchid Trade	Hinsley and Amy and Nuno and Ana and Ridout and Martin and Freya A.V. St John and Roberts and David L
Ethnozoological and commercial drivers of the pangolin trade in Benin	Zanvo and Stanislas and Sylvestre C. A. M. Djagoun and Azihou and Fortuné A and Djossa and Bruno and Brice Sinsin and Gaubert and Philippe
EU must outlaw ivory trade before laxity derails other bans	Zhang and Li and Hua and Ning
Europe faces call to ban imports of wild birds	Dalton and Rex
Evaluating the effectiveness of wildlife protection laws in Uttar Pradesh: an analysis of enforcement and prosecution	Singh, R., Behera, S., and Sethy, J.
Evaluating the relationships between the legal and illegal international wildlife trades	Tittensor, Derek P, Harfoot, Michael, McLardy, Claire, Britten, Gregory L, Katalin Kecse-Nagy, Landry, Bryan, Outhwaite, Willow, Price, Becky, Sinovas, Pablo, Blanc, Julian, Burgess, Neil D, Malsch, Kelly
Evidence on the role of social media in the illegal trade of Iranian wildlife	Sardari and Pourya and Felfelian and Farshad and Mohammadi and Alireza and Nayeri and Danial and Davis and Elizabeth O
Examining the international bushmeat traffic in Belgium: A threat to conservation and public health	Chaber A.-L., Moloney G. K., Renault V., Morrison-Lanjouw S., Garigliany M., Flandroy L., Pires D., Busoni V., Saegerman C., and Gaubert P.
Exotic animal cafes in Japan: A new fashion with potential implications for biodiversity, global health, and animal welfare	Sigaud, M., Kitade, T., and Sarabian, C.
Exploited for pets: The harvest and trade of amphibians and reptiles from Indonesian New Guinea	Natusch and Daniel J. D. and Lyons and Jessica A.
Exploring a Comprehensive Behavioural Model to Investigate Illegal Sea Turtle Trade in Cabo Verde	Ribeiro and Morgan and Patino-Martinez and Juan and Agues and Janete and Marçal-Correia and Alexandra and Nuno and Ana
Exploring drivers and deterrents of the illegal consumption and trade of marine turtle products in Cape Verde, and implications for conservation planning	Hancock and Joana M and Furtado and Safiro and Merino and Sonia and Godley and Brendan J and Nuno and Ana
Exploring the Africa-Asia Trade Nexus for Endangered Wildlife Used in Traditional Asian Medicine: Interviews With Traders in South Africa and Vietnam	Nguyen, T and Roberts, D L
Exploring the dynamics of South Africa's illegal abalone trade via routine activities theory	Warchol and Greg and Harrington and Michael

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Exploring the organization of Russia Far East's illegal wildlife trade: Two case studies of the illegal fur and illegal falcon trades	Wyatt and Tanya
Exposing the illegal trade in Encephalartos species at the Faraday ‘muthi’ market in South Africa using DNA barcoding	Williamson, J., Shiba, S. N. S., Van der Bank, H., Pfab, M., Kabongo, R. M., Pilusa, M., Van der Bank, M.
Field note from CITES CoP 17 on elephants and the ivory trade	Khan, M.Z. and Kanwal, R. and Ghalib, S.A.
Fifteen years of elasmobranchs trade unveiled by DNA tools: Lessons for enhanced monitoring and conservation actions	Alvarenga, M., Bunholi, I. V., de Brito, G. R., Siqueira, M. V. B. M., Domingues, R. R., Charvet, P., Foresti, F., Solé-Cava, A. M., and da Cruz, V. P.
Fighting Wildlife Trafficking: An Overview of the EU's Implementation of Its Action Plan Against Wildlife Trafficking	Lemaître and Sophie and Hervé-Fournereau and Nathalie
First line of defence: Engaging communities in tackling wildlife crime	Crerar and Lorelei D. and Freeman and Elizabeth W. and Domning and Daryl P. and Parsons, E. Christien Michael
First Public Hearing: Investigating Wildlife Trafficking in Viet Nam	Covert and Jennifer
FloraGuard: Tackling the Online Illegal Trade in Endangered Plants Through a Cross-Disciplinary ICT-Enabled Methodology	Lavorgna Anita, Middleton, Stuart E, Pickering, Brian, Neumann, Geoff
Frequency of zoonotic bacteria among illegally traded wild birds in Rio de Janeiro	Rey Matias, Carlos Alexandre, Pereira, Ingrid Annes, Falavina dos Reis, Eliane Moura, Rodrigues, Dalia dos Prazeres, Siciliano, Salvatore
From Freedom to. Cage: Diagnosis of Instruments to Fight. Trafficking in Wild Birds in Pernambuco	Sales, Aldo Torres, Cavalcanti da Silva Holanda, Maria Lucicleide, da Silva, Martorelli Dantas, and Alves Cordeiro, Luiz Filipe
From pets to plates: network analysis of trafficking in tortoises and freshwater turtles representing different types of demand	Sengottuvel, R. R., Mendis, A., Sultan, N., Shukla, S., Chaudhuri, A., and Mendiratta, U.
Galapagos giant tortoise trafficking case demonstrates the utility and applications of long-term comprehensive genetic monitoring	Quinzin, M. C., Bishop, A. P., Miller, J. M., Poulakakis, N., Tapia, W., Torres-Rojo, F., Sevilla, C., and Caccone, A.
Gaps in CITES policy undermine conservation of threatened species by providing loopholes for illegal trade	Waeber P. O., Roberts M. W., Schuurman D., Nijman V., Wittemyer G., Barber C. V., Innes J. L., Lowry P. P., Wilme L.
Genetic assessment, illegal trafficking and management of the Mediterranean spur-thighed tortoise in Southern Spain and Northern Africa	Salinas and María and Altet and Laura and Clavel and Cristina and Almela and Ramón Miguel and Bayón and Alejandro and Burguete and Isabel and Sánchez and Armand
Genetic Diversity of the Critically Endangered Big-Headed Turtle (Platysternon megacephalum) Based on Wild and Traded Samples: Implications for Conservation	Hanh Thi Ngo, McCormack, Timothy E M, Ha Van Hoang, Nguyen, Thuy Thu, Tapley, Benjamin, Mai Huyen Le, Le, Dat Trong, Tham Thi Nguyen, Ha Le Thi Trinh, Ziegler, Thomas, Nguyen, Truong Quang, and Le, Minh Duc

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Genetic evidence of illegal trade in protected whales links JaPan with the US and South Korea	Baker, C. Scott and Steel and Debbie and Choi and Yeyong and Lee and Hang and Kim and Kyung Seok and Choi and Sung Kyoung and Ma and Yong-Un and Hambleton and Charles and Psihoyos and Louie and Brownell, R.L. and Funahashi and Naoko
Genetic material reveals illegal sale in northern Brazil: the case of the critically endangered species Epinephelus itajara	Matos, Marcos José, S, Gomes, Camila Moraes, Oliveira-Filho, Aldemir B, Vallinoto Marcelo, Silva-Oliveira, Gláucia C
Genetic support to uplist an African cheetah subspecies, Acinonyx jubatus soemmeringii, imperiled by illegal trade	Schmidt-Küntzel, Anne, Yashphe, Shira, Hamalwa, Hafeni, Ismail, Shukri H, Tricorache, Patricia, Brewer, Bruce, O'Brien, Stephen J, and Marker, Laurie
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Genomic analyses reveal poaching hotspots and illegal trade in pangolins from Africa to Asia	Tinsman J. C., Gruppi C., Bossu C. M., Prigge T.-L., Harrigan R. J., Zaunbrecher V., Koepfli K.-P., LeBreton M., Njabo K., Wenda C., Xing S., Abernethy K., Ades G., Akeredolu E., Andrew I. B., Barrett T. A., Bernáthová I., Bolfíková B. Č., Diffo J. L., Fopa G. D., Ebong L. E., Godwill I., Pambo A. F. K., Labuschagne K., Mbekem J. N., Momboua B. R., Mousset Moumbolou C. L., Ntie S., Rose-Jeffreys E., Simo F. T., Sundar K., Swiacká M., Takuo J. M., Talla V. N. K., Tamoufe U., Dingle C., Ruegg K., Bonebrake T. C., and Smith T. B.
Global ban sought on ivory trade	Lewin and Roger
Global clampdown on illegal wildlife trade	No authors listed
Global dataset for seized and non-intercepted illegal cheetah trade (Acinonyx jubatus) 2010-2019	Tricorache and Patricia and Yashphe and Shira and Marker and Laurie
Global internet trade of plants - legality and risks	Kaminski and Katrin and Beckers and Franz and Unger and Jens-Georg
Global patterns of illegal marine turtle exploitation	Senko and Jesse F and Burgher and Kayla M and Maria del Mar Mancha-Cisneros and Godley and Brendan J and Irene Kinan-Kelly and Fox and Trevor and Humber and Frances and Koch and Volker and Smith and Andrew T and Wallace and Bryan P
Global population collapse in a superabundant migratory bird and illegal trapping in China	Kamp and Johannes and Oppel and Steffen and Ananin and Alexandr A. and Durnev and Yurii A. and Gashev and Sergey N. and Hölzel and Norbert and Mishchenko and Alexandr L. and Pessa and Jorma and Smirenski and Sergey M. and Strelnikov and Evgenii G. and Timonen and Sami and Wolanska and Kolja and Chan and Simba
Global trade in parrots-Influential factors of trade and implications for conservation	Chan, David Tsz Chung, Poon, Emily Shui Kei, Wong, Anson Tsz Chun, and Sin, Simon Yung Wa

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Going over the wall: insights into the illegal production of jaguar products in a Bolivian prison	Elwin, A., Asfaw, E., Vieto, R., and D'Cruze, N.
Gumtree takes action to tackle illegal pet trade	No authors listed
Harms and the Illegal Wildlife Trade: Political Ecology, Green Criminology and the European Eel	Gutierrez, L., and Duffy, R.
Harvest, trade and conservation of the Asian arowana Scleropages formosus in Cambodia	Rowley and Jodi J. L. and Emmett and David A. and Voen and Seila
Harvesting, local trade, and conservation of parrots in the Northeastern Peruvian Amazon	Gonzalez, JA
Hidden in plain sight: Investigating the illegal trade of medical products derived from the spiny-tailed lizard (Uromastyx spp.) through the surface web	Gondhali, U., and Petrossian, G. A.
Home ranges and activity patterns of Sunda pangolins Manis javanica (Pholidota: Manidae) in Vietnam	Gray R. J., Van Le D., Thi Thanh Nguyen H., Nhat Cau L., Van Nguyen T., Van Pham T., Willcox D., Chen T., and Van Nguyen T.
How has the illegal wildlife trade evolved in Tolima? Multitemporal analysis of a threat to biodiversity; [¿Cómo ha evolucionado el tráfico ilegal de fauna en el Tolima? Análisis multitemporal de una amenaza para la biodiversidad]	Lozano-Suárez, T. E., Bonilla-Liberato, E. D., and López-Delgado, E. O.
Human and Non-Human Primate Coexistence in Argentina: Conflicts and Solutions	García de la Chica A., Oklander L. I., Kowalewski M. M., and Fernandez-Duque E.
Hunting and Illegal Trade of White-Breasted Waterhen Amaurornis phoenicurus: Evidence from District Mardan, Khyber Pakhtunkhwa, Pakistan	Sadam A., Khan R. U., Gabol K., Awais M., Ismail M., Mahmood S., Aslam M., and Hamidullah
Ice Ivory to White Gold: Links Between the Illegal Ivory Trade and the Trade in Geocultural Artifacts	Cox, Caroline, and Hauser, Luke
Identifying opportunities for expert-mediated triangulation in monitoring wildlife trade on social media	Davies and Alisa and Hinsley and Amy and Nuno and Ana and Martin and Rowan O
Illegal and legal parrot trade shows a long-term, cross-cultural preference for the most attractive species increasing their risk of extinction	Tella and José L. and Hiraldo and Fernando
Illegal and Legal Wildlife Trade Spreads Zoonotic Diseases	Nijman, Vincent
Illegal and unreported fishing on abalone-Quantifying the extent using a fully integrated assessment model	Plaganyi, Eva, Butterworth, Doug, Burgener, Markus
Illegal Animal and (Bush) Meat Trade Associated Risk of Spread of Viral Infections	Kilonzo and Christopher and Stopka and Thomas J. and Chomel and Bruno

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Illegal captive lemurs in Madagascar: Comparing the use of online and in-person data collection methods	Reuter and Kim E and Schaefer and Melissa S
Illegal capture and black market trade of sea turtles in Pisco, Peru: The never-ending story	Quiñones and Javier and Quispe and Sixto and Galindo and Oscar
Illegal capture and trade of wild birds in the town Finca Pedregal Dagame Artemisa municipality, Artemisa province	Martínez, F. R. H., and Torrens, Y. A.
Illegal harvests of black bears, sale of black bear parts, and the Canadian legislative response	Twiss and Merilyn P and Thomas and Vernon G
Illegal Ivory Trade as Transnational Organized Crime? An Empirical Study into Ivory Traders in Uganda	Titeca and Kristof
Illegal mass killing of Indian pangolin (Manis crassicaudata) in Potohar region, Pakistan	Mahmood and Tariq and Hussain and Riaz and Irshad and Nausheen and Akrim and Faraz and Nadeem and Muhammad Sajid
Illegal pangolin trade in northernmost Myanmar and its links to India and China	Zhang, Mingxia, Gouveia, Ana, Qin, Tao, Quan, Ruichang, and Nijman, Vincent
Illegal pet trade on social media as an emerging impediment to the conservation of Asian otters species	Siriwat, Penthai, and Nijman, Vincent
Illegal primate trade in Indonesia exemplified by surveys carried out over a decade in North Sumatra	Shepherd and Chris R.
Illegal trade and conservation requirements of freshwater turtles in Nanmao, Hainan Province, China	Shiping and Gong and Jichao and Wang and Haitao and Shi and Riheng and Song and Rumei and Xu
Illegal Trade in Exotic Animals and Its Impacts in Slovenia—A Case Study	Dvojmoč, Miha, and Kubale, Valentina
Illegal trade in Indonesia's National Rare Animal has moved online	Nijman and Vincent
Illegal Trade in Protected Sharks: The Case of Artisanal Whale Shark Meat Fisheries in Java, Indonesia	Nijman, Vincent
Illegal trade in wild cats and its link to Chinese-led development in Central and South America	Morcatty, Thais Q, Bausch Macedo, Jonathan C, K Anne-Isola Nekaris, Ni, Qingyong, Durigan, Carlos C, Svensson, Magdalena S, Nijman, Vincent
Illegal trade in wildlife species in Beirut, Lebanon	Korwin and Sebastien and Lindsay and Keith and Reeve and Rosalind
Illegal trade in wildlife vertebrate species in the West Bank, Palestine	Handal and Elias N. and Amr and Zuhair S. and Basha and Walid S. and Qumsiyeh and Mazin B.
Illegal trade of aquarium species through the Brazilian postal service in Ceará State	Gurjao, Livio M. and Barros and Glaura M.L. and Lopes and Daniele P. and Machado and Daniel A.N. and Lotufo and Tito M.C.
Illegal trade of marine mammal bone exposed: Simple test identifies bones of "mermaid ivory" or Steller's sea cow (Hydrodamalis gigas)	Coetzer and Willem G. and Downs and Colleen T. and Perrin and Mike R. and Willows-Munro and Sandi

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Illegal trade of pangolins in India with international trade links: an analysis of seizures from 1991 to 2022	Gomez, Lalita, Joseph, Tito, Heinrich, Sarah, Wright, Belinda, and D'Cruze, Neil
Illegal trade of songbirds: an analysis of the activity in an area of northeast Brazil	Wallisson Sylas Luna de Oliveira and Martins Borges and Anna Karolina and Sérgio de Faria Lopes and Vasconcellos and Alexandre and Rômulo Romeu Nóbrega Alves
Illegal trade of the Psittacidae in Venezuela	Sánchez-Mercado and Ada and Asmüssen and Marianne and Rodríguez and Jon Paul and Moran and Lisandro and Cardozo-Urdaneta and Arlene and Morales and Lorena Isabel
Illegal trade of tortoises (Testudinata) in Colombia: A network analysis approach; [Tráfico ilegal de tortugas continentales (Testudinata) en Colombia: una aproximación desde el análisis de redes]	Arroyave Bermudez and Felber Jair and Romero Goyeneche and Oscar Yandy and Bonilla Gómez and María Argenis and Hurtado Heredia and Rafael German
Illegal trade on nonnative amphibians and reptiles in southeast Brazil: The status of ecommerce	De Magalhães and André Lincoln Barroso and SãoPedro and Vinícius Avelar
Illegal trade pushing the Critically Endangered Black-winged Myna Acridotheres melanopterus towards imminent extinction	SHEPHERD and CHRIS R and NIJMAN and VINCENT and KRISHNASAMY and KANITHA and EATON and JAMES A and CHNG and SERENE C L
Illegal trapping and local trade of farmland birds in Madhesh Province, Nepal	Katuwal, H. B., Sharma, H. P., Thakur, R. K., Rokka, P., Mandal, D. N., Baral, H. S., and Quan, R. C.
Illegal wild bird's trade in the street market in the region of Guelma, north east of Algeria	Razkallah and Imane and Sadek Atoussi and Telailia and Salah and Merzoug Abdelghani and Bouslama Zihad and Moussa and Houhamdi
Illegal Wildlife Trade and Emerging Infectious Diseases: Pervasive Impacts to Species, Ecosystems and Human Health	Rush, Elizabeth R, Dale, Erin
Illegal wildlife trade and other organised crime: A scoping review	Anagnostou and Michelle and Doberstein and Brent
Illegal wildlife trade in Algeria, insight via online selling platforms	Sadek Atoussi and Razkallah and Imane and Idir Nazim Ameziane and Boudebbouz and Ali and Bara and Mouslim and Bouslama and Zihad and Moussa Houhamdi
Illegal wildlife trade in Galápagos: Molecular tools help the taxonomic identification of confiscated iguanas and guide their rapid repatriation	Gentile and Gabriele and Ciambotta and Marco and Tapia and Washington
Illegal wildlife trade in the Himalayan region of China	Yi-ming and Li and Zenxiang and Gao and Xinhai and Li and Sung and Wang and Niemelä and Jari
Illegal wildlife trade in the mekong: The interplay of actors, legal governance, and political economy	Nillasithanukroh S., Patel E., Malesky E., and Weinthal E.
Illegal wildlife trade in two special economic zones in Laos: Underground–opensale	van Uhm and Daan P. and Zhang and Mingxia

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fluctuations in the Golden Triangle borderlands	
Illegal wildlife trade networks in northeast of México, an analysis from Green Criminology; [Redes de tráfico ilegal de vida silvestre en el noreste mexicano, un análisis desde la Criminología Verde]	Carpio-Domínguez J. L., Vargas-Orozco C. M., and Villarreal-Sotelo K.
Illegal Wildlife Trade to the EU and Harms to the World	van Uhm, Daan
Illegal wildlife trade: An analysis of carnivore products found in markets in Benin and Niger	Gerstenhaber, C., Ipavec, A., Lapeyre, V., Plowman, C., Chabi-N'Diaye, Y., Tevoedjre, F., Amoussa, C. A., Siddo, O. S., Aboubacar, H. A., and Durant, S. M.
Illegal wildlife trade: Indonesian turtle egg traders in kalimantan-sarawak border; [Comercio ilegal de vida silvestre: Comerciantes indonesios de huevos de tortuga en la frontera Kalimantan-Sarawak]	Kaur and Parveen and Khairi and Nurul Nadzatul Farah Binti Mohd and Rehman and Khalil Ur and Jawaid and Arif
Illegal wildlife trade: Look to the elephants	Wittemyer, George
Illegal wildlife trade–surveying open animal markets and online platforms to understand the poaching of wild cats	Nijman and Vincent and Morcatty and Thais and Smith and Jaima H. and Atoussi and Sadek and Shepherd and Chris R. and Siriwat and Penthai and Nekaris, K. Anne-Isola and Bergin and Daniel
Illicit trade in wildlife	No authors listed
Illicit Wildlife Trade, Wet Markets, and COVID-19: Preventing Future Pandemics	A Alonso Aguirre, Catherina, Richard, Frye, Hailey, Shelley, Louise
Impact of musk trade on the decline in Himalayan musk deer Moschus chrysogaster population in Neelum Valley, Pakistan	Khan, Aleem Ahmed, Qureshi, Baseer ud din, Awan, Muhammad Siddique
Impact of the pet trade on the Margarita capuchin monkey Cebus apella margaritae	Ceballos-Mago and Natalia and González and Carlos Enrique and Chivers and David J.
Impacts of animal traffic on the Brazilian Amazon parrots (Amazona species) collection of the Quinzinho de Barros Municipal Zoological Park, Brazil, 1986-2007	Vanstreels and Ralph Eric Thijl and Teixeira and Rodrigo Hidalgo Friciello and Camargo and Luis Carlos and Nunes and Adauto Luis Veloso and Matushima and Eliana Reiko
Implementation of species protection act for the conservation of tanimbar corella, cacatua goffiniana (Finsch, 1863)	Haryoko and Tri and O'hara and Mark and Mioduszewska and Berenika and Sutrisno and Hari and Prasetyo and Lilik Budi and Mardiastuti and Ani
Implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and Law No. 5 of 1990 on the Conservation of Biological Natural ReSupplys and Its Ecosystems in Law Enforcement Efforts and Guarantees of Environmental Rights in Gunung Leuser National Park, Indonesia	Lubis and Muhammad Ikhsan
Improving conservation outcomes: Understanding scientific, historical and cultural dimensions of the illicit trade in rhinoceros horn	Bending and Zara Jean

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In the market for extinction: The cage bird trade in Bali	Chng and Serene C. L. and Krishnasamy and Kanitha and Eaton and James A.
In the post-COVID-19 era, is the illegal wildlife trade the most serious form of trafficking?	Sean, Doody J, Reid, Joan A, Bilali Klejdis, Diaz, Jennifer, Mattheus Nichole
In the shadows of the Congo Basin forest, elephants fall to the illegal ivory trade	Gross and Liza
Indictment of monkey importers could disrupt U.S. research	Grimm and David
Indonesia's sustainable development goals in relation to curbing and monitoring the illegal wildlife trade	Nijman, V., Abdullah, A., Adinda, E., Ardiansyah, A., Campera, M., Chavez, J., Dewi, T., Hedger, K., Imron, M. A., Shepherd, C. R., Sukmadewi, D. K. T., Wirdateti, W., and Nekaris, K. A. I.
Infectious diseases and the illegal wildlife trade	Gómez and Andrés and Aguirre, A. Alonso
Influence of exotic bird and wildlife trade on avian influenza transmission dynamics: Animal-human interface	Burgos and Sigfrido and Burgos and Sergio A.
Insights for reducing the consumption of wildlife: The use of bear bile and gallbladder in Cambodia	Davis and Elizabeth Oneita and Veríssimo and Diogo and Crudge and Brian and Lim and Thona and Roth and Vichet and Glikman and Jenny Anne
Insights from the media into the bird trade in India: an analysis of reported seizures	Kalra, S., Davies, A., Martin, R. O., and Poonia, A.
Insights into the illegal ivory trade and status of elephants in Togo, West Africa	Segniagbeto and Gabriel Hoinsoudé and Kossi Thomas Agbodji and Leuteritz and Thomas EJ and Dendi and Daniele and Fa and Julia E and Luiselli and Luca
Insights into the illegal trade of feline derivatives in Costa Rica	Kelly and Jennifer Rebecca
Insights into the primate trade into the European Union and the United Kingdom	Svensson, Magdalena S., Nijman, Vincent, and Shepherd, Chris R.
Instagram-fuelled illegal slow loris trade uncovered in Marmaris, Turkey	Kitson and Honor and Nekaris, K A I
International illegal trade in wildlife: Threats and U.S. policy	Wyler and Liana Sun and Sheikh and Pervaze A.
International law and criminalizing illegal trade in endangered species (from the Far Eastern perspective)	Chitov and Alexandre
International media coverage of the Bolivian jaguar trade	Li and Yuhan and Arias and Melissa and Hinsley and Amy and Eleanor Jane Milner-Gulland
International trade of CITES listed bird species in China	Li and Linlin and Jiang and Zhigang
International wildlife trade, avian influenza, organised crime and the effectiveness of CITES: The Chinese hwamei as a case study	Shepherd, Chris R., Leupen, Boyd T. C., Siriwat, Penthai, Nijman, Vincent
International Wildlife Trafficking: A perspective on the challenges and potential forensic genetics solutions	Smart, Utpal, Cihlar, Jennifer Churchill, and Budowle, Bruce

Article Title	Author(s)
Internet trade of a previously unknown wildlife product from a critically endangered marine fish	Pytka, Jennifer M., Moore, Alec B M, and Heenan, Adel
Investigação Sobre O Comércio Ilegal De Procambarus clarkii Girard, 1852 (Decapoda: Crustacea) Na Região Sul Do Brasil	Smialoski and Luciana Rodrigues and Almerão and Maurício Pereira
Investigating the origins of ivory recovered in the United Kingdom	Hale C., Ogden R., Ciavaglia S. A., Cook G. T., Clarke G., Ogle S., and Webster L. M. I.
Investigating Vietnam's ornamental bird trade: Implications for transmission of zoonoses	Edmunds and Kelly and Roberton and Scott I. and Few and Roger and Mahood and Simon and Bui and Phuong L. and Hunter and Paul R. and Bell and Diana J.
"Invisible" wildlife trades: Southeast Asia's undocumented illegal trade in wild ornamental plants	Phelps, J. and Webb and Edward L.
Is social media the new wet market? Social media platforms facilitate the online sale of bushmeat in West Africa	Moloney, G. K., Gossé, K. J., Gonedelé-Bi, S., Gaubert, P., and Chaber, A. L.
It's in the news: Characterising Indonesia's wild bird trade network from media-reported seizure incidents	Indraswari, Karlina, Friedman, Rachel S., Noske, Richard, Shepherd, Chris R., Biggs, Duan, Susilawati, Connie, and Wilson, Clevo
Ivory trade: Policy and law change	Lowther and Jason
Japan's ivory trade in the face of the endangered species convention	Sand and Peter H.
Japan's Ivory Trade in the Face of the Endangered Species Convention	Sand and Peter H
Joining the Dots in an Era of Uncertainty – Reviewing Myanmar’s Illegal wildlife trade and looking to the future	McEvoy, J.F. and Connette, G.M. and Huang, Q. and Soe and Paing and Pyone and Khin Htet Htet and Htun and Yan Lin and Lin and Aung Naing and Thant and Aung Lwin and Htun and Wai Yan and Paing and Kaung Htet and Swe and Khine Khine and Aung and Myint and Songer, M. and Leimgruber, P.
Keeping the Ivory Trade Banned	Pagel and Mark and Mace and Ruth
Knowledge and Practices of Expert Fishermen of South Bahia, Brazil, Regarding the International Shark Fin Market	Vargas Barbosa-Filho, Marcio Luiz, Costa-Neto, Eraldo Medeiros, Siciliano, Salvatore
La lutte contre le commerce illégal d'espèces sauvages	T Bernard
Laundered alive? The transnational trade in wild felids through Bangladesh	Uddin, N., Enoch, S., Harihar, A., Pickles, R. S. A., and Hughes, A. C.
Legal and illegal trade between Mexico and the US in plants and plant products listed under CITES	Floyd and J. P.
Limitations of DNA barcoding in determining the origin of smuggled seahorses and pipefishes	Serite C. P., Ntshudisane O. K., Swart E., Simbine L., Jaime G. L. M., and Teske P. R.

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Live exotic animals legally and illegally imported via the main Dutch airport and considerations for public health	Annika van Roon and Maas and Miriam and Toale and Daniela and Tafro and Nedzib and Joke van der Giessen
Live reptile smuggling is predicted by trends in the legal exotic pet trade	Stringham, Oliver C, Pablo García-Díaz, Toomes, Adam, Lewis, Mitchell, Ross, Joshua V, Cassey, Phillip
llegal tortoiseshell harvest of Hawksbill Turtles (Eretmochelys imbricata) in Southeast Asia: Evidence from Baturua Reef, Semporna, Sabah, Malaysia	Kirishnamoorthie J., Hideaki N., James A., Hussien M., and Juanita J.
Longitudinal monitoring of turtle trade through facebook in Vietnam	Pham Van and Thong and Luu and Vinh Quang and Tien and Thinh Vu and Leprince and Benjamin and Khanh and Linh Tran Thi and Luiselli and Luca
Magnitude of the freshwater turtle exports from the US: Long term trends and early effects of newly implemented harvest management regimes	Mali and Ivana and Vandewege and Michael W. and Davis and Scott K. and Forstner and Michael R. J.
Making sense of domestic wildlife and CITES legislation: The example of Nepal's orchids	Bashyal, R., Paudel, K., Hinsley, A., and Phelps, J.
Managing Trade and Environment: The Demand for Raw Ivory in Japan and Hong Kong	Barbier and Edward B
Mapping the Illegal International Ivory Trading Network to Identify Key Hubs and Smuggling Routes	Huang Wenyang, Wang, Huiwen, Wei Yigang
Mapping the online songbird trade in Indonesia	Fink, Christoph, Toivonen, Tuuli, Correia, Ricardo A., Di Minin, Enrico
Media portrayal of the illegal trade in wildlife: The case of turtles in the US and implications for conservation	Easter, Tara, Trautmann, Julia, Gore, Meredith, and Carter, Neil
Medicinal Use and Legalized Trade of Rhinoceros Horn From the Perspective of Traditional Chinese Medicine Practitioners in Hong Kong	Cheung and Hubert and Mazerolle Lorraine and Possingham and Hugh P and Biggs Duan
Merely a transit country? Examining the role of Uganda in the transnational illegal ivory trade	Runhovde and Siv Rebekka
Meta-analyses of molecular seafood studies identify the global distribution of legal and illegal trade in CITES-regulated European eels	Nijman and Vincent and Stein and Florian Martin
Mexican organized crime and the illegal trade in totoaba maw	Martínez Israel Alvarado, Alonso, Aitor Ibáñez
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Missing teeth: Discordances in the trade of hippo ivory between Africa and Hong Kong	Andersson and Alexandra and Gibson and Luke

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"Missing the Trees for the Forest?" An Analysis of the Harms to European Eels Caused by Their Trafficking and Trade	Pons-Hernandez, Monica
Mitochondrial DNA Profiling of Illegal Tortoiseshell Products Derived from Hawksbill Sea Turtles	Foran and David R and Ray and Rebecca L
Mitochondrial DNA-based species testing of confiscated aquatic wildlife in the Philippines	Poniente J. A., Pereda J. M. R., Dela Peña J. T., Ventolero M. F. H., and Santos M. D.
Molecular detection of zoonotic blood pathogens in ticks from illegally imported turtles in Italy	Manoj, Ranju Ravindran Santhakumari, Mendoza-Roldan, Jairo Alfonso, Latrofa, Maria Stefania, Remesar, Susana, Brianti, Emanuele, Otranto, Domenico
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Monetary Value of Live Trade in a Commonly Traded Primate, the Long-Tailed Macaque, Based on Global Trade Statistics	Hansen and Malene Friis and Gill and Mike and Briefer and Elodie Floriane and Nielsen and Daniel R. K. and Nijman and Vincent
Monitoring illegal trade in snow leopards: 2003-2014	Maheshwari and Aishwarya and Niraj and Shekhar Kumar
Monitoring the trade turnover of Red-eared terrapins (Trachemys scripta elegans) in pet shops of the lublin region, East Poland	Kitowski and Ignacy and Pachol and Dorota
Motivations and sensitivities surrounding the illegal trade of sea turtles in Costa Rica	Pheasey, Helen, Griffiths, Richard A., Matechou, Eleni, and Roberts, David L.
Multi-lingual multi-platform investigations of online trade in jaguar parts	Polisar, John, Davies, Charlotte, and Morcatty, Thais
Narrow range of suitable habitat and poaching driving Indian pangolin (Manis crassicaudata) towards extirpation in Mardan District, Pakistan	Munawar N., Saba G., Mahmood T., Akrim F., Khalid A., and Nadeem M. S.
National illegal wildlife trafficking includes threatened species: A descriptive study in manabÃ (ecuador)	CrespoGascón and Sofía and Solórzano and Carlos B. and GuerreroCasado and José
Native species exploited by marine aquarium trade in Brazil	de Gurjão, Lívio Moreira and Lotufo and Tito Monteiro da Cruz
Natural remedies for Covid-19 as a driver of the illegal wildlife trade	Svolkinas, Linas, Goodman, Simon J, Holmes, George, Ermolin, Ilya, Suvorkov, Pavel
New tarantula highlights illegal trade in spiders	Law and YaoHua
Non-human animal abuse and wildlife trade: Harm in the fur and falcon trades	Wyatt and Tanya
North Africa as a source for European eel following the 2010 EU CITES eel trade ban	Nijman, Vincent
Note on the availability of Philippine Forest Turtle Siebenrockiella leytensis in online reptile markets	Janssen, Jordi, and Sy, Emerson Y.

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Nothing to laugh about - The ongoing illegal trade in laughingthrushes (Garrulax species) in the bird markets of Java, Indonesia	Shepherd and Chris R. and Eaton and James A. and Chng and Serene C. L.
Online sale of small turtles circumvents public health regulations in the United States	Montague and Lauren E and Marcotrigiano and Juliana M and Keane and Niamh E and Marquardt and Hannah E and Sevin and Jennifer A and Karraker and Nancy E
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People's Knowledge of Illegal Chinese Pangolin Trade Routes in Central Nepal	Sharma, Sandhya, Sharma, Hari Prasad, Katuwal, Hem Bahadur, Chaulagain, Chanda, Belant, and Jerrold L.
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To Poach or Not to Poach an Endangered Species: Elucidating the Economic and Social Drivers Behind Illegal Sea Turtle Hunting in Baja California Sur, Mexico	Mancini, Agnese, Senko, Jesse, Borquez-Reyes, Ricardo, Poo, Juan Guzman, Seminoff, Jeffrey A., and Koch, Volker
Tracing current wildlife trade: An initial investigation in makassar city, indonesia	Maulany and Risma Illa and Mutmainnah and Aisyah and Nasri and Nasri and Achmad and Amran and Ngakan and Putu Oka
Track illegal trade in wildlife	Toledo and Luís Felipe and Asmüssen and Marianne V. and Rodríguez and Jon Paul
Trade bans and wildlife conservation: The case of African elephant ivory	Heltberg, R.

Article Title	Author(s)
Trade in a smallrange songbird, the Javan crocias, gives insight into the Asian Songbird Crisis	Nijman and Vincent and Ardiansyah and Ahmad and Hendrik and Rifqi and Langgeng and Abdullah and Manson and Sophie and Hedger and Katey and Imron and Muhammad Ali and Nekaris, K. Anne-Isola
Trade in bears in Lao PDR with observations from market surveys and seizure data	Gomez, Lalita, and Shepherd, Chris R.
Trade in Bengal Slow Lorises in Mong La, Myanmar, on the China Border	Nijman and Vincent and Shepherd and Chris R. and Nekaris, K. Anne-Isola
Trade in night monkeys Aotus spp. in the Brazil-Colombia-Peru tri-border area: International wildlife trade regulations are ineffectively enforced	Maldonado and Angela M. and Nijman and Vincent and Bearder and Simon K.
Trade in Prevost's squirrels: legality, risk for introduction and disease transmission	Nijman, V., Abdullah, A., Ardiansyah, A., Campera, M., Chavez, J., Dewi, T., Hankinson, E., Hedger, K., Imron, M. A., Manson, S., Morcatty, T. Q., Payuse, I. N. A. D., Rapone, B. C., Shepherd, C. R., Siriwat, P., Svensson, M. S., and Nekaris, K. A. I.
Trade in the Helmeted Hornbill Rhinoplax vigil: The 'ivory hornbill'	Beastall and Claire and Shepherd and Chris R. and Hadiprakarsa and Yokyok and Martyr and Debbie
Trade in wild-sourced African grey parrots: Insights via social media	Martin, Rowan O., Senni, Cristiana, and D'Cruze, Neil C.
Trade of herpetofauna as ornamental and companion animals in three markets in Mexico City	PinedaVázquez and Mariana and Villegas and Alejandro and PachecoCoronel and Noé and EscutiaSánchez and Jorge Alberto and Gómezálvarez and Graciela
Trade of skulls as novelty and aquarium objects are an additional threat to porcupines	Chavez, J., Kuntayuni, and Nijman, V.
Tradition and trade: culture and exploitation of avian fauna by a rural community surrounding protected areas in the south of Bahia's State, Northeastern Brazil	Neto and Antonio Iderval Sodré and Fraga and Ricardo Evangelista and Schiavetti and Alexandre
Traditional Chinese medicine and international species' protection; [Traditionelle Chinesische medizin und internationaler artenschutz]	Gratwicke and Brian and Mills and Judy and Dutton and Adam and Gabriel and Grace and Long and Barney and Seidensticker and John and Wright and Belinda and You and Wang and Zhang and Li
Traditions, taboos and trade in slow lorises in sundanese communities in southern Java, Indonesia	Nijman and Vincent and Nekaris, K. Anne-Isola
Trafficking of a Tiger (Panthera tigris) in northeastern Mexico: A social network analysis	Domínguez, J. L. C., Quiroz, I. A., Martínez, M. T. V., and Salazar, J. I. C.
Trafficking of emblematic lizards of the genus Abronia (Squamata: Anguidae) ; [El tráfico de lagartijas emblematicas del género Abronia (Squamata: Anguidae)]	MorenoLara and Israel and CruzElizalde and Raciel and SuazoOrtuño and Ireri and RamírezBautista and Aurelio

Article Title	Author(s)
Trafficking of Ornamental Fish in the Brazilian Amazon [Tráfico de Peixes Ornamentais na Amazônia Brasileira]	Beltrão, Hélio and Magalhães and Esner Robert Santos and Benzaken and Zehev Schwartz and Sousa and Raniere Garcez Costa
Transnational links in rhino poaching and the black-market price of rhino horns	Lopes, Adrian A.
Transnational norms and governing illegal wildlife trade in China and Japan: elephant ivory and related products under CITES	Mak and Ginger Jun Ki and Song and Weiqing
Trends and patterns of illegal wildlife hunting and trading in Uttar Pradesh, India	Singh R., Sethy J., and Chatrath D.
Trends and patterns of imports of legal and illegal live corals into the United States	Petrossian, Gohar A., Sosnowski, Monique C., and Weis, Judith S.
Trends in illegal wildlife trade: Analyzing personal baggage seizure data in the Pacific Northwest	Hitchens, Rosemary T., Blakeslee, April M H
Trends in legal and illegal trade of wild birds: a global assessment based on expert knowledge	Ribeiro and Joana and Reino and Luís and Schindler and Stefan and Strubbe and Diederik and Vall-Ilosera and Miquel and Miguel Bastos Araújo and Capinha, César and Carrete and Martina and Mazzoni and Sabrina and Monteiro and Miguel and Moreira and Francisco and Rocha and Ricardo and Tella and José L and Vaz and Ana Sofia and Vicente and Joana and Nuno and Ana
Trends in wildlife trade from India to the United States	Gray-Schofield, L. and McMahan, L.
Trends in wildlife use and trade in Chile	Iriarte, J. A., Feinsinger, P., and Jaksic, F. M.
Trends, patterns, and networks of illicit wildlife trade in Nepal: A national synthesis	Paudel, Prakash K, Krishna Prasad Acharya, Hem Sagar Baral, Heinen, Joel T, Jnawali, Shant Raj
Tricks of the trade—legal trade used to conceal Endangered African grey parrots on commercial flights	Martin and Rowan O and Senni and Cristiana and D'cruze and Neil and Bruschi and Nick
Turning the tide on big cat trade: Expert opinion on trends and conservation lessons from the Republic of Korea	Elves-Powell, J., Lee, H., Axmacher, J. C., and Durant, S. M.
Two sides of the same coin – Wildmeat consumption and illegal wildlife trade at the crossroads of Asia	McEvoy, J.F. and Connette, G. and Huang, Q. and Soe, P. and Pyone and Khin Htet Htet and Valitutto, M. and Htun and Yan Lin and Lin and Aung Naing and Thant and Aung Lwin and Htun and Wai Yan and Paing and Kaung Htet and Swe and Khine Khine and Aung, M. and Min, S. and Songer, M. and Leimgruber, P.
Una aproximación a la problemática del tráfico de especies protegidas en la UE y España. Implicaciones para la seguridad. [An approach to the problem of trafficking in protected species in the EU and Spain. Security implications]	Garrido and Miguel León

Article Title	Author(s)
Uncovering the magnitude of African pangolin poaching with extensive nanopore DNA genotyping of seized scales	Yeo, D., Chan, A. H. J., Hiong, K. C., Ong, J., Ng, J. Y., Lim, J. M., Zhang, W., Lim, S. R., Fernandez, C. J., Wong, A. M. S., Lee, B. P. Y. H., Khoo, M. D. Y., Cheng, T. X. W., Lim, B. T. M., Yeo, H. H. T., Tan, M. M. Q., Sng, W. B. G., Adam, S. S., Ang, W. F., How, C. B., Xie, R., Wasser, S. K., Finch, K. N., Loo, A. H. B., Yap, H. H., Leong, C. C., and Er, K. B. H.
Understanding China's Wildlife Markets: Trade and Tradition in an Age of Pandemic	Zhu and Annah and Zhu and George
Understanding implications of consumer behavior for wildlife farming and sustainable wildlife trade	Nuno, A and Blumenthal, J M and Austin, T J and Bothwell, J and G Ebanks-Petrie and Godley, B J and Broderick, A C
Understanding the illegal ivory trade and traders: evidence from Uganda	Titeca and Kristof
Understanding the illegal trade of live wildlife species in Peru	Leberatto and Antony C.
Understanding the illegal trade of live wildlife species in Peru	Leberatto and Antony C
Understanding why consumers in China switch between wild, farmed, and synthetic bear bile products	Hinsley and Amy and Anita Kar Yan Wan and Garshelis and David and Hoffmann and Michael and Hu and Sifan and Lee and Tien Ming and Meginnis and Keila and Moyle and Brendan and Qiu and Yingjie and Ruan and Xiangdong and E J Milner-Gulland
United States Takes Steps to Combat Illegal Trade in Wildlife	Daugirdas and Kristina and Mortenson and Julian Davis
Use of evidence for decision-making by conservation practitioners in the illegal wildlife trade	Arias, Melissa, Hinsley, Amy, E. J. Milner-Gulland
Uses of vultures in traditional medicines in the Kruger to Canyons Biosphere Region, South Africa	Mashele, N. Mbali and Thompson and Lindy J. and Downs and Colleen T.
Using crime script analysis to elucidate the details of Amur tiger poaching in the Russian Far East	Skidmore, Allison
Using forensics to track pangolin trafficking	No authors listed
Using spatial patterns in illegal wildlife uses to reveal connections between subsistence hunting and trade	Sanchez-Mercado and Ada and Asmussen and Marianne and Rodriguez-Clark and Kathryn M and Rodriguez and Jon Paul and Jedrzejewski and Wlodzimierz
Vendors' perceptions on the bushmeat trade dynamics across West and central Africa during the COVID-19 pandemic: Lessons learned on sanitary measures and awareness campaigns	Gaubert, P., Djagoun, C. A. M. S., Missoup, A. D., Ales, N., Amougou, C. V., Dipita, A. D., Djagoun, J., Gossé, K. J., Koffi, C. E., N'Goran, E. M., Noma, Y. N., Zanvo, S., Tindo, M., Antunes, A., and Gonedelé-Bi, S.
Wanted: A systematic review of the most trafficked songbirds in a Neotropical hotspot	Ferrari, G. C. P., Rheingantz, M. L., Rajao, H., and Lorini, M. L.
Weed wide web: characterising illegal online trade of invasive plants in Australia	Maher, J., Stringham, O. C., Moncayo, S., Wood, L., Lassaline, C. R., Virtue, J., and Cassey, P.

Article Title	Author(s)
Weight-Length and Length-Length Relationships of the Endangered Zebra Pleco Hypancistrus zebra (Siluriformes, Loricariidae) from the Xingu River, Amazon, Brazil	Barros, F. J. T., Rodrigues, E. L. C., Moura, M. C. D., Torres, R. D., Paula, E. A., and Sousa, L. M.
What is driving the increased demand for red panda pelts?	Bista and Damber and Baxter and Greg S and Murray and Peter John
Where are you hiding the pangolins? screening tools to detect illicit contraband at international borders and their adaptability for illegal wildlife trafficking	Moloney, G. K., and Chaber, A. L.
Where did all the pangolins go? International CITES trade in pangolin species	Heinrich, Sarah, Wittmann, Talia A., Prowse, Thomas A. A., Ross, Joshua V., Delean, Steven, Shepherd, Chris R., and Cassey, Phillip
Who Needs the Dark Web? Exploring the Trade in Critically Endangered Plants on eBay	Perdue and Robert Todd
Wild birds as pets in Campina Grande, Paraíba State, Brazil: An Ethnozoological Approach	Licarião and Morgana R. and Bezerra and Dandara M.M. and Alves, Rômulo R. Nobrega
Wild birds as pets in the central region of Cuba: Elements for a mitigation strategy	Ferrer-Sanchez, Yarelys, Abasolo-Pacheco, Fernando, Plasencia-Vazquez, Alexis H., and Ruiz, Idael
Wild birds as pets in the central region of Cuba: Elements for a mitigation strategy; [Aves silvestres como mascotas en la región central de Cuba: Elementos para una estrategia de mitigación]	Ferrer-Sánchez and Yarelys and Abasolo-Pacheco and Fernando and Plasencia-Vázquez and Alexis H. and Ruiz and Idael
Wild birds' illegal trade and their abundance in areas where they are captured, Niceto Perez municipality	Gomez Mato, Yanara, Alonso Torrens, Yatsunaris, and Hernandez Martinez, Fernando R.
Wild birds trade in Dera Ismael Khan and Bannu divisions of Khyber PakhtunKhwa (KPK) Province, Pakistan	Hussain, A., and Khan, A. A.
Wild orchid tuber collection in Iran: A wake-up call for conservation	Ghorbani and Abdolbaset and Gravendeel and Barbara and Naghibi and Farzaneh and de Boer and Hugo
Wild orchids traded in a traditional market in Chiapas, Mexico	Antonio Jimenez-Lopez, Derio, Alberto Perez-Garcia, Eduardo, Martinez-Melendez, Nayely, Solano, Rodolfo
Wild-bird trade and exotic invasions: A new link of conservation concern?	Carrete and Martina and Tella and José L.
Wildlife across our borders: A review of the illegal trade in Australia	Alacs and Erika and Georges and Arthur
Wildlife conservation in Myanmar: trade in wild sheep and goats for meat, medicine, and trophies, with links to China, India, and Thailand	Shepherd and Chris R. and Gomez and Lalita and Siriwat and Penthai and Nijman and Vincent
Wildlife crime in australia	Linacre and Adrian
Wildlife crime: A conceptual integration, literature review, and methodological critique	Wittig and Tim

Article Title	Author(s)
Wildlife Crimes and Legal Protection of Wildlife in China	Cao, Deborah
Wildlife farming: Balancing economic and conservation interests in the face of illegal wildlife trade	Meeks, D., Morton, O., and Edwards, D. P.
Wildlife laundering and 'black-washing': green criminological insights into the interactions between legal and illegal trade in European eels and black caviar; [Blanqueo y 'black-washing' de vida silvestre: interacciones entre el comercio legal e ilegal de anguila europea y caviar negro desde la perspectiva de la Criminología verde]	Alonso A. I. and van Uhm D. P.
Wildlife markets in south China	Chow and Alex T. and Cheung and Szeman and Yip and Peter K.
Wildlife trade, CITES and the protection of marine molluscs in Indonesia	Nijman and Vincent
Wildlife trade, consumption and conservation awareness in southwest China	Zhang and Li and Hua and Ning and Sun and Shan
Wildlife trading in Vietnam: Situation, causes, and solutions	Van Song and Nguyen
Wildlife trafficking between the European union and Mexico	Arroyo-Quiroz and Inés and Wyatt and Tanya
Wildlife Trafficking in Southeast Asia	Deeks P.
Wildlife Trafficking in Spain: a non-speciesist green critical criminology exploration; [Tráfico de Especies Silvestres en España: una exploración desde la Criminología verde crítica no-especista]	Pons-Hernandez M.
Wildlife trafficking in the Internet age	Lavorgna and Anita
Wildlife trafficking on the internet: A virtual market similar to drug trafficking?	Demeau and Elodie and Monroy and Miguel EduardoVargas and Jeffrey and Karolan
Wildlife trafficking: Focusing on the entire supply chain	Nataraajan, Arthi Shri
Wildlife Trafficking: Harms and Victimization	Maher, Jennifer, Sollund, Ragnhild
Wild-Orchid Trade in a Chinese E-Commerce Market	Wong and Shan and Liu and Hong
Women and Illegal Trade in Wildlife: A Nigerian Case Study	Badiora, A. I., and Oresanwo, G. A.
Women and urban wildmeat trafficking in the Republic of Congo	Green, A. R., Plowman, C., Mwinyihali, R., Wieland, M., and Gore, M. L.
Worldwide distribution of non–native Amazon parrots and temporal trends of their global trade [Distribución en el mundo de los loros introducidos del género Amazona y tendencias temporales de su comercio aescala mundial]	Shepherd and Chris R. and Connelly and Ellen and Hywood and Lisa and Cassey and Phillip

Article Title	Author(s)
Zoonotic pathogens from illegally traded wildlife justify adopting the One Health perspective in disease response	Lee and Marianne Allison G. and Valeza and Vinyl Joseph S. and Yan and Jonathan Patrick H. and Cruz and Ronald Allan L.
Zoos consenting to the illegal wildlife trade - The earless monitor lizard as a case study	Nijman and Vincent

Appendix 2: Geographic data tables

Primary study locations

Table 8: Primary study locations aggregated to the continental level.

Continent	Count	Proportion
Africa	69	14%
Asia	214	43%
Europe	51	10%
North America	65	13%
Oceania	11	2%
South America	86	17%

Table 9: All primary study location countries.

Country	Continent	Count
Algeria	Africa	5
Argentina	South America	3
Australia	Oceania	9
Azerbaijan	Asia	1
Bangladesh	Asia	3
Belgium	Europe	2
Belize	North America	2
Benin	Africa	3
Bolivia	South America	7
Botswana	Africa	1
Brazil	South America	42
Bulgaria	Europe	1
Cabo Verde	Africa	2
Cambodia	Asia	3
Cameroon	Africa	3
Canada	North America	3
Cayman Is. (T)	North America	1
Central African Rep.	Africa	1
Chile	South America	1
China	Asia	44
Colombia	South America	7
Congo	Africa	2
Costa Rica	North America	2

Country	Continent	Count
Côte d'Ivoire	Africa	3
Cuba	North America	4
Cyprus	Europe	1
Czechia	Europe	2
Dem. Rep. Congo	Africa	2
Ecuador	South America	5
Egypt	Africa	1
France	Europe	2
Gabon	Africa	2
Germany	Europe	2
Ghana	Africa	3
Greece	Europe	1
Guatemala	North America	2
Guinea	Africa	1
Honduras	North America	1
Hong Kong (SAR)	Asia	7
India	Asia	18
Indonesia	Asia	41
Iran	Asia	3
Italy	Europe	3
Japan	Asia	6
Kazakhstan	Asia	1
Kenya	Africa	2
Laos	Asia	4
Lebanon	Asia	1
Madagascar	Africa	5
Malaysia	Asia	5
Mexico	North America	18
Morocco	Africa	3
Mozambique	Africa	1
Myanmar	Asia	10
Nepal	Asia	9
Netherlands	Europe	2
New Zealand	Oceania	2
Niger	Africa	1
Nigeria	Africa	2
Norway	Europe	2

Country	Continent	Count
Pakistan	Asia	11
Palestine	Asia	1
Peru	South America	17
Philippines	Asia	5
Poland	Europe	2
Portugal	Europe	1
Romania	Europe	2
Russia	Europe	7
Serbia	Europe	1
Singapore	Asia	4
Slovenia	Europe	1
Somalia	Africa	1
South Africa	Africa	11
South Korea	Asia	1
Spain	Europe	7
Tanzania	Africa	5
Thailand	Asia	13
Togo	Africa	1
Tunisia	Africa	1
Turkey	Asia	2
Uganda	Africa	5
Ukraine	Europe	1
United Kingdom	Europe	11
United States of America	North America	32
Venezuela	South America	4
Vietnam	Asia	21
Zambia	Africa	1
Zimbabwe	Africa	1

SAR: Special Administrative Region, T: Territory

Encountered locations

Table 10: Encountered locations aggregated to the continental level.

Continent	Supply	Proportion	Transit	Proportion	Demand	Proportion
Africa	232	22%	58	21%	78	8%
Asia	453	44%	125	46%	532	56%
Europe	94	9%	46	17%	129	14%
North America	98	9%	23	8%	95	10%
Oceania	22	2%	9	3%	20	2%
South America	133	13%	11	4%	88	9%

Table 11: All encountered location countries.

Country	Continent	Supply	Transit	Demand
Afghanistan	Asia	2	0	1
Algeria	Africa	6	0	4
Angola	Africa	1	0	0
Argentina	South America	5	0	5
Armenia	Europe	0	0	1
Australia	Oceania	10	2	11
Austria	Europe	0	0	2
Azerbaijan	Asia	1	2	0
Bahrain	Asia	0	0	1
Bangladesh	Asia	7	4	6
Belarus	Europe	1	0	0
Belgium	Europe	2	3	9
Belize	North America	4	0	2
Benin	Africa	4	0	3
Bhutan	Asia	3	0	2
Bolivia	South America	14	2	8
Bosnia and Herz.	Europe	1	0	0
Botswana	Africa	5	0	1
Brazil	South America	51	5	43
Brunei	Asia	1	1	0
Bulgaria	Europe	0	2	1
Burkina Faso	Africa	2	0	0
Burundi	Africa	3	0	0

Country	Continent	Supply	Transit	Demand
Cabo Verde	Africa	2	0	2
Cambodia	Asia	14	1	7
Cameroon	Africa	13	1	5
Canada	North America	13	4	8
Cayman Is. (T)	North America	1	0	1
Central African Rep.	Africa	5	1	1
Chile	South America	2	1	2
China	Asia	55	8	130
Colombia	South America	8	1	5
Comoros	Africa	0	0	1
Congo	Africa	7	1	3
Costa Rica	North America	4	0	2
Côte d'Ivoire	Africa	6	2	3
Croatia	Europe	1	0	0
Cuba	North America	4	0	4
Cyprus	Europe	1	0	0
Czechia	Europe	3	3	4
Dem. Rep. Congo	Africa	13	1	4
Denmark	Europe	1	0	0
Djibouti	Africa	1	1	0
Ecuador	South America	7	1	4
Egypt	Africa	4	1	3
El Salvador	North America	1	0	0
Eq. Guinea	Africa	2	1	0
Estonia	Europe	0	1	0
Ethiopia	Africa	3	2	0
Fiji	Oceania	3	2	0
Finland	Europe	1	1	0
France	Europe	6	3	12
Gabon	Africa	7	1	2
Georgia	Europe	1	0	1
Germany	Europe	5	4	9

Country	Continent	Supply	Transit	Demand
Ghana	Africa	3	1	4
Greece	Europe	1	1	4
Guatemala	North America	5	0	1
Guinea	Africa	1	1	1
Haiti	North America	1	0	0
Honduras	North America	1	0	0
Hong Kong (SAR)	Asia	18	11	45
Hungary	Europe	1	0	1
India	Asia	29	6	25
Indonesia	Asia	71	7	47
Iran	Asia	5	1	3
Iraq	Asia	0	0	1
Ireland	Europe	0	0	1
Italy	Europe	7	1	10
Japan	Asia	13	5	26
Jordan	Asia	1	1	1
Kazakhstan	Asia	3	1	2
Kenya	Africa	19	7	7
Kuwait	Asia	1	1	4
Kyrgyzstan	Asia	1	0	0
Laos	Asia	19	1	9
Latvia	Europe	1	0	0
Lebanon	Asia	1	0	2
Liberia	Africa	0	1	0
Liechtenstein	Europe	0	1	0
Luxembourg	Europe	0	1	0
Macao (SAR)	Asia	2	1	2
Madagascar	Africa	10	0	4
Malawi	Africa	2	1	2
Malaysia	Asia	22	9	19
Marshall Is.	Oceania	1	0	0
Mexico	North America	33	7	18
Micronesia	Oceania	1	0	0
Moldova	Europe	0	1	0
Mongolia	Asia	3	0	0

Country	Continent	Supply	Transit	Demand
Morocco	Africa	7	3	3
Mozambique	Africa	5	2	1
Myanmar	Asia	24	4	13
Namibia	Africa	5	0	1
Nepal	Asia	18	4	14
Netherlands	Europe	3	3	12
New Caledonia	Oceania	0	0	1
New Zealand	Oceania	2	2	7
Nicaragua	North America	3	0	0
Niger	Africa	1	1	1
Nigeria	Africa	11	3	3
North Korea	Asia	1	0	0
Norway	Europe	1	1	2
Oman	Asia	0	1	3
Pakistan	Asia	16	4	11
Palau	Oceania	1	0	0
Palestine	Asia	1	0	1
Panama	North America	3	0	0
Papua New Guinea	Oceania	1	2	0
Paraguay	South America	1	0	0
Peru	South America	29	1	16
Philippines	Asia	18	4	7
Poland	Europe	1	2	5
Portugal	Europe	3	1	4
Puerto Rico (T)	North America	1	0	0
Qatar	Asia	1	0	4
Romania	Europe	2	1	3
Russia	Europe	24	6	8
Rwanda	Africa	2	0	0
S. Sudan	Africa	5	0	0
Saudi Arabia	Asia	2	1	5
Senegal	Africa	2	2	0
Serbia	Europe	1	0	1
Seychelles	Africa	1	0	0

Country	Continent	Supply	Transit	Demand
Singapore	Asia	9	6	14
Slovakia	Europe	1	0	0
Slovenia	Europe	1	2	2
Solomon Is.	Oceania	1	0	0
Somalia	Africa	3	0	1
South Africa	Africa	30	4	9
South Korea	Asia	6	5	14
Spain	Europe	9	3	10
Sri Lanka	Asia	1	2	4
Sudan	Africa	1	3	1
Suriname	South America	4	0	0
Sweden	Europe	1	0	3
Switzerland	Europe	2	1	5
Syria	Asia	1	1	0
Taiwan	Asia	7	2	9
Tajikistan	Asia	1	0	0
Tanzania	Africa	17	3	5
Thailand	Asia	28	9	32
Togo	Africa	1	3	1
Tonga	Oceania	1	1	1
Trinidad and Tobago	North America	1	0	0
Tunisia	Africa	1	0	0
Turkey	Asia	4	2	3
Uganda	Africa	8	9	2
Ukraine	Europe	3	0	2
United Arab Emirates	Asia	4	4	13
United Kingdom	Europe	9	4	17
United States of America	North America	23	12	59
Uruguay	South America	2	0	0
Uzbekistan	Asia	1	0	1
Vanuatu	Oceania	1	0	0
Venezuela	South America	10	0	5
Vietnam	Asia	38	14	50
Yemen	Asia	0	2	1

Country	Continent	Supply	Transit	Demand
Zambia	Africa	7	0	0
Zimbabwe	Africa	6	2	0

SAR: Special Administrative Region, T: Territory

Kingdom: Article Count

Table 12: Observations of IWT in the literature per taxonomic kingdom, aggregated to the continental level.

Continent	Animals	Proportion	Plants	Proportion
Africa	258	17%	11	11%
Asia	751	49%	49	49%
Europe	200	13%	14	14%
North America	148	10%	16	16%
Oceania	33	2%	2	2%
South America	136	9%	7	7%

Table 13: Observations of IWT in the literature per taxonomic kingdom, per country.

Country	Continent	Animals	Plants
Afghanistan	Asia	3	-
Algeria	Africa	6	-
Angola	Africa	1	-
Argentina	South America	6	1
Armenia	Europe	1	-
Australia	Oceania	17	2
Austria	Europe	4	1
Azerbaijan	Asia	0	1
Bahrain	Asia	1	-
Bangladesh	Asia	8	-
Belarus	Europe	1	-
Belgium	Europe	14	1
Belize	North America	4	-
Benin	Africa	3	-
Bhutan	Asia	3	-
Bolivia	South America	15	-
Botswana	Africa	5	-
Brazil	South America	40	2
Brunei	Asia	1	-
Burkina Faso	Africa	1	-
Burundi	Africa	3	-
Cabo Verde	Africa	2	-
Cambodia	Asia	10	1
Cameroon	Africa	13	-
Canada	North America	14	-

Country	Continent	Animals	Plants
Cayman Is. (T)	North America	1	-
Central African Rep.	Africa	6	-
Chile	South America	5	1
China	Asia	148	9
Colombia	South America	13	-
Comoros	Africa	1	-
Congo	Africa	10	1
Costa Rica	North America	4	-
Côte d'Ivoire	Africa	7	-
Cuba	North America	4	-
Czechia	Europe	6	1
Dem. Rep. Congo	Africa	10	1
Denmark	Europe	1	-
Djibouti	Africa	2	-
Ecuador	South America	8	1
Egypt	Africa	5	-
El Salvador	North America	1	-
Eq. Guinea	Africa	2	-
Estonia	Europe	1	-
Ethiopia	Africa	5	-
Fiji	Oceania	4	-
Finland	Europe	1	-
France	Europe	11	2
Gabon	Africa	7	1
Georgia	Europe	2	-
Germany	Europe	18	2
Ghana	Africa	7	-
Greece	Europe	3	1
Guatemala	North America	4	-
Guinea	Africa	2	-
Honduras	North America	1	-
Hong Kong (SAR)	Asia	50	2
Hungary	Europe	2	-
India	Asia	45	5
Indonesia	Asia	64	5
Iran	Asia	6	2
Iraq	Asia	1	-

Country	Continent	Animals	Plants
Ireland	Europe	1	-
Italy	Europe	13	-
Japan	Asia	38	-
Jordan	Asia	2	-
Kazakhstan	Asia	3	1
Kenya	Africa	23	2
Kuwait	Asia	6	-
Kyrgyzstan	Asia	1	-
Laos	Asia	16	1
Latvia	Europe	1	-
Lebanon	Asia	2	-
Liberia	Africa	1	-
Liechtenstein	Europe	1	-
Luxembourg	Europe	1	-
Macao (SAR)	Asia	3	-
Madagascar	Africa	8	1
Malawi	Africa	3	-
Malaysia	Asia	34	2
Mexico	North America	40	8
Mongolia	Asia	3	-
Morocco	Africa	8	-
Mozambique	Africa	5	-
Myanmar	Asia	31	1
Namibia	Africa	7	-
Nepal	Asia	23	3
Netherlands	Europe	22	1
New Zealand	Oceania	8	-
Nicaragua	North America	3	-
Niger	Africa	2	-
Nigeria	Africa	12	1
North Korea	Asia	1	-
Norway	Europe	8	-
Oman	Asia	3	-
Pakistan	Asia	18	1
Palestine	Asia	3	-
Panama	North America	2	-
Papua New Guinea	Oceania	3	-

Country	Continent	Animals	Plants
Paraguay	South America	1	-
Peru	South America	30	2
Philippines	Asia	17	1
Poland	Europe	4	-
Portugal	Europe	2	-
Puerto Rico (T)	North America	1	-
Qatar	Asia	5	-
Romania	Europe	2	-
Russia	Europe	23	1
S. Sudan	Africa	5	-
Saudi Arabia	Asia	6	-
Senegal	Africa	2	-
Serbia	Europe	1	-
Seychelles	Africa	1	-
Singapore	Asia	23	1
Slovakia	Europe	1	-
Slovenia	Europe	4	2
Somalia	Africa	3	-
South Africa	Africa	29	2
South Korea	Asia	13	-
Spain	Europe	18	1
Sri Lanka	Asia	5	1
Sudan	Africa	5	-
Suriname	South America	4	-
Sweden	Europe	3	1
Switzerland	Europe	6	-
Syria	Asia	1	-
Taiwan	Asia	9	2
Tajikistan	Asia	1	-
Tanzania	Africa	16	1
Thailand	Asia	45	5
Togo	Africa	3	-
Tonga	Oceania	1	-
Turkey	Asia	3	3
Uganda	Africa	14	1
Ukraine	Europe	3	-
United Arab Emirates	Asia	16	-

Country	Continent	Animals	Plants
United Kingdom	Europe	21	-
United States of America	North America	69	8
Uruguay	South America	2	-
Uzbekistan	Asia	1	-
Venezuela	South America	12	-
Vietnam	Asia	77	2
Yemen	Asia	2	-
Zambia	Africa	6	-
Zimbabwe	Africa	7	-

SAR: Special Administrative Region, T: Territory

Kingdom: Article Species

Table 14: Number of species observed in the literature as being illegally traded per taxonomic kingdom, aggregated to the continental level.

Continent	Animals	Proportion	Plants	Proportion
Africa	234	7%	16	4%
Asia	1427	44%	183	45%
Europe	219	7%	32	8%
North America	381	12%	93	23%
Oceania	103	3%	72	18%
South America	916	28%	7	2%

Table 15: Number of species observed in the literature as being illegally traded per taxonomic kingdom, per country.

Country	Continent	Animals	Plants
Afghanistan	Asia	3	-
Algeria	Africa	20	-
Angola	Africa	1	-
Argentina	South America	9	1
Armenia	Europe	1	-
Australia	Oceania	91	72
Austria	Europe	4	2
Azerbaijan	Asia	0	1
Bahrain	Asia	1	-
Bangladesh	Asia	12	-
Belarus	Europe	1	-

Country	Continent	Animals	Plants
Belgium	Europe	29	-
Belize	North America	2	-
Benin	Africa	8	-
Bhutan	Asia	3	-
Bolivia	South America	41	-
Botswana	Africa	2	-
Brazil	South America	450	2
Brunei	Asia	1	-
Burkina Faso	Africa	4	-
Burundi	Africa	2	-
Cabo Verde	Africa	1	-
Cambodia	Asia	6	1
Cameroon	Africa	10	-
Canada	North America	13	-
Cayman Is. (T)	North America	1	-
Central African Rep.	Africa	2	-
Chile	South America	23	1
China	Asia	243	7
Colombia	South America	185	-
Comoros	Africa	2	-
Congo	Africa	10	1
Costa Rica	North America	5	-
Côte d'Ivoire	Africa	3	-
Cuba	North America	30	-
Czechia	Europe	5	9
Dem. Rep. Congo	Africa	4	1
Denmark	Europe	1	-
Djibouti	Africa	2	-
Ecuador	South America	45	1
Egypt	Africa	3	-
El Salvador	North America	1	-
Eq. Guinea	Africa	1	-
Estonia	Europe	1	-
Ethiopia	Africa	3	-
Fiji	Oceania	3	-
Finland	Europe	1	-
France	Europe	7	6

Country	Continent	Animals	Plants
Gabon	Africa	7	1
Georgia	Europe	2	-
Germany	Europe	13	5
Ghana	Africa	8	-
Greece	Europe	2	1
Guatemala	North America	3	-
Guinea	Africa	2	-
Honduras	North America	3	-
Hong Kong (SAR)	Asia	80	1
Hungary	Europe	2	-
India	Asia	114	47
Indonesia	Asia	214	3
Iran	Asia	17	18
Iraq	Asia	1	-
Ireland	Europe	1	-
Italy	Europe	5	-
Japan	Asia	32	-
Jordan	Asia	2	-
Kazakhstan	Asia	3	1
Kenya	Africa	9	2
Kuwait	Asia	5	-
Kyrgyzstan	Asia	1	-
Laos	Asia	35	1
Latvia	Europe	1	-
Lebanon	Asia	4	-
Liberia	Africa	3	-
Liechtenstein	Europe	1	-
Luxembourg	Europe	1	-
Macao (SAR)	Asia	1	-
Madagascar	Africa	33	1
Malawi	Africa	1	-
Malaysia	Asia	25	2
Mexico	North America	115	88
Mongolia	Asia	3	-
Morocco	Africa	12	-
Mozambique	Africa	1	-
Myanmar	Asia	48	1

Country	Continent	Animals	Plants
Namibia	Africa	6	-
Nepal	Asia	55	89
Netherlands	Europe	14	2
New Zealand	Oceania	6	-
Nicaragua	North America	4	-
Niger	Africa	7	-
Nigeria	Africa	11	1
North Korea	Asia	1	-
Norway	Europe	9	-
Oman	Asia	2	-
Pakistan	Asia	29	1
Palestine	Asia	79	-
Panama	North America	2	-
Papua New Guinea	Oceania	2	-
Paraguay	South America	1	-
Peru	South America	101	2
Philippines	Asia	111	1
Poland	Europe	6	-
Portugal	Europe	2	-
Puerto Rico (T)	North America	1	-
Qatar	Asia	4	-
Romania	Europe	2	-
Russia	Europe	25	2
S. Sudan	Africa	3	-
Saudi Arabia	Asia	3	-
Senegal	Africa	2	-
Serbia	Europe	1	-
Seychelles	Africa	1	-
Singapore	Asia	25	1
Slovakia	Europe	1	-
Slovenia	Europe	6	3
Somalia	Africa	2	-
South Africa	Africa	20	7
South Korea	Asia	14	-
Spain	Europe	54	1
Sri Lanka	Asia	6	1
Sudan	Africa	3	-

Country	Continent	Animals	Plants
Suriname	South America	3	-
Sweden	Europe	3	1
Switzerland	Europe	4	-
Syria	Asia	3	-
Taiwan	Asia	7	-
Tajikistan	Asia	1	-
Tanzania	Africa	11	1
Thailand	Asia	73	3
Togo	Africa	2	-
Tonga	Oceania	1	-
Turkey	Asia	3	3
Uganda	Africa	4	1
Ukraine	Europe	4	-
United Arab Emirates	Asia	11	-
United Kingdom	Europe	10	-
United States of America	North America	201	5
Uruguay	South America	2	-
Uzbekistan	Asia	1	-
Venezuela	South America	56	-
Vietnam	Asia	144	1
Yemen	Asia	1	-
Zambia	Africa	4	-
Zimbabwe	Africa	4	-

SAR: Special Administrative Region, T: Territory

Class: Article Count

Table 16: Observations of IWT in the literature per taxonomic class, aggregated to the continental level.

Continent	Amphibians	Proportion	Birds	Proportion	Mammals	Proportion	Reptiles	Proportion
Africa	-	0%	17	8%	221	22%	20	7%
Asia	8	27%	101	45%	485	49%	157	55%
Europe	7	23%	29	13%	124	13%	40	14%
North America	5	17%	31	14%	73	7%	39	14%
Oceania	2	7%	2	1%	19	2%	10	3%
South America	8	27%	44	20%	64	6%	20	7%

Table 17: Observations of IWT in the literature per taxonomic class, per country.

Country	Continent	Amphibians	Birds	Mammals	Reptiles
Afghanistan	Asia	-	-	3	-
Algeria	Africa	-	3	2	1
Angola	Africa	-	-	1	-
Argentina	South America	-	1	4	1
Armenia	Europe	-	1	-	-
Australia	Oceania	2	2	6	7
Austria	Europe	1	-	2	1
Azerbaijan	Asia	-	-	-	-
Bahrain	Asia	-	1	-	-
Bangladesh	Asia	-	-	5	3
Belarus	Europe	-	-	1	-
Belgium	Europe	-	4	6	4
Belize	North America	-	-	4	-
Benin	Africa	-	-	3	-
Bhutan	Asia	-	-	3	-
Bolivia	South America	-	4	11	-
Botswana	Africa	-	-	5	-
Brazil	South America	2	20	12	6
Brunei	Asia	-	-	1	-
Burkina Faso	Africa	-	-	1	-
Burundi	Africa	-	-	3	-
Cabo Verde	Africa	-	-	-	2
Cambodia	Asia	-	-	10	-
Cameroon	Africa	-	1	12	-
Canada	North America	-	2	10	2
Cayman Is. (T)	North America	-	-	-	1
Central African Rep.	Africa	-	-	6	-
Chile	South America	-	1	3	1
China	Asia	2	18	97	31
Colombia	South America	2	2	6	3
Comoros	Africa	-	-	-	1
Congo	Africa	-	1	8	1
Costa Rica	North America	1	-	2	1
Côte d'Ivoire	Africa	-	-	7	-
Cuba	North America	-	4	-	-
Czechia	Europe	-	1	3	2

Country	Continent	Amphibians	Birds	Mammals	Reptiles
Dem. Rep. Congo	Africa	-	1	9	-
Denmark	Europe	-	-	-	1
Djibouti	Africa	-	-	2	-
Ecuador	South America	-	2	4	2
Egypt	Africa	-	-	5	-
El Salvador	North America	-	-	1	-
Eq. Guinea	Africa	-	-	2	-
Estonia	Europe	-	-	1	-
Ethiopia	Africa	-	-	5	-
Fiji	Oceania	-	-	3	1
Finland	Europe	-	-	1	-
France	Europe	-	1	8	2
Gabon	Africa	-	-	7	-
Georgia	Europe	-	-	2	-
Germany	Europe	1	3	9	5
Ghana	Africa	-	1	5	1
Greece	Europe	-	-	3	-
Guatemala	North America	-	-	2	2
Guinea	Africa	-	-	2	-
Honduras	North America	-	-	1	-
Hong Kong (SAR)	Asia	-	4	31	15
Hungary	Europe	-	-	2	-
India	Asia	-	7	28	10
Indonesia	Asia	-	18	28	18
Iran	Asia	1	1	3	1
Iraq	Asia	-	-	1	-
Ireland	Europe	-	-	1	-
Italy	Europe	-	1	9	3
Japan	Asia	2	1	24	11
Jordan	Asia	-	1	1	-
Kazakhstan	Asia	-	1	2	-
Kenya	Africa	-	-	21	2
Kuwait	Asia	-	1	5	-
Kyrgyzstan	Asia	-	-	1	-
Laos	Asia	-	1	14	1
Latvia	Europe	-	-	1	-
Lebanon	Asia	-	2	-	-

Country	Continent	Amphibians	Birds	Mammals	Reptiles
Liberia	Africa	-	-	1	-
Liechtenstein	Europe	-	-	1	-
Luxembourg	Europe	-	-	1	-
Macao (SAR)	Asia	-	-	3	-
Madagascar	Africa	-	-	3	5
Malawi	Africa	-	-	3	-
Malaysia	Asia	-	3	18	13
Mexico	North America	2	12	14	12
Mongolia	Asia	-	1	2	-
Morocco	Africa	-	2	3	3
Mozambique	Africa	-	-	5	-
Myanmar	Asia	-	4	23	4
Namibia	Africa	-	1	5	1
Nepal	Asia	1	2	18	2
Netherlands	Europe	2	4	11	5
New Zealand	Oceania	-	-	7	1
Nicaragua	North America	-	-	3	-
Niger	Africa	-	-	2	-
Nigeria	Africa	-	1	11	-
North Korea	Asia	-	-	1	-
Norway	Europe	-	2	4	2
Oman	Asia	-	-	3	-
Pakistan	Asia	-	3	12	3
Palestine	Asia	-	1	1	1
Panama	North America	1	-	1	-
Papua New Guinea	Oceania	-	-	2	1
Paraguay	South America	-	-	1	-
Peru	South America	3	9	13	5
Philippines	Asia	1	3	8	5
Poland	Europe	-	-	3	1
Portugal	Europe	-	-	2	-
Puerto Rico (T)	North America	-	-	1	-
Qatar	Asia	-	-	5	-
Romania	Europe	-	1	-	1
Russia	Europe	1	5	16	1
S. Sudan	Africa	-	-	5	-
Saudi Arabia	Asia	-	3	3	-

Country	Continent	Amphibians	Birds	Mammals	Reptiles
Senegal	Africa	-	-	2	-
Serbia	Europe	-	1	-	-
Seychelles	Africa	-	-	-	1
Singapore	Asia	-	1	15	7
Slovakia	Europe	-	-	1	-
Slovenia	Europe	-	1	2	1
Somalia	Africa	-	-	3	-
South Africa	Africa	-	5	22	2
South Korea	Asia	-	-	12	1
Spain	Europe	1	3	9	5
Sri Lanka	Asia	-	-	3	2
Sudan	Africa	-	-	5	-
Suriname	South America	-	1	3	-
Sweden	Europe	-	-	1	2
Switzerland	Europe	-	-	6	-
Syria	Asia	-	1	-	-
Taiwan	Asia	-	1	6	2
Tajikistan	Asia	-	-	1	-
Tanzania	Africa	-	1	15	-
Thailand	Asia	-	9	25	11
Togo	Africa	-	-	3	-
Tonga	Oceania	-	-	1	-
Turkey	Asia	-	-	3	-
Uganda	Africa	-	-	14	-
Ukraine	Europe	-	-	2	1
United Arab Emirates	Asia	-	3	11	2
United Kingdom	Europe	1	1	16	3
United States of America	North America	1	13	34	21
Uruguay	South America	-	1	1	-
Uzbekistan	Asia	-	-	1	-
Venezuela	South America	1	3	6	2
Vietnam	Asia	1	10	52	14
Yemen	Asia	-	-	2	-
Zambia	Africa	-	-	6	-
Zimbabwe	Africa	-	-	7	-

SAR: Special Administrative Region, T: Territory

Class: Article Species

Table 18: Number of species observed in the literature as being illegally traded per taxonomic class, aggregated to the continental level.

Continent	Amphibians	Proportion	Birds	Proportion	Mammals	Proportion	Reptiles	Proportion
Africa	-	0%	34	2%	179	18%	21	3%
Asia	9	13%	556	38%	457	47%	405	51%
Europe	11	16%	70	5%	106	11%	32	4%
North America	5	7%	151	10%	71	7%	154	20%
Oceania	1	1%	8	1%	12	1%	82	10%
South America	43	62%	628	43%	151	15%	94	12%

Table 19: Number of species observed in the literature as being illegally traded per taxonomic class, per country.

Country	Continent	Amphibians	Birds	Mammals	Reptiles
Afghanistan	Asia	-	-	3	-
Algeria	Africa	-	13	4	3
Angola	Africa	-	-	1	-
Argentina	South America	-	1	6	2
Armenia	Europe	-	1	-	-
Australia	Oceania	1	8	3	79
Austria	Europe	1	-	2	1
Azerbaijan	Asia	-	-	-	-
Bahrain	Asia	-	1	-	-
Bangladesh	Asia	-	-	3	9
Belarus	Europe	-	-	1	-
Belgium	Europe	-	3	21	5
Belize	North America	-	-	2	-
Benin	Africa	-	-	8	-
Bhutan	Asia	-	-	3	-
Bolivia	South America	-	35	6	-
Botswana	Africa	-	-	2	-
Brazil	South America	37	358	8	47
Brunei	Asia	-	-	1	-
Burkina Faso	Africa	-	-	4	-
Burundi	Africa	-	-	2	-
Cabo Verde	Africa	-	-	-	1
Cambodia	Asia	-	-	6	-
Cameroon	Africa	-	3	7	-
Canada	North America	-	2	3	8
Cayman Is. (T)	North America	-	-	-	1
Central African Rep.	Africa	-	-	2	-
Chile	South America	-	9	12	2
China	Asia	1	77	68	97
Colombia	South America	4	96	52	33
Comoros	Africa	-	-	-	2
Congo	Africa	-	1	8	1
Costa Rica	North America	1	-	3	1
Côte d'Ivoire	Africa	-	-	3	-

Country	Continent	Amphibians	Birds	Mammals	Reptiles
Cuba	North America	-	30	-	-
Czechia	Europe	-	1	2	2
Dem. Rep. Congo	Africa	-	1	3	-
Denmark	Europe	-	-	-	1
Djibouti	Africa	-	-	2	-
Ecuador	South America	-	25	18	2
Egypt	Africa	-	-	3	-
El Salvador	North America	-	-	1	-
Eq. Guinea	Africa	-	-	1	-
Estonia	Europe	-	-	1	-
Ethiopia	Africa	-	-	3	-
Fiji	Oceania	-	-	2	1
Finland	Europe	-	-	1	-
France	Europe	-	1	4	2
Gabon	Africa	-	-	7	-
Georgia	Europe	-	-	2	-
Germany	Europe	1	4	5	3
Ghana	Africa	-	1	5	2
Greece	Europe	-	-	2	-
Guatemala	North America	-	-	2	1
Guinea	Africa	-	-	2	-
Honduras	North America	-	-	3	-
Hong Kong (SAR)	Asia	-	9	11	60
Hungary	Europe	-	-	2	-
India	Asia	-	52	41	21
Indonesia	Asia	-	150	32	32
Iran	Asia	3	6	5	3
Iraq	Asia	-	-	1	-
Ireland	Europe	-	-	1	-
Italy	Europe	-	1	3	1
Japan	Asia	1	3	12	16
Jordan	Asia	-	1	1	-
Kazakhstan	Asia	-	1	2	-
Kenya	Africa	-	-	7	2
Kuwait	Asia	-	1	4	-
Kyrgyzstan	Asia	-	-	1	-
Laos	Asia	-	4	25	6

Country	Continent	Amphibians	Birds	Mammals	Reptiles
Latvia	Europe	-	-	1	-
Lebanon	Asia	-	4	-	-
Liberia	Africa	-	-	3	-
Liechtenstein	Europe	-	-	1	-
Luxembourg	Europe	-	-	1	-
Macao (SAR)	Asia	-	-	1	-
Madagascar	Africa	-	-	30	3
Malawi	Africa	-	-	1	-
Malaysia	Asia	-	2	13	10
Mexico	North America	2	64	25	24
Mongolia	Asia	-	1	2	-
Morocco	Africa	-	3	5	4
Mozambique	Africa	-	-	1	-
Myanmar	Asia	-	6	35	7
Namibia	Africa	-	1	4	1
Nepal	Asia	1	11	41	2
Netherlands	Europe	1	3	8	2
New Zealand	Oceania	-	-	5	1
Nicaragua	North America	-	-	4	-
Niger	Africa	-	-	7	-
Nigeria	Africa	-	1	10	-
North Korea	Asia	-	-	1	-
Norway	Europe	-	1	7	1
Oman	Asia	-	-	2	-
Pakistan	Asia	-	17	6	6
Palestine	Asia	-	59	8	12
Panama	North America	1	-	1	-
Papua New Guinea	Oceania	-	-	1	1
Paraguay	South America	-	-	1	-
Peru	South America	1	53	40	7
Philippines	Asia	2	35	20	54
Poland	Europe	-	-	5	1
Portugal	Europe	-	-	2	-
Puerto Rico (T)	North America	-	-	1	-
Qatar	Asia	-	-	4	-
Romania	Europe	-	1	-	1
Russia	Europe	6	9	9	1

Country	Continent	Amphibians	Birds	Mammals	Reptiles
S. Sudan	Africa	-	-	3	-
Saudi Arabia	Asia	-	1	2	-
Senegal	Africa	-	-	2	-
Serbia	Europe	-	1	-	-
Seychelles	Africa	-	-	-	1
Singapore	Asia	-	1	9	15
Slovakia	Europe	-	-	1	-
Slovenia	Europe	-	2	2	2
Somalia	Africa	-	-	2	-
South Africa	Africa	-	9	10	1
South Korea	Asia	-	-	13	1
Spain	Europe	1	41	7	5
Sri Lanka	Asia	-	-	2	4
Sudan	Africa	-	-	3	-
Suriname	South America	-	1	2	-
Sweden	Europe	-	-	1	2
Switzerland	Europe	-	-	4	-
Syria	Asia	-	3	-	-
Taiwan	Asia	-	1	5	1
Tajikistan	Asia	-	-	1	-
Tanzania	Africa	-	1	10	-
Thailand	Asia	-	14	34	25
Togo	Africa	-	-	2	-
Tonga	Oceania	-	-	1	-
Turkey	Asia	-	-	3	-
Uganda	Africa	-	-	4	-
Ukraine	Europe	-	-	3	1
United Arab Emirates	Asia	-	3	5	3
United Kingdom	Europe	1	1	7	1
United States of America	North America	1	55	26	119
Uruguay	South America	-	1	1	-
Uzbekistan	Asia	-	-	1	-
Venezuela	South America	1	49	5	1
Vietnam	Asia	1	93	29	21
Yemen	Asia	-	-	1	-
Zambia	Africa	-	-	4	-
Zimbabwe	Africa	-	-	4	-

SAR: Special Administrative Region, T: Territory

Appendix 3: Wildlife species potentially affected by illegal trade as assessed through all use and trade

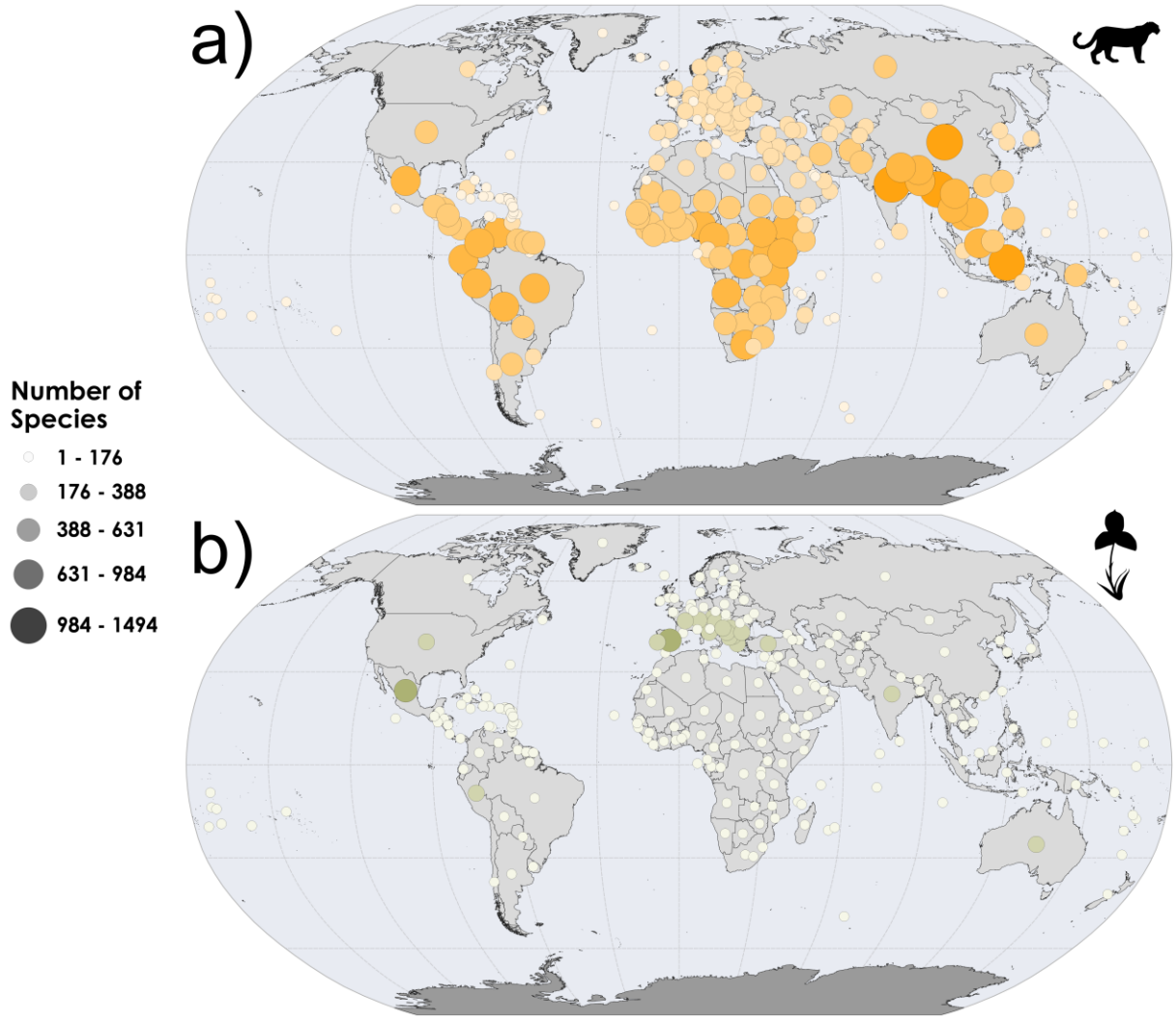


Figure 18: Number of species potentially affected by IWT (through use and trade), per country for a) Animals, b) Plants.

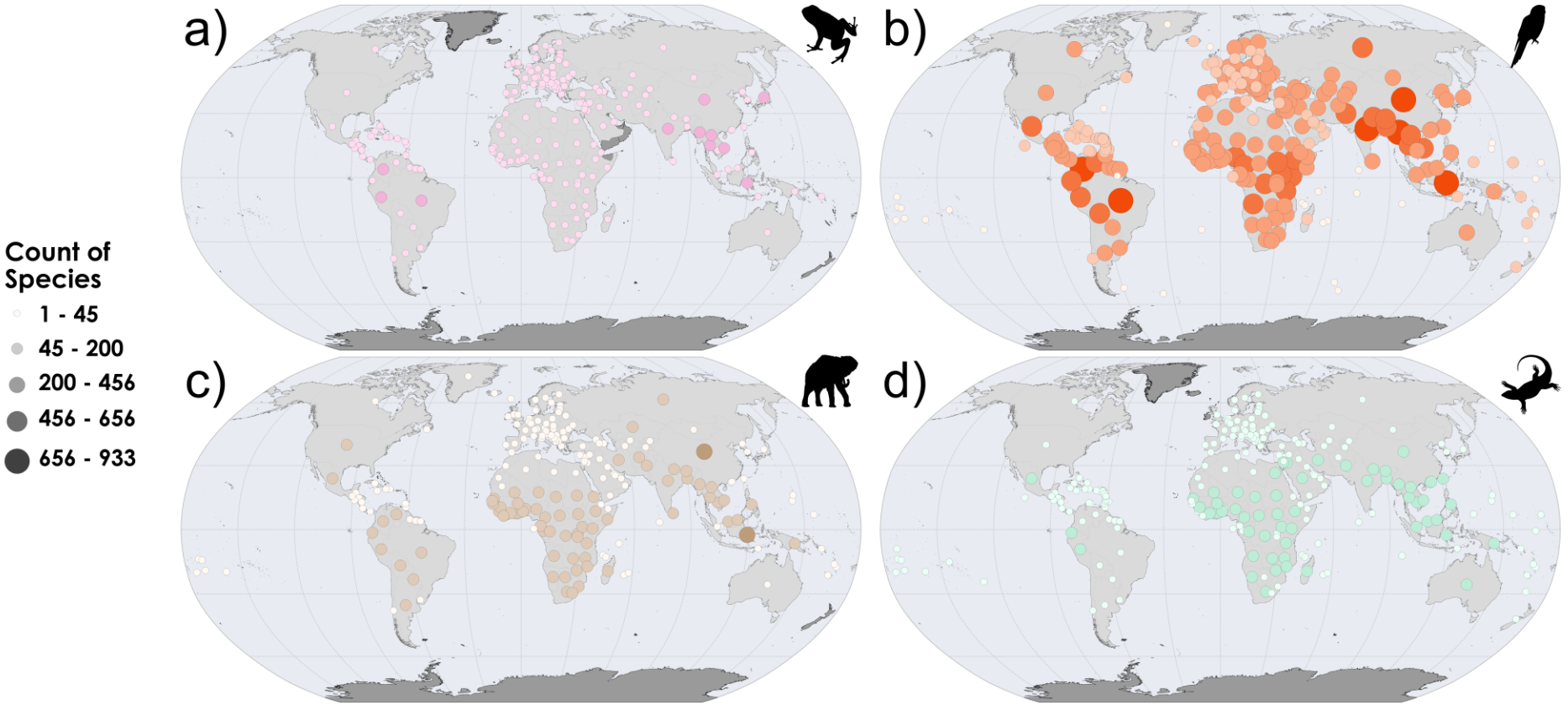
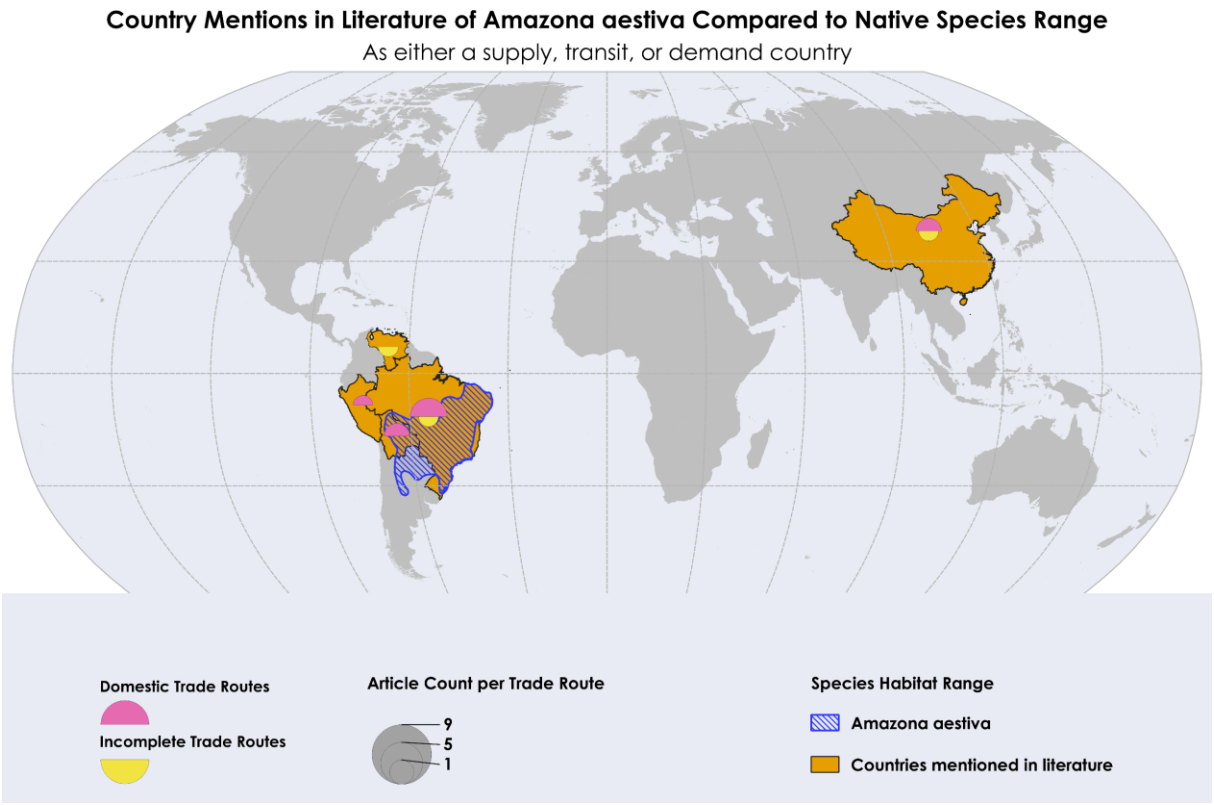


Figure 19: Number of species potentially affected by IWT (through use and trade), per country for a) Amphibians, b) Birds, c) Mammals, d) Reptiles.

Appendix 4: IWT trade routes of frequently observed species in the literature



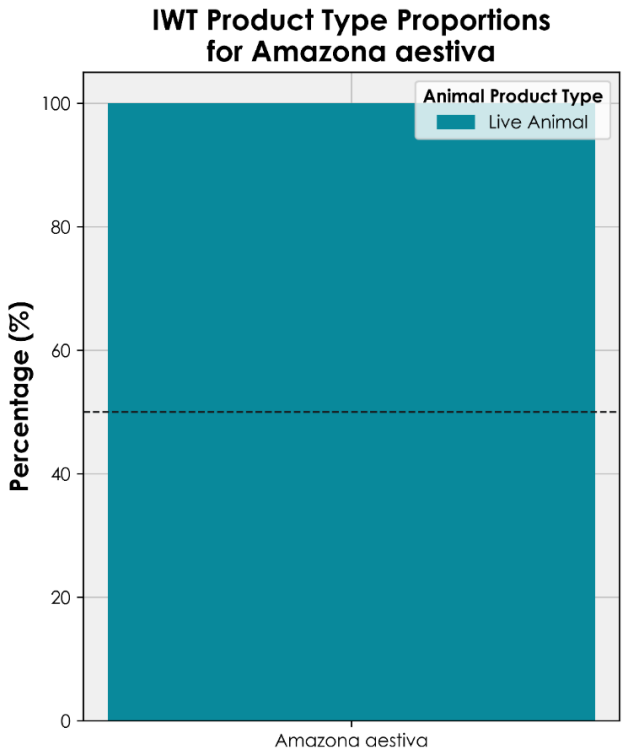
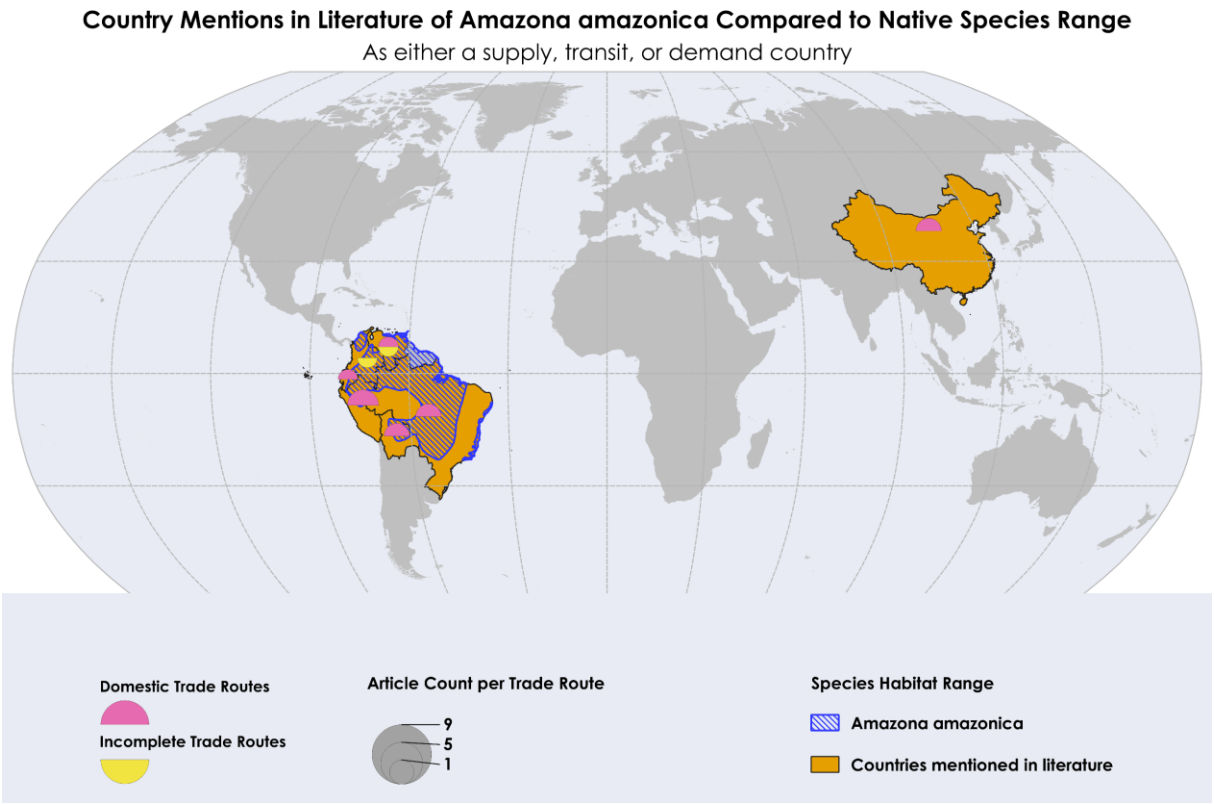


Figure 20: Species habitat range, global IWT trade routes, country occurrences, and product types for *Amazona aestiva.*



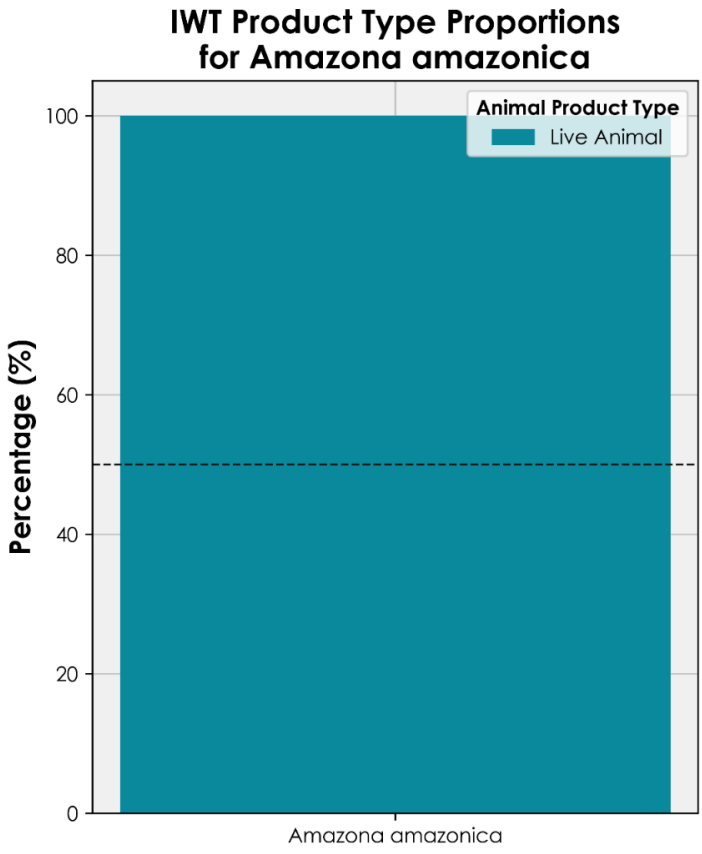
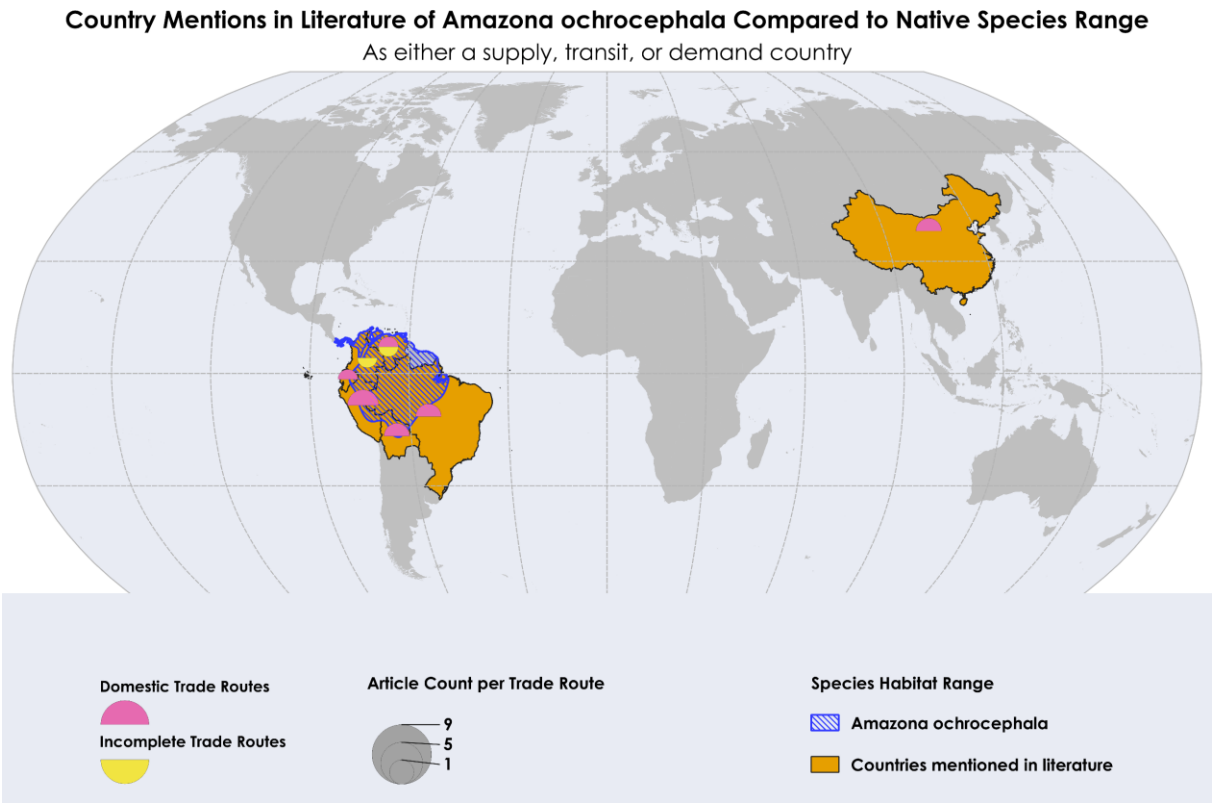


Figure 21: Species habitat range, global IWT trade routes, country occurrences, and product types for *Amazona amazonica.*



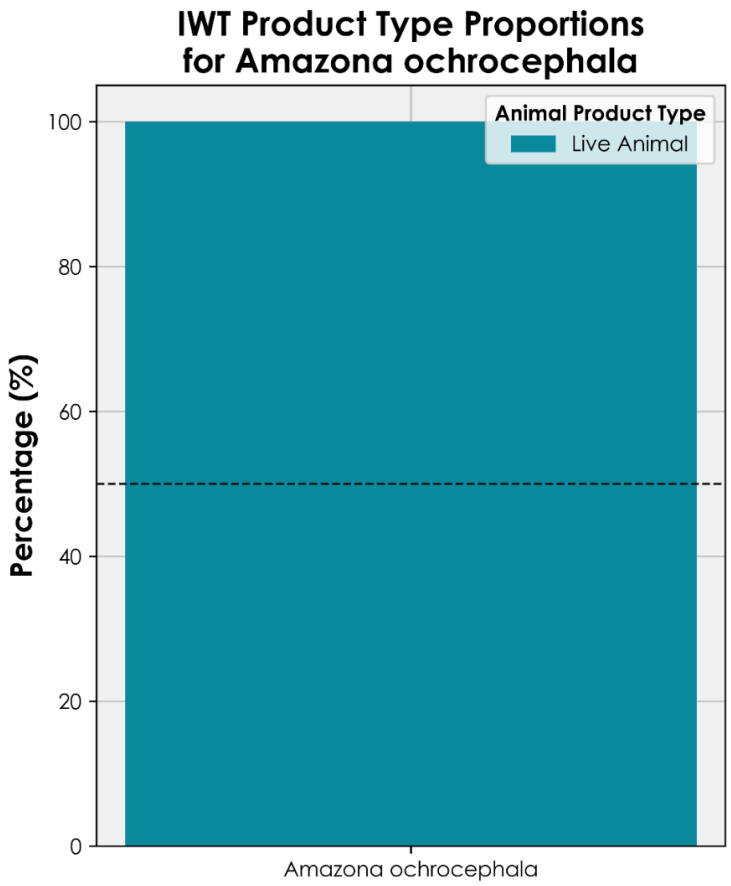
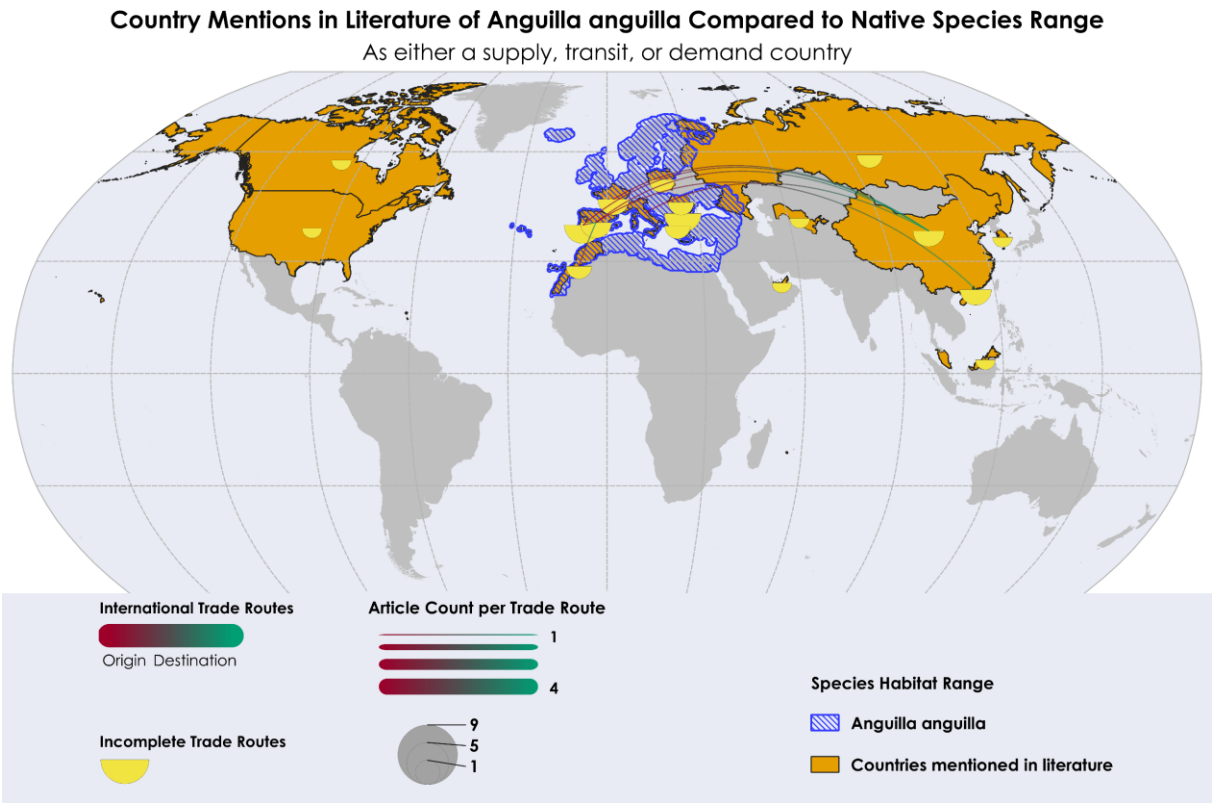


Figure 22: Species habitat range, global IWT trade routes, country occurrences, and product types for *Amazona ochrocephala*.



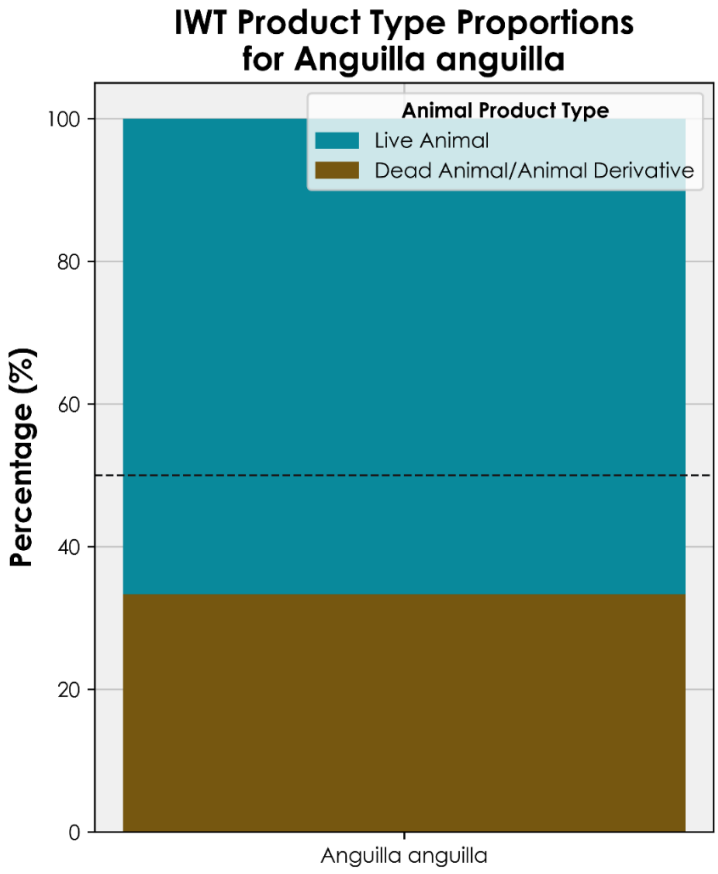
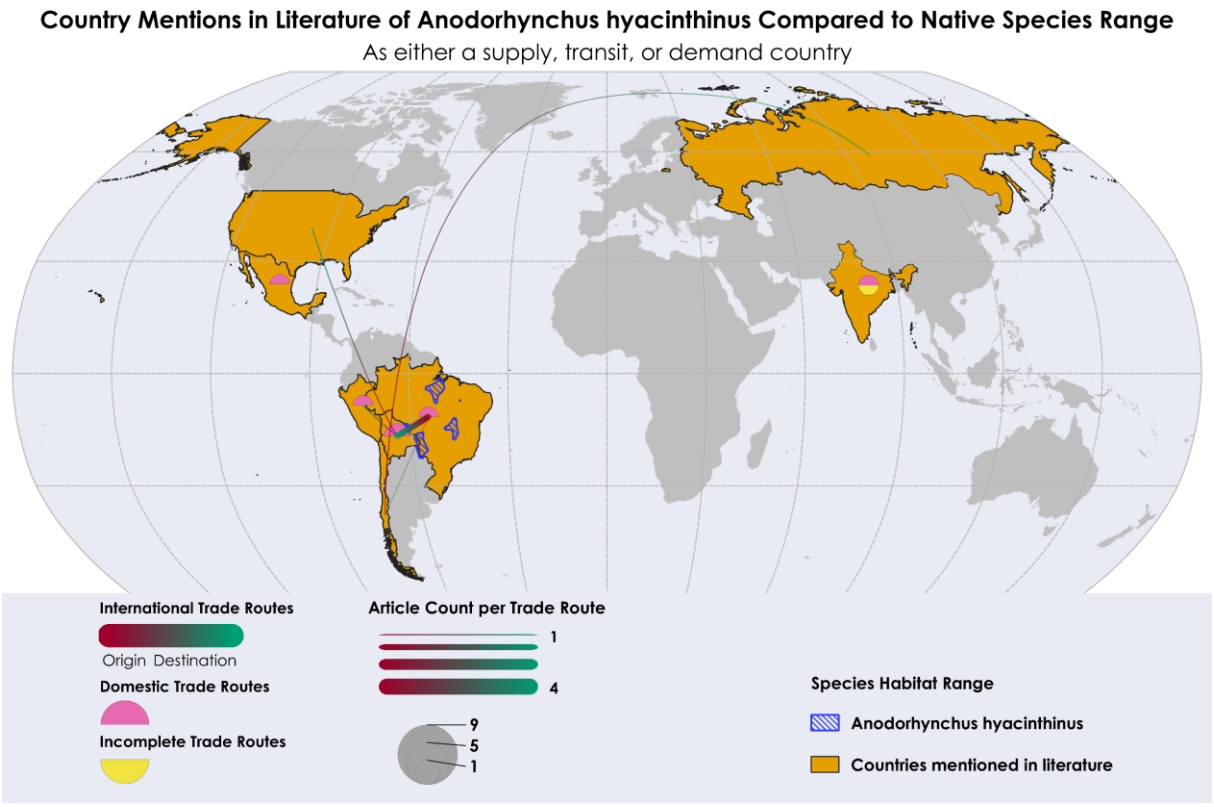


Figure 23: Species habitat range, global IWT trade routes, country occurrences, and product types for *Anguilla anguilla.*



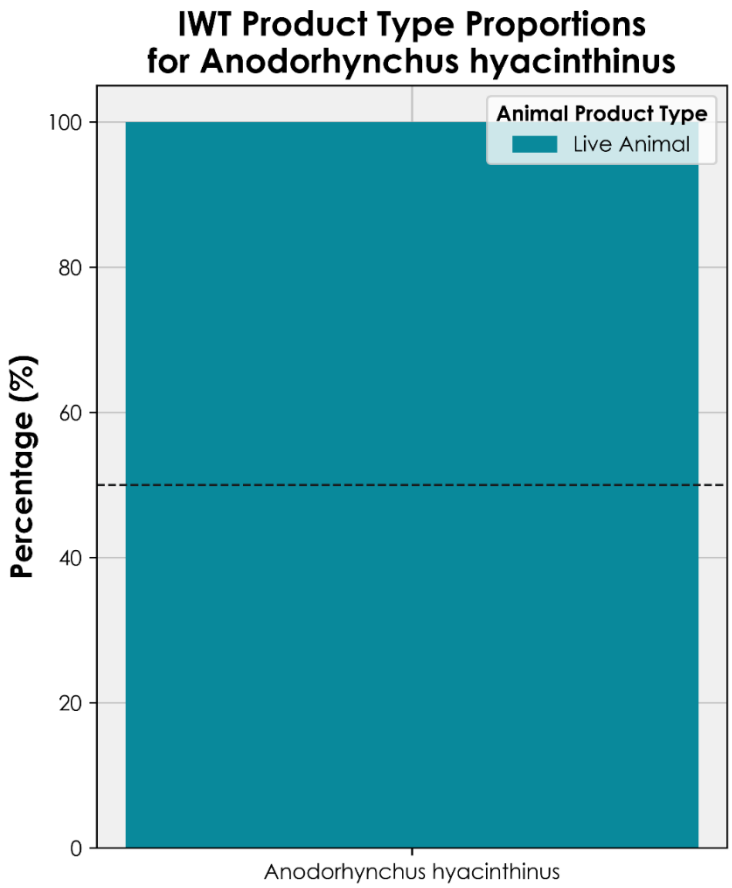
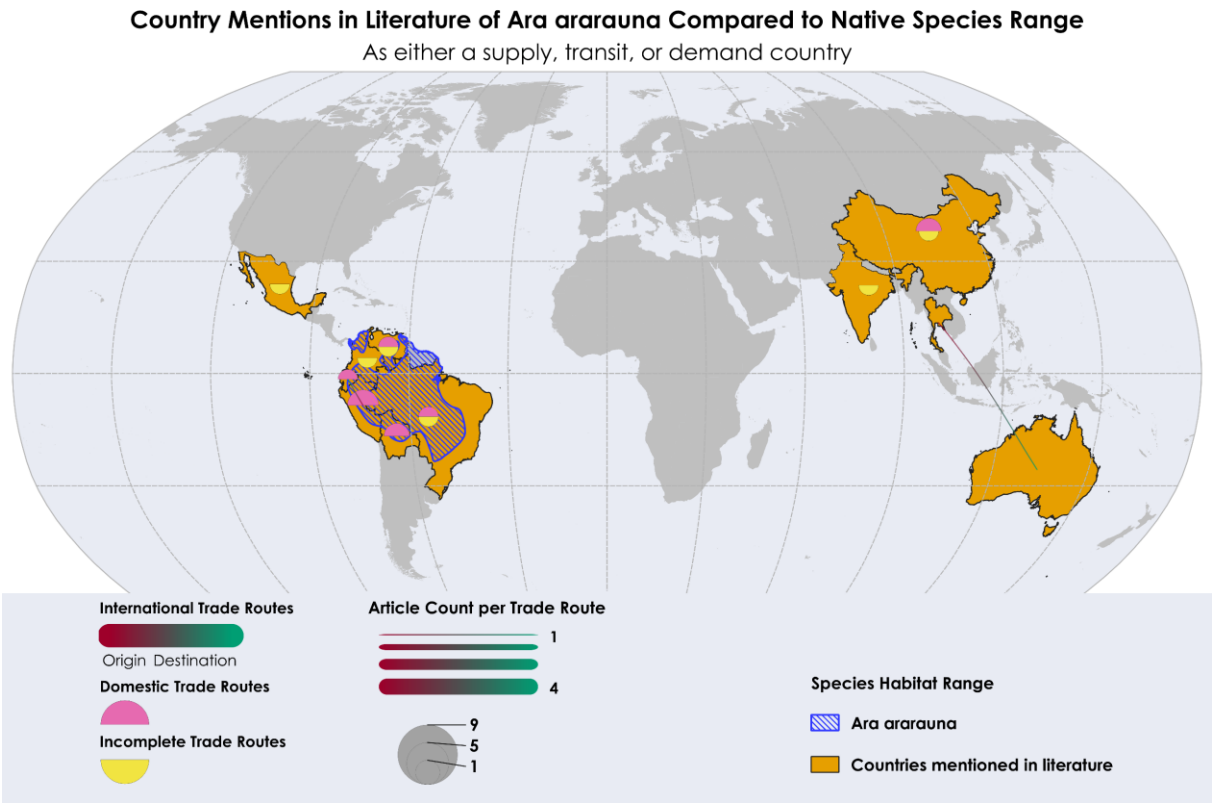


Figure 24: Species habitat range, global IWT trade routes, country occurrences, and product types for *Anodorhynchus hyacinthinus.*



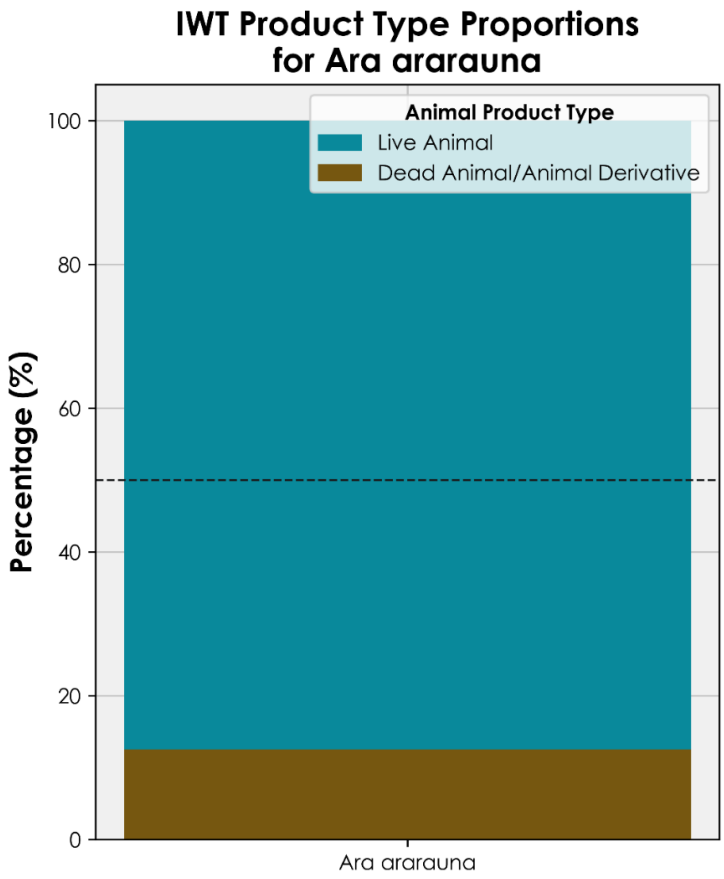
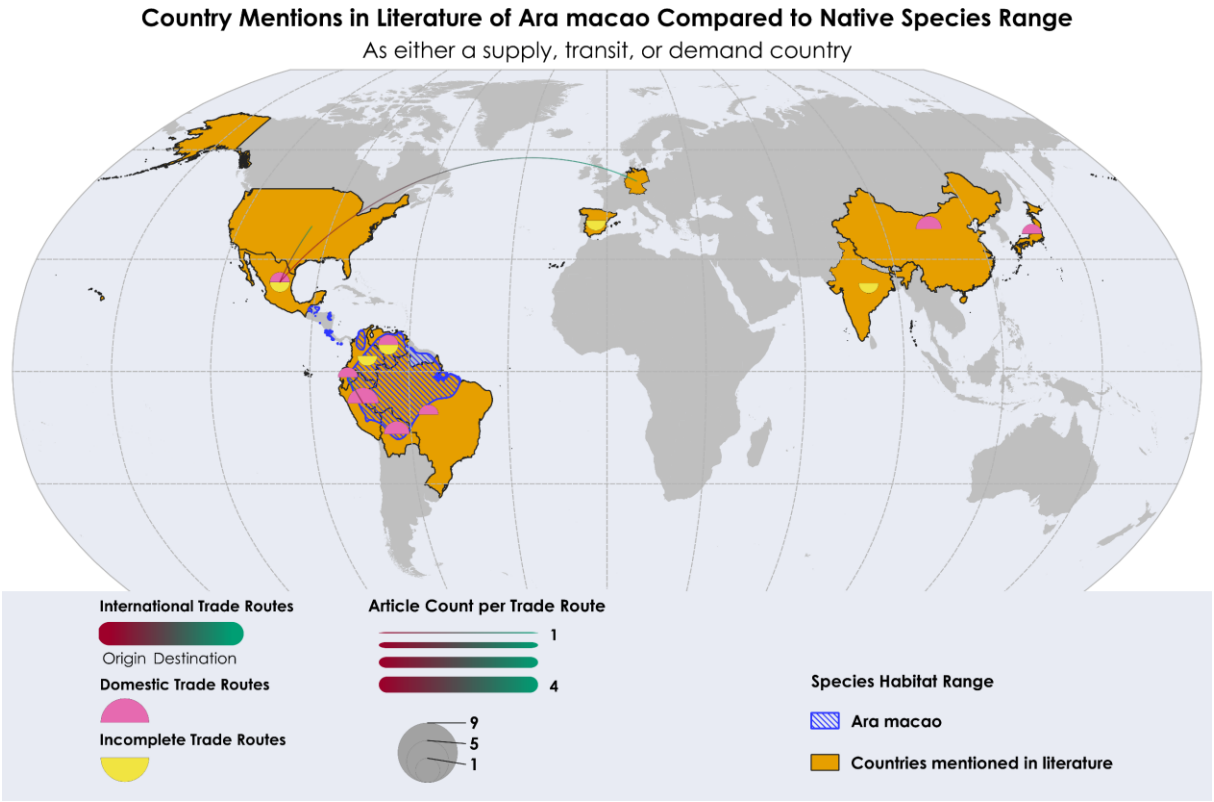


Figure 25: Species habitat range, global IWT trade routes, country occurrences, and product types for *Ara ararauna*.



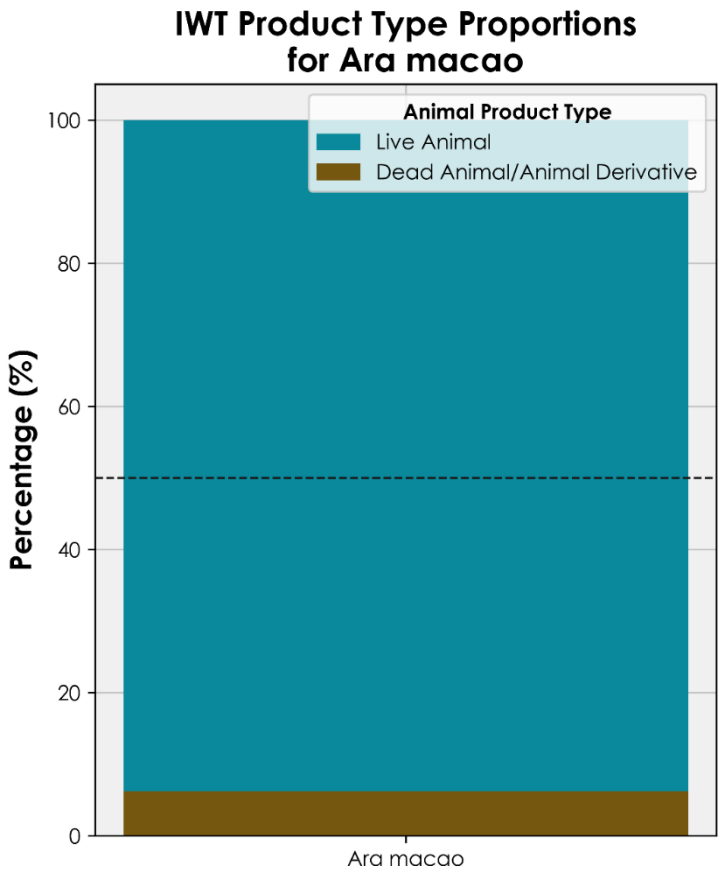
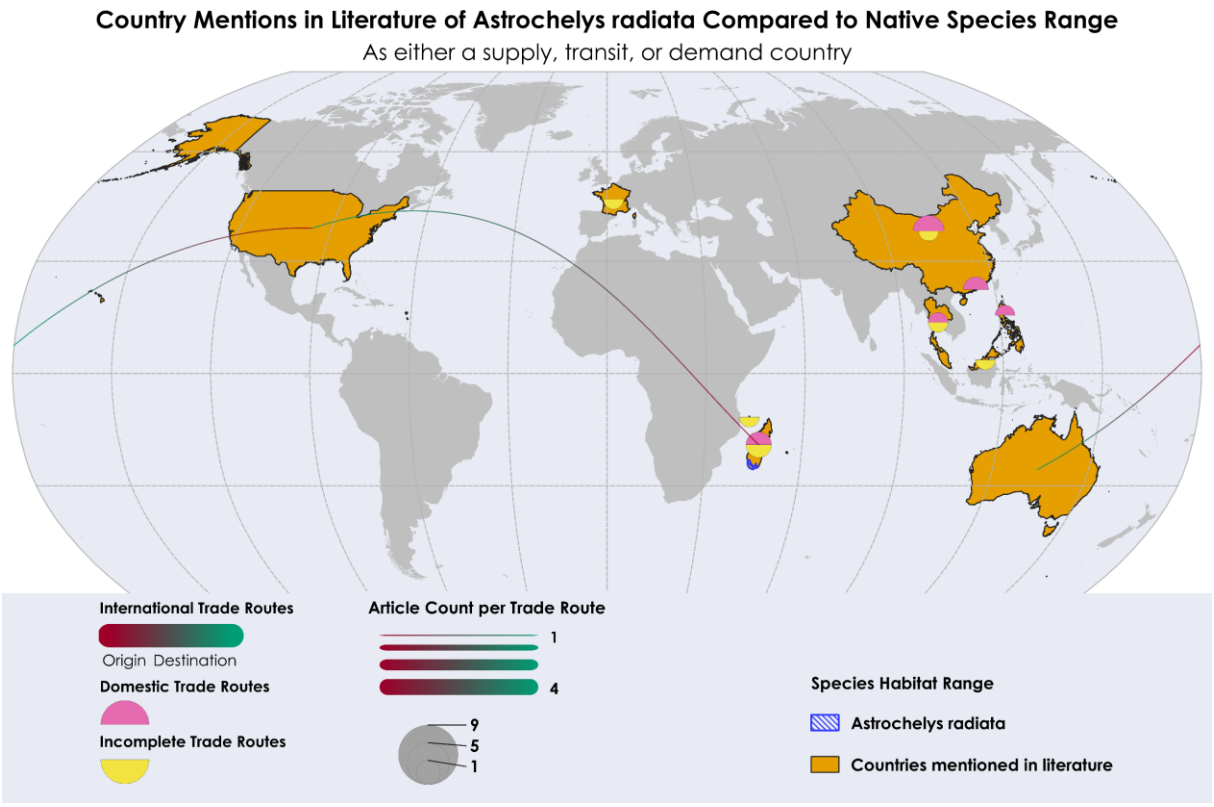


Figure 26: Species habitat range, global IWT trade routes, country occurrences, and product types for *Ara macao.*



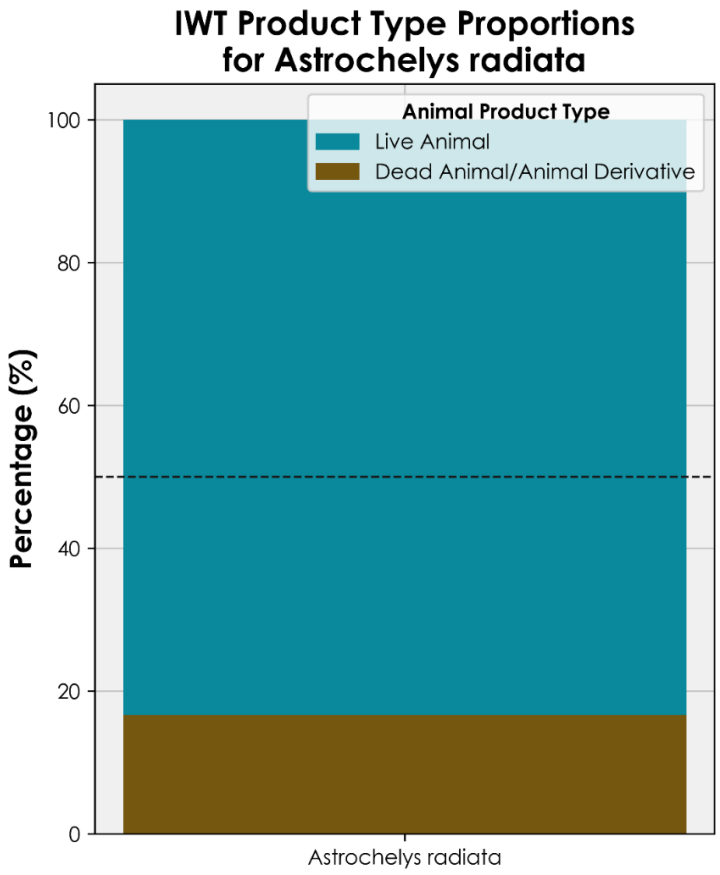
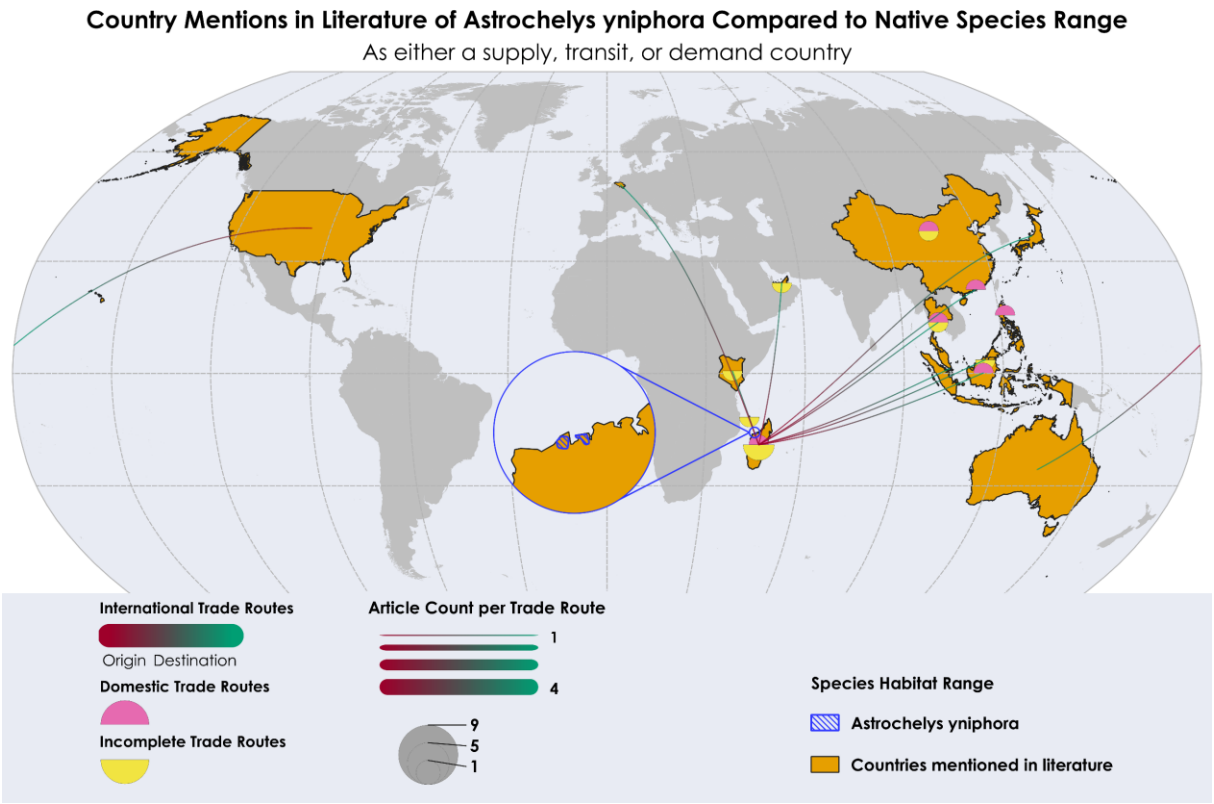


Figure 27: Species habitat range, global IWT trade routes, country occurrences, and product types for *Astrochelys radiata*.



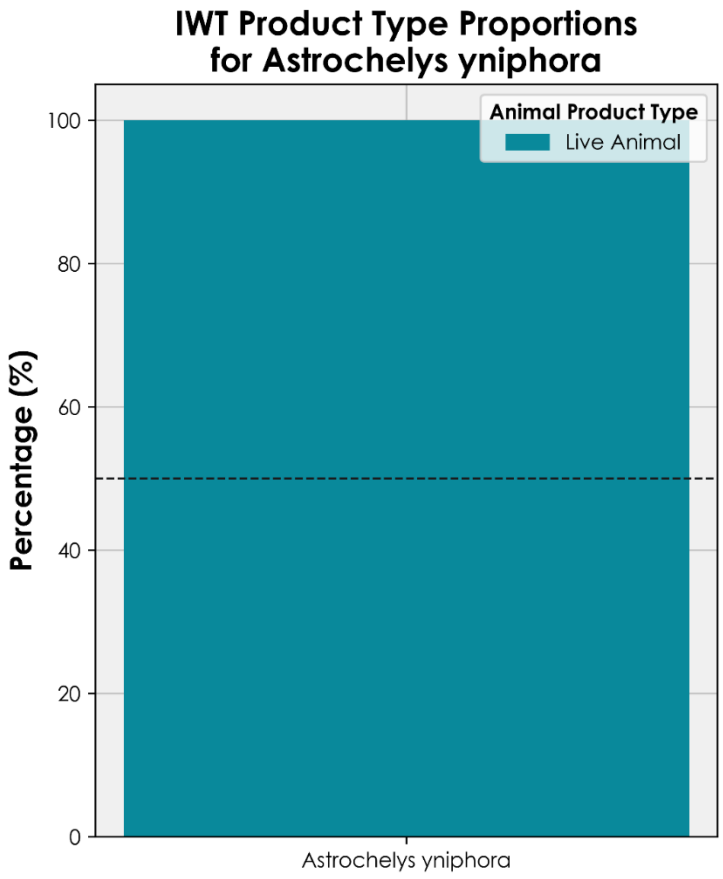
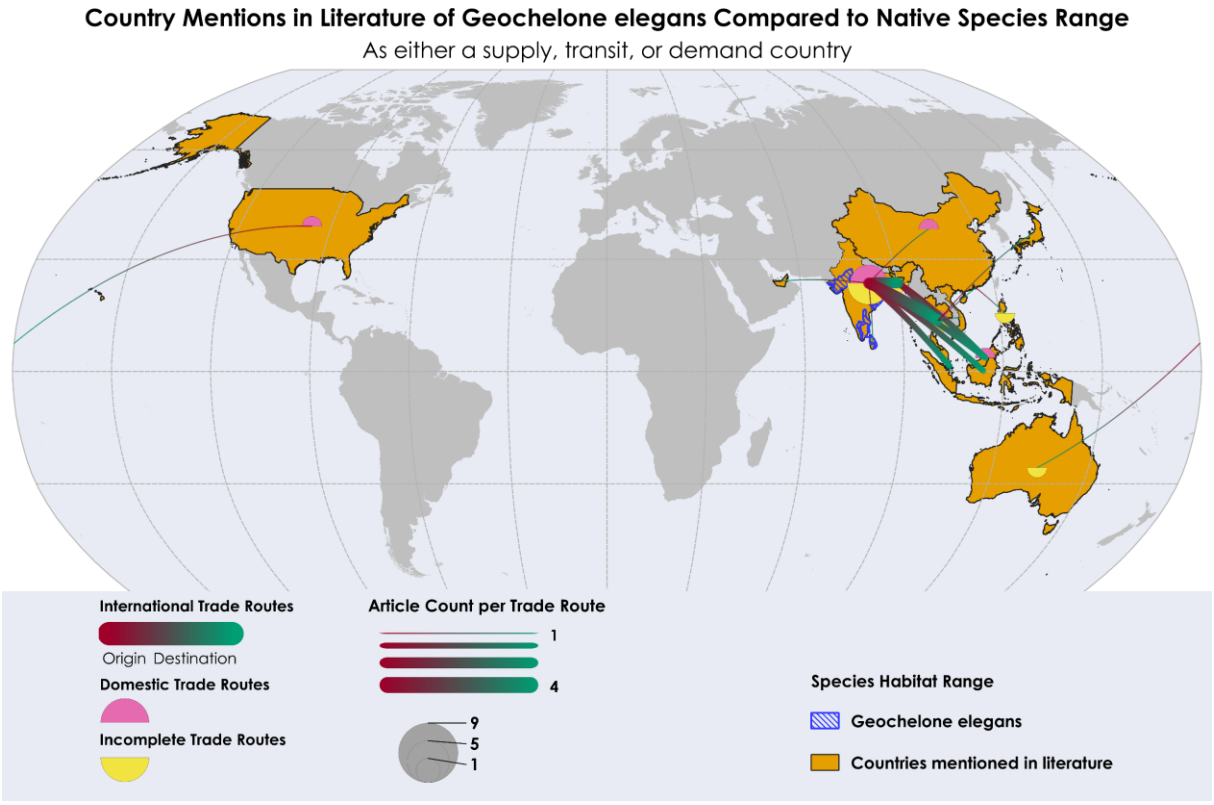


Figure 28: Species habitat range, global IWT trade routes, country occurrences, and product types for *Astrochelys yniphora.*



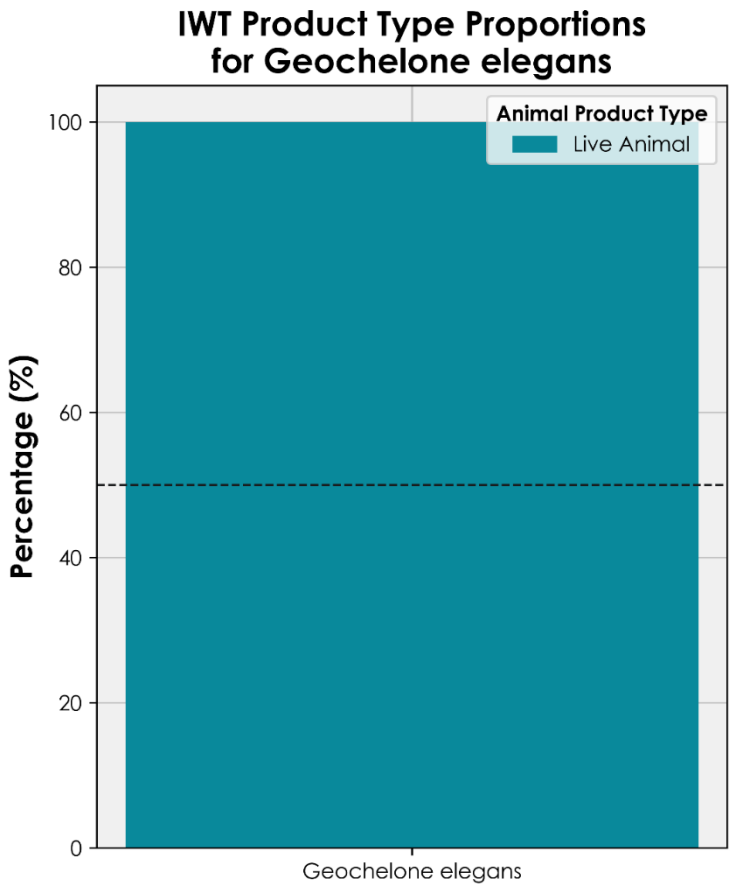
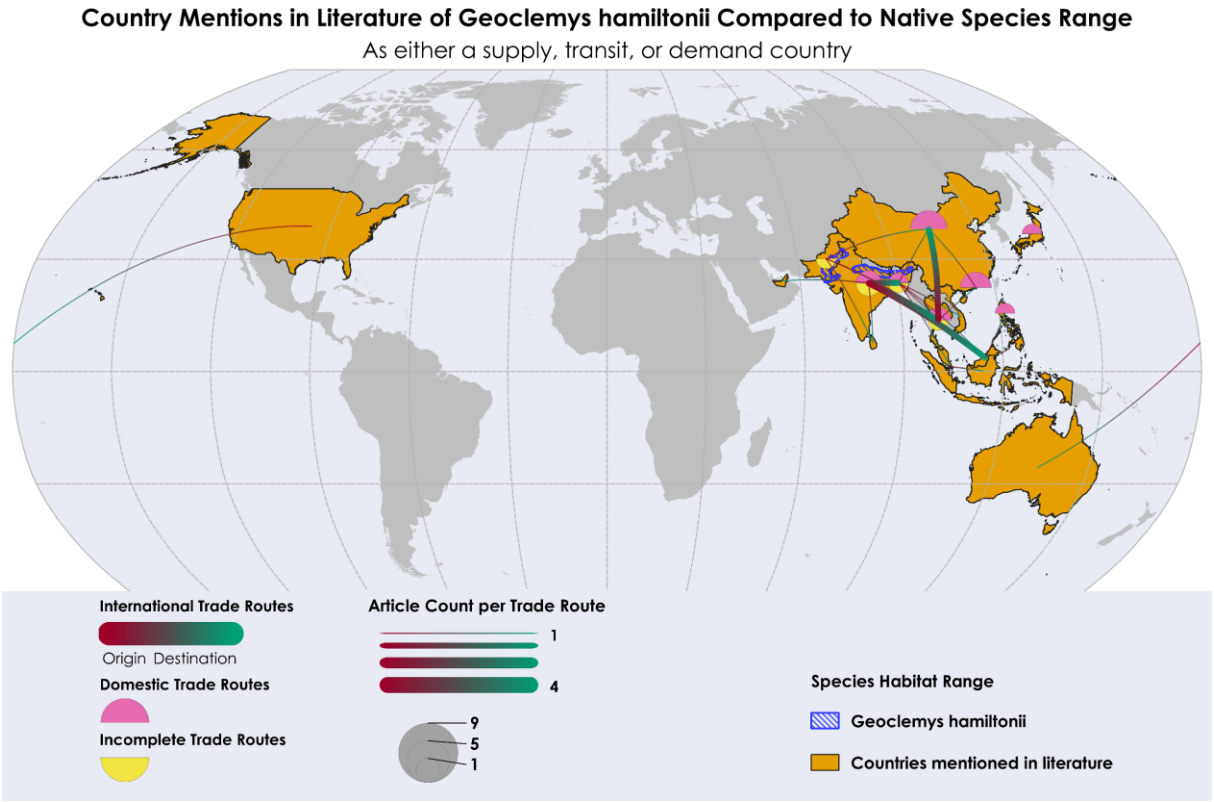


Figure 29: Species habitat range, global IWT trade routes, country occurrences, and product types for *Geochelone elgans.*



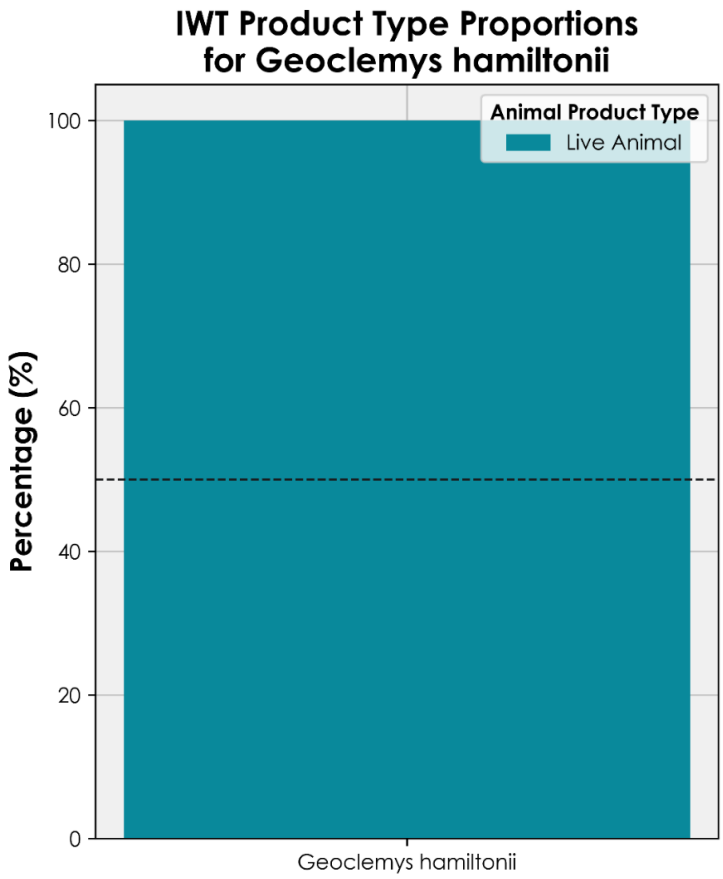
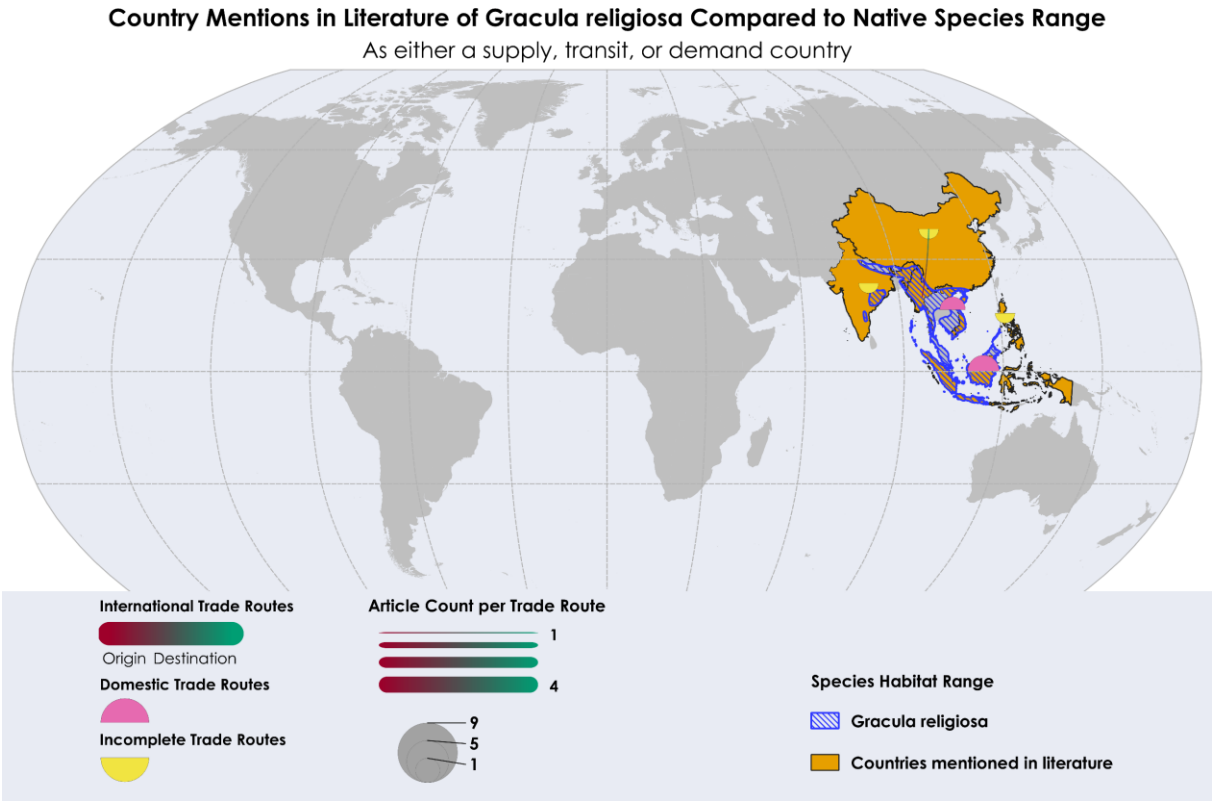


Figure 30: Species habitat range, global IWT trade routes, country occurrences, and product types for *Geoclemys hamiltonii*.



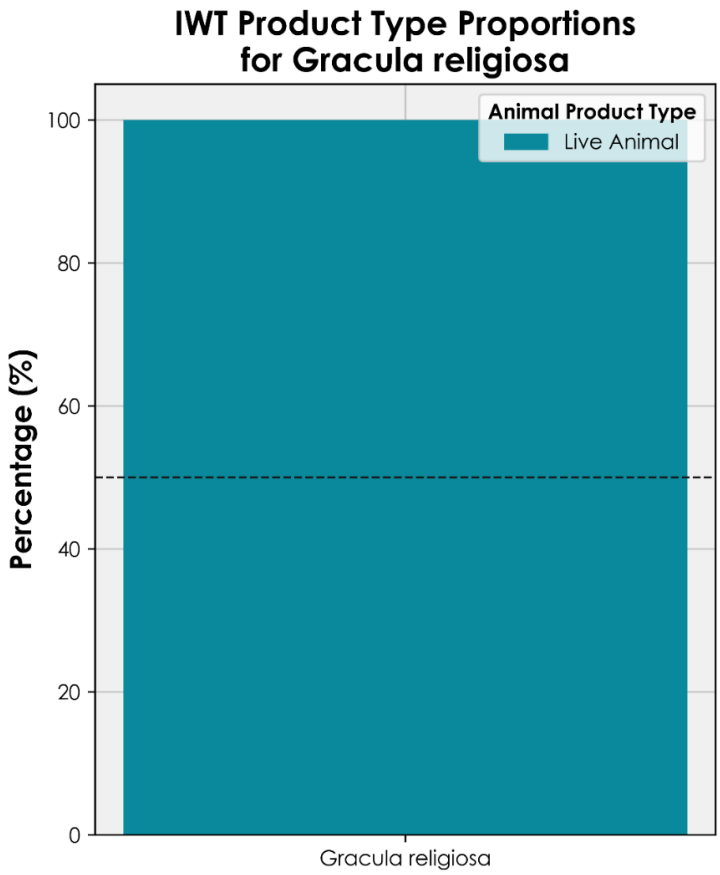
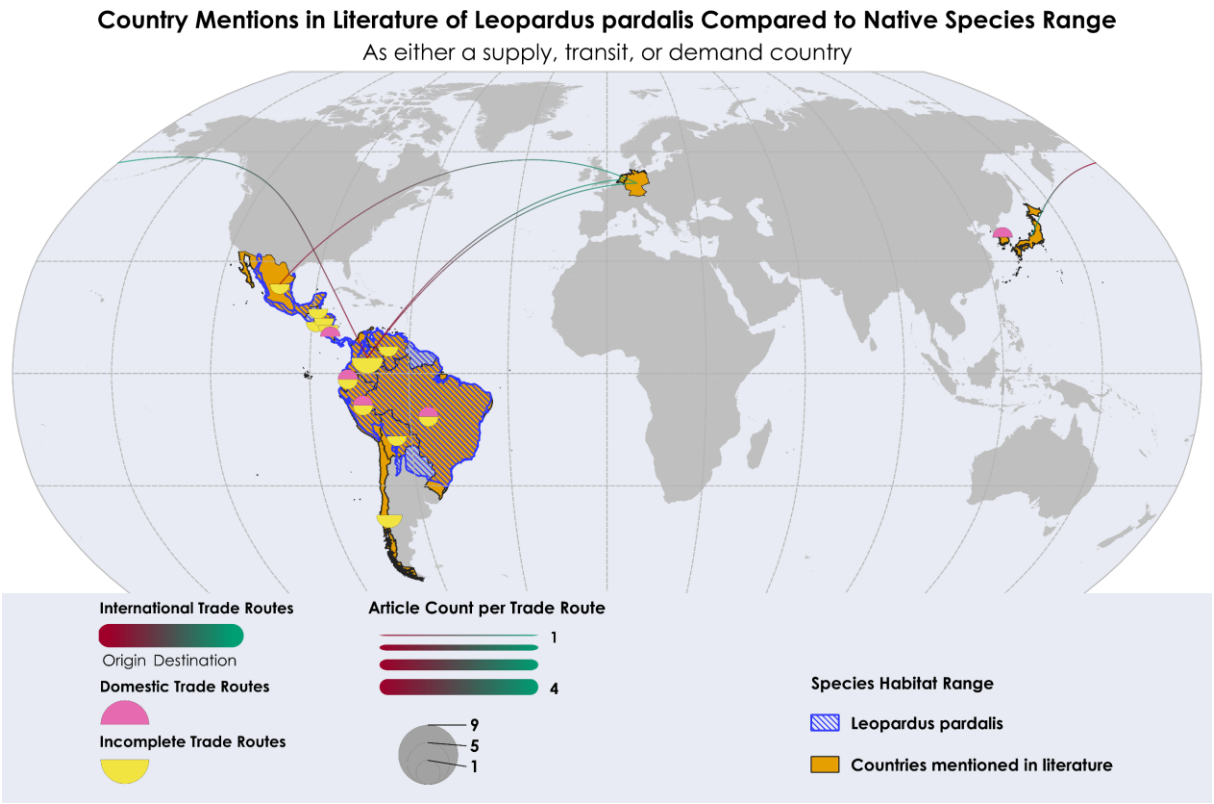


Figure 31: Species habitat range, global IWT trade routes, country occurrences, and product types for *Gracula religiosa.*



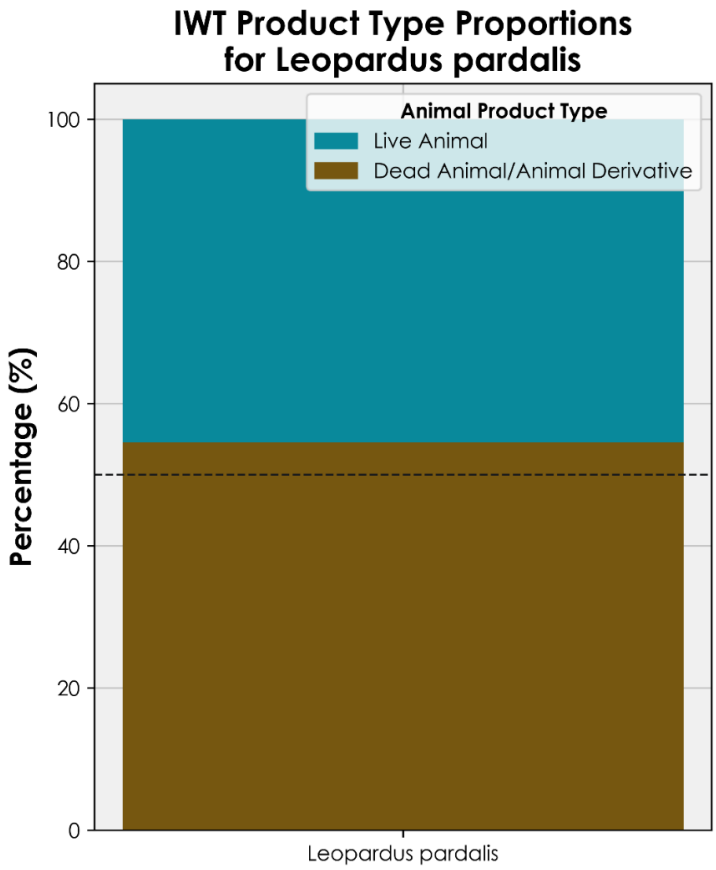
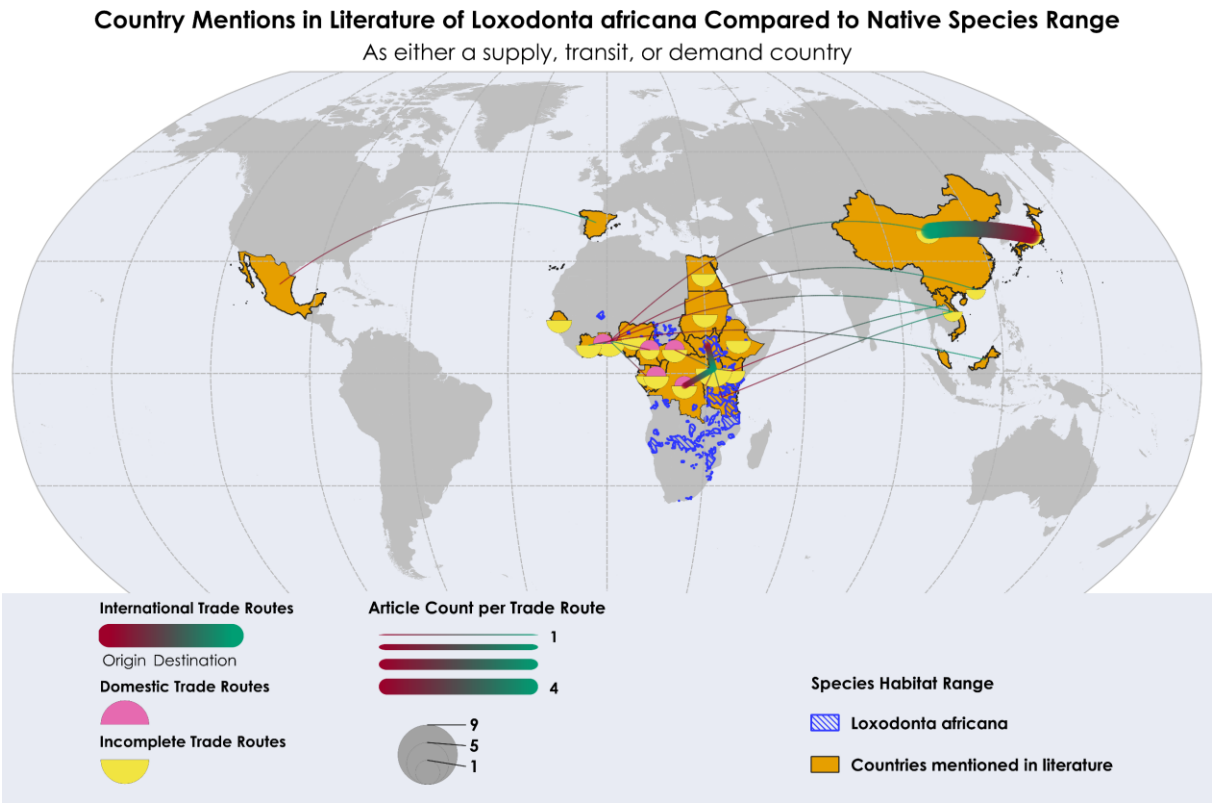


Figure 32: Species habitat range, global IWT trade routes, country occurrences, and product types for *Leopardus pardalis*.



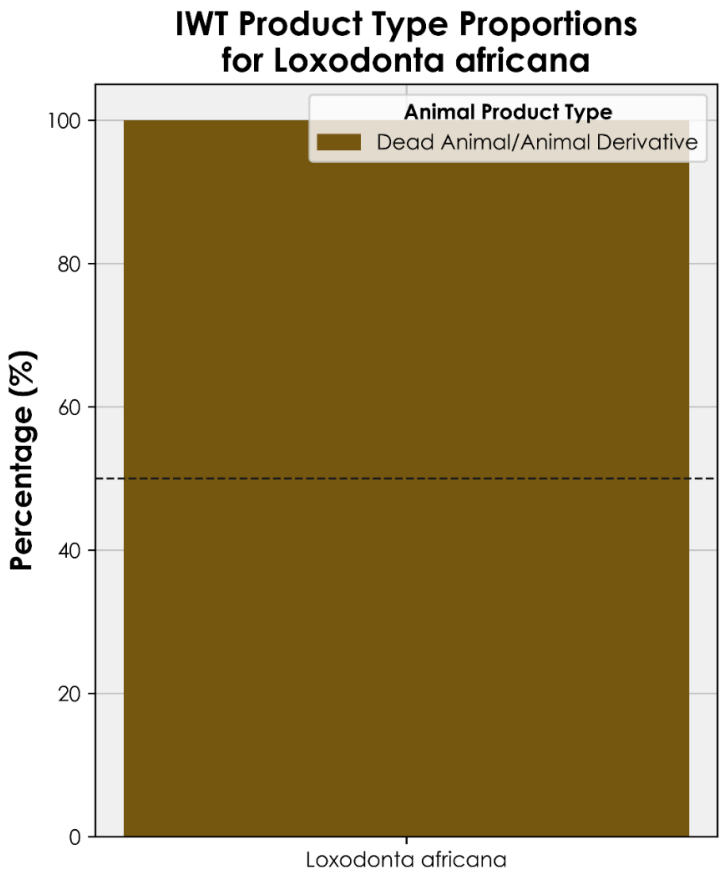
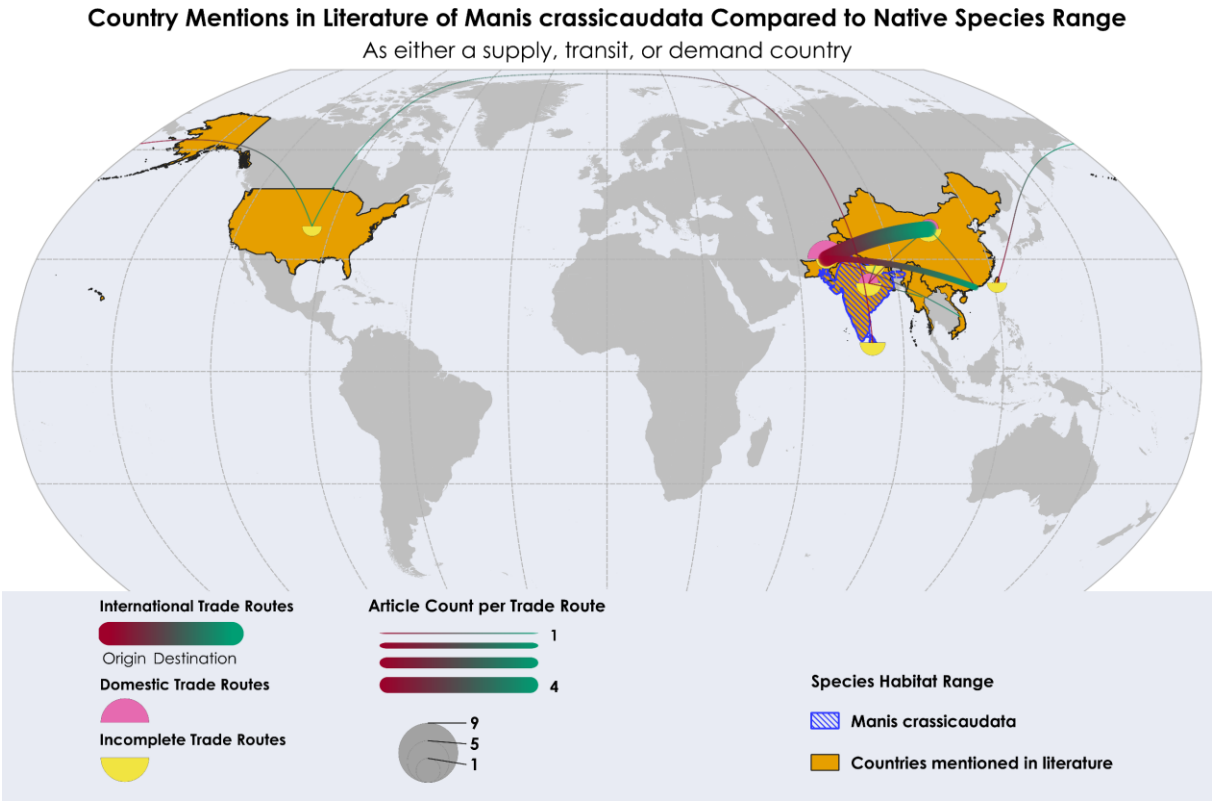


Figure 33: Species habitat range, global IWT trade routes, country occurrences, and product types for *Loxodonta africana.*



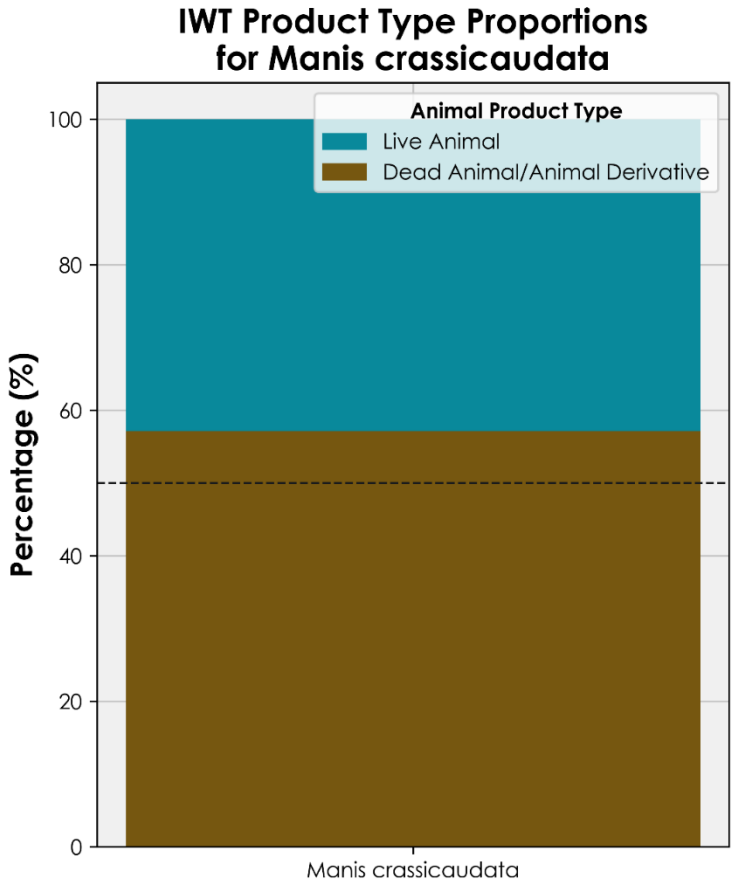
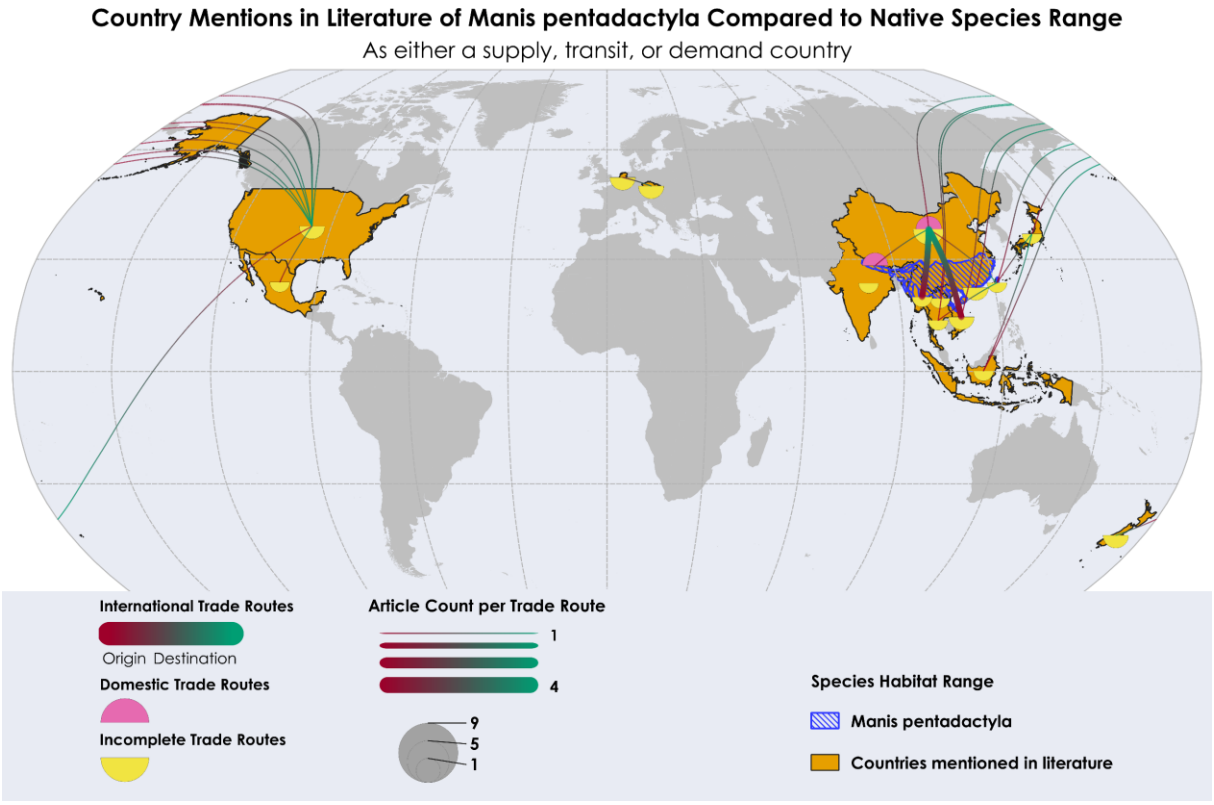


Figure 34: Species habitat range, global IWT trade routes, country occurrences, and product types for *Manis crassicaudata.*



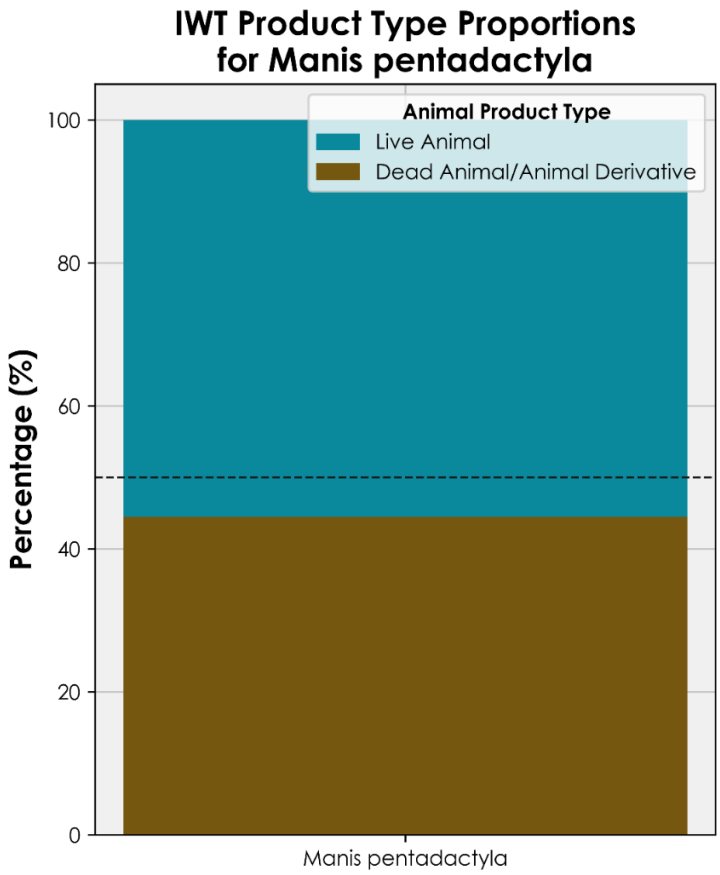
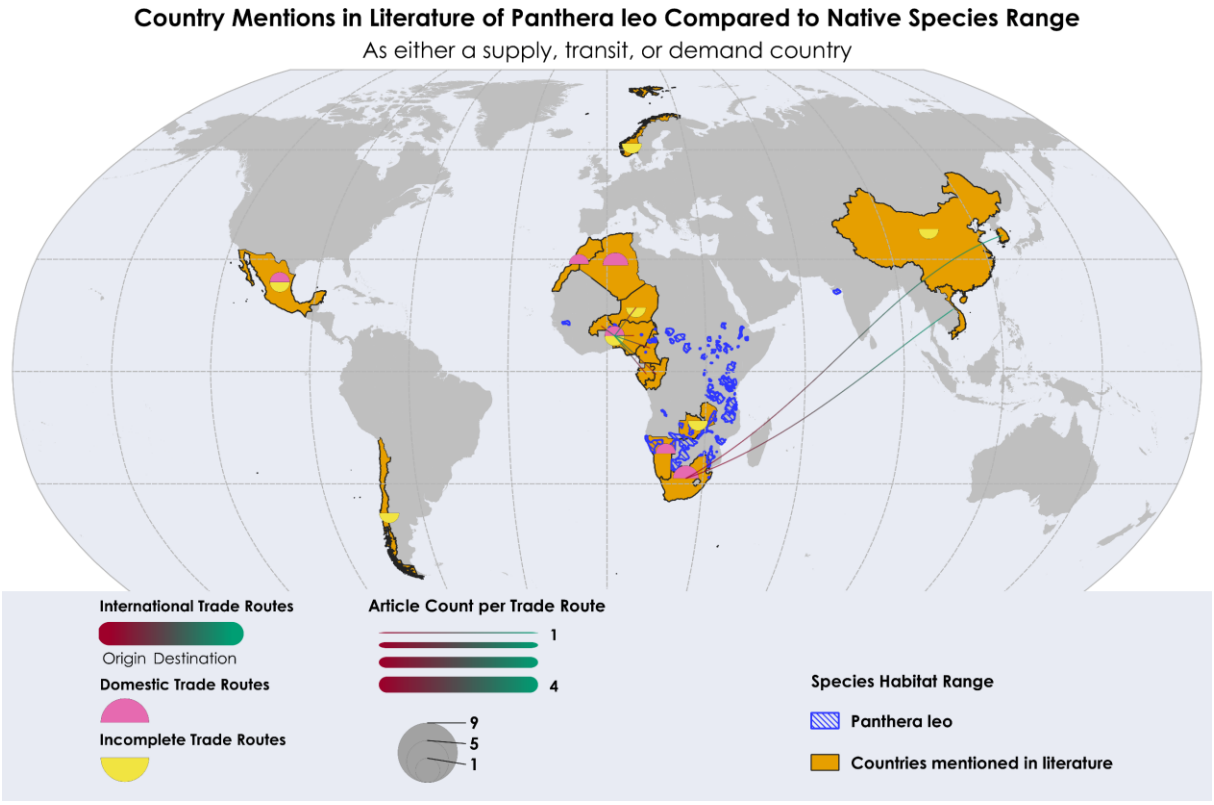


Figure 35: Species habitat range, global IWT trade routes, country occurrences, and product types for *Manis pentadactyla.*



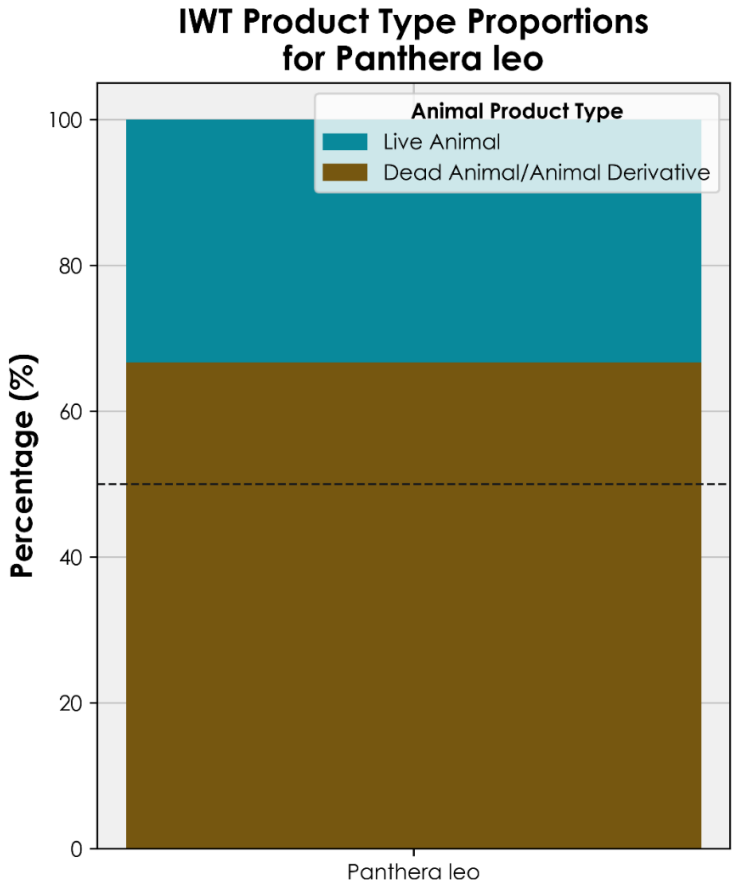
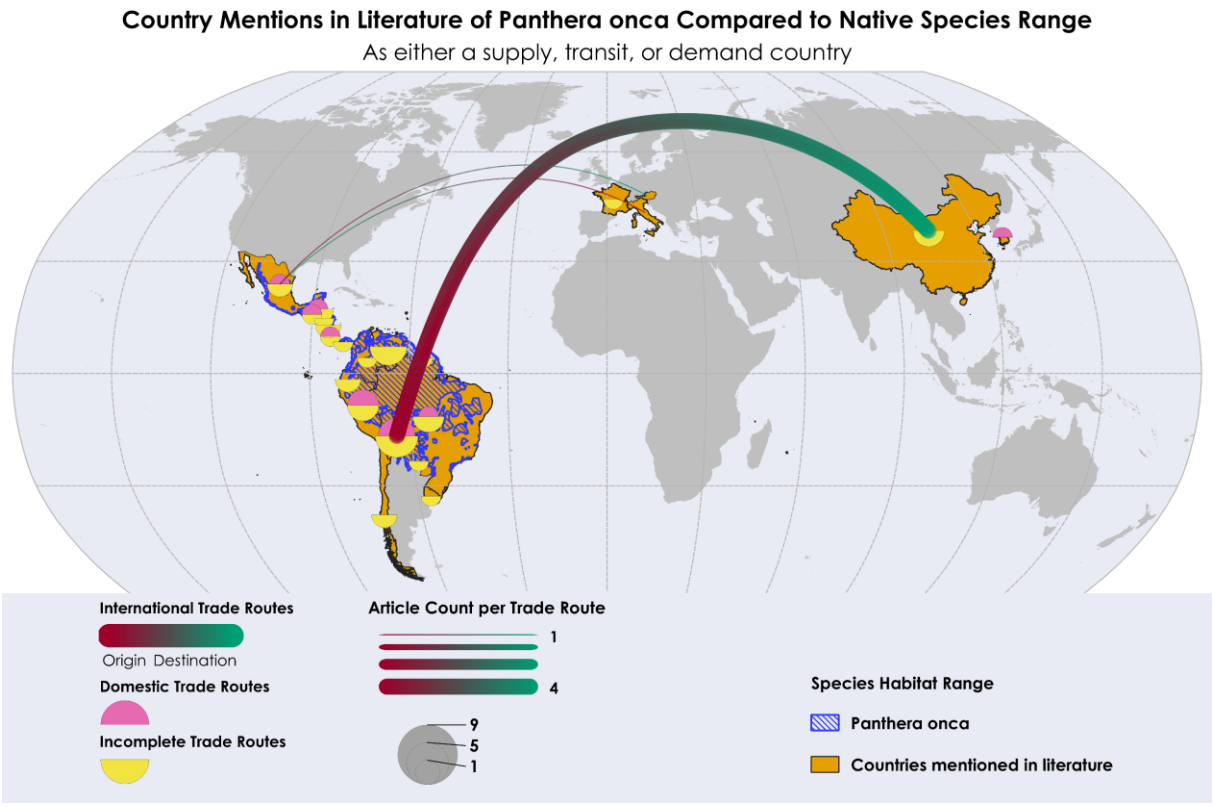


Figure 36: Species habitat range, global IWT trade routes, country occurrences, and product types for *Panthera leo.*



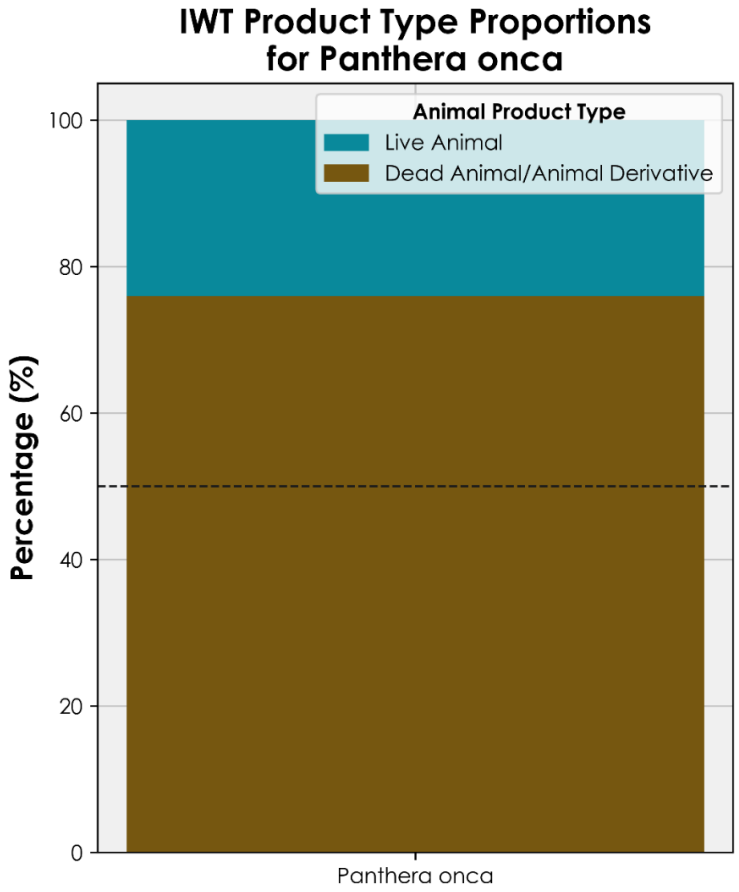
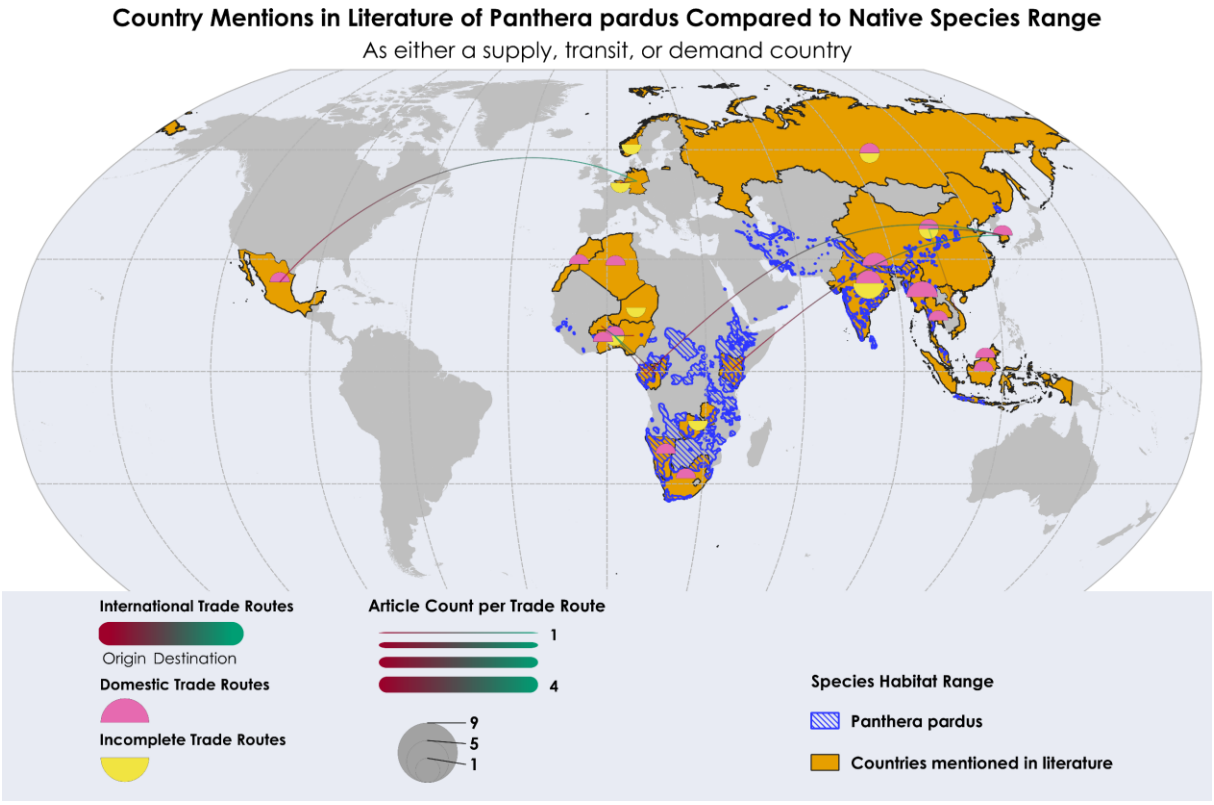


Figure 37: Species habitat range, global IWT trade routes, country occurrences, and product types for *Panthera onca.*



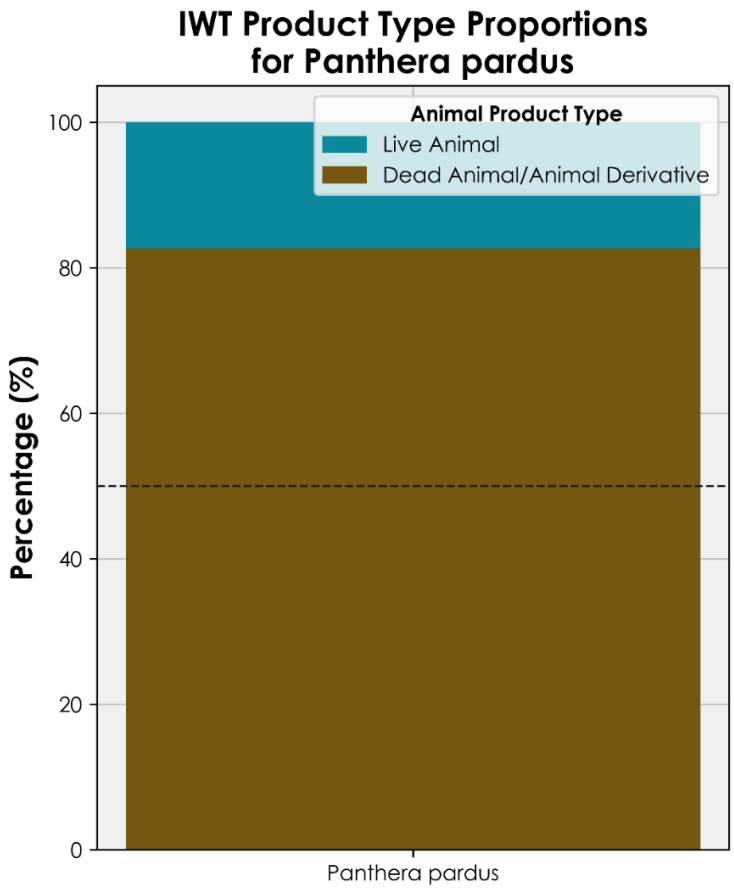
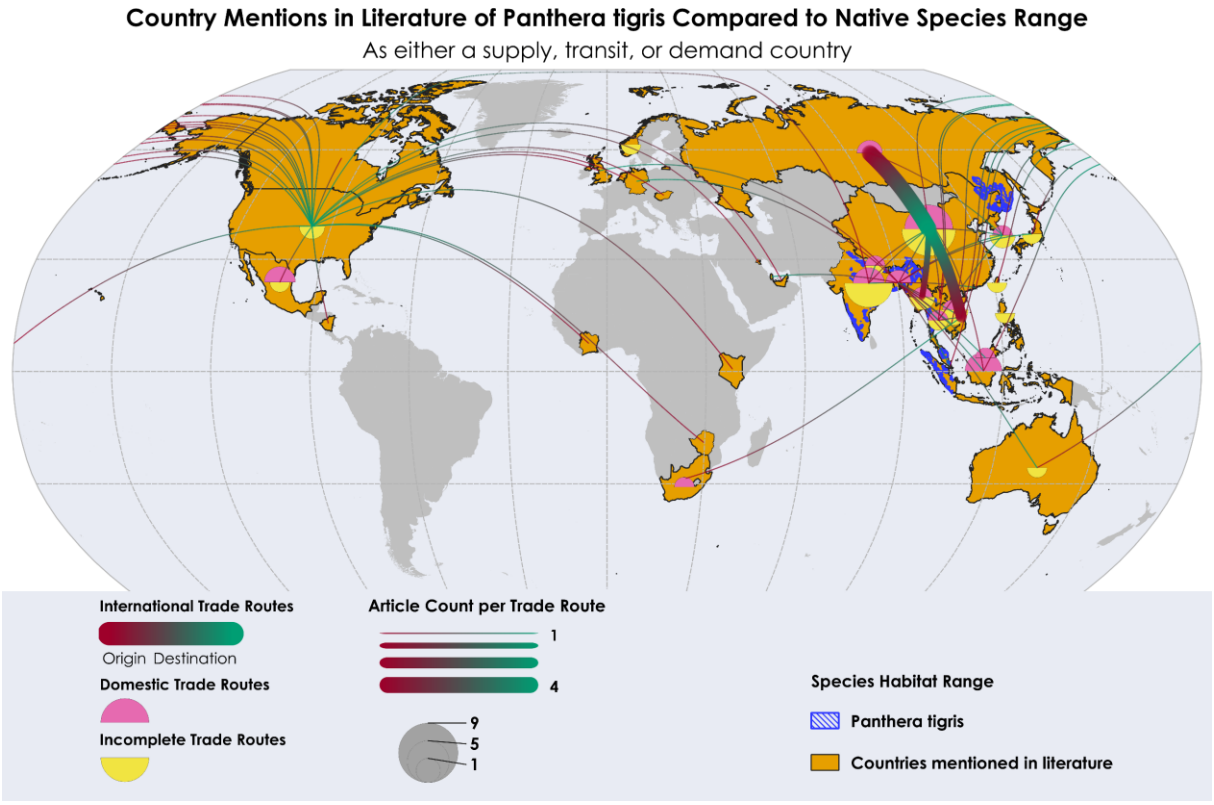


Figure 38: Species habitat range, global IWT trade routes, country occurrences, and product types for *Panthera pardus*.



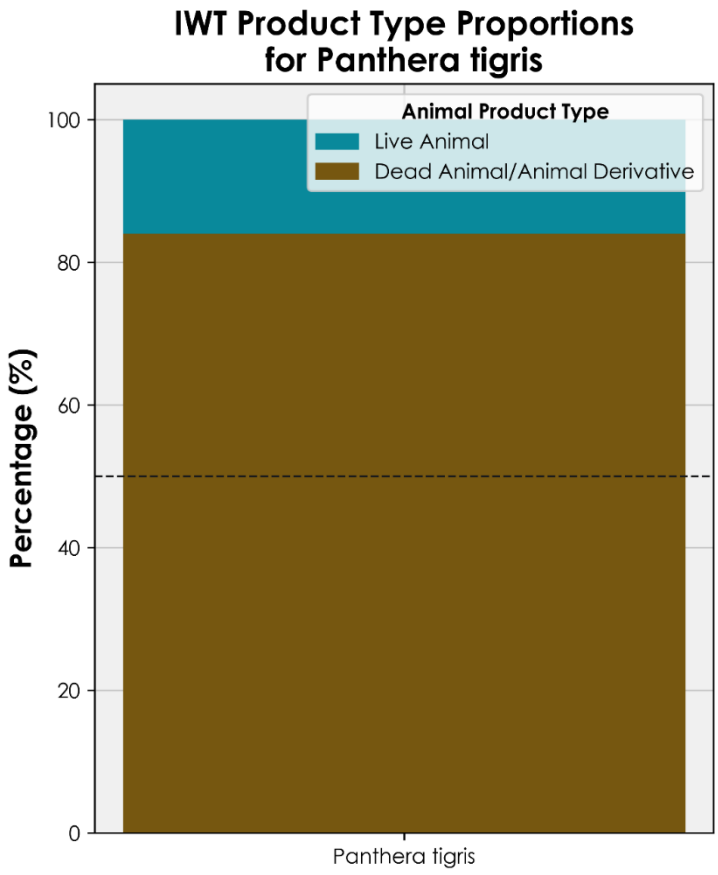
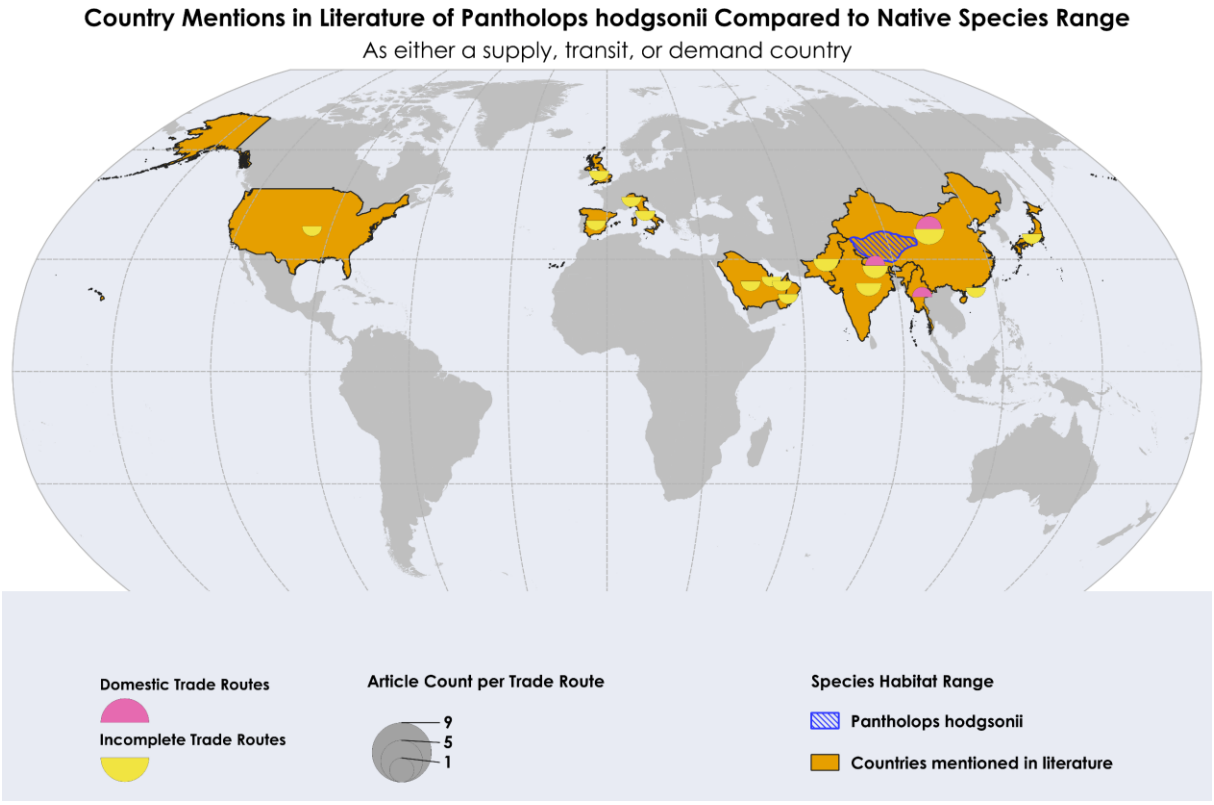


Figure 39: Species habitat range, global IWT trade routes, country occurrences, and product types for *Panthera tigris*.



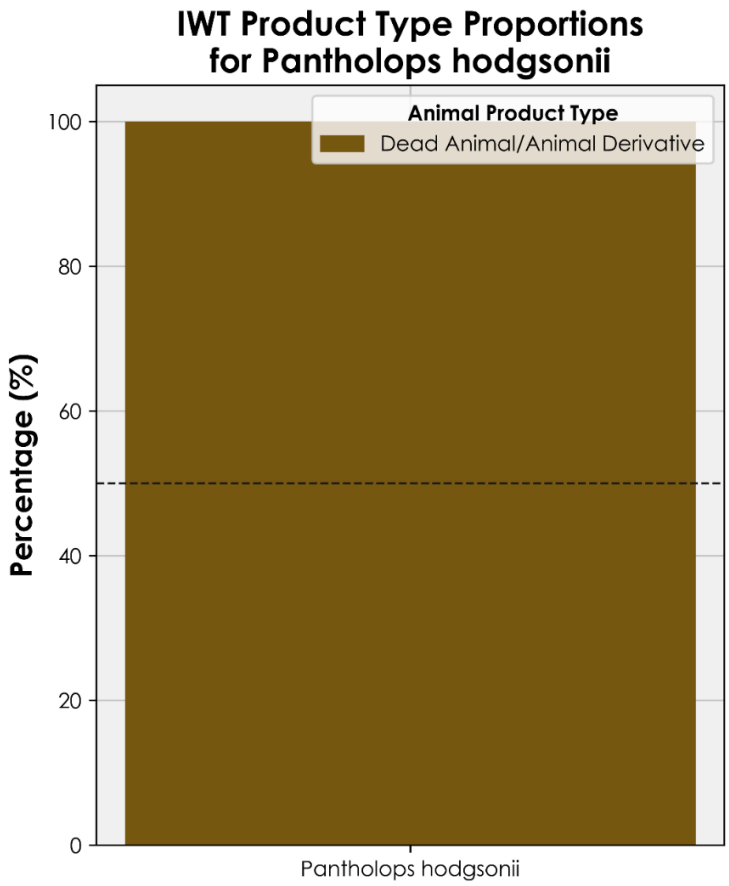
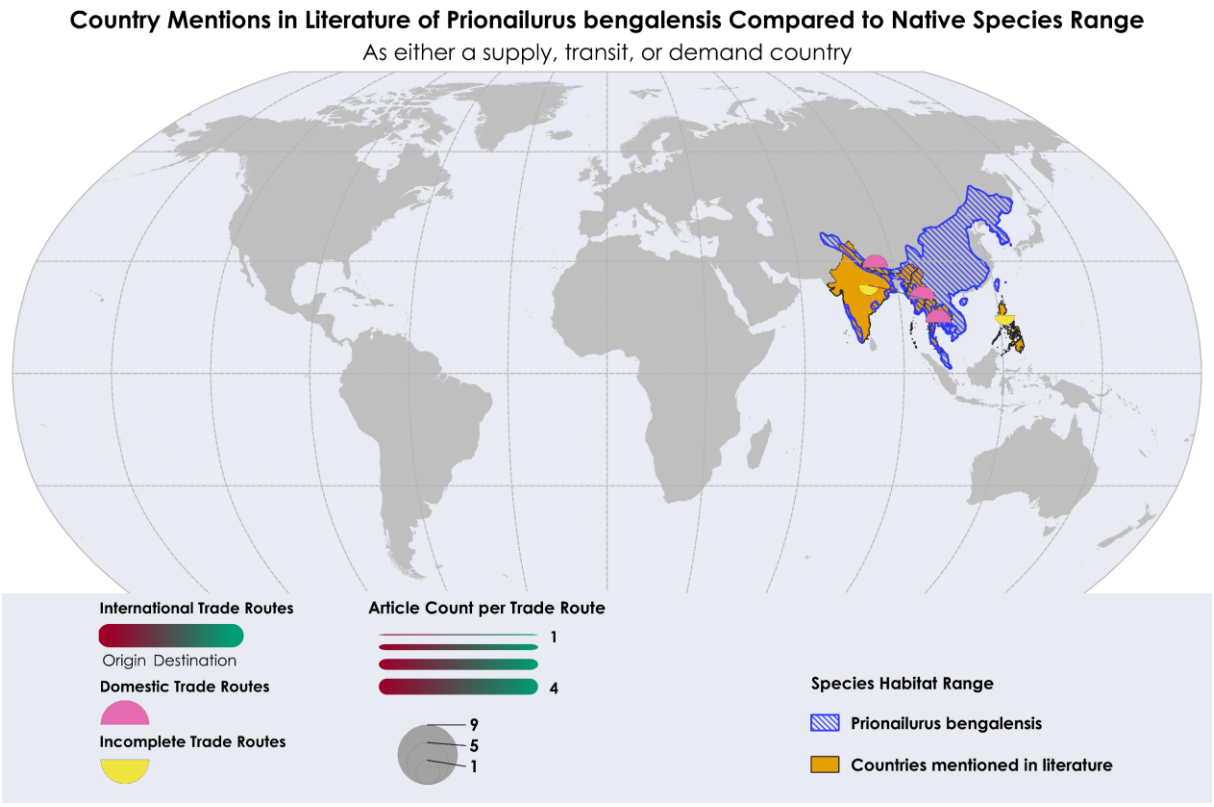


Figure 40: Species habitat range, global IWT trade routes, country occurrences, and product types for *Pantholops hodgsonii.*



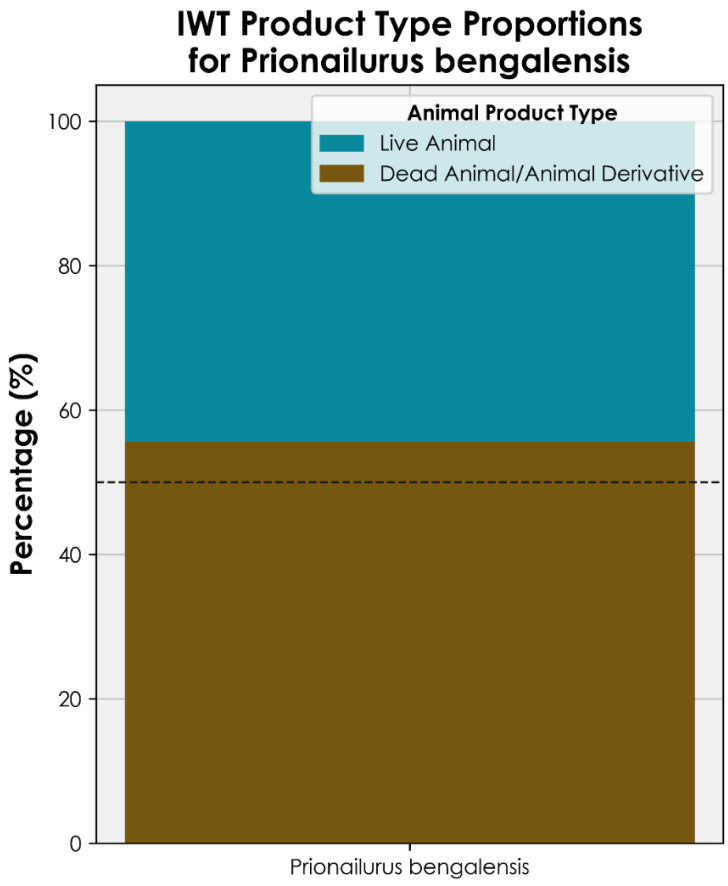
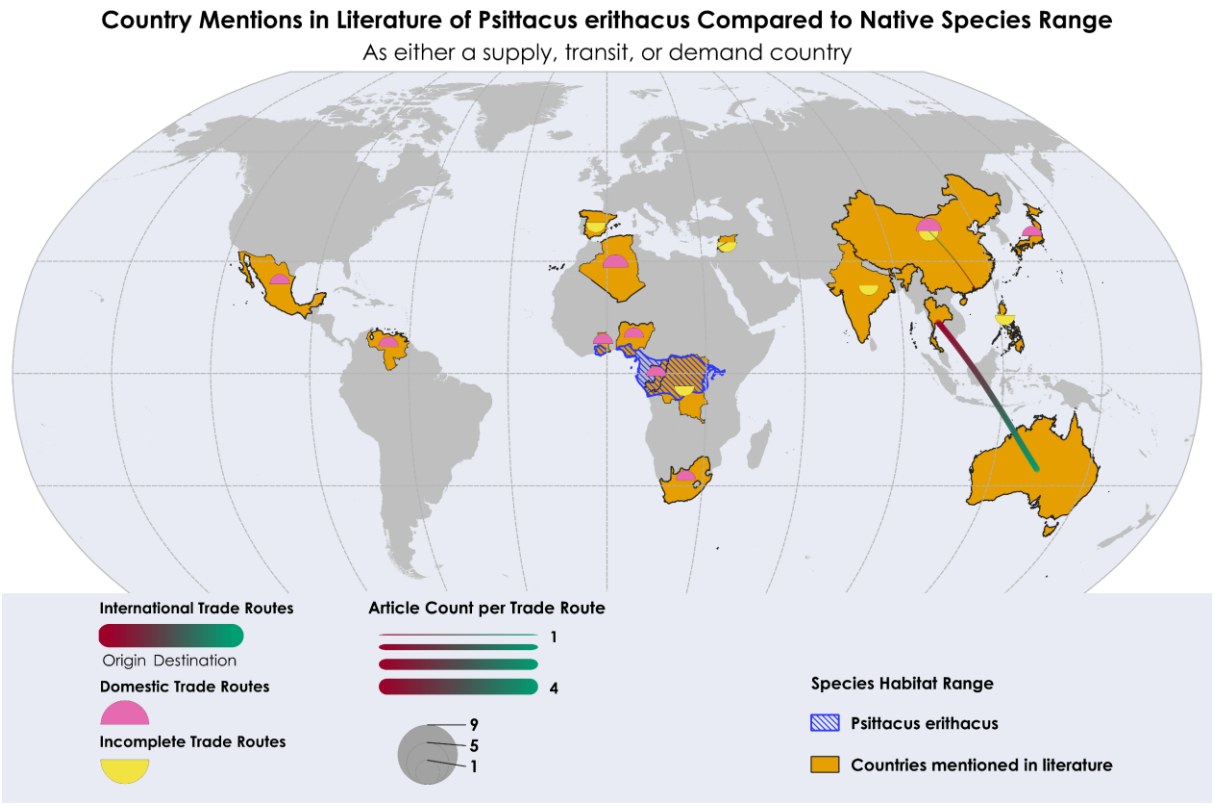


Figure 41: Species habitat range, global IWT trade routes, country occurrences, and product types for *Prionailurus bengalensis.*



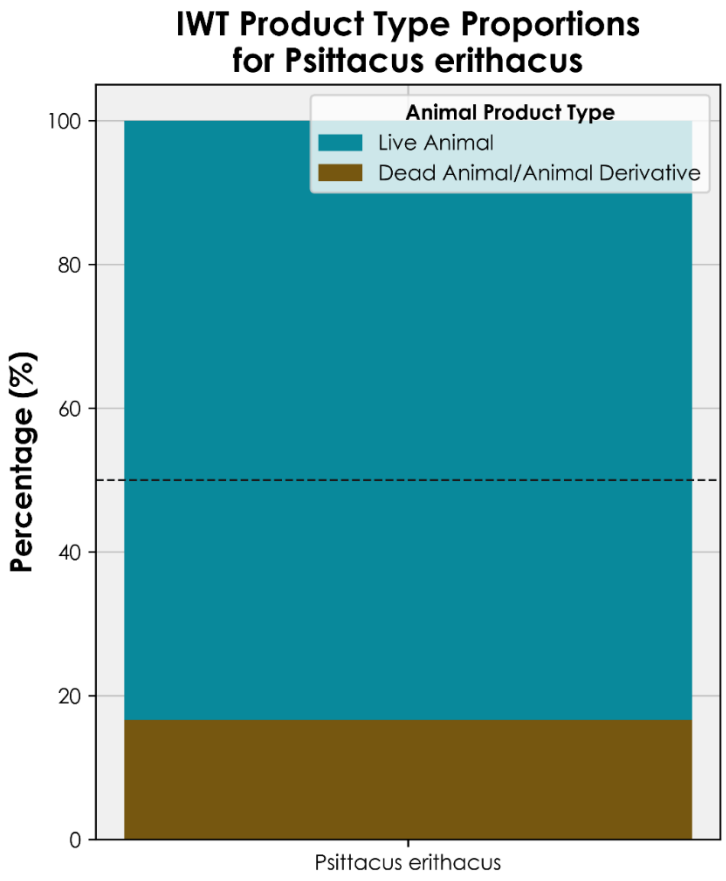
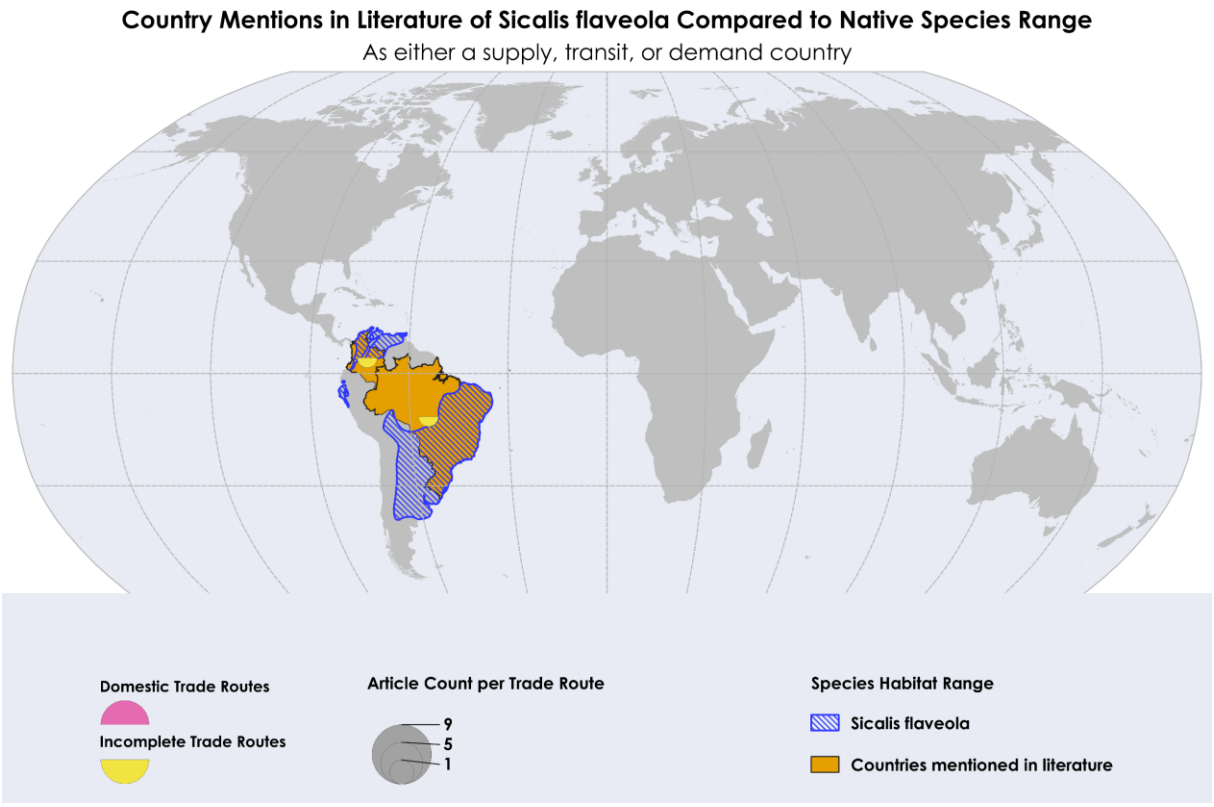


Figure 42: Species habitat range, global IWT trade routes, country occurrences, and product types for *Psittacus erithacus*.



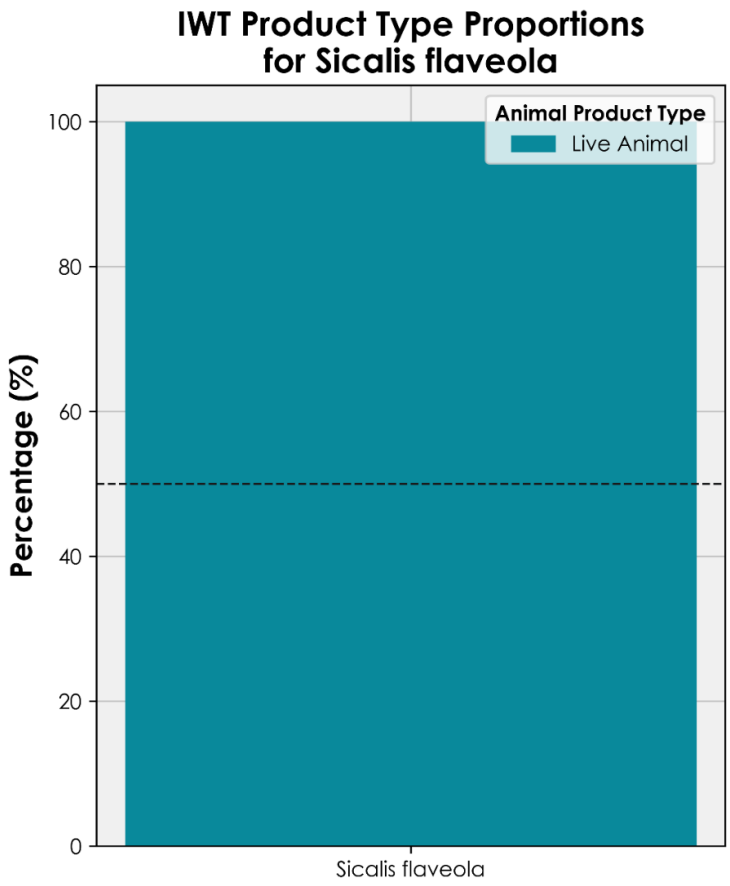


Figure 43: Species habitat range, global IWT trade routes, country occurrences, and product types for *Silalis flaveola*.