7 A comparison of seizures of illegal wildlife between the US and the EU

Implications for prevention

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Introduction

The trafficking of wildlife has emerged as a significant threat to plant and animal species worldwide. The illegal trade in wildlife has an estimated annual worth of approximately $20 billion, making it one of the most profitable criminal enterprises alongside the trafficking in narcotics, firearms, and human beings (WWF/Dalberg, 2012; Rosen and Smith, 2010; European Commission, 2016; African Wildlife Foundation, 2015; UNODC, 2016; Nellemann et al., 2014). The United Nations Office on Drugs and Crime (UNODC) has designated the engagement in wildlife trafficking a "global phenomenon" and a "serious crime" punishable by a minimum of four years in prison (UNODC, 2016).

The illegal trade in wildlife involves the illicit procurement, transport, and distribution of animals, animal parts, and derivatives thereof in contravention of foreign or domestic regulations. This often includes the poaching or otherwise taking of protected or managed species, which has escalated into an international crisis (van Uhm, 2016a; USFWS, n.d.; Wyler and Sheikh, 2013). The wildlife trade can involve a diverse range of commodities including live animals sold to private collectors, pet shops, animal brokers, game farms, biomedical labs, circuses, and meat dealers; animal parts such as elephant ivory, rhinoceros horn, tiger bones, or leopard pelts; and plant species often sold to meet consumer demands for holistic medicine or landscape décor (Warchol, 2007; TRAFFIC, n.d.). Among the most lucrative products are caviar, elephant ivory, exotic birds and reptiles, and rhinoceros horn, which sells for an estimated value between $35,000 and $65,000 per kilogram (Mander, 2012).

Given the serious nature of the illicit wildlife trade at the global level, analysis of wildlife trafficking patterns is paramount for understanding the nature of the trade and to inform policies designed to control wildlife trafficking. The present study examines wildlife seizure patterns made in two of the largest demand markets in the world (the US and the EU) to unveil common characteristics and differences in those markets as they relate to products, and places from which wildlife emanates. In doing so, our study can inform how resources can be better allocated to target export countries more effectively and inform customs agents in the EU and the US on patterns of heavily trafficked wildlife products.

The wildlife trade

The international illicit movement of plant and animal species directly affects global biodiversity, as well as hinders the economic and social development of countries via loss of flora and fauna, spread of invasive species, and introduction of health threats (WWF/Dalberg, 2012). The increase in trade of certain wildlife products has caused direct and dramatic population declines. This is explicitly seen in the case of African elephants (*Loxodonta africana*), whose population plummeted from 1.3 million in 1979, to an estimated 600,000 in 1989, due to the trade in ivory (TRAFFIC, n.d.). The pet trade has also pushed many species to the brink of extinction in the past few decades, including Indonesian bird species, such as the scarlet-breasted lorikeet (*Trichoglossus forsteni*) and yellow-crested cockatoo (*Cacatua sulphurea*) (Eaton et al., 2015), as well as many species of the family Psittacidae, commonly known as parrots, in the neotropics (Pires, 2012). This direct removal of flora and fauna, and subsequent potential loss of species, threatens more than biodiversity and animal welfare, as it damages the health of ecosystems that provide the platform upon which food production and economies are ultimately based upon. Ecosystems play a crucial role in providing development opportunities and supporting livelihoods, particularly those which rely heavily on natural resources, such as agriculture, forestry, and fisheries (Nellemann et al., 2014; Duffy, 2010).

The movement of wildlife further creates opportunity for the introduction of harmful, non-native species that may damage existing ecosystems. These invasive species can affect human, animal, and plant health, as well as cause environmental or agricultural damage. The pet trade is a known route for invasive species introduction; many species are banned only after their damaging effects become well-documented in the new environment (Rosen and Smith, 2010; Wyler and Sheikh, 2013; Ferrier, 2009). The import of plant and animal species also opens the doors for the introduction and spread of disease. Similarly to the threats of invasive species, disease can cause social and economic harm, threatening people, wildlife, agriculture, and ecosystems. Several notable disease outbreaks, including zoonoses, have emerged due to the wildlife trade (van Uhm, 2016a; Wyler and Sheikh, 2013; Gomez and Aguirre, 2008; Karesh et al., 2005).

The demand for wildlife products arises from a number of different consumer groups and is often influenced by social and cultural drivers. Demand is fueled by the perceived medicinal value of some products and social status associated with them, as well as opportunistic buying by tourists purchasing souvenirs or pets abroad and the desire to possess exotic pets and hunting trophies (WWF/Dalberg, 2012; Wyler and Sheikh, 2013; van Uhm, 2018). Steady or increasing demand has driven illicit trafficking of wildlife to increase in recent years. The world is currently losing an estimated 30,000 elephants annually for their tusks; rhinoceros poaching reached a record high in 2015, with nearly 1,215 killed in South Africa alone; and Asian range states seized at least 1,425 tiger parts between 2000 and 2012, indicating the overexploitation of wildlife (TRAFFIC, 2015).

Overview of wildlife seizure research

Seizure data can provide valuable information about import and export countries, and has become an accepted method by which to gain insights into wildlife trade practices (UNODC, 2016; Kurland and Pires, 2017; Petrossian, Pires and van Uhm, 2016; van Uhm, 2016b). Although seizures make up only a selective sample of global activity, they are relevant and reliable to understand global confiscation patterns. The majority of seizure studies have examined the trade in specific commodities, such as elephant ivory (Underwood et al., 2013; Martin and Stiles, 2008), marine ornamental species and coral to the US (Rhyne et al., 2012), and amphibians (Schloegel et al., 2009).

Few studies, however, examine national and international seizure records. A 2010 study by Rosen and Smith (Rosen and Smith, 2010) analyzed 12 years of wildlife seizure records (1996–2008) compiled by the wildlife trade monitoring network, TRAFFIC, to reveal international trafficking patterns, namely the origin and destination of illegal wildlife products around the world. They concluded that most products were exported from Southeast Asia, which had been a recently identified hot spot of emerging infectious diseases. The study noted that imports were not evenly distributed across taxa, with mammals and mammal derivatives constituting 51% of all seizures.[1]

At the national level, Petrossian et al. (2016) analyzed seizures made at US ports of entry between 2003 and 2012 using the LEMIS database managed by the US Fish and Wildlife Service (USFWS). Their findings revealed that 94% of species seized across the US belonged to six major groups, namely mammals, mollusks, reptiles, fish, birds, and coral. Further, it was found that the majority of these US seizures were exported from six countries. In a related US study on the concentration of wildlife seizures by place and products, Kurland and Pires (2017) identified that roughly 80% of all seizures made between 2003 and 2012 were exported from approximately 20% of countries, and occurred at about 20% of US entry points. Additionally, this study found that the most seized genera for the US included *Crocodylus, Python, Caiman, Panthera*, and *Strombus* (Kurland and Pires, 2017).

At the regional level, van Uhm (2016b) performed a similar illicit wildlife seizure analysis within the EU. Using the EU-TWIX seizure database, van Uhm examined products confiscated between 2001 and 2010. He discovered that imports were primarily from Africa and Southeast Asia, with top wildlife groups seized being mammals, birds, reptiles, fish, coral, and mollusks. In particular, Thailand, China, and Vietnam, as well as Morocco, Egypt, and Algeria were important source countries, along with Russia and the US (van Uhm, 2016b).

Based on these studies, it is evident that wildlife seizures are concentrated in various ways, and certain wildlife products are more in demand. However, studies focusing on EU patterns differed from US-based studies as it related to patterns analyzed and the time frame of each study. Consequently, it is unclear whether there are common characteristics between each demand market during the same time period with regard to concentrations of wildlife seizures. That is the focus of the present study. The following section will provide a theoretical explanation for why these seizure patterns may exist.

Theoretical framework

In global illegal wildlife markets, numerous endangered species are traded for a variety of reasons (Petrossian et al., 2016; Van Uhm, 2016a). The demand for illegal trade in wildlife is often socially and culturally driven. For example, animal skins and furs are historically used as wearing apparel in Western societies (Kalof, 2007); tiger bones and rhinoceros horn are used in traditional Asian medicine (Ellis, 2005); live tortoises, parrots, and monkeys are driven by fashion trends or the pet industry (D'Cruze et al., 2015; Pires, 2012); specific fish species are traded for consumption as a delicacy (Petrossian and Clarke, 2014); while possession of animal parts, such as elephant ivory or rhinoceros horn, are a status symbol (Martin and Stiles, 2008). Thus, the value placed upon wildlife products is a function of attributions, motivations, and exchanged commodities instead of the forms or functions of trade (Simmel, 1978; Appadurai, 1986; Van Uhm, 2018). For instance, the possession of luxury or scarce objects manifests one's prestige and "offers access to social networks and to other resources that are closed to those lacking prestige" (Renfrew, 1986: 161). Therefore, the patterns of illegal wildlife can be seen as a reflection of social and cultural demand for certain products.

In addition to sociocultural demand patterns, the illegal wildlife trade is influenced by opportunity structures in the environment. Past research has shown that wildlife crime is highly concentrated in time and space, among offenders and species, and these concentrations are highest where the opportunities are greatest (Petrossian et al., 2016). For example, parrot poaching in the neotropics is concentrated among species, space, time, and by methods (Pires et al., 2016; Pires and Clarke, 2011, 2012) and illegal fishing is highest where there are greater concentrations of highly commercial fish (Petrossian, 2015; Petrossian et al., 2015; Marteache et al., 2015; Petrossian et al., 2016). As such, preventive measures designed to reduce opportunities for poaching can, in turn, reduce overall crime (Moreto and Pires, 2018; Kurland et al., 2017).

Consistent with the expectations outlined above and dwelling on the main findings of illegal imports of wildlife into the United States (Petrossian et al., 2016) and the EU (van Uhm, 2016b), we would expect to find significant concentrations of illegal imports by species groups, export countries, and types of products. We would expect these concentrations to reflect overlaps in demand markets in the US and EU, where a large proportion of seizures would involve a significantly small proportion of wildlife groupings, genera, and types of products, along with a few countries accounting for the largest number of illegal exports. Additionally, we would expect to see specific patterns that reflect the sociocultural demand for these products in the US and the EU. To understand the differences between the US and EU markets and the reasons behind these differences, trends and patterns of illegal wildlife imports into these two markets will be discussed in the context of criminogenic aspects of the illegal wildlife markets.

Methodology

To understand the patterns of illegal wildlife trafficking in the context of two major demand markets, the US and the EU, data on confiscations between 2003 and 2010 were obtained. In the US, confiscated wildlife is recorded in the Law Enforcement Management Information System (LEMIS) database. The LEMIS dataset was obtained through the Freedom of Information Act (FOIA) request made on 23 September 2013 to the USFWS-LEMIS division. The EU dataset was obtained from the European Union Trade in Wildlife Information eXchange database (EU-TWIX), a database of information on wildlife seizures in the EU. From these confiscations, *only those incidents that were deemed illegal and seized by authorities were analyzed* (see Kurland and Pires, 2017). Regarding the LEMIS database, 28,201 seized incidents of illicit wildlife were recorded between 2003 and 2010, while 15,295 incidents of animals and animal products were recorded in the EU-TWIX database during the same period.

The variables in both databases overlap regarding seizure incidents by genus, species, sub-species, CITES status, wildlife description (e.g., live animal, leather product), quantity (reported in individuals or products), unit of measurement (e.g., number of specimens, kg, m^3), country of export and origin, date of entry, exporting country, source country, import and export purpose, source (wild, captive bred, ranch raised, and unknown), and transportation mode. Regarding the wildlife description variable, some attributes in both datasets were slightly different from each other as the EU-TWIX database has fewer attributes. To overcome this issue, attributes in the LEMIS dataset were recoded to be consistent with the EU TWIX categorization of wildlife description attributes. For example, the EU-TWIX wildlife description attribute, whole corals, would encompass all whole coral categories in the LEMIS dataset such as COR,[2] CPR,[3] and ROC.[4]

Analytical strategy

Seizure shipments typically include multiple types of species in varying amounts. Each line of data represents one particular species that was confiscated, and therefore this study treated each entry as a unique seizure incident (Petrossian et al., 2016; van Uhm, 2016b; Kurland and Pires, 2016). Descriptive statistics are predominantly used in this paper to demonstrate how illicit wildlife incidents are concentrated in numerous ways in both datasets. In the results section, we:

1 Analyze the groupings of wildlife seized in both the US and the EU
2 Discuss the top ten most seized product types by incidents in the US and the EU
3 Describe the top 25 genera seized in the US and the EU.

Related to the third analysis, the taxonomic rank of genus was the lowest classification that could be successfully analyzed for seizure patterns, as the lowest taxonomic ranks of *species* and *sub-species* had a substantial amount of missing data in both datasets and precluded us from using such data.

Finally, for the last section, we test whether certain genera and export countries disproportionately account for most seizure incidents by creating Lorenz curve plots and their corresponding Gini coefficients (1921). To do this, four lists were created. For the first two lists, the cumulative percentage of seizures across all known genera seized in both the (1) EU and the (2) US were plotted against the cumulative percentage of total genera seized in both the EU and the US. As a result, the distribution of incidents among genera seized in both datasets are displayed in the left panel of the Lorenz plot of Figure 7.1. For the third and fourth lists, the cumulative percentage of seizures across exporting nations seized in both the (3) EU and the (4) US were plotted against the cumulative percentage of total nations. The resulting Lorenz plot is shown on the right panel. To test the equality or inequality of the distribution, the Gini coefficient was calculated as seen below (range 0.0–1.0), whereby 0.0 suggests the distribution is not skewed (i.e., perfect equality) and 1.0 indicates perfect inequality.

$$G = \frac{A}{(A + B)}$$

The reliability of the data from both LEMIS and EU-TWIX is entirely dependent on the accuracy of these data as reported by states and nations (Blundell and Mascia, 2005). As law enforcement experts estimate that no more than 10% of all contraband wildlife is confiscated (e.g., Stiles et al., 2013), the seizures are likely to reflect only a fraction of the illegal trade (Coleman and Moynihan, 1996). This is likely to specific countries' inadequate reporting of their seizures. For example, Greece is a well-known smuggling hub for illegal wildlife entering Europe, and yet it has zero confiscations recorded. While these are serious limitations, this chapter's objective is not to report the exact quantities of seizures but rather to identify possible trends based on the existing data on seizures.

Results

Table 7.1 presents the different animal groupings seized in the US (left) and the EU (right) between 2003 and 2010. Of the ten major identified groupings, more than half of the seizures in both the US (53.1%) and the EU (50.2%) consist of reptile and mammal species. The largest grouping, around one-third of the seizures in both the US (28.1%) and EU (33.5%), consists of reptiles and their derivatives. The mammal category primarily consists of raw material for traditional Asian medicine and corresponds with worldwide demand patterns for illegal wildlife. Bird-related seizures were identified as the third-highest grouping in the US (12.2%) and as the sixth-highest grouping in the EU (5.7%), while coral seizures were identified as much higher in the EU (21.1%) compared to the US (8.4%). Mollusk seizures are noteworthy as the fourth grouping in both the US (11.1%) and the EU (10.8%) and fish seizures – mainly caviar – consist of 7.9% and 8.8% in the US and the EU, respectively. Relatively low percentages of incidents were related to the groupings of marine mammals, arachnids, insects and amphibians that share the bottom four places in both lists.

Table 7.1 Groupings of wildlife seized by *N* of incidents in the US and the EU (2003–2010)

US Seizures				*EU Seizures*			
Rank	*Grouping**	*Incidents*	*%*	*Rank*	*Grouping**	*Incidents*	*%*
1	Reptile	7,925	28.1	1	Reptile	5,127	33.5
2	Mammal	7,043	25.0	2	Coral	3,225	21.1
3	Bird	3,433	12.2	3	Mammal	2,550	16.7
4	Mollusk	3,141	11.1	4	Mollusk	1,654	10.8
5	Coral	2,381	8.4	5	Fish	1,350	8.8
6	Fish	2,219	7.9	6	Bird	871	5.7
7	Marine Mammal	798	2.8	7	Arachnida	101	0.7
8	Insect	499	1.8	8	Marine Mammal	90	0.6
9	Amphibian	191	0.7	9	Insect	75	0.5
10	Arachnida	135	0.5	10	Amphibian	26	0.2

* This list only documents known species that were seized.

Table 7.2 Top ten most seized product types by % of incidents in the US and the EU (2003–2010)

US Seizures			*EU Seizures*		
Rank	*Types of Products**	*%*	*Rank*	*Types of Products*	*%*
1	Small leather product	10.3	1	Whole corals	21.1
2	Garments (including shoes)	10.3	2	Live specimens	14.3
3	Medicinal part/product	9.7	3	Shells	9.7
4	Carvings	8.4	4	Dead animal (whole)	8.4
5	Shells	7.4	5	Small leather product	7.9
6	Meat	6.8	6	Caviar	7.0
7	Dead animal (whole)	6.5	7	Large leather product	5.0
8	Live specimens	6.0	8	Skins	3.9
9	Whole corals	4.7	9	Carvings	3.7
10	Trophy (all parts)	4.6	10	Derivatives	3.5

* The US top ten products (out of 76) account for 64% of all seizures in the LEMIS Dataset and EU top ten products (out of 45) account for 76% in the TWIX-EU dataset.

Table 7.2 shows the top ten most common types of wildlife seized. These ten types account for three-quarters or more of the documented product type seizures in both the US (74.7%) and the EU (84.5%). Most seizures are related to animal products in the US (94.0%) and the EU (85.7%), rather than live animals (6.0% and 14.3%, respectively). Many types of wildlife products are associated with one of the US or EU wildlife groupings. For instance, most leather products were made of reptiles, seizures of medicinal products were predominantly from mammals, while live animals consist mainly of live reptiles and live birds. Seizures of garments, meat, medicinal part/product, and trophies were only identified in the top ten in the US, while caviar, large leather products, skins, and derivatives seem to play a more important role in the EU.[5]

Table 7.3 presents the most seized genera in both the US and the EU. Following upon the prominent presence of reptiles in wildlife seizures, the majority of

Table 7.3 Top 25 genera seized by *N* of incidents in the US and the EU (2003–2010)

US Seizures					*EU Seizures*			
Rank	*Genus*	*Common Name*	*Incident*	*%*	*Genus*	*Common Name*	*Incident*	*%*
1	*Crocodylus*	Crocodile	1170	4.1	*Loxodonta*	Elephant	976	6.4
2	*Caiman*	Caiman	769	2.7	*Strombus*	Sea snail	940	6.1
3	*Panthera*	Big cats	767	2.7	*Testudo*	Tortoise	710	4.6
4	*Python*	Python	751	2.7	*Python*	Python	616	4.0
5	*Varanus*	Large lizard	597	2.1	*Naja*	Snake	503	3.3
6	*Ursus*	Bear	589	2.1	*Varanus*	Large lizard	266	1.7
7	*Alligator*	Alligator	588	2.1	*Crocodylus*	Crocodile	255	1.7
8	*Moschus*	Deer	584	2.1	*Hippocampus*	Seahorse	228	1.5
9	*Struthio*	Ostrich	583	2.1	*Panthera*	Big cats	215	1.4
10	*Loxodonta*	Elephant	524	1.9	*Ursus*	Bear	175	1.1
11	*Hippocampus*	Seahorse	483	1.7	*Moschus*	Deer	172	1.1
12	*Pinctada*	Clam	478	1.7	*Alligator*	Alligator	170	1.1
13	*Strombus*	Sea snail	467	1.7	*Tridacna*	Clam	154	1.0
14	*Odocoileus*	Deer	438	1.6	*Trachemys*	Turtle	137	0.9
15	*Acipenser*	Sturgeon	374	1.3	*Acropora*	Coral	114	0.7
16	*Saiga*	Antelope	304	1.1	*Chamaeleo*	Chamaeleon	113	0.7
17	*Corallium*	Coral	295	1.0	*Pocillopora*	Coral	111	0.7
18	*Huso*	Sturgeon	265	0.9	*Boa*	Boa	103	0.7
19	*Iguana*	Iguana	262	0.9	*Tupinambis*	Lizard	100	0.7
20	*Tridacna*	Giant clam	254	0.9	*Canis*	Canid	90	0.6
21	*Anas*	Duck	209	0.7	*Elephas*	Elephant	88	0.6
22	*Cervus*	Deer	193	0.7	*Acipenser*	Sturgeon	79	0.5
23	*Naja*	Snake	180	0.6	*Pandinus*	Scorpion	76	0.5
24	*Crotalus*	Viper	168	0.6	*Psittacus*	Parrot	72	0.5
25	*Phoca*	Seal	166	0.6	*Amazona*	Parrot	59	0.4

* The top 25 seized genera in the United States, or 2% of all genera, account for 40.6% of all known and unknown genera seizures. In the EU, the top 25 seized genera, or 5.8% of all genera, account for 42.5% of all known and unknown genera seizures.

genera in both top five lists were reptiles. The reptile products consist mainly of crocodile, caiman, lizard and snake species, while big cats (e.g., tigers, leopards), bears (e.g., black bears) and deer (e.g., musk and saiga deer) were mainly related to Asian traditional medicine (ATM). Tortoises and parrots were predominantly related to live animals. In both demand markets, the top ten seized genera included crocodiles, big cats, pythons, large lizards, bears, and elephants.

Regarding the top panel in Figure 7.1, the Lorenz-plot curve reveals the inequality of genera seizures in the EU and the US more comprehensively than Table 7.3. Because the observed lines for both the EU and the US significantly deviate from the line of equality, it can be concluded that a small proportion of genera account for a large share of seizures. In fact, the Gini coefficient for the US is 0.845 and the EU is 0.846, proving that a small proportion of genera in both datasets account for most seizures (see also Table 7.3).

As it relates to exporting country of wildlife contraband, the bottom panel in Figure 7.1 reveals the inequality of seizures from exporting nations across all nations. The Gini coefficient for the US is 0.828 and the EU is 0.716, proving that a few nations account for most wildlife seizures made in both the EU and the

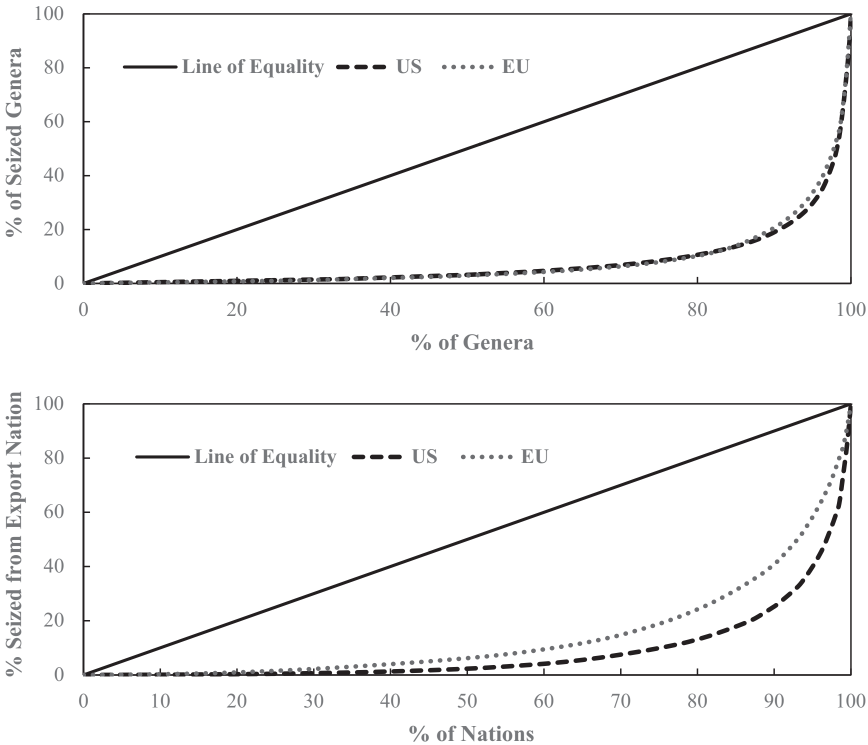

Figure 7.1 Lorenz-plot curve of seizures by genera (top panel) and export country (bottom panel) in the EU and the US

US. In fact, there are some similarities of problematic countries in both demand markets. For example, Southeast Asia and China account for a large share of seizures in both markets. In the US, 30% of all seizures are exported from China, Thailand, the Philippines, Hong Kong, Vietnam, and Indonesia, whereas in the EU, 17.6% of all seizures emanate from China, Indonesia, Vietnam, and Thailand. However, a number of differences between the two major demand markets also exist. In the US, for example, two of the top three problematic exporters are their North American neighbors, Mexico and Canada, accounting for a quarter of all seizures. In the EU, however, Mexico only accounts for 1.5% of seizures, while neighboring regions or countries, such as North Africa (Egypt, Algeria, Morocco, and Tunisia), account for 9.6%. In addition, Russia and Ukraine are responsible for 6.0%, and Switzerland (a non-EU member) is responsible for 1.5% of seizures. Interestingly, the top exporter of seizures into the EU is the US, with 8.8%.

Discussion

Sociocultural demand

In an effort to identify the impact of social and cultural demand in shaping the trade patterns of illegal wildlife imports into the world's major markets, the US and the EU, we examined data on seizures of wildlife entering these markets between 2003 and 2010. Over 28,000 seizures from the US LEMIS database and over 15,000 from the EU-TWIX database were analyzed. The discrepancy between those values alone provides an insight into wildlife demand. In comparing these values with the populations of the EU and US – 508 million and 323 million, respectively – the US has roughly half the population and nearly double the number of seizures. This would suggest that the US has either a larger overall demand for wildlife products or more thorough detection and enforcement activities, or a combination of the two. While we cannot eliminate the latter explanation, it seems unlikely, as there are so few US Fish and Wildlife Service agents tending to this problem in the US. The US only has 330 agents nationwide to inspect millions of shipments and declarations of imported wildlife every year (Fears, 2014). To measure the sociocultural demand patterns, we examined wildlife seizures by identifying specific animal groupings and genera in both markets. By linking these illegal trade findings to existing literature on wildlife demand in both the US and EU, we aimed to reveal embedded social and cultural demand similarities and differences for wildlife that is at the heart of the trade.

Similarities in emerging sociocultural patterns

Various sociocultural patterns emerged through the data analysis. Specifically, the analysis revealed demand similarities in the US and EU for reptiles, mammals, mollusks, and fish. Further examination of the data at the product level indicated that, generally, animal products were preferred over live species in both markets.

Over half of the species illegally imported in both markets were reptiles and mammals, with reptile products and raw mammal products dominating the seizures within these two groups. Reptiles alone, which included snakes, lizards, amphibians, crocodiles, turtles, tortoises, and tuataras (IUCN, 2013), were the largest group in both markets, making up approximately one-third of seizures. At the lower taxonomic level of genus, many of the most seized reptiles were found in the top 25 list in both markets. For example, *Crocodylus, Python, Varanus, Alligator*, and *Naja* disproportionately accounted for most seizures in both markets. Overall, reptile seizures consisted primarily of products, such as skins or by-products for medicinal purposes, as opposed to live specimens. The EU has previously been identified as the world's largest importer by value of reptile skins (Engler and Parry-Jones, 2007), importing a large number of the over ten million reptiles that are killed annually for the largely unregulated leather industry (Liddick, 2011). Substantial and diverse, our data analysis indicates the existence of a large sociocultural demand for reptiles for products in both the US and EU. Frequently seized products of large monitor lizards (*Varanus* spp.) and reticulated python (*Python reticulatus*), for example, are particularly prized for processing into luxury leather goods, such as handbags and shoes (Natusch and Lyons, 2014; Engler and Parry-Jones, 2007). This poses a serious threat to wild populations in the forms of species removal. As of 2013, 1 in 5 reptile species was threatened with extinction (Böhm et al., 2013).

The mammal grouping, which came in second for the US and third for the EU, consisted mainly of raw products for traditional Asian medicine. Although the data reflect that wildlife was imported for numerous reasons, medicinal parts and products made up 9.7% of US seizures and did not appear in the top ten EU categories. However, in the EU, medicine, dominated by ATM, is the largest category across categories in terms of quantity (>47,000 medicines), including mammal products such as big cat, musk deer, bear, saiga antelope, pangolin, and rhinoceros products. Although the effectiveness of traditional Asian medicine treatments is debated (Swan and Conrad, 2014), it is clear that a sociocultural demand has created a sizable market in the Western world (Still, 2003; Jia, 2012; Williamson et al., 2013).

Similar rates of seizures for mollusks and fish in both the US and EU indicate equal demand for these groups, and similar sociocultural preferences. Caviar, included in the fish grouping, was the sixth-most commonly seized EU product but did not appear in the top ten US seizures by product type. This would indicate that although these group seizure rates were similar, the makeup of these groups is likely distinct and varied. However, both Europe and the US are well-known outlets for legitimate and illegitimate caviar (Zabyelina, 2014; Van Uhm and Siegel, 2016).

Diverging sociocultural patterns

Aside from the discrepancy in medicinal product seizures and likely seafood makeup, the findings revealed substantial differences between four categories: corals, birds, the elephant genera, and garments. Overall, less than half of the genera seized in the US coincided with those seized in the EU, most likely reflecting similar cultural demand. Importantly, the Lorenz curve plots demonstrated that a small proportion of genera accounted for a large proportion of seizures in both the US and EU. That said, there were substantial differences. The EU had 1.3 times as many seizures for coral by number of incidents than the US, and 1.9 times as many seizures of the elephant genera. The US, in contrast, had four times as many bird seizures.

Coral was the second most common EU seizure. At the grouping level, corals accounted for 21.1% of all EU imports while accounting for only 8.4% of US imports. Examination at the product level suggests that "whole corals" accounted for the majority of the EU coral seizures. This would imply that corals were imported primarily for jewelry and decorative uses as opposed to marine aquaria purposes. According to Green and Shirley (1999) and Wood et al. (2012), rising demand in Europe for coral has been noticed since the 1990s. The 1.3 time discrepancy in the coral seizures by number of incidents and 2.5 time discrepancy relating to whole coral imports is suggestive of a much stronger sociocultural demand for corals in the EU. This market puts pressure on coral reefs, one-fourth of which are considered damaged beyond repair, and another two-thirds under serious threat (e.g., Carpenter et al., 2008).

Another notable discrepancy between the US and EU was identified for the genus *Loxodonta*. A recent report has identified Spain, the UK, France, and Germany as the four countries that have seized the largest amount of ivory in the EU, all four have seized over one ton and together account for nearly three-quarters of the total EU volume (EIA, 2017). The substantial number of seizures occurring within Europe highlights the significant role the EU has in the global ivory trade (Martin and Stiles, 2008; EIA, 2017).

With regard to birds and garments disproportionately seized in the US as compared to the EU, the differences were striking: bird seizures in the US were four times that of the EU. This discrepancy may be explained by the EU ban on bird imports. As of 2006, wild birds are hardly legally imported to the EU due to protection measures in response to the growing threat of avian influenza (2005/94/E.G.; Cooney and Jepson, 2006). The trade in wild birds has dropped by 90% between 2005 and 2011, translating to a decrease from 1.3 million individuals traded to merely 130,000 (Reino et al., 2017). The existence of this trade ban could explain the comparatively higher levels of US bird imports.

The role of opportunity

The demand in these major markets could be driven by not only sociocultural practices but also opportunity in the form of proximity to the markets that can meet this demand. Some of the genera frequently seized in the United States, such as deer (*Cervus*), caiman, iguana, great horned owl and Canada goose, are specific to the North and South American continents. This could indicate that demand for this wildlife in the US could be a mere reflection of the availability and accessibility of these species in neighboring countries. Easier access to transportation routes from these countries into the United States in addition to US citizens vacationing in neighboring countries more often (and bringing back illicit wildlife souvenirs), could explain the reason why these species appear in the US more often than in the EU. Similarly, in the EU, the demand for tortoises, corals, chameleons, and parrots, some of which originate from Africa, such as the spur-thighed tortoise, the African grey parrot (*Psittacus erithacus*) or the common chameleon (*Chamaeleo chamaeleon*), could be driven by the relative proximity to and accessibility of these species for EU markets. For example, since the late 1990s, Europe is highly involved in the illegal trade in spur-thighed tortoises, where Morocco serves as its main supplier (Interpol, 1996; Bergin and Nijman, 2014). Consequently, certain populations of spur-thighed tortoises have suffered over a 90% decline in Morocco (Van Dijk et al., 2004).

Concentrations were also evident when seizures from exporting countries were examined. The findings revealed that not only did a handful of countries accounted for most exports into both the EU and the US, but also that these markets shared similar exporters, namely Thailand, China, Indonesia, and Vietnam. Importantly, 25% of the seizures made in the US were from its neighboring countries, Mexico and Canada. The relatively large proportion of imports from these two countries could be explained, in part, by busy travel between these countries and the US (Petrossian et al., 2016) or deer hunting patterns from Canada into the US (Ferrier, 2009). This pattern of proximity relating to seizures, however, was not as evident with EU seizures. Only 17% of seizures made in the EU were exported from non-EU states nearby such as North African nations, Switzerland, Russia, and Ukraine.

Policy implications

Comparing patterns of illegal wildlife imports into these two major markets and drawing conclusions about the similarities and differences in these patterns can help devise useful policy recommendations.

Where the US and the EU face similar problems, such as in the case of types of products and the common exporting countries, countries can work closely to devise collaborative prevention strategies. “Illegal markets will thrive as long as there is a public demand for their commodities” (Paoli, 2002: 88). Sociocultural demand patterns reflect the importance of influencing consumer behavior with consumer education campaigns (Ayling, 2015). Identified consumer patterns in the US and the EU can help inform (including education and guilt creation) both the purchasers and the traders about the serious threat of wildlife trade for endangered populations. This has to take into account different kinds of harms, as the illegal wildlife trade may affect humans, local and global environments, and animals (White, 2011). Because sociocultural shifts and trends in demand patterns are often intricate, idiosyncratic, and difficult to tackle – with some noteworthy exceptions[6] – policy changes in the destination countries can be rather easy and may have considerable impact.

At the respective countries' ports of entry, limited inspection resources can be allocated to the specific species groups (and genera), especially if these are imported from the identified countries known to be repeat "offenders." Measures, such as requirements that export documents be provided electronically and approved before the exports are initiated, and inspecting the imports more rigorously that involve these genera and the identified exporters at arrival, are likely to not only deter the exporters from shipping illegally obtained goods but also discourage them from engaging in obtaining such goods in the future. The reduction in the demand at these major markets may lead to the reduction in the supply (Schneider, 2008).

Another option would be in line with the EU-IUU Regulation. The EU-IUU Regulation requires that the EU assess exporting countries based on their efforts to address illegal fishing in their waters. These countries then receive green (good), yellow (warning), and red (failed) cards, where the latter means temporary trade bans on all the imports of fishery products until the country that received a red card demonstrated that it made significant steps to address illegal fishing within its waters (The EU IUU Regulation, 2016). Similarities in the types of products and the top exporters of these products indicate that not only there is similar demand for illegally harvested wildlife, but also this demand is met by a handful of suppliers (i.e., countries). Therefore, creating similar programs in the form of trade sanctions as a way of "strengthening formal surveillance" can be a useful tool in curbing illegal imports from these countries, as well as serve as a deterrent for other likely emerging exporters.

Finally, normative reactions, such as blaming, shaming, and rewarding (e.g., Braithwaite, 1989) may be successful in reducing the illegal wildlife trade. For example, campaigners have supplied scientific evidence regarding stocks and habitats of whales and reported on violations of quotas and hunting restrictions. By blaming countries and companies involved in the hunting, this resulted in norm development, raising awareness, and persuading states to embrace tougher regulations (Eilstrup-Sangiovanni and Bondaroff, 2014). From that perspective, the US and EU as being important wildlife consumers, or identified source states in the illegal wildlife market can be influenced by normative blaming and shaming reactions (e.g., Eilstrup-Sangiovanni and Bondaroff, 2014).

Future research and conclusions

That there is urgent need to stop the overexploitation of natural resources and the killing of wildlife is incontrovertible. This illegal activity has a multitude of harmful consequences not only for the wildlife involved, but also for humans and the world ecosystems. For some species, such as the West African black rhinoceros, illegal hunting has led to extinction. Thousands of other species suffer plummeting populations as a consequence of wildlife overexploitation. And if the current rates of overexploitation remain unchanged, it will soon be impossible for certain species to fully recover. Informing consumers with education campaigns and normative reactions, such as blaming, shaming, and rewarding actions of perpetrators or countries may be successful in reducing the trade in wildlife. More can be done to ascertain risk at ports of entry into major demand markets to increase the difficulty and risk of transporting illicit wildlife, and this paper offers one way of doing so. Unfortunately, we could not obtain reliable seizure data at the port level in both datasets, which precluded us from analyzing variation in seizures at the port level. Data on the number of law enforcement agents and wildlife shipments in each port was also unavailable so that we could calculate a seizure *rate* and determine whether the United States does indeed have a higher demand for protected wildlife or the higher number of seizures experienced in the US is merely a reflection of better enforcement techniques. Future research could attempt to obtain such data to identify patterns of the illegal wildlife trade at the more micro-level and determine the effectiveness of law enforcement efforts to curtail the trade. Alternatively, these patterns could be explained by a political economy approach, by arguing that species demand is driven by the organization of global capitalism (see Stretesky et. al., 2018; Rice, 2007). Empirical assessments of this viewpoint have been made in terms of global fisheries (Clausen and Clark, 2005) and overall species decline (McKinney et al., 2010; Lynch et al., 2015; Shandra et al., 2010), and future analyses that combine this viewpoint to that of the sociocultural demand explanation may reveal interesting results.

Notes

1 This may be due to TRAFFIC's focus on frequently publishing about mammals.
2 COR stands for coral, raw or unworked, excluding live or coral rock.
3 CPR stands for coral products.
4 ROC stands for live rock (e.g., coral rock).
5 Note that animal products may be placed in different categories: an animal skin may be placed in the category garments in the US and in the category skins in the EU.
6 For a long time Japan ranked as the world's largest importer of rhinoceros horn and ivory, but due to domestic awareness campaigns and social pressure, the market for these products declined significantly over the years (Kitade and Toko, 2016).

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