

Wildlife Trade Challenges: Navigating Legal and Illegal Imports into the USA

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Abstract

The United States of America (USA) is the largest consumer of internationally legally traded wildlife in the world. A proportion of this trade consists of species, products and parts listed under the Convention on International Trade in Endangered Species (CITES), which are recorded in the CITES Trade Database. Using this database, we quantified wildlife entering the USA from major exporting countries and political regions, as well as the most traded wildlife products and taxonomic groups. The trends in legal trade, and seizures of illegally traded items, over time were also examined for 21 taxonomic groups, and the relationships between legal trade and seizures were tested against four national measures of biodiversity. We found that: 1) there seems to be an overall relationship between legal and illegal trade flows; 2) Asia was the main region exporting CITES-listed wildlife products and parts to the USA between 1979 and 2013; 3) some taxonomic groups are traded more frequently for consumption while others are more frequently traded as pets or fashion items; 4) bears, crocodylians and the group 'other mammals' (mammals that do not fall into Ursidae, Felidae, Cetacea, Proboscidea, Primates or Rhinocerotidae) increased in both legal trade and

seizures from 1980 to 2013; 5) both seizures and legally traded items from felines and elephants have significantly decreased through time; 6) volumes of legally traded species and seizures are correlated with four attributes of exporting countries: species endemism, species richness, number of IUCN threatened species and country size. One of the challenges facing analyses documenting legal and illegal trade in CITES-listed species is the variation in reporting efficiency and enforcement over time; this is minimised here because we only use import and seizure data from one country – the United States – which has maintained a similar enforcement system over time. We therefore provide a broadly comprehensive analysis of wildlife imports into the USA in a form that can be used by CITES-enforcing agencies such as the U.S. Fish and Wildlife Service to improve decision-making and encourage further exploration of trade patterns and their consequences for species in trade and the conservation of biodiversity of exporting countries.

Keywords CITES, legal wildlife trade, illegal wildlife trade, conservation, CITES Trade Database, United States of America, consumer demand, consumer awareness

Introduction

Annual international trade in wildlife and wildlife products is worth billions of dollars and involves hundreds of millions of plants and animals from tens of thousands of species (TRAFFIC, 2016; Harfoot et al., in press). This trade includes skins, timber, and animal parts used as medicinal ingredients, food, live pets, and trophies, among others (TRAFFIC, 2016; Wyler & Sheikh, 2008; Harfoot et al., in press). Wildlife trade poses one of the biggest conservation challenges globally (Joppa et al., 2016), but also has the potential to play a role in conservation through the sustainable use and management of populations as well as through the generation of conservation incentives (Broad et al., 2003).

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international, multilateral agreement among 183 member states that aims to ensure that the international trade in 35,000 species of wild animals and plants does not jeopardize the survival of these populations in the wild and is legal, sustainable and traceable (CITES, 2016c). This is done through a set of rules which regulate and monitor trade, including a licensing system and requirements to assess that trade is not detrimental to populations before it is permitted, i.e. through the development of national-level Non-Detriment Findings (CITES, 2016a; CITES, 2016b; Hemley, 1994). In the United States, for species listed under the Endangered Species Act (ESA), in addition to Non-Detriment Findings (NDFs), enhancement findings must be made to demonstrate that trade is not only not harmful but enhances the survival of the species in the wild in the country of export. CITES is considered one of the most important Multilateral Environmental Agreements (MEAs) in reducing biodiversity loss and has the potential to play a pivotal role in stemming the trade of threatened species including those listed under ESA. However, despite great strides by CITES since its inception in 1975 it has not been able to fully stem illegal trade in CITES-listed species or derived commodities.

In this paper we analyse the imports of CITES-listed species and products into the USA between 1979 and 2014. We focus on the USA because it is one of the biggest global importers of wildlife and wildlife products both legally and illegally (UNODC, 2016; Petrossian et al., 2016). Furthermore, the USA has an effective system of recording trade in CITES-listed and non-listed species, and for recording seizures that do not comply with CITES, other USA domestic regulations, and regulations in other countries (through the more than 100-year-old Lacey Act) making it an ideal candidate country for analysis. We aimed to illustrate patterns in trade, both in space and time, into the USA, as well as to identify exporting country-level characteristics associated with the magnitude of trade. Our goal is to inform both current international discussions on legal and illegal wildlife trade and consumer awareness programs (e.g. Wildaid) as well as to provide both an evidence base and baseline for further analysis and material relevant to decision-making within CITES and at national levels. The latter could include, for example, the meeting of obligations by the USA of its END Wildlife Trafficking Act, the inter-agency task force for which submitted a list of “focus countries” in late 2017 (<https://www.state.gov/e/oes/rls/rpts/275703.htm>).

Methods

Trade data

We used the global CITES Trade Database that compiles all wildlife trade data submitted by national CITES authorities to the CITES Secretariat in annual reports to CITES (see details in UNEP-WCMC, 2013). This database contains the best available datasets on legal trade and seizures into the USA over a period of 36 years. Despite this, there are important limitations to this data source. First, species not listed by CITES are not captured in our data, which includes numerous species of reptiles destined for the USA pet trade (Robinson et al., 2015), and many species of plants for ornamental gardens (Hinsley et al., 2017). Second, the objective of CITES is to regulate international wildlife trade. Thus all trade within national borders of species listed by CITES is unregulated unless there is relevant national legislation in place, as, for example, in the U.S. where, since July 2016, there is a near total ban on commercial trade in African elephant ivory domestically (UNODC, 2016). From the CITES Trade Database, which is managed by UNEP-WCMC, we used all available trade records (or transactions) between 1979 and 2014, for both legal imports and seizures into the USA, that were entered into the database before 4 July 2016. For each record we extracted information on 1) year of the trade or seizure event, 2) taxonomy (i.e. class, order, family, genus, and species), 3) exporting country, 4) country of origin, 5) quantity (number or units), and 6) type of product. Only data reported by the USA was used for the analysis (i.e. importer reported quantity). Trade data were in the form of “comparative tabulation”, which brings together shipments containing the same species and where all other parameters match, as explained in the CITES Trade Database manual (UNEP-WCMC, 2013; and Robinson & Sinovas 2018). The raw data were cleaned using a standardised set of conversions that removed obsolete and outdated terms (i.e. products), units, quantities and so on (for details see online

material: Table S1). Among others, this reduced the number of products from 94 to 82. Only these converted data were used in further analyses.

The CITES Trade Database contains a range of different units (i.e. number, weight, volume and length) depending on what is appropriate for the specific record. We used only records measured in either weight or numbers in our analysis as both measures of volume and length were very sparse for all species groups in the dataset, except plants. As a result, different types of timber products are excluded from the analysis.

Likewise, more than 90 different types of products are reported in the database, some only very rarely (for details see online material Table S2). Here we analyse data across all types of products and also focus on four specific product types with great relevance to conservation and where data were sufficient: 1) live, 2) processed leather products (i.e. not unprocessed skins, pelts, etc.), 3) meat and 4) trophies (see online material: Tables S2 and S5) which we analysed for all importing countries as well as UN Environment (UNEP) regions separately as set out in Brooks et al. (2016).

Trends over time

We conducted linear regression to examine trends over time based on the number of wildlife products and parts. As not all species have been CITES-listed for the same amount of time and because different taxa might experience different trajectories in trade over time, we aggregated all data into 21 taxonomic groups (Table S2). The start and end years in our time-series, 1979 and 2014 were excluded because these, almost consistently, lacked values for seizure data. Analyses are presented in terms of exporting countries and UN Environment (UNEP) regions as set out in Brooks et al. (2016).

Drivers of import

We modelled the scale of imports across countries into the USA using a Generalized Linear Model (GLM) accounting for a suite of explanatory variables: 1) species richness in the exporting country, 2) level of endemism (number of endemic species) in exporting country, 3) size of the exporting country (in square km) and 4) the number of IUCN threatened species in exporting country (Table 1). Data on species richness and endemism, as well as country size, were sourced from the World Atlas of Biodiversity from UNEP-WCMC (Groombridge & Jenkins, 2002), which presents standardised national information. However, this provided data on only mammals, birds and plants. The most updated data on number of threatened species per country were extracted from the IUCN Red List (IUCN Red List, 2013) and, unlike the Word Atlas of Biodiversity, it provided data across all taxonomic groups listed in the CITES Trade Database. Model selection was based on AICc (i.e., corrected Akaike Information Criteria). All statistical analysis was done in JMP 12.0.

Results

Main exporters to the USA

In total almost a billion (n=820,172,977) legal and five million (n=5,094,253) seized wildlife products and parts were reported in the USA between 1979 and 2014. Taiwan, Province of China (n=141,499,940), Thailand (n=109,269,627), and China (n=77,688,971) were the largest exporters of legal goods in all categories (Figure 1A, Table S3), while the top exporting countries of seized wildlife products/parts were China (n=1,532,175), Indonesia (n=935,399) and Taiwan, Province of China (n=279,011) (Figure 1B, Table S4).

We assessed the imports of the four types of products (live, processed leather products, meat, and trophies) based on UN Environment regions. North America (i.e. Canada) exported the largest number of legal trophies and trophy parts to the USA (n=195,549 individuals, equal to 5,587 per year), the majority of these were bears (American black bear (*Ursus americanus*) and brown bear (*Ursus arctos*)), followed by 72,109 legal trophies from Asia and the Pacific (Figure 2D), which were mainly teeth from hippo (*Hippopotamus amphibius*) and ivory tusks from African elephants (*Loxodonta africana*), exported from the Hong Kong Special Administrative Region of China (these products were originally sourced from Africa). Africa exported the largest number of trophies seized upon entry into the USA (n=1,690) including birds, cats, elephants, other mammals, primates and rhinos. Most of the legally imported leather products were exported from Europe (n=46,590,955), while Latin America and the Caribbean (n=191,338) exported most illegal processed leather products (figure 2B). Latin America and the Caribbean exported the most meat to the USA both legally (n=28,091,630 kg) and seized (n= 390,473 kg) (Figure 2C). This meat was mainly from queen conch (*Strombus gigas*).

Overall, plants were more common than animals in the trade of live specimens, for both legal trade and seizures. Asia and the Pacific provided the most for both legal plants (n = 273,854,354) and animals (n = 18,602,706) and also for seizures of plants (n = 230,599) and animals (n = 53,660) (Figure 2A). The majority of live plants from the region were orchids (Orchidaceae spp. And O. hybrid), cycads (Cycadaceae) and euphorbia (*Euphorbia*) legally exported from Taiwan, Province of China and Thailand as well as ramin wood (*Gonystylus*) seized upon entry from Indonesia and China. Live animals from Asia and the Pacific included black corals (*Antipatharia spp.*) and acropora corals (*Acropora spp.*) seized upon entry from Taiwan, Province of China, stony corals (*Sclerantia spp*) legally exported from Indonesia as well as different bird species, including seized Eurasian teal (*Anas crecca*) from Hong Kong and legally exported species of parrots, such as cockatoos (e.g. white cockatoo (*Cacatua alba*) and the Tanimbar corella (*Cacatua goffiniana*)) from Indonesia. Furthermore, Latin America and the Caribbean also exported large numbers of live birds, which also include parrot species, such as legally imported and seized parakeets (e.g. Nanday

parakeet (*Aratinga nenday*) and the white-winged parakeet (*Brotogeris versicolurus*) from Argentina and Peru.

Trade over time

Total trade for all 21 taxonomic groups and products combined increased from 1980 to 2013 (Table 2). There was a statistically significant increase in legal trade of arachnids, corals, insects, leeches, sea cucumbers, bears, crocodilians, other mammals, sea turtles and tortoises and plants (Table 2). In contrast, there was a statistically significant decrease in legal trade of clams/snails, amphibians, elephants, lizards, rhinos and snakes from 1980 to 2013 (Table 2). For seizures we observed significant increases for clams and snails, bears, cetaceans, crocodilians, fish and other mammals and significant linear decreases in seized quantities of cats and elephants (Table 2). Only in the clams/snails group did legal trade decline while seizures increased. Trade in the parts of elephants (African and Asian) decreased in both legal trade and seizures over time (Table 2).

Explanatory factors of trade

Our analyses showed significant correlations between legal trade and country area size, species diversity, number of endemics and number of IUCN threatened species respectively, though the amount of variation in legal trade was often small (< 5%) (Table 3). More significant positive correlations were observed for illegal imports and the same four independent variables, particularly between seizures and the number of endemic species in a country ($r^2 = 0.43$, $P < 0.0001$). When we used GLMs to determine the most parsimonious model, we found that a model that included only area of the exporting country was the best model). In reality, many additional factors contribute to trade patterns, such as adding species to the CITES list (Janine & Sinovas, 2018), trade restrictions and CITES processes (e.g. reservations, split-listings, Reviews of Significant Trade), and decisions made at national levels for example the re-establishment of a domestic trade in rhino horn in South Africa or the lifting in the U.S. of restrictions in interstate trade of injurious species such as Burmese pythons (<http://www.newsweek.com/landmark-case-paves-way-animals-pythons-be-legally-traded-us-583137>).

Discussion

Our analysis shows that the largest overall exporters of both legal and illegal wildlife products and parts in to the USA are in Asia, but that geographic variation exists depending on product type. Asia's dominance is not surprising, and Southeast Asia in particular, has been identified as a wildlife trade hotspot (e.g. a region where wildlife trade poses a disproportionately large threat to biodiversity (Nijman, 2010; Rosen & Smith 2010; Petrossian et al. 2016). According to Wyler & Sheikh (2008), the globalisation of trade as well as the internalisation of the American population has resulted in demand for traditional Asian medicine spreading from Asia to the USA. In 2010 there were approximately 17 million Asian Americans living in the USA (Hoeffel et al., 2012). Even if only a fraction of this population uses traditional Asian medicine (e.g., shark

fins, pangolin meat and scales as well as fish including seahorses), it would still represent a considerable demand (see also UNODC 2013). For meat, Latin America and the Caribbean was the largest exporting region and also exported large volumes of live animals. The meat imported into the USA consisted mainly of Queen conch, legally exported from Honduras, and seized upon entry from Jamaica and Bahamas as well as meat from Arapaima fish (*Arapaima gigas*) legally exported from Peru. Furthermore, this region also exported large quantities of live animals, the majority of these were parrot species. The large quantities of imports from this particular region might relate to the close proximity to the USA and desire for faster and easier access to US markets, as well as US tourism to these countries and other factors as suggested by several previous studies (Petrossian et al., 2016; Reino et al., 2017). The almost complete lack of meats imported from any regions other than Latin America and the Caribbean and to some extent Asia-Pacific confirms this notion.

Our results show that the number of legally reported animal and plant products in to the USA massively outnumber the amount seized (by a factor of 161), but that with more than five million items registered in seizures between 1978 and 2014, illegal trade in to the USA is considerable and can pose a significant risk to biodiversity conservation. In contrast to the broader global trends (see Milliken, 2014; Underwood et al., 2013; Funston et al., 2016), this study suggests that there has been a decrease in seizures of products from cats, elephants and rhinos in to the US. We identify three factors that might contribute to these observed patterns 1) improvements in enforcement and anti-poaching efforts in the exporting countries (Milliken, 2014; Stoner & Pervushina, 2012), 2) wild population declines, making the species less available and 3) large demand and export directly from range states to Asia (and hence not to the USA). However, poaching activities have also escalated using more sophisticated equipment and approaches, including increased use of online markets on the dark web (Stoner & Pervushina, 2012). Thus, it is likely that increased demand from the largest importer of ivory and rhino horn (i.e., Asia) has displaced trade of rare animal products and in part explains the reduced imports into the USA (Milliken, 2014; Underwood et al., 2013).

For most commodities, countries accounting for the biggest share of the legal trade also exported the largest number of illegal products suggesting an overall relationship between legal and illegal trade flows. The two most important exceptions to this were processed leather products and trophies. For leather products, for which Latin America and the Caribbean were responsible for most of the seized exports, Europe and Asia-Pacific accounted for most of the legal exports. While Europe dominated the legal trade of processed leather products, these do not originate from Europe but are imported to the fashion houses in Italy, and to a lesser extent, France and other European countries from other parts of the world – and then re-exported to the USA. Seized trophies came predominantly from Africa, Latin America and the Caribbean, and Asia-Pacific while legally imported trophies were sourced predominantly from legal hunts of grizzly bears (*Ursus arctos ssp.*) and American black bears (*U. americanus*) in Canada (Garshelis et al., 2008; McLellan et al., 2008;

Petrossian et al., 2016). While Africa was the largest exporter of seized trophies, these were dwarfed by the number of legal trophies exported out of Africa. Legal trophy hunting in many African countries is big business, with South Africa alone generating an estimated US \$137 million per year (in 2014) from international hunting (Sinovas et al., 2016). However, while legal regulated trophy hunting has the potential to contribute to sustainable livelihood for local communities, this is a complicated and highly contested area (Economists at Large, 2013). The import of high-values leather products from Europe illustrated another complication of the role of biological resource use in improving local livelihoods; when the value-adding production stage takes place outside of the native range of a species, it reduces in-country benefits including for conservation of wild animals in their range states, and may promote the farming of these species – e.g. crocodiles or even rhinos in southern Africa (Robinson et al., 2015), or ranches of vicuña in South America (Lichtenstein, 2009).

Overall, we found an increase of legal wildlife trade as well as seizures into the USA over time, and there are a number of possible reasons for this increasing trend. First, this increase is associated with globalised markets and economic and human population growth (Nijman, 2010). Second, international travel and transport of goods is becoming easier and more commonplace, also facilitating trade in wildlife and influencing what people desire and demand (Bush et al., 2014). Third, increasing access to online information and markets has been suggested to be a contributing factor to the increasing demand and market expansion for at least pets and ornamental plants and is potentially a bigger factor in illegal than legal trade (Bush et al., 2014; RBG Kew, 2016). U.S. consumer awareness and education should be urgent priorities.

Conservation applications

There are a number of ways in which our analysis can be applied to wildlife trade policy. First, it is clear that the USA remains a major importer and consumer of both legally and illegally traded wildlife products. As a result, the USA has an important role to play in ensuring that legal and sustainable trade can continue to provide conservation incentives and to support local livelihoods in species range countries, while also stepping up efforts against illegal trade to minimise the profitability of wildlife trafficking. Second, the nature of imports into the USA varies depending on the region of export, reflecting the species/products available from each region and the established trade routes, as well as demand. For example, live birds from South America, animal (mainly reptile) skin products originating in Asia and elsewhere and re-exported from southern Europe, carnivore trophies from Canada and Africa, or queen conch and arapaima meat from Latin America. Addressing illegal trade can be informed by this understanding of legal trade routes and the geography of wildlife trade. In addition, actions need to be tailored to region- and country-specific needs. Third, as with legal trade, illegal trade is often re-exported from intermediary countries, highlighting the importance of understanding key entrepôts that might benefit from enforcement or capacity support in addition to countries of origin. Fourth, there are some relationships between the volumes of legal trade and

seizures and attributes of exporting countries in terms of size, species diversity, species endemism and level of biodiversity threat. This can help prioritise countries in terms of where actions might result in the largest impact. Lastly, as the USA refines its list of focal countries as part of its END Wildlife Trafficking Act, these types of in-depth analyses that examine both legal trade and seizures can help inform anti-trafficking. However, as there is a lag in reporting to the CITES Trade Database, it will be a number of years before it is clear whether decisions taken at CITES Conferences of Parties (the last in 2016), or changes in rules and regulations in the USA, have been effective at reducing legal trade in overexploited species, or curbing illegal trade flows along established wildlife trade routes.

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Tables and figures (figure and table text)

Table 1. Taxonomic grouping of species, including products and units reported in each group. Underlined = Products defined as processed leather products. **Bold** = Products defined as trophies. * Mammalia that do not fall into Ursidae, Felidae, Cetacea, Proboscidea, Primates or Rhinocerotidae. ** Class field left empty. Only bears, birds, cats, elephants, other mammals and rhinos were included in trophy analysis.

Table 1. Potential explanatory variables of legal trade and seizures, the associated hypothesis and source of variable.

Table 2. Statistical results of linear regression for all taxonomic groups and total trade with indication of trend, type of relationship, R², slope(s) and p-value. $\alpha = 0.05$.

Table 3. Statistical output from linear regression test of legal trade and seizures against country size in km², overall species richness for mammals, birds and plants, number of endemic mammals, birds and plants and number of threatened species assessed by IUCN, except protists and fungi. $\alpha = 0.05$.

Figure 1A and 1B. Log of the total “number” of wildlife commodities from a country, that were A) legally exported to or B) seized in the USA from 1979 to 2014. Grey countries indicate that no goods have been either exported or reported. The USA has a colour due to re-imports.

Figure 2 (A-D). Legal trade and seizures from each UNEP-region for a) live, b) processed leather products, c) meat and d) trophy parts (bodies, genitalia, horns, tusks, etc). Meat is disclosed in kilograms, whereas live and leather are disclosed in the unit “number” and trophies in counted individuals. Further, live trade is divided into animals and plants.

Supplementary material

S1: Macroconversion table

S2: Table of categorisation of species

S3 and S4: Tables of values for world maps

S5: List with terms included as processed leather products and trophies