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## An overview of seized illegal wildlife entering the United States

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The current study analyses seizures made at US ports of entry between 2003 and 2013, with the aim to identify concentrations of illegal wildlife imports into the United States. Findings show that 94% of species seized belong to six groups – mammals, molluscs, birds, reptiles, fish and coral – with mammals and reptiles making up more than half of all seizure incidents. Additionally, most seized wildlife is imported as leather products, medicinal products and as meat. The majority of seizures emanate from six countries, and illegal wildlife is primarily brought to the US via airline baggage. Temporal trends of wildlife seizures point to increases in the seizures of all groups of species, with the exception of birds. Based on these findings, we recommend using situational crime prevention techniques at US ports of entry to reduce opportunities that enable this trade.

**Keywords:** LEMIS; illegal wildlife trade; environmental criminology; situational crime prevention; wildlife crime; seizures

### Introduction

In April 2013, the UN Commission on Crime Prevention and Criminal Justice concluded that illegal wildlife trade is a ‘serious crime’ and suggested its member countries to treat it as an offence punishable by a maximum deprivation of liberty of at least 4 years.<sup>1</sup> In July 2013, US President Barack Obama signed the ‘Wildlife Trafficking Executive Order’, announcing that ‘[p]oaching operations have expanded beyond small-scale, opportunistic actions to coordinated slaughter commissioned by armed and organized criminal syndicates’,<sup>2</sup> and calling the global community to mobilise efforts to address the problem.

The illegal trade in wildlife is a serious global problem with far-reaching consequences on species biodiversity and the ecosystem as a whole. Thousands of species, such as elephants, rhinos, bears, tigers, turtles and pangolins, are traded illegally, and this trade has resulted in a significant reduction in their numbers in the wild. Some have called this the sixth mass extinction, citing that between 17,000 and 100,000 species disappear from the wild each year,<sup>3</sup> which is primarily due to human intervention.<sup>4</sup> For example, sharp declines in Asian bears (which include the sun bear – *Helarctos malayanus*, the Asiatic black bear – *Ursus thibetanus*, the brown bear – *Ursus arctos* and the sloth bear – *Melursus ursinus*) have been largely attributed to the illegal trade in bear parts, such as paws and gall bladder.<sup>5</sup> In the neotropics, the Spix’s Macaw is now thought to be extinct in the wild, in part, because of the illegal parrot trade.<sup>6</sup>

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Very little is known about the wildlife and fish that illegally enter major demand markets, such as the United States, China and the western European countries.<sup>7</sup> In this study, we present descriptive analyses of seized illegal wildlife entering the US to gain insight about patterns and concentrations. We use the US Fish and Wildlife Service (USFWS) Law Enforcement Management Information Systems (LEMIS) database to examine these seizure patterns over a 10-year period. The next section will give a brief overview of the illegal wildlife trade, followed by a literature review on LEMIS-based research, theoretical framework, methods, results, discussion and policy implications.

### *The illegal trade in wildlife*

The illegal trade in wildlife is estimated to generate between (US) \$9 and \$20 billion annually, excluding fish and timber.<sup>8</sup> Thousands of species are traded in both domestic and global markets for a variety of reasons. For example, in Asia, where a substantial amount of wildlife is being traded,<sup>9</sup> animal parts are trafficked for use in traditional Asian medicines (TAM).<sup>10</sup> Bear paws, shark fins, wild birds (songbirds in particular) and dried abalone are traded for consumption as a delicacy in Asia and Europe.<sup>11</sup> Animal skins and scales are used as wearing apparel,<sup>12</sup> while other animal parts are used as fashion accessories.<sup>13</sup> Lastly, wild animals are often sold live to private collectors and circuses as pets.<sup>14</sup> The ploughshare tortoise, for example, is one of the most sought-after animals in the world, which can sell for (US) \$100,000 for a live specimen.<sup>15</sup>

The general flow of the illegal wildlife trade is from developing to developed nations,<sup>16</sup> and poor African and Southeast Asian countries are affected the most.<sup>17</sup> Developing countries suffer socially and economically, which can lead to a loss of natural resources.<sup>18</sup> Low development and corruption in these countries not only facilitate the illegal exploitation of their natural resources,<sup>19</sup> but also allow criminal organisations to carry out other illegal activities, such as drug trafficking,<sup>20</sup> human trafficking<sup>21</sup> and illegal dumping of hazardous waste.<sup>22</sup>

Different actors are involved in the global illegal trade in wildlife, including organised criminal groups, opportunistic locals and legitimate companies that trade in wildlife. A study conducted by the United Nations suggested that Chinese, Japanese, Russian and Italian organised criminal groups were 'heavily involved' in this trade.<sup>23</sup> However, much of the literature suggesting the involvement of organised crime is primarily anecdotal, as comprehensive studies of actors in the illegal trade are scarce.<sup>24</sup> Other studies propose that the trade is driven by highly opportunistic and loosely organised criminal networks.<sup>25</sup> That is, the illegal trade resembles more 'crime that is organised' than an activity caused by 'organised crime'. Researchers have also suggested that legally registered wildlife trade companies use their legal (infra)structures to facilitate their illegal operations.<sup>26</sup>

To combat the trade in illegal wildlife, numerous regulations have been implemented at national levels, along with international agreements, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES is a treaty signed by 181 nations, formed to protect endangered species from extinction by listing them into three appendices. Appendix I species cannot be traded internationally, with the exception of the trade for scientific exchange, breeding or educational programmes, and in these cases, the trade must be accompanied by both an import and export permit. Appendix II species can be traded with an export permit, and the exporter has to prove that the trade will not be detrimental to the survival of the species in the wild. Appendix III species can be traded when accompanied by an export permit and a certificate of origin. The difference between Appendix II and Appendix III species is

that for the latter, it is not necessary to provide proof that the trade will not be detrimental to the survival of the species in the wild.<sup>27</sup>

Despite the enacted regulations and measures, major source countries continue to supply the global wildlife market with highly coveted species. It is important to document which wildlife and fish are commonly seized in a major demand nation, as this information will allow customs officials in destination countries to implement more focused prevention methods to stop this flow.

### **Overview of LEMIS-based research**

Few studies have previously been conducted to examine the legal and illegal imports of wildlife into the United States. These studies have used the USFWS LEMIS database either as primary or as supplementary data source to explain this trade.

The majority of studies using the LEMIS database conducted species-specific analyses. Such analyses focused on explaining the general trends in imports of sea turtles into the United States<sup>28</sup>; marine tropical fish imported specifically for the marine aquarium markets<sup>29</sup>; imports of 'live rock' and 'corals'<sup>30</sup>; amphibians and reptiles<sup>31</sup>; and ivory,<sup>32</sup> and were descriptive in nature.

Research using the LEMIS database has also evaluated the impact the legal imports have had on spreading diseases and introducing invasive species. Some studies supplemented LEMIS data with sample market data collected from three major US cities to examine the degree to which the trade involved species infected with pathogens,<sup>33</sup> while others examined the risks associated with the imports of Asian swamp eels in the introduction of non-native fish-borne parasites.<sup>34</sup> More recent studies examined data from 2000 to 2006 to determine the extent to which imports listed as 'live' impacted the introduction of invasive species and diseases<sup>35</sup> and evaluated the environmental impacts the invasive non-indigenous species had on Californian waters.<sup>36</sup> Lastly, one study provided a general overview on agricultural and wildlife smuggling for 2000–2004, by focusing particularly on *refusals* of shipments made into the United States.<sup>37</sup> This study, however, did not examine shipment refusals in a comprehensive way and was only partially focused on the illegal wildlife trade.

No study to date has examined overall wildlife *seizures* as a measure of illegal wildlife imports into the United States. This study, therefore, adds to this body of research by identifying and explaining major trends and patterns of *illegal* wildlife imports into the United States by: (1) specifically focusing on seizures representing the illegal aspect of the trade; (2) providing detailed analyses on the most seized groups of species and types of products; (3) providing an analysis of geographic trends; (4) discussing trends over time; and (5) examining illegal imports by mode of transportation. This detailed information on the patterns of concentration by species, types of products seized, origin of the species, temporal trends and preferred modes of transportation can help in formulating preventive strategies that can serve as a reference tool for US customs and border protection officers in their efforts to curb the problem.

### **Theoretical framework**

Until recently, criminological research on wildlife crimes was rare, and most studies were conducted by scholars from other disciplines, such as ecology, conservation biology, economics, sociology and cultural anthropology. An anthropological view, for example, explains the use of traditional medicine containing animal parts as a

cultural practice deeply embedded in Asian societies.<sup>38</sup> Sociological perspectives may explain how the widespread popularity of exotic pets for entertainment is influenced by fashion trends and role models, particularly in the West.<sup>39</sup> Such a perspective can also explain why caviar developed from being the food of the poor to becoming an upper class delicacy.<sup>40</sup> Thus, peoples' changing attitudes and tastes determined the attractiveness of wildlife products.

Early criminological research on wildlife-related crimes approached the issue from the 'harm' perspective, highlighting the (social) anthropocentric harms of the wildlife trade, such as the disappearance of natural resources for local communities. This research challenged conventional criminological definition of crime by focusing on environmental harms, including harms to ecosystems and animals as victims of human actions.<sup>41</sup>

Researchers have also approached the issue from the environmental criminology perspective,<sup>42</sup> the current framework for this article. The theories within this family suggest focusing on the opportunity structures to understand and explain the crime *event*, and paying less attention to the dispositional causes. These theories suggest that crime is a result of opportunities and influences within the built environment, and it is possible to prevent crime if these opportunity structures can be manipulated to make crime more difficult and less rewarding to commit.<sup>43</sup> Environmental criminological theories also posit that opportunities are not randomly spread, but are concentrated across space,<sup>44</sup> time,<sup>45</sup> targets<sup>46</sup> and victims.<sup>47</sup> As such, crime then clusters around these criminal opportunities.

Recent environmental criminological research has analysed wildlife crime in a variety of ways. One such way has identified reasons why some species are poached more often than others.<sup>48</sup> Through this research, poaching concentrations of species were found in numerous countries, suggesting that opportunity structures facilitate and explain poaching variation of particular wildlife and fish. Another line of research has investigated why certain ports or countries are preferred over others when deciding where to offload illegally caught fish.<sup>49</sup> Lastly, environmental criminological lens were used to explain spatial concentrations of illegal fishing activities and elephant poaching.<sup>50</sup>

In the context of wildlife entering the United States illegally, one would expect concentrations as they relate to the exporting country, types of wildlife products, groupings of species and transportation mode. Certain groups of wildlife and fish are highly coveted in the world and largely emanate from certain regions and countries. China is known as a large importer and exporter of illegal wildlife, particularly for TAM. Such medicines often come from mammals, such as pangolins, tigers, rhinos and elephants. As such, there is an expectation that fewer species groups and types of wildlife products will account for most seizures, and that fewer countries will be responsible for most illegal exports. Regarding transportation mode, wildlife is less likely to be transported by vehicle or train in large quantities because of the limitations in logistics and travelable distance. In cases of bringing in small quantities of illegal wildlife, it can be concealed easily in checked-in luggage by a traveller arriving into the United States via air. Larger quantities of illegal wildlife may be more likely to enter via air cargo or shipping cargo, as most commerce arrives this way. Therefore, once these concentrations are identified, highly focused response strategies, such as those deriving from the techniques of situational crime prevention (SCP), can be used to devise interventions.<sup>51</sup> When opportunities to commit specific types of crime are reduced, this is likely to lead to associated declines in such crime.

## Methods

In the US, imported and exported fish and wildlife have to be declared to the government via USFWS Form 3-177. This information is then transcribed and inputted into the LEMIS database manually.<sup>52</sup> The LEMIS data were obtained via the Freedom of Information Act (FOIA) request made on 23 September 2013 to the USFWS LEMIS division. The database includes all declared imported and exported confiscated wildlife shipments from 1 January 2003 to 23 September 2013. Confiscated shipments may contain multiple types of species, and thus, each line of entry represented one particular species that was confiscated in varying amounts. For the purposes of this study, we treated each entry line as a unique incident.<sup>53</sup>

For each incident, the database includes information on: genus, species, sub-species, wildlife product (e.g. leather product, meat), quantity, unit of measurement, country of export and origin, source (i.e. wild caught, captive), import or export, CITES appendix number, transportation mode, disposition (e.g. seized), violation of specific US legislation and ship date. From the initial 75,699 incidents recorded in the database, we removed all incidents that were exports (<5%), and those that did not lead to seizures. Some confiscations were a result of improper paperwork, not illegal per se, which might be resolved within a short period of time. The focus of our study was to specifically examine illegal wildlife entering the US, and the USFWS deems *seized*, not merely confiscated, wildlife products as illegal.<sup>54</sup> Thus, after eliminating exports and non-seizures, the revised sample size was reduced to 40,113 incidents.

We categorised species resulting in six major groupings: mammals, reptiles, birds, molluscs, fish and corals. These six groupings represented 94% of all seized incidents.<sup>55</sup> Units of measurement for each incident included either the number of specimens, length, weight or liquid weight, although most incidents were measured as number of specimens (>87%). As such, the units of analyses used in this study are both incidents and the number of specimens.

Analysis of LEMIS data came with some limitations that need to be noted. More than 30% of wildlife seizure incidents have an unknown country of origin, whereas the country of export is largely known for seizure incidents (>99%). Thus, this article examines country of export as an indicator of where most wildlife is emanating from, despite some wildlife originating from countries other than the export country. Regarding data on taxonomy, identification of 'species' is unknown for a large percentage of incidents. Therefore, this study used the taxonomic rank above species – genus – to describe concentrations of seized wildlife and fish within the six major groupings.

Regression models were built to examine the trends of imported seizures over time. For all other analyses, results are descriptive in nature and are organised by: (a) general trends and (b) trends for the top six groupings of species. These methods were selected to highlight, rather than explain, the underlying reasons behind the trends and patterns identified. These analyses are accompanied by tables and graphs.

## Results

### *General trends*

#### *Trends in illegal imports over time*

There were a total of 37,485 import incidents of illegal seizures made during the 2003–2012 period examined.<sup>56</sup> Similar to Smith *et al.*,<sup>57</sup> regression analyses were conducted to examine whether illegal imports have significantly increased over time.

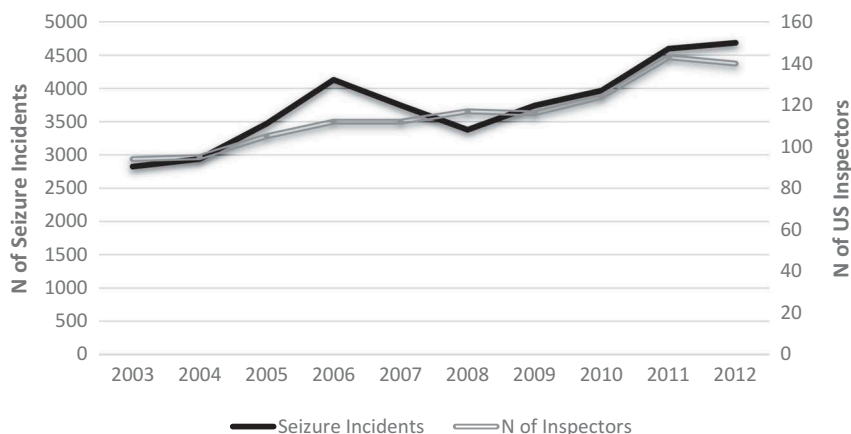


Figure 1. Number of import incidents seized and US inspectors (2003–2012).

Results indicate that monthly shipments of illegal wildlife have increased significantly over the 120 months ( $R^2 = .38$ ,  $\beta = .62$ ,  $p < .001$ ), as displayed in Figure 1. This, however, may be due to the increase in the number of inspectors over the same period of time, because when *years*, rather than *months*, were used as units of analysis, this significant increase in shipments could also be explained by the increase in the number of inspectors over the 10-year period examined ( $R^2 = .85$ ,  $\beta = .92$ ,  $p < .001$ ).

#### *Concentrations by type of wildlife*

Table 1 shows the top nine (out of 64 possibilities) most common types of wildlife seized. These nine types accounted for approximately 61% of all import seizures. Many wildlife products show a concentration within one group of species. For example, leather products (small), which have the highest number of incidents of seizures, are nearly all made of reptiles (82%), while seizures of medicinal products were predominantly from mammals (75%).

#### *Concentrations by country of export*

Figure 2 shows the number of seizure incidents by exporting territory or nation for all species. Of the 37,445 incidents for which 192 exporting nations or territories were reported, 52%

Table 1. Most commonly confiscated wildlife products.

Wildlife type	No. of incidents	Most common grouping	%	Second most common grouping	%
Leather product (small)	4107	Reptile	82	Bird	9
Medicinal product	3723	Mammal	75	Reptile	9
Meat	3185	Reptile	32	Mammal	21
Dead animal (whole)	2893	Reptile	21	Fish	17
Shoe	2526	Reptile	75	Bird	15
Live specimen	2357	Coral	53	Reptile	17
Jewellery	2120	Mollusc	58	Coral	16
Shell	1828	Mollusc	93	Reptile	5
Trophy	1622	Mammal	54	Bird	38

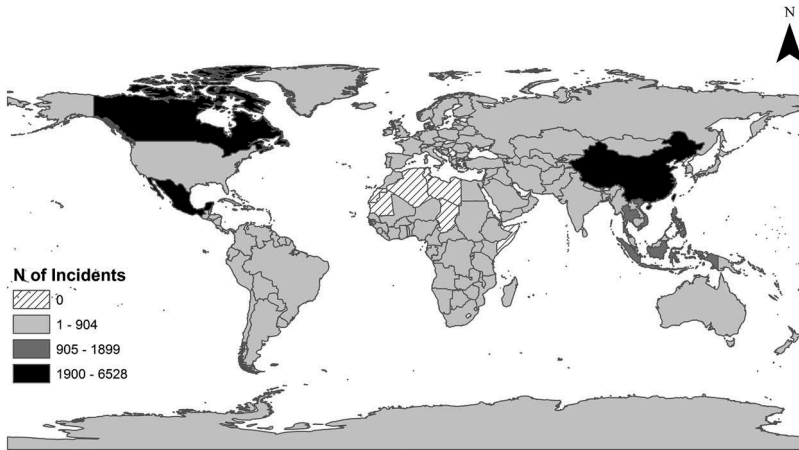


Figure 2. Exporting country of imported incidents.

\* Natural Breaks method is used for classifying values, which is an appropriate method for analysing data that is unevenly distributed (Caplan, 2010).

were from six countries alone, which included Mexico, China, Canada, Indonesia, Thailand and the Philippines. Most seizures emanate from two regions of the world, North America and Southeast Asia. About 27% of seizures emanate from two North American nations, Canada and Mexico, while South East Asia accounts for 20% of all incidents (not including China). No incidents were reported from 57 exporting territories or nations, including Algeria, Libya, Mauritania, Somalia and Chad (shown in map).

#### *Concentrations by transportation mode*

A variety of transportation means were used to traffic wildlife into the United States (Figure 3). The predominant means of transportation included air cargo and trafficking in personal baggage, which together accounted for about 69% of all seizures. Approximately one million specimens were seized from shipments made via air, almost 300 thousand specimens were seized from personal baggage, and more than 200 thousand specimens were seized from shipments made via mail. More precisely, when only seizures from Canada and Mexico were examined, it was found that 68% of seizures arriving from Canada were from vehicles or trucks, while 70% of seizures arriving from Mexico were made from air cargo and personal baggage.

#### ***Species-specific trends: top six groups***

##### *Concentrations in illegal imports by group*

Approximately 95% (N = 40,133) of the seizures were reported as 'dead'. Of the six major groupings, reptiles comprised 29% of the total number of seizure incidents, followed by mammals (26%), molluscs (12%), birds (11%), coral (8%) and fish (8%). However, when seizures are examined by the number of specimens, rather than the number of incidents, molluscs and mammals are by far the most seized groupings of species (Figure 4).



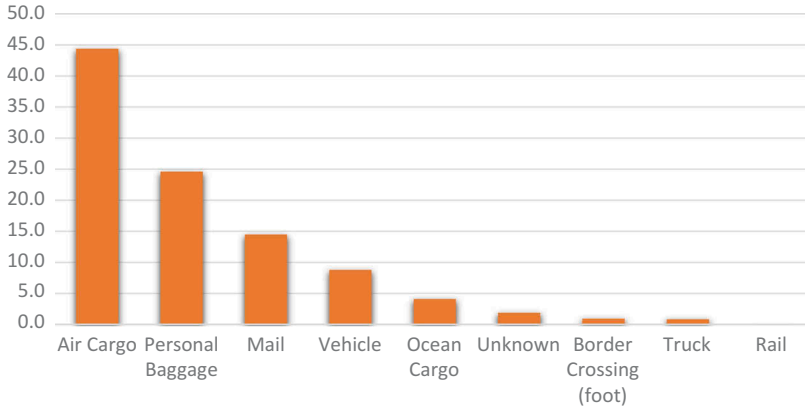


Figure 3. Percentage of import incidents seized by transportation mode.

Finding: Of the 40,113 imported seized incidents in the US, air cargo and personal baggage accounted for 69%.

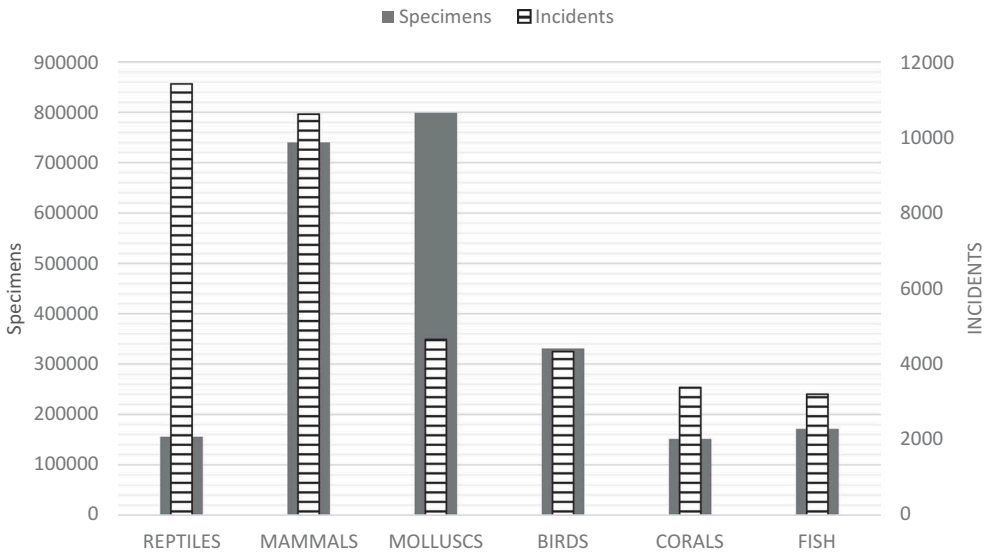


Figure 4. Total number of import incidents seized by each group (2003–2013).

#### *Temporal trends in illegal imports by group*

Figure 5 shows trends in illegal imports by these six groups. For all groups, except for birds, seizures increased significantly over time. Regression analyses confirmed this upward trend at the monthly level (mammals:  $R^2 = .13$ ,  $\beta = .36$ ,  $p < .001$ ; molluscs:  $R^2 = .33$ ,  $\beta = .57$ ,  $p < .001$ ; reptiles:  $R^2 = .12$ ,  $\beta = .35$ ,  $p < .001$ ; fish:  $R^2 = .21$ ,  $\beta = .46$ ,  $p < .001$ ; corals:  $R^2 = .37$ ,  $\beta = .61$ ,  $p < .001$ ). The import of birds declined over time, however, this decline was not statistically significant ( $R^2 = .004$ ,  $\beta = -.06$ ,  $p > .05$ ).

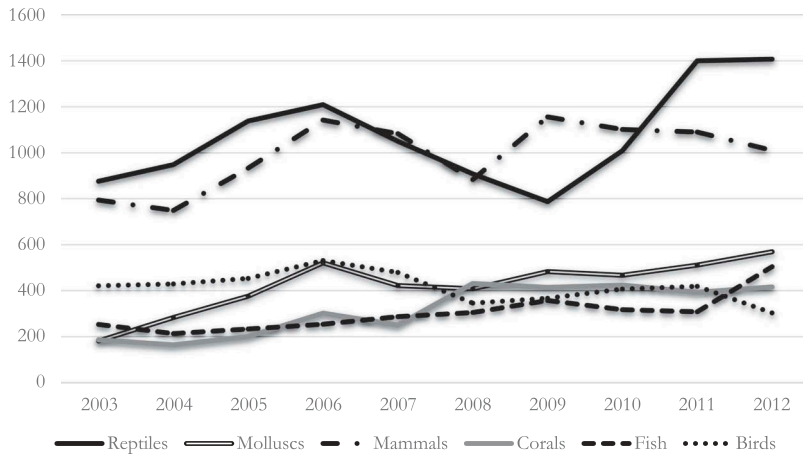


Figure 5. Number of seizure incidents by each grouping (2003–2012\*).

• Since data for the 2013 calendar year are incomplete, we only analyse 2003–2012 for temporal trends.

#### *Concentrations of seizures within each group*

**Mammals.** Nearly 750 thousand mammal specimens were confiscated during 10,617 seizures, making it one of the most seized groups of wildlife. Of those seizures, 98% were reported as *dead*. There were 58 types of mammal confiscations, with the most common types being ‘medicinal’, ‘trophies’, ‘horns’, ‘meat’, ‘ivory carvings’ and ‘skins’. Nearly 45% of the mammal seizures were in the following genera: *Panthera*, *Ursus*, *Loxodonta*, *Moschus*, *Odocoileus*, *Saiga* and *Cervus*. The main illegal exporters of mammals are China, Canada, Mexico, South Africa and Vietnam (in the order given) accounting for 52% of seizure incidents.

**Molluscs.** Nearly 800 thousand mollusc specimens were seized in the US during 4651 seizures, with over 98% being reported as *dead*. Of the total of 32 types of mollusc-related seizures, ‘shells’ and ‘shell products’, as well as ‘jewellery’ comprised 81% of the total seizures. Of the total of 171 genera of molluscs seized, the most seized genera included *Strombus*, *Pinctada* and *Tridacna*, accounting for 40% of all seizures of molluscs. The primary illegal exporters of molluscs were the Philippines, China (including Hong Kong) and Mexico, which together accounted for 43% of all exports.

**Birds.** Data show 330 thousand bird specimens were confiscated based on 4329 seizures. Of these confiscations, over 93% were reported *dead*. A major part of the 40 types of seizures are reported as ‘feathers’ (25%) from mainly *Ara* genera (e.g. macaws), *Haliaeetus* (e.g. eagles) and *Pavo* (e.g. peacocks), with other commonly seized types including ‘trophies’, ‘bodies’ and ‘meat’. The most commonly seized genera, based on seizures, include *Struthio* and *Anas*, which generally come in the form of leather products, shoes and feathers. Of live bird seizures, parrots (*psittacines*) are the most popular with almost 25% of the total. Mexico and Canada were important countries for bird-related seizures accounting for 56% of the total.

*Reptiles.* Over 150 thousand reptile specimens were seized in the US within 11,419 incidents. Approximately 96% of specimens were *dead* reptiles. There were 45 types of reptile-related seizures, with more than 55% of the total reported in the ‘leather products’, ‘shoes’ and ‘meat’ categories. The most common genera – *Crocodylus*, *Python*, *Caiman*, *Alligator* and *Varanus* – accounted for one-third of the seizures of products. A disproportionate share of reptile seizures emanate from Mexico, Thailand, Italy, China (including Hong Kong) and Indonesia (in the order given), which together account for 45% of all reptile exports.

*Fish.* During the 3205 seizures involving fish, a total of 172 thousand specimens were seized, with 93% being reported as *dead*. Fish confiscations were reported under 40 different types, of which ‘caviar’, ‘dead animal’ and ‘meat’ comprised 52%. Of the total of 182 genera of fish confiscated, the most common seized genera included *Hippocampus*, *Acipenser* and *Huso*, which together accounted for 48% of all seizures. Fish seizures were reported from 101 countries, with Canada, Mexico, Russia, China and Vietnam comprising the top five exporting countries, together accounting for 55% of all seizures.

*Corals.* A total of 152 thousand corals were confiscated at US ports of entry during 3380 seizures, with 42% of seizures being reported as *live*. Of the total of 17 types of coral confiscations, 92% were classified as ‘live specimen’, ‘raw or unworked species’, ‘coral products’ and ‘jewellery’. The most seized genera of the 137 confiscated included *Corallium*, *Acropopa*, *Euphilia*, *Antipatharia* and *Helipora*, together accounting for 30% of all coral seizures. Interestingly, 24% of corals were reported under the generic order of *Scleractinia*, with no reference to specific families or species within that order. Exports of corals were reported from 93 countries, with Indonesia, Philippines and China (including Hong Kong) dominating the trade and accounting for 51% of all coral exports.

## Discussion and conclusion

### Summary of findings

This study provided an analysis of wildlife seizures imported into the United States. It showed that the *illegal* international trade in wildlife imports into the US from 2003 to 2013 was substantial, accounting for over 2.5 million animal products and over 90 thousand *live* animals seized, bearing in mind that much of wildlife smuggling goes undetected or undeclared. Of all the animal products seized, mammals and reptiles accounted for the majority of seizure incidents. However, analysing seizures by the number of specimens revealed that mammals and molluscs accounted for the most seizures. From the perspective of US law enforcement at ports of entry, ascertaining which groups of species are most at risk for illegal import allows them to devise more focused response strategies to effectively and efficiently thwart the trade. Quantifying the most commonly seized species, by incidents or by specimen count, are just two factors to consider as it relates to *risk*. Another important risk factor is endemism and reproductive productivity of species,<sup>58</sup> which relate to extinction risk. Some species with small populations are only found in one country and may have low reproduction rates, and, as such, even a small poaching and trafficking operation of such species can be devastating to their survival.<sup>59</sup> Therefore, such factors also need to be taken into account when prevention measures are devised and prioritised.

Wildlife were imported illegally into the United States for a variety of reasons, with the main types of illegal wildlife imports being small leather products, medicinal products and meat. The large proportion of small leather products were made of reptiles, confirming prior research that the reptile skin trade is an enormous industry that is responsible for over 10 million reptiles killed each year.<sup>60</sup> Our analyses showed that ‘medicinal products’ were generally comprised of mammals used in TAM (e.g. big cats, musk deer and saiga antelopes), while ‘meat’ was that of reptiles, molluscs and mammals (e.g. iguanas, conches and monkeys). The latter can especially be problematic, as the smuggling of ‘bushmeat’ may be linked to such zoonotic diseases as Ebola virus, SARS-associated coronavirus and Nipah virus.<sup>61</sup>

Data also revealed that much of the illegal wildlife emanates from North America, Southeast and East Asia. Countries such as Mexico and Canada seem to be major contributors of seizures in the US, which may be explained, in part, as being neighbouring countries with heavy tourism travel that takes place between these countries and the United States. For example, hunters in the United States often drive to Canada in order to kill ducks, deer and other mammals.<sup>62</sup> Such animals are among the most seized wildlife emanating from Canada and this may explain why vehicles are the dominant transportation mode of seizures between Canada and the United States. Meanwhile, tourists traveling back from Mexico will predominantly come to the US by airplane, which explains why passenger bags and air cargo are the most common modes of transportation for seized wildlife between these two countries.

A further analysis of these top six exporting countries revealed that countries had concentrations in certain groupings of species. Mammal seizures were disproportionately exported from Mexico and Canada, while China largely provided mammals in the form of TAM. Molluscs were mainly exported from the Philippines, Mexico and China. Seizures of birds were exported mostly from Mexico and Canada, and, similar to the seizures of mammals and birds, Mexico was the most important illegal exporter of reptiles. Canada, Mexico and Russia dominated fish seizures, and the exports of illegal corals were dominated by well-known coral exporters, such as Indonesia and the Philippines.<sup>63</sup>

In sum, this study found that illegal wildlife is disproportionately coming in certain forms (i.e. product type), animal groupings, transportation modes and from particular export countries. The majority of illegal products come from six countries, use air transportation, comprise three product types which include leather products, medicinal products and meat, and include six wildlife and fish groups – mammals, molluscs, birds, reptiles, fish and corals. These patterns are most likely a reflection of social and cultural demand for certain products and opportunities to traffic. Most sought-after animals are restricted to certain range states, and certain countries make better hosts to smuggle wildlife both in and out the country because of their economic vulnerability, high levels of corruption or lack of resources to combat the trade. Noticeably, the majority of illegal wildlife entering the US emanate from developing countries, which possess rich biodiversity and typically lack resources to combat crimes, such as illegal wildlife trade.

### **Limitations**

The LEMIS database is a tool with great potential for monitoring<sup>64</sup> and developing risk assessments.<sup>65</sup> However, a number of limitations exist that need mentioning. First, the reliability of the LEMIS data is dependent on the accuracy of the reporting. A large part of the illegal trade is unreported or undiscovered, otherwise known as the ‘dark figure of crime’.<sup>66</sup> It is even more likely that certain illegal wildlife products within the trade are

not intercepted, because this ‘dark figure’ is generally fuelled by low priority, low probability of detection due to the limited law enforcement resources<sup>67</sup> and difficulties of seizing all illegal contraband.<sup>68</sup> This is especially true in the enforcement of wildlife crime. That said, we expected this undetected wildlife entering the country to be more or less randomly distributed among groupings of animals and products. Further, we believe that using seizure data over a long period of time increased the reliability of our results in that what is seized is representative of what is smuggled.

Second, data were not always captured accurately or were missing. For example, specific taxonomic information was missing<sup>69</sup> and numerous confiscations contained inappropriate taxonomic data.<sup>70</sup> We also noticed that several taxonomic ranks of Order or Family (e.g. *Elephantidae*) were placed under *Genera*. Therefore, careful cleaning of the data was necessary to identify and remove these data flaws.

### ***Policy recommendations***

In light of the findings in the current study, several policy recommendations are proposed, all of which derive from the framework of SCP.<sup>71</sup> The framework suggests focusing on situational determinants, which include temptations, inducements and provocations, to devise strategies that reduce the opportunity to commit crime, and make it more difficult and less rewarding to commit.<sup>72</sup> The ‘overarching principle’ of this framework is that prevention strategies should try to change the ‘near’ situational causes of crime by understanding *how* it is committed, rather than focusing on the ‘distant’ dispositional causes or *why* someone commits a crime.<sup>73</sup> Because culture shifts and trends in consumer demands are often difficult to reduce and changes in vulnerable and poor source countries are sometimes seen as undesirable Western interventions, policy changes in the situation at ports of relatively wealthy destination countries can be rather easy and likely to have considerable impact. To help in devising a variety of opportunity-reducing crime prevention solutions, the SCP framework offers techniques grouped under five main headings that include ‘increasing risk’, ‘increasing effort’, ‘reducing reward’, ‘reducing provocations’ and ‘removing excuses’.<sup>74</sup> Table 2 provides a summary of the recommended policies discussed below that are based on the applicable SCP techniques.

First, much more could be done *to increase the risk of detection, effort and apprehension* at US entry points. In comparison to drugs, the priority is disproportionately low for wildlife crimes, while the global harms may be more comprehensive. An immediate way of increasing the risk of detection is to increase the number of trained enforcement officers at the USFWS. Currently, there are less than 330 agents and inspectors that are charged with inspecting millions of wildlife shipments every year. This is about the same number of officers that were enforcing wildlife laws and policies when the law enforcement arm of the agency was created 30 years ago.

Second, *formal surveillance can be strengthened* by increasing controls of wildlife exports from major source countries and communicate to these countries that shipments of wildlife arriving from their end will be subjected to more scrutiny that can *increase the risk*.

Third, US customs can require wildlife importers to complete and sign customs declaration forms that declare that their shipments do not include any illegal wildlife or wildlife products, especially shipments of species that fall within the top six groups identified in this research. If a shipping company is caught shipping illegal wildlife, any future shipments from these companies should be automatically checked on the basis of past history to *reduce the reward*. The rewards can also be reduced by immediately

Table 2. Situational prevention of illegal imports of wildlife entering the United States.

Increase the Effort	Increase the Risk	Decrease the Rewards	Reduce Provocations	Remove Excuses
<p><b>Harden Target</b> Shipments that declared mammals, molluscs, birds, reptiles, fish and corals should be checked at a higher rate.</p>	<p><b>Utilize Place Managers</b> Other airport staff and customs officers (not directly involved in screening wildlife imports) should be encouraged to assist in the effort of identifying illegal importers</p>	<p><b>Remove Targets</b> Immediately destroy or remove the confiscated/seized animal products that are 'dead' and place live animals in wildlife shelters or back into the wild, if possible</p>	<p><b>Discourage Imitation</b> Post signs at U.S. Border Protection sites, as well as major airline/airport websites about the penalties related to the smuggling of wildlife.</p>	<p><b>Set Rules</b> Require wildlife importers to complete and sign customs declaration forms that declare that their luggage or shipments do not include any illegal wildlife or wildlife products, specifying the six groups of species and the types of product (i.e. leather, medicinal and meat) that are commonly seized.</p> <p><b>Alert Conscience</b> U.S. customs officials can post signs at entry points indicating that the import of illegal wildlife is, in addition to harms to species and ecosystems, a crime and will be punishable to the fullest extent of the law should such violations be uncovered during random screenings. Additionally, signs should be posted stating that perjury on the punishable by applicable laws should a random search of the shipment discover illegal wildlife in their possession.</p>
<p><b>Control Access to Facilities</b> Exporting countries identified as most problematic should be required to provide proof of export documents electronically before they are cleared to ship to the U.S. This is especially important if shipments include species from the six groups identified.</p>	<p><b>Strengthen Formal Surveillance</b> Increase the number of trained customs officers at airports to screen wildlife imports.</p>	<p><b>Deny Benefits</b> If a shipping company is caught shipping illegal wildlife, any future shipments from these companies should be automatically checked on the basis of past history.</p>		

(Continued)

Table 2. (Continued).

Increase the Effort	Increase the Risk	Decrease the Rewards	Reduce Provocations	Remove Excuses
<p><b>Screen Exits</b> Customer officials at U.S. border should scrutinise the export document, passenger bags and air cargo arriving from the 'risk' countries identified.</p>				<p><b>Assist Compliance</b> Implement faster screening/customs clearance policies for shipments that provided export documents and other required supporting documents (if shipments made from the 'risk' countries or included the species from the six groups identified), in the electronic format, 30 days before the expected arrival of the shipment into the United states.</p>

*removing the targets* by destroying the confiscated/seized animal products that are ‘dead’ and placing live animals into wildlife shelters or back into the wild, if possible.

Fourth, the United States can encourage the exporting nations identified in this research to *screen exits*, especially for wildlife identified in this study, by carefully examining export documents, passenger bags and air cargo before illegal wildlife arrive in the US. Wildlife trade sanctions have been imposed in the past with countries that have not been able to control illicitly obtained wildlife from being exported.<sup>75</sup>

Lastly, in an effort to *alert conscience*, to *reduce provocations*, and to *remove excuses*, the US customs officials can post signs at the ports indicating that the import of illegal wildlife is a crime and will be seriously punishable. This is already happening in some major source countries, such as China, but can also have a preventive effect in major destination countries such as the United States.

### **Concluding remarks**

Using the LEMIS database, this study only began to uncover the patterns and trends of illegal imports of wildlife into the United States. In examining seizures, we treated each individual species as a separate incident, even though some other species may have been found in the same container. Future research should examine the entire contents of containers that were seized to better understand the nature of the illegal trade in wildlife. For example, how often are different species seized within one shipment? In cases where more than one species is seized within a shipment, are they similar in regards to genus or class or are they completely different?

Our analyses also revealed that the illegal imports into the US have increased over the 10-year period examined, but it didn’t account for the increases of USFWS inspectors at each port of entry during the same period of time. These increases can be partially explained by the increase in the number of USFWS inspectors during the same period. Should data on inspectors by port of entry or for a longer period of time become available, future research can conduct similar temporal analyses while controlling for the number of inspectors to determine if this increase in the number of shipments is, indeed, due to the increased demand for such products.

Another future research endeavour can investigate whether exporting nations that disproportionately account for most US seizures are exporting species that are native to their country. If many species are not native to a particular exporting country, it may be indicative that some nations are used as transit nations for the illegal wildlife trade. These and many more research questions can be explored by using the LEMIS database to understand and explain the trends of illegal wildlife imports into the United States, and to devise strategies to address the problem.

### **Disclosure statement**

Authors report no potential conflict of interest.

### **Notes**

1. CITES, “Cites Secretary-General Welcomes Adoption of Draft Resolution on Wildlife Crime.”
2. The White House, “Executive Order.”
3. Leakey and Lewin, “The Sixth Extinction”; Barnosky et al., “Has the Earth’s Sixth Extinction Arrived”; Dirzo et al., “Defaunation in the Anthropocene.”
4. Barnosky et al., “Has the Earth’s Sixth Extinction Arrived.”



5. Mills and Serveen, "The Asian Trade in Bears and Bear Parts."
6. Wright et al., "Nest Poaching in Neotropical Parrots."
7. World Bank, "What's Driving the Wildlife Trade?"; UNODC, "The Globalization of Crime"; Wyler and Sheikh, *International Illegal Trade in Wildlife*.
8. Wilson-Wilde, "Wildlife Crime"; Barber-Meyer, "Dealing with the clandestine nature."
9. Nijman, "An Overview of International Wildlife Trade."
10. Hewson, "Traditional Healers in Southern Africa", as cited in Warchol et al., "Transnational Criminality"; Martin-Smith et al., "Trade in Piperhorses"; Li and Wang, "Wildlife trade in Yunnan Province, China."
11. Shepherd and Shepherd, "The Poaching and Trade of Malayan Sun Bears"; Forero, "Hidden Cost of Shark Fin Soup"; Papp, "The Illegal Trade in Wild Birds"; To, "A study on the Trade."
12. Hutton and Webb, "Crocodiles: Legal Trade Snaps Back"; Bräutigam et al., "Recent Information on the Status and Utilization."
13. Martin and Vigne, "Illegal Ivory Sales in Egypt"; Martin and Stiles, "The Ivory Markets of East Asia."
14. Broad et al., "The Nature and Extent of Legal and Illegal Trade"; van Uhm, *Illegal Trade in Barbary Macaques*; Speart, "War Within" as cited in Warchol et al., "Transnational criminality."
15. Finnegan, "Slow and Steady."
16. Roe et al., "Making a Killing or Making a Living"; Duffy, "Nature Crime."
17. Rosen and Smith, "Summarizing the Trade in Illegal Wildlife"; UNODC, "A Transnational Organized Crime Threat Assessment"; World Bank, "What's Driving the Wildlife Trade?"; Lawson and Vines, "Global Impacts of the Illegal Wildlife Trade."
18. Duffy, 'Nature crime'.
19. Boekhout van Solinge, "The Illegal Exploitation of Natural Resources."
20. UNODC, "Transnational Organized Crime in the Fishing Industry."
21. UNODC, "Trafficking in Persons. Global Patterns."
22. Lipman, "Transboundary Movement of Hazardous Waste."
23. UNECOSOC, "Illicit Trafficking in Protected Species."
24. Pires et al., "Organized Crime or Crime that is Organized?"
25. Pires and Moreto, "Preventing Wildlife Crimes"; Pires and Clarke, "Sequential Foraging, Itinerant Fences"; Pires et al., "Organized Crime or Crime that is Organized?"
26. Lyons and Natusch, "Wildlife Laundering Through Breeding Farms."
27. Sheikh and Corn, *CITES*.
28. Rice and Moore, "Trade Secrets."
29. Rhyne et al., "Revealing the Appetite of the Marine Aquarium Fish Trade."
30. Rhyne and Tlusty, "Trends in the Marine Aquarium Trade."
31. Schlaepfer et al., "Challenges in Evaluating the Impact of the Trade."
32. Stiles and Martin, "The USA's Ivory Markets."
33. Schloegel et al., "Magnitude of the US Trade in Amphibians."
34. Nico et al., "Imported Asian Swamp Eels."
35. Smith et al., "Reducing the Risks of the Wildlife Trade."
36. Williams et al., "Managing Multiple Vectors."
37. Ferrier, "The Economics of Agricultural and Wildlife Smuggling."
38. Coggins, "The Tiger and the Pangolin"; Xu and Yang, "Traditional Chinese Medicine"; van Uhm, "Crime and Traditional Chinese Medicine."
39. Roe et al., "Making a Killing or Making a Living."
40. Siegel and van Uhm, "Zwarte kaviaar. Criminele netwerken."
41. South, "A Green Field for Criminology"; Hillyard et al., "Beyond criminology?"; White, "Crimes Against Nature"; Wyatt, "Wildlife Trafficking"; Sollund, "Animal trafficking and trade."
42. Petrossian and Clarke, "Explaining and Controlling Illegal Commercial Fishing"; Petrossian, "Preventing (IUU) Fishing"; Pires and Clarke, "Are Parrots CRAVED?"; Lemieux and Clarke, "The International Ban on Ivory Sales."
43. Wortley and Mazerolle, *Environmental Criminology*.
44. Sherman et al., "Hot Spots of Predatory Crime"; Weisburd et al., "Trajectories of Crime at Places."
45. Felson and Poulsen, "Simple Indicators of Crime by Time of Day."

46. Clarke, "Hot Products."
47. Pease, "Repeat Victimization"; Grove et al., "Preventing Repeat Victimization."
48. Pires and Clarke, "Sequential Foraging, Itinerant Fences and Parrot Poaching"; Pires and Clarke, "Are Parrots CRAVED?"; Pires, "A CRAVED Analysis of Multiple Illicit Parrot Markets"; Pires and Petrossian, "Understanding Parrot Trafficking Between Illicit Markets"; Petrossian and Clarke, "Explaining and Controlling Illegal Commercial Fishing"; Petrossian et al., "Factors Affecting Crab and Lobster Species"; Moreto and Lemieux, "From CRAVED to CAPTURED."
49. Petrossian et al., "Where Do 'Undocumented' Fish Land?"; Marteache et al., "Factors Influencing the Choice."
50. Petrossian, "Preventing illegal"; Lemieux and Clarke, "The International Ban on Ivory Sales."
51. Cornish and Clarke, "Opportunities, Precipitators and Criminal Decisions."
52. Livengood et al., "The Applicability of the LEMIS Database."
53. See note 33 above.
54. Most seized wildlife products cannot be traded legally between countries either due to international or national regulations, but some proportion of seizures are a result of health concerns (<http://wildlifetracker.org/?db=lemis>).
55. Remaining groups of animals that accounted for 6% of confiscations include: flora, insecta, amphibian, anthozoa, arachnida, cnidaria, crustaceans, echinodermata and porifera.
56. Data for the 2013 calendar year are incomplete, therefore, we only analyse 2003–2012 for temporal trends.
57. See note 35 above.
58. See note 31 above.
59. Courchamp et al., "Rarity Value and Species Extinction."
60. Lawson, *Traded Towards Extinction?*
61. Wolfe et al., "Bushmeat Hunting, Deforestation, and Prediction."
62. See note 37 above.
63. Green and Shirley, *The Global Trade in Corals*; Wood, *Collection of Coral Reef Fish for Aquaria*
64. Schlaepfer et al., "Challenges in Evaluating the Impact of the Trade."; Ceballos and Fitzgerald, "The Trade in Native."
65. Pavlin et al., "Risk of Importing Zoonotic Diseases."
66. Coleman and Moynihan, *Understanding Crime Data*.
67. Fears, "Overwhelmed US Port Inspectors."
68. Cantu et al., *The Illegal Parrot Trade in Mexico*; UNEP, *Stolen Apes*.
69. See note 35 above.
70. See note 31 above.
71. See note 51 above.
72. Clarke, "Situational Crime Prevention."
73. See note 51 above.
74. Ibid.
75. Wyler and Sheikh, *International Illegal Trade in Wildlife*; Fears, "Overwhelmed US Port Inspectors."

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