

Luxury Seafood Trade: Extinction vs. Lavishness

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Introduction	1
Shark Fins	1
Fish Maws	3
Discussion	4
Conclusions	4
Further Reading	5

Introduction

Wildlife trade is the practice of extracting nondomesticated animals or plants from the natural habitats for commercial activities such as food, pets, leather, medicine, etc. This practice has been part of human society for many centuries. For example, at one point in time (1st century B.C.) five major trading forces existed (the Roman Empire, the Parthian empire, the Kushan Empire, the nomadic confederation of the Xiongnu, and the Han Empire) and moved a vast number of exotic plants and animals through large distances. One can even find traces of extravagant wildlife trade in the Bible: “For the king had at sea a navy of Tarshish with the navy of Hiram: once every three years came the navy of Tarshish, bringing gold, and silver, ivory, and apes, and peacocks.”

Most contemporary wildlife trade is legal, and in some cases, does not present a threat to wild populations. Where over-exploitation occurs, one can find several variables driving it but one is a common factor across all scenarios, human population growth. Human population has increased dramatically from less than 2 billion people before 1900 to more than 6 billion by the end of the 20th century, and projections estimate that this number will go beyond 10 billion by 2100. Unsurprisingly, this population growth has increased our negative effect on ecosystems, mainly due to habitat loss and overexploitation of natural resources. Marine habitats and resources are a typical example of the negative effects generated by anthropogenic influences. Among these are ocean acidification, coral bleaching, marine pollution, habitat loss, and fisheries overexploitation, but the list goes on.

Currently, more than 3 billion people rely directly on marine fisheries as a primary protein source, and over 820 million people for their livelihoods, with an estimated asset value of \$2.9 trillion USD. Moreover, the total value of all key oceans assets has been conservatively assessed at \$24 trillion USD. Thus, it is clear that ocean ecosystems are crucial for feeding human populations and the global economy. And so, many research groups, nations, and regional authorities are working to halt the ecosystem degradation and the overexploitation of these important marine resources through science-based fisheries management, although usually encountering lack of political will to implement such policies in the international arena.

Some of these marine resources are considered luxury items and are traded primarily to Asian markets and sold as food and medicine (Table 1). All wildlife species considered luxurious products, marine or terrestrial, have been overexploited to some extent to supply their high demand, usually to critical levels. Normally, as these species become rare and/or protected by national law (e.g., Endangered Species Act [ESA] in the United States) and/or international agreements (e.g., the Convention on International Trade in Endangered Species of Wild Fauna and Flora [CITES]), market prices increase, trade shifts toward closely-related and more abundant species, and “black markets” and criminal activities emerge.

A good example of international governance concerning wildlife trade is CITES. It is a multilateral environmental agreement, created in 1973 to control or eliminate the international trade of endangered species and make its parties ($N = 183$) accountable when violations to the treaty occur. It operates under three main principles: sustainability, traceability, and legality. Heavily traded wildlife species are proposed by one or more parties during each Conference of the Parties (CoP) and listed in one of two primary appendices (Appendix I or II) if supermajority vote is achieved. CITES Appendix I species are banned from all international trade with rare exceptions, while Appendix II species must be traded with a set of permits issued by exporting parties certifying that (i) specimens were obtained legally according to national law, (ii) trade is traceable through the supply chain, and (iii) trade is not detrimental to the survival of the species. Exporting/importing parties must control the outgoing/incoming trade and comply with CITES regulations to avoid international trade sanctions. Although, enforcement and compliance for several marine taxa (e.g., sharks, seahorses, glass eels, etc.) has proven to be defective due to the difficulty of monitoring the large volumes being traded, and to identify CITES-listed species from close-non-CITES relatives. In the following sections I will present two main case-studies where marine taxa, with contrasting life histories, are considered luxury products in Asian markets and have been substantially depleted and threatened with extinction to meet their high demand.

Table 1 List of some highly endangered luxury seafood products, considered best quality, sold in Asian markets as food or medicine

Product	Highly valuable species	Scientific name	Consumption	IUCN status	CITES	Price/kg (USD)
Abalone	Black abalone	<i>Haliotis cracherodii</i>	Food	Critically endangered	Not listed	\$2000–\$3000
Eel	European Eel	<i>Anguilla anguilla</i>	Food	Critically endangered	Appendix II	\$2000 ^a
Tuna	Bluefin tuna	<i>Thunnus maccoyii</i>	Food	Critically endangered	Not listed	\$3500
Shark fins	Scalloped hammerhead	<i>Sphyrna lewini</i>	Food	Endangered	Appendix II	\$516
Sea cucumber	Japanese spiky sea cucumber	<i>Apostichopus japonicus</i>	Medicine	Endangered	Not listed	\$450–\$1000
Fish maws	Totoaba	<i>Totoaba macdonaldi</i>	Medicine	Critically endangered	Appendix I	>\$50,000
Reef fish	Napoleon wrasse	<i>Chelinus undulatus</i>	Food	Endangered	Appendix II	\$509

^aPrice for 1 kg of live larvae in the international trade. Price of adults ranges from \$20–\$25 USD per kilogram.

Shark Fins

The consumption of shark fins in Asia can be traced back to the Ming Dynasty (1368–1644 AD) and since then, it has been part of Asian culture as a status symbol and power. Historically, shark fin soup has been considered a luxury dish that could only be afforded by emperors and extremely wealthy families, keeping the demand for shark fins relatively low. But, since the 1970s Hong Kong's gross domestic product (GDP) per capita has experienced a rapid increase, creating a scenario of economic prosperity, and therefore, a higher demand for luxury items such as shark fins, which also translated into a higher fishing pressure to supply the demand (Fig. 1).

Sharks, rays, and skates (i.e., elasmobranchs) are intrinsically vulnerable to overexploitation due to their slow growth rates, low fecundity, and late maturation. Around 25% of the world's elasmobranchs are threatened with extinction due to overexploitation by fisheries to supply the high demand of fins in Asia and meat in South America and Europe. Furthermore, over 70 million sharks are caught annually, but only 9% of the reported global annual catch to the Food and Agriculture Organization (FAO) is biologically sustainable, and only 4% is managed for sustainability. For example, the oceanic whitetip shark (*Carcharhinus longimanus*), a large oceanic species, was once the most abundant shark in tropical and subtropical regions of the planet. This species is caught as target and bycatch species in a wide range of fisheries in international waters and is currently listed as Vulnerable on the International Union for Conservation of Nature (IUCN) Red List of Endangered Species. Large population declines, of up to 70%, have been observed in the Western Atlantic Ocean mainly to supply the demand for their fins in Asian markets, where they fetch some of the highest values.

Mainland China, Hong Kong, and Taiwan import 90% of the fins in the international trade and can fetch prices of up to 1400 USD/kg at the retail level. Only in 2015, the total volume of imported shark fins into Hong Kong was 5,528,862 kg. This gives us an idea of the volumes being traded and the high demand for this luxury seafood product. Due to this high-volume trade, CITES has recently listed nine commercially important shark species under Appendix II (i.e., the porbeagle shark *Lamna nasus* [2013], scalloped hammerhead *Sphyrna lewini* [2013], great hammerhead *S. mokarran* [2013], smooth hammerhead *S. zygaena* [2013], the oceanic whitetip shark *Carcharhinus longimanus* [2013], silky shark *C. falciformis* [2016], bigeye thresher shark *Alopias superciliosus* [2016], pelagic thresher shark *A. pelagicus* [2016], and common thresher shark *A. vulpinus* [2016]), all of which are globally threatened with extinction and classified as Endangered (2) or Vulnerable (7) on the IUCN Red List of Endangered Species. There are over 90 shark

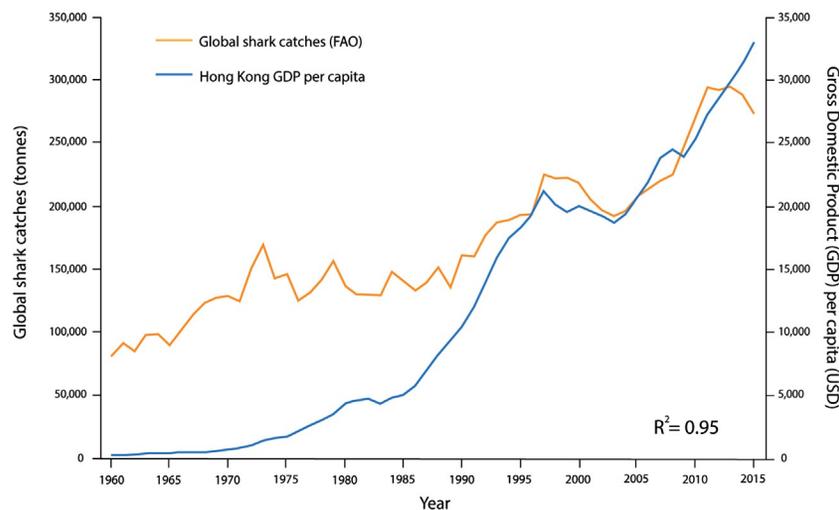


Fig. 1 Global shark catches from 1960 to 2015 based on FAO FishStatJ and gross domestic product (GDP) per capita in Hong Kong for the same period.

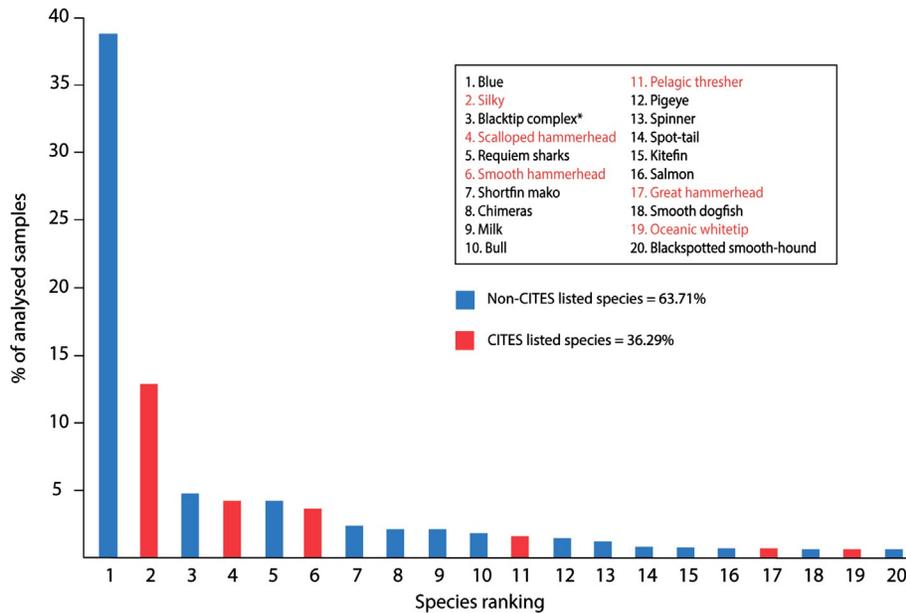


Fig. 2 Top 20 most common species in the shark fin trade based on 9200 samples collected in the shark fin retail markets of Hong Kong from 2014 to 2017.

species being traded for their fins, however, the market is based on a small subset of highly threatened species, including CITES-listed species such as the silky shark, ranked as the second most common in the trade, and scalloped and smooth hammerhead sharks, ranked fourth and fifth respectively (Fig. 2). CITES trade records indicate that incoming shark fins from CITES-listed species represented 0.4% of the total incoming volume of fins to Hong Kong in 2015, while the proportion of these species in the retail markets was at least one order of magnitude higher. Therefore, it is clear that enforcement of CITES regulations has become a challenging task to custom authorities around the world due to the lack of capacity to monitor and control this high-volume trade.

Sharks are a perfect example of how popular believes and luxury culture can drive major declines of wildlife populations. Currently, there are several research and conservation groups working to improve CITES enforcement in major trade hubs and to detect key countries and regions where capacity building and collaborative initiatives are needed in order to increase data collection and ensure best practices. Also, public campaigns are being conducted in major consuming nations (e.g., Hong Kong and mainland China) to engage with the general public and explain the major conservation issues that shark populations are currently facing. The demand for shark fins has decreased in the last couple of years, and although the reasons for this decline are still uncertain, research and public awareness have played a major role by creating a positive momentum for shark trade management among CITES parties and by growing public support for shark conservation.

Fish Maws

In simple terms, unsustainability occurs when something (e.g., animal, plant) is removed at a faster rate than it is being produced. Therefore, it is logical to assume that species, in this case marine fish, that are highly fecund (e.g., teleosts) can withstand a higher fishing pressure than less productive species (e.g., elasmobranchs). If successful fisheries management occur, highly productive species could recover faster than less productive species after fishing pressure stops. To this date, no marine fish species has gone extinct due to fisheries overexploitation. Nevertheless, even highly productive species can succumb to fisheries intended to supply an extremely valuable trade and insatiable demand. This is the case of the totoaba (*Totoaba macdonaldi*) and the Chinese bahaba (*Bahaba taipingensis*), the largest species of the Sciaenidae family (i.e., drums and croakers).

In the 1930s and 1940s, large scale fisheries for the totoaba (Gulf of California) and the Chinese bahaba (China and Hong Kong) were developed to supply the growing demand for fish maws or swim bladders in Asian markets. These air-filled organs, that aid fishes to achieve neutral buoyancy and produce sound, are highly valuable in Asia and consumed mainly as traditional medicine but also as a luxury dish. Both species present similar life history characteristics reaching 2 m in size and over 100 kg in weight, large seasonal spawning aggregations in shallow estuaries, and a limited geographical range (i.e., endemic species). They also share an absence of successful and timely fisheries management, increasing market values due to their current rarity, both were overexploited to critical levels before we could gather basic biological information about them, and both are currently listed as Critically Endangered by the IUCN Red list of Endangered Species.

In the 1930s a single fishing boat in China could make over \$4000 USD in a single haul and catches reached a maximum peak of 50 metric tonnes (mt) a year. Catches started to decline fast to 10 mt in the 1950s and 1960s, and less than 500 kg in the 1990s. Correspondingly, prices went from a few USD per kg in the 1930s to over \$64,000 USD per kg by the end of the 1990s. Even though

catches in the 1990s were around 1% of those in the 1960s, more than 100 boats used to go out to looking for these fishes until it was considered commercially extinct in 1997. Three events in the first decade of the 21st century highlight the absurdity surrounding the trade and consumption of the Chinese bahaba. First, in 2008 a large individual of 81 kg was caught by local fishermen in Hong Kong who happily sold it for \$2500 USD, but it was finally sold in mainland China to the final consumer for \$125,000 USD. In 2010, a 50-year-old fish was sold in south China for 500,000 USD, and finally, in 2012, an 80 kg individual was caught off the coast of Fujian and purchased by a man for \$424,000 USD as a present for his father-in-law for Father's Day.

The totoaba followed a very similar path in the Gulf of California. The fishery started in 1942 with catches peaking at 2300 mt. But as its Chinese counterpart, the fishery followed a systematic decline with catches reaching only 280 mt in 1958, then 59 mt in the 1970s, until the fishery officially closed in 1974. Then, several fisheries management attempts followed, including the declaration of a marine protected area (MPA) to protect the spawning aggregation in 1974, the totoaba was declared protected in 1975, it was listed on the CITES Appendix I in 1976 and in the ESA of the United States in 1979. Nevertheless, illegal fishing activities continue, fuelled by the large prices paid to fishermen for a kg of fish maws, up to \$8500 USD, more or less two adult totoabas.

The high fishing effort in the past, and the current illegal fishing activities created an imminent extinction scenario for the vaquita (*Phocoena sinus*), the world's smallest cetacean endemic of the northern region of the Gulf of California, caught as bycatch in the totoaba's gillnet fishery. The vaquita is currently listed as Critically Endangered by the IUCN Red List of Endangered Species with less than 20 individuals remaining in the wild. The last failed conservation attempt to save the vaquita, worth four million dollars, included conservationists patrolling the area and the use of trained US navy dolphins to find the last remaining vaquitas for researchers to be able catch and transport them to a secure location under human care. The project was discarded soon after it started, when captured vaquitas showed high stress levels to captivity or even died. The faith of the totoaba and the vaquita now lies in the hands illegal fishermen and the fish maw consumers.

Discussion

The presented scenarios showed two marine groups with contrasting life history traits and deep roots in Asian culture as luxury products (e.g., food and medicine) that are threatened with extinctions as a consequence. But, if the totoaba and the Chinese bahaba are more productive, and traded volumes are orders of magnitude less than those of sharks, why are these fish species closer to extinction? The first answer to this question can be found in the number of species being traded in each group of species. The Sciaenid family comprises 275 species but only two (0.7%), the totoaba and Chinese bahaba, are heavily sought for their swim bladders. This is mainly because of what is considered a "high-quality" product. The fish maws from these large species are older, larger and thicker, and therefore more expensive than those of smaller close-relatives. In contrast, there are over 500 species of sharks currently described and around 90 (~18%) are present in the international shark fin trade. Unfortunately, the large number of species in this group allows for species substitution, meaning that once a species becomes rare the demand gets picked up by another. In 2006, a study assessed the species composition of the 11 shark fin categories in Hong Kong, but a new assessment is required in order to evidence if such a species substitution has taken place in the last decade.

The second answer relates to the geographic range of the species. As seen above, the totoaba and the Chinese bahaba show large and predictable spawning aggregation in shallow coastal areas and have small geographical ranges, making them an easy target for fisheries. In contrast, all of the top 10 most common shark species in the trade (Fig. 2) are cosmopolitan species, with five species, including the two most common, inhabiting the epipelagic zones of all major ocean basins (i.e., Atlantic Ocean, Pacific Ocean, Indian Ocean). These wide geographical ranges give them an advantage over the endemic totoaba and Chinese bahaba.

These are two well-documented and contrasting cases of wildlife populations that have been depleted to supply their high demand as luxury seafood, but there are many other species that are following the same path for this kind of trade (Table 1). For example, bluefin tuna populations have been heavily fished with population declines of over 85% in the last four decades. A single bluefin tuna can fetch prices of up to \$50,000 USD in Japanese markets, where most of the demand is being generated. There is an overwhelming amount of evidence showing the severe bluefin tuna population declines around the world and still, CITES parties refuse to list the bluefin tuna, reflecting the lack of political will to protect this endangered species. Also, the glass eels (*Anguila spp.*) are the subject of a multimillion-dollar industry where three main species are traded (the European eel [*A. anguilla*], the America eel [*A. rostrata*], and the Japanese eel [*A. japonica*]). The larvae of these species are caught at river mouths and traded alive to Japan and other Asian countries where they are grown to a certain size to be consumed locally or reexported to supply the demand for eel sushi among other luxury dishes. The price for a pound of these larvae can be as high as \$2000 USD (Table 1). The European eel has experienced declines of up to 95% in recruitment, is considered Critically Endangered and is currently listed on CITES Appendix II. The American and Japanese eels are Considered Endangered with population declines of up to 60%.

Conclusions

From climate change, to overexploitation of natural resources, the negative impacts that human populations have caused to the environment are innumerable and some of them irreversible. Wildlife trade is one we can still reverse for many species with enough political will and changes in consumers' choices. Most wildlife trade issues can be explained by simple economic dynamics where

prices are a reflection of the relationship between the supply and demand. Basically, prices and supply will keep increasing as long as there are people willing to pay for it. This is bad news for wildlife populations, as the law of supply shows us that the higher the price, the higher the quantity supplied, which naturally leads to overexploitation. The prices that luxury seafood consumers are currently willing to pay are a reflection of the desire for these products and how deeply embedded these beliefs and traditions are in the culture.

The survival of these species not only depends on more and better science, but also the general public's will to decrease the demand. Unfortunately, history has shown us that as long as there is a demand and high profits to make, there will always be someone willing to supply it, even if it requires breaking the law (e.g., illegal drugs). Hence, it is crucial to keep shifting the general public's eye toward these conservation issues since public pressure has played an increasingly important role in setting conservation and management actions in recent years. Without deep cultural changes and the general public's resolve to change its consumption choices, the future of these endangered species will be uncertain and will likely disappear in front of our eyes and on our plates.

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