Sharks in Trouble
Hunters Become the Hunted

THE PEW ENVIRONMENT GROUP

Most shark species are unable to withstand the pressure of modern fishing technology and practices.[1] Their life history characteristics– they grow slowly, become sexually mature relatively late and produce few offspring– make them especially vulnerable to overfishing. Once depleted, shark populations can take years, decades or more to recover.[2,3] Some fisheries that collapsed in the first half of last century have yet to recover.[4,5] This report provides an overview of the status of sharks globally, including:

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Overview

- Commercial fisheries targeting sharks exist throughout the world. Sharks are sought primarily for their fins (for shark fin soup) and their meat but also for their cartilage, liver and skin.
- Up to 73 million sharks are killed every year, according to an analysis of the Hong Kong shark fin trade. The demand for shark fins, meat and other products has drive numerous shark populations to the brink of extinction.
- Shark populations have declined by as much as 70 to 80 percent, according to global reports. Some populations, such as the porbeagle shark in the north western Atlantic and spiny dogfish in the northeastern Atlantic, have been reduced by up to 90 percent.
- Thirty percent of all shark and ray species are now Threatened or Near Threatened with extinction, and accurate scientific assessments cannot be done on an additional 47 percent of the species because of a lack of data.
- The highest numbers of reported shark landings are from: Indonesia; India; Taiwan, Province of China; Spain; and Mexico.
- The catching of sharks in fisheries that target other species (bycatch) is frequently reported in open-sea longline fisheries targeting tuna and swordfish and can represent as much as 25 percent of the total catch. This bycatch is considered to be a major source of mortality for many shark species worldwide.
- Blue sharks make up a particularly large proportion of shark bycatch in open-sea fisheries (47 to 92 percent).
- The value of shark fins has increased with economic growth in Asia (particularly China), and this increased value is a major factor in the commercial exploitation of sharks worldwide. One bowl of shark fin soup can cost US$100.
- Sharks play an important role in maintaining the structure and function of the ecosystem. They regulate the variety and abundance of the species below them in the food chain. Impacts from the loss of sharks can be felt throughout the entire marine environment.
- Live sharks have a significant value for marine ecotourism (such as recreational diving, snorkelling, and shark watching) that is more sustainable and often far more valuable than their worth to fisheries. Whale shark tourism, for example, is estimated to be worth $47.5 million annually worldwide, and shark tourism activities in the Bahamas generate $78 million annually for the Bahamian economy.
- To reverse declines in shark populations, shark sanctuaries should be established, and strong, science-based management should be put in place by all fishing countries and international bodies that regulate shark fishing and trade.

C/O STUART COVE'S DIVE BAHAMAS

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Sharks are targeted and caught as bycatch throughout the world's oceans and in fisheries that use surface, mid-water and bottom longlines, drift and set gill nets, and trawls.[6,7,8] *Sharks are targeted primarily for their fins and meat but also for cartilage and oils.*[9] *A study used statistics based on data from the Hong Kong fin trade to estimate that up to 73 million sharks are killed by humans each year.*[10] *Ecosystem models and some field studies suggest that the loss of these top predators could have significant impacts on many marine ecosystems.*[11,12,13]

This document summarizes the threats to sharks, focusing on the number of sharks killed per year, the drivers of this mortality, the status of shark species worldwide and the impact on ecosystems when large predators are removed. It also provides management recommendations that can help reverse the steep declines of many shark populations and begin rebuilding them.

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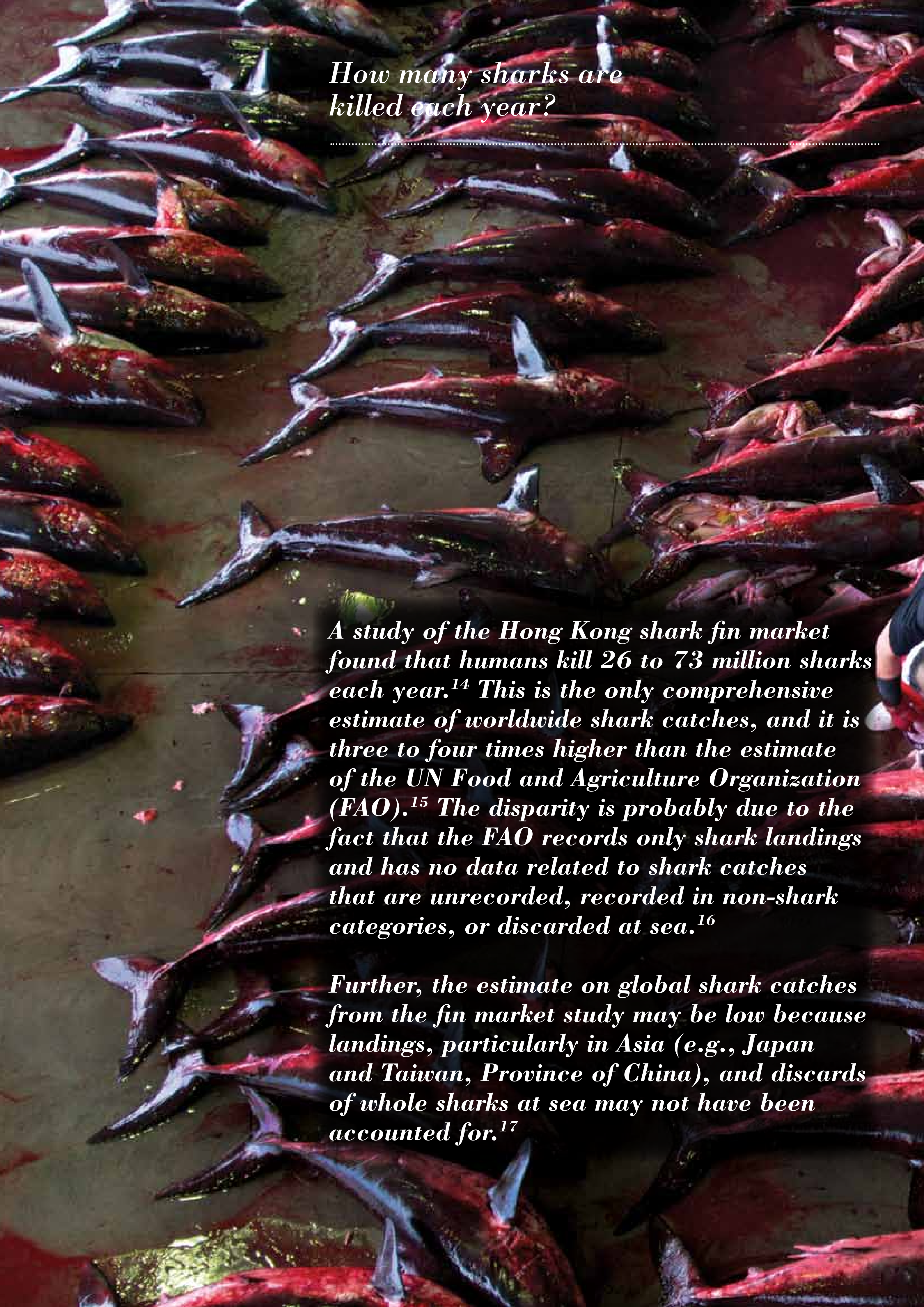

How many sharks are killed each year?

A study of the Hong Kong shark fin market found that humans kill 26 to 73 million sharks each year.[14] This is the only comprehensive estimate of worldwide shark catches, and it is three to four times higher than the estimate of the UN Food and Agriculture Organization (FAO).[15] The disparity is probably due to the fact that the FAO records only shark landings and has no data related to shark catches that are unrecorded, recorded in non-shark categories, or discarded at sea.[16]

Further, the estimate on global shark catches from the fin market study may be low because landings, particularly in Asia (e.g., Japan and Taiwan, Province of China), and discards of whole sharks at sea may not have been accounted for.[17]

73M

The study of the Hong Kong shark fin market found that humans kill up to 73 million sharks each year.

SHAWN HEINRICHS

What is the result of intense fishing pressure on sharks?

30%

The International Union for Conservation of Nature (IUCN) Red List assessed 1,045 species of sharks and rays and found that 30 percent of the species are Threatened or Near Threatened with extinction.

What is the result of intense fishing pressure on sharks?

AMOS NACHOUM / CORBIS

What is the result of intense fishing pressure on sharks?

JIM ABERNETHY

Recent research has documented dramatic declines in population sizes for many species of sharks worldwide. Sharks are susceptible to overfishing because of their life history characteristics, which include slow growth, late maturation and few offspring.[18 19] The International Union for Conservation of Nature (IUCN) Red List assessed 1,045 species of sharks and rays and found that 30 percent of the species are Threatened or Near Threatened with extinction.[20] Their findings are as follows:

Category	Percentage of Assessed Species
Vulnerable	11
Endangered	4
Critically Endangered	2
Total Threatened	**17**

Category	Percentage of Assessed Species
Near Threatened	13
Least Concern	23
Data Deficient	47

It is important to note that the IUCN has categorized nearly half (47 percent) of all globally assessed sharks and rays as "data deficient" because available information is insufficient to accurately assess their extinction risk. The status of individual shark species is often difficult to determine because of a shortage of long-term data on fishing effort and species-specific catches, landings and discards in commercial fisheries.[21 22 23 24] The fact that so many species are classified as data deficient highlights the urgent need for countries to gather accurate, species-specific data so that assessments can be made.

As a Data Deficient listing simply indicates a lack of data, it does not mean that a species is not at risk of extinction. Indeed, unless fisheries management improves immediately and dramatically, enhanced knowledge of Data Deficient species will undoubtedly find even more sharks and rays qualifying for Threatened classification.[25 26]

Dulvy *et al.* used the IUCN Red List Categories and Criteria to determine the status of 21 pelagic (open ocean) shark and ray species commonly caught in high seas fisheries.[27] Sixteen of the 21 species were considered globally Threatened or Near Threatened with extinction:

Threatened:
- Whale shark *(Rhincodon typus)*
- Pelagic thresher shark *(Alopias pelagicus)*
- Bigeye thresher shark *(Alopias superciliosus)*
- Thresher shark *(Alopias vulpinus)*
- Basking shark *(Cetorhinus maximus)*
- Great white shark *(Carcharodon carcharias)*
- Shortfin mako shark *(Isurus oxyrinchus)*
- Longfin mako shark *(Isurus paucus)*
- Porbeagle shark *(Lamna nasus)*
- Oceanic whitetip shark *(Carcharhinus longimanus)*
- Giant devil ray *(Mobula mobular)*

Near Threatened:
- Blue shark *(Prionace glauca)*
- Crocodile shark *(Pseudocarcharias kamoharai)*
- Silky shark *(Carcharhinus falciformis)*
- Manta ray *(Manta birostris)*
- Spinetail devil ray *(Mobula japanica)*

SHAWN HEINRICHS

The best-studied ocean area for shark populations is the northwest Atlantic. Studies carried out there in the past few years have revealed severe declines in many shark species.

Species	Decline from Unexploited Levels
Sandbar shark	64 to 71% [28]
Dusky shark	80% minimum [29]
Hammerhead shark (3 species)	70% [30]

Other studies have indicated declines as follows:

- Porbeagle shark populations are estimated at 10 to 20 percent of unexploited levels.[31]
- North Atlantic shortfin mako populations are at about 50 percent of unexploited levels.[32]
- The northeast Atlantic spiny dogfish *(Squalus acanthias)* population stands at less than 10 percent of unexploited levels.[33]
- Sandbar shark stocks off Western Australia are estimated at about 35 percent of unexploited levels.[34]
- Oceanic whitetip sharks in the Gulf of Mexico have declined 99 percent since the 1950s.[35]

The most significant causes of shark mortality

45%

The percentage of all reported shark landings in 2008 coming from Indonesia; India; Spain; Argentina; and Taiwan, Province of China.

JEFF ROTMAN / CORBIS

The most significant causes of shark mortality

FRED BAVENDAM / MINDEN / FLPA

Commercial shark fishing

Commercial fisheries targeting sharks exist throughout the world. Sharks are targeted primarily for their fins but also for their meat, cartilage, liver and skin.[36] Well-documented collapses of directed shark fisheries (where sharks are the primary target) include:

- spiny dogfish off British Columbia[37] and the North Sea.[38 39]
- soupfin (or school) sharks *(Galeorhinus galeus)* off Australia[40] and off California.[41]
- porbeagle sharks in the North Atlantic Ocean.[42 43]
- sandbar and dusky sharks in the northwest Atlantic.[44 45]

The highest numbers of reported shark landings are from: Indonesia; India; Spain; Argentina; and Taiwan, Province of China. They accounted for 45% of reported shark landings in 2008.[46]

Directed shark fisheries are typically characterized by a "boom and bust" pattern, in which high initial catches are followed by a rapid crash and usually result in the fishery being closed.

Although some target shark fisheries are well documented, there are many others worldwide about which little is known. Unfortunately, many of these fisheries operate in the Indo-Pacific, where shark biodiversity and endemism are high, which means that many obscure, range-restricted sharks may be in danger of biological extinction.

Shark bycatch fisheries

Bycatch is the part of the catch that is not targeted – the collateral damage caught along with the targeted fish species. In essence, it is unregulated and often unreported and is considered to be a major source of mortality for many shark species worldwide.[47 48] Although some sharks caught as bycatch may be retained and landed for sale, often they are thrown overboard either dead or seriously injured.

Bycatch of sharks is particularly problematic because sharks usually have slower growth rates than the target fish species. Shark populations can be seriously depleted through bycatch from a fishery that may be sustainable for the target species but not for sharks.[49] In pelagic longline fisheries, sharks can make up more than a quarter of the total catch (and therefore constitute more of an unregulated/unmanaged fishery, than true bycatch).

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Sharks Caught as Bycatch

Where	When	Percentage of total catch
U.S. pelagic longline tuna/swordfish fishery	1992-2003	25% [i]
South African longline fishery	1998-2005	16% [ii]
Australian longline tuna/billfish fishery	1999	25% [ii]
Fiji longline tuna fishery	1999	25%+ [ii]
Portuguese semi-pelagic longline fishery	1997-1998	33% [iii]

i - Abercrombie, D.L., H.A. Balchowsky and A.L. Paine. 2005. 2002 and 2003 Annual Summary: Large Pelagic Species. NOAA Technical Memorandum NMFS SEFSC-529.
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What are the driving forces behind shark fishing?

$700/kg

Shark fins are considered one of the most valuable food items in the world, reaching prices as high as US$700 per kg.

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What are the driving forces behind shark fishing?

JEFF ROTMAN

Fins

The value of shark fins has escalated in recent years with economic growth in China and is a major factor in the commercial exploitation of sharks worldwide.[50 51] The shark fin trade is driven by economic, traditional and cultural factors.[52]

From 1985 to 1998, shark fin imports to Hong Kong and Taiwan increased by more than 214 percent and 42 percent, respectively.[53 54] In the Chinese market, trade in shark fins grew by 6 percent a year from 1991 to 2000.[55] Shark fins are considered one of the most valuable food items in the world,[56] reaching prices as high as US$700 per kg.[57] The minimum value of the global trade of shark fins has been estimated at $400 million to $550 million a year.[58]

Shark "finning"—the practice of cutting off the fins at sea and discarding the rest of the shark—is a major source of fins for the lucrative international shark fin trade. By keeping only the fins, a single vessel can kill an extraordinary number of sharks on a single trip. For example, in 2002, the U.S. vessel King Diamond II was caught by the U.S. Coast Guard off the coast of Guatemala with 32 tons of fins on board (estimated to represent 30,000 sharks), without the corresponding carcasses.[59]

Shark finning is outlawed in several countries, including the United States, Costa Rica, South Africa, the United Kingdom, Oman, Colombia and the member states of the European Union. Several regional fishery management organizations (RFMOs), including the International Commission for the Conservation of Atlantic Tunas (ICCAT), the Inter-American Tropical Tuna Commission (IATTC), the Indian Ocean Tuna Commission (IOTC) and the Western and Central Pacific Fisheries Commission (WCPFC), have also prohibited finning. There are often no clear guidelines on how the bans are to be enforced, however, and loopholes remain.[60 61]

The IUCN advises that sharks be landed with their fins attached to prevent the excessive mortality and waste associated with finning.

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Where shark finning regulations exist, the fin-to-carcass ratio is the most widely adopted management measure, but it is not effective with respect to enforcement. This ratio is intended to prevent finning by ensuring that the fins landed are proportional to the bodies landed. The shark fins retained usually cannot exceed 5 percent of the weight of the sharks onboard. This ratio has several problems: It is highly inconsistent, as it varies with species, the choices of fins, finning procedure, the state of the shark carcass and even the degree to which the fins are dried.[62] Further, the ratio system allows high grading, in which fishing vessels can bring mismatched fins and carcasses to port, keeping carcasses from sharks valued for their meat and the non-matching fins from sharks with highly valuable fins but low-quality meat.

Sharks should be landed with their fins attached to prevent the excessive mortality and waste associated with finning. Further, a 2006 scientific paper on fin ratios prepared for the ICCAT stated that "the only guaranteed method to avoid shark finning is to land sharks with all fins attached."[63] Indeed, most shark experts agree that this straightforward approach is the most reliable means to implement a finning ban.

Meat

Shark meat is more difficult to process than meat from most fish species because of its high urea content,[64] which also makes it less marketable in many areas and has led to many species of sharks being targeted for their fins alone. Shark meat is less economically valuable than shark fins, or meat from other more widely eaten fish species, such as tuna and swordfish.[65] For example, U.S. exports of shark fins in 2006 had a value of US$93.68 per kilogram; by contrast, fresh and frozen shark meat was worth $2.09 and $1.94 per kg, respectively.[66]

However, shortfin mako, thresher and porbeagle sharks are considered high-value species for meat in the European and U.S. seafood markets and for sashimi in Asia.[67] Many smaller species, such as the spiny dogfish, are also commonly used for food.[68 69] Some shark species, such as blue and hammerhead sharks, are targeted specifically for their fins because of a perceived difficulty in processing their meat.[70]

What happens to our oceans when top predators are lost?

The decline in shark populations can lead to unpredictable consequences, including the collapse of important fisheries.

JIM ABERNETHY

What happens to our oceans when top predators are lost?

JEFF ROTMAN


GEORGETTE DOUWMA / GETTY IMAGES

As top predators, sharks play an important role in maintaining the structure and function of the marine ecosystem.[71 72] The loss of sharks can cause dramatic shifts in the marine environment, including a cascade of indirect effects resulting from changes in the abundance of other organisms.[73 74 75 76] Without sharks to regulate the abundance of species below them, shifts in population sizes can cascade throughout the food chain and disrupt the balance of the ecosystem.

The decline in shark populations can lead to unpredictable consequences, including the collapse of important fisheries. In the northwest Atlantic, for example, populations of sharks have dropped to the point that they may no longer fulfil their role as a top predator in the ecosystem.[77] Off the coast of North Carolina, scientists believe that the cownose ray population exploded due to the loss of large sharks, which helped keep the ecosystem in balance and their prey in check. With more cownose rays, which eat scallops, clams and oysters, the bay scallop population collapsed and was terminated.[78] With the loss of the bay scallops, the clams and oysters along the eastern coast of the United States may experience a similar fate.[79] A model of the French Frigate Shoals ecosystem in Hawaii found that the removal of tiger sharks presented a similar scenario. Without the tiger sharks to keep the seabird population in check, increased seabird predation on tuna and jacks caused a significant decline in the populations of these important commercial fish species.[80]

Impacts from the loss of sharks can be felt throughout the entire system. In coral reef ecosystems, such as those in the Caribbean and Pacific, corals depend on herbivorous fish such as parrot fish to eat algae and provide space for corals to settle and grow.[81] When sharks are removed from the system, the larger fish, which feed on herbivorous fish, increase in abundance.[82] Without the smaller fish to eat the algae, corals can no longer compete for space. As a result, the ecosystem switches to an algae-dominated system, lacking the diversity and abundance of species once found within the coral reef ecosystem.[83]

Impacts from the loss of sharks can be felt throughout the entire ecosystem.

What is the value of a live shark?

WOLCOTT HENRY / MARINE PHOTOBANK

$47.5M

It has been estimated that whale shark tourism, mainly through recreational diving, is worth about US$47.5 million worldwide.

What is the value of a live shark?

C/O STUART COVE'S DIVE BAHAMAS

Live sharks have a significant value for marine ecotourism, such as recreational diving and shark watching from boats, that is typically more sustainable and often more lucrative than shark fishing and trade.[84 85] Shark ecotourism sites include the Bahia de los Angeles conservation area in Mexico;[86 87] the Seychelles;[88 89] South Africa;[90] the Philippines;[91] Phuket, Thailand;[92] the Maldives;[93] Belize;[94] and Ningaloo Marine Park in Western Australia.[95]

Indeed, researchers document more than 200 shark dive tourism operations around the world.[96] Although many shark species are the focus of marine ecotourism,[97] large, charismatic species yield the highest revenue. It has been estimated that whale shark tourism, mainly through recreational diving, is worth about US$47.5 million worldwide.[98]

In Australia, the value of each living whale shark was estimated at AU$282,000, [99] and in Belize, the value was put at US$2.09 million over a shark's lifetime, or $34,906 a year.[100] In the Maldives, individual grey reef sharks were estimated to have an annual value of US$33,500 in 1993.[101] In 2005, whale shark ecotourism created 300 jobs, an increase in annual income and an economic return of about US$623,000 in Donsol, Philippines.[102] Finally, a 2010 study found that an individual reef shark in Palau was estimated to have an annual value of US$179,000 and a lifetime value of US$1.9 million to the tourism industry.[103]

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JIM ABERNETHY

Shark Tourism Values in Selected Locations

Location	Activity	Value (millions)*	Year
Ningaloo, Australia	Whale shark tours	US$5.93	2006[a]
Seychelles	Whale shark research/tours	US$2.02	Projected annually[b]
Gansbaai, S. Africa	Shark diving	US$4.4	2000/2001[c]
Belize	Whale shark tours	US$3.7	Annually[d]
Donsol, Philippines	Whale shark watching	US$0.62	Annually[e]
Canary Is., Spain	Shark diving	US$24.7	Annually[f]
Indo-Pacific region	Shark diving	US$40	Annually[g]

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**For consistency and ease in comparison, non-USD figures were converted to USD in October 2010.*

Conclusions and recommendations

The exploitation of sharks in commercial fisheries for their fins, meat, liver oil, cartilage and other parts remains largely unregulated across most of the world. Overfishing, excessive bycatch, a lack of scientific data, poor management, shark finning and the lack of political will to adopt best practices have led to declines in populations of many shark species worldwide. To reverse these declines, Pew's Global Shark Conservation campaign believes concerted action must be taken by all fishing countries and international bodies that regulate shark fishing and trade, including:

Fishing countries should:

- Establish shark sanctuaries within their waters, including their full exclusive economic zones (EEZ), where sharks are fully protected from exploitation.
- Devise and implement effective National Plans of Action for sharks.
- End fishing of sharks that are Threatened or Near Threatened with extinction and sharks that do not have science-based management plans in place.
- Enact legislation prohibiting the removal of shark fins at sea.
- Work to eliminate shark bycatch.
- Enact immediate protections for species listed by multilateral agreements such as the Convention on Migratory Species (CMS) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).
- Impose precautionary shark catch limits that are based on sound science.
- Improve species-specific fisheries and trade data collection.
- Generate high-quality scientific research on shark fisheries, shark population status, and national and international trade to inform decision making that is precautionary and ecosystem-based.

RFMOs and bodies tasked with regulating shark fisheries and trade should:

- Adopt binding measures prohibiting the fishing and retention of shark species that do not have science-based fishery management plans or are listed by the IUCN as being Threatened or Near Threatened with extinction.
- Adopt binding measures that prohibit the removal of shark fins at sea.
- Require their members to provide reliable, species-specific data on landings and discards and impose meaningful penalties on those who do not comply.
- Ensure full independent observer coverage of vessels fishing within the areas they manage.
- Adopt gear modifications and other measures, such as bans on wire leaders, to ensure that bycatch of sharks is minimized as much as possible.

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