Bleeding the oceans dry?

The overfishing and decline of global sharks stocks

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About WildAid

WildAid UK is a registered charity in the United Kingdom working for effective conservation of wildlife and natural environments, with special focus on wildlife trade.

WildAid is a US registered public charity based in San Francisco with representation in the Galápagos Islands, Beijing and New Delhi, with affiliate Canadian and UK registered charities.

WildAid's mission is to end the illegal wildlife trade in our lifetimes. WildAid focuses on reducing the demand for unsustainable and illegal wildlife products through public and policy maker education.

WildAid's Shark Conservation Program aims to:

- Raise awareness globally about threats to sharks
- Promote sustainable management of shark populations
- End the practice of finning globally
- Reduce excess demand for shark fin

In addition, WildAid is providing financial and technical support to the Galápagos Islands for patrolling and enforcing the Marine Reserves. In addition, we are working to strengthen enforcement of key MPAs of the Eastern Tropical Pacific Corridor and bolster regional cooperation.

To learn more visit **www.wildaid.org**

Picture: Fishermen slaughtering a whale shark.

Contents

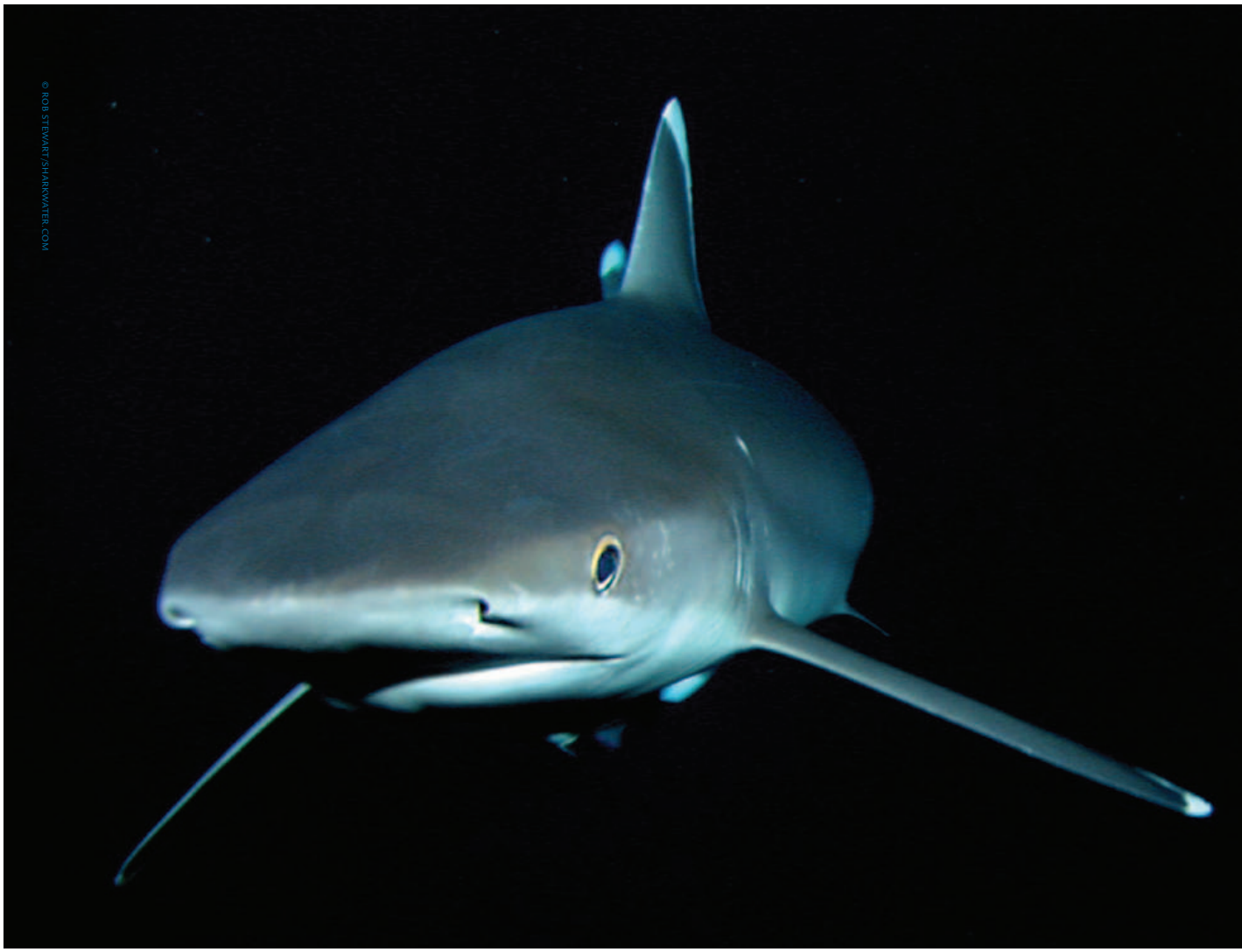
Foreword

Sharks are in trouble. And they need urgent action to prevent the collapse and possible extinction of populations and entire species – events that will cause far wider ecological disruption and with it massive economic losses, decreased food security and social problems. How do we know this to be the case? We can simply look at what the latest science tells us is happening to sharks, and it presents a clear, profound and compelling warning. Collapses in populations of up to 99% have been recorded. Sharks have swum in our seas and oceans for over 400 million years – they are living dinosaurs – yet within the space of our lifetimes we could wipe out most of them.

Why is this happening? Simple: over-fishing, wasteful and destructive fishing practices and, increasingly, the growing demand for shark fins. Over the past 25 years shark catches have increased dramatically, driven by booming populations, increasing affluence (particularly in Asia) and an increasingly accessible global market and today demand for shark products is greater than ever. The global production and trade of shark products has doubled since 1991 and now is worth around US$310 million globally with as many as 79 million sharks killed each year for their fins. Alarmingly, it appears that the majority of consumers are eating shark fin unknowingly. A survey conducted by WildAid and the China Wildlife Conservation Association in 16 cities across China found that 35.1% of those surveyed had consumed shark fin soup, but that 76.3% did not even know it was made using sharks.

Some may ask why we should we care about sharks? Again, science presents some compelling answers. When shark populations are wiped out, it can have a devastating impact on other species within the marine environment, some of them commercially valuable species that are needed for food, employment and income.

Can anything be done about the threats now facing sharks? Yes, there is no doubt that a few, economically and logistically viable steps could make a profound difference to their conservation and survival.



First, we urgently need to see controls placed on the level of exploitation of sharks to bring it to sustainable levels – we need to stop consuming so much shark fin. Consumers need to recognize that their individual choices generate a demand that is driving the decline in sharks. By that same token, consumers must be aware that they have the potential to effect change, enabling sustainable fishing efforts to expand and thrive, ensuring that sharks will still swim in our waters in the future. At the same time, governments need to promote far greater education and awareness among consumers of the problems and solutions.

Binding agreements on national, regional and international scales must be reached and actively enforced, to manage and conserve sharks, before it is too late. Shark catches – both directed catch and bycatch – must be reduced, and the highly wasteful practice of finning prohibited and enforced. The invasion of protected areas and marine reserves by shark fishermen, operating illegally and driven by mounting demand for fins, can and must be stopped. Also necessary is the adoption by fishing, trading and consuming nations of mechanisms to monitor their activities and create accurate, up-to-date data – exactly how many sharks are being caught, traded and consumed and by whom? China has a special role to play in this – a leadership role – that will benefit the entire planet, millions of people and countless species.

There is nothing to stop either individuals or governments taking up these actions to prevent the decline and loss of these invaluable species and much that encourages them to do so – all that is necessary are leaders. We believe in China's ability to take on this role and lead the world in reducing the consumption of sharks to sustainable levels, preventing the illegal fishing and wasteful practices that all too often characterize industrial fishing and, perhaps most importantly, among its consumers, to stop eating shark fin soup.

Steve Trent
President, WildAid

About 520 million people – around 8 percent of the world's population – depend on fisheries and aquaculture as a source of protein, income or family stability*.

While around 90% of the world's fishers operate at and depend upon small-scale, local fishing operations, accounting for around half the global catch, more and more fish each year harvested from our oceans are taken by a heavily industrialized globalised fleet of industrial vessels. Today no part of the ocean is out of reach for modern fishing vessels, and some deep water trawlers harvest fish down to a depth of over 1.5km. For virtually all species of fish there is simply nowhere left to hide. While efficiency in industry may be good, in fishing if you are too efficient you leave nothing to restock the population. Overfishing is now a global issue, with more than 80% of fisheries for which there is data are believed to be either fully exploited or over-exploited. We can reasonably conclude that the maximum yield from our seas and oceans of wild fish has already probably been reached.

*** http://www.fao.org/news/story/ru/item/20188/icode/**

Executive Summary

In recent years, shark catches have hit a record high. Statistical analysis of shark fins traded through Hong Kong indicate that as many as 79 million sharks are caught and killed each year, equivalent to as much as 1.73 million tons of shark. This is significantly more than the reported catches to the United Nations Food and Agriculture Organization (FAO).

Half the global catches of sharks, skates and rays are not caught by targeted fisheries, rather they are caught as bycatch. Some are kept for their meat, although this is traditionally considered to be of low quality, and many others have their fins removed and then are discarded back into the ocean. This practice, called 'finning', wastes as much as 98% of the shark. It is also extremely cruel, and the finned sharks either drown or bleed to death.

Much of the shark fishing industry goes unreported and unregulated, and can be illegal (IUU fishing). In fact, despite anecdotal information suggesting declines and collapses in shark fisheries in West and East Africa, parts of Latin America and many other parts of the world, there is a general paucity of records and monitoring efforts. This lack of catch and trade data makes it very difficult to establish the health of shark populations, and subsequently makes it extremely difficult to plan and develop conservation and management strategies.

People may perceive sharks as invulnerable killing machines, widely-spread, with inexhaustible populations, but the reverse is true. Sharks are naturally vulnerable, reaching sexual maturity late and producing few young, which means they have a low resilience to fishing.

Based on the data available, we now know that 20% of all shark species, and more than 50% of pelagic sharks targeted by high-seas fisheries, are threatened with extinction. Some species, such as the oceanic whitetip shark, are already locally extinct. In the Mediterranean, 18% of shark species are considered to be 'Critically Endangered', 11% are 'Endangered' and 13% are 'Vulnerable'. Only 11% are legally protected.

WHAT IS A SHARK?

Sharks, skates and rays belong to the subclass Elasmobranchii, which in turn is part of the marine class Chondrichthyes. They are different from other fish because of their cartilaginous skeletons. There are more than 500 known species of shark in the world. Sharks first appeared around 400 million years ago and thrived in the world's oceans ever since; outliving the dinosaurs and surviving the end-Permian extinction event (251 million years ago), when as much as 95% of all species were wiped out[1]. Their current population declines can therefore serve as an indicator of humankind's adverse impact on marine ecosystems[2].

Despite the mounting concerns of the Food and Agriculture Organization of the United Nations (FAO), the United National General Assembly (UNGA), and the parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), little implementation of shark management and conservation plans has taken place. Of the frameworks in place, the majority are non-binding and poorly enforced.

Of the more than 500 known species of shark, only three are protected in the majority of countries in which they are encountered.

The majority of Regional Fisheries Management Organizations (RFMOs) have now banned shark finning, yet only around 20 shark fishing countries have issued complementary national bans.

Instruments used by Regional Fisheries Management Organizations (RFMOs) to control shark finning, particularly fin to weight ratios, are criticised for being difficult to enforce, for making shark catch information hard to collect, and for being open to abuse.

More accurate and fine resolution catch and trade data is essential to shark management and conservation planning, and with Hong Kong as the world's leading entrepôt for shark fins, China is excellently placed to lead monitoring efforts.

Demand for shark products needs to be reduced, and consumers can play a central role in this. Particularly, focus should be paid to consumers of shark fin, as demand for fins encourages the wasteful and barbaric practice of finning.

National governments should evaluate the net worth of conserving shark populations for tourism, rather than as exporting them as food and curios. In the Maldives, shark-generated tourism is worth three times the amount of exported shark products – driving the decision to introduce a national ban on targeted shark fishing.

Commentary

Global Threat Status of the World's Sharks, Rays and Chimaeras

By Nicholas K. Dulvy[i] and Sarah L. Fowler[ii]

The status of the world's 1000 or more species of sharks, rays and chimaeras (chondrichthyans) will soon be known when the Global Shark Red List Assessment draws to a close at the end of 2009. The GSRLA is the product of ten workshops and a decade-long concerted effort by more than 300 scientists coordinated by the World Conservation Union (IUCN) Shark Specialist Group. Even without the benefit of the complete results, the conclusions published so far suggest concerted action is required to stabilize and recover many chondrichthyan populations. There are two main findings: sharks rays and chimaeras include similar proportion of threatened species as other vertebrate animals and a large number of chondrichthyans are so poorly known that they were categorized as Data Deficient. Both underscore the need for shark fishing nations to develop an International Plan of Action for the Conservation and Management of Sharks.

Sharks, rays and chimaeras are as threatened as other vertebrate groups, such as mammals, birds and amphibians. Here, "threatened" means that a species has qualified for one of three IUCN Red List categories: Critically Endangered, Endangered or Vulnerable. Species are assigned to one of these threatened categories based on their past or past, current and projected trends in population size. To qualify as Vulnerable, a species has to have declined (or experience an ongoing decline or projected to decline into the future) in adult abundance of greater than or equal to 50% over the time period of either ten years or the time spanning three generation lengths, whichever is greater. The three-generation long time span accounts for the different life histories of species and their capacity to cope with and recover from elevated mortality, such as from fishing. The qualifying decline thresholds for Endangered and Critically Endangered are 70 and 90% respectively.

By the end of 2007, almost half (591) of all chondrichthyans had been evaluated at a global scale and 126 species or 21.3% of the known chondrichthyans were threatened. As far as we can tell no chondrichthyans have become globally extinct, however a number of species are classified Critically Endangered and have not been seen for decades. An example is the Pondicherry shark Carcharhinus hemiodon, known only from 20 museum specimens captured from the heavily-fished inshore waters of Southeast Asia, and not seen since 1979. A small proportion of species has been assigned with Endangered status (29 species or 5%), and 75 species (12.7%) have been found to be Vulnerable. A further 117 species (18%) were listed as Near Threatened, largely because past declines were not quite severe enough to qualify them as Vulnerable and on the basis of the ongoing or increasing potential threat faced by these species. The regional Red List status of the sharks, rays and chimaeras has been completed for the NE Atlantic Ocean, Mediterranean Sea and Australasia: around thirty species are threatened (classified as Critically Endangered, Endangered or Vulnerable) in each region. The threatened species include inshore sharks and rays with relatively shallow depth distributions that are highly accessible to and catchable by inshore trawl, net and longline fisheries, such as skates, angel sharks, guitarfishes and sawfishes. These species have declined because they are caught as a byproduct of fisheries focusing on other more abundant and productive fish species. The types of fishing gears used in coastal waters tend to be fairly indiscriminate and tend to catch all species larger than the net mesh size. Consequently, sharks and rays can decline almost unnoticed provided the catches of other targeted more productive fishes remain relatively high. In Australian waters, however, many inshore endemics (found only in Australian waters) are Least Concern, where fishing pressure is low and fisheries tightly regulated.

Fisheries have long since moved beyond the narrow confines of the shallow coastal waters of continental shelves. Trawlers and longliners are now fishing the deep waters of the continental slopes beyond the shelf edges. Here exist numerous poorly-known species of skate and dogshark, many of which have slow life histories and low capacity to cope with the mortality imposed by fishing fleets. Where scientific data exist some dogfishes have declined by over 99% in a quarter century of fishing (less than three generation spans) and are Critically Endangered, such as Harrison's dogfish (Centrophorus harrissoni). These fisheries and these species are poorly understood, consequently many deepwater species were assigned Data Deficient categorizations by the IUCN Shark Specialist Group.

Fishing fleets have also expanded out over the surface of the high seas of the world's oceans. The number of true oceanic pelagic sharks is low, comprising around 6% of all chondrichthyans; however they are mostly large charismatic predators, such as hammerheads, threshers and mako sharks and many swim alongside the tuna and billfishes targeted by ocean-wide fisheries. Once caught, the shark fins are removed and sold on to feed growing Asian demand for shark fin soup. The relatively low productivity of most of these oceanic pelagic sharks, the high value of fins and increasing demand for shark fin soup means that, unless specific action is taken to manage the incidental shark catch, they will inevitably decline at a faster rate than the more productive tunas and billfishes. It is estimated that 23-73 million sharks, mainly oceanic pelagic sharks, are killed each year to supply the Hong Kong-based trade in soup fin. The large tunas of the world are in decline, so it is little surprise that many of the largest oceanic sharks are also threatened. According to the consensus of scientists that undertook the IUCN Red List assessments of these 64 oceanic sharks

and rays over half (54%) face an elevated risk of extinction – 31% or 20 species are threatened (16 species are Vulnerable, four are Endangered) and an additional 15 species (23%) lie just outside the threatened categories and were assigned a Near Threatened status, including the manta ray (Manta birostris) and the blue shark (Prionace glauca). A number of species appear to be safe: 12 species were assigned a Least Concern listing, not least the large salmon shark (Lamna ditropis), which appears to have benefited from improved fisheries management, the bizarre goblin shark (Mitsukurina owstoni) and the ectoparasitic cookie cutter sharks (Isistius spp.).

The scientific community has known the nature and scale of the problems facing chondrichthyans for a couple of decades now. The global status assessment provides more badly-needed detail: (1) to compare the states and fate of sharks alongside mammals, birds, amphibians and corals – the poster children of the past decade of global change, and (2) to prioritize species and populations, geographic locations and specific fisheries for management action. A decade ago, in 1999, the Food and Agriculture Organisation of the United Nations recognized the high priority of shark fisheries management by adopting and promoting the International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks). Nevertheless, few (~10%) shark fishing nations are managing their shark fisheries and the great majority have yet to make significant progress towards the development of shark fishery management plans. The Global Shark Red List findings underscore the need to urgently develop and implement IPOAs for sharks rays and chimaeras.

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Pressures on sharks

Overfishing

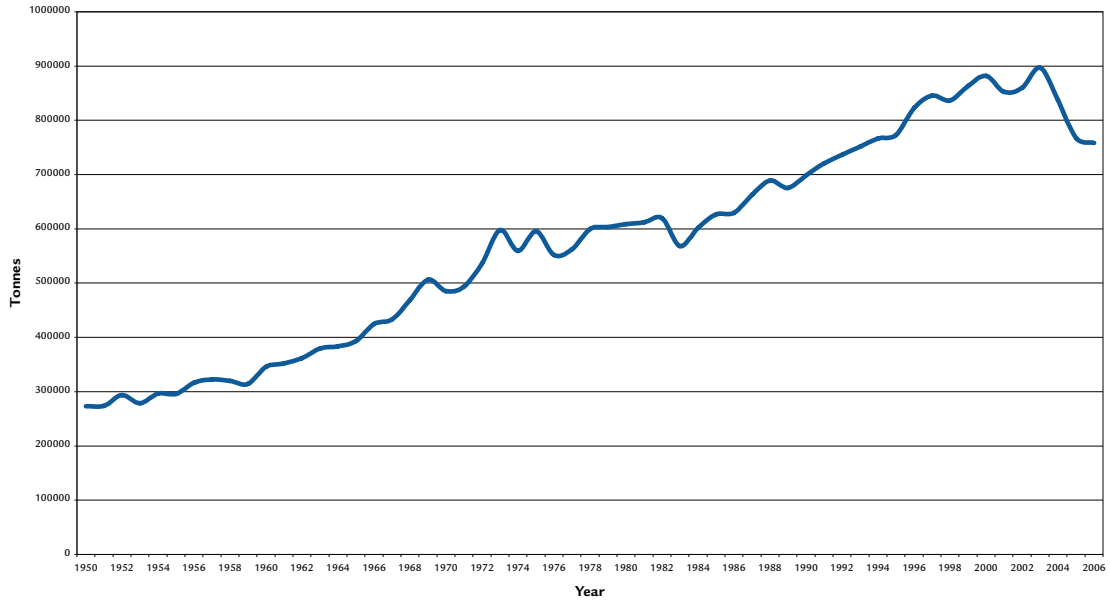
"Recent estimates indicate that exploitation has depleted large predatory fish communities worldwide by at least 90% over the past 50-100 years."

—Myers & Worm, 2005[3]

Shark fishing has reached a critical level in recent years, with more than 125 countries now engaging in the trade of shark products[4]. Between 1984 and 2004, reported world catches of sharks grew by more than 200,000 tons[5], and the annual reported catch now rests at approximately 800,000 tons[6]. But these are only the reported figures. Based on shark fin trade data it is estimated that 30 - 52 million sharks, equivalent to as much as 1.73 million tons of sharks, are caught and killed each year. Depending on statistical analysis, this figure could be as high as 79 million sharks a year[7].

The increases in global shark catches are deceptive in that they are indicative of the technological advances in fishing efficiency and a wider geographic effort, rather than a sustained or greater supply of sharks. In fact, many shark stocks are actually decreasing dramatically. This is because sharks are now targeted in areas where they were previously unexploited and are targeted more intensely than ever before. In many cases, more and more juveniles are being caught, so while catches are sustained or increase the stock may be headed toward collapse. Vague categories in catch data also act to disguise these declines, and so fishing in an area with no sharks but increased catches of rays would still indicate an increasing catch.

Overfishing is one of, if not the, single greatest threat to sharks, pushing many species to the brink of extinction[6]. As a whole, a third of pelagic sharks are threatened, but of those targeted by high-seas fisheries more than half are at risk[8]. Recent studies have observed global declines in predatory fish biomass to around 10% of pre-industrial abundance[3]. Some fisheries have shown up to a 99% loss of sharks[9].



Below: Total fishery production for all species of sharks, skates and rays, from all areas submitting information to the FAO, 1950-2006[10]

TABLE 1 **Major importers of key shark products, 2000-2005**

Fresh/chilled shark meat (not fillets)	**Fresh/chilled and frozen shark fillets**	**Fins, dried salted**	**Fins, other**
Spain	Italy	China, Hong Kong	China, Hong Kong
USA	Spain	China	Indonesia
Italy	France	China, Macao	Taiwan
Mexico	Germany	Malaysia	
UK	Greece	Thailand	

Source: FAO, 2007 cited in Lack & Sant, 2008[11]

Bycatch

Most fisheries target a specific species or group of species. Everything else caught is termed 'bycatch'. In some cases this is used, in many it is simply dumped overboard, invariably dead. For some fisheries, bycatch dwarfs the catch of targeted species; the shrimp industry in the Gulf of Mexico is among the most wasteful in the world, with a 10:1 ratio of bycatch to shrimp[12]. It was estimated that around 50% of the global catch of sharks, skates and rays was taken as bycatch[13].

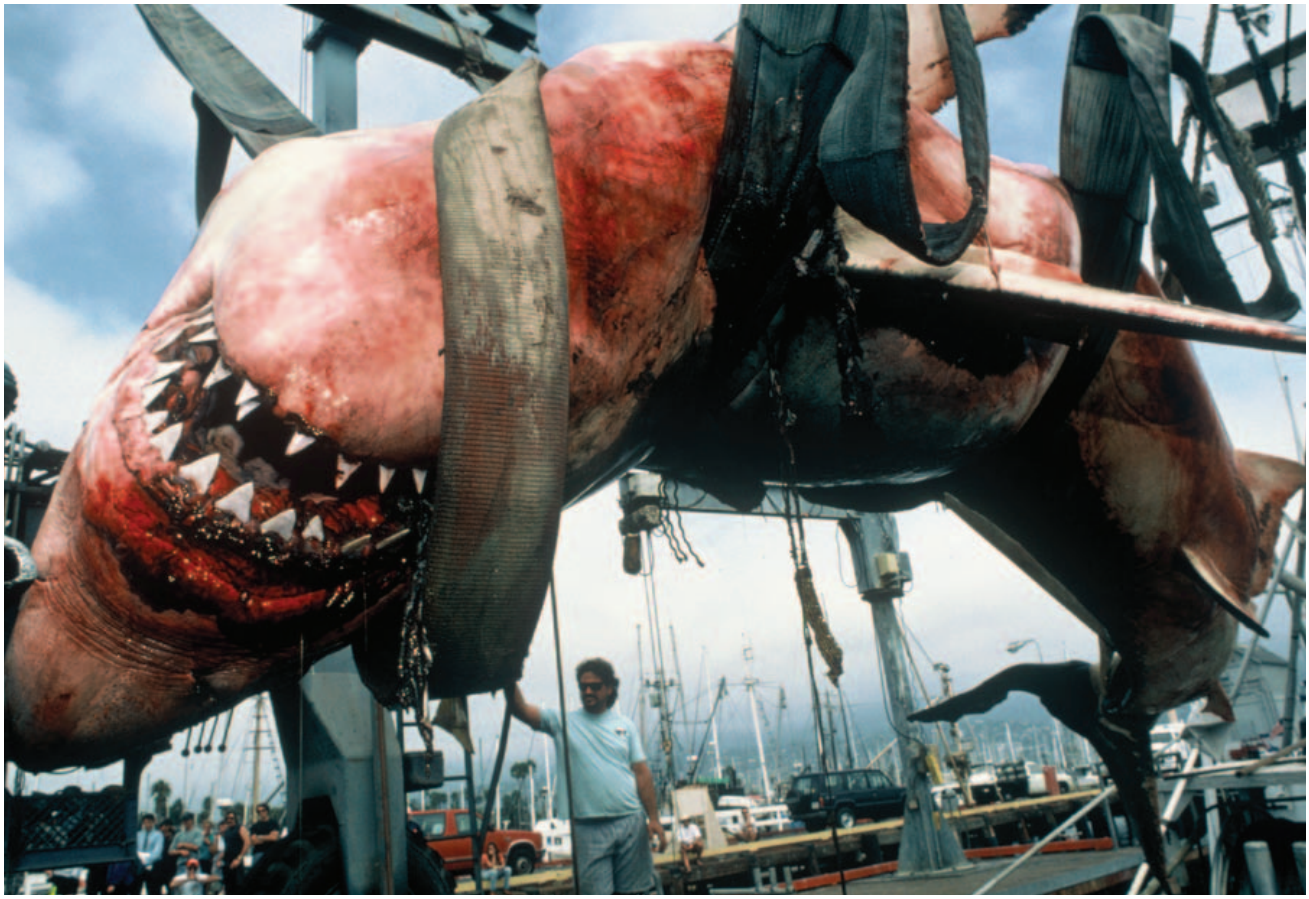
Traditionally, shark meat has been of low value and so sharks caught were thrown back. However, because of the high market value of the fins, combined with easy processing and storage, many sharks may now be finned or even become part of the target, especially as the targeted species decline. For example, in 2005, in the Spanish longline swordfish fishery in the northeast Atlantic the shark catch was greater than the swordfish[14]. Sharks caught as bycatch on longlines can often survive release, but are more invariably finned.

Above: Investigators find fishermen finning a guitarfish caught as bycatch.

Below: A 15-foot great white is caught and killed as accidental bycatch in a driftnet.

"If left un-finned, survival rates for discarded sharks can be high, even up to ~60% of sharks released may survive."

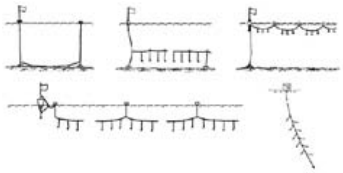
—Campana et al., 2005 in ICES, 2007[15]



Commercial fishing gear

LONG LINES

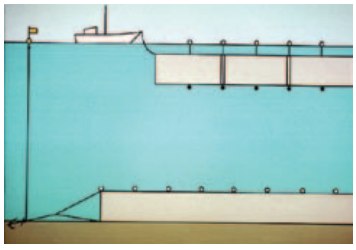
Longlines are often used by tuna, swordfish, mahi mahi and billfish fisheries. Thousands of baited hooks may be set off a main line that can be kilometres long. As many as 10-20 million blue sharks are caught as bycatch by longlining efforts each year[16].



NET ILLUSTRATIONS COURTESY OF FAO/ FISHERIES AND AQUACULTURE DEPARTMENT

ENTANGLING NETS

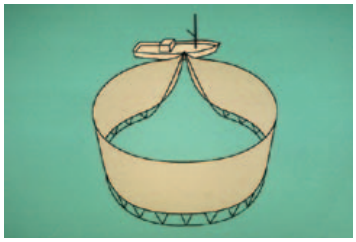
Driftnets are vertical, weighted nets which float in the current and left to drift for hours or even days. Despite a UN moratorium on their use, as well as numerous national bans, this method is still used by many countries. It is particularly wasteful – with an estimated 85% of catch thrown back into the sea[17].



Gillnets tend to be in fixed position. Before their use was banned in the high sea, typical bycatch rates for pelagic gillnets were of about 30-40% of the total catch[6].

PURSE SEINE NETTING

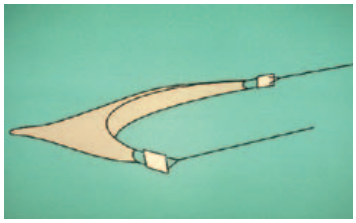
Purse seine fishing is primarily used for catching schooling fish such as sardines. A purse seine is a large wall of netting that encircles a school of fish.



The bottom of the netting is then pulled closed (like a drawstring purse), trapping the fish. Shark bycatch in purse seine fisheries targeting tuna totalled up to 1,500 tons in 2004[18].

TRAWLING

Trawlers drag a cone-shaped net behind a boat. With various modifications this can be set to any height in the water column. This is considered the most indiscriminate form of fishing,



with bycatch rates ranging from 60% of the target fish as in some temperate groundfish fisheries, to over 10 times the amount of target species in some tropical shrimp fisheries[6]. Bottom trawling also damages the ocean floor.

© ENVIRONMENTAL JUSTICE FOUNDATION

Right: An illegal trawler fishing in Sierra Leone waters.

PROTECTING OUR BEACHES?

Beach-nets are designed to trap and kill shark species that are considered dangerous to beach users. They have been criticised for giving the illusion of complete protection of bathers and surfers by acting as a barrier to sharks, when in fact 40% of sharks are caught on the beach side of the nets on their way back out to sea[19]. As with commercial fishing gear, the nets catch both target species, such as great whites, bull and tiger sharks, and non-target species (harmless to humans) such as reef and nurse sharks[20]. Along the coastline of KwaZulu-Natal, South Africa, anti-shark nets catch an average of 628 sharks, 237 rays, 58 turtles and 53 dolphins annually[21].

© FIONA AYERST/ MARINE PHOTOBANK

GHOST NETS

Lost and discarded fishing gear makes up about 10% of all marine litter[22]. The gear is designed to be extremely durable, and is often made of synthetic materials that do not biodegrade. This means that lost and discarded fishing gear can continue to attract marine organisms, ensnaring them and killing them, indefinitely. This is known as 'ghost-fishing'. One study based in the Puget Sound, Washington, calculated that a discarded net could potentially catch an average of 92 invertebrates, 13 fish and seven seabirds each month[23].

Above: A bull shark is killed in an anti-shark net off Durban

The trade in shark fins

Shark fins account for 40% of the global market value of shark trade, but only 7% of the volume[11]. Therefore, the relative value of shark fin is much higher than that of shark meat. It was recently reported that a set of shark fins can sell for as much as US$700 per kg in Asia[7], making the fins of large sharks worth thousands of dollars. There is increasing concern that in some fisheries shark bycatch is playing a significant role in the economics of fishing operations. The combined effects of factors such as increased operating costs and the high value of shark fins makes retention of shark bycatch very attractive[11]. It has been reported that the crews of some longline tuna vessels operating in the western and central Pacific can obtain as much as half of their wages from shark fin revenue[24].

Because of the difference in market value between shark fins and meat, many fishermen are encouraged to engage in the deplorable and wasteful practice of shark finning. Shark finning entails the live capture of sharks and the removal of their fins. In order to preserve storage space on the fishing vessel for high value produce, the live sharks are then thrown back into the ocean where they will either drown or bleed to death. As much as 98% of the shark is wasted. This practice is widely condemned, and has been banned by many countries, yet it continues today.

The production and trade of shark fins has followed an upwards trajectory since the mid-1970s. Asian countries are the source of greatest demand for this fishery product, with China, Malaysia, Thailand and Indonesia importing the greatest quantities of shark fins[11]. According to the FAO, in 2004 Indonesia was the largest producer of shark fins globally (1660 tons), followed by Singapore (1000 tons) and India (455 tons)[26]. Hong Kong is the world's largest entrepôt, through which more than 50% of the global fin trade passes, for easy access to consumer markets[7]. In 2005, Hong Kong imported 5,776 tons of dried shark fins and 4,572 tons of frozen shark fins[27].

© WILDAID

Above: Shark fins during the drying process

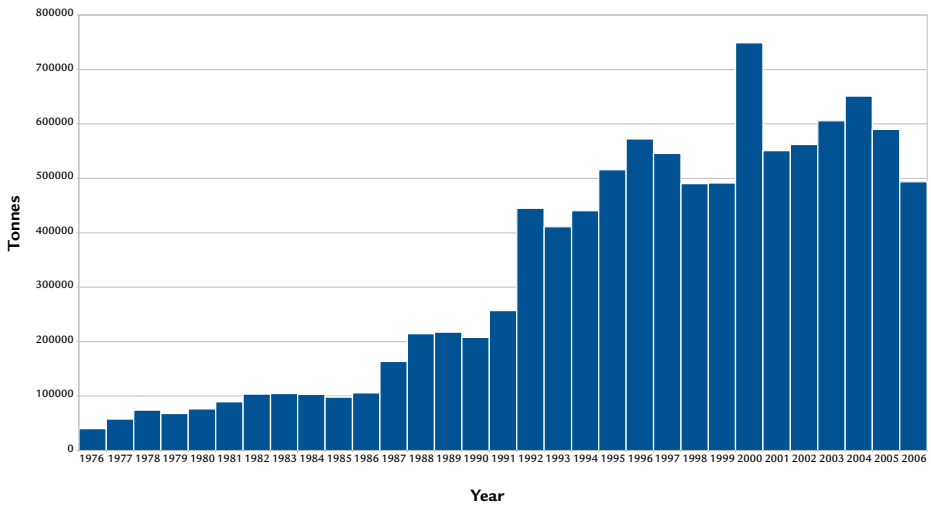
© KATHLEEN REAUGH/ MARINE PHOTOBANK

Below: Dried shark fin for sale in Hong Kong

Much of the shark fin bought by Asian consumers is used in 'shark fin soup', or 'fish wing soup' (*Yu Chi*). This is a soup made of processed shark fin, vegetables and meat stock. Traditionally, the dish was served at the banquets of Emperors, as an expensive show of hospitality to guests. However, in recent years it has been served more widely including at all-you-can-eat buffets and even in cat food. It is deemed by some to have various medical benefits and aphrodisiac effects. However, there is no documented scientific evidence for this, and a number of studies have found that shark fins can contain high levels of dangerous substances including methylmercury, DDT and arsenic[28].

Commodity Production and Trade: Shark Fins, 1976-2006

Source: FAO FishStat Database, accessed 2009



The catch and trade data deficits and the challenge to sustainable fishing

Accurate catch data is essential to any sustainable fisheries management. Yet information on shark catches is sadly deficient worldwide, making it impossible to monitor shark abundance. Where data is available, it is often only in the form of aggregated landing statistics- making it harder to discern if a species is declining or if smaller, younger sharks are being caught. There might only be limited information gained due to generic species codes such as 'shark' or 'other'[2], or because of poor or incomplete identification. Only 20% of all shark catches reported to the FAO are recorded by species[29]. The quality and quantity of data is also highly variable amongst regions (most notably there is a paucity of data from the Indo-Pacific)[30]. This means that it is hard to get a reliable picture of the 'data poor' areas, which are frequently in the developing world or the high seas.

Bycatch and other mortality are often excluded in catch data, adding to an incomplete account of fishing further compounded by deliberate misreporting and IUU fishing (Illegal, Unreported and Unregulated Fishing)[7]. This is highlighted by recent studies of the fin trade. Global shark catches estimated by using shark fin trade records reveal that shark biomass in the fin trade is three to four times higher than shark catch figures reported to the FAO- which is the primary global fisheries data collection facility[7].

Above: Finned sharks from a Taiwanese fishing vessel.

Since trade data could equally be used to monitor trends in fishing and population, and since Hong Kong represents the world's largest entrepôt for shark fins[7], it makes sense that China take the lead in tracking the shark fin trade. Comprehensive, fine resolution identification and recording of shark fins being traded would provide a vital overview of exploitation and shark abundances, and would be an important step towards sustainable fisheries.

Natural vulnerability

The fearsome reputation of sharks as invulnerable killing machines, combined with the assumption that the oceans are limitless and that populations of wide-ranging marine species are inexhaustible, lead many to believe that sharks are 'extinction proof'. However this has been conclusively shown to be false[5]. In fact, the inverse is true; sharks are naturally vulnerable. Sharks typically grow slowly and are long-lived, reaching sexual maturity later and having only a few offspring with high investment of energy in those offspring[30]. The female Atlantic dusky shark doesn't reproduce until it is at least 20 years old, and the spiny dogfish carries her pups for nearly two years[31].

Such traits result in very low rates of population increase and very low resilience to fishing mortality. Because of their low population resilience, even modest levels of fishing can cause population depletion and stock collapse in most shark species[32]. But global fishing efforts aren't modest, and in reality shark populations are declining both regionally and globally due to intense and far-reaching industrial fishing.

Even modest levels of fishing can cause population depletion and stock collapse in most shark species.

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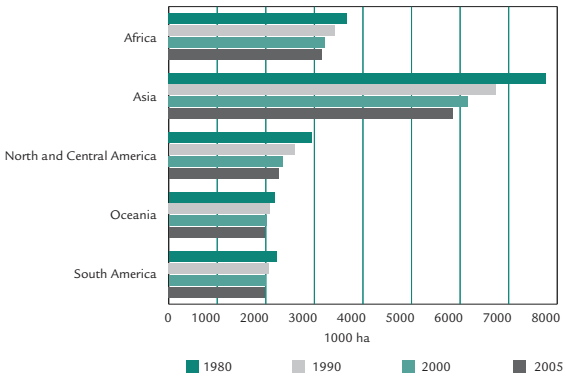
Habitat loss

Habitat loss is considered a principal cause of loss of biodiversity on land[33], but in the oceans it can be just as devastating; sharks and their food base are affected by damage to mangroves, reefs, sea mounts and estuaries, and by destructive fishing practices such as bottom trawling, dynamite fishing and pollution.

Decades of shrimp aquaculture, charcoal production and logging, exploration and drilling for oil, tourism, and urban and agricultural expansion have all contributed to extensive global mangrove losses. More than half of the world's original mangrove forest area (estimated at 32 million hectares) has already been lost, and the current rate of decline is estimated to be around 1% per year[34]. Coral reefs are also under threat; it is estimated that 19% of the original area of coral reefs has been lost globally. Fifteen per cent of reefs are estimated to be seriously threatened with loss within the next 10–20 years and 20% are predicted to be under threat of loss within 40 years[35]. Meanwhile, pollution combined with river and estuary (mis)management, such as mangrove clearance and dam building, is degrading the tropical river and estuary habitats of river sharks in the Australasian region[36].

Changes in world mangrove area, 1980-2005

Source: FAO, 2007[11]



Pollution

The release of sewage and industrial effluent, the dumping of garbage and agri-chemical runoff have wide ranging impacts, contaminating beaches, oceans and marine life. The runoff of nitrogen and phosphate-based fertilizers is devastating for coral reef health, often resulting in eutrophication; encouraging algal growth and subsequently decreasing oxygen levels, which can result in significant fish kills. Similarly, fertilizers have been linked to specific coral diseases including black band disease.

Every year an estimated 10 million tonnes of plastic ends up in the ocean, so that now there are 13,000 pieces of plastic litter floating on every square kilometre of ocean[37]. Oceanographers have identified an area twice the size of the Continental US, a 'plastic soup', where the millions of tons of marine litter has aggregated. Like in other parts of the oceans, plastic in this soup has disintegrated over time into smaller fragments. These fragments act like 'sponges' absorbing the chemical pollutants in the water. Mistaking the fragments for food, many marine animals will accidentally ingest these chemicals which may then build up inside them to dangerous concentrations. A 2005 study found both polychlorinated biphenyls (PCBs) and organochlorine pesticides (DDTs) in the livers of Mediterranean sharks[38], both of which are considered to have severe adverse effects on human and environmental health.

Above: Marine pollution in Port Honduras Marine Reserve.

The decline of shark populations

Species declines

The International Union for Conservation of Nature (IUCN) Red List of Threatened Species™ catalogues and highlights those plants and animals that are facing a higher risk of global extinction. In 2006, the IUCN conducted its first comprehensive regional assessment of selected marine groups, and sharks and rays were among the first to be assessed. The assessment highlighted the serious decline of shark populations, both regionally and globally. Of the 547 shark, skate and ray species listed, 20% are considered to be threatened with extinction[25].

ASSESSING THE LEVEL OF THREAT FOR INDIVIDUAL SPECIES

The IUCN Red List of Threatened Species™ provides taxonomic, conservation status and distribution information on plants and animals. The list is designed to determine the relative risk of extinction for each species, cataloguing and highlighting those organisms that are facing a higher risk of global extinction. It is internationally recognized as a sound source of information to be used in conservation and management decision-making.

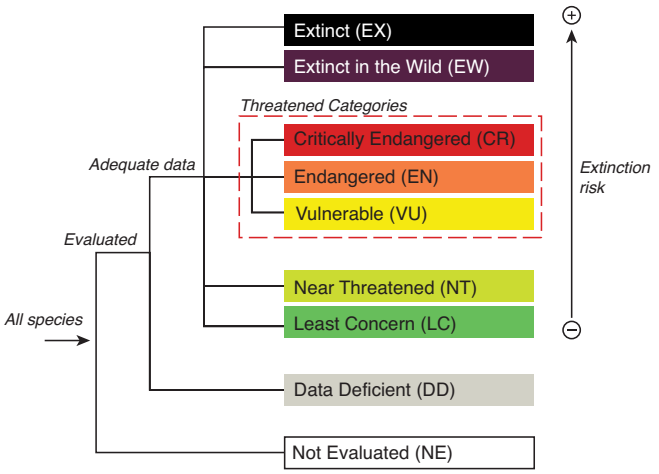


TABLE 2 **The main species in the shark trade and a basic assessment of threat**

Main Species in Trade	*Main products in trade (in order of importance)*	Trade *International*	Trade *Domestic*	Threats *Targeted fishing*	Threats *Bycatch*	Threats *IUU fishing*	Threats *Recreational fishing*	Threats *Environmental Change*
White Shark	Fins, jaws, teeth	**	*	*	**	*	*	
Basking Shark	Fins, liver oil, meat	**	*	**	**	*		
Whale Shark	Meat, liver oil, fins	***	*	***	*	*		
Spiny Dogfish	Meat and fins	****	**	****	***		*	
Porbeagle	Meat and fins	***	**	***	*		*	
Sawfish	Fins and rostra	***	**	*	***	**	*	*
Pelagic sharks	Fins and meat	*****	***	***	*****	**	**	
Gulper sharks	Liver oil, meat and fins	***	**	***	**	*		*
School Shark, Smooth-hounds, angle sharks, skates and rays	Meat and fins	**	****	****	**	*	*	*
Requiem sharks, hammerheads, shovelnose rays, guitarfishes	Fins and meat	*****	****	****	****	**	*	*
Freshwater stingrays, Leopard Shark, Grey Nurse Shark & Longtail Carpet Shark	Ornamental fish trade, meat	**	**	***	**	**	*	***

*** Greater number denotes higher threat level**

Source: Lack & Sant, 2008 [p8]

Shark declines

1. BLUE SHARK

Prionace glauca

Whilst they are not considered the most desirable shark species by traders, blue sharks make up at least 17% of the Hong Kong market of shark fins, and an estimated 10.7 million blue sharks are killed each year for the global trade in fins[30]. They make up 75% of EU catches in the central Atlantic and 88% of catches in the Indian Ocean[5]. The reported world catch of blue sharks more than doubled between 2000 and 2007, reaching 45,000 tons in 2007[29]. Blue sharks have declined by 50-70% in the North Atlantic[39] and are the most common species in bycatch in the Pelagic Long Line (PLL) fisheries of the Atlantic, constituting 17-32% of overall catch between 1987 and 1995. As of 2000, estimated annual discards totalled 1,575 mt[24].

IUCN Status: Although the blue shark is considered the most abundant and fast reproducing shark of the larger ocean (pelagic shark), it was listed as 'Near Threatened' on the IUCN Red List in 2000. Despite concerns over stock declines, IUCN scientists convening in 2007 could not reach a consensus to heighten its threat status to 'Threatened with Extinction' on a global scale.

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2. SPINY DOGFISH OR SPURDOG

Squalus acanthias

The spiny dogfish, also known as the spurdog, is Europe's most commercially important shark species. Traditionally it was fished for its liver oil, but now it is prized for its meat. In the UK, spurdog is sold as rock salmon or huss and sold in fish and chip shops. In Germany, its belly flaps are smoked to make the delicacy *Schillerlocken*. In France, fresh spurdog meat is sold as *aiguillat commun* or *saumonette d'aiguillat*[31].

Spurdogs are characteristically late to mature, reproducing very slowly (the female carries her pups for two years), and mature females tend to aggregate making them highly vulnerable to overfishing. During the twentieth century, there was a 95% decline in biomass of spiny dogfish in the Northeast Atlantic, with a 75% decline in the Northwest Atlantic in just 10 years, and a 60% decline detected in the Black Sea between 1981 and 1992[40].

Above: The spiny dogfish is Europe's most commercial important shark.

Below left: Blue sharks account for 17% of shark fins on the Hong Kong market.

Below right: The EU proposal to list porbeagle sharks under CITES failed in 2007, despite their being a species vulnerable to extinction.

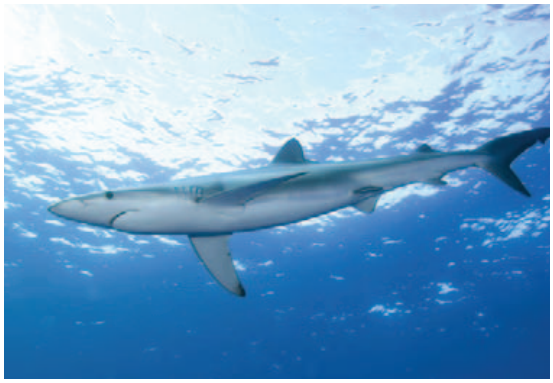
IUCN Status: The global threat level for the spurdog was upgraded to 'Vulnerable' in 2006. However, in the Northeast Atlantic the population has declined by more than 95%, and so for this region it is listed as 'Critically Endangered'.

3. PORBEAGLE SHARK

Lamna nasus

North Atlantic populations of the porbeagle shark have been seriously over-exploited by targeted longline fishing efforts. In the 1960s, the collapse of the Northeast Atlantic population led to the intense exploitation of the Northwestern populations, decimating that population in just six years. Renewed efforts in the 1990s led to further declines, to around 11-17% of virgin biomass within three generations of porbeagle shark[30]. Elsewhere, declines of > 99.99% over 56 years have been observed in Camogli, Genoa[40] and >90% in the southwest Atlantic[41].

IUCN Status: Listed as 'Vulnerable' in 2006.



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4. SHORTFIN MAKO

Isurus oxyrinchus

Second only to the blue shark in landings by European fleets, the mako is also a prime target for sports anglers[5]. Its meat is considered to be of high quality, and its aggressive nature makes it a prime game fish. The meat is consumed fresh, frozen, smoked and dried salted; the oil is extracted for vitamins; the fins used for shark-fin soup; the hides processed into leather and the jaws and teeth used for ornaments[42].

IUCN Status: Its global threat status was upgraded from 'Near Threatened' to 'Vulnerable' in 2007.

5. OCEANIC WHITETIP SHARK

Carcharinus longimanus

Over a period of 50 years, oceanic whitetip sharks declined by more than 99% in the Gulf of Mexico- rendering them ecologically extinct[9]. Although considered to be 'Vulnerable' globally, it is labelled as 'Critically Endangered' in the Northwest and Western Central Atlantic[30].

IUCN Status: Upgraded to 'Vulnerable' in 2006.

Below left: A mako shark is caught by a recreational fishing vessel.

Below right: Oceanic whitetips are now a 'rare exception' in the Gulf of Mexico, where they were once common.

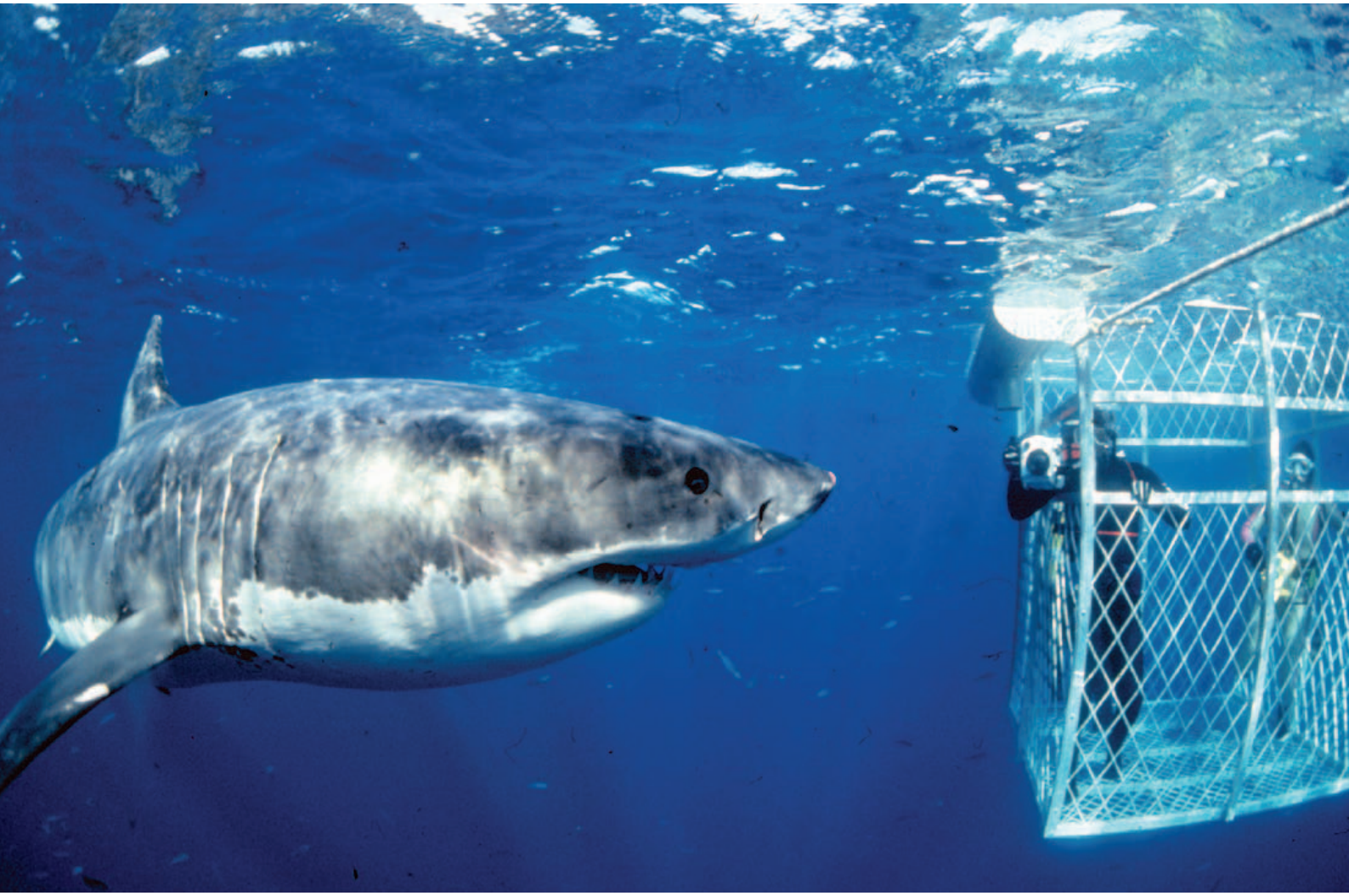
Bottom right: Hammerheads have experienced some of the greatest declines of all shark species.

6. HAMMERHEAD SHARK

family *Sphyrnidae*

Hammerhead species have experienced some of the greatest declines of all shark populations[43]. Semi-oceanic hammerhead sharks are the second most traded species for the fin market, comprising 4-5% of the fins in the Hong Kong market, or up to 2.7 million individuals/ 90,000 mt[7]. They are specifically targeted by Indian fleets and fishermen for export to Hong Kong[4]. In the Atlantic, hammerhead decline has been estimated at 89% since 1986[43].

IUCN Status: The IUCN global threat status for the scalloped hammerhead shark (*Sphyrna lewini*) was upgraded to 'Endangered' in 2007.



7. THRESHER SHARK

family *Alopiidae*

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Thresher sharks have experienced drastic declines in the Mediterranean, notably the Ionian Sea and Spanish waters. Overall, one study concluded that the decrease in abundance was >99.99%[39]. At these levels sharks can be considered 'functionally extinct' in coastal and pelagic waters of the northwest Mediterranean[40].
IUCN Status: Three species of thresher shark (*Alopias pelagicus, A. superciliosus and A. vulpinus*) were added as 'vulnerable' (VU) to the IUCN Red List in 2008.

8. GANGES SHARK

Glyphis gangeticus

This species is known only from the lower reaches of the Ganges-Hooghli river system, West Bengal, India. There have been very few samples of the species caught and studied, the most recent of which was caught in 2001 but was eaten and could only be identified from its jaws. It is currently still fished, despite restrictions, using gillnets and appears in the international trade in shark jaws as curios, it is likely to be in the oriental fin trade and is consumed locally for its meat[44].
IUCN Status: Listed as 'Critically Endangered'.

Left: Threshers are considered to be 'functionally extinct' in some parts of the Mediterranean.

Above: Despite its fearsome reputation, the great white shark is actually more vulnerable to exploitation than other large sharks.

9. GREAT WHITE SHARK

Carcharodon carcharias

The great white shark has relatively lower productivity than other large sharks, making them particularly vulnerable to exploitation[45]. Overfishing of the species has led to dramatic declines; catch ratios of white to other large shark species dropped from 1:22 in the 1960s to 1:651 in the 1980s and the Northwest Atlantic population declined by 79% in as little as 8 years[43].
IUCN Status: The great white is listed as 'Vulnerable'.

10. WHALE SHARK

Rhincodon typus

Whale shark fishery data, though limited, points to a decline in catches within a short period of time. Whale shark catches from Taiwan's commercial fishery declined by around 70% between 1997 and 2001[46]. Between the late 1990s and 2005, the average length of whale sharks caught off Taiwan declined from 10-20m to 4.6m[46]. It is likely that this reduction in mean length is a direct result of the larger (breeding) females being 'fished out' from the shark population in the waters surrounding Taiwan. In 2008, the Taiwanese whale shark fishery closed.

Data from the rest of the world show similarly steep reductions in catch sizes. In Gujarat, India, whale shark catches declined by 40% from 1999 to 2000, before the Government closed the fishery[46]. At Ningaloo Reef, Western Australia, whale shark sightings over the last decade revealed that the mean shark length decreased linearly by nearly 2m, and abundance declined by 40%[47]. These declines have persisted despite whale shark protection in Australian waters, which indicates that the declines are a result of fishing outside Australian waters.

IUCN Status: Listed as 'Vulnerable'.

Below: The mean shark length of whale sharks sighted off Australia has decreased by nearly 2m, indicating that adults are being fished, leaving only juveniles who are not reproductively active.

Regional decline

"It is estimated that populations of large sharks have declined regionally by 90% or more."[48]

THE MEDITERRANEAN

The greatest recorded declines of sharks, skates and rays have been in the Mediterranean. Of the 71 species living and breeding in the Mediterranean Sea, 18% are considered to be 'Critically Endangered', 11% are 'Endangered' and 13% are 'Vulnerable'[49] predominantly as a result of bycatch. In 2008, only 11% had any form of protection[50]. Declines in biomass are generally greater than declines in abundance, which may indicate that younger and smaller sharks are being caught.

In this region, thresher, hammerhead and mackerel sharks have declined in abundance by 99% over the last 200 years[40]. Porbeagle and mako sharks, as well as the Maltese Skate, are also highlighted as at significant risk. The shortfin mako and porbeagle are both prized for their meat and fins, and are listed as 'Critically Endangered' in the Mediterranean[51]. Meanwhile the Maltese Skate, found only in the Mediterranean, and is listed as 'Critically Endangered' by the IUCN. Bottom trawl fisheries are the main cause for population declines of 80%[51].

THE ATLANTIC

In the Central Atlantic, sharks are mainly caught as bycatch in the surface longline fisheries for tuna and swordfish, where the shark catch rate can be as high as 68% of the total catch[5]. According to official sources, European vessels catch around 31,000 tons of sharks per year in this region, mostly consisting of blue shark and shortfin mako, with blue shark representing 75% of all shark catches[5]. In 2005, 5,776 tons of dried shark fins and 4,572 tons of frozen shark fins were imported to Hong Kong, the world's largest shark fin market[52]. Nearly half of the frozen shark fins came from Spain, with notable quantities from France and the Netherlands. By 2007, sharks were considered the main target fish species of the European Union surface longline fleet (mostly Spanish and Portuguese), with more than 200 efficient vessels over 24 metres long[27]. There is much concern over unreported Atlantic shark catches. By studying the amount of shark fins traded through Hong Kong, one scientist estimated the actual blue shark catches are up to 5 times higher than reported. For the shortfin mako this figure could be nearly as high[53].

WEST AFRICA

In 2007, the Sub-Regional Fisheries Commission (CSRP) announced that shark catches in West Africa had declined to around 50% of the 1990s level[54]. Between 2002 and 2008, catches dropped from 30,000 to 10,000 tons, with the average length of sharks also declining[55]. The CSRP linked these declines to the intensified fishing effort over the last two decades to meet the demand for fins in Asia and meat consumed in countries such as Ghana and Nigeria.

GULF OF MEXICO

Longlining and shrimp trawling have caused severe overexploitation of sharks in the Gulf of Mexico. Researchers found a 79% decline in dusky sharks between the 1950s and 1990s, and were unable to find dusky sharks in the north since 1973[9]. Oceanic white tips declined by 99% and silky sharks by 90%[9]. All three species may soon disappear from the area.

Below: A shrimp trawler off Belize. As a result of shrimp trawling, some shark species have experienced as much as a 99% population decline.

Above: Reef sharks on the Great Barrier Reef are so depleted in numbers that they are approaching ecological extinction.

PACIFIC

A recent study of reef sharks on the Great Barrier Reef found that immediate and substantial reductions in the fishing of both reef and pelagic sharks was necessary to prevent their ecological extinction[56]. It recommended that the threat status for whitetip and grey reef sharks be upgraded.

Marine reserves off the coast of Central and South America are literally besieged by shark finning operations. The fact that foreign vessels travel large distances and risk legal action rather than fish legally off the coast is probably an indicator of coastal stock crashes. Cocos Islands off Costa Rica is routinely surrounded by longline vessels that enter the reserve at night laying specially disguised longlines to poach sharks. Major finning operations have been seen in Mexico's Revilligigedos Islands, Panama's Coiba and Columbia's Malpelo.

Since 1994 shark fishing has been prohibited in the Galapagos Marine Reserve (GMR), but every year it is estimated some 12,000 sharks are poached for their fins in the GMR. In 2007, an investigation with the Ecuadorian Environmental Police led to the seizure of more than 19,000 shark fins[57]. This poaching is carried out by a small number of locals, who coordinate with larger vessels moored outside the GMR which then transport the fins to the continent, Peru or to Asia. Large scale fishing has been identified as the single greatest threat to the GMR, and yet there is still pressure from domestic and foreign fishing interests to legalize shark fishing[58]. This pressure was likely a contributing factor to the 2007 amendment made to the national ban, legalising the sale and export of shark meat and fins caught as accidental bycatch. Finning is also a problem for other marine protected reserves (MPAs) in the region. Costa Rica, Panama and Colombia also struggle with a lack of resources and means of efficiently patrolling. In Costa Rica, sharks can still be landed at private docks where authorities are not permitted to enter.

A number of shark fisheries in the Pacific have collapsed as a result of severe population depletion. The gillnet fishery off southern California, USA, for the Pacific angel shark initially experienced an upwards trends in landings in the 1980s, but currently is closed until further notice[59]. Similarly, commercial and recreational fishing of the sevengill shark off California has been effectively terminated[51].

Indonesia is currently the world's top shark fishing country, catching nearly 117,000 tons in 2007[29]. Bali, Kupang and Surabaya are leading centres of shark finning and trading, and the majority of business done with traders in Hong Kong, Singapore and Taiwan[60]. Surveys conducted in selected fishing villages indicate that the fin trade in Indonesia is booming, totally uncontrolled and predominantly controlled by mafia-style organizations[61].

INDIAN OCEAN

The Chagos Archipelago, in the central Indian Ocean, has suffered the severe effects of both legal and illegal fishing activities; with an estimated 86% decline in shark abundance between the 1970s and 1990s[61]. The silvertip shark has experienced the greatest declines of the five most abundant species observed in the area. The decrease in shark numbers is attributed to a rapid intensification of fishing efforts in the surrounding waters by Mauritian and Sri Lankan fishermen. In the 1980s, an agreement between the governments of Britain and Mauritius enabled Mauritian reef fishermen to operate in the archipelago under licence targetting finfish, but likely catching sharks as bycatch. Meanwhile, Sri Lankan vessels operate in the water illegally to meet the local demand for shark meat and to export fins. A number of illegal vessels have been caught by British Indian Ocean Territory (BIOT) fisheries patrol vessels[62].

The annual production of shark, skates and rays in India is around 70,000 tons, over 4% of the total marine fish landings[4]. The whale shark has become a regular fishery in successive years off Gujarat coast for its meat, fins, liver, skin and cartilage. More than a thousand whale sharks were hunted off the Saurashtra coast during 1998[62]. Sharks are mainly caught for their fins, and these are mainly exported to other Asian countries. In 2001, the Government of India passed legislation prohibiting the fishing of all elasmobranches, but this was repealed later in the year[4].

Consequences of decline

LOSS OF AN APEX PREDATOR

"Fishing at the early stage of fisheries development most probably approximated natural predation. Nowadays, fishing approximates 'extermination' with dramatic effects on aquatic ecosystems."

—STERGIOU, 2002[63]

Sharks are often at the top of the food chain in marine ecosystems, they are apex predators, so their removal or depleted numbers can drastically affect the rest of the ecosystem. They regulate the populations of species beneath them, removing the sick and weak and preventing species from monopolizing ecosystem resources. Recent research in North Carolina, USA, has shown that the decimation of large shark species has caused a collapse of the local shellfish industry. As large sharks declined so populations of their prey (smaller sharks, skates and rays) have increased. Cownose rays (*Rhinoptera bonasus*) increased tenfold to over 40 million individuals and are estimated to consume 840,000 tons of bivalves annually, which includes commercially important bay scallops (*Argopecten Irradians*)[64]. The Quahog, a hard clam often used in clam chowder, is now commercial extinct and the century-old shellfish industry in the area has declined significantly.

Similarly, pelagic stingray populations have exploded in the tropical Pacific, believed to be caused by the 10-fold declines of tuna, billfish and sharks[48]. In the Caribbean, due to the overfishing of sharks, groupers have increased in turn decreasing the numbers of algal-grazing fish, such as parrot fish[65]. This enables unrestricted algal growth across the reef, impacting adversely on biodiversity and the health of the reef, further undermining the resilience of the reef to climate change.

The presence of sharks can also affect the feeding behaviour of prey species. Studies in Shark Bay, Australia, found that dugongs and turtles were prevented from overgrazing sea grass by tiger sharks, whose presence forced them to graze more widely without lingering in one area for too long, allowing natural regrowth[66]. In Prince William Sound, Alaska, simulations found that the removal of the Pacific sleeper sharks lead seals to hunt in deeper water for walleye Pollack rather than the normal diet of Pacific herring, which in turn effects the marine ecosystem[67].

***Trophic cascade**: changes in the relative abundances of a number of species in an ecosystem as a result of increases or decreases in one species. Trophic cascades ensue from both direct predation and risk effects of predators.*

Scientists use mass-balance models of ecosystems to assess the ecological consequences of population declines in top marine predators. A recent review of 34 of these models, covering reef and open ocean ecosystems, suggested that large sharks are the most commonly identified keystone species. This means that sharks have a far greater impact on ecosystem structure than they should do based on their abundance[48].

Below: Sharks are generally the apex predator in most ecosystems.

Conservation and management of shark populations

Concern over shark population declines has been mounting since the 1990s, and since then has led the Conference of the Parties (CoP) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Food and Agriculture Organization of the United Nations (FAO) and the United Nations General Assembly (UNGA) to call for greater conservation and management of sharks. However, international measures to protect sharks have been undermined by patchy implementation, non-binding agreements and lack of complementary domestic bans and national action plans.

In 1999, the FAO drew up an International Plan of Action for the Conservation and Management of Sharks (IPOA Sharks), part of the Code of Conduct for Responsible Fisheries. This was an agreement between parties to ensure the conservation and management of shark populations, enabling their sustained long-term use, and parties were urged to adopt national plans of actions by 2001. However, the agreement was voluntary and non-binding. Up until 2009 implementation of the IPOA and its offshoots have been limited, but greater efforts could be expected in the future after the FAO presents a report at the request of the UNGA in September 2009.

Only a small number of species are protected under international conventions. Only ten species are listed in the appendices of CITES, which provides an international legal framework for controlling and regulating trade in endangered and threatened species. Listing under Appendix I is tantamount to a ban on the international trade of a species and, as of 2007, six species of sawfish were listed under this appendix. Great white, basking and whale sharks are listed under Appendix II, which requires their trade to be monitored and restricted. These three are also listed in the Appendices of the Convention on Migratory Species (CMS also known as the Bonn Convention) along with a further four shark species. However, parties to the CMS are negotiating on a less formal Memorandum of Understanding (MoU), rather than a legally binding instrument for international cooperation on migratory shark species.

"Whereas Asia is the source for the demand for shark fins as well as much opposition to shark fishing and trade limits, Asian countries do not bear the responsibility for the plight of sharks alone."

—Sonja Fordham

Despite the rapid and devastating depletion of shark populations, and the international nature of the shark product trade, certain CITES parties have strongly resisted listing shark species on CITES. The reasons cited include lack of trade data (a catch 22 as until they listed on CITES there is no current international mechanism to require and enforce the reporting of trade data) and the difficulty of accurately identifying the species of shark from which detached fins originate.

REGIONAL AND NATIONAL ACTION ON SHARK FISHING

Regional fisheries body	*Action*
Commission for the Conservation of Antarctic marine Living Resources (CCAMLR)	*Ban on targetted shark fishing*
Northwest Atlantic Fisheries Organization (NAFO)	*Quota on thorny skate*
North East Atlantic Fisheries Commission (NEAFC)	*Ban on targeted fishing of basking shark and spiny dogfish*
International Commission for the Conservation of Atlantic Tunas (ICCAT)	*Agreed to reduce fishing mortality of shortfin mako and porbeagle sharks*
	Requires the release of bigeye thresher sharks caught as bycatch
Western and Central Pacific Fisheries Commission (WCPFC)	*Seeking stock information for blue, oceanic whitetip, mako and thresher sharks*

COUNTRIES WITH NATIONAL RESTRICTIONS PLACED ON SHARK FISHING INCLUDE:

American Samoa; Australia; Brazil; Canada; Cape Verde; Colombia; Congo-Brazzaville; Costa Rica; Egypt; El Salvador; EU countries; French Polynesia; India; Israel; Maldives; Mexico; Namibia; Nicaragua; Oman; Palau; Panama; Seychelles; South Africa; USA

Source: Lack & Sant, 2009

THE EUROPEAN UNION

In 2009, the European Commission presented the 'European Action Plan for the Conservation and Management of Sharks' in line with the aims of the IPOA Sharks. Provisions suggested in the action plan to meet these aims include increased numbers of onboard observers, prohibition of discarding most sharks as bycatch, science-based catch limits for sharks and a re-iteration of the EU ban on shark finning, although special permits authorizing shark finning will still be allowed as long as vessels comply to regulations requiring that the weight of the fins they land does not exceed 5% of the dressed (gutted and beheaded) carcass weight of the shark[70]. During 2009, this action plan will be sent to both the Council of Ministers and the European Parliament and the Commission will draw up legislative proposals to convert the plan into concrete measures.

THE MALDIVES LEADS THE WAY

In March 2009, the Maldives extended the national ban on reef shark hunting, banning shark fishing within the Maldives' atolls and lagoons and in the waters up to 12 miles off the Maldivian atoll coast. The Minister of Fisheries and Agriculture, Dr. Ibrahim Didi, announced that within a year the government would extend this ban to all of the country's territorial waters, protecting oceanic sharks and enabling a complete ban on all shark product exports. The government hopes the ban will create a 'safe haven' for sharks, rebuilding their populations[71]. The decision to impose this ban was taken based on evidence that sharks are more valuable as tourist attractions than as exported meat and fins; in 1992 tourists paid a total of US$2.3 million for shark watching dives while the export of shark products only earned a revenue of US$0.7 million[71].

Commentary

Stepping up shark conservation

By Sonja Fordham

The last fifteen years have seen tremendous advances in the conservation of sharks and yet these fascinating species remain among the oceans' most imperiled inhabitants.

In 1994, growing concern about declining shark populations prompted the Convention on International Trade in Endangered Species (CITES) to call on countries around the world to examine the biological and trade status of sharks, which in turn led to the development of an International Plan of Action (IPOA) for Sharks through the United Nations Food and Agricultural Organization (FAO). The landmark Shark IPOA, adopted in 1999, directs shark fishing nations to craft national and regional plans of action to improve shark fisheries data collection, ensure shark catch is sustainable, safeguard particularly vulnerable populations, minimize waste, protect biodiversity and conserve ecosystem function.

Ten years later, however, implementation of the Shark IPOA has proved pitifully slow. Most of the world's shark fishing countries have not yet completed national shark action plans. Only a handful of countries impose catch limits on their shark fisheries; still fewer can report success in terms of shark population recovery. Around the world, shark fisheries data collection and reporting remain grossly inadequate, and most finning bans are too lenient.

The Mediterranean boasts the world's only regional shark action plan and yet its poor implementation leaves the vast majority of Mediterranean shark and ray species, 42% of which are threatened with extinction, completely unprotected. Although two of the world's nine most relevant Regional Fisheries Management Organizations (RFMOs) have taken steps to discourage targeted shark fishing, none of these bodies has adopted any concrete, international catch limits for sharks. A regional thorny skate quota for the Northwest Atlantic is the only international catch limit for a member of the shark Class and now stands at twice the level advised by scientists. This situation persists despite dozens of shark and ray species being listed and highlighted as endangered or declining under numerous international wildlife conventions.

Of the roughly 400 species of shark, only white, basking and whale sharks are protected in most of the countries in which they are regularly encountered. These three species are also the only sharks for which international trade is regulated through CITES. A CITES ban on trade in sawfish, among the most endangered of the shark Class, was adopted a decade after it was initially proposed and does not apply to all species.

Too often, significant steps forward are hampered by lack of follow up action or even steps back. In late 2008, Parties to the Convention on Migratory Species (CMS) took groundbreaking action by adding commercially valuable shark species — spiny dogfish, porbeagle and mako sharks — to the CMS Appendices. Just days later, however, Parties could not agree that the developing CMS global instrument for migratory shark conservation should apply to these species. Parties to the Barcelona Convention for the Protection of the Mediterranean Sea have listed giant devil rays on an Annex associated with endangered status and need for strict protection, and yet, roughly a decade later, Malta and Croatia are the only Mediterranean countries to have banned take of the species. In 2004, the International Commission for the Conservation of Atlantic Tunas (ICCAT) became the first RFMO to adopt a ban on shark finning, but nearly five years later, only 14 of ICCAT's 48 Contracting Parties have adopted complementary finning bans for their waters. Worldwide, although most RFMOs have banned finning, only the EU and 20 of the more than 100 shark fishing countries have adopted domestic finning bans; many of these contain loopholes. EU officials

pledged in early 2009 to strengthen the EU finning ban by reducing the allowable fin to body ratio by which appropriate proportions of shark parts on board are measured. A month later, however, the EU attempted to weaken the Indian Ocean finning ban by replacing the ratio with untested methods involving placing severed fins in plastic bags — a complete departure from their brand new shark plan.

It is clear that, whereas Asia is the source for the demand for shark fins as well as much opposition to shark fishing and trade limits, Asian countries do not bear the responsibility for the plight of sharks alone. For example, the EU is the source of the bulk of shark fins in trade as well as a persistent demand for shark meat, and yet, EU shark management is notoriously weak. Despite scientists' conclusions that the Northwest Atlantic porbeagle shark population needs 100 years to recover and that landings from the even more seriously depleted Northeast Atlantic population should not be allowed, targeted porbeagle fisheries continue legally in Canada and France. New Zealand and Canada were leaders in the fight to defeat the EU's 2007 proposals to list porbeagle and spiny dogfish under CITES and New Zealand still allows shark finning under certain circumstances.

As demand for shark products grows in the absence of management, so does the number of shark and ray species categorized by IUCN as Threatened with extinction. Currently, IUCN classifies 21% of 591 assessed shark, ray and chimaera species as Threatened (in the Vulnerable, Endangered or Critically Endangered categories of the IUCN Red List). Only one quarter of these species are considered to be of Least Concern. Data are insufficient to determine the conservation status of another 35%.

While data on shark catches are generally lacking and many mysteries of sharks' habits remain, there is plenty we do know about sharks and much of it is cause for concern. Scientists regularly stress that the tendency of most sharks to grow slowly and produce few young leaves them especially vulnerable to overfishing. Experts also tell us that most sharks serve as important predators and that losing them is likely to have cascading, negative effects on marine ecosystems.

These factors helped provide the impetus for the development of the Shark IPOA and yet the management priority assigned to sharks — at local, national and international levels — remains very low. The need for serious recommitment to the Shark IPOA and related shark conservation initiatives has never been more urgent. To turn the tide, countries must work unilaterally and collaboratively to improve shark data collection, limit shark fishing, protect particularly vulnerable shark species, strengthen finning bans, and develop plans of action for long-term conservation.

Shark conservationists have had substantial success in the last fifteen years, and yet, progress in most cases is still being outpaced by rising commercial interest in shark products and rapid depletion of shark populations. Public concern for the welfare of sharks has grown dramatically in this time, but is not yet reflected in today's inadequate shark fishing policies. We must immediately step up our efforts if we are to ensure sustainable shark fisheries, rebuild depleted populations, and save some shark species from extinction. People must not only change the way they think about sharks but also care enough about their survival to act on their behalf. Vocal, informed and persistent citizens demanding more for sharks from their policymakers offer the best hope for securing a brighter future for these valuable yet vulnerable animals.

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THE 5% OF WEIGHT RULE

RFMOs are criticized for the instruments used to control shark finning[29], predominantly fin to weight ratios of which the '5% of weight' rule is most common. This rule is a feature in many strategies on shark management and conservation, such as the US Shark Finning Prohibition Act (2000). It stipulates that the weight of the fins onboard a vessel must not exceed 5% of the weight of the shark. In some legislation, the weight of the shark is further defined as the weight of a dressed (gutted and beheaded) carcass. This distinction is important because a shark's head and liver are very heavy in relation to the rest of its body. By using the weight of the dressed carcass it means that vessels can fin many more sharks and conform to legislation. US scientists believe that figure is too high, allowing fishermen to land two or even three fins for every carcass, with the remains of the rest of the sharks dumped overboard.

Further problems with the rule include[68]:

- The difficulty in collecting species-specific data once the fins are removed
- The difficulty to enforce the rule
- The capability of fishermen to mix and match the higher value fins and meat

In June 2008, the US National Marine Fisheries Service (NMFS) filed new rules that require federal shark fisheries in the Atlantic Ocean and Gulf of Mexico to land sharks with their fins still naturally attached. It is hoped that the new rules, which are part of Amendment 2 to the Highly Migratory Species (HMS) Fisheries Management Plan, will aid shark management and conservation by facilitating species identification and data collection and by ensuring that vessels are not engaged in shark finning at sea[69].

Above: US scientists believe that the 5% of weight rule is too high, allowing fishermen to land two or even three fins for every carcass, with the remains of the rest of the sharks dumped overboard.

"Controls on finning are a blunt instrument that have no capacity to provide differential protection to those shark species most at risk from overfishing"

—Lack & Sant, 2009: p15

SNAPSHOT

- The Mediterranean is the only region with a regional shark action plan, yet 42% of sharks and rays in the Mediterranean are still threatened with extinction
- Only two of the nine most relevant Regional Fisheries Management Organizations (RFMOs) have taken action to discourage targeted shark fishing, and none have implemented international catch limits for sharks
- ICCAT became the first RFMO to ban finning in 2004, and since then the majority of RFMOs have followed suit. However, only 20 shark fishing countries (plus the EU) have adopted complementary, domestic finning bans

Sharks are more valuable as tourist attractions than as exported meat and fins

- RFMOs continue to rely on instruments such as the 5% rule to control finning, which have been questioned on a number of issues
- There are around 500 known species of shark, yet only three are protected in the majority of countries in which they are encountered; the great white, the basking and whale shark
- Only 10 species are listed in the annexes of CITES
- Eleven species are recognized as 'high priority' threatened species under the Helsinki Convention, yet no management action has been taken to address this

Conclusions

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Shark populations have declined drastically and rapidly over recent decades. For certain species these declines have been as great as 99%, and some species are now considered to be ecologically extinct. In the Mediterranean Sea, the region with the greatest shark declines, 18% of sharks are considered to be 'Critically Endangered', 11% are 'Endangered' and 13% are 'Vulnerable'. Sharks are not the plentiful, invulnerable animals people imagine them to be.

Overfishing through targeted fishing and bycatch represents the single greatest threat to sharks. Intense, widespread fishing efforts have reduced large predatory fish communities to 10% of the levels 50-100 years ago. Commercial fishing gear is notoriously unselective, and in some fisheries the ratio of bycatch to target species is as great as 10:1. Shark meat wasn't always so valuable, so historically sharks weren't targeted species. However, growing demand for shark products and shark fins has encouraged targeting and sharks caught as bycatch to be retained. In order to get enough shark fins onto our plates, fishermen are turning to the deplorable and wasteful practice of shark finning: slicing fins from live sharks and then dumping the rest.

It is clear that current conservation and management efforts, both national and international, are falling short of the efforts required to conserve and protect sharks and are unlikely to improve in the immediate future – if and when they are in place it may be too late. It is necessary to inspire political will and to act to halt these population declines over the short-term. This will involve reducing demand to more sustainable levels, and significantly reducing the targeted catch and bycatch of sharks.

The overwhelming question is how to shift to better managed, more sustainable fisheries. It is likely that this will require both push and pull factors, and that market pressure will play an integral role in this shift. More accurate and detailed catch and trade data will be absolutely essential. As a leading importer of shark products, and with the largest entrepôt for the shark fin trade, China would be an excellent candidate to lead collection and collation efforts for trade data. All countries should be taking steps to develop and implement national plans of action (NAPAs), and globally it is time to bring an end to the wasteful and cruel practice of finning. Demand for fins drives this practice, so if consumers turned their backs on this delicacy there would no longer be a reason for fishermen to fin.

It is possible for us to manage and conserve sharks so that they continue to swim in our waters, and it is important that we do so. As these keystone species move closer and closer to extinction, marine ecosystems will suffer. Prey species have experienced population explosions and displayed significant changes in behaviour. More effective fisheries management, and greater conservation of sharks, has powerful economic incentives. As well as ensuring the sustainability of fisheries, and therefore incomes and livelihoods, protecting sharks also offers another revenue stream for many countries; as tourist attractions. As the Maldives' shark fishing ban has already shown, sharks are worth more alive than exported as food.

Recommendations

GOAL 1: A OVERALL REDUCTION OF SHARK FISHING EFFORT

Fishing has reduced shark populations to 10% their pre-industrial levels, and targeted catches and bycatch of sharks must be reduced. This will be best achieved through market pressures – reducing consumer demand – and also through catch limits, tighter enforcement of fishing legislation and a greater preventative action against illegal, unreported and unregulated (IUU) fishing.

Effective, proactive steps must be taken to reduce bycatch. This may include a reduction in overall fishing effort, or the modification of fishing gear with the aim of reducing bycatch mortality.

GOAL 2: MORE EFFECTIVE FISHERIES MANAGEMENT

Overfishing represents the single greatest threat to sharks, and lack of catch data on country of origin or species identification hampers more effective fisheries management. Even in the most sophisticated fisheries catch data is lacking and it would seem beyond the capabilities of many areas, such as Indonesia, to collate accurate data. However, the global trade of shark products does have a bottleneck, where data could be cheaply and easily collected and collated in order to monitor shark exploitation. China (including Hong Kong SAR) is both consumer and processor for the vast majority of the world's shark fin trade, possibly in excess of 90%. Shark fin traders already distinguish between species to get the best prices, often keeping detailed records which are kept in private hands.

China and Hong Kong could legislate to require mandatory declarations of all fin imports by species, weight and catch area by shark fin importers and then collate and publish this data widely. Accuracy of the species identification could be randomly checked using now readily available DNA identification tests. In this way catch, and therefore population trends, could be identified and the data fed into the IUCN and CITES listings processes.

National governments should develop national plans of action (NPOAs) for sharks. These should make provisions for sustainable catch, data collection, stakeholder consultation, waste minimisation, biodiversity protection, ecosystem preservation and special attention to threatened and vulnerable populations. Dedicated fisheries managers must be appointed to ensure that fishing is sustainable. Where fishing methods are deemed to be inappropriate or destructive in terms of bycatch, managers should seek and promote alternatives. National governments should monitor and regulate the trade and markets of marine products more stringently.

GOAL 3: GREATER CONSERVATION OF SHARKS

A third of shark and ray species are classed as threatened with extinction yet only 3 species are protected by CITES. A number of parties have argued against the listing of further species on the grounds that there is insufficient trade data available and the difficulty of identifying the species from which detached fins originate. However, the only available mechanism for gathering such trade data would be to list all sharks in CITES Appendix III, which requires the reporting of country of origin and export permits. Readily available DNA testing now means that species can be accurately identified.

Greater areas should be designated marine reserves in order to protect key life-cycle areas for marine biodiversity. These must be managed and restrictions on fishing enforced. International financing should be made available if necessary.

GOAL 4: A GLOBAL BAN ON FINNING

Fin to weight ratios are a weak control on the wasteful and barbaric practice of finning, and regional fisheries management organisations (RMFOs) must re-evaluate their use. Landing sharks with all their fins naturally attached is a possible alternative. There must also be greater enforcement of RFMOs bans on finning, and national governments should introduce domestic finning bans.

European countries should call an end to the provision of special fishing permits which permit the removal of shark fins at sea.

GOAL 5: CONSUMER ACTION

Consumers should help protect sharks by reducing their consumption of shark meat and products, and by stopping eating shark fin altogether. Avoiding dishes such as shark fin soup will curb the demand that encourages fishermen to engage in finning. Individuals can also show their support for countries that protect their shark populations, such as the Maldives, by booking their holidays in these locations.

Concerned citizens could also write to their fisheries minister to voice their concern about the depletion of shark populations, and to encourage the use of catch limits.

References

1. Benton. M & Twitchett. R (2003) How to kill (almost) all life: The end-Permian extinction event. Trends in Ecology and Evolution. Vol. 18 (7): p358-365
2. Kyne. P & Simpfendorfer. C (2007) A Collation and Summarization of Available Data on Deepwater Chondrichthyans: Biodiversity, Life History and Fisheries. IUCN SSC Shark Specialist Group, Marine Conservation Biology Institute
3. Myers. R & Worm. B (2005) Extinction, survival or recovery of large predatory fishes. Philos. Trans. R. Soc. Lond. B. Biol. Sci. Vol. 360 (1453): p13-20
4. Verlecar. X, Snigdha, Desai. S & Dhargalkar. V (2007) Shark Hunting – an indescriminate trade endangering elasmobranchs to extinction. Current Science. Vol. 92(8): p1078-1082
5. European Commission (last updated 05/02/09) Press Corner: Questions and answers – shark action plan. – http://ec.europa.eu/fisheries/press_corner/press_releases/2009/com09_01_en.htm, accessed on 14/04/09
6. Bonfil. R (2000). The problem of incidental catches of sharks and rays, its likely consequences and some possible solutions. Shark Conference 2000, Hawaii, 21-24 February
7. Clarke. S et al (2006) Global estimates of shark catches using trade records from commercial markets. Ecology letters. Vol. 9: p1115-1126
8. IUCN (25/06/09) Third of open ocean sharks threatened with extinction - http://www.iucn.org/?3362/Third-of-open-ocean-sharks-threatened-with-extinction
9. Baum, J & Myers. R (2004) Shifting baselines and the decline of pelagic sharks in the Gulf of Mexico. Ecology Letters. Vol. 7: p135-145
10. FAO FishStat Database, accessed 15/01/09
11. Lack, M. and Sant, G. (2008). Illegal, unreported and unregulated shark catch: A review of current knowledge and action. Department of the Environment, Water, Heritage and the Arts and TRAFFIC, Canberra
12. Shepherd. T & Myers R (2005) Direct and indirect fishery effects on small coastal elasmobranchs in the northern Gulf of Mexico. Ecology Letters: 8.
13. Stevens, J. D. Et al, (2000), 'The effects of fishing on sharks, rays and chimaeras (chondrichthyans), and the implications for marine ecosystems. Journal of Marine Science. Vol. 57: p476-494
14. Megalofonou, P. et al, (2003), 'Incidental catch and estimated discards of pelagic sharks from the swordfish and tuna fisheries in the Mediterranean Sea', Fisheries Bulletin: 103
15. ICES WGEF Report, (2007), 'ICES Advisory Committee on Fishery Management: ICES CM 2007/ACFM:27', REF. LRC, Report of the Working Group on Elasmobranch Fishes (WGEF)
16. Smith. D (25/10/07) Sharks Harmed by Long Line Fishing. Ecosystem preservation. - http://ecosystem-preservation.suite101.com/article.cfm/sharks_harmed_by_long_line_fishing
17. Environmental Justice Foundation (EJF) (accessed 21/04/09) Illegal driftnetting in the Mediterranean. - http://www.ejfoundation.org/page166.html
18. Oceana (2008) Shark fisheries- http://oceana.org/europe/what-we-do/shark-conservation/research-photos/shark-fisheries/
19. Save our Seas Foundation. Shark nets update - http://www.saveourseas.com/sharknets (accessed 22/06/09)
20. National Geographic (2002) South Africa Rethinks Use of Shark Nets - http://news.nationalgeographic.com/news/2002/06/0603_020604_shark2.html
21. KZN Sharks Board (accessed 12/05/09) Reducing mortalities. - http://www.shark.co.za/mort.htm
22. UNEP (2009) Marine Litter: A Global Challenge. Nairobi: UNEP. 232 pp
23. Natural Resources Consultants, Inc. (15/05/08) RATES OF MARINE SPECIES MORTALITY CAUSED BY DERELICT FISHING NETS IN PUGET SOUND, WASHINGTON. Northwest Straits Marine Conservation Initiative.
24. Gilman. E, Clarke. S, Brothers. N, Alfaro-Shigueto. J, Mandelma. J, Mangel. J, Petersen. S, Piovano. S, Thomson. N, Dalzell. P, Donoso. M, Goren. M, Werner. T (2007) Shark Depredation and Unwanted Bycatch in Pelagic Longline Fisheries: Industry Practices and Attitudes, and Shark Avoidance Strategies. Western Pacific Regional Fishery Management Council, Honolulu, USA.
25. IUCN (04/05/07) News Release: Release of the 2006 IUCN Red List of Threatened Species reveals ongoing decline of the status of plants and animals. - http://www.flmnh.ufl.edu/fish/organizations/ssg/2006Mayredlist.pdf
26. Hareide. Net al (2007) European shark fisheries: a preliminary investigation into fisheries, conversion factors, trade products, markets and management measures. European Elasmobranch Association
27. Oceana (2007a) Hunted for Fins. http://www.oceana.org/fileadmin/oceana/uploads/europe/reports/hunted_for_fins.pdf
28. WildAid (2009) In the Soup: how mercury poisons the fish we eat. WildAid UK, London
29. Lack. M & Sant. G (2009) Trends in global shark catch and recent developments in management. TRAFFIC International, Cambridge UK
30. Dulvy, Baum, Clarke, Compagno, Cortés, Domingo, Fordham, Fowler, Francis, Gibson, Martínez, Musick, Soldo, Stevens and Valenti (2008) You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays. Aquatic Conservation: Marine and Freshwater Ecosystems.
31. Fordham. S (2006) Shark alert: Revealing Europe's impact on shark populations. Shark Alliance.
32. Musick. J, Burgess. G, Cailliet. G, Camhi. M & Fordham. S (2000) AFS POLICY STATEMENT #31b: Management of Sharks and Their Relatives (Elasmobranchii). Fisheries. Vol. 25(3): p9-13
33. Purvis. A, Jones. K & Mace. G (2000) Extinction. BioEssays. Vol. 22 (12): p 1123-1133
34. FAO (2007) FAO Forestry Paper 153: The world's mangroves 1980-2005. Food and Agriculture Organization of the United Nations, Rome
35. Wilkinson. C ed (2008) Status of Coral Reefs of the World: 2008. Global Coral Reef Monitoring Network and Reef and Rainforest Research Center, Townsville, Australia.
36. Martin. R (accessed 12/05/09) The Mysterious, Endangered River Sharks (Glyphis spp.). ReefQuest Centre for Shark Research - http://www.elasmo-research.org/conservation/river_sharks.htm
37. UNEP (2009) Marine Litter: A Global Challenge. Nairobi: UNEP. 232 pp
38. Storelli. M, Storelli. A & Marcotrigiano. G (2005) Concentrations and hazard assessment of polychlorinated biphenyls and organochlorine pesticides in shark liver from the Mediterranean Sea. Marine Pollution Bulletin. Vol.50 (8): p850-855
39. IUCN (22/02/07) More oceanic sharks added to the IUCN Red List. - http://www.flmnh.ufl.edu/fish/organizations/ssg/redlistupdate2007.pdf
40. Ferretti. F, Myers. R, Serena. F & Lotze. H (2008) Loss of Large Predatory Sharks from the Mediterranean Sea. Conservation Biology. Vol. 22 (4): p1-13
41. IUCN. Lamna nasus (Northeast Atlantic subpopulation) - http://www.iucnredlist.org/details/39343/0/full
42. Stevens, J. 2000. Isurus oxyrinchus. In: IUCN 2009. IUCN Red List of Threatened Species. Version 2009.1. <www.iucnredlist.org>. Downloaded on 03 June 2009
43. Baum. J et al (2003) Collapse and Conservation of Shark Populations in the Northwest Atlantic. Science. Vol. 299 (5605): p389 - 392
44. Compagno, L.J.V. 2007. Glyphis gangeticus. In: IUCN 2009. IUCN Red List of Threatened Species. Version 2009.1. <www.iucnredlist.org>. Downloaded on 03 June 2009.
45. CITES [2004] CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II: Inclusion of Carcharodon carcharias in Appendix II. CoP13 Prop. 32 Rev.1
46. DEH, Government of Australia (2005) Whale Shark (Rhincodon typus) Issues Paper. Department of the Environment and Heritage, Australian Government. ISBN 0 6425 5082 4
47. Bradshaw.C et al (2008) Decline in whale shark size and abundance at Ningaloo Reef over the past decade: the world's largest fish is getting smaller. Biological Conservation. Vol.141 (7): p1894-1905
48. Heithaus. M, Frid. A, Wirsing. A, Worm. B (2008) Predicting ecological consequences of marine top predator declines. Vol. 23(4): p202-10
49. IUCN (16/11/07) Press Release. Mediterranean Sea: most dangerous place on Earth for sharks and rays. - http://www.iucn.org/about/union/secretariat/offices/iucnmed/communication/press_releases/?58/Mediterranean-Sea-most-dangerous-place-on-Earth-for-sharks-and-rays
50. IUCN (28/10/08) Mediterranean Cartilaginous Fishes. http://cmsdata.iucn.org/downloads/sharks_lr.pdf
51. Bester. C (accessed 15/04/09) Biological Profiles: Sevengill shark. Ichthyology Department, Florida Museum of Natural History. http://www.flmnh.ufl.edu/fish/Gallery/Descript/Sevengill/Sevengill.html
52. Oceana (2007b) Treated as Trash. http://oceana.org/fileadmin/oceana/uploads/europe/reports/Treated_As_Trash.pdf
53. Clarke. S (2004) Report of the 2004 inter-sessional meeting of the ICCAT subcommittee on bycatches: shark stock assessment. SCRS/2004/014 Col. Vol. Sci. Pap. ICCAT. Vol.58 (3): p799-890
54. Exit Stage Right (10/10/07) West Africa's sharks risk extinction - http://exitstageright.wordpress.com/2007/10/10/west-africas-sharks-risk-extinction/
55. African Press Agency (17/09/08) West African Shark Catches Show Drastic Reduction - http://www.flmnh.ufl.edu/fish/sharks/InNews/drastic2008.html
56. Robbins. W (2006) Ongoing Collapse of Coral-Reef Shark Populations. Current Biology. Vol. 16: p2314-2319
57. Sea Shepard (13/06/07) Sea Shepherd Galapagos Sting Results in Seizure of Over 19,000 Shark Fins - http://www.seashepherd.nl/galapagos/galapagos_defending_sharks.html
58. Charles Darwin Foundation (2007) Charles Darwin Research Station Fact Sheet: Sharks in Galapagos. Charles Darwin Foundation for the Galapagos Islands. Galapagos, Ecuador
59. Bester. C (accessed 15/04/09a) Biological Profiles: Pacific angel shark. Ichthyology Department, Florida Museum of Natural History. http://www.flmnh.ufl.edu/fish/gallery/descript/pacificangelshark/pacificangelshark.html
60. Al-Janahi. A & Cherian. T (2008) Shark Finning. Marine Resources Research Centre, UAE Environmental & Agricultural Information Centre. - http://www.uae.gov.ae/uaeagricent/Fisheries/Sharkfin1_en.stm
61. Anderson. C (January 1998) Shortage of sharks at Chagos. Florida Museum of Natural History. The IUCN/SSC Shark Specialist Group: Shark News Vol. 10
62. Pravin. P (2000) Whale shark in Indian coast - Need for conservation. Curr. Sci. Vol. 79: p310-315
63. Stergiou. K (2002) Overfishing, tropicalization of fish stocks, uncertainty and ecosystem management: resharpening Ockham's razor. Fisheries Research. Vol. 55 (1-3): p1-9
64. Myers. R et al, (2007) Cascading Effects of the Loss of Apex Predatory Sharks from a Coastal Ocean. Science. Vol. 315 (5820): p1846 - 1850
65. Bascompte. J, Melián. C & Sala. E (2005) Interaction strength combinations and the overfishing of a marine food web. PNAS. Vol.102 (15): p5443-5447
66. Wirsing. A, Heithaus. M & Dill. L (2007) Living on the edge: dugongs prefer to forage in microhabitats that allow escape from rather than avoidance of predators. Animal Behavior. Vol. 74: p93-101
67. Frid. A, Baker. G, Dill. L (2008) Do shark declines create fear-released systems? Oikos. Vol. 117(2): p191-201
68. Oceana (2007c) U.S. Shark Finning Regulations. - http://www.oceana.org/sharks/threats/finning-sharks/us-shark-finning-regulations/
69. Oceana (19/06/09) U.S. Government Issues Shark Finning Ban in Atlantic Ocean and Gulf of Mexico Waters. - http://oceana.org/north-america/media-center/press-releases/press_release/0/806/
70. European Elasmobranch Association (EEA) - IPOA-Sharks. http://www.eulasmo.org/v.asp?level2=6489&depth=2&level3=6489&level2id=6489&rootid=6463&nextlevel=6489
71. Maldives Marine Research Centre- http://www.mrc.gov.mv/index.php?cID=99

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