Université Libre de Bruxelles
Institut de Gestion de l’Environnement et d’Aménagement du Territoire
Faculté des Sciences
Master en Sciences et Gestion de l'Environnement

"THE CONSERVATION OF KEY SPECIES AND THE CULTURAL AND ECONOMIC IMPLICATIONS THEREOF: THE CASE OF SHARK FINNING."

Master's Thesis presented by
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To obtain the academic degree of
Master en Sciences et Gestion de l'Environnement
Finalité Gestion de l’Environnement Ma 120ECTS
Réorientation avec programme adapté - 2e année - ENVI5G-M
Academic Year: 2011-2012

Promoter : Prof. Marie Françoise GODART

Printed on recycled paper

Special thanks...

...To the deep blue world in which I have spent so many hours;

...to Ahmed Tiger who showed me for the first time a school of hammerhead sharks,
to my good friend Eduard Espinel with who I shared so many unforgettable times underwater,
to Alice Velge and Laurence Wauthier for helping me take a great decision,
to John Janssens and my sister in the distance for their help with the final corrections of the text and images,
to my teachers of the IGEAT for their valuable instruction and
to François and Antonio de Ribaucourt for supporting me unconditionally and being an important part of my life.

Summary

Sharks are *apex* predators whose role in the oceans cannot be replaced. Shark fishing began several centuries ago, but nowadays their populations are under strong anthropic pressure, especially because of the growing demand for shark fin soup (part of an Asian culinary tradition), among the elite and the growing middle classes in China.

Shark fins have become a valuable commodity and are trafficked (mainly) to Hong Kong (*HK)* as part of a worldwide business. According to some authors more than 116 countries have shark-business relations with *HK*. As the demand for this product is growing, more and more fisherman are drawn to catch sharks and cut their fins all around the world. The rest of the animal is dumped back into the ocean, which is condemnable on the grounds of animal cruelty alone, but also represents a huge loss of biomass with severe ecological consequences.

Sharks are fragile species, with slow growth and reproduction rates, which means that if measures are not taken promptly, some of their populations will come under threat or face extinction in the next decades.

Some authors estimate that more than 70 million sharks are killed for their fins each year. Nevertheless, the exact real-global representation of shark catch is difficult to establish because of the high amount of discards, under-reported catch and the lack of information in landing ports.
The lack of data and the fact that shark fin soup consumption is embedded historically and culturally in Asia are important obstacles for conservationists.

The awareness towards shark conservation has increased during the last years and to date, several *NGO's* and more specifically six international and regional organisations have become involved in trying to protect and manage c*hondrichthyan* populations. Nevertheless their instruments are new and still insufficient in the light of the difficulties they face. Decision making is slow and previously established regulations prove to have major loopholes. Many countries have banned shark finning, but few have the resources to enforce these regulations.

A case study is presented in the last chapter of this work, with a focus on the marine reserves of Central and South America where shark-abundant waters are being depleted.

Résumé

Les requins sont des prédateurs *alpha* essentiels à l'équilibre des océans. Ces espèces sont consommées par les hommes depuis des siècles, mais aujourd'hui leurs populations subissent les conséquences d'une plus forte pression anthropique liée à l'émergence des classes moyennes en Chine qui apprécient tout particulièrement ce produit de luxe qu'est la soupe d'ailerons de requins (issu de la tradition culinaire asiatique).

Les ailerons de requin sont à la base d'un lucratif trafique mondial dont la plaque tournante est Hong Kong (HK). Selon certains auteurs, plus de 116 pays entretiennent des relations commerciales de ce genre avec Hong Kong. Puisque la demande pour ce produit est en progression constante, les pêcheurs sont de plus en plus incités à capturer les requins et couper leurs nageoires avant de les rejeter vivants dans l'océan, ce qui, au delà de la cruauté envers les animaux, représente une perte énorme de la biomasse ayant de graves conséquences écologiques.

Les requins sont des espèces fragiles, avec une croissance lente et un faible taux de reproduction, ce qui signifie que si des mesures ne sont pas prises rapidement, certaines populations seront sérieusement menacées et risquent même de s'éteindre complètement dans les prochaines décennies.

Certains auteurs estiment que plus de 70 millions de requins sont tués chaque année pour leurs nageoires mais la collecte de données à l'échelle mondiale fait cruellement défaut en raison des rejets de carcasses, du braconnage et du manque d'informations fiables dans les ports de débarquement.

Le manque de données scientifiques et l'ancrage profond, à la fois historique et culturel, de la tradition culinaire en Asie sont des obstacles majeurs pour ceux qui s'attèlent à protéger les requins.
La sensibilisation à la conservation des requins a augmenté au cours des dernières années et à ce jour, plusieurs ONG et surtout six organisations internationales et régionales luttent pour essayer de protéger et de gérer les populations de chondrichtyens. Néanmoins, leurs structures sont nouvelles et encore insuffisantes face aux nombreuses difficultés. La prise de décision est lente et les règlementations en place sont aisément contournantes. De nombreux pays ont interdit le "finning", mais peu sont capables de punir les infractions. Qui plus est, les eaux internationales ne sont pas règlementées.

Un exemple de cette problématique est présenté dans le dernier chapitre de ce travail, s'agissant des réserves marines d'Amérique centrale et d'Amérique du Sud où des eaux autrefois riches en requins sont quasiment épuisées.

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LIST OF ACRONYMS

CCAMLR	*Commission for the Conservation of Antarctic Marine Living Resources*
CITES	*Convention on International Trade in Endangered Species of Wild Fauna and Flora*
CMAR	*Maritime Corridor for Conservation*
CMS	*Convention of Migratory Species*
EC	*European Commission*
EEA	*European Elasmobranch Association*
ETPS	*Eastern Tropical Pacific Seascape*
EU	*European Union*
EZZ	*Exclusive Economic Zones*
FAO	*Food and Agricultural Organization*
FMP	*Shark Fishery Management Plan*
GFCM	*General Fisheries Commission of the Mediterranean*
IATTC	*Inter-American Tropical Tuna Commission*
ICCAT	*Conservation of Atlantic Tunas*
IOTC	*Indian Ocean Tuna Commission*
IPOA-Sharks	*International Plan of Action for sharks*
ITCZ	*Inter-tropical Convergence Zone*
IUCN	*International Union for Conservation of Nature*
IWC	*International Whaling Commission*
MoU	*Memorandum of Understanding*
MPA	*Marine Protected Areas*
NAFO	*North Atlantic Fisheries Organization*
NEAFC	*Northeast Atlantic Fisheries Commission*
NGO	*Local non-governmental organization*
NOAA	*National Oceanic and Atmospheric Administration*
RFMO's	*Regional Fisheries Management Organizations*
SEAFO	*Southeast Atlantic Fisheries Organization*
SSG	*IUCN Shark Specialist Group*
SSG	*Sharks Specialist group*
USA	*United States of America*
ULB	*Université Libre de Bruxelles*
UN	*United Nations*
UNEP	*United Nations Environment Program*
UNGA	*United Nations General Assembly*
WWF	*World Wide fund*

INTRODUCTION

Sharks are considered by many to be mysterious, terrifying or dangerous. The reality is that sharks represent a group of fish of extreme importance for ecosystems and for the human population.
Shark species have managed to survive and have evolved for more than 400 million years, but in the last decades the insatiable appetite for shark fins compounded by the economic growth of China has pushed many of their populations to a notorious decline. These cultural habits violate international norms and put not only sharks in serious danger, but whole marine ecosystems.

This work explores the topic of *shark finning* from a multidisciplinary point of view, including the environmental, cultural, economic and regulatory implications of the trade. The problem is presented from a global to a local point of view. The main object of this research is to assess what has been done to date with regards to shark finning, and what hampers shark conservation efforts.

The first chapter describes the background of the issue and attempts to provide some answers to the important questions that arise such as: What is the importance of sharks and what are the consequences of the lack of these species in the oceans? Which are the most affected shark species? How would the lack of sharks in the oceans impact the environment?

The cultural obstacles to reduce shark finning related to the Chinese traditions and the anthropocentric image of sharks are described in the second chapter.

The business of fin trade represents a global economic activity, which is described in the third chapter of this work. It exposes who are the main actors and countries implied in the trafficking of fins, the marketing procedures, the pricing and the forms in which these *products* are sold.

An important purpose of the present work is to draw attention to the different international agreements in place to protect sharks and to discuss whether there are some obstacles delaying the implementation of such regulations. Which are the Institutions involved in the protection of sharks? Are they effective? What are the obstacles and difficulties for the conservation of sharks? These questions are answered in the fourth chapter, which also highlights the latest conventions and agreements on this topic.

To illustrate the situation using a concrete example, the last chapter describes the case of the shark decline in the Marine Corridor for Pelagic species of the Eastern Tropical Pacific Seascape (ETPS).

Indeed, Asian fishing fleets regularly cross the Pacific and enter Columbian and Costa Rican territorial waters to obtain this valuable resource. The main question that arises is whether the sharks that inhabit the Natural Reserves of the area are really protected? Are the governments of these countries doing enough to mobilize their resources in order to tackle this problem and what are the environmental, social and economic consequences of shark finning in the region?

The many challenges faced by regulators of shark finning are examined throughout the text, and this raises a subsidiary question: What can be done to reduce the decline of shark populations? Some recommendations to the problematic and personal opinions are expressed at the end of this paper.

METHODOLOGY

While reading the main Colombian newspaper *El Tiempo* during October, 2011[1], I became aware of the vast massacre of hammerhead sharks in the pacific island of *Malpelo,* belonging to this country. I searched for more information on the website of the local non-governmental organization "*NGO* Fundación *Malpelo",* dedicated to the preservation of Columbian marine diversity in this *Marine sanctuary*. This was the starting point for the realization of this thesis.

To obtain enough relevant information on the topic extensive bibliographic and audiovisual research was done. Additionally different actors involved in the topic of shark conservation were contacted to obtain adequate sources of information.

This paper addresses the problem of shark finning globally and at the local level with a special focus on the case of the *Eastern Tropical Pacific Seascape* (*ETPS*).

An initial comprehensive research was done in the databases of the *Université Libre de Bruxelles* ULB. The catalogue *CIBLE* and its linked catalogues were explored with the help of the personal of both libraries. The *Bibliothèque des Sciences Humaines* and the *Bibliothèque des Sciences et Techniques* (BST) were consulted and general information about sharks was found in biology and ecology books from the *BST*. Additional information was demanded in the *Musuée de Zoologie* from the ULB. The web catalogue of external Belgium Universities "*UNICAT*" was visited, but unfortunately the information present in this database was limited.

The next step was to research for recent and trustworthy scientific articles. Initially I searched in foreign scientific databases as *BIOSIS*, *Science Direct*, *SciVerse*, *Scopus*, *PUbM* and *Google Scholar*. Through the website of CIBLE I have obtained access to some electronic magazines, and additionally I researched directly in the websites of some other publications as: *Conservation Biology, Ecology Letters, Oikos, and Science*; among others. In the cases where the full article was not available, I contacted the authors who in most of the cases have sent me copies of their publications in a *PDF* format. The cooperation of Dr. Gordon C.K. Cheung from the *Durham University* in the UK and Dr. Shelley Clarke from the *Imperial College of London (both experts in the topic), are truly appreciated.*

[1] For more information see: Nullvalue, 2011 «*Condenan la matanza de 2.000 tiburones en Malpelo* ». http://www.eltiempo.com/archivo/documento/MAM-4898089

Afterwards I started searching for audiovisual material and I found several useful material including videos, documentaries and films on the topic. This helped me obtain a global idea of the problematic and to filter who are the main organizations involved in shark conservation.

Extensive information was found in the websites of *Shark Alliance*, the *Food and Agricultural Organization (FAO)*, TRAFFIC, the *International Union for Conservation of Nature (IUCN)*, the *European Elasmobranch Association (EEA)*, *OCEANA*, *The Shark Trust* and *Seas at Risk* among others. Several online reports and paper brochures were obtained from these organizations.

I established personal contact with: Caroline Dosche from *Greenpeace Belgium*, who had refer me to Saskia Franklin from the same organization. The organizations *OCEANA*, and *Seas at Risk* in Brussels were as well contacted telephonically. Sandrine Polti from *The PEW Environment Group* and Lucy Harrison from the *Sharks Specialist group (SSG)* of the *UICN* have as well, contributed with valuable information to my research.

During the research I realized that the European Union plays a key role in the implementation of regulations related to shark exploitation and shark finning. In the *Department of Maritime Affairs and Fisheries (MARE)* of the *European Comission (EC)* I have obtained reports on policies, and conventions plus several press releases that were relevant to my research.

A delimitation in the bibliographic material was required at this stage of the research.

To obtain information related to the *Natural Protected Areas* of the ETPS the main organizations related to shark conservation in Colombia and Costa Rica were contacted. The Costa Rican NGO "Fundación *Marviva"* and the Colombian NGO "Fundación *Malpelo"* were contacted via internet; further telephonic calls were done to the second one. Additionally, the website of the Library of the *University Jorge Tadeo Lozano,* and the *Pontificia Universidad Javeriana* in Bogotá were visited in search of scientific articles.

Valuable photographic material, plus a big source of inspiration was obtained from Fred Buyle[2] .

[2] World's record free diver and underwater photographer, involved in hammerhead shark tagging projects in Colombia. Buyle*,* 2012.

CHAPTER 1

Shark history and success

Sharks appeared during the *Devonian period* (Paleozoic era), and have inhabited our oceans for more than 400 million years as shown by the fossil record (Annex 1). They are fish belonging to the class *Chondrichthyes* (together with *rays*, torpedos, sawfish, chimaeras and elephant fish), whose cartilaginous skeleton makes them differ from the *Osteichthyes* (or bony fish). The class *Chondrichthyes* is divided by main taxonomists into two subclasses: *Holocephalii* (chimaeras or ratfish and elephant fish) and the *Elasmobranchii,* which include sharks (Parker, 2002).

Sharks are a very diverse group of fish. Actually they can be found in a wide variety of habitats from coastal regions to deep oceans or fresh waters; from the tropics to the poles. They can live up to 60/70 years, as the case of the tope shark (*Galeorhinus galeus*), or around 20 years as the blue shark (*Prionace glauca*). Sharks' characteristics can vary enormously from one to specie to the other (Annex 2). They exist in miniature sizes from 25cm (*Etmopterus vierens*), while other species can reach up to 18m (*Rhincodon typus*) (Vannuccini, 1999).

Sharks have been able to survive and reproduce successfully since the Paleozoic era. They have adapted to the world's climate changes, ice ages, droughts and heat waves (Parker, 2002). The success of sharks might be due to several factors as their morphology, their senses, and their ecological place in the food chain. These aspects are described as follows.

1.1 Shark morphology and movement

Body

The basic body design of sharks has remained remarkably stable but this does not mean that shark species have stopped evolving in time. Shark's streamlined and hydrodynamic designed body (torpedo shape), their light weight skeleton, made of cartilage that can flex from side to side (Annex 3), their subterminal (under the head) mouths and the characteristics of their skin (with tiny placoid scales or denticles, all pointing to the tail) allow them to flow smoothly through the water and avoid drag. The combination of these characteristics reduces their energy use, contributes to their powerful swimming capacities, allows them to move efficiently underwater[3], and makes them strong hunters (Skomal and Caloyianis, 2008).

Fins

Sharks have five types of fins: Dorsal fins, pelvic fins, anal fins, pectoral fins and caudal (tail) fins (Figure 1).

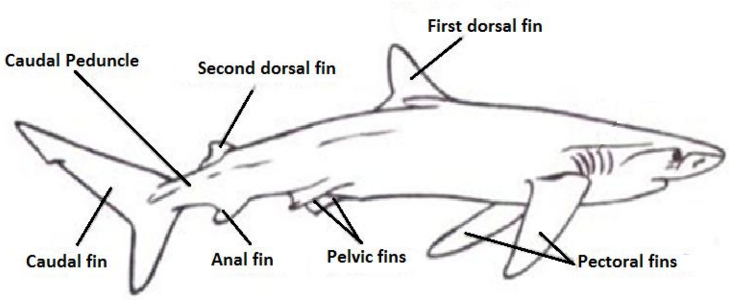


Figure 1. Types of shark fins. Source: Skomal and Caloyianis, 2008

Shark fins are rigid (in difference with other fish), but their internal muscles allow them subtle movements. Fins are crucial to guarantee swimming and they are involved in main functional components as acceleration, cruising, maneuvering, turning, and doing vertical movements in the water column. Each one of the fins has a specific function:

The pectoral fins provide lift to their bodies while the two dorsal, anal and pelvic fins provide stability. The main dorsal fin has a great importance, because it provides thrust to the animal. All the force generated by the body muscles is transmitted to the strong caudal fin, which acts as a propeller and provides forward rapid movements and acceleration to the animal. These rapid movements allow quick escapes or strikes to prey. The caudal fin is composed by two lobes (upper and lower); the upper lobe is usually longer than the lower lobe[4] (Levinton, 2009) (Figue 2).

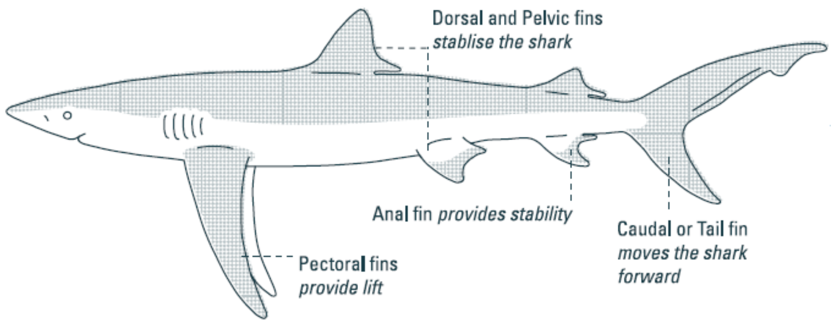


Figure 2. Morphology of a shark. Detail on shark's fins and their functions. Each pair of fins has a specific function for the movement of a shark. Source: Shark Alliance, 2010.

[3] Exceptions to this body design are present in some species such as Angel sharks (*Squatina squatina*), Carpet Sharks *(Order Orectolobiformes)*

[4] Exceptions in some species as the mako shark (*Isurus oxyrinchus*) and great white shark (*Carcharodon carcharias*)

The shape of the fins and their disposition in the body changes from one shark specie to the other. Some sharks have different body configurations, which make them fast swimmers (as *mako* and *great white shark*s), others are moderate swimmers (as *blacktip, blue* and *tiger sharks*), slow swimmers (as *nurse* and *leopard sharks*), deep water swimmers, with no anal fin (as *dogfish*) or bottom sharks (as *angel sharks*) (Annex 2) (Skomal and Caloyianis, 2008).

Most sharks can move in an excellent way forwardly, but they cannot swim backwards as other fish do, as well, they might have difficulties maneuvering in small spaces and it is possible that sometimes they swim forward into danger (Parker, 2002).

Senses

Another important aspect that has guaranteed the survival of sharks for millions of years is related to their sensory systems. Sharks have seven types of senses. Two-thirds of a shark's brain total weight is made up of olfactory lobes, which makes their olfactory sense very well developed. Two additional senses help sharks detect prey and avoid predators: magneto – induced electroreception (tiny pores in the head's skin known as *Lorinzini electroreceptos* which detect minor electrical currents in the water) (Johnsen and Lohmann, 2005) (Annex 4), and a lateral line sense (pressure sensitive cells beneath their skin) (Parker, 2002).

Jaws

Sharks mouth is an efficient tool for biting, slicing, chopping and crunching. A shark's jaw can extend and protrude to grab, hold and bite more effectively. They present multiple rows of very sharp teeth, of different sizes and shapes (varying between species). As teeth get old and dull, they fell down and get replaced all along the life of a shark (Skomal and Caloyianis 2008).

Reproduction

Sharks present internal fertilization and bear their young in three ways: oviparity (the baby hatches from an egg which has been deposited outside the body of its mother), viviparity (a fully developed and functional baby is born), and ovoviviparity (eggs hatch in the oviduct of the mother, and youngs are retained, protected and nourished within the female body) (Pough et al., 2005).

The fact that the fertilization is internal, and that in the cases of ovoviviparity and viviparity, the new born is fully developed at birth, are factors that have contributed to the high rates of survival of their young and the survival the survival of sharks.

Ecological Position in food chains

Most sharks are *Apex Predators*. These organisms (also known as *alph*a, *supe*r, or *top-level* predators) reside on the top of the food web and do not have, or have very few natural predators (only preyed by other sharks or sometimes killer whales). They are few in numbers, usually large in body size and ingest large preys (Levinton, 2009).

Apex predators maintain the balance of food webs. They keep many marine populations in the proper proportion, avoiding that they becoming too populous and cause harm to ecosystems (Newton et al., 2006; Frid et al., 2007).

Top predators like sharks eat the weaker/slower and sick individuals of their prey's populations, inducing the reproduction of the largest, strongest, and healthiest fish. While eating the sick and/ or dead bodies, they help preventing the spread of diseases and they play an important role in regulating the health of marine ecosystems. These two factors contribute to strengthen of the gene pools of the prey population (Myers et al., 2007).

Their ecological position in food webs, together with their biological characteristics, has assured the existence of sharks in the oceans for millions of years.

1.2 Humans and Sharks

Sharks are a valuable resource for human societies. Shark meat consumption has been recorded since the fourth century. In some regions of the world, they represent an important source of alimentation and some coastal communities depend on the subsistence of their populations (Shehe and Jiddawi, 2002). Basically, all parts of a shark (meat, liver-oil, skin, teeth, cartilage and fins) can be consumed which has induced the growing human population to overexploit and threaten their populations.

In the last decades, shark's populations have been seriously in danger especially because they are being killed to obtain their fins. The problematic is known as of *Shark Finning.*

1.2.1 Shark finning

Finning a shark is the practice of slicing off the animal's fins and discarding[5] the rest of the shark's body (dead or alive) back into the ocean (Photos 1 and 2)[6].

Photo 1. Shark fin being cutted off. Source: Hilton, 2008
Photo 2. Hammerhead shark being discarded back into the ocean after its fns have been removed.
Source : Planet ocean news, 2011

Shark fins are exported mainly to China, where they are considered as one of the eight treasured foods from the sea and are included in their traditional cuisine since several centuries (Simoons, 1991).

Shark fins are the main ingredient of a traditional Chinese soup: The *shark fin soup* (Photo 3).

Photo 3. Shark Fin soup. Source: Wildman, 2011

Nevertheless not all the parts of the fin are consumed. The fin's membrane, a few muscular tissues, a cartilaginous platelets and a fatty layer under the skin are removed and a bundle of round collagen fibers with a sharp edge located in the interior of the fins is removed for the preparation of the soup.

[5] Body discarding also occurs frequently in other fisheries, due to different reasons: market considerations, lack of commercial or alimentary value, quota restrictions or minimum landing sizes (Kelleher, 2005, Seas at Risk, 2011).
[6] Pretoma, 2009. *Shark Finning* http://costaricanconservationnetwork.wordpress.com/2009/11/23/the-costa-rican-shark-finning-crisis/

These fibers are known as *fin needles*. This is the only part that is used from a whole shark. Needles are valued, very fragile, and their preparation and handling require great care (Vannuccini, 1999).

As only a very small quantity of the shark is used, shark fin soup was considered as a precious delicacy only eaten by emperors and noblemen during the Ming Dynasty (1368-1644). Later, during the Qing Dynasty (1644 -1911) shark fin soup was included in traditional formal banquets (Vannuccini, 1999).

More recently and as a result of the economic development (in Hong Kong during 1970-1980 and in general in China since the 1990's); the demand for shark fin soup has increased among emerging middle class, eager to manifest their social status and exotic taste (Wu and Cheung, 2002).

Shark finning and the consequent body discarding, means that only 1 – 5 % of the organic material of the fish is used. The rest of the *biomass* is lost and potential quantities of fish protein resources are wasted (Shark Alliance, 2011). Dumping at sea a portion of the organic material of an animal is inconsistent to with responsible fisheries regulations (Kelleher, 2005) and is a threat to food security, sustainability of marine ecosystems and does not provide any benefits to society (Fowler and *Séret*, 2010).

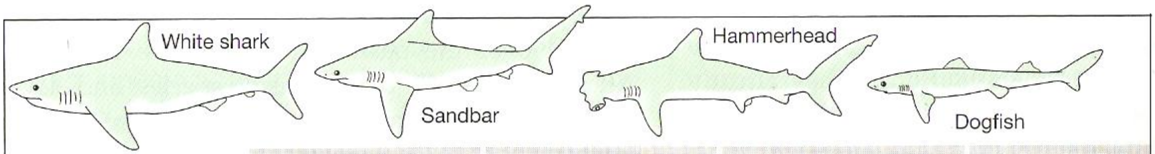
The discarding of shark's bodies implies several consequences for shark populations, marine communities and ecosystems and the fact that the bleeding shark is thrown back into the water to die slowly and painfully is considered as a cruel animal practice (Our ocean news, 2012).

1.2.2 Environmental consequences of shark finning and the lack of sharks in the oceans

Consequences for shark populations

Shark's populations are very sensitive to fishing. The killing and/or discarding of even a few individuals may be critical (European Commission, 2007). This is due primarily because sharks are "*K-selected*" species. They grow slowly, mature late, and the reproduction requires a significant amount of energy by the female, which means she does not reproduce every year and produces relatively few number of offspring during her lifetime. The discarding of juvenile individuals will result in the reduction of the spawning biomass in the future because those juveniles will not contribute in future spawning seasons. The discard of mature individuals represents an immediately waste and also reduces the spawning biomass of a stock (Harvey et al., 2005).

Life-history parameters of elasmobranches vary depending on the species (Table 1). Factors as the age of maturity, the number of pups per female, the reproductive frequency, and the gestation period menace this species if they are overfished.



	White shark *Carcharodon carcharias*	Sandbar *Carcharhinus plumbeus*	Scalloped hammerhead *Sphyrna lewini*	Spiny dogfish *Squalus acanthius*
Age to maturity (years)	m 9–10, f 12–14	m 13–16	m 4–10, f 4–15	m 6–14, f 10–12
Size at maturity (centimeters)	m 350–410, f 400–430	m 170, f >180	m 140–280, f 150–300	m 60, f 70
Life span (years)	m 15(?)	m 25–35	m 35	m 35, f 40–50
Litter size	2–10 pups	8–13 pups	12–40 pups	2–14 pups
Reproductive frequency	Biennial (?)	Biennial	(?)	Biennial
Gestation period (months)	>12	9–12	9–12	18–24

Table 1. Life-history parameters of 4 different species of sharks. (*m= male, f= female*). Note that sharks reach sexual maturity minimum after the fourth year of life and their gestation period is of minimum nine months. Source: Pough et al., 2005.

Consequences for the marine communities and ecosystems

When shark's body discarding occurs, a top predator is automatically turned into a prey. A shark with no fins represents a precious amount of biomass available for other species. This phenomenon can produce the development of opportunistic species and scavengers[7] (European Commission, 2007), cause changes in the populations of commercially important fish species down the food chain, and disrupt the functioning, structure and nutrient cycling of marine ecosystems[8] such as coral reefs and sea grass beds (MacKenzie, 2008).

The removal of top predators is likely to produce an ecological phenomenon known as a *trophic cascade*[9]. It refers to the changes in the relations predator *vs.* prey caused by a disturbance in the top level of a food chain. Depending on the targeted population, forward effects will be seen in food

[7] Animals (especially carnivorous) who feed on dead organisms rather than or in addition to hunting live prey.

[8] For more information see: http://www.pewenvironment.org/news-room/other-resources/video-cartoonist-jim-toomey-on-sharks-and-ocean-health-85899396248

[9] The term trophic cascade was first used by the American zoologist Robert Paine in 1980 and it was initially used to describe the reciprocal changes in food webs caused by experimental manipulations of top predators and to represent the changes in aquatic ecosystems caused by overfishing.

chains. A decrease (or increase) in carnivores will causes an increase (or decrease) in herbivores and an decrease (or increase) in primary producers such as plants and phytoplankton (Lynam et al., 2006).

Different studies[10] have reported examples of marine trophic cascades. For example, Scheffer et al., 2005, exposed the cascading effect produced by the collapse of large predators and its effects in ecosystems (Figure 3).

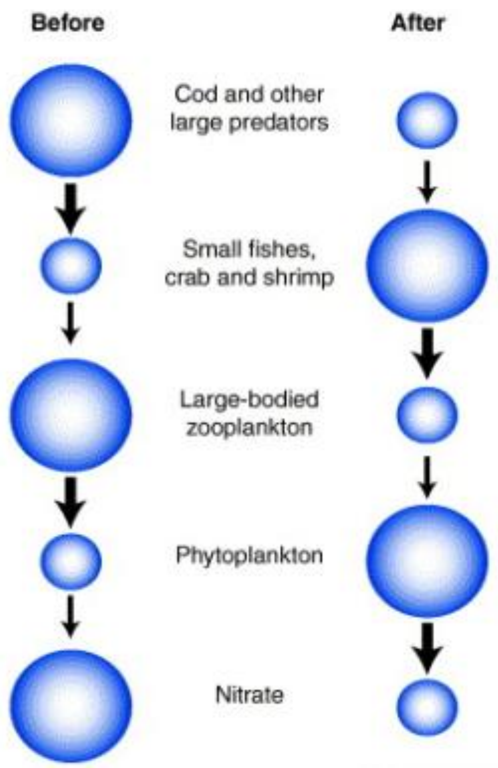


Figure 3. Diagram of the cascading effect of the collapse of cod and other large predators in the Scotian Shelf (1980-1990). The size of the spheres represents a trophic level in two lapses of time. The arrows describe the inferred top down effects. The decrease in large predators caused the increase in the populations of small fish, invertebrates, decrease in large-bodied zooplankton and the increase of phytoplankton. As a final result, the amount of nitrates was considerable lower compared to the initial situation. Source: Scheffer et al., 2005.

Heithaus et al. in 2008 outlined that the decline in predators have also *indirect* influences in communities. He described the modifications in the behavior of preys when predators are absent. *(risk effects)*. He states that *meso-consumers* are likely to change their habitat distribution, their use of time and energy time use, their resource exploitation and their reproductive patterns.

The decline on sharks across the world's ocean is expected to influence *top – down* relations. Myers, et al., 2007, studied (between 1970 and 2005), the decline of the populations of 11 large (> 2 m.) sharks in the U.S northwest Atlantic coastal ecosystems. Sharks were targeted directly by fisheries or caught by bycatch. This phenomenon produced clear cascade effects. The populations of inferior *elasmobranchs* such as rays, skates and small sharks, increased nearly exponentially. During the

[10] Frank et al., 2005 reported the changes caused in marine ecosystems due to overfishing of Atlantic cod; Lynam et al., 2006, exposed the increased abundance of jellyfish in overfished ecosystems, among others.

same period of time the population of one ray in particular, the cow nose rays (*Rhizoprionodon terraenovae*) achieved a great magnitude increasing to more than 40 million individuals. As this meso-consumer is a bottom feeder who consumes large quantities of bivalves, subsequent surveys suggested that since 1996, cow nose rays have been responsible for almost the complete depletion to the population of bay scallop (*Argopecten irradians*) and possibly other bivalves. This example of a trophic cascade, which began with shark fishing had consequences for the basal phytoplanktonic level and sea grasses.

The lack of large sharks will also reduce the natural mortality of species such as sea mammals and sea turtles (who have few other predators), therefore causing changes in their abundance, their spatial distribution and their behavior (Ferretti et at., 2010, Newton et al., 2006).

Another study done by Wirsing et al., 2007, reported that the presence/absence of tiger sharks in two habitats (shallow banks, and deep waters) and two microhabitats (seagrass bank interiors and bank edges) in shark Bay, Australia, influenced the distribution of large herbivores (megagrazers). The absence of sharks caused additional changes in the foraging tactics and the time devoted to excavation of large herbivores (Figure 4).

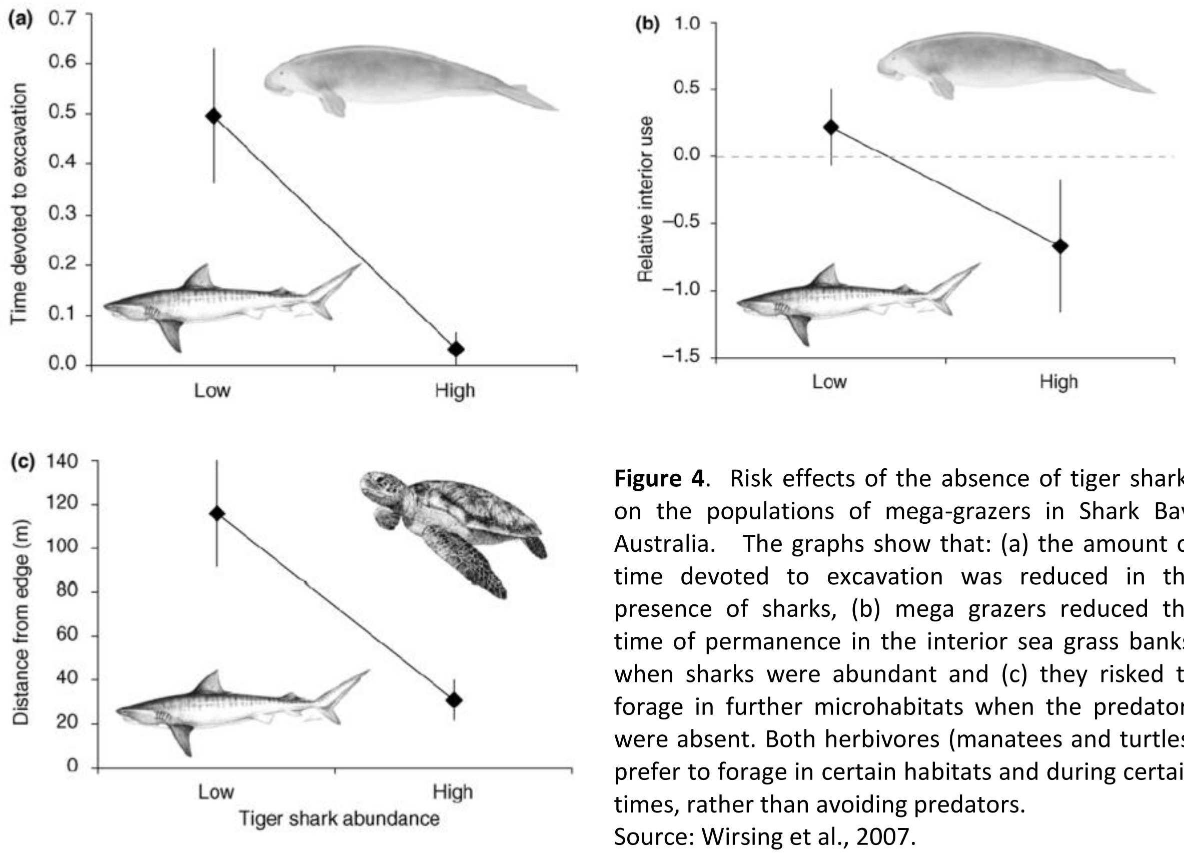


Figure 4. Risk effects of the absence of tiger sharks on the populations of mega-grazers in Shark Bay, Australia. The graphs show that: (a) the amount of time devoted to excavation was reduced in the presence of sharks, (b) mega grazers reduced the time of permanence in the interior sea grass banks, when sharks were abundant and (c) they risked to forage in further microhabitats when the predators were absent. Both herbivores (manatees and turtles) prefer to forage in certain habitats and during certain times, rather than avoiding predators.
Source: Wirsing et al., 2007.

Heithaus et al., 2008 reported the decline of abundance of black tip sharks (*Carcharhinus limbatus*) in U.S.A Atlantic ecosystems and the subsequent increase of mesoconsumers and the increase mortality rate of lower species. He also documented the behavioral change in the populations of cow nose rays (*Rhizoprionodon terraenovae*), who increased their foraging time in previously dangerous habitats (Figure 5).

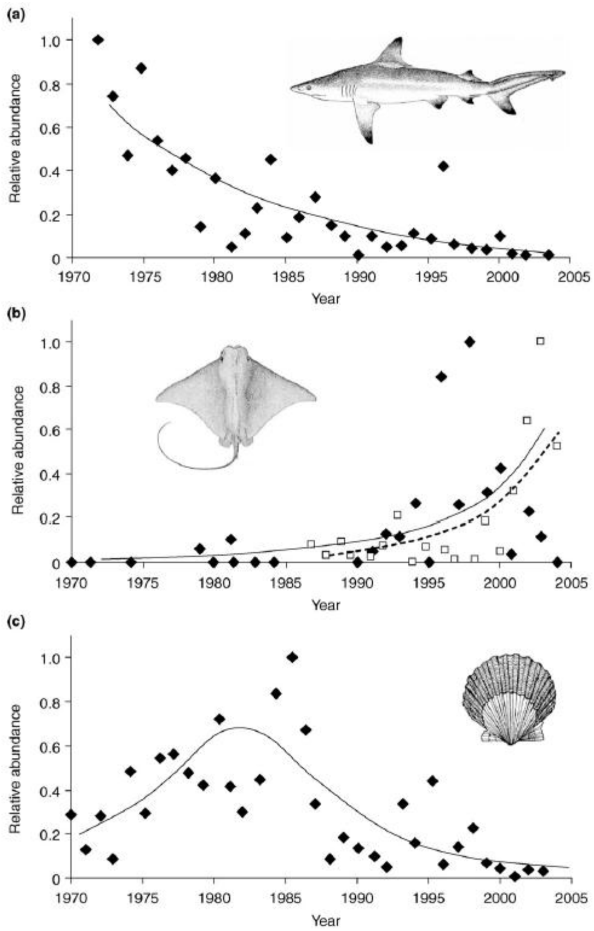


Figure 5. Effects of the removal the marine predator *Carcharhinus limbatus* along the east coast of the U.S.A *Filled symbols and line denote surveys in Delaware Bay, and open symbols and dashed line denote surveys in Pamlico Sound, N.C*. *a-b) The decrease in relative abundance of Carcharhinus limbatus* was reported from 1970 - 2005, in the same period of time, the relative abundance of *Rhizoprionodon terraenovae increased,* and *risk effects where reported: rays increasingly forage in new habitats (which were previously dangerous); c) an initial increase in the relative abundance of Argopecten irradians* was followed by a decline in the abundance of this bay scallop. *Source:* Heithaus et al., 2008

Conclusions of Chapter 1

The fact that sharks occupy the top levels of trophic chains, present internal fertilization, have low mortality rates among their young, have long life expectancy, large sizes, special morphology and facility of movement, are some of the characteristics that have guaranteed their evolution and survival for more than 400 million years.

On the other hand their slow growth, their late sexual maturation, and the few amounts of young born per year (among others) make sharks vulnerable to over exploitation.

Nowadays sharks all over the world are exposed to a severe threat, which is unsustainable for their populations. The increasing shark finning, to satisfy the growing demand for shark fin soup, together with the high levels of discards, can strongly put at risk the populations of this species. As the Chinese economy grows, a steady decline in shark populations can still be observed.

The environmental consequences of this situation are manifold. We can predict that if apex predators such as sharks are eliminated, severe changes at spatial and temporal scales would be evidenced in the structure of water column communities, as well as the transformation of oceanic ecosystems and even the collapse of some fisheries.

Shark finning is a topic that must be seen from different perspectives. Historical, cultural, economical and political factors play an important role for the understanding of this practice. Each one of these topics presents difficulties for the implementation of shark conservation measures. The following chapters discuss the aspects related to this topic and the obstacles that they present for conservation programs in a global context.

CHAPTER 2

Social and cultural contexts related to the practice of shark finning

2.1 The Chinese Cultural Obstacles for shark conservation

Even if at a global level, technological advances, mass production and standardization in the production of food have increased, the case of China is particular. Several dietary products form part of this country's cultural identity and involve a dietary ritualism not tied to the consumption of food for subsistence. Consumption of high-value food and exotic species has been present in Chinese dietary habits throughout history. The ingestion of certain products (bear paws, sea cucumbers, bird's embryos and nests … etc) has been related to richness and high social standing (Simoons, 1991).

Shark fin soup is one of the examples of this situation. Old Chinese medicine books even claim that consuming shark fins is beneficial for the lungs, bones and kidneys, that increase appetite, vital energy, blood nourishing and stimulate rejuvenation. These affirmations are questioned and the composition of dried shark fin has been tested (Annex 5) (Vannuccini, 1999).

Shark fin soup is consumed daily in China. Especially during important celebrations as a Chinese new year's business dinner or the birthday celebration of someone considered important, shark-fin soup is a 'must have' dish. In wedding ceremonies, the soup is a delicacy with a ritual meaning that cannot be absent. Wedding banquets are known to be an "once-in-a-lifetime" occasion and it will be criticized by friends and family guests if shark fin soup is lacking. All guests expect a "money – value" dinner, reciprocal to the wedding gift that they have offered. This cultural tradition has been degenerated into a symbol of richness to fulfill the material needs of Chinese people (Cheung and Chang, 2011).

The processing of shark fins involves networks, ethnic associations and high skilled workers with special handicraft skills. To properly process shark fins and extract the most amount of fibers inside the fin; complicated drying, cleaning, boiling and freezing techniques are required (Cheung and Chang, 2011) (Photos 4 to 6).

Photo 4

Photo 5

Photo 6

Photo 4. A worker puts shark fins into baskets at a processing plant in Wenzhou city, East China's, Zhejiang province. Source: Hong, 2011

Photo 5. Shark fins drying in the sun in Kaohsiung before processing. Source: Heinrichs, 2012

Photo 6. Workers in Hong Kong sort shark fins destined for dinner tables. Source: European Pressphoto Agency, 2010.

The business of fin's processing has grown in Hong Kong and mainland China, from small family enterprises to newly processors who has been established their manufactories. The amount of specialized shark fin restaurants had also increase, especially since 1992 (Cheung and Chang, 2011). The economical development of the country is making this (formerly inaccessible) product, attainable to many more consumers, which increases the demand for shark fins and puts into danger the populations of this species.

2.2 Shark Awareness

Studies in shark biology, behavior and genetics are not abundant as for the case of other species. Nevertheless, the scientific community has evidenced the decline of shark populations, and the changes in community's composition (as described in chapter 1), and the awareness on the threats to sharks has increased in the last years. Several scientists, scuba and free divers who have been in direct contact with sharks. Several, have started to interpret shark behaviors and their way of communication[11]. Understanding sharks has changed some attitudes and there is a global concern

[11] For more information see: <http://www.joeromeiro.com/>.,<http://www.sharkwater.com/>.,<http://www.nektos.net/>., <http://www.seashepherd.org/>., <http://www.sharkangels.org/>., http://www.thedorsalfin.com/>., <http://www.thedorsalfin.com/>., <http://www.supportoursharks.com/>., <http://www.sharkwater.com>.

for shark conservation has been growing. The importance of this top predators and the vulnerability of their populations to overfishing have awakened conscience in several international conservation organizations. Different bodies as the Food and Agriculture Organization (FAO) of the United Nations (UN), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention of Migratory Species (CMS) and the European Union (EU) have been doing efforts for the protection of world's shark stocks. But still there are many obstacles / difficulties to assure the protection of this species.

2.3 The difficulty of using moral environmental arguments to protect sharks

Even if awareness is increasing especially by the concern of several (western) conservation organizations; cultural issues appear when western nations try to persuade China and other nations to engage in shark conservation. Arguments to protect a natural resource can be problematic when traditional/cultural aspects are involved, because cultures perceive the protection of species in a differently way, according to their traditional contexts (Paul, 2000).

Persuading China to engage with international regulations for the protection of sharks is very difficult if based in a moral arguments or cultural norms. As a result, western nations are more likely to use scientific arguments instead. The problem increases, however, because scientific data are not always available or reliable (Anderson, 2011) (discussed in following chapters).

2.4 The negative reputation of sharks

A fact that slowed down the amount of scientific studies in past decades, and the awareness towards shark protection was the negative image of these species. In general western cultures typically perceive sharks in a repugnant way. Throughout history, sharks have gained an evil reputation, much of it based on myths, folk tales and films[12], which present sharks as dangerous predators to be feared (Photo 7).

Photo 7. Shark attack headlines in South Africa. Kock, 2012

[12] Steven Spielberg's "Jaws" (1975), "Jaws 2" (1978), "Jaws 3" (1983), "Jaws 4" (1987), "Jaws 5" (1995) and Renny Harlin's "Deep Blue Sea" (1999); David R. Ellis's "Shark Night" (2011) among others

Additionally, several shark attacks have been reported (view global statistics in Annex 6a, Annex 6b), which make people believe that sharks are solitary killers who have the tendency to attack humans. The reality is that only about a dozen of sharks are dangerous to humans, and of those, only two species[13] are responsible for more than half of the attacks. In 60 % of the cases, the victims are surfers and others, who practice board sports in near shore waters. The main reason of the attacks is that sharks confuse their silhouette with that one of their prey (turtles, seals, etc). In those near - shore waters where sharks attacks happen, usually many other fatalities occur (such as drowning, heart arrests, jellyfish or stingray stings…). These fatalities, together with others as bees, wasps, snakes and alligator attacks or lighting strokes, are responsible for many more human fatalities every year but are not published by the Medias and they do not produce the same psychological effects in the population as shark attacks do (The International Shark Attack File, 2011).

If we compare the reputation of sharks with the one of other marine species (dolphins, sea turtles, sea otters, whales, penguins ...etc) we can observe that sharks do not have an *aesthetic value*, or are not considered as *flagship species*[14]. For example, the arguments for the conservation of whales, differed significantly with those of sharks, in big part because whales are perceived as peaceful and intelligent animals (Anderson, 2011). This can be one of the reasons for which there is a lack of concrete action in shark conservation.

2.5 Comparison to the whaling case

The clear decline in whale's populations was due to the overexploitation in the past done by several nations which led to the devastation of many of their species, mainly blue whales (*Balaenoptera musculus*). This species avoided total extinction in large part, because of the action of conservationists, and even whaling nations who convened to international regulations through the International Whaling Commission (*IWC*) by the year of 1946 (Mc Neil, 2000). Thanks to the delimitation of catch limits, commercial whaling continued to a sustainable level. At the beginning, and for more than four decades the *IWC* struggled to accord to scientific recommendations about the right capture quotas and during this period of time most of the whale species continued to decline. Finally, when the precise scientific information was available in 1986, commercial whaling got banned worldwide[15]. The action of the *IWC* did not stop there, its scientists have kept on working into managing whale populations and into preventing fisherman from harvesting those species

[13] White sharks (*Carcharodon carcharias*) and tiger sharks (*Galeocerdo cuvier*)
[14] *Flagship* species – iconic animals that provide a focus for raising awareness and stimulating action and funding for broader conservation efforts (WWF, 2012).
[15] Exceptions to the whaling ban: aboriginal subsistence whaling and scientific research. (Anderson, 2011).

whose populations might fall below their minimal levels of sustainability (Anderson, 2011). Nowadays cetaceans are considered as Flagship species (World Wide Fund, 2012).

Conclusions of Chapter 2

The consumption of peculiar animal parts has been part of Chinese culture since several centuries. This way of alimentation is grounded in their society and socially accepted especially in eastern nations. Furthermore, the consumption of some of these eccentric products (as shark fins) is considered as an emblem of wealth and prosperity.

As the economy develops in China, and the population expands at considerable rates, the amount of individuals who have access to this "*commodity*", increments. The demand for shark fins is nowadays very high.

Some western actors have developed an interest in the issue, troubled with the decrease in shark populations throughout the planet's oceans. Some attempts to aware Asian countries (especially China) and convince their citizens to reduce the consumption of these products, have been done in the last years; nevertheless it results challenging to find robust arguments and cause changes in the attitudes of entire societies.

The accumulated bad reputation of sharks symbolizes another obstacle for their protection. Sharks are not considered flagship species as other marine animals and it does not exist a unique international institution that safeguards their populations. Meanwhile significant amounts of sharks are being killed every day for their fins.

CHAPTER 3

The economical context of shark finning

3.1 Pricing and marketing of fins

Shark fins are considered very valuable products that are marketed mainly according to the characteristics of their needles. Buyers and chefs are extremely conscious of the quality of those thin collagen fibers (color, texture, length) (Vannuccini, 1999) (Photo 8).

Photo 8. Shark fin soup.
Detail of the collagen fibers in the final product: shark fin soup. Source: Hong, 2008

The economical values of shark fins depend on the following factors:

1. Length of the fin's needles

The length of the needles of a fin depends on the type of fin (dorsal, pectoral, caudal…) and the shark species from where they are extracted. Needles can be extra large (>40 cm), large (30-40 cm), medium (20-30 cm), small (10-20 cm) or very small (4-10 cm).

2. Needle concentration

The highest concentration of needles are found in the pectoral, the first dorsal and the lower lobe of the caudal fins (Figure 6).

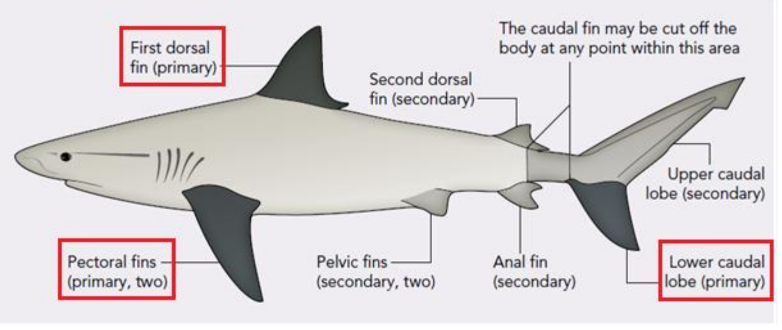


Figure 6. Types of fins and their economical importance. Primary fins (dark grey) have a higher price and secondary fins (light grey) have a lower price. Source: Fowler and Séret, 2010

3. Appearance of the needles

Color and texture are important factors determining the price of fins. White needles (Photo 9) are more expensive than black needeles and tender needles are more expensive than harder ones. Buyers can recognize as well the moisture and smell of the needles (Vannuccini, 1999).

Photo 9. Detail of white shark fin needles. Packs of wet shark fin nests displayed for sale in Hong Kong. Source: Vannuccini, 1999

4. Fin's cut

The way in which a fin is removed a shark, influences the quality (and price) of the product (Subasinghe, 1992). The manner in which fins are cut off (Photo 10), depends on the experience and interests of the fisherman, but also in rather the fins will be frozen or sun dried during the period of transportation.

Photo 10. A fisherman holding a freshly cut shark's dorsal fin. Source: Jeff Rotman Photography, 2011

There are basically three common ways to cut off the fin from a shark:

- "*Half-moon*" cut: This type of cut (Figure 7) is mostly common when fins are not going to be frozen, (but sun dried), to avoid damage and the risk of contamination. It is a more careful cut; proceed by the cleaning and removal of extra meat and cartilage of the freshly cut fins. Buyers of dried fins prefer fins that are removed using a "half moon cut".

- "*Crude* cut": This type of cut (Figure 8) is more often used when fins are being frozen while exportation and there is not risk of pollution if some flesh is left attached to the fin. Fins are cut and frozen immediately. The extra flesh is removed before exportation to Asia or directly in Asia. This type of cut might be do intentionally with the purpose of increasing the prices because of the extra weight, but in reality it reduces the value of the fin, and include some extra cost in the moment of cleaning and preparing the fin.
- "*Straight* Cut": Is another type of cut (Figure 9) used to remove mainly caudal fins. It is not common for the dorsal or pectoral ones (Fowler and *Séret*, 2010).

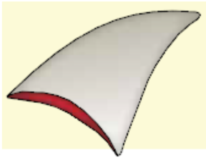


Figure 7. Fin's "Half-moon cut". Source: Fowler and Séret, 2010

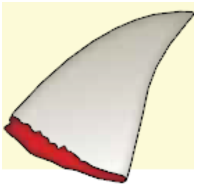


Figure 8. Fin's "Crude cut". Source: Fowler and Séret, 2010

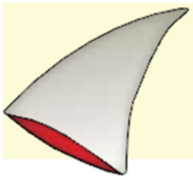


Figure 9. Fin's "Straight Cut". Source: Fowler and Séret, 2010

5. Form of the fins

For marketing purposes, fins are presented in different ways:

- Raw, dried fins: fins with extra meat, dermal denticles[16] and cartilaginous platelets
- Wet fins: fresh and chilled
- Frozen fins: prepared, cleaned
- Semi prepared: the cleanest and most expensive presentation, are dried fins, without skin or fibers, presented in one single mass.
- Fully prepared fins: the cartilaginous platelets are removed and they are packed in a cardboard box or inside a film
- In brine: fins contained in highly salty water
- As fin nets: the fin needles have been separated, boiled and dried and are presented in packs
- Prepared, "*ready-to-eat*" or cooked fins: canned soups or dishes, instant soup powders (Vannuccini, 1999)

[16] Very small thorn - like structures covering the fins' skin, and shark's body. These make the kin feel like sandpaper (Biology of Sharks and Rays, 2012.)

6. Shark species

The quality and abundance of needles varies widely from one shark species to another. The preferred species (main choices) at a global context are shown in Table 2:

<u>FIRST CHOICES</u>	<u>SECOND CHOICES</u>	<u>THIRD CHOICES</u>
Blue Shark *Dusky Shark* *Giant Guitarfish* *Hammerhead shark* *Mako shark* *Oceanic whitetip shark* *Sandbar shark*	*Blacktip reef shark* *Blacktip shark* *Great white shark* *Lemon shark* *Requiem sharks* *Smalltooth sandtiger shark* *Spadenose shark* *Thresher shark* *Tiger shark* *Tope shark* *Scalloped hammerhead*	*Basking shark* *Picked dogfish* *Whale shark*

Table 2. Shark species preferred by finning markets. (Must not be considered as a standard, but as a worldwide tendency). Source: Vannuccini, 1999

The prices (in 2010), of the fins from some species of sharks are presented in Table 3.

Fin classification	Fin size (pectoral, dorsal, caudal)	Price €/kg
Hammerhead	–	27.50
Mako shark 1	P(>30cm) D(>20cm) C lobe (>30cm)	24.50
Mako shark 2	P(20-30cm) D (10-20cm) C lobe (20-30cm)	15.50
Blue shark 1	P(>50cm) D(>25cm) C(>60cm)	12.30
Blue shark 2	P(40-50cm) D(20-25cm) C(50-60cm)	10.58
Blue shark 3	P(25-40cm) D(15-20cm) C(35-50cm)	8.45
Blue shark 4	P(<25cm) D(<15cm) C(<35cm)	7.17
Thresher shark	–	8.13
Anal fins	–	7.65

Table 3. Prices of shark fins delivered from the European Union to Asia. Data from 2010 for *frozen shark fins*. The prices are shown in *€ / kg*. *P*: pectoral fin; *D*: dorsal; *C*: caudal fin.
Note that the preferred and most expensive shark fins are those from hammerhead sharks (27.5 € / kg) and that caudal fins are the ones which have the least economical value. Source: Fowler and Séret, 2010

7. Set of fins

Fins can be commercialized separately or in sets. The value depends on the type of fin but definitely the *sets of primary fins* (Figure 10) have the highest prices:

VALUE	TYPE OF FIN
Low	*Secondary fins*: Smaller anal fin, pelvic fin, second dorsal, upper caudal
Medium	*Primary fins* : 2 pectoral fins, first dorsal fin, lower caudal fin
High	*Fin sets:* Four largest primary fins

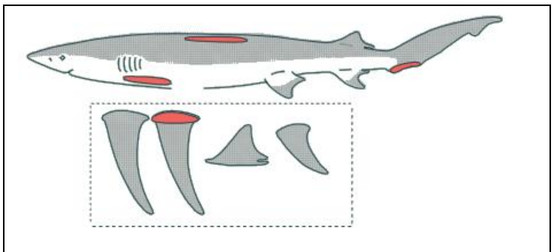


Figure 10. Sets of primary fins (pectoral fins, dorsal fin and lower caudal (or tail) are the most expensive in the market. Source: (Shark Alliance, 2011).

3.2 A strong economical incentive towards shark finning: fins price *vs.* meat price

Shark fin trade is extremely profitable compared to shark meat trade. The marked difference between both of the prices (fin *vs.* meat), encourages fisherman to keep only the fins and discharge the rest of the shark back into the ocean (Shark Alliance report, 2011). Shark fins correspond to only around 5% of the volume of a shark (Photo 10), but 40% of the economic value (Table 4):

Photo 10. Shark meat and shark fins.
Body volume is significantly bigger when compared to fin's volume. Source: Ocena, 2012

Table 4. Prices of shark fins *vs.* prices of shark meat:

Prices of Shark fins		***Prices of shark meat***	
1 kg of processed *set* of fins	90-300 Euros (Fowler and Séret, 2010)	1 kg of shark meat (in EU markets)	1 – 7 Euros (Fowler and Séret, 2010)
1 kg of dried[17] *set* of fins	up to 500 Euros (Shark Alliance report, 2011)		
1 bowl of shark fin soup	more than 90 Euros (Shark Alliance report, 2011)		

Additionally fins are easy to dry (Photo 11) and store on board, while meat takes up a lot of space and requires strict handling practices from the moment the shark is caught[18]. Additionally it is not easily preserved (Fowler and Séret, 2010).

Photo 11. Shark fins being dried on the deck.
Source, Greenpeace, 2006

[17] Semi prepared dried fins with no skin, no fibers is the most expensive presentation of shark fins

[18] Differing from other fish (who eliminate urea quickly), sharks accumulate urea and trimethylamine in their tissues and blood. If shark's blood is not removed at the moment of capture, urea will degrade into ammonia, which will contaminate shark's flesh. So, shark meat should be frozen and treated (preferably, sharks should be *skinned* to prevent bacteriological growth). The process of skinning big sharks is difficult because of their robust fibrous structure and the presence of muscles attached to the skin (Vannuccini 1999).

3.3 Shark-fin business is a global business

Shark finning is a big and organized worldwide economic activity related to Asian markets since the decade of 1980. Hong Kong (Annexes 7a and 7b) is the largest single market for this product and it is known that many countries have established commercial relations with this nation.

The trade of shark fins involves several steps:

1. The raw fins collected worldwide are exported to Hong Kong (*HK);*
2. After being collected in HK, they are transported to mainland China, to reduce processing costs [19];
3. The processed product is shipped back into HK;
4. 99% of the final product is re-exported back to mainland China[20] and other countries (Singapore Philippines, Thailand, Japan Taiwan, Indonesia, Vietnam Macao USA, and Canada);
5. Fins are offer for sale in the black market (in different presentations) or commanded directly by restaurants (Photos 12, 13, 14).

Photo 12. Assortment of Shark fins.
Source : Heinrichs, 2011

Photo 13. Shark Fins in jars
Source: Sharma, 2011.

Photo 14.
Fins sorted by size and grade and displayed for sale in a shark fin trader's store.
Source: Heinrichs, 2011

[19] Chinese from the mainland, who have being related in the intensive labor of processing for several years; are increasingly getting conscious about the best fin quality *vs.* the best prices. They are starting to search business opportunities in foreign countries for trading fins by themselves (Clarke et al., 2005). Hong Kong shark fin traders attribute a loss of market due to the action of mainland China (Clarke, 2008).

[20] A complex trading relationship has been established between the 2 jurisdictions, where raw and finished good are being moved back and forth between borders (Clarke et al., 2005)

3.4 Obstacles for the interpretation of shark trade

The exact information on fin trading (the amount of product exported to Hong Kong, the the countries involved in the market, the trading routes, the shark species marketed, etc) has been reported by different authors, but there still are substantial uncertainties. Some of the information is just obtained from the testimony of fishermen. They are supposed to report their shark catches in the *fisherman's logbook*, which is verified by the port's authorities, but unfortunately, there is not a way to prove if the logged information is true or not.

Some other data is collected from existing market databases as the Hong Kong's and/or Chinese *Customs and Statistics Departments* but the access to this information is restraint (especially the ones of mainland China). The data on fisheries trade requires advanced statistical modeling techniques to be interpreted. Additionally, there are several confounding factors in these assessments because the reported catches do not necessarily reflect the real amount of death sharks. As there a high amounts of bodies discarding, many of the fin trade is done in remote open ocean areas where there are few or none mechanisms of control, and/or the fins are landed in foreign ports, the exact landing information is lacking widely (Clarke et al., 2005).

3.5 Existing information

Estimations on the species and number of sharks marketed have been done by Clarke et al. in 2005 using records[21] of the largest trading center in Hong Kong. The same authors estimate that up to *73 million* sharks are killed every year for their fins (Clarke et al., 2006a)[22].

According to the data of the *FAO's FishStat* (2007), published in Lack and Sant (2008) the global subtotal export of *shark fins* between 1990 -2005 is of almost *6.000 tons* (Annex 8). However the data were criticized by the same authors (Lack and Sant, 2009) who estimate that FAO's data should not be taken as the real-global representation of shark catch, because there is an under-reporting of catches, the data only represents the reported catch of some countries , and the data do not include mortalities incurred through discard of bodies. Clarke et al. (2006b), have equally estimated that the figures reported by *FAO* are sub estimated, and that the real exportation of fin biomass is three or four times higher.

[21] Records include 10.000 fin's descriptions and fin's weights which translated using the statistical Bayesian Markov Chain Monte Carlo methods (WinBUGS).
[22] For more information visit : Clarke, Shelley. 2012: <http://vimeo.com/37958874/>.

3.5.1 Countries involved in trading of shark products (meat and fins)

In 2007, the *FAO* communicated the *top 10* countries responsible for the exportation of shark products to Hong Kong. According to their data, in 2005; Taiwan, Spain, Japan, Panamá and Costa Rica were the leading exporters (Lack and Sant, 2008) (Table 5).

1990		2003		2005	
Exporter	%	Exporter	%	Exporter	%
1. Norway	15.91	1. Taiwan	20.47	1. Taiwan	21.38
2. UK	11.88	2. Spain	13.36	2. Spain	14.85
3. Japan	10.80	3. Costa Rica	6.7	3. Japan	5.82
4. Canada	7.36	4. Chile	6.29	4. Panama	5.76
5. USA	7.19	5. UK	5.44	5. Costa Rica	5.40
6. Taiwan	6.11	6. Japan	4.98	6. New Zealand	4.06
7. Germany	5.96	7. Canada	4.85	7. UK	3.98
8. New Zealand	4.62	8. Panama	4.40	8. Canada	3.38
9. Denmark	3.99	9. New Zealand	4.04	9. Chile	3.27
10. Chile	3.83	10. USA	4.04	10. Indonesia	2.92

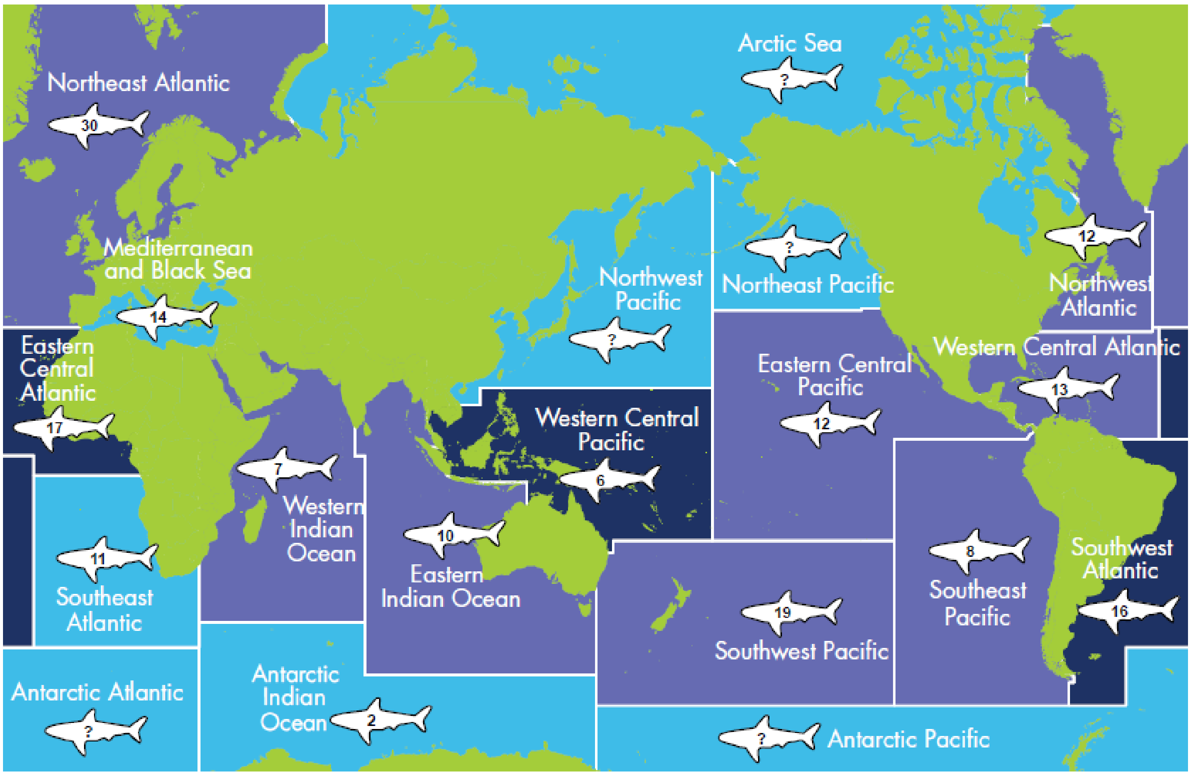
Table 5. Top 10 *shark product* exporters (by tonnage). Note that countries like Taiwan, UK, Japan, Canada, New Zealand, and Chile have been involved in the trade of shark products since the decade of the 1990s. Other countries like Norway and Germany have apparently decreased their exportations. The table shows information on *shark products* (not only shark fins). Source: *FAO FishStat* (2007), in Lack and Sant (2008).

Another list of "The top 10 exporting countries" was presented by Fowler and Séret in 2010. Table 6:

Country	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Average
Spain	12,383	17,462	17,963	16,539	12,377	11,555	11,555	11,552	13,737	14,742	13,987
Taiwan	2,705	2,198	3,105	4,403	9,716	10,630	17,161	15,095	19,109	23,764	10,789
US	9,241	6,854	6,636	6,319	3,669	4,068	3,011	2,339	2,491	3,059	4,769
Japan	3,228	3,792	3,921	3,576	3,258	3,716	4,087	4,841	5,339	4,143	3,990
Panama	-	70	215	4,450	7,462	5,859	3,714	4,899	5,353	3,433	3,939
Costa Rica	616	532	886	3,858	7,658	6,593	5,757	4,132	5,104	3,595	3,873
Canada	2,844	3,107	1,895	3,123	4,446	4,594	4,197	4,142	3,197	3,716	3,526
New Zealand	2,569	2,337	4,289	3,926	3,203	3,928	3,492	2,823	3,835	3,941	3,434
UK	1,997	3,314	3,142	3,447	5,306	4,489	3,947	3,654	3,195	1,307	3,380
China	2,433	2,047	2,134	2,237	1,845	2,282	2,450	2,587	1,548	1,106	2,067
*primarily meat and fin											

Table 6. Top 10 *shark product* exporters during 1997-2006 (Data is presented in tons). Note that Spain is considered as the main exporter of shark products with an average of almost 14.000 tons. The only year in which another country exceeded the records of Spain was during 2003, when Taiwan was reported to catch more than 17.000 tons of shark products. Source *FAO Fishtat* (2007), extracted from Lack and Sant (2008).

According to a report from PEW environment in 2011[23], approximately *600.000 tons* of *sharks products* were reported to be landed *globally* in 2010. The Eastern Central Atlantic, the Western Central Pacific, and the Southwest Atlantic are the three regions where the highest catch of sharks is reported. Several species seem to be affected by the business (Figure 11).



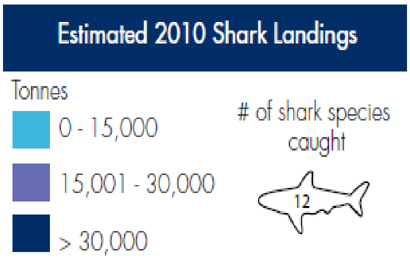


Figure 11. Estimated Shark Landings in 2010. The colors represent the amount (in tons) of *shark products* landed per area. And the number inside the sharks figure represents the number of shark's species. Note that The Eastern Central Atlantic, the Western Central Pacific, and the Southwest Atlantic are the areas with the highest landing of sharks, and that there are between six and seventeen affected species in those regions Source: PEW Environment, 2011

In the *EU*, the shark catch done by their Member States (combined) is not negligible and the depletions of shark populations are notorious inside and outside the union's waters (Fowler and Séret, 2010). The *EU* fleets catch sharks to market their meat and fins, and its total catch was ranked as second worldwide in 2008 (mainly by means of Spain, Portugal, France and the UK) (Figure 12).

[23] Compiled from FAO, 2010

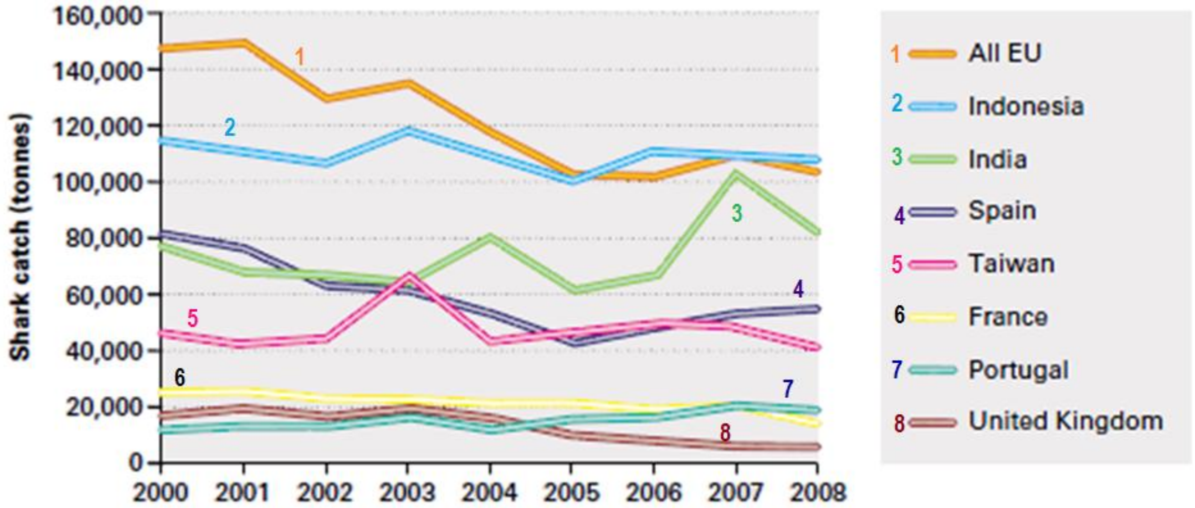


Figure 12. Shark catches (tones/year) by mayor fishing nations (2000-2008). Note that even if the *EU* catch was reduced since 2000, their vessels landed more than *100.000 tons of shark products* in 2008. Data include shark catches for meat and fins. Source: Fowler and Séret, 2010

A report done by The Shark Alliance (2011), according to the records of *FAO* 2009; shows that Spain, Portugal, France and the UK are position inside the "Top 20 shark fishing countries[24]" and that approximately one third of the *EU* shark populations are classified as "*threatened*" according to the Red List of the International Union for Conservation of Nature (*IUCN*). The estimate total catch of sharks, rays and chimaeras done by the *EU* is more than 112.000 tons, from which almost the half (62, 158 tons) correspond to the catches done by Spain[25] (Figure 13).

Ranking of EU Countries in shark and ray catches	2009 total catch (t)
Spain	62,158
France	19,498
Portugal	18,614
UK	5,113
Belguim	1,952
Italy	1,696
Ireland	1,482
Greece	966
The Netherlands	477
Denmark	133
Sweden	83
Bulgaria	58
Malta	39
Estonia	29
Germany	27
Slovenia	6
European Union	**112,329**

Source: FAO FishStat Plus, 2009

Figure 13. Shark and rays catches by EU States in 2009. Amounts are showed in tons. Note that the three main responsible countries for the landings are Spain, France and Portugal; and that Spain itself caught more than 62.000 tons of the total catches whole *EU* (approximately 112.000 tons)**.**
Source: FAO Fish Stat (2009) in Shark Alliance, 2011

24 Data also include rays catches
25 "Blue sharks make aproximately 80% of the shark catches done by Spanish and Portuguese longliners all overs the world" (Shark Alliance, 2011)

The species that has been the most affected by European fleets is the blue shark (*Prionace glauca*), (*FAO* Fishstat (2009), in The Shark Alliance (2011)). Meaning that the populations of this species lost a biomass of minimum of 53.000 tons (reported) in 2009. Spain and Portugal appear to be the responsible of most of these shark landings with approximately 40.500 tons and 12.000 tons respectively (Annex 9).

3.5.2 Countries involved in the trading of shark fins

In 2010, the International Organization *Oceana*, presented more detailed data about the origins of the shark fins exported to Hong Kong (Figure 14, Annex 10) (Oceana, 2010b).

Figure 14. Shark fin exportation to Hong Kong. The total fin exports data (in kg) include the weight of dried + frozen fins exported by the involved countries to Hong Kong. Source: Oceana, 2010b.

The authors Cheung and Chang had compiled data from the *Census and Statistics Department* of Hong Kong (2002-2008) and had published in 2011 information about shark fins' importation, exportation, and re-exportation. They presented mainly 12 countries who are involved in the trading: USA, Brazil, Mexico, Peru, UA Emirates, Yemen, Taiwan, Indonesia, Japan, China, India, and Singapore, but indicated that more than 116 countries have "fin - business relations" with Hong Kong. The researchers estimate that the total global catch (weight of *fins*) in 2008 was of more than 4.130.000 *kg* (Annex 11).

3.5.3 Exporting regions

A recent review done by PEW environment, which compiles information from the *Census and Statistics Department* of Hong Kong (2011) presents a map of the exportation of shark fins per region (Figure 15), and estimates that more that 10.3 million kilograms of shark fin products where exported by 83 countries to HK during 2011

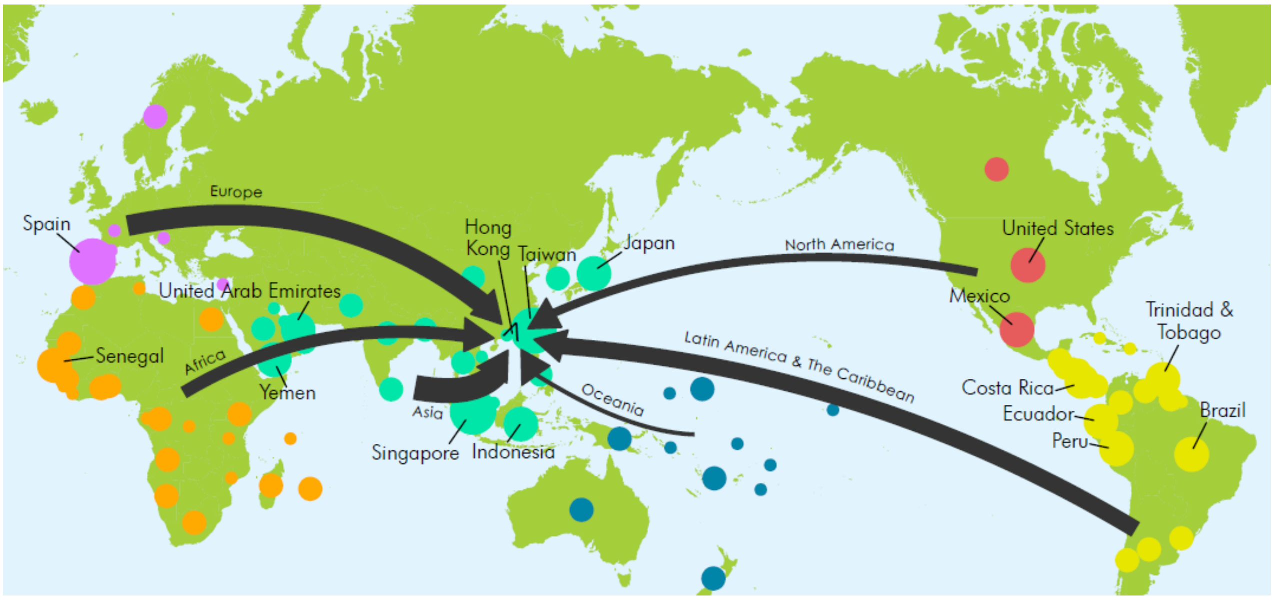


Figure 15. Import of shark fins to Hong Kong. The diameter of the circles represent the amount in weigh (kg) of fins exported; and the size of the arrows represent the regions which are export the most amounts of the product. Note that Spain, Southern Asia and Latin America and the Caribbean are the main providers of shark fins to Hong Kong. *Source*: PEW Environment, 2011.

3.5.4 Trade of "Dried fins" *vs.* "frozen fins"

A comparison between the amounts of "*dried fins*" *vs.* "*frozen fins*" exported was presented by Fowler and Séret in 2010[26]. In the *EU*, fins are deriving mainly from Spain (95%- 100%), mostly in the *frozen* presentation (Figure 16).

[26] Source of the authors: Hong Kong Customs and Statistics Department (2010). *Unpublished data on Hong Kong trade statistics 1996-2009*.

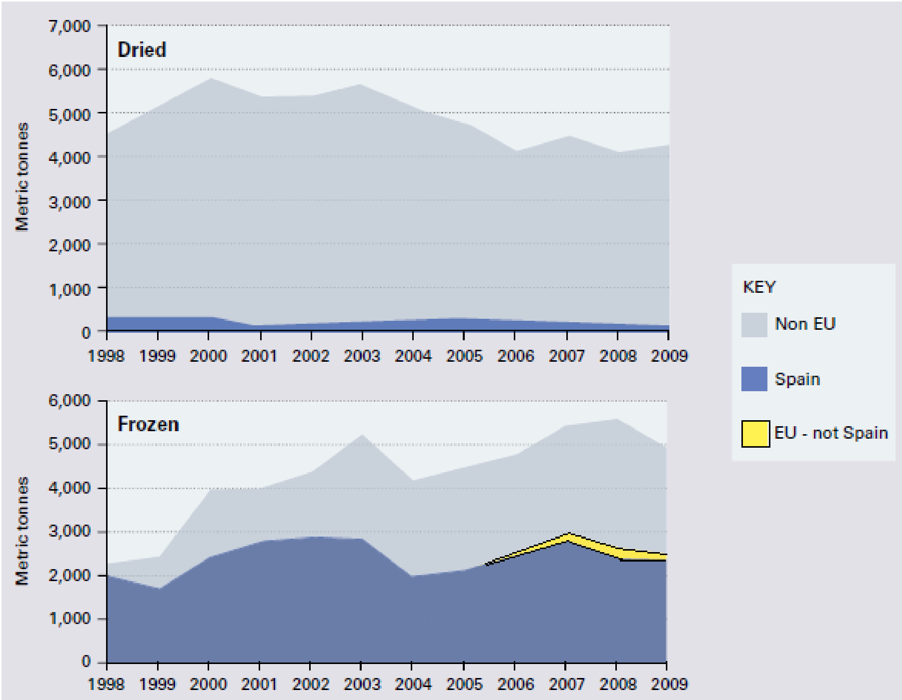


Figure 16. Shark Imports to Hong Kong 1998 – 2009. Detail on the proportion of "dried" and "frozen" fins derived from non-EU countries, EU countries (not Spain) and Spain. The amount of dried fins though, is very low (around 3% in 2009) if compared to that one of frozen fins (50% in the same year). The EU is a key exporter of *frozen fins* (50% of the world's total in 2009)
Source: Hong Kong CDS (2010) in Fowler and Séret, (2010)

Conclusions of Chapter 3

It is difficult to obtain a single, trustable, global statistic or a conclusion on the exact amount of shark fins traded. Existing reports cannot be easily compared because some of them include the trade of both sharks and rays, others show the amount of all shark products (meat, fins, etc), other focus in a determined geographic area, or others, more specific, compare the amounts of exportation of frozen or dry fins. Nevertheless, even if the existing data might have some inexactitudes or can be misjudged, it is clear that the fin market is an organized, strong and worldwide business. There is no doubt about the fact that shark populations are being overexploited and that immense amounts of biomass are lost every year by ways of shark finning and carcass discarding.

The subsequent concern that appears is to prove exactly which species are the most affected, until what point their populations have been depleted and what is the actual situation of the shark species which are vulnerable. Existing data related to the main species caught in the different regions, need to be analyzed carefully; for example if a region reports a high amount of species caught, this can be related to the fact that there is a better reporting of the landings in that area, rather than a greater amount of species fished.

In order to establish shark trading regulations, and/or to manage this valuable resource, plenty more information is needed. The existing figures, based on the information collected in port and trading databases is useful but cannot be taken as a reflect of the reality of shark finning.

To keep on the track of populations and to manage them and guarantee their existence in the future; it is essential and almost compulsory that detailed monitoring, biological research and the action of diverse actors takes place.

CHAPTER 4

Regulation and management of shark stocks

As described in chapter 2, the awareness towards shark conservation has increased by the part of some individuals and organizations, but this is not enough to guarantee the protection of these species. International management has been required.

To the date certain institutions are implied in the management of sharks. On a global level the institutions the most involved in this issue are the Food and Agriculture Organization (*FAO*) with its International Plan of Action for sharks (*IPOA-Sharks*), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (*CITES*), and the Convention on Migratory Species of Wild Animals (*CMS*). At regional levels, fish stocks are managed by localized organizations known as the Regional Fisheries Management Organizations (*RFMO's*). The European Commission (*EC*), and the International Union for Conservation of Nature (*IUCN*), also play a decisive role in the decision making and establishment of policies related to shark management.

This chapter describes the actions of these main institutions, their tools, and the obstacles that interfere with the establishment of effective regulations.

4.1 Institutions involved in shark management and conservation

4.1.1 Food and Agriculture Organization (*FAO*)

The FAO of the United Nations (*UN*) plays a crucial role in food availability, nutrition security, sustainable fisheries and aquaculture. This organization has been involved in the management of shark's populations since decades and by the year 2000 they launched the "*International Plan of Action for sharks (IPOA-Sharks)*[27], with the main objective of ensuring the long-term sustainable use of these species.

The *IPOA-Sharks* aims to:

- Evaluate the threats to shark populations and protect their critical habitats;
- Facilitate the identification and reporting of the species being traded;

[27] The IPOA – SHARKS was developed through the meeting of the Technical Working Group on the Conservation and Management of Sharks in Tokyo, 1998 and the Consultation on Management of Fishing Capacity, Shark Fisheries and Incidental Catch of Seabirds in Longline Fisheries in Rome, 1998

- Aid in the monitoring of data on shark catches and landings;
- Stimulate the use of all parts of fished sharks;
- Identify and support, in particular, vulnerable or threatened shark species;
- Ensure sustainable shark direct and non direct fisheries;
- Minimize accidental catches of sharks (bycatch), and waste (discards) as established in the Article 7.2.2 g of the "*Code of Responsible Fisheries*"[28](FAO, 2000).
- Develop the participation (research, management, education, consultation) between the different implied states (FAO, 2012)

The IPOA-Sharks is addressed to all countries that have vessels involved in shark fisheries and must be implemented in a voluntarily bases. Each state should carry on a *National Management Program for Shark Conservation*, based on the "Code of Responsible fisheries". In the case of the exploitation of migratory shark species or if *trans-boundary fishing* exists, all the concerned states should get involved in the proper management of their shark stocks.

Each state is responsible for its own funding resources, for establishing its own program's actions, and should assess in a regular basis (every 4 years) the state of its shark populations (FAO, 2012). To date, 54 countries have attached to the *IPOA-Sharks*. Unfortunately, many of their or their actions are unclear or have unspecific schedules. There are not apparent signs of an improvement or rebuilding of depleted shark populations (PEW Environment, 2011).

4.1.2 Convention on International Trade in Endangered Species of Wild Fauna and Flora (*CITES*)

CITES is an international agreement conceived in the spirit of cooperation between governments to ensure that international trade in specimens of wild animals and plants does not threaten the survival of their populations. *CITES* accords protection to more than 30.000 species of animals and plants and in the last years, and fish species have gained special attention in decision taking processes because of their economical and social importance. Due to the slow progress in the implementation of the *IPOA-Sharks*, and concerned about the international trade and over-exploitation of shark species, *CITES* had increased its level of attention on the conservation of shark species (FAO, 2012).

[28] The FAO's *Code of conduct of Responsible Fisheries* can be consulted in <http://www.fao.org/fishery/ipoa-sharks/about/en/>.

According to the degree of protection they need, species are included into three lists, called *CITES Appendices*:

- *Appendix I*:
  Includes species threatened with extinction. Trade in these plants and animals is permitted only in exceptional circumstances, such as for research.
- *Appendix II*:
  Includes species not necessarily threatened with extinction, but for which trade must be controlled in order to avoid threats to their survival.
- *Appendix III*:
  List species that are protected in at least one country, which has asked for assistance in controlling the trade

According to these listings, species are protected by a system of trade permits and certificates (IUCN, 2012)[29]. For a species to be included in the Appendices I or II, it is necessary that two thirds of the countries that are parties to *CITES* (currently 175 countries) vote in favor of including the specie in the list.

To date, only three shark species are listed on *CITES* Appendices II: the white shark (*Carcharodon carcharias)*, the whale shark (*Rhincodon typus*) and the basking shark (*Cetorhinus maximus*) (FAO, 2012).

Conservationists have pursued to convince *CITES* to include more shark species into the lists, but their efforts have been failed until the moment. For many, this is related to the fact that if the party countries vote to protect more shark species through the *CITES* Appendices, this will represent the increase in restrictions and permits on international trading of those species.

Recently in the *CITES* meeting of the *Conference of the Parties in 2010*, the applications for six additional shark species were refused. Asian countries, lobbied that their economies will be affected in the presence of an international shark fishing ban, and managed to persuade a majority of *CITES* members to vote against the ban. Conservationist argument that *CITES* does not have the political will to forbid the fishing of economically valuable species (Shark Alliance, 2010).

[29] For more information visit: <http://www.iucn.org/news_homepage/events/cities/>.

4.1.3 United Nations Convention of Migratory Species *(CMS)*

The *CMS* also known as the *Convention on the Conservation of Migratory Species of Wild Animals* or as *The Bonn Convention* is an intergovernmental treaty**,** concluded under the patronage of the United Nations Environment Program (*UNEP*). The convention is concerned about wildlife and habitat conservation on a global scale.

It aims to protect migratory species throughout their range, and their migration routes. The Convention had 116 parties from Africa, Central and South America, Asia, Europe and Oceania. Parties to *CMS* should establish agreements together to protect these species and are encouraged to take actions towards their conservation. The *CMS* complements and co-operates with a number of other international organizations, NGO's and partners in the media as well as with the corporate sector.

The convention has 2 Appendices:

- *Appendix I:*
  Includes migratory species threatened with extinction**.** *CMS Parties* attempt towards protecting these species strictly, conserving or restoring their habitats, reducing the obstacles to their migration and controlling other factors that might endanger them. The *CMS* establishes obligations for each joining State and promotes action among the *Range States* of many of these species.
- *Appendix II***:**
  Includes migratory species that need or would benefit significantly from international co-operation. For this reason, the Convention encourages the Range States to conclude global or regional Agreements.

Seven shark species are listed on the *CMS* Appendices. he basking shark (*Cetorhinus maximus)* and great white shark (*Carcharodon carcharias)* are included in Appendix I. These species are also listed on Appendix II, together with the longfin mako (*Isurus paucus*), the shortfin mako (*Isurus oxyrinchus*), the whale shark, the porbeagle (*Lamna nasus*) and the spiny dogfish (*Squalus acanthias*).

The *CMS* acts as a framework convention. The compromises by the Parties may range from legally binding treaties (called Agreements) to less formal instruments, as for example the Memorandum of Understanding (*MoU*) (Convention on Migratory Species, 2012).

In 2010, a *MoU* on the Conservation of Migratory Sharks was adopted under the *CMS*. The *MoU* was applied to the shark species listed on the *CMS* Appendices and focused on increasing the international cooperation to ensure shark protection. There are 25 signatories[30] to the *MoU* on sharks.

These instruments are relatively new and the benefit of their actions is still to be determined (PEW Environment, 2011).

4.1.4 Regional Fisheries Management Organizations (*RFMO's*)

The *RFMO's* are international organizations, which act at regional levels towards the managing of their fish stocks. They can be formed by countries of one delimitated ocean area ("*coastal states*") with common interests, or include foreign countries that have interest in the fisheries of a region.

Most *RFMO's* have control and own management competences, they are autonomous to set their catch and fishing quotas, to monitor fishing effort and capacity and to establish technical measures. Some others have only an advisory role[31].

There are seventeen designed *RFMO's* in the world. Twelve of them focus in the management of highly-migratory species, and they require multinational cooperation (Annex 12). The other five *RFMO's* were established to manage tuna (and tuna like) populations (Annex 13). Shark species are usually included in the second type of fisheries (PEW Environment, 2011).

The *RFMO's* that have adopted legal measures (Recommendations or Resolutions) to prohibit shark finning are: the International Commission for the Conservation of Atlantic Tunas (*ICCAT*), the General Fisheries Commission of the Mediterranean (*GFCM*), the Indian Ocean Tuna Commission (*IOTC*), the Inter-American Tropical Tuna Commission (*IATTC*), the North Atlantic Fisheries Organization (*NAFO*), the Southeast Atlantic Fisheries Organization (*SEAFO*), the Western Central Pacific Fisheries Commission (*WCPFC*) and the Northeast Atlantic Fisheries Commission (*NEAFC*). One *RFMO*, (the Commission for the Conservation of Antarctic Marine Living Resources (*CCAMLR*) prohibited shark finning but only when sharks are the targeted for this purpose, on the contrary, if shark sharks are fished by *bycatch*, shark finning is allowed. In the past years, many *RFMO's*, specially the tuna ones

[30] Signatories to the MoU: Australia, Belgium, Chile, Congo, Costa Rica, Denmark, European Union, Germany, Ghana, Guinea, Italy, Kenya, Liberia, Monaco, Nauru, Netherlands, Palau, Philippines, Romania, Senegal, South Africa, Togo, Tuvalu, the United Kingdom, and the United States

[31] For more information see: www. ec.europa.eu/fisheries.htm

(whose fleets catch considerable number of sharks), have implemented that their vessels must submit data related to sharks catch and have forbid them to have more than a limited amount of fins onboard (Fowler and Séret, 2010).

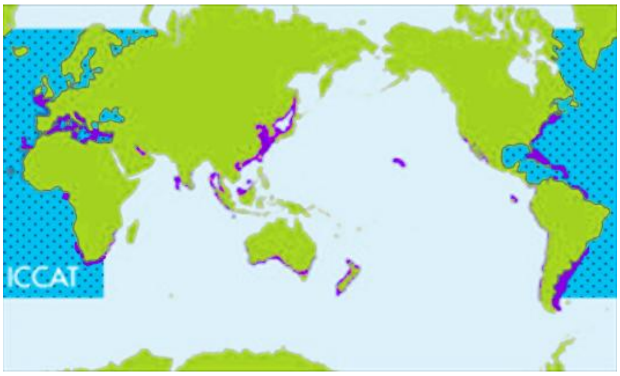
Some RFMO's have introduced measures to protect some specific species, but there are still many of them for which no measures are being adopted. Table 7 shows some of the shark species that are the most traded for their fins, and the few *RFMO's* which have adopted management measures:

SHARK SPECIES	RFMO's WITH SHARK MANAGEMENT MEAUSURES
‣ *Smooth hammerhead shark*	ICCAT
‣ *Scalloped hammerhead shark*	ICCAT
‣ *Great hammerhead shark*	ICCAT
‣ *Common thresher shark*	ICCAT
‣ *Bigeye thresher shark*	ICCAT and IOTC
‣ *Pelagic thresher shark*	IOTC
‣ *Silky shark*	ICCAT
‣ *Oceanic whitetip shark*	IATTC, ICCAT, and WCPFC
‣ *Tiger shark*	---
‣ *Shortfin mako shark*	---
‣ *Blue shark*	---
‣ *Dusky shark*	---
‣ *Bull shark*	---
‣ *Sandbar shark*	---

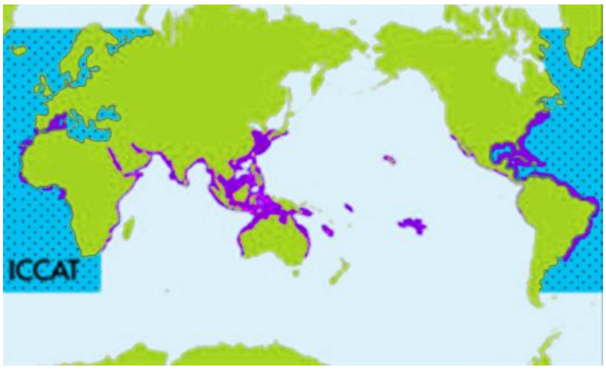
Table 7. Most traded shark species and the RFMO's that have implemented measures for their conservation. Note that only four *RFMO's have adopted management measures.* Compiled from PEW Environment, 2011.

RFMO's play an important role in regulating the sustainability of shark stocks (including migratory species) because they can put in place concrete shark management measures, or prohibit the catch of certain species. Nevertheless, even if some shark populations are managed by some *RFMO's*, it doesn't mean they are globally protected. It is important to recall two aspects:

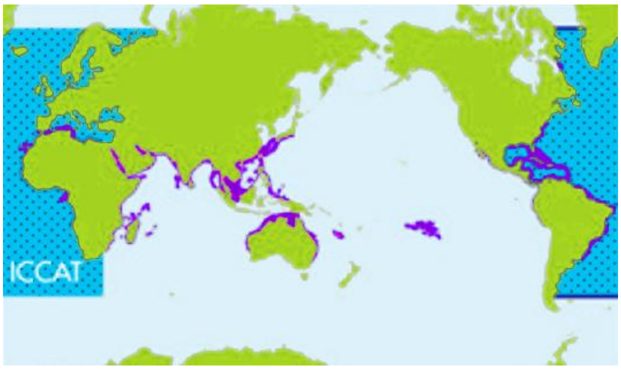
First, that shark species are migratory, and inhabit extended areas (including zones managed and non-managed by RFMO's). For example, the populations of the *smooth*, the *scalloped* and the *great hammerhead* sharks reside in several oceans; but they are only managed in the Atlantic Ocean and its adjacent seas, by the *ICCAT*. In all the rest of their distribution areas protection is lacking (PEW Environment, 2011).



Smooth hammerhead shark



Scalloped Hammerhead shark



Great hammerhead shark

Figure 17. Habitat ranges of three hammerhead shark species commonly found in the fin markets, and the regions where management measures are available. The pointed area marked as ICCAT represents the region where the *RFMO ICCAT* has established shark management measures for the protection of hammerhead sharks; the areas marked with dark color represent the range of habitat of hammerhead sharks. Note that large populations occupy regions where protection measures are lacking. Source: PEW Environment, 2011.

Second, that the measures taken by a *RFMO* only apply to the *RFMO's* members, or only to the fisheries that are managed by that *RFMO* (PEW Environment, 2011). This means that if foreign fleets break into the waters of a *RFMO* and catch sharks for any purpose or by bycatch, the regulations would not apply to them.

4.1.5 The European Commission (*EC*)

Parallel to the immense catch of sharks from several of its *Member States* (as described in chapter 3), the European Union (*EU*), represented by the *EC* has a significant role in the development of shark regulations, in the adoption of international policies, and has a powerful influence at the world's wildlife conservation bodies.

The *EU* has done efforts for shark conservation and is conscious that *discarding* is a serious problem and must be address with priority (EC, 2007). The *EC* has shuttled down various unsustainable fisheries, established new quotas for sharks and rays and protected threatened shark species (Shark Alliance, 2011). It has an important role into the making and implementation of fin bans, which are important tools implemented at a global level and in *EU*'s waters since 2003[32].

[32] Council Regulation (EC) No 1185/2003 of June 2003, on the removal of fins of sharks on board vessels

4.2 Obstacles for the management of shark populations

4.2.1 The finning ban: Implementation and obstacles

A fin ban is an instrument used to reduce the vast numbers of shark trade and irresponsible finning, that aims to reduce the discarding of shark bodies and the commercialization of separated *(cut off)* fins.

The first world's fin ban was implemented in 1993[33] by the US Atlantic shark fisheries. It prohibited removing shark fins at sea and discarding shark bodies, but allowed to remove the fins once the sharks were dead and onboard vessels (in order to facilitate storage and processing). To control the amount of sharks caught, the authorities in landing ports will weight fins and bodies (carcasses) to determine that there were not excess of fins. For that purpose the first fin ban delimitated the proportion of *fins vs. bodies* for shark landings. The established ratio between *fins weight vs. carcass weight* was of 5%. By 1998, few other shark-fishing countries had adopted the ban and in the next decade several other countries followed. That is how, by 2009, more than 20 countries, the 27 Member States of *EU* and 8 *RFMO's* had approved shark finning bans. They all have followed the models of the US Atlantic fisheries example (Fowler and Séret, 2010).

But the fin bans were too flexible. They had loopholes that fisherman knew very well and that made the bans ineffective. The loopholes to the fin ban include the following aspects:

1. The specifications for the established *fins: carcass* ratio of 5% were unclear. The ban described the word: "*body weight*", but it did not specify if the body weight was referred to body's "*whole weight*" or "*dressed weight*". Both definitions are described in Table 8.

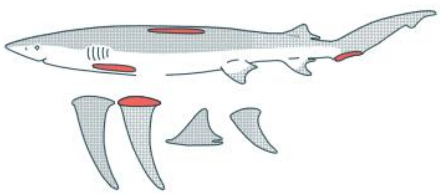
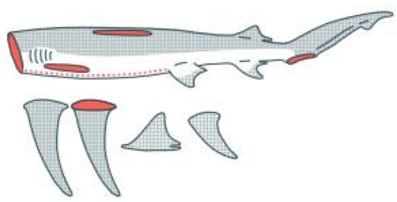
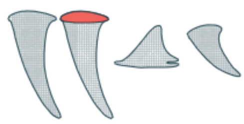
WHOLE WEIGHT: Shark's weight with head and guts	**DRESSED WEIGHT** shark's weight after the head and the guts are removed (Photo 15)	**WEIGHT OF A SET OF PRIMARY FINS**
		
Example of a shark's whole weight : *100 kg*	Example of a shark's dressed weight: *40 kg*	Fin's weight : *2 kg*

Table 8. Definition and differences between Bodies' "*Whole Weight* and *dressed weight* (Used for the first fin ban). Adapted from: Shark Alliance 2010.

[33] The fin ban was adopted in the Shark Fishery Management Plan (FMP) for US Atlantic waters

Photo 15. Dressed Carcasses unloaded from a longline vessel in Tung Kang, Taiwan.Source: Henrichs, 2011.

To illustrate the loophole we can use the example of a fisherman who catches a shark that weights 100 kg, and its fins weight 2 kg. This will represent that he has caught only 2% of his allowed quota, and he can still be allowed to kill more sharks for fins until he obtain 5% (5 kg) of fins. (Shark Alliance, 2010)[34].

2. Shipping vessels were allowed to land shark fins and shark carcasses in separate ports. An inspector will sign up the fisherman's logbook at the arrival to one port in a country (where bodies where landed) and later in the next port in another country, the next authority will weigh the fins and determine if the proportions were respected. Inspecting fisherman logbooks resulted in a complete lack of certainty. No real control existed (European Commission, 2011).
3. The weight of fins compared to the weight of carcasses differ between shark species. Studies have shown ratios differences of 2% to 8% between species (Mejuto et al., 2008).
4. The weight ratios are influenced by the techniques used for cutting the fins (see chapter 3) and to the number of fins removed (Fowler and Séret, 2010). To illustrate this loophole we can take into account that the weight of a set of *crude - cut* fins will be higher (because it has more meat attached) than a set of fins cut with a *half-moon cut*. This will be an incentive to use the second method to reduce the weight and be able to land more fins

The ban required verification and reinforcement, and for that, international institutions as the *UN* the *IUCN*[35] have gotten involved for supplying advice. Between 2003 and 2009, the *UN*'s General

[34] For more information see: Shark Alliance, 2012. http://vimeo.com/40649549

[35] The IUCN is the conservation inventory of the world's plant and animal species. It assess species' population's health and classify them under categories (ranging from Extinct to Least Concern) in the Red List of Threatened Species. The IUCN counts with several specialist groups. In the case of shark species, the IUCN Shark Specialist Group (*SSG*) provides advice for the conservation of all chondrichthyan fishes. There are scientific members of the SSG from 90 countries distributed among 12 ocean-regions. For more information see: <http//www.iucnssg.org/>.

Assembly (*UNGA*) have adopted several resolutions supporting the implementation of the *FAO's IPOA-sharks* urging States and *RFMO's* to extend and strengthen their fin bans. Additional recommendations on shark finning were adopted by the *IUCN* in 2004 and 2008[36] (Fowler and Séret, 2010).

Subsequently, several RFMO's adopted measures to modify the fin ban. The initial measures to close its loopholes were:

- Clarify that: the weight to be taken into account when measuring the proportions *fins: carcass* must be the *dressed* carcass weight (Photo 15). Translated into percentages, this will mean that the ratio will be reduced to 2%; rather than the previous 5% (Shark Alliance 2010).
- The landing of *separate fins* became restricted. Each set of fins needed to be landed together with a body. An accepted alternative allowed cutting the fins and reattaching (tying) them to the carcass. Nevertheless, this solution was quickly violated by several fisheries with a term known as "*high-grading*". High grading refers to the mismatching of high value fins, with bodies from different shark species (Oceana, 2010a), or to the mismatching of large fins with smaller carcasses (Fowler and Séret, 2010).

Still after the modifications, several scientist, fishing entities, *RFMO's*, conservationists and concerned citizens, supported that the ban should be strengthen even more. During the year 2009, the *EC* adopted new measures to strengthen the fin ban in the "*Action Plan for Sharks*" (Annex 14), willing to ensure the recovery of many depleted populations of sharks inside and outside the Community waters. Additionally, in 2010 the *EC* opened a public consultation searching for options to modify the fin ban and in November and in 2011 it proposed a *complete ban on fins removal at sea*. The complete ban prohibits the "*at-sea-removal*" of fins, and affirmed that all sharks, with no exception, must be landed with their fins naturally attached (Shark Alliance, 2010).

This reinforcement is the most reliable way to apply consistently the fin ban. Keeping the fins attached to the body avoids several problems including:

- Weighting and calculating ratios fins and carcasses in landing ports;
- Mixing carcasses and fins of different animals with the intension of high grading;
- Misunderstandings when calculating ratios between "*whole weight*" or "*dressed weight*"
- Misunderstandings related to the type of fin cut (*half moon, straight*...)

[36] IUCN Recommendation 3.116 (2004), Recommendation 4.114 (2008) on Shark Finning

As expected, fisherman established some complaints to the new complete ban, arguing that the storage of sharks with fins attached was copious / complicated, and that fins required to be cut off for being dried. The complaints by fisherman and the solutions proposed are illustrated as follows:

COMPLAINT BY FISHERMAN	PROPOSED SOLUTION
1) Storage of whole bodies with fins attached is difficult, it occupies big space, fins are sharp and can cause injuries.	Fins can be partially cut for facilitating storage and bent towards the animal's body, but they need to remain partially attached (Figure 18) (Oceana, 2010a)
2) Fins must be cut for drying and not frozen with the carcass. Cutting fins is more difficult when frozen	Removing fins from carcasses is best done when frozen hard, because it is easier to control the cut (Sharkfin and Marine Products association, Hong Kong, 2010. In Fowler and Séret, 2010)

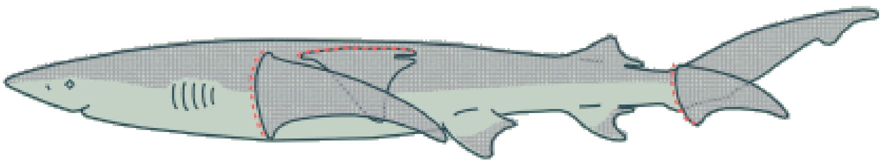


Figure 18. A shark with its fins naturally attached. Fins are partially cut but remain attached to the body. Source: Shark Alliance 2010.

According to a review done by PEW Environment in 2011, only approximately one-third of the countries have established shark finning bans.

The implementation of complete fin bans, represents an important advantage, not only to diminish the amounts of shark discards, but also because if sharks are landed with their fins attached, more information on shark populations will be available. A worldwide fin ban and its appropriate application is needed.

4.2.2 The obstacle of the lack of biological information

Collecting data on marine animal populations is challenging. The difficulties increase if species are migratory, cross countries borders and are fished in oceanic waters. In the case of sharks the problem of body discarding represents an additional obstacle. As discards are not reported to management bodies and cannot be really measured, the exact records about the shark biomass extracted *vs.* shark biomass discharged back into the ocean, are almost inexistent. The only existing tool is to identification the shark species based on the fins landed at ports and try to establish which are the main species marketed.

There is an enormous lack of scientific information about species and their population dynamics. Facts of actual shark stocks are almost inexistent. It is known that several different species of sharks are being catch and finned but it is a big challenge for scientists to track which species exactly are the most vulnerable at a global scale (FAO, 2010). In order to determine sharks species, it is needed to collect evidences at ports. One method is taking into account trade databases and the information logged in fisherman logbooks (but this will not represent scientifically trustful information). Another method is to examine the dead sharks and the landed fins. Unfortunately very few experts are able to identify a shark's specie by a visual examination of a fin, or a set of fins. Scientific data on shark trends by species is essential in order to establish proper regulations and to develop accurate catch limits. Without precise information, institutions slow down the taking of decisions and the development of regulations (Anderson, 2011).

Even if the exact information is not extensive, some of the published data acknowledge that the most frequently shark species catch by illegal fishing are hammerhead sharks *Sphyrna spp.* and silky sharks *Carcharhinus falciformis* (Lack and Sant, 2008). Clarke et al., 2006 a, b., estimated that that between 1.3 and 2.7 million sharks of *those* species are for *fished* their fins trade each year[37], representing an equivalent biomass of up to 90,000 tons. Some Fisheries management specialists speculate that there are few chances that populations of sharks which have been overfished will show recovery in less than 50 years (even if strict fishing limitations are adopted) (Harvey, et al., 2005).

Conclusions of Chapter 4

The increasing participation of international institutions towards the management of shark stocks can be considered as a positive advance, having in mind that the problematic involves an important number of countries and it must be addressed at a global level. Nevertheless, the actions of the institutions involved are still insufficient, mainly because the existing management instruments are relatively new and still ineffective. They present serious gaps and do not provide full protection for any shark species.

Fin bans have existed since a couple of decades ago, but they have been fooled by fisherman and the whole finning industry. Existing loopholes in international codes are recently in process of getting closed, and only one third of the countries have established complete finning bans. Meanwhile the shark traffic continues globally.

[37] The authors used commercial data on traded weights and sizes of fins, coupled with DNA and Bayesian statistical analysis to account for missing records.

Scientific data on shark biology / ecology is lacking. The exact global status of shark stocks is not concrete, the available information from ports and trade databases, present numerous disadvantages to be used, it does not reflect the authentic magnitude of shark discards, and does not allow identifying precisely shark species. The appliance of *complete fin bans* will increase the chances for scientists to collect and analyze data on shark stocks. Without scientific data, it is unconceivable to estimate the exact decrease in shark stocks and the implementation of regulations is slowed down.

Gathering accurate data on shark populations can result problematic. To date, separate national governments and ONG's collect scientific data but it does not exist a unique organization or scientific committee that standardizes, compiles, and analyzes it. It is not clear which organization or institution would be able to do this task.

CHAPTER 5

The case of shark finning in the Marine Protected Areas of the Eastern Tropical Pacific Seascape

Even if the trade of shark fins must be addressed at a global level, it is interesting to contemplate the situation in situ, in one of the areas where the most amounts of sharks are catch.

To illustrate the subject at a local level, this chapter will describe the environmental, social, and economic situation in a region known as the Eastern Tropical Pacific Seascape. Parallel to its ecological importance (high abundance of *Chondrichthyes* and exceptional marine biodiversity), this area seems to be a meaningful spot for the catch and traffic of sharks.

5.1 The Eastern Tropical Pacific Seascape (ETPS)

The *ETPS*[38] is a region of approximately two million square kilometers adjacent to the South - Central American continent. As the result of the convergence of 8 marine currents[39] in this area, this region presents complex oceanographic characteristics and ecological interconnectivity. The confluence of these currents creates upwelling conditions which represent high productivity. The region coincides with the Inter-Tropical Convergence Zone (*ITCZ*) where the *Trade Winds* from north and south converge; and it presents high levels of pluviosity. The region is exceptionally rich in biodiversity, and it presents high levels of *endemism*. The elevated concentrations of species, support local fisheries and tourism (Fundación Malpelo, 2012; Conservation International, 2012).

The region incorporates the national waters and Exclusive Economic Zones (*EZZ*) of four countries (Costa Rica, Panamá, Colombia and Ecuador), and several of their isolated islands considered as Marine Protected Areas (*MPA's*): Galapagos Marine Reserve in Ecuador (138.000 km^2), Cocos island National Park in Costa Rica (1997km^2), Malpelo Flora and Fauna Reserve in Colombia (9584 km^2), Gorgona National Park in Colombia and Coiba National Park in Panamá(Figure 19). All of them (except Gorgona National Park) have been declared as World Heritage sites by the United Nations Educational, Scientific and Cultural Organization *UNESCO* (UNESCO, 2012).

[38] Area also known as the Eastern Tropical Pacific Maritime Corridor for Conservation (*CMAR*)

[39] Oceanic currents converging in the *ETPS*: North Equatorial current, Equatorial crosscurrent, South Equatorial current, Humboldt current, Cromwell current, Panamá cyclonic countercurrent, and Colombia current

Figure 19. Map of the Eastern Tropical Pacific Seascape. Detail of the Marine Protected Areas of the *ETPS* (Cocos Island National Park, Coiba National Park, Malpelo Flora and Fauna Reserve, Gorgona National Park, Machalilla National Park and Galapagos Marine Reserve). The discontinued line: Exclusive Economic and Fishing Zones of the respective countries. Source: Migramar, 2012.

5.1.1 Ecological Importance of the *ETPS* : A marine corridor for shark populations

The area is known to be the residence of several populations of shark species. 88 shark species have been recorded for the region, and several are mentioned in international treaties because of the concern about their population status (Migramar, 2012). Scientific research, done by the organization *Migramar*[40] since 2006 and by Bessudo et al., published in 2011[41]; have focused in the degree of connectivity and spatial dynamics of some of the largest populations of sharks present in the area (the scalloped hammerhead shark (*Sphyra lewini),* the galapagos shark (*Carcharhinus galapagensis*), the whale shark (*Rhincodon typus*), the silky shark (*Carcharhinus falciformis*), the whitetip reef shark (*Triaenodon obesus*), the bull shark (*Carcharhinus leucas*) and the sandtiger shark (*Carcharias taurus*)). Their results evidenced that sharks are not exclusive to one MPA, but that migrate at different times of the year, covering journeys of up to 1500 km between Cocos, Malpelo and Galapagos islands (Figure 20).

[40] Used methodology Pop-up archival tags (PAT tags) and Smart Position and Temperature (SPOT tags) have allowed to measure information about sharks activities during specific periods of time.
[41] Methodology of shark tagging (ultrasonic transmitters techniques) during a 3 year study (2006-2009)

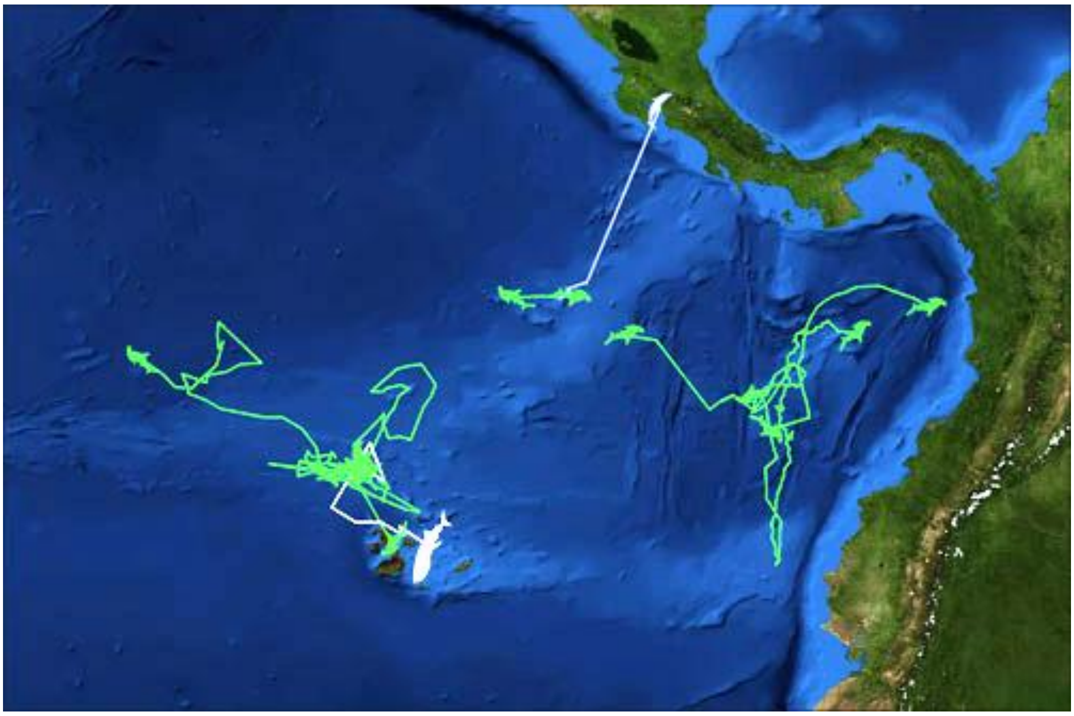


Figure 20. Evidence of the journeys of pelagic sharks (*Sphyra lewini, Rhincodon typus, and Carcharhinus falciformis* between the *MPA* of the *ETPS*. The results show evidence of the interconnectivity between the shark populations of the *MPA*'s.
Source: Migramar, 2012

This region, which has been designed as a "marine corridor for pelagic species"[42] (Botero, 2011) has been conferred with special attention because of the vast populations of scalloped hammerhead sharks (*Sphyra lewini)* (Photos 16a, 16b), that aggregate in schools in the region (Photo 17).

Photos 16a and 16b. *Sphyra lewini.* Source: personal photos

[42] "San Jose Declaration" of 31 March and 2 April 2004, where Ecuador, Panama, Colombia and Costa Rica have signed and established the definition, principles and objectives of the CMAR.

Figure 17. Scalloped hammerhead sharks *Sphyrna lewini*, Malpelo, Colombia. Source: Lefevre, 2011

As described in Chapter 3 (Table 2), hammerhead sharks are one of the first choices for the finning industry. Clarke et al., 2005, 2006a, 2006b acknowledge that they are the second-most abundant species in the international fin trade. Their large fins contain high amounts of needles (Rose, 1996), and are very valuable in the market. On the contrary to their meat, which is hard, fibrous, and not desirable by consumers, their fins are extremely valuable (Abercrombie et al., 2005).

Additionally, in sites where hammerhead sharks are abundant, there are often generous numbers of other pelagic species which make the *ETPS* an attractive area for Asian fishing fleets. Their vessels arrive fish using the *longline method* usually at night, when sharks are offshore[43], and several individuals of this species became hooked on their long lines. Studies in which shark are tagged, several of the tracked individuals have been caught by fishing vessels (Migramar, 2012).

During the last 20 years, the populations of hammerheads have been exposed to considerable risks and some authors affirm that their populations have been reduced as much as 90% (Pretoma, 2012) *Sphyra lewini* has been categorized as: *Endangered globally* by the *IUCN* (IUCN Red List of Threatened species, 2012).

The practice of shark finning has become common in the *ETPS*. Finning has been reported and documented in Galapagos Marine Reserve (Migramar, 2012), but the *MPA's* that are the most affected are the islands of Malpelo and Cocos, where the species are the most abundant (Migramar, 2012; Bessudo et al., 2011).

The next sections describe the actual situation of shark finning in Malpelo and Cocos Islands.

[43] Scalloped hammerhead sharks form large schools around specific points of the island, during the day. At dusk they move offshore, presumably to feed (Migramar, 2012)

5.1.2 Malpelo Flora and Fauna Reserve (Colombian Pacific Ocean)

Malpelo Island is located in the Panamá Basin and at 500 km west of Buenaventura (an important harbor in the Colombian Pacific coast) (Annexes 15a, 15b) (Fundación Malpelo, 2012). The total marine area of the reserve is 9.584 km² (Garcia, 2010) and it is managed by the "*Unidad de Parques Nacionales Naturales*"[44] (Parques Nacionales Naturales de Colombia, 2012) and "Fundación *Malpelo*". The island has been declared as a:

- Fauna and Flora Sanctuary of in 1995[45],
- Particularly Sensitive Sea Area in 2006[46],
- Natural heritage of Humanity in 2006[47]

The biological and ecological importance of the island was described in 2006 by UNESCO as:

> *"This vast marine park, the largest no-fishing zone in the Eastern Tropical Pacific, provides a critical habitat for internationally threatened marine species, and is a major source of nutrients resulting in large aggregations of marine biodiversity. It is in particular a 'reservoir' for sharks, giant grouper and billfish and is one of the few places in the world where sightings of the short-nosed ragged-toothed shark, a deepwater shark, have been confirmed. Widely recognized as one of the top diving sites in the world, due to the presence of steep walls and caves of outstanding natural beauty, these deep waters support important populations of large predators and pelagic species (e.g. aggregations of over 200 hammerhead sharks and over 1,000 silky sharks, whale sharks and tuna have been recorded) in an undisturbed environment where they maintain natural behavioral patterns".*
> *(*UNESCO, 2012).

5.1.3 Cocos island National Park (Costa Rican Pacific Ocean)

The National Park Isla de Coco is an island surrounded by coral reef formations that is located in an oceanic area at 550km from the Pacific coast of Costa Rica (Annexes 16a, 16b).

The total conservation area is of 11,629 Km² (the second biggest protected area of the ETPS). In 1978 it was declared National park, and in 1997, Natural Heritage of Humanity by UNESCO. Its biodiversity includes several endemic species, 250 species of fish, 600 mollusks, 30 types of corals, 60 species of crustacean and several important pelagic species (including dolphins, sea lions, yellowtail tuna and 18 species of sharks) (Randall, 2010).

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[44] National Natural Parks Unit of Colombia
[45] « Resolución 1292 de 1995 del Ministerio de Ambiente ».
[46] Law 6 of 1974 (Resolución MEPC.97(47) of 2002 - Organización Marítima Internacional (IMO) -United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships. IMPO, 2012: http://www.imo.org
[47] Law 45 of 1983 (Desition 30 COM 8B.28) Comitee of World Heritage of UNESCO - 2006

5.2 Existing regulations to protect shark resources in Costa Rica and Colombia

Both countries are members of the Inter-American Tropical Tuna Commission *IATTC*[48] and they have taken measures to manage and conserve shark populations in their waters. Both states have committed to developing National Action Plans for sharks, within the framework of the IPOA Sharks of the FAO.

Colombian law has banned shark finning completely in 2007[49]. Sharks must me landed with their fins naturally attached and special permits are required to transport and ship fins after the sharks are landed. *Transshipping*[50] of fins at sea is prohibited and all fishing is prohibited inside the waters of the Colombian *MPA* of Malpelo (Fundación Malpelo, 2012).

In Costa Rica there is also a shark fin ban[51], and there are penalties for port authorities who allow the landing of detached fins and for fisherman who practice shark finning[52]. Limited fishing is allowed in some areas of the Coco's island waters. All foreign vessels that land at public docks are subjected to the Costa Rican law. There is a mandatory monitoring and data collection on sharks loaded off from all vessels (Fowler and Séret, 2010).

The research institutions from each of these areas have agreed in recognizing that only through the joint efforts of both nations the conservation and sustainability of the shared marine resources can be guaranteed (Migramar, 2012).

5.2.1 Existing patrolling in the Marine Protected Areas

"Fundación Marviva" with its "*Programa de Control y vigilancia*" (Surveillance and Control Program) is patrolling the National Park del Coco since 2003 together with the environmental and coastguard authorities of Costa Rica. Their surveillance area can be seen in figure 21 (Fundación Marviva, 2011).

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48 The IATTC is responsible for the conservation and management of tuna and other marine resources in the eastern Pacific Ocean (for more information visit: IATTC, 2012: <http://www.iattc.org/>.)

49 The regulation for the Prohibition on finning in Colombian waters is documented in the: Resolucion 1633 de 2007: Prohibicion del Aleteo. (Ministerio de agricultura y desarrollo Rural. Instituto Colombiano de desarrollo rural INCODER, 2007).

50 The act of passing the fins from one vessel to another in open ocean

51 Article 40 / 2005 of the National Fisheries Law. This article, stipulates that sharks need to be landed with their fins naturally attached and applies to all vessels fishing in the EEZ, or foreign vessels that offload in Costa Rica

52 Article 40 of the 2005 Fisheries Law Article 139

Figure 21. Operation areas of Fundación Marviva. (*Areas de operacion de marviva).* The areas of the *ETPS* where patrolling by part of the foundation is present: Gulf of Nicoya, Osa, Coco's Island (Costa Rica), Gulf of Chiriqui (Panamá), Chocó (Colombia). The protection measures taken by Marviva have shown positive results (ecosystems under patrol have shown 15 times a better ecosystemic health). Note that even if the patrolling is existent in several areas including the surroundings of the *MPA* of Coco's Island, there are still important patrolling gaps along the marine corridos of the ETPS (In dark: *ETPS*) Source: Fundación Marviva*, 2011*

To protect the *MPA* of Malpelo, the Colombian Pacific Ocean's Navy, the Service of National Parks and the Fundación Malpelo have established an inter-institutional model in agreement with Conservation International (*CI),* to patrol the reserve and to conduct scientific research within the sanctuary. A navy's patrolling vessel (the *A.R.C. Sula*), is dedicated solely to monitor the area and apprehend illegal fishing boats (Conservation International, 2012.).

5.3 Illegal fishing in the ETPS

Despite that management resources have been implemented by both States, that the islands of the *ETPS* are protected areas and are designated as "no take zones", both Cocos and Malpelo Islands, are affected by the problem of illegal fishing by the Asiatic finning industry[53].

For the case of Costa Rica, studies reported that the large schools of hammerhead sharks that were abundant in these waters, suffered a strong depletion in the decade of 1970 (Cook, 1990). The

[53] For more information see: <http://www.noticiascaracol.com/nacion/video-255351-trafico-de-aletas-de-tiburon-alimenta-al-mercado-asiatico/>.

decline in theses shark populations was reported by Arauz[54] et al., 2004 and Myers et al. in 2007, who affirmed that the populations *S. lewini* in the area had declined in 71% between 1992 and 2004.

Costa Rica was reported in 2004 as the world's third largest exporter of shark products (including 800 tons of fins). Asian vessels (from Taiwan, China, Indonesia, Japan and Korea) infringe into this Central American shark-rich waters, pay to local governments to land on their docks, and bring their catches to Hong Kong's markets (Sherman and Adams, 2010). Fisherman testify[55] that is an international *mafia* in the region and that artisanal fisherman, commercial vessesl, and Asiatic fleets are competing for the same fish resources. While Asiatic fleets can take up to 30.000 or 40.000 kg of fish in one vessel using longlines, local fisherman attain to take maximum 2.000 kg. Local fisherman declare that they are forced to venture into neighbour countries' waters in search of fish.

The first time this illegal business was officially videotaped and reported to the media was by Arauz[56]. Arauz evidenced the Taiwanese fleets illegally landing 30 tons of shark fins (representing 30,000 death sharks). After the video was launched, private docks from Costa Rica where closed to international ships, but unfortunately, the closure lasted only a few weeks.

After the finning banned went into effect in 2005, fines and jail terms where established for fisherman caught landing shark fins at Costa Rican ports. However, the finning problem is known to persist in the area (Sherman and Adams, 2010).

For the case of Illegal fishing in the Colombian island of Malpelo, the biggest reported event occurred in September 2011. Colombian environmental authorities announced a significant massacre of sharks. Hammerheads and silky sharks were reported to be slaughtered for their fins in the *MPA*. Witnesses declared to have seen 10 illegal fishing boats and scuba divers reported a large amount of dead sharks, without their fins. Bessudo[57] estimates that if each boat will have catch an average of 200 sharks, the total number of death sharks could be of as many as 2000 individuals[58]. The reported vessels were identified[59] with Costa Rican flags. The Costa Rican foreign ministry

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[54] Conservationist founder of the Association for the Restoration of Sea Turtles (PRETOMA) in 1997, and one of the world's leading voices working to ban shark finning. Winner of the Goldman Environmental Prize, 2010

[55] For the complete video report visit: http://www.noticiascaracol.com/nacion/video-255351-trafico-de-aletas-de-tiburon-alimenta-al-mercado-asiatico

[56] For more information visit: <http://www.goldmanprize.org/2010/southcentralamerica/>.

[57] Sandra Bessudo. Colombian president's top adviser on environmental issues

[58] For more information visit: www.noticiascaracol.com, <http://migramar.org/hi/>., <http://www.fundacionmalpelo.org/>., www.elpais.com.co, <http://www.armada.mil.co/>.

[59] At least three of the ships reported fishing illegally in Colombian waters in September 2011, were identified by their names: the Marco Antonio, the Jefferson and the Papante (<http://www.projectaware.org/update/shark-massacre-reported-colombian-waters/>.)

disapproved the fact that their where vessels belonging to the Central American country, and affirmed that the law was going to prosecute if the participation of Costa Rican flagged ships were involved. Diplomatic issues have flourished between the two countries.

During the first four months of 2012 the Colombian Army captured thirteen vessels with Costa Rican and Ecuadorian flags in Malpelo, carrying 12 tons of illegal fish, including tunas and sharks; which put again into tension the relations between both States (Armada Nacional Republica de Colombia, 2012; El Pais, 2012). The risk of conflict between stakeholders (fisheries, conservationists, politicians) of both countries is likely to increase because of the limited scientific information on which to base decisions. Argumentation between the nations is many times based on perceptions and rumors rather than concrete facts (Migramar, 2012).

5.3.1 The Obstacles for the surveillance at the MPA of Malpelo

The event of September, 2011, (which was not the first in the list of illegal vessels venturing into the *MPA*), have demonstrated that there are still gaps in the surveillance of the island. There are several aspects related to this lack of patrolling. The first one is that Colombian navy maintains only a small post of control on the island (Annex 15b), and it patrolls the waters only sporadically. It has also been mentioned that the navy's patrol vessel (*A.R.C. Sula*) was out of order during six months during 2011. Additionally, illegal vessels reach the area at night (when hammerhead sharks are offshore) making the surveillance more complicated for local authorities (Migramar, 2012).

An additional problem in Colombia is that illegal fishing is treated by different entities. For example if a national vessel is found inside of a Natural Protected Area, the responsible entity is *"Paruqes Nacionales Naturales de Colombia*", but if it is an international vessel, the situation is more complicated, because foreign authorities must be involved and the illegal fishermen need to be presented to the continental jurisdiction in max 36 hours. Note that the distance (by water) from Malpelo to the nearest port in the continent is 36 hours (El pais, 2012)

5.4 Socio - economic problematic in the MPA's

The issue of shark finning is straightly tied to socio – economic aspects.

Costa Rican fisherman who have been arrested fishing illegally in Colombian waters, have argued that their economic situation is arduous, having in general big families to feed. They declare that in their country's waters the fish resources have shown a remarkable descent and that it is necessary to search for stocks in foreign waters.

Economically speaking, it is important to remark that the finning business is much more lucrative than usual fishing. For example, in the port of Buenaventura, Colombia; a kilogram of shark fins can cost up to 150.000 colombian pesos (U$84[60]), and 1 kg of other fish, will worth in average U$1 (data of 2012) (El pais, 2012).

Soler[61] (Armada Nacional Republica de Colombia, 2012), have stated that Costa Rican fisherman compete with illegal Asiatic vessels and they decide to search for other fishing areas. The Colombian Commander Palomino[62] manifested that 80% of the captured fisherman declare to be escaping from the attack of "pirate vessels". However, he says: "*This version is not confirmed*".

The fact that one state is venturing into the waters of another one and taking its resources implies an act of thievery. Additionally it can be an evidence of the lack of resource in that state. If this situation is seen at a long term scale, drastic results can be predicted as the resource will be depleted not only in one area but in the adjacent regions.

Conclusions of Chapter 5

The region of the ETPS has been confirmed to be an important marine corridor for several species, mainly pelagic sharks. The vast concentration of this species, together with to the isolation of the *MPA's* of the *ETPS*, makes these natural reserves an extremely attractive region for Asian illegal fishing vessels from the finning industry. These fleets count with better technology and bigger vessels, compared to the local ones, and they are able to extract enormous quantities of fish resources.

The most affected species of sharks in the area is known to be the species *Sphyra lewini*, which is an easy shark to fish due to its common aggregations in large schools, especially at night.

The most affected MPA's of the region are the Coco's island, and the Malpelo island. The governments of Costa Rica and Colombia, and their environmental representations have adopted international management resources, and execute local patrolling in the surrounding waters of the

[60] Exchange rate 04/2012 www.xe.com
[61] German Soler: Director of Fundacion Malpelo
[62] William Palomino : Commander of the Coastal Guard, Colombian Pacific

marine reserves. Nevertheless, Asian finning fleets manage to venture into the less or none patrolled areas and extract considerable amounts of fish stocks. The problematic has evolved, and actually even vessels from one *MPA* are entering other *MPA's* water to fish illegally.

The problem disrupts with the cultural and economic traditions of the local communities and besides that, it has caused diplomatic issues between these Latin American countries.

Illegal and unregulated fishing in the region, promotes environmental disturbances that together with the lack of scientific investigation, are menacing the integrity of this important maritime corridor.

DISCUSSIONS

What had happened until now?

Human beings have affected most of the planet's resources and depleted many animal and plant species. The decline in shark populations is just one more example of this phenomenon.
The eagerness of the Chinese to show social standing by consuming shark fin soup has increased the demand and exploitation of shark resources around the world. The problem has been accentuated due to the economic rise of China and the growing middle class, which has now access to the product. The issue of shark finning is therefore tied to cultural and economic factors.

The excessive consumption of shark fins, together with the enormous amounts of shark dumping in the ocean is evidently causing a decline in shark populations, and menacing several of these species of *Chondrichthyes*. We are facing the prospect of a genuine ecological catastrophe.

Human beings have started realizing the magnitude of their actions against nature and biological conservation has arisen as a possible solution to protect biodiversity from the different menaces. Several species and their habitats are somehow being protected. However, for the case of shark conservation, things get more complicated and their protection is encumbered for various reasons.

The challenges for shark conservation

Protecting pelagic and migratory species throughout large oceanic surfaces is challenging on more than one level. Additionally the fact that shark fin consumption forms part of the cultural tradition of a fast developing nation, worsen the situation. Shark fins are traded at a global level and are part of an organized market. Several fisherman and their families benefit from the high prices paid for a single shark fin. The problem has important economic repercussions.

Even if some nations have realized the importance of shark protection, their actions are usually not effective. Shark species cross jurisdictional boundaries and international waters making it difficult to protect a given population on a national level only. This conservation obstacle is not limited only to marine species; and establishing the right conservation measures for migratory species is not easy. Some solutions have been developed by Intergovernmental Treaties as the Convention for the Conservation of Migratory Species of Wild Animals, which protects the habitats and migration pathways of specific species, in direct cooperation with States, local NGO's, the media and the corporate sector.

There have been international measures for the conservation of shark populations, but in many cases they are not enforced. One such weak regulation is the *finning ban*, which has been in place with major loopholes for decades.

Other regulations that have been implemented by international institutions are still not enough or are too recent. For example the *IPOA- Sharks* does not have clear guidelines for countries who *voluntarily* decide to adopt to it. There is no system to monitor their actions either. Additionally the funding must come from each state, which represents an economic strain, especially for developing countries. For the case of *CITES* the protection of sharks depends on whether the species are included or not in their *Appendices*, which is a slow process causing considerable delays in the management of the affected shark species. The action of the *RFMO's* has a positive side, bearing in mind that the problem is managed at a regional level, in a more punctual way. Nevertheless there are still serious gaps to protect species from foreign fishing vessels or shark populations located outside of the *RFMO*'s. The latest efforts by the *EU* should be encouraged although the damage to shark populations, mainly by Spain and Portugal, will be serious by the time these new regulations are implemented by member states.

Another considerable difficulty is the lack of biological information, which is strongly related to the lack of studies and lack of concrete data. Massive amounts of sharks without their fins are discarded and there are no records for this situation. It is almost impossible, then, to measure the exact portion of biomass that is being lost and the specific species that are at risk.

Several shark populations inhabit tropical waters, usually under the jurisdiction of third world countries. In those areas, shark stocks are theoretically protected by legislation, but unfortunately control agencies are restricted by budgetary and technological limitations. Their ability to carry out effective monitoring and to reduce illegal fishing within the protected areas is also influenced by the long distances from the coasts to the protected areas. The example of the Maritime Conservation Corridor of the Eastern Tropical Pacific Seascape, which is under pressure because of illegal fishing, shows that even if the Marine protected areas of the region are supposedly surveilled, offenders are still mostly undeterred. Asian fleets that have managed to enter south and Central American waters, are causing environmental, economic and social changes in the region, and proper regulation in this area is critical to preserve the remaining shark populations.

The case of the shark decline and the intents for their conservation show that unfortunately it is difficult to establish clear worldwide rules and that even once they are proposed it is more difficult to make sure that they are properly applied. For the issue of shark trading it is almost beyond the bounds of possibility to verify exactly what is happening. To control anything occurring in the open ocean, as for example the transshipping of products, accounting of exact number of traded fins, or verifying that they are not camouflaged among other fish products is a regulatory conundrum. Furthermore the control by port authorities is also dubious.

Future perspectives and personal suggestions

Today it is widely accepted that the tradition of shark-fin consumption contradicts many global environmental norms, but concrete actions to avoid it are still not clear. A tragic scenario is in the making if the situation continues as it is now and shark populations fall to their minimum carrying capacity, and eventually some of them collapse.

One of the possible ways to proceed will be for example to look at the case of whaling with its many similarities to shark finning. Indeed, in both cases marine migratory species are threatened by commerce, and for both, regulatory and cultural difficulties existed, as well as the lack of scientific data.

To solve the issues related to cultural differences, the International Whaling Commission *IWC*, acted distinctly in each region, according to how the animal was percieved. In the case of shark finning, for example, Chinese people see sharks as just another fish from the sea, and shark fins are considered a luxury product to consume. For fisherman across the Pacific Ocean, in Central American countries, for example, catching a shark brings in a considerable amount of money, enough to feed their families for several days. For some citizens who are aware of the environmental consequences of shark finning and dumping, the shark trade is an ecological disaster and violates basic animal rights of existence. So, each of these interest groups must be approached in a particular way in order to steer society as a whole towards shark conservation.

To get around the problem of scientific evidence, the *IWC* has issued a full ban on the capture of whales until hard scientific data was available. Meanwhile it appointed a group of approximately 200 whale biologists[63] to establish the appropriate catch limits and collect genetic information.

[63] See: Anderson, 2011

Furthermore, the *IWC* obtained help from specialized research organizations, for instance the National Oceanic and Atmospheric Administration, *NOAA*. After the data was analyzed, quotas were established and the ban became effective. Additional management procedures to monitor and protect whale populations have been adopted subsequently.

Data collection could take several years, bearing in mind that whales and sharks migrate long distances, so, it requires an international and coordinated effort by researchers worldwide. Afterwards, if all the information is centralized and analyzed by a unique body, results can be effective. Currently, for the case of sharks, information is decentralized for lack of a dedicated institution that is in charge of this task. In my opinion it will be necessary to create an international committee responsible for collecting and standardizing biological and genetic studies, but the action of the *RMFO*'s should not be overlooked because these organizations have an excellent regional focus with the understanding of local cultural specificities and sensitivities.

Another suggestion will be to perform effective shark management actions at all levels of the trade process. Working together with fisheries all along the supply chain can moderate the use of shark resources. For example, supporting local communities where sharks are fished is crucial. Educating kids and granting economic incentives to local fishermen is crucial in places where fishermen are who drawn to shark finning for purely financial reasons. In open seas, appropriate monitoring along trafficking routes and in exchange ports must be intensified. The use of technological instruments such as satellite remote systems in each vessel will allow authorities to monitor their routes and their landing ports and to identify boats outside their allowed EEZ.

Strong fines should be applied to captains of vessels who are found fishing in forbidden waters, finning and transshipping shark products in open oceans or landing shark fins ports.

Additional surveillance in the main trading centers, where numerous worldwide products are collected, must be done. In these locations meaningful data can be gathered in a cost-effective way. In landing ports, the number of controlling agents must be augmented and they should receive periodical training on shark biology, species identification and be encouraged with high economic incentives. The cooperation of governments is needed.

In third world countries where sharks are abundant (see the case of the *ETPS*), additional funds are needed in order to train local authorities, patrol and carry out biological studies. The latest technology and scientific know-how have to be transferred to these regions urgently.

From my point of view establishing "half-way finning bans" and strengthening them every time they have a loophole is not a viable solution. Bearing in mind that biological and ecological data are subject to considerable uncertainty, stakeholders and decision-makers must act according to the principle of precaution and ban shark finning completely in all States. Countries like Egypt[64], French Polynesia, Honduras, Israel, Micronesia, Maldives and Palau, who have prohibited completely the fishing of sharks in their Exclusive Economic Zones (*EEZ*), are models to follow.

I consider that the strongest efforts must be done to develop consciousness in Asian countries, especially in China, to try to decelerate the demand and aim for a total prohibition of shark fin soup consumption in the next years. It might not be easy to challenge Chinese traditions and present convincing arguments against the brutality of the shark finning practice, but to develop pro-shark campaigns will hopefully contribute to reduce shark consumption to sustainable levels. It is essential that Asian societies apprehend the risks of the disappearance of sharks and the further economical consequences that this can represent.

Finally, I believe that the importance of sharks worldwide can not be stressed enough. The *chondrichtyes* are crucial to the balance of ecosystems given their position at the top of food webs. Sharks keep marine habitats healthy and their function cannot be replaced by any other fish species. The absence of this key predator will mean changes in communities' composition, and the bloom of invasive species. It could put our own food resources at risk and we could face serious economic consequences.

[64] Egyptian waters of the red sea

CONCLUSIONS

After ruling the seas and being a top predator for more than 400 millions of years, sharks have become a prey under the action of human beings. Being an important ingredient of Chinese cuisine, the market value of fins has skyrocketed, far more than shark meat on a pound per pound comparison. As a result, fins are traded worldwide whereas most of the edible part of the animal is discarded, representing a huge loss of biomass and a cruel animal practice. The ecological effects of shark finning and the lack of these apex predators is alarming.

Several shark populations are being severely affected and their parts are being trafficked overseas. The species that appear to be the most at risk are the blue shark (*Prionaca glauca*), the silky shark *(Carcharhinus falciformis),* the oceanic whitetip shark *(Carcharhinus longimanus),* the dusky shark *(Carcharhinus obscures)* and complete shark genus as hammerhead sharks *(*genus *Sphyrna),* mako sharks (genus *Isurus oxyrinchus*) and thresher sharks *(*genus a*lopias).*

Shark conservationists face several important challenges. Apart from the cultural and economic difficulties to remove shark fins "from the menu", there are complications due to the scarcity of information.
Even if some data can been obtained from the main fishing and trading centers, scientific facts are still not extensive, and therefore we can not achieve a precise understanding of the decline of shark populations and which species are most at risk. The real catch of sharks is often under the radar and shark mortality data are under-represented. This is due to the difficulty of interpretation, unreliable information and the vast amount of unreported cases. A strong limitation for the accounting of shark deaths is due to the fact that bodies are discarded in remote ocean areas where supervision is unavailable. To this day, the facts about the decline of *chondrichthyan* populations have been supplied by various fisheries management specialists, and their conclusions are alarming. Some of them speculate that there is little chance that populations of overfished sharks will show recovery in less than half a century, even with strict fishing limitations[65].

The main institutions involved in the topic of shark finning are the *FAO, CITES*, the *CMS,* the *RFMO's*, the *EC* and the *IUCN*. Unfortuantely, their management instruments are relatively new and their actions are still insufficient. Extensive scientific information and concrete actions are missing.

[65] Harvey, et al., 2005

The case of the illegal fishing in the islands of the *ETPS* illustrates the regular violations of Central and South American waters by Asian fishing vessels. These foreign fleets travel around 16.000 km to invade shark-abundant waters. In spite of the fact that these areas are categorized as Marine reserves, local authorities seem to be powerless. Neither the sharks nor the local fisherman are correctly protected in these areas.

Additional actions are required to avoid the irreversible effects of the lack of sharks in the oceans. In order to maintain the appropriate functioning of ocean communities it is necessary to act at local and global levels. Overseas, it will be necessary to create sufficient incentives for fisherman to respect sharks. Additionally the use of technological advances to monitor vessels in oceanic waters might provide valuable information, and an organized network of researchers who can provide reliable scientific data to regulators, is vital. Additional suggestions for species management can be borrowed from the case of whaling in the past decades.

A total shark finning ban; developing strong educational campaigns in China in order to reduce the demand and even forbidding completely the consumption of shark fin soup in Asia; these are some of the actions that must be undertaken as a matter of priority.

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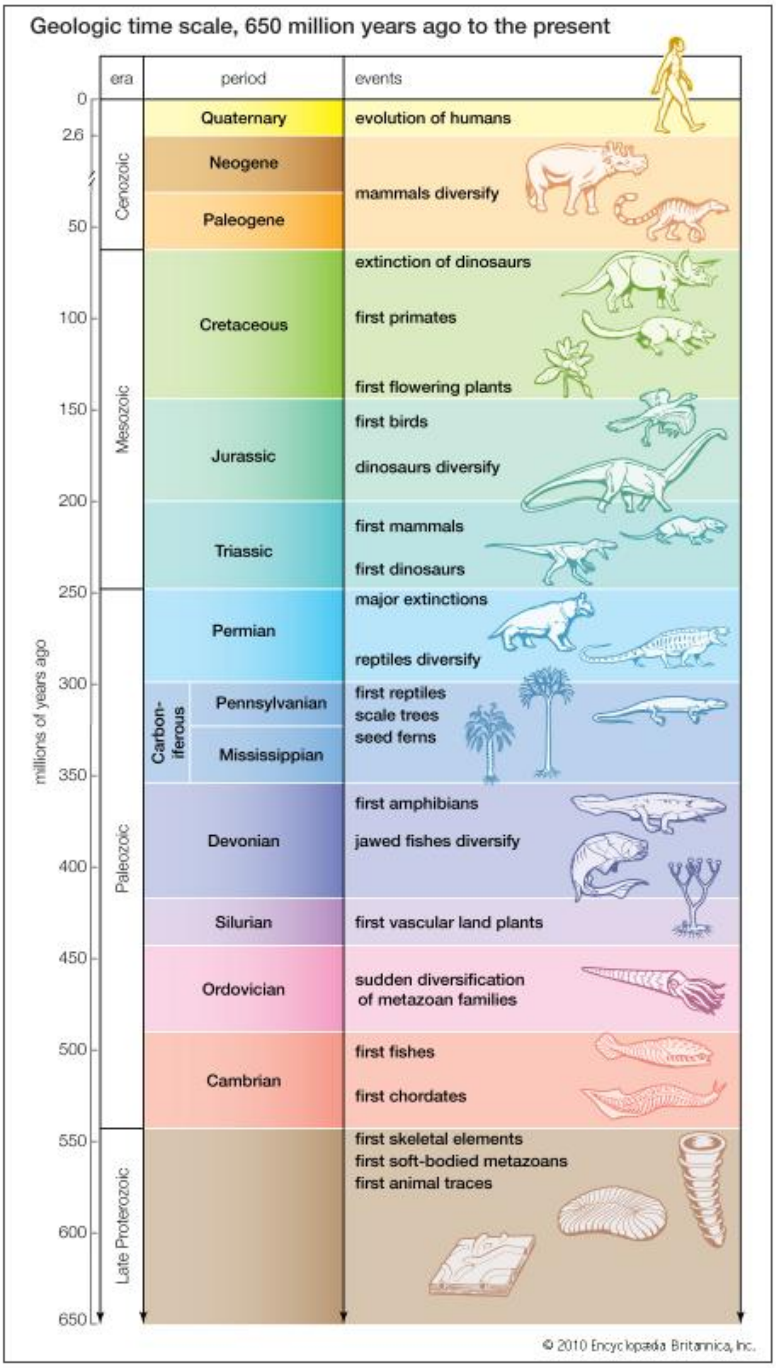
ANNEXES

Annex 1. Fossil record: geologic time scale with major evolutionary events.
Shark fossil records have been found in Devonian rocks together with other jawed fish and amphibians; which indicates their presence on earth for more than 400 million years ago.
Source: Encyclopedia Britannica, 2012.



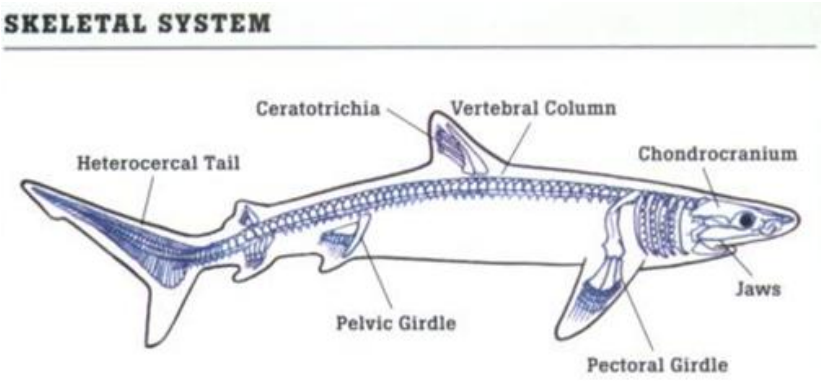
Annex 2. Comparison of shark orders.

Shark species from the different orders present several morphological, reproductive, and ecological dissimilarities. Source: Shark Savers, 2012.

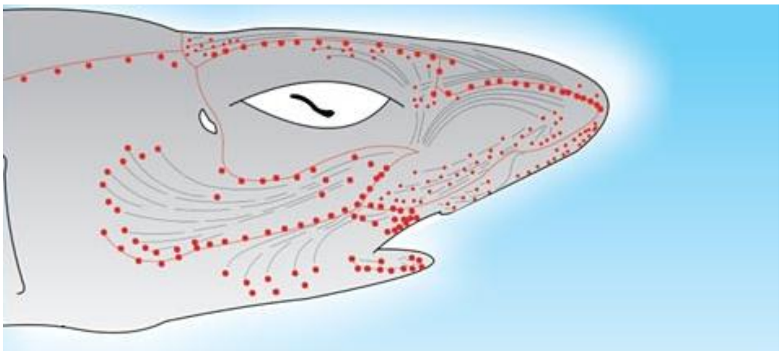
Comparison of Shark Orders

Order	Frilled Sharks Chlamydoselachiformes	Cow Sharks Hexanchiformes	Bramble Sharks Echinorhiniformes	Dogfish Sharks Squaliformes	Angel Sharks Squatiniformes	Saw Sharks Pristiophoriformes	Bullhead Sharks Heterodontiformes	Carpet Sharks Orectolobiformes	Mackerel Sharks Lamniformes	Ground Sharks Carcharhiniformes
# Species	2	4	2	119	19	9	9	39	15	277
Anal fin	✓	✓					✓	✓	✓	✓
Fin spines				✓			✓			
Dorsal Fin	1	1	2	2	2	2	2	2	2	2
# Gill slits	6	6 or 7	5	5	5	5 or 6	5	5	5	5
Famous Species	Frilled Shark	Bluntnose Six-gill Shark	Bramble, Prickly Shark	Gulper, Spiny Dogfish, Lantern, Pigmy	Pacific Angel Shark	Common Saw Shark	Port Jackson, Horn Shark	Whale, Nurse, Zebra Carpet Shark	Great White, Basking, Mako, Megamouth, Thresher	Hammerhead, Catsharks, Tiger, Bull Sharks
Unique Qualities	Eel-like shape; 3-cusped teeth; frilly growth on gills	Cockscomb-shaped bottom teeth	Thorn-like denticles over body	Many bioluminescent	Shape; eyes & spiracle at top of head; fleshy barbels	Long snout; long nasal barbels	Pronounced brow;	Specialized nostrils; barbels	"lamnoid dental pattern"	Nictating eyelids
Habitat	Deep marine waters	Deep, often cold marine	Deep, marine, temperate to tropical	Marine; many bottom oriented	Marine; from temperate to tropical; bottom	Mostly marine; temperate to tropical	Marine coastal; bottom, temperate to tropical	Marine, mostly tropical	Marine; coastal to open-ocean; cold temperate to tropical	Virtually every marine habitat, some estuaries
Body shape	Long, thin, eel-like	Rounded	Rounded	Rounded	Flattened	Slightly flattened	Rounded	Many Rounded; some flattened	Rounded	Rounded
Mouth	Terminal mouth; blunt snout	Underneath	Underneath	Underneath	Terminal mouth; blunt snout	Underneath, long blade like snout	Underneath;	Underneath, short, ends before eyes	Underneath, extends well past eyes	Underneath
Reproduction	ovoviviparous						oviparous; egg case	some oviparous; ovopiraous	ovoviviparous some are oviphagous	variable

Annex 3. **Skeletal system of a shark**.
Source: Skomal and Caloyianis 2008.



Annex 4. Side view of a shark's head.
Detail of the inductive magneto reception sense points. Dots represent the Lorenzini electroreceptos.
Source: Huh, 2008.



Annex 5. Composition of shark fins.
Source: Vannuccini, 1999

Water	14 g
Protein	83.5 g
Fat	0.3 g
Carbohydrate	0 g
Calcium	146 mg
Phosphorus	194 mg
Iron	15.2 mg
Food Energy	337 kcal

Annex 6a. Statistics for the World Locations with the highest Shark attack activity (2000-2011).
Source: The International Shark Attack File, 2011

HAWAII (N=44)			
YEAR	Total Attacks	Fatal	Non-fatal
2000	2	0	2
2001	3	0	3
2002	6	0	6
2003	5	0	5
2004	3	1	2
2005	4	0	4
2006	3	0	3
2007	7	0	7
2008	1	0	1
2009	3	0	3
2010	4	0	4
2011	3	0	3

CALIFORNIA (N=36)			
YEAR	Total Attacks	Fatal	Non-fatal
2000	3	0	3
2001	1	0	1
2002	4	0	4
2003	1	1	0
2004	6	1	5
2005	3	0	3
2006	1	0	1
2007	4	0	4
2008	2	1	1
2009	4	0	4
2010	4	1	3
2011	3	0	3

BRAZIL (N=22)			
YEAR	Total Attacks	Fatal	Non-fatal
2000	0	0	0
2001	3	0	3
2002	4	1	3
2003	1	0	1
2004	5	1	4
2005	1	0	1
2006	3	1	2
2007	0	0	0
2008	2	0	2
2009	0	0	0
2010	1	0	1
2011	2	0	2

BAHAMAS (N=12)			
YEAR	Total Attacks	Fatal	Non-fatal
2000	4	0	4
2001	2	0	2
2002	1	0	1
2003	0	0	0
2004	1	0	1
2005	1	0	1
2006	2	0	2
2007	0	0	0
2008	0	0	0
2009	0	0	0
2010	1	0	1
2011	0	0	0

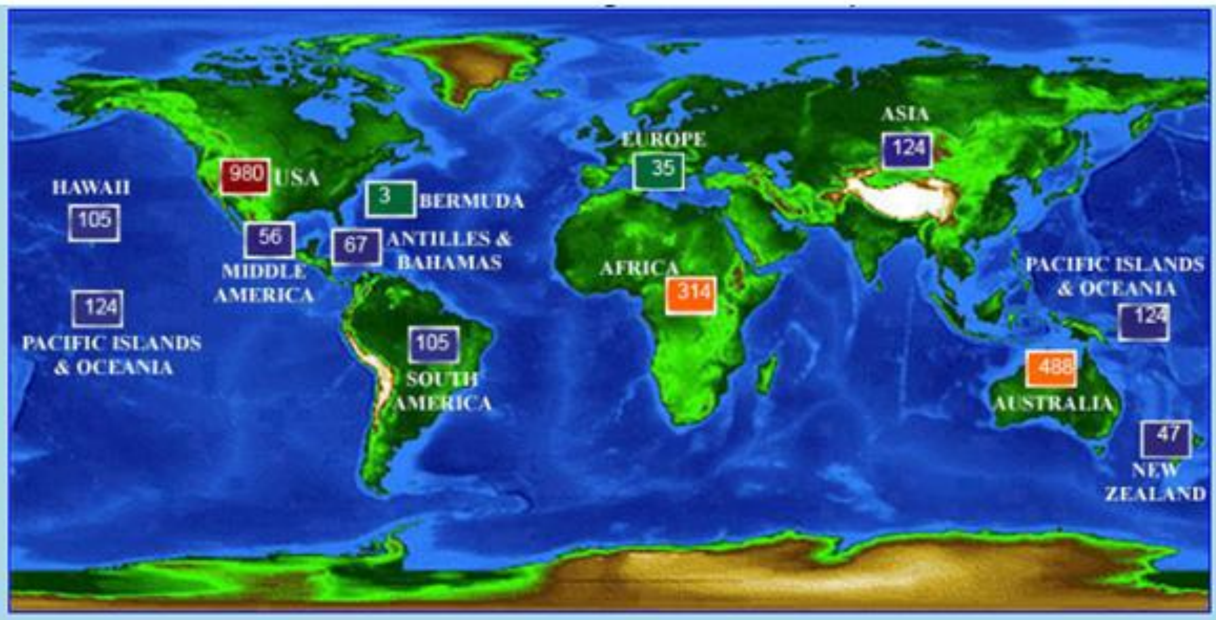
AUSTRALIA (N=141)			
YEAR	Total Attacks	Fatal	Non-fatal
2000	17	3	14
2001	9	0	9
2002	9	2	7
2003	8	1	7
2004	13	2	11
2005	10	2	8
2006	7	1	6
2007	13	0	13
2008	9	1	8
2009	21	0	21
2010	14	1	13
2011	11	3	8

SOUTH AFRICA (N=45)			
YEAR	Total Attacks	Fatal	Non-fatal
2000	4	0	4
2001	3	0	3
2002	3	0	3
2003	2	1	1
2004	5	1	4
2005	4	0	4
2006	4	0	4
2007	2	0	2
2008	0	0	0
2009	6	4	2
2010	7	2	5
2011	5	2	3

FLORIDA (N=281)			
YEAR	Total Attacks	Fatal	Non-fatal
2000	37	1	36
2001	34	1	33
2002	29	0	29
2003	29	0	29
2004	12	0	12
2005	17	1	16
2006	21	0	21
2007	31	0	31
2008	28	0	28
2009	19	0	19
2010	14	1	13
2011	11	0	11

WORLD (N=807)			
YEAR	Total Attacks	Fatal	Non-fatal
2000	89	11	78
2001	75	4	71
2002	65	3	62
2003	55	4	51
2004	65	7	58
2005	58	4	54
2006	58	4	54
2007	70	1	69
2008	52	4	48
2009	64	6	58
2010	81	6	75
2011	75	12	63

Annex 6b. **Map of the World's Confirmed Unprovoked Shark attacks** (N=2,463). Period: 1580-2011
Source: The International Shark Attack File, 2011



Territory	Total Attacks	Fatal Attacks	Last Fatality	Territory	Total Attacks	Fatal Attacks	Last Fatality
USA (w/out Hawaii)	980	36	2010	Antilles & Bahamas	67	15	1972
Australia	488	144	2011	Middle America	56	27	2011
Africa	314	85	2011	New Zealand	47	8	1968
Asia	124	51	2000	Europe	35	17	1984
Pacific/Oceania Islands (w/out Hawaii)	124	50	2011	Bermuda	3	0	
Hawaii	105	8	2004	Unspecified/Open Ocean	14	7	2006
South America	105	23	2006	WORLD	2,463	471	2011

500 and above | 200 - 499 | 40 - 199 | 1 - 39 | 0

Annex 7a. Global localization of special administrative regions (SAR) of Hong Kong (People’s Republic of China)
Source: Wkigraphists, 2010

Annex 7b. Close up of Map of Hong Kong.
Source: CIA, 2012

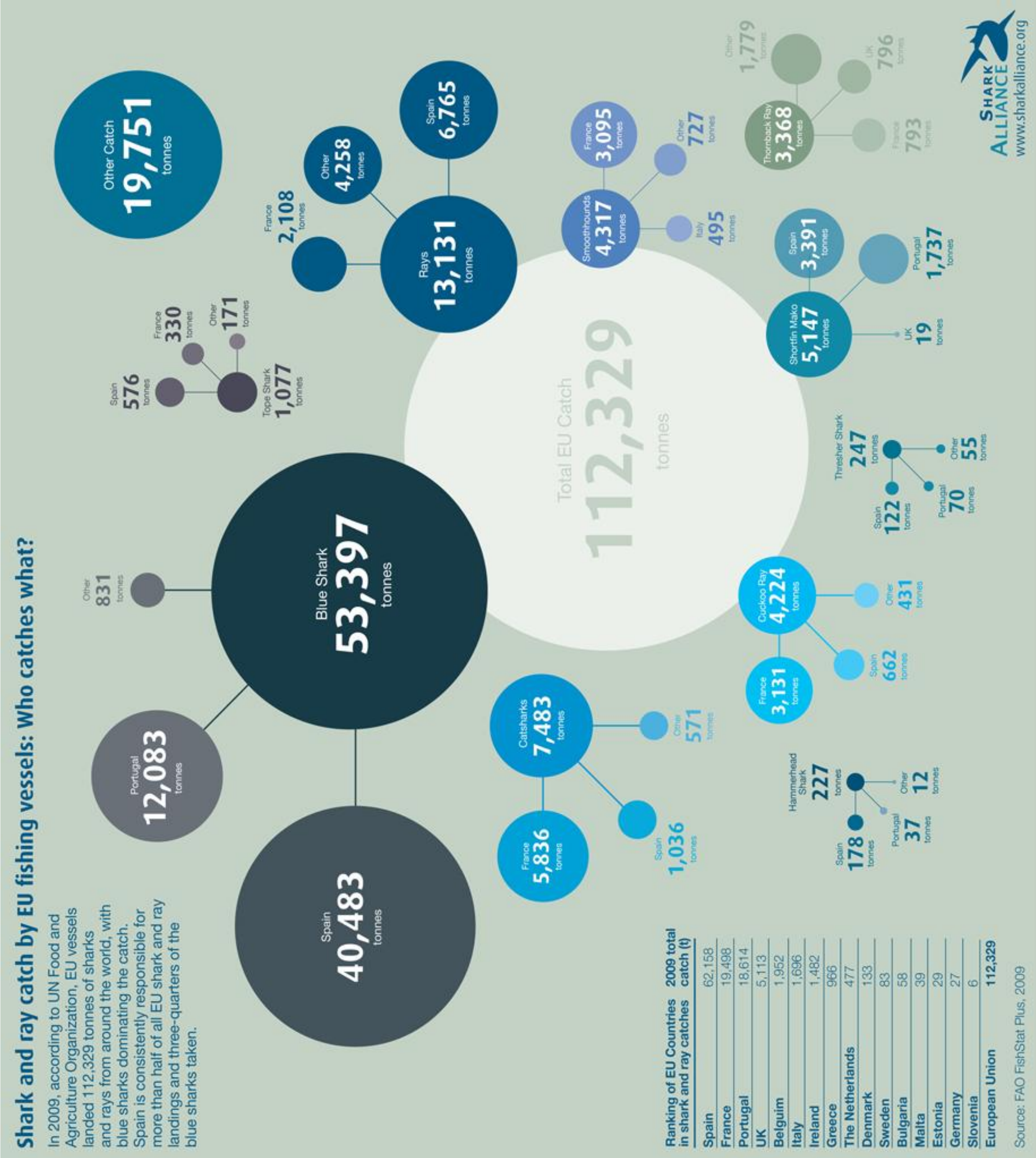
Annex 8. Global exports of shark fins between 1990 -2005. Data expressed in weight (tons)
Source: FAO 2007, cited in Lack and Sant, 2008

Product	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Fins																
Shark fins, dried, salted, etc.	2960	1654	3089	3213	3285	2166	3985	3174	3253	3147	3240	2767	3229	3429	4216	2788
Shark fins, dried, unsalted	1099	1069	988	991	1126	1070	1527	1312	1013	1529	2266	1761	2122	2634	2001	2619
Shark fins, frozen	394	165	75	95	2	5	241	299	223	429	1027	664	661	901	786	553
Shark fins, salted and in brine but not dried or smoked	209	135	185	212	164	373	50	64	22	1	2	1	9	0	0	28
Sub-total	4662	3023	4337	4511	4577	3614	5803	4849	4511	5106	6535	5193	6021	6964	7003	5988

Annex 9. Sharks and rays catches per EU country and per specie. Note that the shark species which are catch in Europe are the: Blue shark (53, 397 tons), catshark (7,483 tons), shortfin mako shark (5,147 tons), smooth hound shark (4,317 tons), tope shark (1, 077 tons), tresher sharks (247 tons) and hammerhead sharks (227 tons).

The catch of blue sharks done by Spain, reflects that this state is responsible of the landings of aproximately 77% of blue sharks in Europe.

Source: *FAO* Fishstat, 2009 in The Shark Alliance (2011)



Annex 10. Origins of shark fin exports to Hong Kong (HK). The data are presented in weight (kg) of dried and frozen fins exported to HK in 2008. Note that the information about China might contain double counted shark fins, because after importation to HK, fins are re imported to China to be processed and then exported back to HK.
Source: Oceana, 2010b

Spain	2646442	New Zealand	79789	Bangladesh	16899	Seychelles	2594
Singapore	1201236	Philippines	73320	Marshall Islands	16870	Germany	2512
Taiwan	990664	Senegal	70796	Congo P.R.	14980	Solomon Islands	2423
Indonesia	681012	Guyana	58369	Morocco	14623	Honduras	2210
United Arab Emirates	511197	Canada	57828	Mozambique	14622	Angola	2134
Costa Rica	327385	Oman	55757	Venezuela	14592	Kuwait	1865
USA	251310	Guinea Conakry	50735	China[B]	13096	Kiribati	1546
Yemen	226738	Madagascar	40107	Vietnam	12078	Cuba	1333
Mexico	216833	Pakistan	39807	Kenya	10984	Nigeria	1308
Brazil	200732	Sri Lanka	39448	Saudi Arabia	8858	Cote D'Ivoire	1062
Argentina	185380	Uruguay	39059	Nicaragua	8657	Turkey	1048
South Africa	182953	Norway	38236	Tonga	7981	France	847
Netherlands	171863	Mauritania	37396	Maldives	7593	Iceland	708
Japan	162276	Chile	36249	Tunisia	7045	Sudan	377
Ecuador	134726	Colombia	27247	Egypt	6666	Iran	300
Peru	121548	Malaysia	25341	Andorra	5932	Macau	222
India	117241	Togo	24918	Namibia	5280	Micronesia & Palau	217
South Korea	104177	El Salvador	21591	Aust. + Oceania	4715	Congo Dem. R	121
Trinidad & Tobago	103104	Gabon	19922	Gambia	4288	Bahrain	114
Australia	95014	Mauritius	18844	Liberia	4215	Total	9949556
Fiji	93884	Guatemala	18070	Suriname	3809		
Panama	85151	Papua New Guinea	17258	Tanzania	3024		

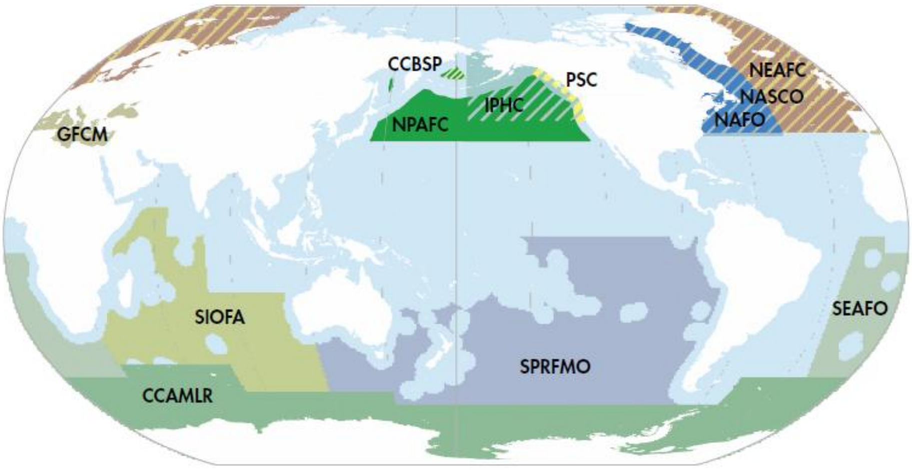
Annex 11. 12 main countries from which Hong Kong imports *fins* (both dried and non dried). The amounts are presented in **kg**. The catch done by these 12 countries represent 60-70% of the total global imports. Data compiled from the Census and Statistics Department, Hong Kong (2002-2008). Source: Cheung and Chang (2011).

	2002		2003		2004		2005		2006		2007		2008	
Country	Weight (kg)	Value '000	Weight (kg)	Value '000	Weight (kg)	Value '000	Weight (kg)	Value '000	Weight (kg)	Value '000	Weight (kg)	Value '000	Weight (kg)	Value '000
USA	121,945	60,522	173,105	91,111	172,496	79,723	122,676	61,412	110,827	52,509	97,652	44,829	69,611	30,133
Brazil	266,583	109,064	281,520	129,976	269,150	141,929	236,285	126,232	166,674	88,892	172,850	85,294	199,895	90,081
Mexico	259,603	91,466	197,441	97,982	174,622	100,007	192,949	110,444	171,583	86,881	200,570	123,034	213,120	96,218
Peru	109,366	37,545	91,885	30,109	64,959	21,018	129,037	54,976	143,026	45,960	204,256	67,844	115,276	41,671
UA Emirates	493,009	122,926	469,807	95,623	450,143	85,671	535,244	121,964	425,199	116,421	471,094	120,483	491,801	152,528
Yemen	103,098	21,651	93,022	19,038	41,485	14,849	83,077	17,796	190,579	41,808	247,704	62,994	225,804	83,552
Taiwan	751,692	275,509	691,276	196,469	492,430	89,951	423,652	65,935	562,329	100,752	456,968	100,872	442,034	108,502
Indonesia	242,298	101,571	300,250	112,316	357,928	157,064	361,273	160,413	309,688	124,523	362,814	159,576	281,035	130,058
Japan	172,144	59,206	170,370	60,178	180,173	77,121	148,035	61,739	192,842	66,108	241,618	71,074	136,012	57,344
China	1,151,972	164,292	1,225,429	173,859	916,322	111,864	618,640	90,179	241,845	37,093	267,556	37,899	179,362	43,065
India	174,020	34,220	180,652	31,148	134,682	28,125	119,203	21,699	104,499	26,344	76,585	31,056	84,908	26,351
Singapore	277,643	90,851	317,471	102,496	387,697	135,854	243,002	72,174	242,599	62,443	248,301	100,620	262,336	109,350
12 countries' Total	**4,123,373**	**1,168,823**	**4,192,228**	**1,140,305**	**3,642,087**	**1,043,176**	**3,213,073**	**964,963**	**2,861,690**	**849,734**	**3,047,968**	**1,005,575**	**2,701,194**	**968,853**
12 countries' %	76%	75%	74%	71%	71%	67%	67%	63%	69%	66%	69%	66%	65%	62%
All Country's Total:	**5,410,371**	**1,564,537**	**5,634,105**	**1,613,155**	**5,094,423**	**1,559,344**	**4,766,712**	**1,523,711**	**4,139,069**	**1,293,054**	**4,432,382**	**1,524,587**	**4,130,710**	**1,552,744**

Annex 12. Regional Fisheries Management Organizations RFMO's responsible for the management of transboundary fish stocks (Non-tuna species).

The initials represent the name of the RFMO's as follows:

- *GFCM: General Fisheries Commission of the Mediterranean*
- *SIOFA: South Indian Ocean Fisheries Agreement*
- *CCAMLR: Commission for the Conservation of Antarctic Marine Living Resources*
- *CCBSP: Convention on Conservation and Management of Pollock Resources in the Central Baring Sea*
- *NEAFC: Northeast Atlantic Fisheries Commission*
- *IPHC:* International Pacific Halibut Commission
- *PSC:* Pacific Salmon Commission
- *SPRFMO: South Pacific Regional Fisheries Management Organization*
- *NASCO: North Atlantic Salmon Conservation Organization*
- *NAFO: North Atlantic Fisheries Organization*
- *NEAFC: North-East Atlantic Fisheries Commission*
- *SEAFO: Southeast Atlantic Fisheries Organization*

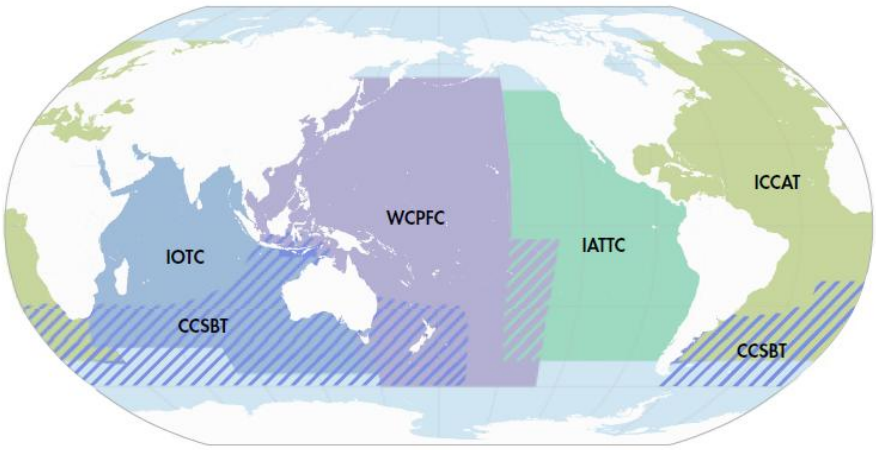


Source: EC, 2012

Annex 13.
Regional Fisheries Management Organisations RFMO's Responsible for Tuna and Tuna – like species.

The initials represent the name of the RFMO's as follows:

- *IOTC: Indian Ocean Tuna Commission*
- *CCSBT: Commission for the Conservation of Southern Bluefin Tuna*
- *WCPFC: Western Central Pacific Fisheries Commission*
- *IATTC: Inter-American Tropical Tuna Commission*
- *ICCAT: International Commission for the Conservation of Atlantic Tunas*



Source: EC, 2012

Annex 14. The Action Plan for Sharks.
Source: EC, 2009.

THE ACTION PLAN

The Community Action Plan for sharks: general purpose, scope and operational objectives

The reference point for this Action Plan is the FAO IPOA SHARKS, which aims to ensure the conservation and management of sharks and their long-term sustainable use worldwide.

The purpose of the Community Action Plan is to contribute to that general objective by ensuring the rebuilding of many depleted stocks fished by the Community fleet within and outside Community waters. The Action Plan outlines what is already in place and what is still needed to do to ensure a comprehensive and coherent legislative policy and legislative framework for the conservation and management of sharks within and outside Community waters.

The scope of the proposed Plan of Action covers directed commercial, by-catch commercial, directed recreational, and by-catch recreational fishing of any chondrichthyans within Community waters. It also includes any fisheries covered by current and potential agreements and partnerships between the European Community and third countries, as well as fisheries in the high seas and fisheries covered by RFMOs managing or issuing non-binding recommendations outside Community waters.

The Action Plan pursues the following three specific objectives:

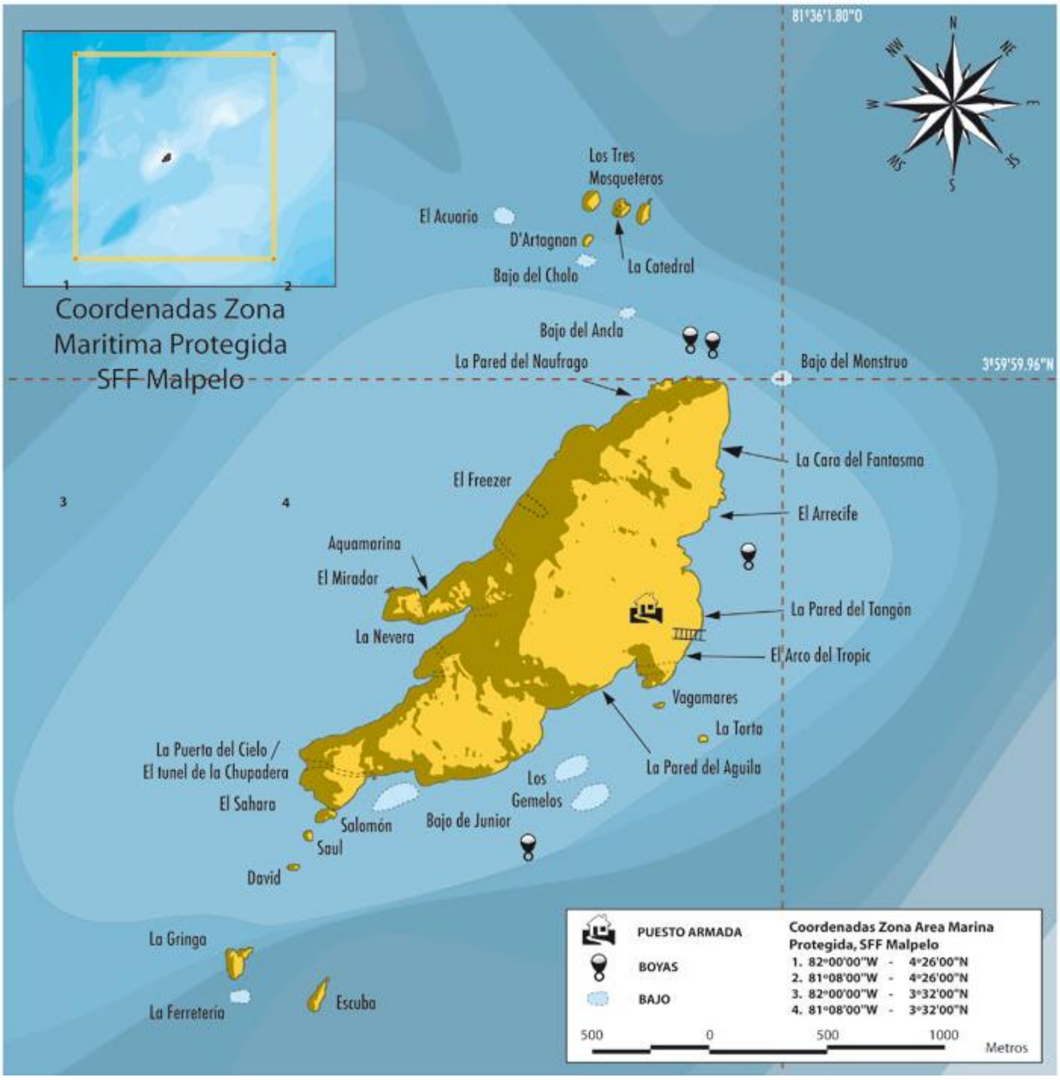
a) *To broaden the knowledge both on shark fisheries and on shark species and their role in the ecosystem;*

b) *To ensure that directed fisheries for shark are sustainable and that by-catches of shark resulting from other fisheries are properly regulated;*

c) *To encourage a coherent approach between the internal and external Community policy for sharks.*

Annex 15a . Location of Malpelo Island in the *ETPS*.
Source: Fundación Malpelo, 2012.

Annex 15b. Map and geographic coordinates of the MPA Malpelo Island. Note that there is one post of control from the Colombian navy on the island (*Puesto Armada*).
Source: Fundación Malpelo, 2012.



Annex 16a. Map of the location of Cocos Island in the ETPS. Source: Llantrisant Sub-Aqua Club, 2012

Annex 16b. Detail of Cocos Island and several of its dive spots. The abundance of sharks in the area is an attractive for scuba divers. Source: Llantrisant Sub-Aqua Club, 2012