

Sharks Need Protection and Surfers Want Security: The Recent Shark Control Program of *La Réunion* in the Context of the International Legal Framework

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Structured Abstract

Article Type: Research Paper

Purpose—There are few studies about the protection of sharks and international law, and new measures have recently been enacted. While efforts have been made to change the negative image of the species in public opinion, it is a delicate matter to treat the legal framework aimed to protect sharks and the response to shark attacks simultaneously. However, recent Shark Control Programs, as in the French Island of La Réunion, raise new legal issues regarding their conformity to international law.

Design, Methodology, Approach—This study was undertaken by listing and organizing international, regional and national legal frameworks aimed to protect the elasmobranchs species. It was then possible to draw a conclusion about applicable measures and to compare them to the new programs developed to face the “shark risk” in La Réunion. The comparison was also made to other countries with such programs.

Findings—The research demonstrates that the legal framework aimed to protect sharks has been substantially developed, but it is still very incomplete, fragmented, and suffers a low enforcement rate. Even if the Shark Control Program of La Réunion

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concerns unprotected species, the tiger shark and bull shark are listed in the IUCN red list as “near threatened.” The measures taken, such as the authorization of mass capture and the installation of nets, could have a negative impact on these protected species, and on the global environmental balance. To conform with international law, the effects of shark nets should be evaluated by scientific and transparent studies.

Practical Implications—This study highlights that even if it is legitimate to react to situations of danger, such as in the “shark crisis” in La Réunion, public authorities must take into account the international, regional and national laws regarding the environment. It also demonstrates that the rise of shark attacks can be at least partly explained by pollution, climate change and overfishing. Measures for protection of the environment then constitute an efficient long-term solution.

Originality, Value—These findings can be of interest for a comparative study of shark control programs, and are new in their approach from the perspective of international environmental law.

Keywords: environment, law of the sea, protection of sharks,
shark control program, sharks

“*The ocean is a mighty harmonist*”—William Wordsworth, “On the Power of Sound,” st. 12 (1828)

Introduction

Sharks were put under the spotlight during the last several years, but for different reasons. On one hand, the international community has started to realize the importance of appropriate protection for this increasingly threatened group of fishes. Scientists and academics have been calling for efficient measures for a long time, and the existing norms are far from being sufficient. However, substantial developments have occurred, as the result of the Second Meeting of the Signatories to The Memorandum of Understanding on the Conservation of Migratory Sharks (Sharks MOU), held in February 2016, which led to the addition of 22 species of sharks and rays to the list of the species protected by the text. On the other hand, media all over the world has covered several shark attacks in the last few years. One of them was spectacular, occurring during a famous surf competition in South Africa, and watched live by thousands of amazed people. Fortunately, the surfer remained unharmed.¹ Other attacks were dramatic, and the “shark crisis” that started a few years ago on the small French island of “La Réunion” in the Indian Ocean is a grim demonstration of that. Between 2011 and 2015, 20 attacks were reported, including seven fatal ones. The tragic situation—some of the victims were teenagers—required the intervention of public authorities and the prohibition of aquatic activities in all the open waters of the island. Sharks first represent a threatened group of animals before being a source of risk, and for that reason it is difficult to address both considerations. Especially when associations have worked for years to fight against the negative image

of the shark in public opinion. The risk that is present during the meeting between human and shark is insignificant according to statistics. The Sea Shepherd Conservation Society recalls, for instance, that more people are killed each year by falling vending machines than by shark attacks—about ten a year²—when at least 100 million sharks are killed annually for their fins.³ However, the need to protect the population from shark attacks was legally raised in La Réunion, and it opened new questions as to the conformity of the measures adopted by international law. The purpose of this study is to show why sharks need protection, to present which rules of international law participate in protecting sharks, and to consider the national measures taken against the “shark risk,” as in the French territory of La Réunion, regarding their conformity with these rules.

Why Sharks Need Protection

In scientific and legal studies, the word “sharks” is frequently used out of ease to include all of the elasmobranchs, a group of species encompassing sharks, rays, skates, and chimeras.⁴ It will also be used in this way in this article. They are also known as cartilaginous fishes, as their skeletons are made of cartilage rather than bone.⁵ The group is particularly diverse, and one of the oldest in the world.⁶ They can be found in the majority of marine ecosystems and several freshwaters river systems.⁷ Nearly 1,200 species of elasmobranchs are globally recognized,⁸ but new species are discovered nonstop by researchers.

Three main considerations explain the fundamental need to protect sharks in the world. First, sharks are particularly vulnerable. They grow slowly, have a late age of sexual maturity, a low fecundity and long gestation periods.⁹ Depending on the type of shark, their reproduction can be oviparous (depositing eggs on the floor), ovoviviparous (live birth with eggs developing in a shark’s body), or viviparous (live birth), with fecundity being lower for the viviparous species.¹⁰ Regarding the period of reproduction, some species need more than one year to engage in a new cycle.¹¹ They also produce few offspring.¹²

Second, sharks are suffering from overexploitation. Institutional publications point out how alarming the situation has become. In 2014, the IUCN Shark Specialist Group (SSG) published a study demonstrating that a quarter of sharks and rays are threatened with extinction.¹³ This analysis has been confirmed by several sources.¹⁴ In 1,041 species reported, 249 are classified as threatened (24 percent); and among the species with sufficient data, 14 species of sharks and 11 species of rays are classified as critically endangered.¹⁵ According to the study, rays are particularly threatened, and, generally, the highest risk for extinction are large-bodied species that live in shallow coastal waters and/or fresh waters.¹⁶ One of the facts underlined by IUCN is that at least 28 populations of sharks and rays have already disappeared locally or regionally.¹⁷

Overfishing is the main threat to the species, along with bycatch, and intentional killing due to the perceived risk sharks pose to people.¹⁸ They also suffer habitat loss

and/or habitat degradation.¹⁹ The market for fins, used in shark fin soup, which is particularly appreciated in China, has been denounced as a reason for the depletion of sharks and rays for a long time. Other products are made with elasmobranchs, such as main dishes comprised of shark meat or a Chinese tonic made from manta and devil ray gills,²⁰ while some pharmaceuticals are made from deep sea shark livers.²¹ These products turn sharks and rays into valuable targets. It is estimated that 63 to 273 million sharks are killed per year for these commercial reasons.²² Although finning is banned in a large number of states, law enforcement is very low. Among the zones where the situation is the most dramatic, we find the most violations in the Gulf of Thailand, the Red Sea, and the Mediterranean Sea.²³ Climate change and global warming also have an impact on shark species, as demonstrated in several scientific studies. A group of researchers from an Australian University published an article in which they assert that “the hunting ability and growth of sharks will be dramatically impacted by increased CO2 levels and warmer oceans.”²⁴

Finally, sharks are highly important, first of all for the sake of biodiversity, but also for the economic interests sharks represent. In ecological terms, “eliminating the largest animals in any ecosystem can have complex, sometimes counter-intuitive effects,” and “may result in unpredictable ecosystem cascades and a damaged environment.”²⁵ As predators, they exert control on smaller organisms, can prevent changes such as algal overgrowth of coral reefs and declination in food fisheries, and the largest predatory sharks hold the bulk of some nutrients which would be otherwise transferred to land.²⁶ The economic value of sharks is considerable, and is a strong argument for the governments in providing substantial efforts for their conservation. Tourism centered on sharks, such as shark watching, represents 314 million dollars in economic benefit per year and could reach 780 million dollars in 20 years if sharks were efficiently protected.²⁷ The Convention on Conservation of Migratory Species of Wild Animals (CMS) gives a measure of the wide range of interests involved when it mentions “the ever-growing value of wild animals from environmental, ecological, genetic, scientific, aesthetic, recreational, cultural, educational, social and economic points of view.”²⁸

The Legal Framework Protecting Sharks

Measures protecting sharks exist, but they are ensured by different conventions and institutions; some of them are binding, while others are not, and they all suffer a low level of enforcement. Hence, the legal framework protecting sharks is complex and fragmented. Efforts are now being made in terms of efficiency of measures, raising awareness of governments and professionals, and coherent articulation between regulations and actors.

The International Framework

THE INTERNATIONAL CONVENTIONS

UNCLOS. The United Nations Convention on the Law of the Sea (UNCLOS) provides general dispositions on the preservation of the marine biodiversity. States must protect marine living resources near their coasts, and also in their Exclusive Economic Zone.²⁹ It also especially promotes national and international cooperation for the protection of the highly migratory species, and sharks are considered as such in Annex I of the Convention. Article 64.1 UNCLOS provides:

The coastal State and other States whose nationals fish in the region for the highly migratory species listed in Annex 1 shall cooperate directly or through appropriate international organizations with a view to ensuring conservation and promoting the objective of optimum utilization of such species throughout the region, both within and beyond the exclusive economic zone. In regions for which no appropriate international organization exists, the coastal State and other States whose nationals harvest these species in the region shall cooperate to establish such an organization and participate in its work.

According to the Convention, States also have a duty of cooperation to manage and conserve living resources in the areas of the high seas.³⁰

In 1995 the United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNFSA) was also signed. It created obligations for States to cooperate within Regional Fisheries Management Organizations (RFMOs) to do so, in the application of Article 64 of the Convention already quoted.³¹

Several other international treaties complete these general obligations. Three international binding agreements with universal scope are of particular importance: the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the 1979 Convention on Migratory Species (CMS), and the Convention on Biological Diversity (CBD).

CITES. CITES is an international governmental agreement, which entered into force in 1975, and whose aim is “to ensure that international trade in specimens of wild animals and plants does not threaten their survival.”³² There are currently 182 state parties to the agreement, which meet every two or three years to review implementation of the agreement. For the species identified, international trade requires special control. That means that all import, export, re-export and introduction from the sea requires a license provided by the entities designated by each State.³³ Three appendices list the species according to the degree of protection they need. Parties to CITES have been concerned with shark protection since some species were officially identified as threatened in 2000.³⁴ At the time of this writing, all sawfish species are listed in Appendix I (species threatened with extinction, trade can only be permitted in exceptional circumstances), and all manta ray species are listed in Appendix II (species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival). The listing

of manta rays in Appendix II was decided during the 16th Conference of the Parties in 2013. This Conference of 2013 also decided to add five shark species in Appendix II³⁵ and conserved the already classified ones.³⁶ None are mentioned in Appendix III (species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade).³⁷ Biological and trade criteria determine classification in Appendix I or II,³⁸ while Appendix III can be unilaterally amended by a State.³⁹

CMS. The application of the Convention on the Conservation of Migratory Species (CMS) is also based on listings and concerns “the species that migrate across or outside national jurisdictional boundaries.”⁴⁰ Endangered species are listed in Appendix I, which implies that parties that are range states “to conserve and, where feasible and appropriate, restore habitats of those species...,”⁴¹ “to prevent, remove, compensate to minimize, as appropriate, the adverse effects of activities or obstacles that seriously impede or prevent the migration of the species,”⁴² and “to the extent feasible and appropriate, to prevent, reduce or control factors that are endangering or are likely to further endanger the species...”⁴³ These dispositions, as we can observe, give a certain margin for interpretation by the parties concerned. Appendix II is related to species with unfavorable conservation which require international agreements.⁴⁴ It is then possible for some species to be listed both in Appendix I and II.⁴⁵ Several species of sharks are mentioned in these two lists: for example white sharks and basking sharks are listed in Appendix I and II, while whale sharks, and dogfish sharks are listed in Appendix II only. A special agreement was signed in 2010—the “Memorandum of Understanding on the Conservation of Migratory Sharks” (CMS Sharks MOU) covers “any of the migratory species, subspecies or populations in the class Chondrichthyes included in Annex I of the MOU.”⁴⁶ In 2016, it concerns 29 species of sharks. It is a non-binding instrument, but very important for its material scope. Any state or organization exercising jurisdiction over any part of the range of migratory sharks can sign it. So can any state whose flag vessels engage in taking migratory sharks outside national jurisdictional limits.⁴⁷ There are currently 39 member states and two special entities members of the MOU.⁴⁸ Some of them, like the United States, are not parties to the CMS Convention. Others, such as France, are parties to the CMS but not to the Memorandum. MOU members first met in September 2012 and decided on a plan of action. The second meeting took place in San Jose, Costa Rica, where new measures were approved. The most important decision was the addition of 22 species of sharks and rays to Annex 1 of the MOU.⁴⁹ Parties also voted in favor of an annual voluntary contribution, to make the implementation of the MOU effective,⁵⁰ new rules of procedure, and some measures to properly organize the actions taken.⁵¹ The CMS secretariat became the permanent secretariat of the Sharks MOU, the Parties decided on a triennium program of work (2016–2018), focus was also put on the cooperation with Regional Seas Conventions and Actions Plans, Regional Fisheries Management Organizations, and fisheries-related organizations.⁵² A list of experts specialized in the conservation of sharks was appointed to support the work under the MOU.⁵³

CBD. The CBD was agreed upon in 1992 under the auspices of United Nations

and now includes 196 Parties.⁵⁴ The Cartagena Protocol on Biosafety (2000) and the Nagoya Protocol on Access and Benefit-Sharing (2014) complete the text.⁵⁵ It promotes the use of resources in terms of the environment⁵⁶; it recommends, for instance, the implementation of protected areas (as Marine Protected Areas—MPA).⁵⁷ Cooperation is organized between CBD programs and the United Nations Strategic Plan for Biodiversity (2011–2020). Various decisions and recommendations concern the elasmobranchs subclass. For instance, the presence of sharks is an important and frequent factor taken into account when considering the ecological criteria justifying the creation of an MPA.⁵⁸

THE INSTITUTIONAL SUPPORT AND THE PLANS OF ACTION

As already mentioned, the United Nations is a key organization in providing general conservation measures that concern sharks, through the UNCLOS and the CBD.⁵⁹

Including conservation of sharks in the laws regarding fisheries is fundamental, and the UN Food and Agriculture Organization (FAO) has such a cornerstone mission. Under the 1995 FAO Code of Conduct for Responsible Fisheries—a non-binding agreement that lists principles and international standards of behavior, of which one of the purposes is to facilitate the formulation of other legal instruments for conservation and management of fisheries—an International Plan of Action for the Conservation and Management of Sharks (IPOA Sharks) was decided in 1999.⁶⁰ It applies to all species of sharks, skates, rays and chimaeras, and also to all types of catches (directed, bycatch, commercial, recreational or others).⁶¹ It has a very large scope and concerns waters under its jurisdiction, but also international waters when flag vessels catch sharks. It encourages regulation and cooperation in all forms, as the implementation of National Plans of Action for the Conservation and Management of Sharks (NPOAS Sharks).⁶² It has come a long way since 1999, and the study published in 2012 underlines the progress of the IPOA implementation regarding the “26 top shark-fishing countries.”⁶³ A lot of policy efforts were institutionally developed, and regular evaluation and formulation of recommendations allowed substantial progress.⁶⁴

Also relevant is the very active concern of the International Union for Conservation of Nature (IUCN) regarding the protection of sharks. The well-known organization specialized in the conservation of biodiversity founded a special group named the Shark Specialist Group (SSG). This was motivated by the mention of several shark species in the “IUCN red list.” The SSG publishes scientific studies, as the one previously quoted that contains alarming information about the current situation of elasmobranchs.⁶⁵ The technical and legal support provided constitutes a real motor in the promotion of conservation and management of sharks, as the IUCN reports the benefit of wide recognition.

The IUCN is also a cooperation effort between international organizations and NGOs, whose role is essential. This general overview wouldn't be complete without mentioning the incredible efforts civil society has made to try to promote the protection of sharks, to enforce international conservation law, and to contribute to

giving them a better image with the public. They are too numerous to all be listed, but some of them certainly should be include Sea Shepherd,⁶⁶ Requins en peril,⁶⁷ and ASPAS.⁶⁸

The Regional Frameworks

Numerous regional plans of action for the conservation and management of sharks (RPOA-Sharks) have been created. The FAO website mentions, as an example, the UNEP/IUCN Action Plan for the Conservation of Chondrichthyes in the Mediterranean Sea (2003), the CPPS Regional Plan of Action for the Conservation of Sharks, Rays and Chimeras in the South East Pacific (2010), the shark finning ban by the Central American Integration System (SICA, 2012), the Central American Fisheries and Aquaculture Organization (OSPESCA) Regional Plan of Action on Shark Conservation (Plan de Acción Regional para la Ordenación Conservación de los Tiburones en Centroamérica—PAR-TIBURON, 2011), the Pacific Island RPOA (2009, a collaborative effort by the Pacific Island Forum Fisheries Agency, Secretariat of the Pacific Regional Environmental Programme, Secretariat of the Pacific Community and WCPFC), and the CSR and International Foundation for the Banc d'Arguin Sub-Regional Plan of Action on the Conservation and Sustainable Management of Shark Populations in West Africa.⁶⁹

Shark fisheries represent a great volume of the catch in Europe. According to the European Union, in the 2000s, the EU fleet took around 100,000 metric tonnes of sharks and related species each year, and shark meat entered the EU market.⁷⁰ Sharks are caught in the North Sea and in the North East Atlantic, near Norway and the Faroe Islands.⁷¹ The EU has its own plan of action, voted in by the commission in February 2009. It is based on the 1999 FAO IPOA Sharks and offers a framework for catch limits, as well as for the collection of data regarding shark populations, through different legislative and strategic measures.⁷² It also aims to strengthen control of the EU ban on shark finning as decided in the Council Regulation of 2003.⁷³ The plan requires the cooperation with other involved entities such as RFMOs.⁷⁴ The EU plan of action applies to fisheries located in Community waters, to waters covered by agreement or partnership between the Community and third countries, to international waters, and to waters covered by a Regional Fishery Management Organization (RFMO).⁷⁵

The measures fit into the international legal framework already mentioned, but some European conventions are applicable, such as the Bern Convention and the Barcelona Convention. The Bern Convention on the Conservation of European Wildlife and Natural Habitats is a legally binding agreement signed in 1979 under the auspices of the Council of Europe and entered into force into 1982, so it has a wider geographical scope than the EU plan of action. It even extends to some States of Africa.⁷⁶ Its aim is to protect nature, to conserve wild flora and fauna species and their habitats. Fifty countries, including four African States (Burkina Faso, Morocco, Senegal and Tunisia) and the European Union, have signed the Convention.⁷⁷ Their obligations are to promote conservation policies, to consider the environmental

impact of planning and development, to promote education and information in that field, to share practice and expertise on biodiversity management, to harmonize legislation on biodiversity protection, and to coordinate environmental research.⁷⁸ Several elasmobranchs species, such as basking sharks, are listed in Annex II of “strictly protected fauna species.”⁷⁹ Others, like blue sharks, are listed in Annex III of “protected fauna species.”⁸⁰ All forms of deliberate capture and keeping and deliberate killing of Annex II species are prohibited, including “the deliberate damage to or destruction of breeding or resting sites, the deliberate disturbance of wild fauna, particularly during the period of breeding, rearing and hibernation, in-so-far-as disturbance would be significant in relation to the objectives of this Convention, the deliberate destruction or taking of eggs from the wild or keeping these eggs even if empty, the possession of and internal trade in these animals, alive or dead, including stuffed animals....”⁸¹ Regarding species in Annex III, the “Contracting Parties shall prohibit the use of all indiscriminate means of capture and killing and the use of all means capable of causing local disappearance of, or serious disturbance to, populations of a species, and in particular, the means specified in Appendix IV.”⁸² Special dispositions for migratory species are set by for Article 10 of the Convention.

The Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (originally named the Barcelona Convention for the Protection Mediterranean Sea against pollution) has 22 members. Under the 1995 “Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean,” several shark species are listed in Annex II (species endangered or threatened)⁸³ and Annex III (species whose exploitation is regulated).⁸⁴

Other European texts of interest that should be mentioned include the OSPAR Convention for the Protection of the Marine Environment of the Northeast Atlantic,⁸⁵ the Helcom Convention on the Protection of the Marine Environment of the Baltic Sea,⁸⁶ and the Black Sea Convention on the Protection of the Black Sea.⁸⁷

Another essential way of protecting sharks is the body of quotas and measures decided through the Regional Fisheries Management Organizations (RFMOs). These are international organizations created by states that have fishing interests in a special maritime area; some have a mere advisory mission, but most of them can set limits to the catches, as well as controls, in order to guarantee the conservation of the fisheries stocks. Several RFMOs are involved with shark protection issues: the FAO lists the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the Commission for the Conservation of Southern Bluefin Tuna (CCSBT), the General Fisheries Commission for the Mediterranean (GFCM), the Inter-American Tropical Tuna Commission (IATTC), the International Commission for the Conservation of Atlantic Tunas (ICCAT), the Indian Ocean Tuna Commission (IOTC), the Northwest Atlantic Fisheries Organization (NAFO), the North East Atlantic Fisheries Commission (NEAFC), the Southeast Atlantic Fisheries Organization (SEAFO), and the Western and Central Pacific Fisheries Commission (WCPFC).⁸⁸ The coordination of shark protection measures through RFMOs is of great importance, because their scope of action is wide, and most of their decisions compulsory.

The National Frameworks

National plans of action (NPOAs), including national legislation, obviously represent an important level of enforcement of measures, even if they cannot be sufficient by themselves. They normally fit into regional and international programs and must be reported to the involved institutions. The previously quoted report published under FAO offers an interesting review of these national tools.⁸⁹ It is not within our scope to list them, and this would be impossible in the space available here, but some useful representative examples can be mentioned.

A member of several RFMOs (as the International Commission for the Conservation of Atlantic Tuna or the Inter-American Tropical Tuna Commission), the United States adopted a National Plan of Action and special regulations to protect sharks in 2001. The 1996 Magnuson-Stevens Fishery Conservation and Management Act (amended in 2006) is the main framework of shark management and conservation. Shark finning is prohibited⁹⁰ and measures of control and collection of data are specified in the Shark Conservation Act, the High Seas Driftnet Fishing Moratorium Act, the Endangered Species Act, and the National Marine Fisheries Service By-Catch Plan.⁹¹ The National Marine Fisheries Service Agency is in charge of the institutional aspects and fixing quotas.⁹²

Such types of initiatives and management can be found worldwide. For an Asian example, the 2011 National Plan of Action of the Republic of Korea is of interest. The country reports an average of 12,242 metric tonnes of sharks harvested every year (31,325 in the United States for a comparison) in the last decade. The plan refers to international legislation, and includes a commitment for biennial review.⁹³ Fisheries management is endorsed by the Ministry for Food, Agriculture, Forestry and Fisheries, based on the 2009 Fisheries Act and 2009 Fisheries Resources Management Act.⁹⁴ Finning is not prohibited in the EEZ, but endangered species are protected under CITES.⁹⁵

In Europe, the volume of shark catches is very high, even if they have been reduced due to the effect of the efforts in their regulation. According to FAO, in 2010, members of the European Union together, declared almost 130,000 tonnes harvested,⁹⁶ Spain being responsible for half of this volume, followed by France.⁹⁷ The data is important to understand the situation regarding La Réunion.⁹⁸ EU Member States are subject to the European legislation previously mentioned.⁹⁹

Critical Approach of the Legal Framework

Three main observations can be formulated to qualify the existing legal framework protecting sharks.

First, the existing regulation is far from sufficient. Such a statement can appear to be an exaggeration after going over the extensive list of international conventions, plans, regional and national actions. It is true that the international community has made some strong progress in the last decade, especially as the point of departure

was that regulation was almost non-existent. The vulnerability of sharks became public, and a wide range of measures was created. Interstate cooperation was promoted by the enormous economic actors at stake. However, many of these measures are not directly binding,¹⁰⁰ and, above all, have to be analyzed in the context of the alarming disappearance of the elasmobranchs. The fact, as previously mentioned, is that one-quarter of the 1,200 known species of this group of animals is in danger,¹⁰¹ and a massive mobilization for their protection is required. The scope of the existing legal framework is much narrower. It covers only a small portion of these endangered species. As an example, the CMS Sharks MOU concerns only 29 species, is not binding and includes “only” 39 Member States.¹⁰² Among the binding agreements mentioned earlier in this article, many are applied “late,” in the sense that they concern already extinct species.

Second, applicable law for the protection of sharks is especially fragmented. The multiplicity of sources is not only due to the different international, regional and national levels but also to different aspects of environmental law involved. The useful legal agreements deal with the law of the sea, fisheries management, protection of fauna, and migratory species. Some shark species can migrate thousands of miles,¹⁰³ others less, but the protection, to be efficient, always needs to be enforced in national waters, in the EEZs, and on the high seas. Different institutions (United Nations, FAO, IUCN, Regional Institutions, RFMOs, Secretariats of the different conventions, national agencies, etc.) have a key role in the collection of data and the efficiency of the regulation. This requires huge efforts in terms of coordination.¹⁰⁴

Finally, the level of enforcement of this legal framework is low. Issues regarding the enforcement of environmental law are not new, but they are particularly pronounced in this sphere. The fragmentation of regulations is one explanation, but not the only one. Some convention dispositions are too general and some dispositions are only recommendations. They require the governments’ efforts and collaboration. For instance, in 2009, the Oceana report underlined that that very few parties to the Barcelona Convention had implemented national measures to protect the sharks listed in the Barcelona Protocol or the Action Plan.¹⁰⁵ Studies also demonstrate that “Fisheries compliance is particularly difficult.”¹⁰⁶ It requires flag-state enforcement, and measures of control in the high seas.¹⁰⁷ Efficient enforcement of the protection of sharks is also dependent on the existence of tools to recognize the protected species. New technological instruments should offer better short-term solutions, as the iSharkFin, which is “an innovative new system that uses machine learning techniques to identify shark species from shark fin shapes.”¹⁰⁸ It works by uploading a photo of the shark fin to the internet and should soon be developed as a mobile application.

There is no doubt that the strong need for legislative and institutional cooperation has been recognized. Official initiatives and regulation increasingly mention the existence of a global framework. So do the resolutions of the General Assembly of the United Nations¹⁰⁹ or the European regulations.¹¹⁰ Some inter-institutional workshops are also being organized. The FAO/CITES/CMS workshops are a good example of these kinds of projects.¹¹¹ The whole mechanism would probably gain in

efficiency if collaboration could be managed in a unified structure. Some specialists pleaded for the creation of a special commission (International Commission for the Conservation and Management of Sharks) such as the one that exists concerning whales.¹¹² There is no such equivalent at the moment, but this option could permit a better level of enforcement, even if any improvement in that sense first relies on the state's will.

In this complex legal landscape, RFMOs are often appointed as important tools. They present the advantage, for most of them, of providing for binding and concrete measures, and are able to have a real impact on shark populations. That's why they are mentioned in the official texts, such as in the European regulations, the resolutions of the General Assembly of the United Nations,¹¹³ or the CITES Conference of Parties Resolution.¹¹⁴ It is important to insist on the key role they have, and how their action could be improved through the strengthening of their structure, their participation in agreements, and the use and share of good practices and management tools.¹¹⁵

The Questionable Legality of the French “Shark Control Program” in La Réunion

Sharks have been suffering from a negative image for a very long time. They appear to the public as dangerous, and this reputation as predators doesn't help them in the fight for their protection. NGOs specialized in the defense of sharks have done very important work in order to recall the truth: sharks are in danger because of human activity; humans are not in danger because of sharks. Elasmobranches' disappearance is a massive phenomenon, while attacks on humans by sharks can be considered exceptional cases. For that reason, studies dedicated to environmental considerations don't mention any risk induced by the presence of sharks, nor the measures governments are taking to try to keep sharks away from the coasts. However, several countries, such as Australia, South Africa, or France (in La Réunion), have adopted “shark control programs.” These measures must be connected with environmental considerations, first, because climate change and pollution have an influence on shark behavior and can, at least partly, explain the rise of attacks in some areas. Second, because states must consider their legal obligations when they take such measures.

The Impact of Environment on Shark Behavior

According to different sources, attacks by sharks have slightly risen in the world in the last few years.¹¹⁶ From a few attacks in the beginning of the 80s, we have reached one hundred annual attacks since 2000, 10 of them being fatal.¹¹⁷ Three main international files offer some data regarding shark attacks: the Shark Attack Survivors,¹¹⁸ the International Shark Attack File (ISAF),¹¹⁹ and the Global Shark Attack File (GSAF)¹²⁰—none of them being official or exhaustive. However, these numbers

must be read while keeping in mind that the attacks are probably much more easily reported nowadays, that the world population has significantly risen since the 80s (more than threefold), and that the number of nautical sports and swimmers has multiplied, too. At the same time, the population of sharks has considerably diminished.

Among the worldwide panorama, La Réunion appears as a “hotspot” for shark attacks. Since 1980, this small territory in the Indian Ocean is overrepresented in terms of the numbers of attacks. The frequency of attacks and their rate of mortality once compared with the population and area sets the island ahead of places as Florida, Hawaii or Australia.¹²¹ In recent years, most of the attacks occurred in a marine reserve, on the west side of the island, along a 40-kilometer portion of the coastline. La Réunion is a French overseas territory of 2,512 square meters, located in the Indian Ocean, near Madagascar, and has about 840,000 inhabitants who live mostly on the west coast of the island. Sharks have been present near the west coast for a very long time, but a higher concentration of attacks began to be reported in the 1980s. In 1997, the French Institute for the Exploitation of the Sea (IFREMER) published a longitudinal study in which it recommended the adoption of a prevention program, including the implementation of several physical barriers, in order to avert shark attacks. Despite the study, such measures were not adopted. In 2011 there began what has come to be known as the “shark crisis” by the official institutions, with “an exceptional concentration of attacks in the west part of the island.”¹²² Between 2011 and 2015, there were 21 shark attacks, including seven fatal ones. The public was highly startled by the deaths of swimmers, which included teenagers. Above the human tragedy, the media coverage of the attacks had a very strong impact on the island economy, which has a substantial basis in tourism and ocean sports like surfing.¹²³ The magnitude of the phenomenon required the reaction of the authorities to protect the population.¹²⁴ It appeared that the sharks involved in the attacks were almost always bull sharks and perhaps tiger sharks in a few of them. To get more data, a global scientific study of the bull shark and tiger shark’s behavior was undertaken by the Research Institute for Development within the program “CHARC” between 2011 and 2014 and was published in April 2015.¹²⁵

Several explanations were advanced to try to explain this incredible rise of attacks. It is still not possible to give a singular answer, and it is true that aquatic activity has considerably increased on the island. However, many sources appoint environmental causes as an explanation. The creation of a marine reserve—officially inaugurated in 2007 to fight against environmental degradation¹²⁶—on the west coast has frequently been denounced, as it would constitute a great reserve of food for sharks.¹²⁷ According to specialists, the reserve does not explain it all. The impact of pollution, climate change, and overfishing has been pointed out as other major causes.¹²⁸ The consequence of excessive fishing results in insufficient presence of predators of juvenile bull sharks.¹²⁹ Bull sharks are responsible for most of the near-shore attacks in the world. They have the particularity of osmoregulation; which means they can survive both in salt and fresh water. That explains why bull sharks can be found in rivers several hundreds of kilometers away from the coast.¹³⁰ They

particularly suffer from the consequences of pollution and global warming, which modifies the feeding behavior of sharks.¹³¹ According to the ICUN red list on bull sharks, “(t)he location of nursery areas in estuarine and freshwater systems makes the species vulnerable to pollution and habitat modification.”¹³² The IRD report of April 2015 also reports that the west part of the island is an area of reproduction for the bull sharks, above all between March and June.¹³³ These considerations demonstrate that an appropriate plan of action cannot ignore protection of the environment and global ecosystem management must be a necessity.

The French Interministerial Shark Control Program

To face this atypical situation, the French government decided to create a “special plan for prevention of the shark risk,”¹³⁴ which relies on different structures and measures.

THE CREATION OF THE PLAN AND ITS INSTITUTIONAL FRAMEWORK

From the collaboration between government and local authorities a plan was brought forth against the shark crisis, and was officially announced in July 2013.¹³⁵ It was the result of an interministerial mission dedicated to the issue raised by the rise in shark attacks, and was signed by the Minister of Ecology, Sustainable Development and Energy, the Minister of the Overseas Territories, the Minister of Sport for Youth, Popular Education and Associative Life, and the Minister delegated to Transport, Sea, and Fisheries.¹³⁶ The objectives that had already been identified—scientific knowledge of the coastal sharks of La Réunion, reinforcement of conveying the information to the population, reinforcement of alarm operational management, and guidance of the most vulnerable aquatic activities—were conserved. The plan added four main directives: “the operational prevention through innovative technologies and study of the need for evolution in the regulation of aquatic activities,” “evaluation of the surveillance stance and professionalization of the involved agents,” “improvement of the knowledge of the shark population and the risk for people,” and “reasoned management of the fisheries stocks connected to the Marine Reserve.”¹³⁷ To enable the enforcement of the plan, a fund of one million Euros each year for the period 2015–2020 has been allocated to the collection of data, the measures of prevention and securitization, as well as the support for tourism in La Réunion.¹³⁸

The fulfillment of such directives requires the collaboration of the State, the region, local authorities, academic and scientific communities, as well as local associations. Two local steering committees about the shark crisis had already been created before the official creation of the plan: the C4R and the C04R. The C4R (Réunion’s Committee for the reduction of the shark risk) was established in 2012 by Prefectural Order to gather the main actors interested in the plan of action, and to discuss the strategic orientations and the effects of the measures taken. It is presided over by the prefect, and its members are representatives of state services, rescue services, territorial collectivities, sea users, the scientific community, associ-

ations and qualified leaders.¹³⁹ The C04R is an operational unit for the reduction of the shark risk created in September 2012, headed by the local authority of Saint Paul. The field actors meet twice a month under this structure to share technical information.¹⁴⁰

Despite this important institutional structure, it appeared that more information was needed about scientific and technical issues. In April 2016, an Association for the Centre for Resources and Support on the Shark Risk was created by a constitutive general assembly.¹⁴¹ In the framework of the National Plan of Action, this partnership between State, Region, the University of La Réunion, and five littoral municipalities of the west coast of the island, aims to offer a consultation and collaboration space for all the members, including tourism and surf professionals.¹⁴²

It appears then that massive financial and administrative efforts were displayed to manage this crisis. Maybe it should not be surprising in such a society turned toward security issues. The multiplication of tools supposes efficiency, but only with good coordination between the different structures—some of them seem to have at least partly similar missions—and the various geographical scales—municipality, region, state—involved. They all tend to ensure the establishment of concrete measures.

THE MEASURES OF REDUCTION OF THE SHARK RISK

Since the beginning of the shark crisis, a large range of measures were taken. Different regulatory decisions were published in order to deal with the crisis. In a first instance, when the situation became critical, water activities were prohibited, until a prefectural decision of February 2015 allowed municipal authorities to permit their restart in the ZONEX¹⁴³ (special zones of operational experimentation, where some nets were installed).¹⁴⁴ Six plans of action can be seen as the crux of the Shark Control Program. They are listed in accordance their spatial position from land to sea.¹⁴⁵ The first measure is the surveillance of bathing zones by lifeguards and rescuers. The second is the creation of some bathing areas protected by drumlines and shark nets. The third is underwater surveillance performed by divers in the water column. The fourth and fifth ones are respectively based on prevention and notification of sea users by agents present near the seaside on speed boats, and the installation of a system of listening stations in order to track the marked sharks. The last one is part of the program “Cap Requins” consisting of the preventive marking of sharks and the selective capture of the species involved in the attacks (bull sharks and tiger sharks) to limit the population of the “dangerous” sharks near the coast. It is based on drumlines and bottom longline fishing. Different scientific studies were completed to design these measures,¹⁴⁶ and the research is on-going, through cooperation with the University of La Réunion and scientific agencies as IFREMER.

Therefore, these measures can be divided into the ones that are non-invasive for the environment, as the non-invasive techniques of surveillance, and measures that are invasive and potentially damaging to the environment. The latter are obviously the ones generating legal issues. For that reason, their efficiency and their conformity with the law must be discussed.

The legal aspects of measures invasive for the environment concern at the same time internal, European and international frameworks. The very specific issue of liability between the different public entities according to French law will be here left out, as it is not the point of this article.¹⁴⁷ Globally, the question of the legality of the Plan of Action cannot receive a simple answer. A difficult balance must be reached between considerations of security for persons and the preservation of the environment. In its ordinance of 13 August 2013, the French Council of State (the supreme administrative Court), admitted the emergency of the shark crisis and the deficiency of the administrative authority in taking appropriate measures on the basis of the fundamental right to life consecrated in Article 2 of the European Convention for the Protection of Human Rights and Fundamental Freedom.¹⁴⁸ There was no doubt that, regarding the tragic consequences of the numerous shark attacks, the protection of people was a necessity. There was an obligation to address the crisis and to inform people about it, even if it was not possible to completely eradicate it. On the other hand, considerations about the environment cannot be ignored, and legal obligations also exist regarding its protection. Furthermore, as we have explained, the negative impact on the environment can—at least partly—explain the occurrence of the attacks. The question is about the impact of the captures and the installations on the shark populations and other species. Several observations can be formulated to address this issue.

First, the national plan of action in La Réunion allows selective capture, as part of the program “Cap Requins 2,” of bull sharks and tiger sharks,¹⁴⁹ and that was a controversial point, including in the Marine Reserve. Several associations submitted the prefectural decision of 13 August 2012 for judicial review, arguing that these measures were illegal. In the decision of 30 July 2013, the Administrative Tribunal of Saint-Denis canceled the prefectural decision on the basis that capture of bull sharks and tiger sharks could not be authorized, for reasons different than scientific ones, in the marine reserve.¹⁵⁰ The “Council of State” ordinance of 13 August 2013¹⁵¹ mentions that the capture of sharks considered dangerous is a possibility, but specifies that, according to international studies, this could only be effective on sedentary species. As a matter of fact, this kind of measure did not demonstrate any effectiveness according to environmental associations and academic studies.¹⁵² At the same time, it is defended as effective by associations of prevention for sea users’ safety.¹⁵³ A recent decision of May 2016 of the Administrative Tribunal of Saint-Denis, Capital of La Réunion, suspended the permission of capture and the installation of new drumlines, as the Scientific Council of the Marine Reserve had not been consulted by the prefect decision despite the emergency of the environmental impact it could have.¹⁵⁴ Even if the program Cap Requins was then suspended, captures were ongoing, as illustrated by the capture of two tiger sharks in the Saint-Paul Bay on the 1st and 2nd of June 2016. The captures are numerous—thirteen bull sharks and twelve tiger sharks were caught between August and November 2015.¹⁵⁵

Bull sharks and tiger sharks are not listed as species in danger by the binding

conventions and do not benefit from special measures. They do, however, figure on the red list of IUCN as “near threatened.”¹⁵⁶ Their populations are declining, and the existing shark control programs regarding these species did not demonstrate significant results.¹⁵⁷ In the assessment of the balance between risk and protection of the environment, the principle of precaution could be usefully invoked here,¹⁵⁸ regarding the quantity of scientific material on the disappearance of shark populations, its consequences on the global oceanic system, and the lack of certainty about the results of such programs of capture.¹⁵⁹ Recall that UN recommendations push states to “apply the precautionary approach and ecosystem approaches in adopting and implementing conservation and management measures addressing, among other things, bycatch, pollution and overfishing, and protecting habitats of specific concern, taking into account existing guidelines developed by the Food and Agriculture Organization of the United Nations.”¹⁶⁰

Moreover, the operations of fishing and capture can lead to the catch of protected species. As an example, a great white shark was caught and killed in La Réunion in October 2015, although the species is protected under both CITES and the Bonn Conventions.¹⁶¹ Officially, the techniques used (“smart drumlines” and longline fishing) are supposed to allow the selective capture of the only bull shark and tiger shark species, and the systematic release of protected species.¹⁶² Nevertheless, such incidents tend to plead against the lawfulness of these allowances.

Second, the installation of shark nets initiated by the shark control is also very controversial. Such physical barriers were already established in other tropical areas like Hong Kong, South Africa and Australia. Their purpose is to try to separate sharks from swimmers, and to catch species identified as “dangerous.” Here again, there is a question of balance between efficiency and environmental impact, but it also has to be put in perspective with the very high economic cost of the system.

The efficiency of these installations is highly disputed. The French Shark Control Program was based on comparative studies and the other “hot spots” experiences, as the South African Program. The Natal Sharks Board of South Africa considers the nets to have been very efficient.¹⁶³ However, regarding various scientific studies, it seems that the effects of the nets on bathers’ security are difficult to evaluate and uncertain,¹⁶⁴ especially because of the damage the nets suffer due to tough climatic conditions. Even if their efficiency can be criticized, assuming that they can be frequently checked, they do constitute a barrier and offer the advantage of calming public fears. However, they cannot, in any case, be installed as a magic bullet solution, as it is impossible to net the entire coast, and they are often located before the zone where the waves break. That is why they can, in a certain measure, protect swimmers, but much less surfers and other aquatic sports practitioners. Case in point, in 2015, there was a rise of shark attacks on the north coast of Australia (13) where shark nets are installed.¹⁶⁵

The impact of shark nets on other species is also difficult to evaluate but is increasingly being denounced. The 1997 IFREMER study on measures to limit shark risks underlined their high cost and the negative impact on other species.¹⁶⁶ A recent and interesting academic study on “the impact of the Queensland Shark Control

Program on local populations of threatened shark species” between 1962 and 2014 gives some clue.¹⁶⁷ Australia is one of many countries that has Shark Control Programs (SCPs). In Queensland, a series of 369 drumlines and 30 shark nets are used in different popular beaches to target “dangerous” sharks.¹⁶⁸ The study points out the inefficiency of the system and the damage caused to the environment,¹⁶⁹ even if it mentions the existence of a new, less invasive system.¹⁷⁰ The fact that other species of animals, including protected ones such as some turtles, are being caught in the nets raises serious issues, including their conformity with the international legal framework prohibiting such catches.¹⁷¹ It seems that no tribunal had to deal with this delicate issue, but many associations regularly denounce such breaching of the environmental obligations of states. Many have started to ask their governments to remove these nets, for the tragic impact they have on marine life. A press article in Australia recently stated that “it’s time to acknowledge they don’t work, and instead do much harm to other marine species.”¹⁷² Some official voices have started to make themselves heard. For instance, the Australian New South Wales Primary Industries Minister declared in February 2016 that “the shark nets along the east coast of Australia cannot be rolled out elsewhere as they breach Commonwealth environmental laws.”¹⁷³ Sue Higginson, from the Environmental Defender’s Office, commented this declaration about “drumlines, whether they be smart or traditional, and nets in particular,” and said that “the evidence suggests that they are having a significant impact on those marine species that we have legal obligations to protect.”¹⁷⁴

While shark nets are controversial in other parts of the world, it is surprising to observe their recent installation in La Réunion. It is important to underline that the state-of-the-art technology nets are supposed to cause less damage to the environment, as they use modern material and a mesh width that allows other marine species to swim through without being trapped.¹⁷⁵ It is, however, difficult to find appropriate information on the nets installed on the west coast of La Réunion, as official publications offer little data. According to the press dossier that public authorities edited in February 2016, the nets were installed by the firm Seanergy OI, and are made of a 12-millimeter polysteel meshing.¹⁷⁶ The local press reported that the installations at Roches Noires and Boucant Canot, which are as long as 120 Olympic swimming pools, would have cost more than 4 million Euros,¹⁷⁷ and they would have to soon be replaced because of the damage suffered from extreme meteorological conditions.¹⁷⁸ However, it is impossible to obtain reports of all species, including protected ones, caught in the nets, and then to properly evaluate the impact on the marine fauna.¹⁷⁹ Although the installations use recent technology, it can be induced from the studies concerning other Shark Control Programs¹⁸⁰ that there is a risk for other species. The catch of protected species is prohibited by legally binding agreements. France is a party to UNCLOS, CITES, CBD, CMS and some other Regional Instruments as the Barcelona Convention.¹⁸¹ The island is also an Ultra-Peripheral Region according to Article 349 and 355 TFEU, where EU Regulation applies, but eventually with some adaptations.¹⁸² The conformity with environmental law requires at least a strict and transparent evaluation of the impact of the nets installed in La Réunion into the mark of the Shark Control Program.

Conclusion

The international community is slowly becoming conscious of the alarming disappearance of the elasmobranchs species, of the terrible consequences for the ecosystem, and of the potentially disastrous economic impact for many countries. Particularly vulnerable, sharks and rays are victims of overfishing, finning, bycatch and pollution. A growing number of shark species benefit from special status under various international and regional conventions, but that protection is still not enough to address the situation. Governmental efforts need to be displayed to improve existing regulations, to coordinate them, and to improve their enforcement. In that sense, RFMOs play a key role. So do others actors, including regional organizations such as the European Union.

The phrase “shark crisis” can appear inappropriate when so many efforts have been made for years to fight against the negative image of the shark populations and we should recall that they are the ones in danger, by addressing both aspects of sharks protection and attack prevention. However, the existence of Shark Control Programs to secure swimmers and aquatic sports practitioners raises important legal issues. The slight rise of shark attacks in the world, and their concentration in some areas, such as the French island of La Réunion, can at least partly be explained by environmental aspects, degradation of shark habitats, pollution, and global warming. For that reason, management of the uneasy balance between security and protection of the environment, to offer a long-term solution, needs to be focused on environmental considerations.

The invasive environmental measures adopted into Shark Control Programs, including the different methods of “selective” capture and the installation of drumlines and nets, as a comparative overview demonstrates, cannot totally guarantee security and have a negative impact on marine life. The capture of other species, such as protected sharks or protected turtles, is a breach of international law. Even if the recent Shark Control Program of La Réunion uses drumlines and nets of the newest technology, the question of its legality regarding international and European law must be raised. Various aspects do not comply with actual environmental regulation, and some measures ignore the necessary precautionary approach. Non-invasive solutions, such as control by drones, must be prioritized, capture of sharks should be forbidden or at least strictly limited, and the environmental impact of recent drumlines and nets, especially on protected species, should be evaluated through independent and transparent processes.

Notes

1. Emanuella Ginberg and Vasco Cotovio, “Surfer Mick Fanning Escapes Shark Attack,” 19 July 2016: <http://edition.cnn.com/2015/07/19/world/shark-attack-wsl-mick-fanning-feat/>. All the websites mentioned in this article were consulted in May 2016, unless otherwise noted.

2. Seashpherd.org, brochure 2009.

3. Boris Worm, “Global Catches, Exploitation Rates, and Rebuilding Options for Sharks,” *Marine Policy* 40 (2013), p. 197. The Convention on Migratory Species website affirms that between 63 and 273 million sharks are killed each year: www.cms.int.

4. A. Herdon, "The Case for an International Commission for the Conservation and Management of Sharks (ICCMS)," *Marine Policy* 34 (2010), p. 1239. <https://doi.org/10.1016/j.marpol.2010.05.001>.
5. "A Quarter of Sharks and Rays Threatened with Extinction," *News Story*, 21 January 2014.
6. *Ibid.*
7. FAO, *Report of the FAO/CITES Workshop to Review the Application and Effectiveness of International Regulatory Measures for the Conservation and Sustainable Use of Elasmobranchs*. Genazzano, Italy, 19–23 July 2010.
8. FAO Fisheries and Aquaculture Report. No. 984. Rome, FAO. 2012, p. 1.
9. *Ibid.*
10. C.R. Funk, "Sharks on the Precipice of Extinction: A Proposal for National and International Management of Sharks," *Willamette Journal of International Law and Dispute Resolution* 20 (2012), p. 106.
11. *Ibid.*
12. CMS, Memorandum of Understanding on the Conservation of Migratory Sharks (Sharks MOU), Fact sheet, www.cms.int/sharks.
13. The study is the result of the collaboration of 302 experts from 64 countries. It includes the analysis of the conservation status of 1,041 shark, ray and closely-related chimaera species. Nicholas K. Dulvy et al. "Extinction Risk and Conservation of the World's Sharks and Rays," *Elife* 3 (2014): e00590. <https://doi.org/10.7554/elife.00590>. The main results of the study can be read in the following document: IUCN Red List Assessment Results, *Extinction Risk & Conservation of the World's Sharks and Rays, Analysis from the IUCN Shark Specialist Group*, January 2014, available on the IUCN website.
14. CMS, Memorandum of Understanding on the Conservation of Migratory Sharks (Sharks MOU), Fact sheet, www.cms.int/sharks; Quoting Dulvy et al. (2014).
15. Dulvy et al. (2014).
16. *Ibid.*
17. *Ibid.* The most threatened families are sawfishes, angel sharks, wedgefishes, sleeper rays, whiptail stingrays, guitarfishes, and thresher sharks.
18. *Ibid.*
19. *Ibid.*
20. *Ibid.*
21. *Ibid.*
22. CMS, factsheet, *op. cit.*; quoting Boris Worm et al. "Global Catches, Exploitation Rates, and Rebuilding Options for Sharks." *Marine Policy* 40 (2013), pp. 194–204. <https://doi.org/10.1016/j.marpol.2012.12.034>.
23. *Ibid.*
24. Jennifer C.A. Pistevo, Ivan Nagelkerken, Tullio Rossi, Maxime Olmos, and Sean D. Connell, "Ocean Acidification and Global Warming Impair Shark Hunting Behaviour and Growth," *Scientific Reports*, 2015; 5: 16293, quoted by www.sciencedaily.com/releases/2015/11/151112055246.htm. <https://doi.org/10.1038/srep16293>.
25. S. Fowler, "The Conservation of Migratory Sharks and Rays," *Save Our Seas*, Presentation of CMS MOS2, Costa Rica, 15 February 2016, p. 1.
26. *Ibid.* For a complete explanation, see E. Griffin, K.L. Miller, B. Freitas and M. Hirshfield, *Predators as Prey: Why Healthy Oceans Need Sharks* Griffin, July 2008, Oceana, p. 16.
27. *Ibid.*, p. 2. Figures are given in U.S. dollars. See also the publications and statements of the Organization "Divers for Sharks," a global coalition of more than 15,000 diving businesses, professional, and recreational divers concerned with the conservation of sharks and rays "to protect jobs and revenue generated by shark and ray watching and these animals' role in maintaining a healthy marine ecosystem," for instance: CBD document, <https://www.cbd.int/cop/cop-12/cop12/vtable/d4s-sharks-en.pdf>.
28. CMS Convention, preamble.
29. See article 61 UNCLOS for conservation of living resources in the Exclusive Economic Zone.
30. See article 118 UNCLOS.

31. *Supra*.
32. Website of the Convention: <https://cites.org/eng/disc/what.php>, accessed November 25, 2016.
33. *Ibid*.
34. J. Fischer, K. Erikstein, B. D’Offay, S. Guggisberg and M. Barone, *Review of the Implementation of the International Plan of Action for the Conservation and Management of Sharks*. FAO Fisheries and Aquaculture Circular No. 1076. Rome: FAO, 2012, p. 4.
35. Oceanic whitetip shark, porbeagle shark, scalloped hammerhead shark, smooth hammerhead shark and great hammerhead shark.
36. Basking shark, whale shark, great white shark.
37. CITES Convention website: <https://cites.org/eng/disc/how.php>.
38. CITES Resolution Conf. 9.24 (Rev. CoP16). The Conference of Parties Resolutions can be downloaded on the Convention website, *op. cit*.
39. One State can ask the other Parties for assistance in controlling the trade.
40. CMS Convention, preamble.
41. CMS Convention, Article III.4.a.
42. CMS Convention, Article III.4.b.
43. CMS Convention, Article III.4.c.
44. CMS Convention, Article IV.1.
45. CMS Convention, Article IV.2.
46. CMS/Sharks/MOS2/Inf.2.
47. CMS MOU Sharks §3.
48. CMS/Sharks/MOS2/Inf.2.
49. CMS/Sharks/MOS2/Decisions. Rev.2.
50. CMS MOU Sharks, §15 as amended in the 2016 version.
51. CMS/Sharks/MOS2/Decisions. Rev.2.
52. *Ibid*. See *infra*.
53. *Ibid*.
54. www.cbd.int.
55. www.cbd.int.
56. CBD Convention, Article 3.
57. CBD Convention, Article 8.
58. See CBD Document, “Decisions Adopted by the Conference of the Parties to the Convention on Biological Diversity at Its Eleventh Meeting (Hyderabad, India, 8–19 October 2012),” UNEP/CBD/COP/11/35, p. 173; and “Decisions Adopted by the Conference of the Parties to the Convention on Biological Diversity at Its Twelfth Meeting,” UNEP/CBD/COP/12/29, p. 119.
59. See UNGA A/RES/63/112.
60. Fischer et al. (2012), p. 1. Other agreements were voted in the FAO Framework as The 1993 FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (Compliance Agreement) (partly similar to the UNFSA), and the The 2009 FAO Port State Measures Agreement (PSMA) to fight against illegal fishing.
61. *Ibid*.
62. *Ibid*. The 2000 Technical Guidelines on the Conservation and Management of Shark can help the States in implementing such measures.
63. *Ibid*.
64. Several CITES-FAO-CMS workshops were organized, for instance: FAO, *Report of the FAO/CITES Workshop to Review the Application and Effectiveness of International Regulatory Measures for the Conservation and Sustainable Use of Elasmobranchs*. Genazzano, Italy, 19–23 July 2010. FAO Fisheries and Aquaculture Report. No. 984. Rome, FAO. 2012.
65. Dulvy et al. (2014).
66. www.seashepherd.org.
67. www.requinsenperil.com.
68. ASPAS: Association pour la Protection des Animaux Sauvages, www.aspas-nature.org., accessed 26 November 2016.
69. Organisation des Nations Unies pour l’alimentation et l’agriculture, <http://www.fao.org/ipoa-sharks/national-and-regional-plans-of-action/fr/>, accessed 26 November 2016.

70. EU press release, February 2009: http://europa.eu/rapid/press-release_MEMO-09-52_en.htm?locale=en.
71. *Ibid.*
72. See Communication from the Commission to the European Parliament and the Council of 5 February 2009 on a European Community Action Plan for the Conservation and Management of Sharks (COM, 2009) 40 final; and for instance Council Regulation (EC) No. 199/2008 establishing a community framework for the collection, management and use of data in the fisheries sector, which covers sharks issues.
73. Council Regulation (EC) No. 1185/2003 of 26 June 2003 on the removal of fins of sharks on board vessels.
74. *Infra.*
75. Communication from the Commission to the European Parliament and the Council of 5 February 2009 on a European Community Action Plan for the Conservation and Management of Sharks (COM, 2009) 40 final.
76. See the Convention website: <http://www.coe.int/en/web/bern-convention>.
77. *Ibid.*
78. Bern Convention, article 3: <http://chm.nature.cz/en/other-biodiversity-relating-international-commitments/bern-convention/about-the-convention/>.
79. Annex II to the Bern Convention: <https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=0900001680304355>.
80. Annex III to the Bern Convention: <https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=0900001680304355>.
81. Bern Convention, Article 6.
82. *Ibid.*, Article 8.
83. Annex II as amended in 2013: http://www.rac-spa.org/sites/default/files/annex/annex_2_en_2013.pdf. See also Oceana, *Keeping the Balance: How Environmental Conventions Can Be Used to Protect Sharks and Their Habitats*, 2009, p. 12.
84. Annex III as amended in 2013: http://www.rac-spa.org/sites/default/files/annex/annex_3_en_2013.pdf.
85. <http://www.ospar.org/convention>.
86. http://helcom.fi/Documents/About%20us/Convention%20and%20commitments/Helsinki%20Convention/1992_Convention_1108.pdf.
87. http://www.blacksea-commission.org/_convention.asp. For more details on these three conventions, see Oceana, *Keeping the Balance: How Environmental Conventions Can Be Used to Protect Sharks and Their Habitats*, 2009, p. 12.
88. <http://www.fao.org/ipoa-sharks/regional-sharks-measures/en/>.
89. Fischer et al. (2012).
90. U.S. Shark Finning Prohibition Act.
91. FAO report, *op. cit.*, p. 22.
92. *Ibid.* For details on the U.S. legislation, see C.R. Funk, "Sharks on the Precipice of Extinction: A Proposal for National and International Management of Sharks (Bridging Governments: The Role of International Law in State Government)," *Willamette Journal of International Law and Dispute Resolution* 20 (2012), p. 113.
93. FAO report, p. 40.
94. *Ibid.*
95. *Ibid.*
96. *Ibid.*, p. 61.
97. *Ibid.*
98. *Infra.*
99. *Supra.*
100. *Infra.*
101. *Supra.*
102. *Supra.*
103. For the example of the great white shark, see the Stanford University Report of January 9, 2002, <http://news.stanford.edu/news/2002/january9/sharks-19.html>, accessed 26 November 2016.

104. *Infra*.
105. Oceana, *Keeping the Balance, How Environmental Conventions Can Be Used to Protect Sharks and Their Habitats*, 2009, p. 13.
106. S. van Osch, "Save Our Sharks: Using International Fisheries Law within Regional Fisheries Management Organizations to Improve Shark Conservation," *Michigan Journal of International Law* 33 (2012), p. 417.
107. *Ibid.*, p. 417ff.
108. Food and Agriculture Organization of the United Nations, www.fao.org/fishery/ipoa-sharks/isharkfin, accessed November 2016.
109. For instance, paragraph 157 of UNGA Res. A/RES/67/79 encourages states' action through RFMOs.
110. For instance, EU Parliament and Council Regulation No. 1185/2003 on the removal of fins of sharks on board vessels insisting on RFMOs.
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144. There is a bathing net in "Étang Salé," and two others in the beaches called "Boucant-Canot" and "Roches Noires." *Infra*.

145. See the illustrative representation of the measures in the already quoted General Assembly decision creating the Association for the Centre on Resources and Support on Shark Risk: <http://www.info-requin.re/IMG/pdf/AG042016.pdf>.

146. Such as the CHARC Program already mentioned.

147. On this important point in French law, see C.E., Juge des référés, 13 août 2013, Ministre de l'intérieur c/Commune de Saint-Leu, no. 370902; L. Peyren, "Le Risque requin, le droit et la société: Scolies sur l'encadrement d'un risque naturel," *Droit administratif* no. 1, January 2016, étude 2; and also a recent parliamentary question of March 2016: QST-AN-14-31105QE.

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149. Arrêté préfectoral no. 1226 du 13 août 2012 Autorisant des opérations de marquage et de prélèvement de requins, et portant interdiction temporaire de la navigation maritime, de la plongée sous marine, de la baignade, des activités nautiques et de pêche dans les eaux maritimes bordant le littoral de la Réunion; Arrêté préfectoral du 16 février 2016 portant réglementation de la pêche.

150. T.A. Saint-Denis, 30 July 2013, Association Sea Shepherd, Association citoyenne de Saint-Pierre et Association pour la protection des animaux sauvages c/ Préfet de La Réunion, no. 1200778.

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158. The international principle is also consecrated in Article 191 TFUE and in the Article 5 of the French Charter on Environment.

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