



Republic of Mauritius

NATIONAL PLAN OF ACTION FOR THE CONSERVATION AND MANAGEMENT OF SHARKS (NPOA-Sharks, Mauritius)



**Ministry of Ocean Economy, Marine
Resources, Fisheries, Shipping and Outer Islands**

February 2015

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Executive Summary

Concerns about the declines in populations of many of the species of sharks and rays (Chondrichthyans), allied to their low fecundity have led to the adoption of an International Plan of Action for sharks through the FAO CCRF process. Implementation of the IPOA is to be effective at the national level through National Plans of Action. The objective of both the IPOA and the NPOA are to ensure the conservation and management of sharks and their long-term sustainable use.

Despite its maritime zones of 2.3 million kilometres square, Mauritius has no fisheries targeting sharks and the shark bycatch from domestic fisheries is negligible. However, Port Louis harbour is the main hub for longliner transshipments in the western Indian Ocean, with close to 700 port calls yearly. In addition, Mauritius licences a number of foreign fishing vessels to fish in the EEZ. The number of Asian longliners landing sharks fins in Port Louis has declined following the adoption of measures by Taiwan obliging their fishing vessels to keep sharks carcasses with the fins attached. Most of the shark fin exports through Mauritius are therefore from EU longliners. In Mauritius, 54 species of Chondrichthyans have been reported.

The IOTC has adopted a number of Resolutions concerning sharks. Mauritius needs to make changes in its fisheries legislation to meet the obligations created by IOTC resolutions and other instruments to which Mauritius is a party. The measures taken by IOTC also need to be improved. A major constraint also exists in the identification of sharks and particularly of the fins if they have been detached from the carcasses. Finally, the statistical system used by the Fisheries Department needs to be improved with needed security and functionality.

The NPOA, therefore, concentrates on actions needed to exercise influence on foreign fishing through the IOTC process and licence conditions, as well as improving the national legislation and the skills and data handling systems available for managing fisheries.

Summary of Actions

Action	Priority	Responsibility
• Decrease fishing effort in any fishery where shark catch is unsustainable		
1. Phase out “large nets” used in the coastal fishery from the list of authorised fishing gears.	Medium term	MOEMRFSOI
2. Present draft Recommendation to the IOTC afresh, calling for the use of nylon leaders on longlines for those fleets that do not target sharks.	Short term	MOEMRFSOI
3. Present draft Recommendation to the IOTC calling for rapid implementation of techniques aimed at releasing sharks unharmed.	Short term	MOEMRFSOI

Action	Priority	Responsibility
4. Support research into the (cost-effective) options to reduce or eliminate damage to netting aquaculture enclosures by sharks.	Short term	MOEMRFSOI; (AFRC); Industry
• Improve data collection and monitoring of shark fisheries		
1. Modify catch-recording sheets; train vessel crews in identification of sharks; ensure that correct records are collected.	Short to medium term	MOEMRFSOI; IOTC; Industry
2. Introduce an integrated referential database system to record Mauritian fisheries statistics; verify and integrate historical records and train staff in its use.	Short to medium term	MOEMRFSOI; Industry
• Train all concerned in identification of shark species		
1. Develop a field identification guide for coastal and demersal sharks and train staff in species identification to permit collection of statistics of shark catches at the species level for the small-scale sector by enumerators.	Medium term	MOEMRFSOI; Relevant Research Institutions such as PSRC, IRD etc...; IOC/Smartfish
2. Ensure that field guides are available in sufficient numbers for the use of statistical enumerators and vessel crews; train users in applying the identification techniques.	Short to medium term	MOEMRFSOI
3. Secure copies of sharkfin identification guides and train port inspectors in identification of detached fins.	Short to medium term	MOEMRFSOI (Seafood Hub)
• Facilitate and encourage research on sharks		
1. Establish a cooperation agreement between national, regional and international research institutions and shark specialists.	Short to medium term	MOEMRFSOI; Relevant Research Institutions, such as PSRC, IRD etc...;

Action	Priority	Responsibility
<ul style="list-style-type: none"> • Improve the utilization of sharks caught 		
<ol style="list-style-type: none"> 1. Monitor catch and landing statistics to ascertain whether substantial quantities of sharks are entering the local market to promote the development of shark-based industries. 	<p>Long term</p>	<p>MOEMRFSOI (Seafood Hub)</p>
<ul style="list-style-type: none"> • Ascertain control over access of fishing vessels exploiting shark stocks 		
<ol style="list-style-type: none"> 1. Promulgate the laws and regulations needed to meet IOTC Resolutions; ensure that any future Resolution is reflected in the national legislation. 	<p>Short term</p>	<p>MOEMRFSOI; State Law Office</p>
<ol style="list-style-type: none"> 2. Present draft Resolution to the IOTC calling for sharks to be landed with fins attached to the carcasses, except in fleets targeting blue sharks, where the FW/DW ratio should be no less than 14%. 	<p>Short term</p>	<p>MOEMRFSOI</p>

Acronyms and Abbreviations

AFRC	Albion Fisheries Research Centre
CCAMLR	Convention of the Conservation of Antarctic Marine Living Resources
CCRF	FAO Code of Conduct for Responsible Fishing
CCSBT	Convention of the Conservation of Southern Bluefin Tuna
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
COFI	FAO Committee on Fisheries
CPC	Cooperating non-contracting Party (of IOTC)
EEZ	Exclusive Economic Zone
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organization of the United Nations
FPA	Fisheries Partnership Agreement (EU)
IFREMER	Institut français de recherche pour l'exploitation de la mer
IGSCI	The Global Shark Conservation Initiative
IOTC	Indian Ocean Tuna Commission
IPOA	International Plan of Action
IRD	Institut de recherche pour le développement
ISSF	International Seafood Sustainability Foundation [<i>iss-foundation.org/</i>]
IUCN	International Union for the Conservation of Nature
IUU	Illegal, unreported or unregulated
MOEMRFSOI	Ministry of Ocean Economy, Marine Resources, Fisheries, Shipping and Outer Islands, Government of Mauritius
NPOA	National Plan of Action
NTAD	Non-target, associated and dependent species (= bycatch)
PSRC	Pacific Shark Research Centre, Moss Landing Marine Laboratories, CA, USA
RFMO	Regional Fisheries Management Organization
UNGA	United Nations General Assembly

Introduction

IUCN¹ lists 1 088 species of sharks and rays (Chondrichthyans), but it is likely that many deepwater species are still to be described. Unlike most bony fish, sharks are recognised as having a low fecundity; they can be viviparous, oviparous or ovoviviparous. The sand tiger shark (*Carcharias taurus*), for example, produces only one pup every two years, although some pelagic sharks may have litters of the order of 55 [i]. The larger species are also relatively slow-growing with age at maturity at up to 18.5 years [ii]. Finally, many species are demersal, with very limited migration range. As a consequence, sharks may be very vulnerable to overexploitation [iii,iv].

The vulnerability of sharks to over exploitation is heightened by the difficulties in effectively managing fisheries which:

- are often data deficient particularly with regard to discarded bycatch from multi-species fisheries [v], and
- often involve wide-ranging, transboundary or migratory species [vi,vii]

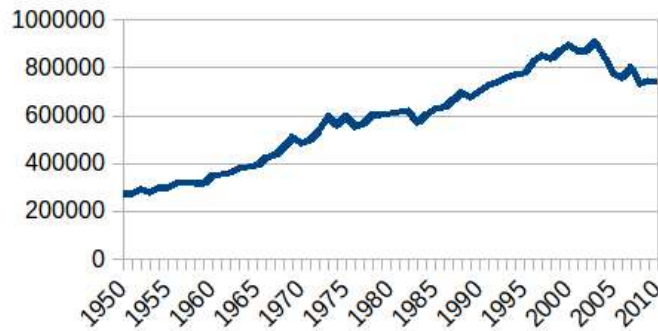
Significant loss of apex predator populations may seriously affect marine ecosystems and even lead to ecosystem phase shift or even collapse [viii,ix,x]. A large portion of the prey of large sharks is composed of smaller elasmobranchs and reduction in their biomass may allow these prey species to proliferate. For example the South Pacific biomass of blue shark was estimated to have increased by 20% relative to the 1970s [xi].

Reporting of shark catches is extremely uneven. Where the species in question are a target of the fishery, statistics for that species can be accurate, while, in the same fisheries, bycatch of other shark species may not be recorded, particularly if the dead sharks are discarded. In other fisheries where sharks are a bycatch, statistics may be limited to a partial record of generic “sharks”. For example, it was estimated from observer data in part of the Asian longline fleet active in the Indian Ocean that the actual shark catch was three times that in the logbook records, amounting to 19% of the total catch [xii]. The same review established that purse-seine fisheries accounted for less than 1 000t of sharks annually, whereas the sharks bycatch for the gillnet fishery for India and Sri Lanka was estimated to exceed 80 000t [xiii], with as much as 115 000t estimated for landings in the North Arabian Sea, despite the UNGA moratorium on the use of driftnets measuring more than 2,5km [xiv]. These fisheries are artisanal in scope and, in common with most of the sector, catch reporting is virtually inexistent.

Figure 1 shows the sharks catches reported to FAO.

1 <http://www.iucnredlist.org/>

**Figure 1: Shark catches (t) reported to FAO, 1950 to 2010:
Source FAO FishStat J**



Peak catches of over 900 000t were attained in 2003, with a decline to below 800 000t recorded annually since then. These figures are certainly an underestimate.

A recent estimate of global catch and mortality of sharks from reported and unreported landings, discards and shark finning was evaluated at 1.44 million tonnes for the year 2000, and at only slightly less in 2010 (1.41 million tonnes) [xv]. Clarke *et al.* came to a median estimate for 2000 of 1.7 million tonnes from the sharkfin trade [xvi] The data included FAO statistics, calculations based on the sharkfin trade and published estimates of IUU catches. Although double counting probably occurred in these estimates², the actual catch mortality is almost certainly higher, as discards, unrecorded mortality and small-scale fisheries landings were not included. The resulting three independent estimates of the average exploitation rate ranged between 6.4% and 7.9% of sharks killed per year. This exceeds the average rebound rate for many shark populations, estimated from the life history information on 62 shark species (rebound rates averaged 4.9% per year), and explains the ongoing declines in most populations for which data exist.

A. Description of the prevailing state of:

- **Associated fisheries**

For the purpose of this National Plan of Action on Sharks, Mauritian waters are taken as the waters surrounding Mauritius island, as well as the outlying islands of Rodrigues, Tromelin, Agalega, the Cargados Carajos (St. Brandon) and Chagos archipelagos. The Plan also covers both domestic and foreign registered vessels licensed to fish within the Mauritian Exclusive Economic Zone and the Mauritian Flag vessels fishing outside the EEZ, as well as landings in Mauritius of foreign tuna fishing vessels.

² Shark fins from IUU catches also enter the shark fin trade.

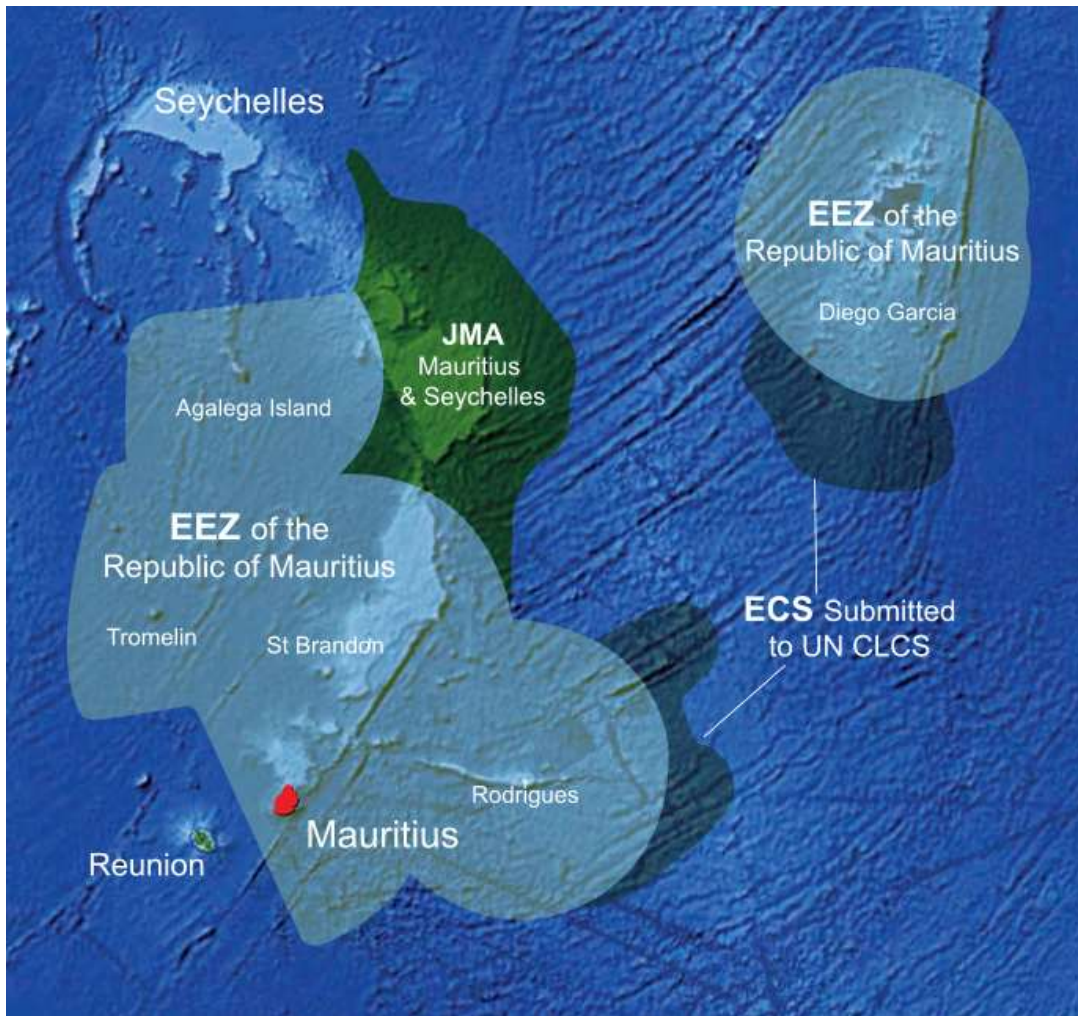


Figure 2: Mauritian territories and EEZ

In the absence of fisheries specifically targeting sharks, those having a bycatch of sharks or affecting shark distribution are considered. These include:

1. Small-scale, banks fisheries and tourism:
 - a) “Large nets”
 - b) Line fisheries
 - c) Troll-line
 - d) Diving and underwater viewing
2. Aquaculture
3. Tuna fisheries:
 - a) Domestic longline
 - b) Domestic purse-seine
 - c) Foreign longline

d) Foreign purse-seine

4. Transshipment operations

1.a) “Large nets”

These nets, limited to 500m with 9cm mesh [xvii], are used in shallow water around Mauritius and Rodrigues. While sharks and rays have always formed a small proportion of the catch, the result has been an almost complete elimination of the small sharks and rays which are common around the islands where this gear is not utilised, such as the Cargados Carajos and Chagos archipelagos.

Illegal net fishing also exists, but the nets are rarely of a size to fish in the deep channels found within the reefs where sharks are likely to be found.

1.b) Line fisheries:

Two forms of handlines are in use: those set while drifting outside the reefs in depths of up to 350m targeting snappers or groupers and drifting vertical longlines usually set near FADs to catch tunas (mainly Albacore). A new generation of smaller vessels fish for deepwater snapper resources on the shelf outer slopes of the Mascarene Ridge banks. In these situations, the hook leaders are monofilament nylon which generally allows any sharks hooked to bite off. The shark bycatch is therefore minimal and consists largely of deepwater species which are lightly exploited.

The techniques used are also employed by eleven motherships exploiting the emperor resources of the banks on the Mascarene ridge. Again, the shark bycatch is negligible.

1.c) Troll-line fisheries:

This gear is used mainly in sports angling, often in the context of tourist charter hire craft. The primary targets are marlins and tunas, but pelagic sharks are sometimes caught. The fishery operates largely as a catch-and-release, in which case sharks are cut loose. If this is done with the hook still embedded in the jaw, there may be long-term consequences to the shark's survival. Very few individuals are caught with hooks still attached, however, indicating that many of the hooks may fall out.

Anecdotal reports [xviii] indicate that the catch of sharks and depredation by sharks of line-caught tunas has diminished markedly over the last few decades. This is almost certainly a result of declining pelagic shark populations from longline mortality³.

1.d) Diving and underwater viewing

Spear fishing is prohibited [**Error! Reference source not found.**]. Although there is some sporadic illegal spear fishing, the number of sharks killed is probably anecdotal. However, particularly for the tourist trade, there is a considerable amount of undersea viewing by glass-bottom boats, submersibles and snorkel and scuba diving. The economic value of sharks, in particular to the tourist trade, should be privileged through responsible empowerment of the operators.

2. Aquaculture

Cage culture enclosures have been installed and operated within the lagoon. This activity is expected to expand in coming years. There have been cases where the netting enclosures have been torn by

³ Northern hemisphere driftnet catches are probably too remote to be incriminated.

sharks, identified as *C. leucas*, with the loss of substantial numbers of the aquaculture fish. It is thought that the sharks, juveniles or one year old which live in brackish water in the summer months, may have been attracted to fish which died and fell to the bottom of the enclosures. Research is being conducted to find means of dissuading the sharks from attacking the enclosures. At this time, divers remove any dead fish which have sunk to the bottom [xix,xx].

3.a) Domestic longline

Three to five small longliners are operated in the domestic fleet. Their main target is swordfish and they have landed less than one tonne of sharks annually over the last three years. The hooks on their longlines are mounted on nylon leaders, which explain the low shark bycatch.

Table 1: Catch of shark from local licensed longliners (<24m)

Year	2009	2010	2011	2012	2013
Catch of sharks (kg)	No operation	Nil	740	455	680
Total catch (kg)		Nil	89 374	36 121	67 973

3.b) Domestic purse-seine

In 2013, a single Mauritian purse seiner was operational. Applying the estimated sharks catch for oceanic purse seiners determined by Ardill *et al.* [Error! Reference source not found.], some 3t of sharks may have been caught. The same review paper estimates the survival of sharks caught and released by seiners at 20%. These figures would not include any sharks killed by snagging in FAD netting. However, the use of old netting has been abandoned in the new “ecological” FADs.

In 2014, seven purse seiners were registered and authorised to fish for tunas in the Indian Ocean. Two of these vessels are large and five are medium-sized. No catch data are available for this fleet.

3.c) Foreign licensed longline

Mauritius does not issue fishing licences to local or foreign vessels targeting sharks in its EEZ⁴. However, foreign fishing vessels often land shark as by-catch. The catch of sharks landed by vessels targeting swordfish is higher than that of vessels targeting tuna. The blue shark is the predominant species of sharks landed by fishing vessels targeting both tuna and swordfish followed by the shortfin mako shark. As far as licensed fishing vessels are concerned, one of the conditions of the licence stipulates that the vessels are required to abide by international and regional fisheries conservation and management measures. The officers of the Port State Control Unit ensure that shark fins do not exceed 5% of the total body weight of sharks on board during vessels inspection.

Trip records were consulted for 2010 to 2013 for foreign longliners licensed to fish in Mauritian waters. As set-by-set records were not available, it must be assumed that catches came from both within and outside the EEZ. Data relating to each trip contained sharks catches from zero to 25% of

⁴ The Spanish and Portuguese longliners operating under the EU FPA are covered by licences for fishing tunas, although they are known to also target blue and shortfin mako sharks.

the trips, without species information. The Ardill *et al.* [Error! Reference source not found.] review estimated sharks catches at 19% of total catch for Asian longliners. Applying this percentage to the total catches reported for the three years provided estimates of shark landings ranging from approximately 6 670 to 8 500 t. Reported catches ranged from 2 294 t in 2009 to 3 166 t in 2011 (Tables 2 & 3), representing 6 to 10.4% of the total catch, which would indicate a substantial level of under-reporting and probably of discards of shark carcasses. The dominant species in these shark catches was probably *P. glauca*, the blue shark, together with shortfin mako and oceanic whitetip.

Table 2: Catch of sharks from vessels targeting swordfish (tonnes)

Year	2009	2010	2011	2012	2013
Catch of sharks	929	683	896	635	1100
Total catch	3 058	2 077	2 293	2 612	4 427

Table 3: Catch of shark from vessels targeting tuna (tonnes)

Year	2009	2010	2011	2012	2013
Shark	1 365	2 323	2 270	2 016	1 508
Total catch	32 157	32 979	28 283	29 753	40 034

3.d) Foreign licensed purse-seine

Between seven and thirteen EU purse seiners have provided trip data for catches presumed to have been made in the Mauritian EEZ. Some data were provided on discards for 2013, without any species breakdown. Based on the sharks catch rate of this class of vessel estimated from Ardill *et al.*, discards of about 65t were probably made in 2012 and 2013 within the Mauritian EEZ. However, there are no records of shark landings and the operators report that any sharks caught are released immediately.

4.a) Transshipment operations

Port Louis harbour is the main tuna transshipment hub for longliners in the Western Indian Ocean, with close to 700 port calls annually. Many fleets actually tranship the sashimi catch at sea outside the Mauritian EEZ under an IOTC-monitored programme, and then enter Port Louis to offload albacore and bycatch species. Fishing vessels entering Port Louis are subjected to the inspection procedures detailed in Appendix II.

Shark fins and carcasses are weighed to establish whether the 5% fin to carcass ratio has been respected. No attempt is made to convert dried to fresh fin weights. The weight of dried fins transhipped is negligible as only 1-2% of vessels (mostly Korean) transship dried fins. The Port State Control Unit has noted that most vessels (>95%) are transshipping their sharks with fins attached. No shark landings take place.

4.b) Shark fin transshipment through Mauritius

Since 2008, in line with its NPOA-Sharks, Taiwan has promulgated *Directions on the Disposal of the Fins of the Shark Catches of Fishing Vessels* which specify that, as from December 31, 2012

and July 1, 2013, respectively, vessels of over and under 100 tons will preserve sharks with the fins naturally attached. There is a proviso, however, that fishing vessels within the area of competence of RFMOs will adhere to the measures adopted by these organizations. In the absence of a similar proviso in the IOTC Resolutions, some of the vessels in this fleet are still finning the sharks on board. In practice, when Taiwanese longliners have frozen sharks with the fins attached, the carcasses are not landed or processed in Port Louis.

Table 4: Exports of Shark Fins from Port Louis, 2007-2013 (in kg)

2007	2008	2009	2010	2011	2012	2013
147 282	38 575	131 640	77 138	111 311	143 196	126 012

Table 4 lists the exports of shark fins from Port Louis between 2007 and 2013. The records for 2006 were certainly only partial, but the reduced figures for 2008 and 2010 are not explained. It should be noted that, whereas all the fins were exported to the Far East in 2007, this proportion dropped to 53% by 2009 and, by 2012 and 2013 virtually all the fins were destined to Spain and Portugal and were probably from sharks caught by EU longliners. This would be consistent with sharks caught by the Taiwanese longliners being retained on board and re-exported.

Clarke *et al.* (2006b)[xxi], based on molecular genetics and trade records for the Hong Kong sharks fin market estimated blue shark fins constituting 17% of the total auctioned fin weight, followed by shortfin mako, silky, sandbar, bull, hammerhead and thresher, ranging between 6 and 2% of the trade. This figure is consistent with the proportions of sharks species estimated for the EU longliners fishing in the Indian Ocean [Error! Reference source not found.



Figure 3: Whale shark fin worth up to US\$20 000

Traditionally, the shark fins retained on longliners were considered the property of the crew. Now, with fins often valued at over US\$400/kg, the fins are retained by the vessel operators and more control is exercised.



Figure 4: Dried shark fins in Shanghai

4.c) Shark stocks, populations

Appendix I lists the cartilaginous fish (sharks and rays) which have been identified in Mauritian waters. Thirteen species are coastal, moving between the lagoon and shallow seas outside the coral reefs, while ten species are pelagic, found both offshore and sometimes in shallow waters. Finally, six species are found exclusively in the deep shelf areas, usually at depths of over 400m.

Of the species habitually found within the fringing reefs, the bull-shark (*C. leucas*) is known to breed in the deeper channels off Grand Port and Grand River South-West. The resident population, present mostly in the summer months, is composed mainly of juveniles and young-of-the-year (YOY) individuals. The males are all small (<120 cm FL) but larger females (>180 cm FL) are found in the winter months, possibly related to giving birth. This species is likely present in other lagoons with a deep channel fed by rivers, such as in Black River bay.

C. melanopterus, *C. amblyrhynchos*, *C. sorrah*, *C. albimarginatus* and *C. leucas*, as well as the rays *Taeniura melanospilos* and *Aetobatus narinari* are found in passes and in the South of Mauritius island but are rarely seen in any shallow lagoon. In areas such as the Cargados Carajos and the Chagos archipelagos, these species are present in large numbers. It is highly likely that the absence of these inshore species in Mauritius can be attributed to the long-term depletion of populations through coastal large net fishing.

4.d) Statistical information and knowledge of stock status

The fishery statistics in Mauritius do not list sharks as a group, let alone by species [xxii]. No data are, therefore, available to assess the stock status of sharks other than listing their presence. As there are no directed fisheries for pelagic sharks in Mauritius, assessments and management measures would have to be conducted and coordinated through RFMOs.

• Management framework and its enforcement.

The IPOA-Sharks

In 1994, CITES adopted Resolution 9.17 [xxiii], which called upon:

- FAO and other relevant agencies to establish programmes to collect the necessary biological and trade data on shark species;
- All nations utilising and trading in shark species to assist FAO in this endeavour, and
- FAO to fully inform CITES on the progress of collection, elaboration and analyses of said data.

The FAO Committee on Fisheries (COFI) subsequently convened the Technical Working Group on the Conservation and Management of Sharks (Tokyo, April 1998) [xxiv].

Following consultations in Rome, the 23rd Session of COFI in 1999 adopted the IPOA-Sharks. IPOA-Sharks is a voluntary mechanism and was elaborated in the context of Article 2d of the Code of Conduct for Responsible Fisheries [xxv].

The objective of the IPOA is

**“...to ensure the conservation and management of sharks
and their long-term sustainable use.”**

The IPOA Sharks applies to all species of sharks, skates, rays and chimaeras, and it applies to all types of catches (directed, bycatch, commercial, recreational or others) and waters where such fishing takes place. It also applies to coastal States where sharks are caught in their waters and to flag States where vessels entitled to fly their flags catch sharks on the high seas. The IPOA establishes not only the need to start managing directed shark catches but also calls for improving shark bycatch regulations in multispecies fisheries, in particular in tuna fisheries. Finally, it encourages States to cooperate through regional fisheries management organizations (RFMOs) to ensure the effective management of transboundary stocks.

The IPOA encourages States to develop and implement national plans of action for the conservation and management of sharks (NPOA-Sharks), and suggests a structure and contents for such a plan [xxvi]. Countries should adopt measures to manage the shark species within their territories and should strive to have updated information and data at all times.

The IPOA-Sharks integrates aims derived from its objective and which place emphasis upon:

- sustainability of catches (targeted and by-catch);
- assessment of threats to populations and key habitats to enable adaptive management and

prioritisation of actions;

- contribution to the protection of biodiversity and ecosystem structure and function;
- encouraging full use of sharks (i.e. ban the practice of finning);
- collection and distribution of data pertaining to shark catches and landings, species specific biology and trade, and
- capacity building and assistance to developing countries and international cooperation in general for the integrated and harmonised implementation.

CITES

Under CITES, all import, export, re-export and introduction from the sea of species covered by the Convention has to be authorized through a licensing system. CITES utilises appendices to classify endangered species with regard to international trade this includes so called “look-alike species” i.e. species of which the specimens in trade look like those of species listed for conservation reasons [xxvii].

There are three appendices under CITES:

1. Appendix I includes species threatened with extinction. Trade in such species is permitted only under exceptional circumstances e.g. scientific research or conservation programmes.
2. Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilisation incompatible with their survival.
3. Appendix III contains species that are protected in at least one country which has asked other CITES Parties for assistance in controlling its trade.



Figure 5: Great hammerhead

CITES first substantively addressed the issue of shark populations in Resolution 9.17 (CITES 1994)

which initiated the process that ultimately led to the development of the FAO IPOA–Sharks. Seventeen species of sharks are currently listed by CITES [xxviii]. These include the three hammerhead sharks, the oceanic whitetip, great white, porbeagle and whale sharks, seven species of sawfish and two manta rays. The detailed list is reproduced in Appendix IV.

RFMO obligations

Mauritius is a Member of IOTC and, as such, is obliged to observe and enforce its Resolutions. Recommendations are facultative. Although the IOTC Agreement gives a mandate only to manage sixteen tuna species, by consensus the Commission has extended its management actions to cover NTADs and ecosystem considerations.

IOTC adopted a number of Resolutions for the conservation and management of sharks in 2005, 2012 and 2013 [xxix] which apply to Members and CPCs:

Shark fin measures: The IOTC requires that fishers fully utilize their entire catches of sharks and has adopted a 5 percent fin-to-body weight ratio for sharks on board vessels up to the first point of landing (Res. 05/05).

Discard measures: In fisheries that are not directed at sharks, CPCs are encouraged to release live sharks, especially juveniles and gravid females, to the extent possible, which are caught incidentally and are not used for food and/or subsistence. NTADs are to be retained on board if dead (Res. 13/11).

Prohibited species: Fishing, landing and trade of thresher sharks (Alopiidae) (Res. 12/09) is prohibited. Intentional setting of purse seines on whale sharks (*Rhincodon typus*) is prohibited, in the case of a whale shark being found in a net, it is to be released unharmed (Res. 13/05). Oceanic whitetip (Res. 13/06) are to be released unharmed unless caught by artisanal fisheries within an EEZ⁵. Discard and reporting requirements apply in all cases.

Gear restrictions: Large-scale driftnets are prohibited⁶ (Res. 12/12) and FADs are to be non-entangling (Res. 13/08).

Reporting requirements: Catches of commonly caught sharks (blue shark, shortfin mako, silky shark, scalloped hammerhead, oceanic whitetip) and, where possible less common species, have to be reported annually, in accordance with IOTC data reporting procedures, including available historical data (Re. 12/02). Particular reporting requirements apply to thresher, whale and oceanic whitetip sharks (see above).

Data collection and research: Since 2006, the Scientific Committee has provided regular information and advice on key shark species (including assessment of the implementation of IPOA Sharks among CPCs in 2011). The IOTC encourages CPCs in undertaking research towards more selective fishing gear and to identify shark nursery areas. The IOTC Working Party on Ecosystem and By-catch also addresses sharks.

Domestic legislation

Current Mauritian fisheries laws [**Error! Reference source not found.**] and regulations [xxx] have

⁵ This Resolution is to be examined in 2016.

⁶ Longer than 2.5km, in line with the UNGA 1991 requirements.

no provisions related specifically to sharks. However, as from February 2015, all the provisions of the IOTC Resolutions on sharks listed above have been included in the terms and conditions of fishing licences and Certificate of Authorization for local purse seiners. The Fisheries and Marine Resources (Vessel Monitoring System) Regulations 2005 do provide for both domestic and foreign fishing vessels to be licensed to fish in Mauritian waters. These licences are issued subject to conditions. Separate conditions are attached to Mauritian fishing vessels, longliners, purse seiners and carrier boats. For foreign flagged vessels, licence conditions are attached to vessels exploiting the Banks⁷ fishery, to both EU and non-EU longliners and purse seiners.

For both Mauritian and foreign fishing vessels, licence conditions impose vessel location devices (AIS and VMS) and submission of catch data. Mauritian vessels are required to land their catches in Mauritius and restrict any processing on board. Foreign vessels are expected to land all EEZ catches in Mauritius.

A clause is included in foreign vessel licence conditions to the effect that Mauritian Authorities may impose other specific conditions to this licence to ensure the management and conservation of the living resources in Mauritian waters should the need for these conditions be felt by the Mauritian Authorities. No such conditions are imposed at this time, but this does open the door for the imposition of shark management measures.

The Ministry of Ocean Economy, Marine Resources, Fisheries, Shipping and Outer Island is in the process of drafting legislation aimed at meeting the obligations created through the various instruments (regional/international) to which Mauritius is a Party, as well as those identified in the NPOA. New provisions brought to the Fisheries Bill will better empower the enforcement officers to effectively and efficiently carry out their duties.

B. The objective of the Sharks-plan.

The objectives of the sharks plan are the same as those identified in the IPOA:

**“...to ensure the conservation and management of sharks
and their long-term sustainable use.”**

In view of the fact that the domestic shark catch is negligible, most of the actions will involve foreign fishing and, as such, will be exercised through RFMOs and access agreements.

The NPOA is therefore aimed principally at exercising influence on foreign fishing through the IOTC process and licence conditions, as well as improving the national legislation and the skills and data handling systems available for managing fisheries.

C. Strategies for achieving objectives:

- **Decrease fishing effort in any fishery where the shark catch is unsustainable**

There are clear indications that the drastic reduction of small reef sharks can be attributed to “large nets”[**Error! Reference source not found.**] used in coastal fisheries, notably in the absence of any

⁷ This refers to the banks on the Mascarene Ridge

other fishing gears used within the lagoons capable of catching sharks. In view also of the environmental damage resulting from this gear and the fact that all the fish caught by this fishery can be exploited by other gears, it is proposed to phase out the use of this gear:

Action: Phase out “large nets” used in coastal fisheries from the list of authorised fishing gears.

Priority: Medium term

Responsibility: MOEMRFSOI

In longline fisheries, the use of wire leaders for hooks results in shark catches an order of magnitude higher than when hooks are attached to nylon leaders [**Error! Reference source not found.**]. In the Pacific, research has indicated that tuna catch rates are actually increased by the use of nylon leaders and that the loss of hooks from sharks bite-off is more than compensated by the increased catch [xxxi]. The Mauritian longline fleet already use nylon leaders; such a change would affect most of the Asiatic fleets (Japan, Taiwan, Korea, China...). The EU longliners, which target blue shark in addition to swordfish and temperate tunas, would need derogation as there are currently no restrictions on the catch of blue sharks. The proper avenue to effect such a change would be IOTC, where draft resolutions calling for a change from wire to nylon leaders have been defeated due to adherence to the practice of taking decisions by consensus.

Action: Present draft Recommendation to the IOTC calling for the use of nylon leaders on longlines for those fleets that do not target sharks.

Priority: Short term

Responsibility: MOEMRFSOI

In purse seine fisheries, the main source of shark mortality is thought to be snagging of juvenile silky and whitetip sharks in old netting used as attracting material on FADs. There has been an enormous expansion in the use of FADs in the Indian Ocean, with some seiners setting thousands of FADs, many of which are lost and could contribute to “ghost” fishing. The industry has conducted extensive experimentation on the use of “ecological” FADs which avoid the use of netting which could snag sharks and turtles. This is enshrined in Resolution 13/08.

At the same time, the ISSF has run training courses and published manuals for tuna fishing vessel crew to return live sharks to the sea unharmed. The ISSF is also attempting to find ways of isolating and releasing sharks found in purse seine sets.

Action: Present draft Recommendations to the IOTC calling for rapid implementation of techniques aimed at releasing sharks unharmed.

Priority: Short term

Responsibility: MOEMRFSOI

The depredation of aquaculture enclosures in lagoons poses a particular problem if measures are not to be taken to reduce the populations of young bull-sharks. Interim measures include removal of dead fish which have sunk to the bottom of the enclosures and the deployment of secondary shark barrier nets around the enclosures holding the size and species of aquaculture fish which appear to attract the

sharks. Meanwhile, a literature survey is being undertaken on the biology and behaviour of bull-sharks as well as of mitigation measures such as electrical or magnetic barriers or the use of shark-resistant netting for the enclosures.

There is also a perception among the small-scale lagoon fishermen that aquaculture enclosures attract sharks into the vicinity, contributing to conflicts between the two sectors. However, the presence of sharks around the aquaculture installations seems to be episodic, largely in periods of river flooding extending to the lagoon.

Action: Support research into the (cost-effective) options to reduce or eliminate damage to netting aquaculture enclosures by sharks.

Priority: Short term

Responsibility: MOEMRFSOI (AFRC); Industry

- **Improve data collection and monitoring of shark fisheries**

The IOTC now requires recording⁸ blue, mako, porbeagle, hammerhead, thresher and oceanic whitetip sharks caught on longliners, lumping all other species in the “Other sharks” aggregation, although tiger, crocodile, great white sharks, manta and devil rays and pelagic stingrays as well as “Other rays” may optionally be recorded. For purse seiners, whale sharks, thresher and oceanic whitetip sharks are to be recorded, silky sharks, manta and devil rays, other sharks and rays are optional. Further requirements apply to gillnets, but these are not active in this region. This Resolution entered into force on November 13, 2013. Log sheets used to record catch data need to be updated to accommodate these new records.

Action: Modify catch-recording sheets⁹ to accommodate species-level data for sharks; train vessel crews in identification of sharks; ensure that correct records are collected.

Priority: Short to medium term

Responsibility: MOEMRFSOI; IOTC; Industry

In Mauritius, the computerised data recording systems need to be completely updated to a relational database from the current practice of using spreadsheets which enforce no referential integrity and are subject to being lost or overwritten, as well as not providing fisheries managers with real-time data. Such a database needs to record catch statistics from all the Mauritian small-scale and industrialised fisheries, licensed vessel data, vessel and gear data, landings and transshipments, processing and exports, etc., and be integrated with the VMS and Port Inspection systems. With the planned introduction of electronic catch reporting on EU vessels, these data can be added automatically to the database system. It will be necessary in the process of migration, to include historical data which will also need to be verified.

Action: Introduce an integrated referential database system to record Mauritian fisheries statistics; verify and integrate historical records and train staff in its use.

8 Resolution 13/03 On the Recording of catch-and-effort data by fishing vessels in the IOTC Area of Competence

9 This must be done through the IOTC process as the reporting forms are to be used on all vessels flagged in Member States.

Priority: Short to medium term

Responsibility: MOEMRFSOI; Industry

- **Train all concerned in identification of shark species**

For the shallow water sharks, there is no recent field guide for the western Indian Ocean, available publications dating from 1984 [xxxii,xxxiii] and now out of print. Assuming the ban on large nets is effective in permitting the small reef shark populations to recover; catches may increase for line fisheries and should be recorded.

Action: Develop a field identification guide for coastal and demersal sharks and train staff in species identification to permit collection of statistics of shark catches at the species level for the small-scale sector by enumerators.

Priority: Medium term

Responsibility: MOEMRFSOI; and relevant research institutions, such as PSRC, IRD etc...; IOC/SmartFish

Training of port inspectors, statistical enumerators and industry participants in pelagic shark identification has been conducted through the Indian Ocean Commission SmartFish project. In this context, a new field guide for the identification of pelagic sharks prepared with the participation of FAO [xxxiv] was distributed. A data sheet format was also provided to participants to record catches. Another guide is available from IOTC [xxxv]. For the deepwater species, another FAO field guide is available [xxxvi].

Action: Ensure that field guides are available in sufficient numbers for the use of statistical enumerators and vessel crews; train users in applying the identification techniques.

Priority: Short to medium term

Responsibility: MOEMRFSOI

While the training will certainly help port inspectors identify shark carcasses with fins attached, the clear tendency is for the carcasses to be re-exported without being landed or transhipped. The training and identification manuals are not adequate for the identification of fins which have been detached from the carcasses. A guide is available for the identification of oceanic whitetip, porbeagle and hammerhead sharks [xxxvii]. While this list is restricted to five of the most endangered species, all on the CITES Appendix II (Appendix IV), the fins of other species of sharks which might be confused with these five species, including shortfin mako, thresher, guitarfish and blacktip sharks are illustrated in the key.

Action: Secure copies of sharkfin identification guides and train port inspectors in identification of detached fins.

Priority: Short to medium term

Responsibility: MOEMRFSOI; Seafood Hub

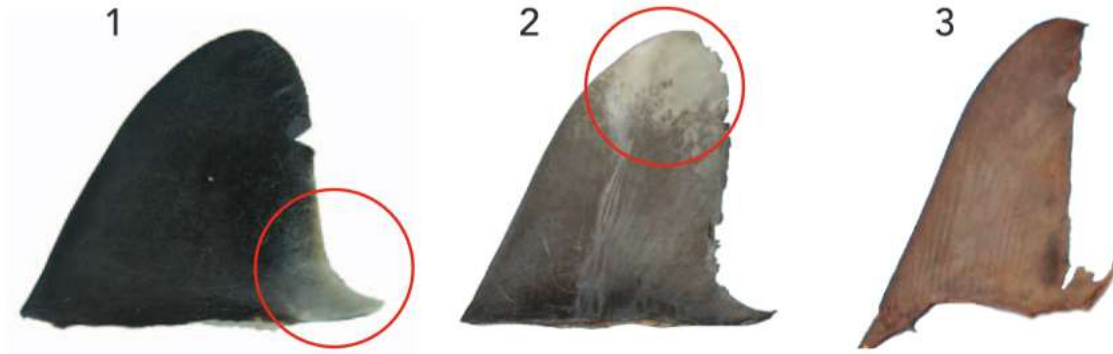


Figure 6: Porbeagle, whitetip and hammerhead fins (Source [Error! Reference source not

- **Facilitate and encourage research on sharks**

In the absence of shark specialists in Mauritius, such research will have to be conducted with outside assistance, contributing to local expertise.



Figure 7: Possibly a new species of deep-water dogfish

Action: Establish a cooperation agreement between national, regional and international research institutions and shark specialists.¹⁰

Priority: Short to medium term

Responsibility: MOEMRFSOI; and relevant research institutions such as PSRC, IRD etc...;

- **Improve the utilization of sharks caught**

While fins remain the most lucrative part of the sharks, the flesh is widely consumed. No tanning facilities exist for the skins and the volume of catches is unlikely to justify investing in tanning operations. As the main thrust of the actions called for above will be to reduce shark catches in non-

¹⁰ Specialists from the Pacific Shark Research Centre, Moss Landing Marine Laboratories, CA, USA, have already provided support and contacts could be established with shark specialists from IRD and IFREMER working in La Réunion.

directed fisheries, landing of substantial quantities of sharks for local consumption are not likely. There is, however, a possibility that some fleets which currently re-export their sharks may in the future decide to process them locally.

Action: Monitor catch and landing statistics to ascertain whether substantial quantities of sharks are entering the local market to promote the development of shark-based industries.

Priority: Long term

Responsibility: MOEMRFSOI

- **Ascertain control over access of fishing vessels exploiting shark stocks**

Mauritian laws and regulations are in the process of being updated to conform to the obligations created through the IOTC process.

Action: Promulgate the laws and regulations needed to meet IOTC Resolutions ; ensure that any future Resolutions are reflected in the national legislation.

Priority: Short term

Responsibility: MOEMRFSOI; State law Office

IOTC Resolution 05/05 establishes the wet fin (FW) to dressed carcass ratio (DW) at no less than 5%. There are considerable problems linked to this requirement notably that, in fisheries which target sharks such as the Portuguese and Spanish longliners, the practice is to dress the carcasses. One paper [xxxviii] deals with the wet fin: body weight ratios for Portuguese vessels in the Indian Ocean, dealing with a single species – *P. glauca*. The ratios observed were 6.02% and 14.78%, for the round and dressed weight, respectively, representing a major deviation from the assumed 5% when dealing with dressed carcasses. In a second study concerning Spanish vessels [xxxix], the FW/RW¹¹ ratios found varied between 4.07% for *Isurus oxyrinchus* and 6.60% for *Carcharhinus longimanus*, while the extreme values for the FW/DW ratio were 6.26% for *Isurus oxyrinchus* and 16.05% for *Carcharhinus longimanus*. The ratios for DW are thus three times those for RW. A EU Regulation [xl] has removed a derogation to the 2003 Regulation banning finning of sharks on board fishing vessels but this may not be observed in the fleets targeting blue sharks.

On many Asian longliners, the fins are dried and, if the carcasses are retained on board, they are normally headed and gutted. As there are no conversions available for conversion of fins from round weight to dried weight, this creates a further difficulty for port inspection staff.

Action: Present draft Resolutions to the IOTC calling for sharks to be landed with fins attached to the carcasses, except in fleets targeting blue sharks, where the FW/DW ratio should be no less than 14%.

Priority: Short term

Responsibility: MOEMRFSOI

11 RW=Round weight, i.e. the weight of the whole shark which has not been finned, headed or gutted.

Appendix III proposes the content of shark finning regulations.

Appendix I

Sharks and Rays identified in Mauritius

Source Baissac (1990)[xli] reviewed and updated by David A. Ebert¹²

#	Scientific Name	Local Name	IUCN	Fishery Interaction
ORDER HEXANCHIFORMES				
Family: Hexanchidae				
Genus: <i>Hexanchus</i> (Rafinesque 1800)				
1	<i>Hexanchus griseus</i> (Bonnaterre 1788)? ¹³		Near threatened	1.d)
2	<i>Hexanchus nakamurai</i> (Teng, 1962)?		Data Deficient	
3	<i>Heptranchias perlo</i> (Rafinesque, 1810)?			
Genus: <i>Notorynchus</i> (Ayres 1855)				
4	<i>Notorynchus cepedianus</i> (Peron 1807)	Requin malais	Data Deficient	
ORDER SQUALIFORMES				
Family: Squalidae				
Genus: <i>Squalus</i> (Linnaeus 1758)				
5	<i>Squalus megalops</i> (Me Leay 1881)		Data Deficient	1.b)minor
6	<i>Squalus mitsukurii</i> (Jordan & Snyder 1903) ¹⁴	Requin trois piquants	Data Deficient	1.b)minor
Genus: <i>Euprotomicrus</i> (McGill 1864)				
7	<i>Euprotomicrus bispinatus</i> (Quoy & Gaimard 1824)			
8	<i>Isistius brasiliensis</i> (Quoy & Gaimard 1824)		Least concern	1.b)minor
Family: Squatinidae				
Genus: <i>Squatina</i> (Risso 1910). Monotypic				
9	<i>Squatina africana</i> (Regan 1908)	Violon	Data Deficient	
ORDER ORECTOLOBIFORMES				
Family: Ginglymostomatidae				
Genus: <i>Ginglymostoma</i> (Müller & Henle 1837)				
10	<i>Pseudoginglymostoma brevicaudatum</i> (Gunter 1866)		Vulnerable	Rare
Genus: <i>Nebrius</i>				
11	<i>Nebrius ferrugineus</i> (Lesson 1830)		Vulnerable	1.d)
Family: Stegostomatidae				
Genus: <i>Stegostoma</i> (Müller & Henle 1837). Monotypic				
12	<i>Stegostoma fasciatum</i> (Hermann 1783)	Requin tigre	Vulnerable	Rare
Family: Rhinodontidae				
13	<i>Rhincodon typus</i> (Smith 1828)	Requin baleine	Vulnerable	
ORDER SQUALIFORMES				
Family: Alopiidae				
Genus: <i>Alopias</i> (Rafinesque)				
14	<i>Alopias superciliosus</i> (Lowe 1839)		Vulnerable	3.a) b)
15	<i>Alopias vulpinus</i> (Bonnaterre 1788)		Vulnerable	3.a) b)
Family: Lamnidae				
Genus: <i>Carcharodon</i>				
16	<i>Carcharodon carcharias</i> (Linnaeus 1758)		Vulnerable	Rare

12 This exercise has not been carried out for the outer islands (Agalega, Tromelin, the Cargados Carajos and Chagos Archipelagos).

13 ? indicates that the species identification is uncertain

14 This may be a misidentification and could be a new species.

Family: Rhinidae
 42 *Rhina ancylostoma* (Bloch & Schneider, 1801) Vulnerable

Family: Pristidae
 Genus: *Pristis* (Linck 1790)

#	Scientific Name	Local Name	IUCN	Fishery Interaction
43	<i>Pristis pectinata</i> (Latham 1794)		Critically Endangered	1.b)
44	<i>Pristis zijsron</i> (Bleeker 1851)	Requin scie	Critically Endangered	1.b)

ORDER TORPEDINIFORMES

Family: Torpedinidae

Genus: *Torpedo* (Houttuyn 1764)

45	<i>Torpedo fuscomaculata</i> (Peters, 1855)			1.a)
46	<i>Torpedo marmorata</i> (Risso 1810)	Trembleur	Data Deficient	1.a)

ORDER MYLIOBATIFORMES

Family: Dasyatidae

Genus: *Dasyatis* (Rafinesque 1810)

ORDER MYLIOBATIFORMES

47	<i>Himantura imbricata</i> (Bloch & Schneider, 1801)		Data Deficient	1.a),b)
48	<i>Himantura uarnak</i> (Gmelin, 1789)	La raie blanche	Vulnerable	1.a),b)
49	<i>Neotrygon kuhlii</i> (Muller & Henle, 1841)		Data Deficient	1.a)
50	<i>Taeniura meyeni</i> (Muller & Henle, 1841)			1.a),b)

Family: Myliobatidae

Genus: *Aetobatus* (Blainville 1816)

51	<i>Aetobatus narinari</i> (Euphrasen 1790)	Aigle de mer; Raie chauvesouris	Near threatened	
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Family: Mobulidae

Genus: *Manta* (Bancroft 1829)

52	<i>Manta alfredi</i> (Krefft, 1868)?	Likely occurs around Mauritius		
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53	<i>Manta birostris</i> (Walbaum 1792)		Vulnerable	
54	<i>Mobula diabolus</i> (Shaw 1804)	Diable de mer	Endangered	

Key to fisheries

- | | | | |
|----|---|----------------------------------|-------------|
| 1. | Small-scale, banks fisheries and tourism: | | Fishery key |
| | | a) Large nets | 1.a) |
| | | b) Line fisheries | 1.b) |
| | | c) Troll-line | 1.c) |
| | | d) Diving and underwater viewing | 1.d) |
| 2. | Aquaculture | | 2. |
| 3. | Tuna fisheries | | |
| | | a) Domestic longline | 3.a) |
| | | b) Domestic purse-seine | 3.b) |
| | | c) Foreign longline | 3.c) |
| | | d) Foreign purse-seine | 3.d) |
| 4. | Transshipment operations | | 4. |

Appendix II

Inspection procedures in Port Louis harbour

A mechanism in line with the FAO model scheme on Port State measures to combat Illegal, Unreported and Unregulated fishing has been set up. Under this mechanism three types of forms have been designed taking into consideration the measures prescribed in the model scheme. The procedures put in place for foreign fishing vessels calling into port are as follows

1. All foreign fishing vessels must notify the Ministry at least 72 hours before arrival in port through their local agent;
2. The agent submits the application for Port Access for foreign fishing vessels (*Form A*) 72 hours before the arrival of the vessel;
3. Information on the purpose of the call, the fishing trip, vessel monitoring system, fishing authorisation, quantities of fish on board and other documentation must be provided;
4. The name of the vessel is verified to ensure that it does not appear on the list of Illegal Unreported and Unregulated Fishing (IUU List);
5. For tuna and tuna like species, the name of the vessel is checked against the authorised list of the Indian Ocean Tuna Commission (IOTC List);
6. All Information received from the Form A with regard to the vessel are collated and validated in the office prior to boarding
7. The vessel is first boarded by the Officers from the Ministry of Health. Once the Health Officers has cleared the vessel, Officers from Fisheries, Customs, Passport and Immigration Office and the NCG may board the vessel.
8. The Port State Inspection form (*Form B*) is filled in by the Fisheries Protection Officer during boarding of the vessel.
9. All relevant documents are collected and verified including the fishing logbooks, the crew list, the fishing licence and authorisation.
10. Fish holds, gear, markings and flag are inspected.
11. After verification, an authorisation for unloading/transshipment is issued.
12. The unloading of fish is monitored by the Fisheries Protection Officers.
13. During unloading operations, catch species are recorded on the *Form C*.

Appendix III

Suggested shark regulations

Content of sharks finning Regulations

These Regulations should place restrictions on the removal of fins of all species of shark on board of foreign-owned or local fishing vessels of a total length of 24 metres or more fishing within or outside the Mauritian Waters. Removal of fins requires an authorisation of the Permanent Secretary of the line Ministry. The Regulations should prescribe rules relative to processing and disposal of sharks on board of a vessel. Only a given percentage of weight of fins may be landed. All fishing vessels arriving at the port of destination in Mauritius should declare the quantities of shark fins and products on board of the vessel.

Appendix IV Species listed by CITES

(Effective September 2014 for Appendix II listings)

Scientific Name	Author	Appendix listing
<i>Sphyrna lewini</i>	(Griffith & Smith, 1834)	II
<i>Sphyrna mokarran</i>	(Rüppell 1837)	II
<i>Sphyrna zygaena</i>	(Linnaeus 1758)	II
<i>Carcharhinus longimanus</i>	(Poey 1861)	II
<i>Cetorhinus maximus</i>	(Gunnerus, 1765)	II
<i>Carcharodon carcharias</i>	(Linnaeus, 1758)	II
<i>Lamna nasus</i>	(Bonnatere, 1788)	II
<i>Rhincodon typus</i>	Smith, 1828	II
<i>Anoxypristis cuspidata</i>	(Latham, 1794)	I
<i>Pristis clavata</i>	Garman, 1906	I
<i>Pristis microdon</i>	Latham, 1794	I
<i>Pristis pectinata</i>	Latham, 1794	I
<i>Pristis perotteti</i>	Müller & Henle, 1841	I
<i>Pristis pristis</i>	(Linnaeus, 1758)	I
<i>Pristis zijsron</i>	Bleeker, 1851	I
<i>Manta alfredi</i>	Krefft, 1868	II
<i>Manta birostris</i>	(Walbaum, 1792)	II

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