Publication 37

Smart Fish

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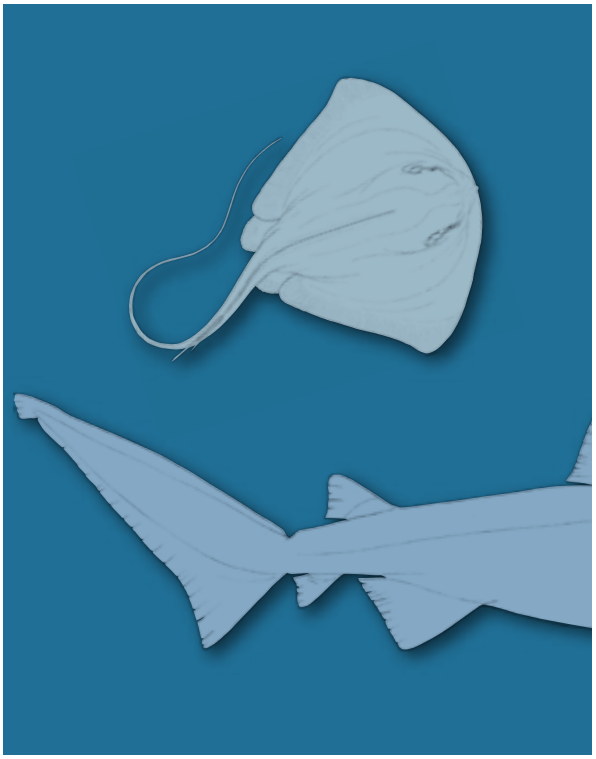

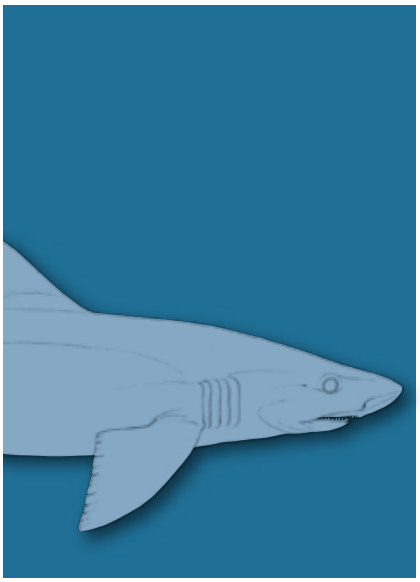

WORKSHOPS ON THE IDENTIFICATION OF PELAGIC SHARKS AND RAYS IN THE WESTERN INDIAN OCEAN

INDIAN OCEAN COMMISSION

Food and Agriculture Organization of the United Nations

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Workshops on the Identification of Pelagic Sharks and Rays in the Western Indian Ocean

Albion, Mauritius
28-30 October 2014

Victoria, Mahé, Seychelles
4-6 November 2014

Saint Denis, Reunion
25-27 January 2016

GCP/RAF/466/EC SmartFish Project

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For more information, please contact smartfish@fao.org

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Acronyms and abbreviations

CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	The Convention on the Conservation of Migratory Species of Wild Animals
CNDRS	National Documentation and Scientific Research Centre *(Centre National de Documentation et Recherche Scientifique)*
CPC	Cooperating Non-Contracting Parties
CROSS	Regional Centre for Surveillance and Rescue (*Centre Régional Opérationnel de Surveillance et de Sauvetage)*
CRPMEM	Regional Committee for Maritime Fisheries and Marine Aquaculture (*Comité Régional des Pêches Maritimes et Elevages Marins)*
DEAL	Directorate of the Planning, Environment, and Housing (*Direction de l'environnement, de l'Aménagement et du Logement)*
DMSOI	Directorate of the South Indian Ocean (*Direction de la Mer Sud Océan Indien)*
EU	European Union
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organization of the United Nations
IOC	Indian Ocean Commission
IOTC	Indian Ocean Tuna Commission
IUCN	International Union for Conservation of Nature
NDF	Non-detriment Findings
NPOA Shark	National Plan of Action for the Management and Conservation of Sharks
SFA	Seychelles Fishing Authority
SWIO	South Western Indian Ocean
WIOMSA	Western Indian Ocean Marine Science Association

1. Background

The importance of obtaining information relating to species caught or impacted by fisheries, either as a target, bycatch or incidental catch, has been highlighted in several international fora and instruments.

Sharks and rays are one of the most successful fish groups, occupying most marine habitats including coastal, deep-sea, and pelagic zones. New shark species are still being discovered: about 157 between 2007 and 2013 against 199 over a much longer period (1970-1999). Moreover, the Western Indian Ocean (WIO) is a worldwide 'hotspot' in terms of the diversity of shark species after Australia. About 290 species of sharks have been identified in the WIO region.

However, given their comparatively low economic value when compared to other higher value bony fish species, e.g. tunas, species-specific catch information, is frequently overlooked in many fisheries, if collected at all. Part of the problem is a lack of knowledge as to the species that might be encountered combined with a lack of practical field identification tools. Shark and ray fisheries whether targeted, bycatch, or incidental, are on the increase globally and as such it is very important to develop field tools for improved species-specific catch identification and better statistical data gathering.

Either targeted or caught as bycatch, a number of shark species are under heavy exploitation on a worldwide scale. Two sharks were first included in Appendix II of CITES in February 2003: The Basking Shark (*Cetorhinus maximus*) and the Whale Shark (*Rhincodon typus*). Species included in Appendix II are not necessarily threatened with extinction, but their trade is controlled to avoid over utilization incompatible with their survival. The Great White Shark (*Carcharodon carcharias*) was listed in appendix II in 2005, followed by the Sawfish species (*Pristidae spp*.) in 2007.

Furthermore in the Indian Ocean, catch information and stock status for sharks and rays is rather limited, especially when compared with other large oceans such as the Atlantic or the Pacific.

In this context, sharks and rays were programmed into the agenda of the South Western Indian Ocean (SWIO) Fisheries Director's Meeting that was held in Reunion in June 2012 and supported by the IOC SmartFish project. The meeting brought together Directors of Fisheries from seven countries of the Indian Ocean, (Comoros, Kenya, Madagascar, Mauritius, Reunion, Seychelles and Tanzania) to identify and discuss issues of common interest.

During this meeting, countries recognized their common interest in improving the knowledge and information (including status and catches) about sharks and rays in the region.

The countries present, with Mauritius as the lead, requested support from FAO to produce a professional on-board guide to improve the identification of pelagic sharks and rays in the Western Indian Ocean as a first step towards better management and conservation of these species.

On this basis, the On-board Identification of Sharks and Rays Initiative was launched under the FAO component (fisheries management) of the IOC-SmartFish programme in June 2012.

Since then however, concerns about the status of shark and ray stocks have increased. In 2013, at the COP 16 event, five new species of sharks and all manta rays species (belonging to the same subclass, *Elasmobranchii*) were listed under Appendix II of CITES. Enforcement of this listing was postponed by 18 months to allow countries to resolve related technical and administrative issues.

In 2014, the CITES Animals Committee established a working group for the conservation and management of sharks, whose mandate is, amongst others, to identify challenges, such as scientific and technical gaps, and provide advice to make non-detriment findings (NDF) and to be able to implement the CITES listings for sharks effectively.

On the basis of suggestions from the working group, the CITES Animals Committee formulated a specific recommendation directed at the CITES Secretariat, the Secretariat of the Convention on Migratory Species (CMS) and the Food and Agriculture Organization of the United Nations (FAO).

"*The Animals Committee encourages the Secretariat to continue to work closely with FAO, the Secretariat of the Convention on Migratory Species, and Regional Fisheries Management Bodies, both with respect to CITES-listed shark species and, where appropriate, wider issues of shark conservation relevant to Resolution Conf. 12.6 (Rev. CoP16).*

The Animals Committee encourages FAO to continue its efforts to improve harmonised tariff codes for shark products and their work on shark identification (iSharkFin).

The Secretariat should ensure that all available guidance material relating to the identification of shark species listed in the Appendices (e.g. iSharkFin) are made available promptly through the shark portal on www.cites.org, including identification of fins and other shark products, and genetic testing protocols[1]."

Directed at the parties: The Animals Committee "*encourages Parties to continue to work to improve collection of data at the species level, especially in respect of CITES-listed species*".

[1] Source: Report of the Twenty-eighth Meeting of the Animals Committee Tel Aviv (Israel), 30 August - 3 September 2015. https://cites.org/sites/default/files/eng/com/ac/28/E-AC28-17-01-01.pdf

"*Parties are* (also) *encouraged to involve both fisheries and CITES officials, and those of relevant Regional Fisheries Management Bodies, wherever possible, in meetings, events and processes concerning implementation of shark listings*."

Following the shark and rays initiative, new decisions were taken at the CITES level. In 2016 at COP17, the Silky Shark (*Carcharhinus falciformis*), Threshers Shark (*Alopias spp.*) and Mobula Rays (*Mobula spp.*) were listed under Annex II with a 6 - 12 month implementation delay. More species are now under scrutiny and might be included in Appendix II in the coming years.

Initiated in early 2012, the IOC-SmartFish initiative on pelagic sharks and rays in the Western Indian Ocean responds to regional concerns and further international developments. It also supports the need of country and fleet adaptation for the establishment of new international measures (CITES, IOTC requirements, Nairobi Convention) and to reduce global pressure on sharks and rays.

2. Objectives of the Sharks and Rays Initiative

As a first step, the IOC-SmartFish programme developed a professional on-board guide for the identification of pelagic sharks and rays in the Western Indian Ocean. This guide aims to be a handy tool for a wide range of users from both the public and private sectors (e.g. professionals of the fishery sector, observers, fishery inspectors, environmental associations, etc.). The guide also falls under the FAO's Fish Finder Programme (species identification and data programme) whose role it is to: (i) Secure the best up-to-date information calling upon knowledgeable specialists in taxonomy; (ii) Compile information on species distribution to produce distribution maps; (iii) Draw reliable and accurate illustrations of marine organisms and their anatomical details; (iv) Produce and distribute species identification information for fishery purposes through various media.

The on-board guide was designed to assist in the identification of pelagic sharks and rays of the Western Indian Ocean and intended to help fishery workers collecting catch data in the field with the identification of those sharks and rays they were most likely to encounter. It was conceived to be updatable - offering the possibility to add additional species accounts as new information becomes available – with removable rings on the printed copies.

The second part of this initiative was the facilitation of access to and use of this guide. In this regard, training workshops were organised for IOC countries (Comoros, Madagascar, Mauritius, Reunion and Seychelles) in 2014 and 2016 to train professionals on shark identification and other related matters.

The training was open to professionals (observers, fishery officers, researchers, fishing operators, etc.) as well as to non-governmental organizations involved in this field. In total, about 150 participants from the six countries participated in the three workshops (see Participant List in Annex A).

The first workshop was held at the Albion Fisheries Research Centre, on 28 - 30 October 2014, Albion, Mauritius with the full collaboration of the Ministry of Fisheries of Mauritius. The second workshop was held at the Seychelles Fishing Authority (SFA) in Victoria, Mahe, Seychelles, on 4 - 6 November 2014 with the collaboration of the SFA. The third workshop, organised for the IOC's francophone countries (Comoros, Madagascar, Reunion) in Saint Denis, Reunion, was held on 25 - 27 January 2016 at the University of Reunion with the full collaboration of the Prefecture, the Directorate of Planning, Environment and Housing (DEAL), the Directorate of the South Indian Ocean (DMSOI) and the Regional Committee for Maritime Fisheries and Marine Aquaculture (CRPMEM) in Reunion.

The three workshops followed a similar logic with slight variations to reflect a country's particular interests and context.

The workshops combined theoretical lectures with practical sessions on shark samples to improve recognition of identification keys and to learn additional practices related to biological sampling and research.

The lectures covered the following areas:

- CITES listing and IOTC regulations regarding sharks and rays;
- National regulations and/or plans concerning sharks and regulations: In Mauritius more focus was given to the implication of sharks appearing under Annex II of the CITES list; In Seychelles, the SFA presented their National Plan of Action for the Management and Conservation of Sharks (NPOA Shark); In St-Denis, as Comoros, Madagascar and Reunion do not have NPOAs, participants presented their specific national regulations regarding sharks and rays;
- Existing documentation (guides, manuals, web tools) that can be used to identify sharks and rays and documentation about safe release techniques;
- Presentation of the on-board guide for pelagic sharks and rays developed by the IOC-SmartFish programme;
- Identification of the major groups of pelagic sharks;
- Identification of genera and species. In Reunion, a complementary presentation was made on the main species of coastal sharks;
- Taking photographs for identification;
- Data collection and basic biological data.

The practical sessions gave participants an opportunity to: use the guide; use the identification keys on sharks and rays; practice scientific photography for identification purposes; learn measurement methods; collect and condition basic biologic samples for various purposes (age determination, genetic analysis, etc.); and practice basic visual methods to analyse stomach content, etc.

Different speakers animated the lectures and practical sessions for each workshop; the workshops in Mauritius and Seychelles were lead by Dave Ebert, the taxonomist shark specialist who developed the on-board identification guide. The agenda and speakers for each meeting can be found in Annex B.

As many presentations, with slight variations, were given over the course of the three workshops, only some of the interventions are summarized in the following sections of this report, with a focus on shark identification and available tools. More detailed information concerning other presentations can be found in the annexes of this report.

Photo 1: Group photo, Mauritius

Photo 2: Group photo, Seychelles

Photo 3: Group photo, Reunion

3. Presentation of the on-board guide and other existing identification tools

3.1 Presentation by Dave Ebert, Shark Taxonomist

The aim of the pelagic sharks and rays of the Western Indian Ocean field guide is to improve the capabilities of observers to identify many of the common and some of the not so common shark and ray species that may be encountered in the region. By using an established species identification process and through the correct use of the identification tools developed by the IOC-SmartFish programme, fishery observers should be able to improve their knowledge by keying in on certain anatomical features to guide them to the taxonomic family, genus and species caught in the region. In addition, the proper methods to photograph sharks and rays, and to take basic biological data are also covered in the field guide.

The field guide to the pelagic sharks and rays of the Western Indian Ocean is the latest tool for improving the identification of this fish group to species level. Other recent tools include the two-volume, Catalogues to the Deep-sea Cartilaginous Fishes of the Indian Ocean (Ebert, 2013, 2014) and an Identification Guide to the Deep-sea Cartilaginous Fishes of the Indian Ocean. The pelagic guide compliments these other FAO-supported projects and follows a similar format to the deep-sea field guide. Other recently produced identification tools produced were by the Indian Ocean Tuna Commission (IOTC) and the Manta Trust. The IOTC produced a series of identification cards to help improve catch data and statistics on sharks and rays that are caught in tuna fisheries. The IOTC identification cards highlight the key external morphological characteristics and provide the scientific name as well as the common name in Japanese, Chinese, French, Spanish, and English.

The Manta Trust produced an identification guide, but it is focused exclusively on the identification of Mobulid rays and does not include sharks. The guide includes a key to the Mobulid species that occurs within this region. Another publication, currently being prepared, is a monograph to the Coastal Fishes of the Western Indian Ocean that will include all of the known coastal Chondrichthyan species in this region. This latter project is being produced by the South African Institute for Aquatic Biodiversity and is to be published in 2015.[2]

Additional products and tools include a good practices guide to reduce shark and ray mortality of incidentally caught species, fin identification guides, and a guide to the gill plates of Mobulids. The EU MADE programme developed a guide to reducing the mortality of incidentally caught sharks and rays that also includes suggestions for mitigating adverse impacts of fisheries targeting large pelagic fish in the open ocean. This includes purse seiners using fish aggregating devices (FADs) and longliners. The manual also includes recommendations on how the crew can reduce injuries in handling small, medium, and large-sized species. The manual is in English, French, and Spanish. The increasing demand for shark and ray fins has sparked recent interest in developing means to identify fins in the field. Frequently fins have been removed from sharks or rays making it difficult to tell the species. The PEW Charitable Trusts recently published a guide to identify sharks, whilst the FAO has also developed a shark fin identification guide. This latter project has also developed user-friendly software for identifying shark and ray fins in the field[3]. Another product tool, recently developed by the Manta Trust, is a field identification guide for the gill plates of Mobulid rays. The removal of gill plates from Mobulid rays is a little known industry that is emerging as a potential problem for this group of poorly known Batoids.

In Seychelles a national identification guide in Seychellois Creole was published in 2016[4]. This specific Seychellois shark identification guide highlights the characteristics of the local population.

Presentation of the on-board guide

The field guide includes those pelagic species in the Western Indian Ocean that are of major, moderate, minor, and minimal importance to fisheries, as well as those of doubtful use to fisheries. It includes little known species that may be of research, educational, or ecological importance. The field guide is intended to help fishery workers collect catch data in the field and to identify those sharks and ray species that they are likely to encounter.

[2] http://www.saiab.ac.za/coastal-fishes-of-the-western-indian-ocean.htm
[3] http://www.fao.org/ipoa-sharks/tools/software/isharkfin/en/
[4] https://drive.google.com/file/d/0B0BM5LxuuPBbekt1aDJ3V0VuWGM/view

The format is designed to be updatable with the possibility of adding additional species accounts as new information becomes available.

Table 1: Availability of the on-board guide

	Hard copy in library	Web version online
FAO	X	X
IOTC	X	X
IOC	X	X
CITES		X
Seychelles Fishing Authority	X	
Comorian Ministry of Fisheries	X	
CNDRS	X	
National School of Fishing, Anjouan	X	
Ministry of Fisheries, Madagascar	X	
Ministry of Fisheries, Mauritius	X	
WIOMSA	X	X
University of Comoros	X	
University of Reunion	X	

The format is designed to streamline the process of identifying the most common, and some of the less common, pelagic shark and ray species found in the Western Indian Ocean. A generalised morphological illustration of a shark and ray is provided with the external morphological terminology for each. A glossary is also provided to define those terms that may not appear obvious or are used throughout the guide.

The key guide starts at the highest level by determining whether one has a shark or a ray. The key characters to each family for the sharks and rays follows and by comparing the key family characters to those of the specimen the family should be determined. Once the family has been determined one can go to the page for that family and follow the steps for determining the genus and subsequent species within that genus. Some families are wide-ranging and have only a single species whilst other families may have multiple genera and multiple species within each genus.

Once the family and genus (if necessary) have been determined the key morphological characteristics are highlighted for each species. Each species account has the family name, both scientific and common names, and the common English, French, and scientific names of the species. In addition to the key morphological characters the main colour features, size given as total length, and dentition of each species is provided.

The colour patterns, and dentition on some shark species, can be useful characteristics for some of the more problematic groups such as the genera *Alopias*, *Carcharhinus*, and *Mobula*. A photograph of each species is also included on the species page. On the back of each species account are similar species that may be confused with the species in question. This similar species page illustrates the position of the dorsal fins relative to the pectoral, pelvic, and anal fins. An underside view of the snout is also given, as this latter view can be very helpful in distinguishing similar species such as the Hammerhead Sharks, *Sphyrna*.

It is very possible that a species not represented in the guide may be encountered from time to time. If a specimen is encountered that cannot be identified and is not in the guide care should be taken to photograph it (see section below on how to take photographs) and tissue samples taken if possible (see section below on how to take samples). Photographs of problematic species can be sent to Dr David Ebert or Mr Paul Clerkin for identification (contact details can be found in Annex A). Tissue samples can also be sent to Dr David Ebert, Mr Paul Clerkin, or to a lab that conducts molecular studies (see Annex C). It is recommended that unless previous arrangements have been established with one of these labs it would be best to contact Dr David Ebert or Mr Paul Clerkin prior to sending any unsolicited tissue samples to these labs. Typically these labs will not run any samples unless the specimen has been properly photographed and if possible saved for deposition into a major museum collection.

Identification of major groups of pelagics: introduction to the external characteristics and identification of genera and species

The public's perception of sharks often conjures up images of a large, fearsome, toothy predator. However, the reality is that sharks come in a variety of sizes and shapes from the world's largest fish, the Whale Shark (*Rhincodon typus*), to the Dwarf Pygmy Shark (*Squaliolus spp.*). In addition to sharks, Batoids and Chimaeras collectively form a distinct group of fishes referred to as Chondrichthyans. This group comprises nearly 1,200 species of shark and shark-like fishes, with more than 500 species of sharks, nearly 650 species of Batoids and about 50 species of Chimaeras. The diversity of sharks and their relatives has increased exponentially over the past decade with more than 200 new species having been described since 2000. Since 2007, over 160 new species have been described, an average of about 20.5 new species per year. This represents nearly 20 per cent of all shark species that have already been described. Most of the new species discovered over the past decade have come from the Indo-Australian region followed by the Western Indian Ocean. Many of these newly described species are deep-sea inhabitants, mostly living at depths in excess of 200m. The discovery of new species, combined with the taxonomic resolution of species complexes, has led to a scientific renaissance in Chondrichthyan taxonomy, and highlights the importance of taxonomy for proper identification and management of this charismatic fish group.

The Western Indian Ocean is one of the most diverse regions for Chondrichthyans, but is insufficiently studied. Approximately 160 sharks, 129 Batoids, and 9 Chimaeras occur in the Western Indian Ocean, representing about 25 per cent of all known Chondrichthyan species. Of this total, about 20 species primarily inhabit the pelagic zone, whilst at least another 21 species may spend part of their life history in the pelagic environment. Most of those pelagic species are wide-ranging and occur throughout most of the ocean basins of the world. The majority of species fall within eight families, including the *Pseudocarchariidae, Megachasmidae, Alopiidae, Lamnidae, Carcharhinidae, Sphyrnidae, Dasyatidae* and *Mobulidae*. Two of these families are monotypic, with only a single species; whilst the single species representative of the family *Dasyatidae* (*Pteroplatytrygon violacea*) is unique within that family in being the only species to inhabit the pelagic environment.

The most important families though with regards to species representatives are the *Alopiidae, Lamnidae, Carcharhinidae, Sphyrnidae*, and *Mobulidae*. All three species representatives of the *Alopiidae* and the three largest members of the *Sphrynidae* are all known to occur in the pelagic zone. Members of the families *Alopiidae* and *Sphyrnidae* are very similar morphologically, but can be easily distinguished by body coloration or for the *Sphyrnidae* by the shape of the hammer-like head. The *Lamnidae* can also be distinguished relatively easily by comparing the coloration of the different species and the position of the dorsal fins to the pectoral, pelvic and anal fins, and by the presence of one, two, or no lateral keels on the caudal peduncle.

The most problematic groups are those members of the genera *Carcharhinus* and *Mobula*. Several members of the *Carcharhinus* look very similar to each other, especially the Dusky (*Carcharhinus obscurus*) and Galapagos (*C. galapagensis*) Sharks. The *Mobulas* are also problematic especially if their colour has faded. However, their disc shape and relative horn length is useful in separating the various species.

In addition to the commonly seen species, several poorly known species are infrequently caught and whilst they may not be of any fisheries importance they hold great scientific and educational interest. Amongst these species are members of the families *Somniosidae* and *Dalatidae*. Most of the species in these two families are relatively small and may easily be missed. The one exception to size is the Southern Sleeper Shark (*Somniosus antarcticus*) that may grow to a total length of 5 m or more.

3.2 Taking pictures and collecting samples

The importance of samples

Very little is known about many of the world's sharks. Basic information such as length, sex, maturity and diet can greatly help researchers learn about sharks in the Indian Ocean and help maintain a healthy fishery.

Scientists rarely have access to sharks as regularly as fishers do, and any information collected and submitted will make an important contribution toward sustaining a healthy ocean.

Data collection techniques covered here include:

- Photo-documentation;
- Genetics;
- Lengths;
- Maturity Ranking (M/F);
- Reproduction parameters;
- Pups;
- Diet;
- Vertebrae and spines;
- Preservation/Tag and bag.

Photo-documentation

Equipment required: camera and ruler (or other size reference).

Photo-documentation is one of the most important pieces of data to collect. It is very useful, easy to share with colleagues, and necessary for genetic tissue verification. It is standard procedure to photograph a shark with its head facing left. Each photograph should include a size reference such as a ruler and an identifying number to link the photo to its associated data for later reference. Each set of photographs should include:

- A full lateral view. A side view of the shark including its entire body from snout tip to tail. The photo should be taken 'straight-on' (i.e., at 90 degrees to) to the side of the body, and at a angle not too high nor too low on the shark. All the fins should be erect. This is the most important picture to take.
- Detailed photos of the head. Three photos (top, bottom, and side of head), from tip of snout to origin of pectoral fin. It is important to show features of snout length and mouth shape and size.
- Close up of teeth. Photos should show the shape of the teeth in both the upper and lower jaws. These are helpful for identification, especially for sharks of the genus *Carcharhinus*.
- Fins and trunk. Photos should show erect fins, inter-dorsal ridge (if present), and colour marks of the flank. Close up photos of individual fins should also be taken.

- Anything unusual. Include photos of other characteristics that stand out, such as denticles or eyes, as well as any anomalies such as injuries, parasites, or growths.

Collection of genetic material

Equipment required: knife, vials or bags, ethanol and gloves (recommended).

Genetics is a useful tool to define species and evolutionary lineages on a molecular level. Additionally, tissues can be used for a variety of other important studies such as isotope analysis, pollutants and heavy metals studies, and multiple paternity. All the tissues of the body have genetic material, but when available the liver and muscle tissue provide the best sample for genetic studies. Genetics should be taken inconspicuously behind the pelvic fins from specimens to be kept for science. Genetic samples are taken as fin clips from live specimens.

When taking genetic samples remember to:

- Sterilize the equipment. Rinse all tools, cutting surfaces, and hands. Clean off any material (blood, scales, etc.) on the area of the shark from which the sample will be collected.
- Wear gloves when available, or wash your hands.
- Take a pea-sized sample and cut it into slivers.
- Put the sample in a vial of ethanol (highest percent available) and shake. If ethanol is not available, tissue can be stored in drinking ethanol (spirits), or frozen.
- Mark and record vial to match with data, photos, and/or specimen.
- Photographs must be taken and/or the specimen kept. Tissues are not useful without a voucher photo (or specimen) to verify identification.

Length data

Equipment required: measuring board, measuring tape, or a large pair of callipers.

Length data is the most important data to record. It is simple to take and correlates directly to many important life history parameters such as: age, maturity, weight, and reproductive output. There are three length measurements for sharks and 1 for skates and rays. Measurements should be taken as a straight line, not arching over the body. Measuring over the body will be effected by the contour of the body, so the most reliable way to take a length is by laying the measuring tape down on a flat surface such as the deck, floor, or a table and laying the shark over it. A large pair of callipers works well if available. Always record species, location, and sex data when recording length.

Sharks:

- Total length (TL) is the entire length of the shark and is measured from the tip of the snout to the end of the tail. This is the most used length measurement.
- Fork length (FL) is the distance from the snout tip and the fork of the tail (where the upper lobe meets the lower lobe). This length can be useful if the tail tip is damaged.
- Pre-caudal length (PCL) is the length from the tip of the snout to immediately in front of the dorsal origin of the caudal fin. This measurement is useful for sharks with unusual tail shapes, long terminal caudal margins, or lack fork lengths.

Skates and rays:

- Disc width is measured as the distance across the body between the wing tips.

Maturity and reproduction

Maturity and reproduction are measured differently for males and females, and can be done by maturity ranking and by measurement of reproductive organs.

- Male Chondrichthyans can be differentiated from females by the presence of claspers, a pair of reproductive appendages formed from the posterior portions of the pelvic fins.

Male maturity ranking:

1. Male maturity ranking 1 (M1): Neonates can be identified by the presence of an umbilical scar, visible on their ventral surface between their pectoral fins.
2. Male maturity ranking 2 (M2): Juveniles lack an umbilical scar and have short, undeveloped claspers. Claspers are flexible and do not exceed the posterior edge of the pelvic fins.
3. Male maturity ranking 3 (M3): Adolescences have developing claspers which exceed of the posterior edge of the pelvic fins, but are flexible and the individual is not reproductively active.
4. Male maturity ranking 4 (M4): Fully mature males have long claspers extending beyond the posterior edge of the pelvic fins. The claspers are rigid and calcified.

Male reproductive measurements can be taken externally as the length of the claspers. Using the inner jaws of the callipers, measure the inner claspers length as the length between the apex of the vent and the distal tip of the clasper.

Female maturity ranking:

1. Female maturity ranking 1 (F1): Neonates can be identified by the presence of an umbilical scar visible on their ventral surface between their pectoral fins.

2. Female maturity ranking 2 (F2): Juveniles lack an umbilical scar and are reproductively undeveloped. Internally they have little or no development of oocytes in their ovaries, and their oviducal glands are not discernable from their undeveloped, string-like uteri.
3. Female maturity ranking 3 (F3): Adolescences are developing, but are not reproductively active. Oocytes are present in ovaries, but lack large yolky eggs. Oviducal gland can be developing along a thin uterus.
4. Female maturity ranking 4 (F4): Fully mature females have large yolky eggs in uteri and a developed oviducal gland along a wide uterus which hangs freely away from the body cavity wall.
5. Female maturity ranking 5 (F5): Gravid females are pregnant, with eggs or pups at any stage of development within uteri.

Female reproductive measurements can be measured internally with the outer jaws of sliding callipers at the greatest width across the oviducal gland.

The number of pups should be recorded. Very little is known about the reproductive output of many shark species. A pup count can help scientists estimate fecundity.

Diet

Equipment required: knife.

Diet is an important way to investigate the place of sharks in the food web, and to have an idea of what they are feeding on. Diet is taken by studying stomach content, and can be recorded in two ways: item count and estimated percent volume.

- Item count is done by counting the number of food items and recording them to the lowest possible taxa. Example: 6 fish, 1 crab, 1 squid.
- Percent volume is the estimated volume of each food item in an individual's stomach. Example: 60 per cent fish, 10 per cent crab, and 30 per cent squid.

It is preferable to use both methods, and, if possible, photograph stomach contents.

Collecting vertebrae for age and growth studies

Equipment required: knife, bag, tags or labels.

Sharks lack bones, but they do have hard calcified structures, namely their vertebrae. As sharks grow, they lay down calcified rings in their vertebrae, which can be counted for an age estimate.

Vertebrae collection is important for scientists to have a good estimate of how old different species of sharks are, at what age they reproduce, and how quickly they can reproduce offspring.

- Collect vertebrae from the trunk region of the shark, roughly between the pectoral fins and below the first dorsal fin.
- Excise 10 pieces (centrum) by cutting between the discs.
- Remove excess flesh and store the vertebrae in a plastic bag and freeze.
- Make sure the sample is clearly labelled, so it can be matched to length and species data.
- A sample cannot be used without both length and species information.

Preservation

Equipment required: formalin, syringe and needles, safety equipment (ventilation mask, eye protection and gloves).

Preservation is essential for keeping and sharing shark specimens[5]. Freezing will keep a specimen in good condition, but in order to ship a valuable specimen to a research institution for study, proper preservation is needed to ensure the integrity of the specimen.

- First inject pure formalin into the specimen. Formalin is a very strong preservative but does not diffuse readily through more than a few centimetres of tissue. For this reason, pure formalin should be injected into the gut cavity and throughout the body of the specimen. Injections should be spaced roughly the width of a person's fist. If a syringe is not available a small incision made in the abdomen of the shark will allow the formalin to enter the body cavity during submersion.
- After the animal has been injected with pure formalin, it should be submerged in 10 per cent formalin for 2-4 weeks depending on the size of the animal. The pure formalin can be diluted to this concentration by taking one part formalin and adding 9 equal parts of water.
- After the sharks have been soaked for a few weeks, they will be fully preserved. They should be removed from the formalin and placed in a water bath. Leave the specimens in running water or change the bath water regularly for 1-2 days.
- Once rinsed, remove the shark from the water and prepare to package it for shipment.

[5] If nothing else is available on board, any kind of spirit could also work as long as it is indicated what kind of alcohol was used to facilitate analysis in laboratory. Samples can also be frozen for a short time, e.g. a few months, if no alcohol is available.

- Specimens should be wrapped in cloth (to protect them and keep them moist), and then packaged in several plastic bags. It is very important that the specimen package does not leak.
- Remember to include a tag or label with the shark (placed in its mouth) so it can be matched with genetic samples, location data, photographs and other data.
- Be sure to use proper safety equipment and work in a well-ventilated area. Equipment can include: an organic respirator, eye protection and gloves.

Additional clarifications were given by D. Ebert at the end the presentation. In particular, he mentioned that in countries where no genetic analysis is available, tissue samples can be shipped by airplane, or just mailed. There are several laboratories that can do genetic studies worldwide, but the choice of one really depends on what questions want to be answered. For a species identification question the Tree of Life project, under the direction of Dr Gavin Naylor, would be a solution. If it is a question on population structure then there are other laboratories to consider. The cost of running genetic samples can be expensive (US $35/sample) therefore many laboratories will be reluctant to proceed without some source of funding. Funding can be overcome if a collaborative project is established such that funding can be requested.

The presentation given by Sébastien Jaquemet in French, a Professor at the University of Reunion, on biological sampling and data collection by on-board observers can be found in Annex D.

3.2 Practical sessions in Mauritius, Seychelles and Madagascar

Mauritius

Specimens examined in Mauritius included two species, a Shortfin Mako Shark (*Isurus oxyrinchus*) and Blue Shark (*Prionace glauca*). All the specimens examined had already been gutted with the heads and fins removed. However, despite the lack of the head and fins, which can be key features for identifying sharks, the practical session was still very well received since the participants had to use other, non-typical, methods to identify the two species. These included body colouration and the approximate position of the fins. Examination of the vertebrae was also possible. A demonstration was done on how to properly remove the vertebrae, label it, and save it for future ageing studies. How to take tissue samples for genetic studies was also demonstrated.

Photo 4: Practical session, Mauritius

Photo 5: Practical session, Mauritius

Photo 7: Collecting biological samples, Mauritius

Photo 6: Collecting biological samples, Mauritius

Seychelles

The practical session in the Seychelles had 16 specimens representing 11 species available for examination, with all of the specimens having been kept intact. The species examined included: *Carcharhinus albimarginatus*, *C. amblyrhynchos*, *C. falciformis*, *C. limbatus*, *0*. *Nebrius ferrugineus*, *Negaprion acutidens*, *Sphyrna lewini*, *S. mokarran*, *Triaenodon obesus*, and *Rhynchobatus australiae*. The participants were divided into four groups and took turns examining and identifying as many different species as possible. One shortcoming of the identification portion of the practical session was that only five of the 11 species were in the field guide. The other six species were mostly coastal species. However, despite those species not being in the field guide the participants were still able to use the key to get several of the sharks down to genus.

After everyone had had an opportunity to examine each of the species and identify them, each group then proceeded to take basic biological samples including length measurements, determine the sex, and then perform a dissection on the various species to determine maturity status, diet (if stomach contents were present), and in general to examine the internal anatomy of each specimen. Tissue samples were taken from the specimens and saved for possible future genetic studies.

Upon completion of the dissections, each group prepared a PowerPoint presentation on what they had learned from the practical sessions.

Photo 8: Data collection, Seychelles

Photo 9: Identification, Seychelles

Reunion

Two practical sessions were organised during the workshop in Reunion.

The first session took place in the University laboratory. The three objectives were to identify small specimens of sharks using the identification keys explained during the previous sessions. Participants familiarized themselves with the protocols for measurements and recording length data. They also took biological samples. The session ended with a dissection of the species.

The second session took place in facilities at the port. Dissections of larger shark species (Bull Shark and Tiger Shark) took place. The participants were divided into two groups to allow for the proper exchange of information amongst participants. A visit to Reunion's Regional Centre for Surveillance and Rescue (*Centre régional opérationnel de surveillance et de sauvetage*: CROSS) was organised during the second session.

Photo 10: Data collection and identification, Reunion

4. National, regional and international obligations, resolutions and action plans

4.1 National regulations and National Plans of Action in the IO region

Concerns about expanding shark fisheries lead the FAO to develop an international plan of action (IPOA) for the conservation and management of sharks in 1999, with the objectives of ensuring the conservation and long-term sustainable use of sharks in both targeted and non-targeted fisheries. In 2012, a review of the IPOA implementation was carried out by the FAO. The review focused on the top 26 shark-fishing countries over the past decade from 2000 to 2009.

It was determined that the top 26 countries catch 84 per cent of the reported shark landings to the FAO. The review showed that during this decade landings had declined by about 20 per cent and that 18 of the top 26 countries had adopted a NPOA[6].

In 2014, at the time of the first two workshops, Mauritius was developing an NPOA Shark whilst Seychelles was inscribing the update of its NPOA Shark in the 2015 budget. Reunion, Madagascar and Comoros have not yet developed an NPOA Shark but have some specific national regulations.

Of the IOC member countries, Seychelles was the first to develop an NPOA in 2007. The first 4-year phase of the Seychelles NPOA Shark had two main objectives: (i) to establish the necessary capacity, systems and databases to enable the informed adaptive management of shark stocks in Seychelles, and (ii) to implement an active and progressive precautionary approach to the management of targeted and non-targeted shark fishing effort that takes into account the transitional needs of stakeholders. The Seychelles Plan of Action was examined, evaluated and updated in November and December 2015 to cover the period (2016 - 2020).

Box 1. NPOA Shark (2016 - 2020), Seychelles

Vision

"Shark stocks in the Seychelles EEZ are effectively conserved and managed to enable the fulfilment of their ecological role and optimal long-term sustainable use."

Mission

Fishery-related shark mortality is reduced and critical habitats managed such that shark populations are in recovery and special measures are in place for endangered/heavily-depleted populations.

Strategic objectives

1). Ensure that shark catches from directed and non-directed fisheries are sustainable.

2). Assess threats to shark populations, determine and protect critical habitats and implement harvesting strategies consistent with the principles of biological sustainability and rational long-term economic use.

3). Identify, and provide special attention to, vulnerable or threatened shark stocks.

4). Improve and develop frameworks for establishing and coordinating effective consultation involving all stakeholders in research, management and educational initiatives within and between States.

5). Minimize unutilized incidental catches of sharks.

6). Contribute to the protection of biodiversity and ecosystem structure and function.

7). Minimize waste and discards from shark catches in accordance with article 7.2.2.(g) of the Code of Conduct for Responsible Fisheries.

8). Encourage full use of dead sharks.

9). Facilitate improved species-specific catch and landings data and monitoring of shark catches.

10). Facilitate the identification and reporting of species-specific biological and trade data.

[6] http://www.fao.org/ipoa-sharks/national-and-regional-plans-of-action/en/

In Seychelles, a national identification guide in Seychellois creole was developed and finalized in 2016 (it can be found on:

https://drive.google.com/file/d/0B0BM5LxuuPBbekt1aDJ3V0VuWGM/view).

This specific Seychellois shark identification guide highlights the characteristics of the local population. It is meant to be used as a tool by Seychellois fishers, fishery technicians, NGO's and the general public to identify species caught in the Seychelles artisanal fishery and facilitate monitoring of shark catch.

The Mauritian NPOA Shark was developed in 2015 with the aim of implementing strategies, amongst others, for:

(a) Decreasing the fishing effort in any fishery where shark catches are unsustainable;

(b) Supplementing the Indian Ocean Tuna Commission resolutions calling for the use of nylon leaders on long lines for those fleet not targeting sharks and releasing sharks unharmed;

(c) Improving data collection and monitoring of shark species; and

(d) Exercising control over the access of fishing vessels that exploit shark stocks.

Reunion, Madagascar and Comoros do not have an NPOA Shark. Comoros have no specific regulations on sharks apart from those that apply to all countries at the regional and international levels (IOTC resolutions). Madagascar, which has an artisanal shark fishery (see box 2), has a strictly national legislative framework that is quite limited. The main measure (beyond regional requirements for Thresher Sharks) has been to freeze the number of permits issued for the collection of shark fins since 2007. [7]

Box 2. Artisanal shark fishery in Madagascar

Boats: canoes (4–6m), boats (7-9m, motor, sail), *botry kely* (8m, 3–5 MT, motor, sail) and *botry* (20-25 fishers, motor, sail).

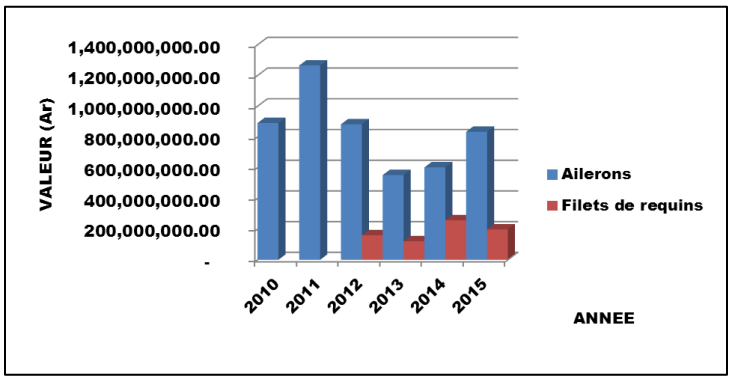
Fishing gear: gill nets (Jarifa, Bemaso, GTZ): 100-900m long, 3-7m deep, mesh 3-7 inches; 1Km long, 4m deep, mesh 30cm; 600m long; long lines and harpoons.

Fishing season: All year round, between November and March

Tide: 12 h - 4 days; 21 days and 1-2 months

[7] More information about the artisanal shark fishery in Madagascar can also be found in the IOC report: A Preliminary Value Chain Analysis of Shark Fisheries in Madagascar, 2015: http://www.fao.org/documents/card/en/c/4cb92ba9-6492-4409-8675-baf4791d6b99/

Figure 11: Estimated value of shark fins and fillets



Legend: blue = fins red = shark fillet
Source: Ministry of Fishing and Fishery Resources

4.2 CITES resolutions and CITES Appendix

Kevin Ruhoomaun, Senior Scientific Officer from the Ministry of Agro-Industry, Mauritius, articulated his presentation in three parts:

- What is CITES;
- How CITES works;
- What are the new CITES decisions impacting pelagic sharks.

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES regulates international trade. Decision concerning CITES are taken during the Conference of Parties (COP) held, more or less, every three years.

CITES works under the precaution principle. To protect species, they are classified under three appendices:

- Appendix I lists those species that are the most endangered amongst CITES-listed animals and plants.
- Appendix II lists species that are not necessarily threatened with extinction at this time but that may become threatened unless trade is closely controlled. About 96 percent of species are listed under this appendix. Trade regulation measures have proven to be successful in most cases.
- Appendix III is a list of species included at the request of a Party that already regulates trade in a particular species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation. Only one percent of species listed are listed under Appendix III.

At COP 16 in Thailand in 2013 several commercially exploited pelagic sharks and rays were added to Appendix II. Concrete requirements related to Appendix II apply to the trade of products or products derived from the following species:

- *Sphyrna lewini*, Scalloped Hammerhead (2013)
- *Sphyrna mokarran*, Great Hammerhead (2013)
- *Sphyrna zygaena*, Smooth Hammerhead (2013)
- Carcharhinus longimanus, Oceanic White Tip Shark (2013)
- *Lamna nasus*, Porbeagle Shark (2013)
- *Manta spp.,* Manta Ray (2013)

In addition to the previously listed species:

- *Pristidae spp*.(7 species)*,* Sawfishes (2007)
- *Carcharodon carcharias*, Great White Shark (2005)
- *Rhincodon typus*, Whale Shark (2003)
- *Cetorhinus maximus*, Basking Shark (2003)

Given the difficulties many countries had to implement the 2013 decision; an 18-month delay was allocated to allow Parties time to resolve related technical and administrative issues; the resolution therefore came into force in September 2014.

What is actually going to happen to the trade of these species? In concrete terms, international trade in specimens listed under Appendix-II may be authorized by the granting of an export permit or re-export certificate. Permits or certificates should only be granted if the relevant authorities are satisfied that certain conditions are met, above all that any trade will not be detrimental to the survival of the species in the wild.

Permits and certificates are only required for international trade; this means that for a Mauritian-flagged boat that only fishes and trades locally, there is no need for a CITES permit.

The flag country CITES authority is the one that has to issue the permit. In Mauritius, the re-export permit should be on-board; the Mauritian CITES Authority will issue the re-export permit. At the time of the workshop (end of October 2014), Mauritian legislation was not yet applying the new CITES regulations. The priority was the organisation of adapted controls and assessment of stocks and their vulnerability.

In Mauritius, the CITES regulations fall under the Wild Life National Park Act and the Wild Life Regulations of 2014.

4.3 IOTC resolutions

The IOTC resolutions on sharks and rays were presented by Jude Talma (SmartFish Expert, MCS), at the workshop in Mauritius, Miguel Herrera (IOTC Data coordinator) in Seychelles and Evgeny Romanov (CAP RUN, ex-Vice President of the IOTC Working Party on Ecosystem and Bycatch) in Reunion. The presentations of Miguel Herrera and Evgeny Romanov are given below.

IOTC requirements for fisheries data (with a focus on sharks)

In Seychelles, the IOTC Data Coordinator, Mr Miguel Herrera, provided an overview of the IOTC with a focus on the data requirements agreed by the IOTC. He reported that the IOTC is one of five Regional Fisheries Management Organisations, with 32 Members and 3 Cooperating Non-Contracting Parties (CPC), with a mandate to manage 16 species of tuna and tuna-like species in the Indian Ocean. In addition, the Commission has agreed to "Promote sustainable development of fisheries based on those stocks", as stated in the IOTC Agreement, and for this reason has identified and is closely monitoring some species of pelagic sharks.

Mr Herrera noted that the IOTC has adopted: i) Minimum requirements for the collection of operational catch and effort data (logbooks) on industrial vessels, including twelve species of pelagic sharks and rays, depending on the type of gear used; ii) Minimum levels of sampling coverage, by enumerators at landing stages, for artisanal fisheries, set at 5 per cent of the total number of fishing activities (e.g. fishing trips); iii) Minimum data requirements and levels of sampling coverage, by observers at-sea, for industrial fisheries, set at 5 per cent of the total number of fishing operations (e.g. fishing sets); including all species of shark and other bycatch; iv) Requirements for the reporting of observer trip reports to the IOTC; and v) Requirements for the reporting of estimates of catch, effort, and size frequency data, in an aggregated manner, to the IOTC. He further noted that the IOTC has also adopted four resolutions for sharks that include data requirements: Resolution 05/05 concerning the conservation of sharks caught in association with fisheries managed by the IOTC, which includes minimum requirements for the reporting of data on sharks caught in IOTC fisheries; Two other resolutions to ban the retention of catches of Oceanic White Tip Sharks and Thresher Sharks; and one resolution to ban the encircling of Whale Sharks by purse seiners.

The IOTC Data Coordinator also gave an overview of levels of compliance by IOTC Members concerning sharks. He stated that, despite improved levels of reporting in recent years, data on sharks is still insufficient, in particular regarding the availability of historical catches of sharks and breakdown of the existing catches by species. This has compromised past attempts by the IOTC Scientific Committee to assess the status of stocks of Blue Shark and the Oceanic White Tip Shark, as requested by the Commission.

Finally, Mr Herrera reported that statistics for sharks are likely to improve in the future as more IOTC CPCs implement sampling schemes and observer programmes in full. In this regard he stated that the IOTC and its partners have been assisting some of the IOTC CPCs to strengthen their data collection and management systems and will continue to do so in the future.

Regulations of the Indian Ocean Tuna Commission on shark conservation and catch reporting

In Reunion, Evgeny Romanov (CAP RUN, ex-Vice President of the IOTC Working Party) gave the presentation on IOTC resolutions. The presentation, summarised below, is an updated version of a similar one given in 2014. The PowerPoint presentation (in French) is available in Annex D.

Mr Romanov started by highlighting the 28 most commonly caught species of sharks and rays in the Indian Ocean.

For sharks: the Carcharhinidae family dominated by 15 species of the *Carcharhinus* genus and two monospecific sharks, the Tiger shark (*Galeocerdo cuvier*) and the Blue Shark (*Prionace glauca*), species from the Lamnidar family, the Sphyrnidae family (Hammerhead Sharks) and the Alopiidae family (Thresher Sharks).

For rays: The Dasyatidae (Sting Rays), the Myliobatidae (Eagle Rays) and the Mobulidae (Manta Rays) families.

The vulnerability of a number of species is increased by their biological characteristics: low fertility (1 - 75 infants), long gestation period (8 - 24 months), very low ability to reproduce (once every 1 - 3 years), late maturity age (5 - 10 years) and a long life (20 - 30 years).

At the international level, the main organisations launching recommendations and resolutions regarding sharks and rays, pertinent to the IO region, are: the IOTC (fisheries); CITES (international trade); the Convention on the Conservation of Migratory Species of Wild Animals (CMS) and; the International Union for Conservation of Nature (IUCN).

In general, the quality of catch data for sharks is low worldwide. For the IO region, the quality of data transmitted to the IOTC is insufficient for a quantitative stock assessment: the status of most stocks is therefore uncertain. Since 2012, semi-quantitative methodologies are being used to try to overcome data poverty. Despite these difficulties, the IUCN has already classified a number of pelagic shark species as endangered (*Sphyrna lewini, Sphyrna mokarran, Rhincodon typus*), vulnerable (*Carcharhinus longimanus, Carcharhinus albimarginatus, Isurus oxyrinchus*, *Alopias superciliosus, Alopias pelagicus, Lamna nasus*) or near threatened (*Carcharhinus falciformis*).

At the IOTC level, the four main resolutions that directly address the management of sharks are:

- Resolution 05/05 concerning the conservation of sharks caught in association with fisheries managed by the IOTC;
- Resolution 12/09 on the conservation of Thresher Sharks (*Alopiidae*) caught in association with fisheries in the IOTC area of competence;
- Resolution 13/05 on the conservation of Whale Sharks (*Rhincodon typus*);
- Resolution 13/06 concerning the Scientific and Management Framework for the conservation of shark species caught in association with IOTC managed species.

Other resolutions indirectly target sharks such as Resolution 13/03 concerning the recording of catch and effort data. Applying to all seine, long line, pole and line, hand line and trolling fishing vessels over 24m and those under 24m if fishing outside their EEZ within the IOTC area of competence, it requires IOTC State Members to record catches of Elasmobranch species in certain fisheries.

Resolution 14/06 on the establishment of a programme for transhipment by large-scale fishing vessels and Resolution 13/08 on fish aggregating devices management plans also indirectly address shark catches. It is concerned with improving the monitoring of such devices and mitigating potential effects on the ecosystem.

Details of the IOTC resolutions can be found in the IOTC compendium, which is regularly updated and available on the IOTC website. Mr Romanov's PowerPoint presentation is available in French in Annex D and provides details on the resolutions.

5. Conclusion and ways forward

Over recent years, awareness and attention have been raised concerning the status of sharks and rays in the SWIO. Parallel to work undertaken by the project, several stakeholders have also pursued efforts on shark conservation and the improvement of data on shark fisheries and shark stocks [8].

The SWIO has been identified as a global hotspot, not only of Chondrichthyan species richness, but also of endemic, threatened and data deficient (as per the IUCN Red List of Threatened Species) species. No fewer than 38 species (20 per cent) are endemic to the SWIO, and in some instances to a single region within one country.

[8] The recent ORI/WIOMSA report is along the same lines: Offshore Fisheries of the Southwest Indian Ocean: Their Status and the Impact on Vulnerable Species, Oceanographic Research Institute Special Publication No. 10

To date, only a small minority of the Nairobi Convention SWIO countries have adopted a National Plan of Action for Sharks under the FAO International Plan of Action for the Conservation and Management of Sharks (IPOA Shark): France, Seychelles and South Africa.

Significant gaps in knowledge of sharks and rays exist both generally and in the SWIO region, including distribution, ecology, reproductive biology, population status and trends, and the nature, extent, and impact of fisheries on their status. There are also significant gaps in management, technical capacity, and awareness.

The work initiated through the IOC-SmartFish project is to be continued through other projects such as the IOC-Biodiversity project and under the umbrella of the Nairobi Convention.

The next step is the elaboration, assessment and approval of a regional review of the status of sharks and rays in the Southwest Indian Ocean with the Nairobi Convention Secretariat. This should take place in 2017. It is also expected that once Seychelles updates of its NPOA Shark and Mauritius further develops its NPOA, other countries will embark on the development of national action plans.

Annex A. List of participants

Mauritius workshop

Name	Institution/Organisation	E-mail address
David Ardill	Shark Specialist Consultant	ardilldn@gmail.com
Anishta Audit	Albion Fisheries Research Centre	Anishta141289@hotmail.com
Julien Barde	IRD/IOC	Julien.barde@ird.fr
Rai Y. Basant	Albion Fisheries Research Centre	ybasant-rai@mail.gov.mu
Gerard Bassy	Froid des Mascareignes	gbassy@fdm.mu
Keshini Beetul	Albion Fisheries Research Centre	Keshini.beetul@hotmail.com
Devin Bhunjun	Albion Fisheries Research Centre	devinbhunjun@live.com
Clotilde Bodiguel	FAO/SmartFish Programme	clotilde.bodiguel@fao.org
Luvna Caussy	Albion Fisheries research Centre	Luvna_caussy@yahoo.com
Soodeshsingh Caussy	Albion Fisheries Research Centre	soodeshcaussy@hotmail.com
Paul Clerkin	Moss Landing Marine Laboratories	pclerkin@mlml.calstate.edu
Manisha Curpen	Technical Officer Albion Fisheries Research Centre	mcurpen@mail.gov.mu
Dave Ebert	Moss Landing Marine Laboratories	debert@mlml.calstate.edu
Terence Gaiqui	Gladius Ltd	
Harishchand Gunesee	Albion Fisheries Research Centre	hgunesee@live.com
Baccus Hassenjee	Albion Fisheries Research Centre	hbaccus@mail.gov.mu
Clivy Lim Sheung	Ministry of Fisheries	clivilim@yahoo.com
Christophe Louison	Gladius Ltd.	
Anwar. Sheik Mamode	Albion Fisheries Research Centre	asheik-mamode@mail.gov.mu
Ganessan Murday	Ministry of Fisheries	charlenmurday@hotmail.com
Vedanand Muthoorah	Ministry of Fisheries	vedanandmuthoorah@yahoo.com
Georges Noel	Island Marine Entreprises Ltd.	marinetrade@intnet.mu
Melvyn Novel	Scott Shipping International Ltd.	pmn@scottship.com
Minakshi Pallut	FAO/SmartFish Programme	Minakshi.pallut@fao.org
Laurent Pinault	Sapmer/IOSMS	lpinault@iosms.com
Juthiah Ramoniah	Albion Fisheries Research Centre	movesha.j@gmail.com
M. Rault	Managing Director Froid des Mascareignes	MRault@fdm.mu
Denis Reiss	European Union Delegation	Denis.REISS@eeas.europa.eu
Kevin Ruhoomaun	Ministry of Agro Industry	kruhomaunster@gmail.com
Kaviraj Somar	Ministry of Fisheries	ksomar@hotmail.fr
Trishna Sooklall	Ministry of Fisheries	triis80@hotmail.com
Anil Soomary	Island Marine Entreprises Ltd	marinetrade@intnet.mu
Vishnu Soondron	Ministry of Fisheries	ssoondron@gmail.com
Poornah singh Sreekissoon	Albion Fisheries Research Centre	psreekeessoon@mail.gov.mu
Bachraz Vishnuduth	NPS	vbachraz@mail.gov.mu
Florence Wallemacq	FAO/SmartFish Programme	florence.wallemacq@fao.org
Patrick Wan	Froid des Mascareignes	patrickwan@fdm.mu

Seychelles workshop

Name	Institution/Organisation	E-mail address
Jennifer Appoo	Green Islands Foundation	jappoo@gif.sc
Lyndy Bastienne	Mangroves For the Future	lyndy.bastienne@iucn.org
Joanna Bluemel	Marine Conservation Society	info@mcss.sc / bluemeljh@gmail.com
Nathalie Bodin	IRD	nathalie.bodin@ird.fr
Emmanuel Chassot	IRD	emmanuel.chassot@ird.fr
Arjan De Groene	Green Islands Foundation	gm@gif.sc
Patsy Theresine Denis	Seychelles National Parks Authority	p.theresine@snpa.sc
Miguel Herrera Armas	IOTC	mh@iotc.org
Tove Jorgensen	Nature Seychelles	tove@natureseychelles.org tovelj@gmail.com
André Keith	Fishing Boat Owners Association	andre.kit@hotmail.com
Virginie Lagarde	Fishing Boat Owners Association	virginielagarde@libertysurf.fr fboa.labelproject@sfa.sc
Ashley Pothin	Wild life enforcement and permit / Ministry of Environment	a.pothin@env.gov.sc
Celeste Alvin	Seychelles Fishing Authority	alvinceleste7@gmail.com
Clara Belmont	Seychelles Fishing Authority	cbelmont@sfa.sc / clarabelmont52@gmail.com
Gregory Berk	Seychelles Fishing Authority	gregoryberk@gmail.com
Maria CEDRAS	Seychelles Fishing Authority	mcedras@sfa.sc
Roy Clarisse	Seychelles Fishing Authority	royc@sfa.sc
Kettyna Constance	Seychelles Fishing Authority	kconstance@sfa.sc
Randolph Fernandez	Seychelles Fishing Authority	rgl.fernandez73@gmail.com
Stephanie Hollanda	Seychelles Fishing Authority	shollanda@sfa.sc
Michel Labrosse	Seychelles Fishing Authority	mlabrosse@sfa.sc
Sabrena Lawrence	Seychelles Fishing Authority	slawrence@sfa.sc
Ernesta Mervin	Seychelles Fishing Authority	
Norris Mondon	Seychelles Fishing Authority	norrismondon@hotmail.com
Sheena Mondon	Seychelles Fishing Authority	smondon@sfa.sc
Sonny Naiken	Seychelles Fishing Authority	snaiken@sfa.sc
Tracey Pillay	Seychelles Fishing Authority	pillay.tracey@ymail.com tracypillay@sfa.sc
Calvin Radegonde	Seychelles Fishing Authority	calvinradegonde95@gmail.com
Melanie Rodney	Seychelles Fishing Authority	rmelanie@sfa.sc
Andrew Savio	Seychelles Fishing Authority	sandrew@sfa.sc
Elisa Socrate	Seychelles Fishing Authority	esocrate@sfa.sc
Clotilde Bodiguel	FAO	clotilde.bodiguel@fao.org
Paul Clerkin	Moss Landing Marine Laboratories	pclerkin@mlml.calstate.edu
Dave Ebert	Moss Landing Marine Laboratories	debert@mlml.calstate.edu
Florence Wallemacq	FAO Outreach Consultant	florence.wallemacq@fao.org

Reunion workshop

Name	Institution/Organisation	E-mail address
Rajo. A Andrianaivo	Centre de Surveillance des Pèches	rjandrianaivo@gmail.com
José Joseph Tombo	MRHP	t2jose@yahoo.fr
Harimandimby Rasolonjatovo	Centre de Surveillance des pèches/Ministère des ressources halieutiques et de la pèche	rasolo.vevey@madagascar-scs-peche.mg
Ferdinand Ndriananambinina	Ministère des ressources halieutiques et de la pèche	ferdinand.mbinina@yahoo.fr
Norbert Andrianarivelo	IHSM	a.norbert@ihsm.mg
Eric José Robsomanitrandrasana	Ministère de l'Environnement, de l'Ecologie de la Mer et des Forets	robsomanitrandrasana@yahoo.fr
Jean Berthieu Fezany Nomenjanahary	Blue Ventures	jb@blueventures.org
Tahiry Randrianjafimanana	Community Centred Conservation (C3)	tahiry.randrianjafimanana@gmail.com
Dorothée Ravomanana	IOC-SmartFish	dorothee.ravomanana@coi-ioc.org
Ali Mohamed Mohamed	Centre National de surveillance des pêches	rachad_ali@yahoo.fr
Mmadi Ahamada	Centre d'information sur le cœlacanthe et l'environnement marin - ONG/AIDE-APG	ahamadam09@yahoo.fr
Mouhiddine Jaffar	Ecole de pêche Anjouan/Université des Comores	jaffar_mouhhidine@yahoo.fr
Athoumani Mistoihi	Centre National de surveillance des pêches	vidjay99@yahoo.fr
Issoufa Saindou	Coopérative des pécheurs Moheli	mohelimarinepark@gmail.com
Soilihi Said Ahmed	Direction nationale des ressources halieutiques	alimohamed.soilihi@yahoo.fr
Clotilde Bodiguel	FAO	clotilde.bodiguel@fao.org
Minakshi Pallut	FAO	minakshi.pallut@fao.org
Florence Wallemacq	FAO	florence.wallemacq@fao.org
Frédéric Chanut	AEM/Gendarmerie Maritime (Port des Galets)	chanut.frederic@laposte.net/frederic-j.chanut@gendarmerie.gouv.fr
Antony Cheraud	AEM/Gendarmerie Maritime (Port des Galets)	antony.cheraud@gendarmerie.defense.gouv.fr
Thierry Hugues	AEM/Gendarmerie Maritime (Port des Galets)	thierry.hugues@gendarmerie.defense.gouv.fr
Didier Gicquel	AEM/Gendarmerie Maritime (Port des Galets)	didier.kerbeban@orange.fr
Jean Francois Nativel	Asso OPR	oceanpreventionreunion@gmail.com/jfnativ@wanadoo.fr
Olivier Marimoutou	Asso PRR	prreunion@gmail.com
Giovanni Canestri	Asso Elio Canestri	giovannicanestri@hotmail.fr
Boutron Yves	Asso Elio Canestri	rendanoulamerrendanoulareunion@hotmail.com
Veminardi Mylene	Collectif Renda nou la mer/(OPR) Ocean Prevention Reuinon	
Florence Trentin	Asso Vie Oceane	florence.trentin@orange.fr
Thierry Nikolaeff	Collectif Galves	t.nikolaeff@gmail.com

Nicolas Mariel	Direction de la Mer Sud-Océan Indien	nicolas.mariel@developpement-durable.gouv.fr
Dominique Person	Cross Reunion/Le Port Base Navale	dominique.person@developpement-durable.gouv.fr
Nicolas Toro	Cross Reunion/Le Port Base Navale	lucinico@orange.fr
Paco Rodriguez	CRPMEM	
Christopher Perry	CRPMEM	criket974@gmail.com
Guillaume Malfait	DEAL	guillaume.malfait@developpement-durable.gouv.fr
Jean Paul Russeil	DJSCS	Jean-Paul.RUSSEIL@drjscs.gouv.fr
Marc Soria	IRD	marc.soria@ird.fr
Chantal Ambroise	Préfecture	secretariat-spstpaul@reunion.pref.gouv.fr
Patrick Cohen	Préfecture	patrick.cohen@reunion.pref.gouv.fr
Nathalie Kubicek	Préfecture	nathalie.kubicek@reunion.pref.gouv.fr
Nicolas Le Bianic	Prévention du risque requin	Nicolas.Le-Bianic@developpement-durable.gouv.fr
Karine Pothin	Reserve Marine	karine.pothin@reservemarinereunion.fr
Chloé Goulie	Shark Citizen	chloe.goulie@gmail.com
Karim Patel	Squal'Idees	pk1980@hotmail.fr
Clément Quetel	TAAF	clement.quetel@taaf.fr
Thibaut Thellier	TAAF	thibaut.thellier@taaf.re
Sophie Marinesque	TAAF	sophie.marinesque@taaf.fr
Michel Bernard	DMSOI	michel-gaston.bernard@developpement-durable.gouv.fr
David Moussay	DMSOI	David.Moussay1@developpement-durable.gouv.fr
Mohamed Rochdi	University of Reunion	
Jean-Pierre Chabriat	University of Reunion	
Sebastien Jaquemet	University of Reunion	sebastien.jaquemet@univ-reunion.fr
Antonin Blaison	Spécialiste du comportement des requins	antonin55@hotmail.fr
Evgeng Romanov	Hydro Reunion	prosper.arda@orange.fr
David Guyomard	CRPMEM	dguyomard.crpm@wanadoo.fr
Jerome Huet	IFREMER	Jerome.Huet@ifremer.fr
Hugues Evano	IFREMER	hugues.evano@ifremer.fr
Salim Issac	Museum d'histoires naturelles	salim.issac@cg974.fr
Sonia Ribes	Museum d'histoires naturelles	sonia.ribes@cg974.fr
Gaetan Lerceteau	Direction des Risques et Milieux Naturels Associés	gaetan.lerceteau@saintpierre.re/gaetan.lerceteau@gmail.com
Bruno Deurveilher	Brigade nautique	bruno.deurveilher@gendarmerie.interieur.gouv.fr
Benjamin Dumont	Brigade nautique	benjamin.dumont@gendarmerie.interieur.gouv.fr
Emmanuel Reuillard	Zone Maritime Sud de L'Océan Indien	emmanuel.reuillard@fazsoi.defense.gouv.fr
Didier Slachmuyders	Projet Biodiversité-COI	didier.slachmuylders@coi-ioc.org
Joanna Kolasinski	TAAF	joanna.kolasinski@taaf.fr

Annex B. Workshop agendas

Mauritius Workshop

Day 1: Tuesday 28 October 2014	
09:00 - 09:30	Registration of participants
09:30 – 10.30	Opening ceremony: • Welcome address from the Indian Ocean Commission (Mr Leon Martial Razaka, Officer in Charge, Indian Ocean Commission) • Welcome address by Mauritius Fisheries Authorities (Mr Soondron Sreeneevassen, Interim Fisheries Director, Ministry of Fisheries) • Overview of the workshop objectives, activities and expected outputs (Mrs Clotilde Bodiguel, FAO Chief Technical Advisor, SmartFish Programme) • Self-introduction of participants • Group photo
10:30 – 11:00	***Coffee break***
11:00 – 11:20	CITES presentation, followed by question and answer session (Mr Kevin Ruhoomaun, Senior Scientific Officer, National Parks and Conservation Service)
11:20 – 11:50	International Regulatory Framework: IOTC catch reporting requirements and resolutions (Mr Jude Talma, MCS Expert, Indian Ocean Commission, SmartFish Programme)
11:50 – 12.30	Presentation of pelagic sharks and rays identification products including the On-board Identification Guide: structure, information available, uses, etc. (Mr Dave Ebert, FAO Consultant, Moss Landing Marine Laboratories)
12:30 – 13:30	***Lunch***
13:30 – 15:30	Identification of major pelagic groups: introduction to external characteristics (M. Dave Ebert, FAO Consultant, Moss Landing Marine Laboratories)
15:30 – 16:00	***Coffee break***
16:00 – 17:00	Wrap up discussion: questions, clarifications, review of the day's work

Day 2: Wednesday 29 October 2014	
09:00 - 10:45	Lectures: • Identification of genera and species (Mr Dave Ebert) • Taking photographs for identification (Mr Paul Clerkin • Collecting basic biological data (Mr Paul Clerkin)
09:30 – 10.30	Opening ceremony: • Welcome address from the Indian Ocean Commission (Mr Leon Martial Razaka, Officer in Charge, Indian Ocean Commission)

	• Welcome address by Mauritius Fisheries Authorities (Mr Soondron Sreeneevassen, Interim Fisheries Director, Ministry of Fisheries) • Overview of the workshop objectives, activities and expected outputs (Mrs Clotilde Bodiguel, FAO Chief Technical Advisor, SmartFish Programme) • Self-introduction of participants • Group photo
10:15 – 10:45	***Coffee break***
10:45 – 12:30	Practical session: identification of genera and species (D. Ebert and P. Clerkin)
12:30 – 13:30	***Lunch***
13:30 – 15:15	Practical session: identification of genera and species (D. Ebert and P. Clerkin)
15:15 – 15:45	***Coffee break***
15:45 – 16:30	Wrap up discussion: questions, clarifications, review of the day's work

Day 3: Thursday 30 October 2014	
09:00 - 10:45	Lectures: • Wrap up of the lecture sessions and introduction to the day's session (Mr Dave Ebert) • Brainstorming and discussions on most useful tools that could be extracted from the guide
10:15 – 10:45	***Coffee break***
10:45 – 12:30	Wrap up discussion: questions, clarifications, review of the day's work, conclusions and closure of the workshop
12:30	***Lunch***

Seychelles Workshop

Day 1: Tuesday 4 November 2014	
08:30 - 09:30	Registration of participants
09:30 – 10.15	Opening ceremony: • Welcome address and overview of the workshop objectives • Self-introduction of participants • Group photo
10:15 – 10:45	***Coffee break***
10:45 – 11:20	Presentation of Seychelles NPOA Shark (SFA)
11:20 – 11:55	Presentation of the pelagic sharks and rays identification products including the On-board Identification Guide (Mr Dave Ebert, FAO Consultant, Moss Landing Marine Laboratories)
12:00 – 13:00	***Lunch***
13:00 – 14:45	Identification of major pelagic groups: introduction to external characteristics (M. Dave Ebert, FAO Consultant, Moss Landing Marine

	Laboratories)
14:45 – 15:00	***Coffee break***
15:00 – 16:00	Taking photographs for identification and collecting basic biological data (Mr Paul Clerkin, Moss Landing Marine Laboratories) Wrap up discussion: questions, clarifications, review of the day's work

Day 2: Wednesday 5 November 2014	
08:30 - 10:00	Lectures: • IOTC catch reporting requirement and sharks (IOTC) • Identification of genera and species (Mr Dave Ebert)
10:00 – 10:30	***Coffee break***
10:30 – 12:00	Practical session: identification of genera and species (D. Ebert)
12:00 – 13:30	***Lunch***
13:30 – 15:15	Practical session: identification of genera and species (D. Ebert)
15:15 – 15:45	***Coffee break***
15:45 – 16:00	Presentation of the groups' findings Wrap up discussion: questions, clarifications, review of the day's work

Day 3: Thursday 6 November 2014	
08:30 - 10:00	Lectures: • Wrap up of the lecture sessions and introduction to the day's session (Mr Dave Ebert) • Brainstorming and discussions on most useful tools that could be extracted from the guide
10:00 – 10:30	***Coffee break***
10:30 – 12:00	Practical session: identification of genera and species (D. Ebert)
12:00 – 13:00	***Lunch***
13:00 – 14:45	Practical session: identification of genera and species (D. Ebert)
14:45 – 15:15	***Coffee break***
15:15 – 16:00	Presentation of the groups' findings Wrap up discussion: questions, clarifications, review of the day's work

Reunion Workshop

Day 1: Monday 21 January 2015	
08:15 - 09:00	Registration of participants
09:00 – 10.15	Opening ceremony: • Welcome speeches: Mr Mohamed Rochdi, President of the University; Mr Jean–Pierre Chabriat, Dean of the Faculty of Science and Technology; Mrs Chantal Ambroise, Deputy Prefect of Reunion • Overview of the workshop objectives, activities and expected

	outputs (Mrs Clotilde Bodiguel, FAO Chief Technical Advisor, SmartFish Programme)
09:45 – 10:15	***Coffee break***
10:15 – 11:15	National management measures: • Mr Nicolas Mariel, Deputy Directeur, DMSOI (Reunion); • Mr Mohamed Ali Mohamed, Inspector, National Centre for Fisheries Monitoring (Comoros) • Mr Rasolonjatovo Harimandimby, Executive Director, Fisheries Monitoring Centre (Madagascar)
11:15 – 12:00	IOTC requirements (Mr Evgeny Romanov)
12:00 – 13:30	***Lunch***
14:00 – 14:15	Presentation of existing shark identification products (Mr David Guyomard)
14:15 – 14.30	Presentation of the IOC-SmartFish On-board Guide (Mrs Clotilde Bodiguel)
14:30 – 15:30	Identification of genera and species (Mr Antonin Blaison)
15:30 – 16:00	***Coffee break***
16:00 – 16:30	Taking photographs for identification (Mr Antonin Blaison)
16:30 – 17:00	Collecting basic biological data (Mr Sébastien Jaquemet)

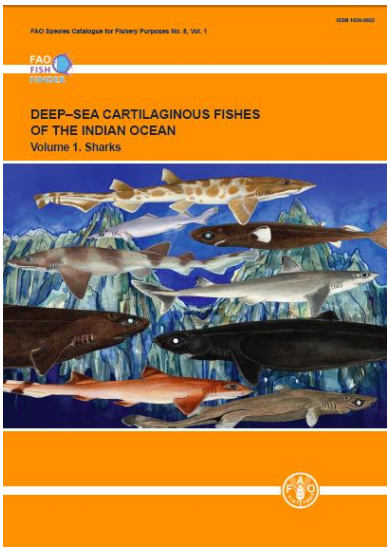
Day 2: Tuesday 26 January 2015	
09:00 - 10:30	Pelagic sharks and rays (Mr Evgeny Romanov)
10:30 – 11:00	***Coffee break***
11:00 – 12:30	Coastal sharks (Mr Antonin Blaison)
12:30 – 14:00	***Lunch***
14:00 – 17:00	Practical session on small sharks (Mr Sébastien Jaquemet)

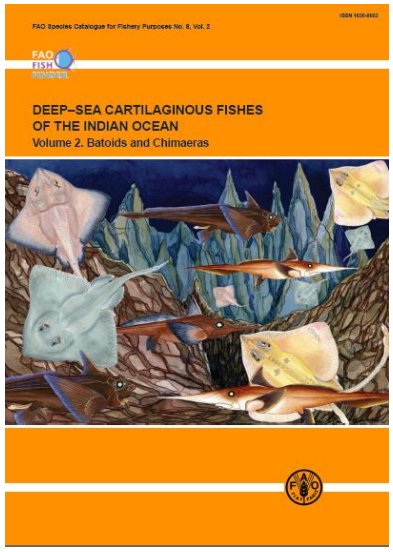
Day 3: Wednesday 27 January 2015	
09:00 - 12:30	Practical session at the port on large sharks Visit to CROSS Reunion
13:00 – 14:00	***Lunch (University)***
14:00 – 15:00	Debriefing/Closure in the presence of the Deputy Prefect of St-Paul
15:00 – 16:00	Discussions on future regional activities (Didier Slachmuyders, Team Leader, IOC-Biodiversity Programme)

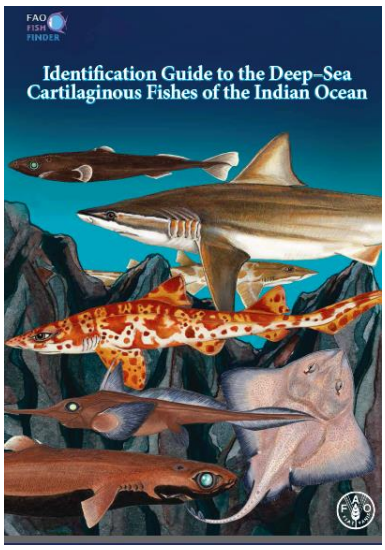
Annex C. Identification tools

On board guide for the Identification of Pelagic Sharks and Rays - Western Indian Ocean (IOC-SmartFish FAO)

http://commissionoceanindien.org/activites/smartfish/publications/manuals-and-guides/ (No. 34 in five parts)





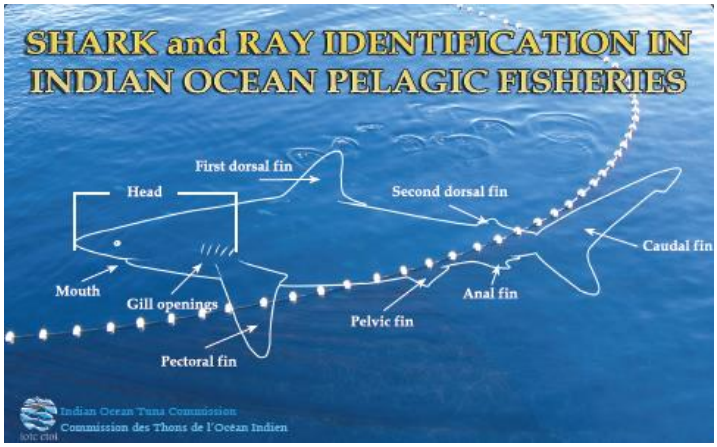


Deep Sea Cartilaginous Fishes of the Indian Ocean Vol. 1 and 2; Identification Guide to the Deep-Sea Cartilaginous Fishes of the Indian Ocean (FAO Fish Finder)

Vol 1: http://www.fao.org/docrep/019/i3477e/i3477e.pdf

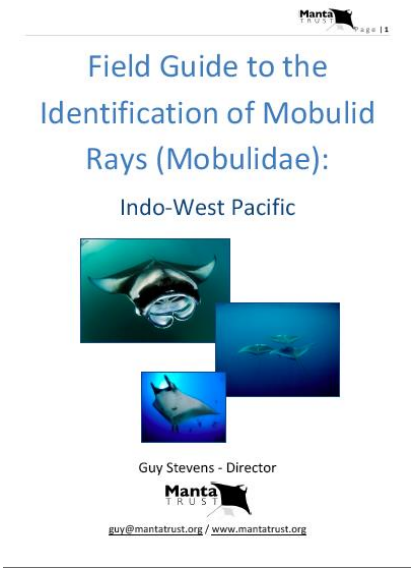
Vol 2: http://www.fao.org/documents/card/en/c/956b9ba7-4c93-4722-a928-28b283febd96/

Identification Guide: http://www.fao.org/documents/card/en/c/42d8a473-21d8-48cd-83d7-9b7be0b1797f/



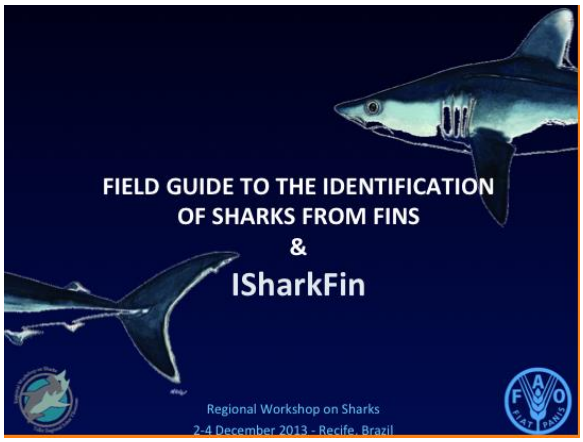
Shark and Ray Identification in Indian Ocean Pelagic Fisheries, IOTC

http://www.iotc.org/science/species-identification-cards

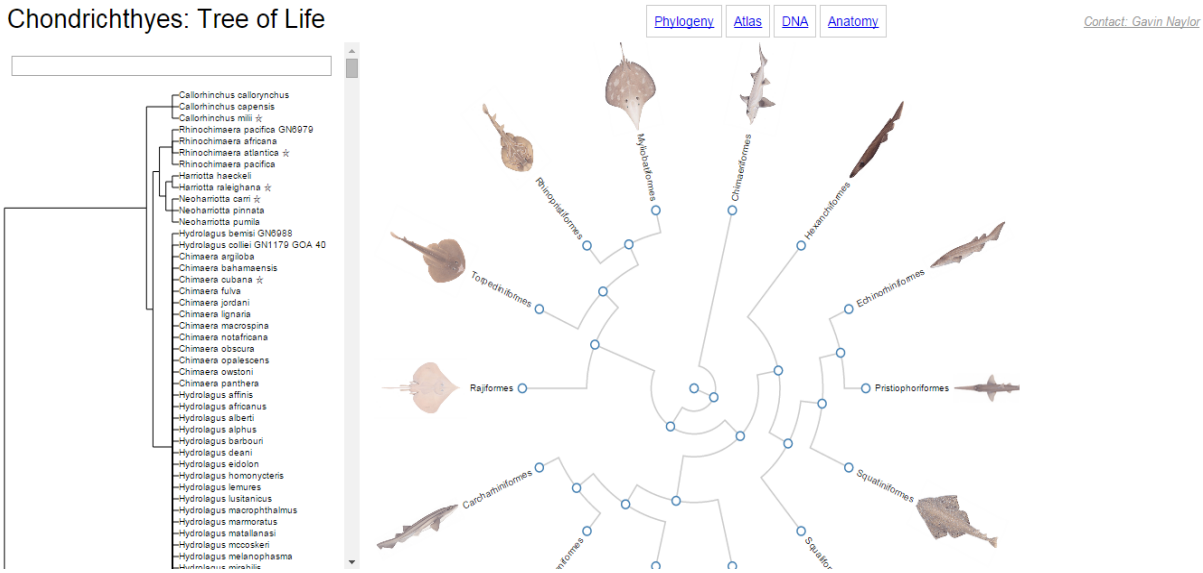


Field Guide to the Identification of Mobulid Rays (Indo-West Pacific)

http://www.mantatrust.org/wp-content/uploads/2011/09/Field-Guide-to-the-Identification-of-Mobulid-Rays-Indo-West-Pacific.pdf



Field guide to the identification of sharks from fins and ISharkFin



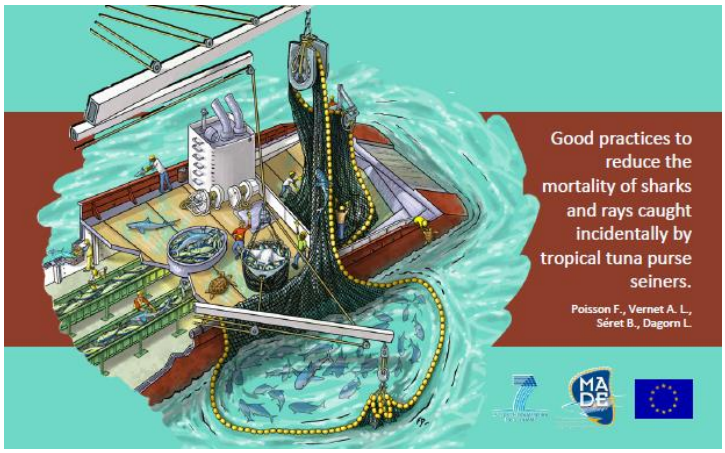
http://sharksrays.org/

Guide des requins, des raies et des chimères des pêches françaises

http://agriculture.gouv.fr/IMG/pdf/100421-guideraies_requins.pdf

Identifying Shark Fins - PEW Charitable Trust

http://www.pewtrusts.org/en/research-and-analysis/reports/2012/02/16/identifying-shark-fins-oceanic-whitetip-porbeagle-and-hammerheads



Good Practices to Reduce the Mortality of Sharks and Rays Caught Incidentally by Tropical Tuna Purse Seiners, Orthongel/OCUP Programme

http://ebfmtuna-2012.sciencesconf.org/conference/ebfmtuna-2012/pages/D6.2_Practices_to_reduce_shark_mortality_purse_seiners.pdf

http://www.fao.org/ipoa-sharks/tools/software/isharkfin/en/

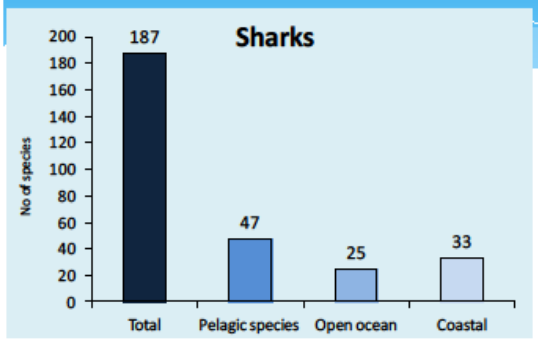
https://drive.google.com/file/d/0B0BM5LxuuPBbekt1aDJ3V0VuWGM/view

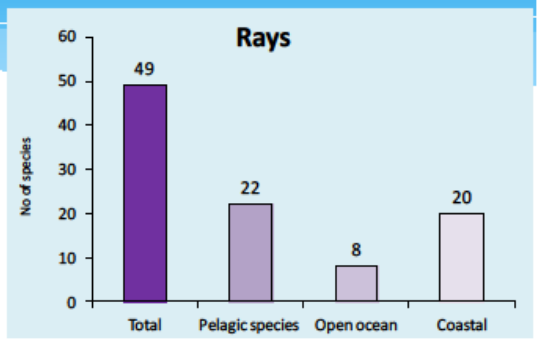
Annex D. PowerPoint presentations

1. Indian Ocean Tuna Commission Regulations on Shark Conservation and Catch Declarations
2. Data Collection and Biological Sampling by On-board Observers, Sébastien Jaquemet

Indian Ocean Tuna Commission Regulations on Shark Conservation and Catch Declarations

Diversité des requins et des raies pélagiques dans l'océan Indien





* Espèces pélagiques: 25% des requins et 45% des raies
* Espèces de l'océan hauturier: <15% des requins et <20% des raies

Diversité des requins et des raies pélagiques dans l'océan Indien

Requins pélagiques dans les captures: 28 espèces

* Fam. des requins gris **Carcharhinidae** dominée par 15 espèces de genre ***Carcharhinus*** et deux genres monospécifiques req. tigres ***Galeocerdo*** et peau bleue ***Prionace***
* Fam. des requins taupe **Lamnidae**
* Fam. des requins marteau **Sphyrnidae**
* Fam. des requins renards **Alopiidae**

Diversité des requins et raies pélagiques dans l'océan Indien

Raies pélagiques représentées par trois familles:

* Fam. des raies pastenagues **Dasyatidae**

* Fam. des aigles de mer **Myliobatidae**

* Fam. des diables de mer **Mobulidae**

Menaces de la pêche

Ordre	Famille	Espèces	Environnement		Impact de pêche		
			Open océan	Côtier	LL	PS	Artisanal
		Requins					
Squaliformes	Dalatiidae	1	1		+	+	+
Orectolobiformes	Rhincodontidae	1	1	1	-	+	++
Lamniformes	Odontaspididae	3	1	2	+	-	+
	Pseudocarchariidae	1	1		+++	-	+
	Megachasmidae	1	1		-	...	-
	Alopiidae	3	3		++	...	+
	Cetorhinidae	1		1	-	-	...
	Lamnidae	4	4		+	+	+
Carcharhiniformes	Carcharhinidae	28	~10	~25	+++	+++	+++
	Sphyrnidae	4	3	4	+++	++	+++
		Rayes					
Rajiformes	Dasyatidae	1	1		+++	+	-
	Myliobatidae	13		13			++
	Mobulidae	7	7	7	+	+	+++

Pourquoi certaines espèces sont menacées?

Fécondité basse: **1** au **75** nourrissons

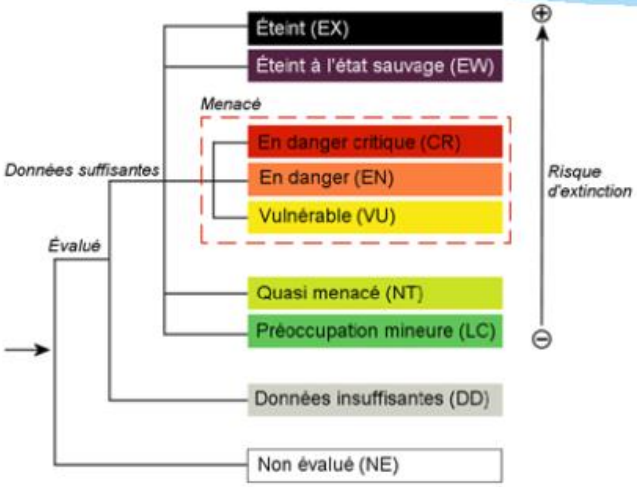
Gestation longue: **8-24** mois

Capacité à se reproduire très basse: **1** fois par **1-3** ans

Maturité tardive: âge de maturité entre **5** et **10** ans

Durée de vie longue: **20-30** ans

IUCN critères



Règlementation internationale

Organisation	Activité
CTOI	Pêche
CITES	Commerce internationale
CMS	Protection globale
IUCN	Listes rouges

Règlementation de la CTOI

1. Collecte et rapport des données statistiques:

   * Journal de bord
   * Débarques
   * Observateurs (schéma des observations régionales)

2. Mesures de conservation et de gestion

Etat des stocks et statistique de pêche

* Etat des stocks des requins est **inconnu**: une seule espèce passe la procédure quantitative de l'évaluation du stock: le requin peau bleu 2015 – **incertitude**
* Analyse PSA (analyse de productivité susceptibilité) semi-quantitative **2012**. Majorité des espèces pélagiques est au niveau **haut risque**.
* Analyse **IUCN**: majorité des espèces pélagiques classée en danger (SPK, SPL) vulnérable (OCS, SMA, LMA, BTH, PTH, RHN, SPZ), quasi menacée (FAL)
* **Mauvaise qualité des données de statistique des pêches fournies par CPCs au CTOI**

CTOI- Mesures courantes sur la conservation et la gestion des requins

Conditions requises	Groupes d'espèces ciblées	Résolution CTOI
Enregistrement dans journal du bord	Tout prises accessoires	**Res. 15/01* & Res. 15/02***
Observateurs	Tout prises accessoires	Res. 11/04
Rapport des captures	Requins	**Res. 05/05***
Utilisation complète des requins	Requins	**Res. 05/05***
Limite 5% de proportion des ailerons	Requins	**Res. 05/05***
Etudes sur interaction requin-engin	Requins	**Res. 05/05***
Programme de recherche	Requins	**Res. 13/06***
Interdiction de conserver à bord	Requins renard et point blanch océanique	**Res. 12/09, 13/06***
Conservation des requins renard	Thresher shark	**Res. 12/09***
Conservation de requins pointe blanche océanique	Oceanic whitetip shark	**Res. 13/06***
Interdiction de calée autour de requins baleines	Whale shark	Res. 13/05

*Résolutions concernant petite bateaux <24 m

Mesures de protection en cours

* **Requins renard**
interdiction de garder
à bord: tous engins
* **Requin océanique pointe blanche**
interdiction de garder
à bord: tous engins
* **Requin baleine**
interdiction de caler
intentionnellement la senne
autour d'un requin-baleine

Résolution 15/01

Concernant l'enregistrement des captures et de l'effort de pêche par les navires de pêche dans la zone de compétence de la CTOI

* Les rejets de thons, d'espèces apparentées et de **requins**, devraient être consignés par espèce en poids (kg) ou en nombre dans les commentaires.
* 2. Toute interaction avec des requins baleines (*Rhincodon typus*), des mammifères marins et des oiseaux de mer devrait être consignée dans les commentaires.

Résolution 15/01

Concernant l'enregistrement des captures et de l'effort par les navires de pêche dans la zone de compétence de la CTOI

Engin de pêche			
Filets	**Palangre**	**Purse seine**	**Pêche a la canne**
Espèces obligatoires			
Peau bleue **BSH**	Peau bleue **BSH**		
Requins-taupes **MAK**	Requins-taupes **MAK**		
Requin océanique **OCS**	Requin océanique **OCS**	Requin océanique **OCS**	
	Requin soyeux **FAL**		
Requins-marteaux **SPN**	Requins-marteaux **SPN**	Requins-marteaux **SPN**	
Requins-renards **THR**	Requins-renards **THR**	Requins-renards **THR**	
Requin baleine **RHN**		Requin baleine **RHN**	
Autres requins **SKH**	Autres requins **SKH**		Autres requins **SKH**
Espèces optionnelles			
Requin-tigre **TIG**	Requin-tigre **TIG**		
		Requin soyeux **FAL**	
Requin-crocodile **PSK**	Requin-crocodile **PSK**		
	Grand requin blanc **WSH**	Autres requins **SKH**	
Mantas et diables de mer **MAN**	Mantas et diables de mer **MAN**	Mantas et diables de mer **MAN**	
Pastenague violette **PLS**	Pastenague violette **PLS**		

Résolution 05/05

Concernant la conservation des requins capturés en association avec les pêcheries gérées par la CTOI

* Déclarer, chaque année, les données des prises de requins…,
* Utiliser intégralement la totalité des prises de requins …,
* Poids d'ailerons détenus à bord ne dépasse pas 5% du poids des requins retenus à bord…,
* Interdiction de retenir à bord, transborder ou débarquer des ailerons capturés à l'encontre de la présente résolution…,
* Pêcheries ne ciblant pas directement les requins, les CPC devront encourager autant que possible la remise à l'eau des requins vivants…,

Résolution 15/02

Déclarations statistiques exigibles des parties contractantes et parties coopérantes non contractantes (CPC) de la CTOI

* **Données de captures totales** : ' ... ainsi que pour les espèces les plus fréquemment capturées d'élasmobranches*... '
* **Données de prises et effort** : par engin de pêche, par espèce, par zone géographique... '

*BSH, SMA, OCS, FAL, SPL, BTH, PTH, RHN, MAN, POR, PLS, TIG, PSK, LMA, SPY

Résolution 12/09

Sur la conservation des requins renards (famille des Alopiidae) capturés en association avec les pêcheries opérant dans la zone de compétence de la CTOI

* Les observateurs scientifiques auront le droit de prélever des échantillons biologiques... ,
* Les CPC, en particulier celles ayant des activités de pêche tournées vers les requins, devront déclarer les données concernant les requins, comme exigé par les procédures de déclaration des données de la CTOI.

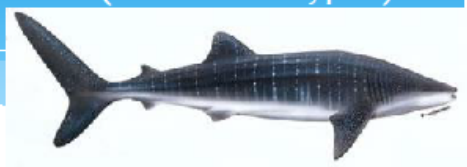
Résolution 12/09

Sur la conservation des requins renards (famille des Alopiidae) capturés en association avec les pêcheries opérant dans la zone de compétence de la CTOI

* Interdiction de conserver à bord, de transborder, de débarquer, de stocker, de vendre ou de proposer à la vente toute ou partie des carcasses de requins-renards, d'une des espèces de la famille des Alopiidae,
* Remettre à l'eau promptement, et dans la mesure du possible indemnes, les requins-renards…,
* Encourager les pêcheurs à enregistrer et déclarer les captures accidentelles, ainsi que les remises à l'eau d'individus vivants,
* Les pêcheurs amateurs et sportifs devront relâcher vivants tous les requins-renards des espèces de la famille des Alopiidae…,

Résolutions 13/05

Sur la conservation des requins-baleines (Rhincodon typus)



* Interdiction de caler intentionnellement le senne coulissante autour d'un requin-baleine,
* libération indemne si requin-baleine est involontairement encerclé et signalement de l'incident aux autorités compétentes de l'État…
* Pêcheurs utilisant d'autres types d'engins pour pêcher des thons et des espèces apparentées associés à des requins-baleines déclareront les interactions avec les requins-baleines aux autorités compétentes de l'État,

Résolution 13/06

Sur un cadre scientifique et de gestion pour la conservation des requins capturés en association avec des pêcheries gérées par la CTOI

* Interdiction de retenir à bord, de transborder, de débarquer ou de stocker tout ou partie de carcasses de requins océaniques…,
* Relâcher promptement et indemnes, dans la mesure du possible, les requins océaniques…,
* Encourager les pêcheurs à consigner les captures accidentelles et les remises à l'eau de requins océaniques…,
* Les observateurs scientifiques auront le droit de prélever des échantillons biologiques…,
* Les CPC, en particulier celles qui ciblent les requins, devront déclarer les données concernant les requins, comme exigé par les procédures de déclaration des données de la CTOI.

Sommaire

Identifier les requins au niveau des espèces ou groupes (dans certain cas),

Enregistrer dans le système d'enregistrement des données (journal de bord, liste des débarques, etc…),

Enregistrer les effort de pêche,

Déclarer à la CTOI.

Résolutions 11/04

Sur un mécanisme régional d'observateurs

Fonction des observateurs:

* observer et estimer les captures, dans la mesure du possible, en vue d'identifier la composition des prises et de surveiller les rejets, les prises accessoires et les fréquences de tailles
* recueillir des informations pour permettre de vérifier les entrées saisies dans les registres de pêche (composition spécifique et quantités, poids… , et lieu de capture…),
* accomplir toute autre tâche à caractère scientifique (par exemple échantillonnages) comme demandé par le Comité scientifique de la CTOI.

Questions?

Règlementation CTOI

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien

iotc ctoi

Recueil des Mesures de conservation et de gestion actives de la Commission des thons de l'océan Indien

Dernière mise-à-jour : 10 septembre 2015

Site CTOI: http://www.iotc.org/fr

http://www.iotc.org/fr/mcgs

Data Collection and Biological Sampling by On-board Observers, Sébastien Jaquemet

INTRODUCTION

Objectifs initiaux des programmes «d'observateurs»?

1- Obtenir en temps réel des informations sur l'état de la ressource,

2- Obtenir des données fiables sur les captures, sur les rejets et sur la régularité des opérations à bord d'un navire de pêche (FAO 2009)

=> Préserver les ressources halieutiques par un contrôle et une surveillance des activités pour une pêche durable et respectueuse (code de bonne conduite de la FAO de 2005)

lundi 25 janvier 16

INTRODUCTION

Objectifs secondaires des programmes «d'observateurs»?

1- Collecter des données scientifiques spécifiques non relevées lors des activités de base

2- Prélever des échantillons biologiques dans le cadre de programmes scientifiques

3- Déployer des équipements ou des marques sur des individus relâchés

=> Profiter de la présence d'un observateur pour accéder à des données et des échantillons difficiles à obtenir et qui peuvent alimenter des programmes de recherche fondamentaux ou appliqués

lundi 25 janvier 16

COLLECTE DES DONNÉES ET D'ÉCHANTILLONS POUR PROGRAMME SCIENTIFIQUE

Avant la marée:

1- Rencontrer ou échanger avec le scientifique en charge du projet pour faire le point sur les objectifs du projet et la modalité de mise en oeuvre de la collecte des données. Vérifier que le projet est autorisé par les autorités compétentes

2- Prendre contact avec le patron-pêcheur ou l'armement pour les vérifier avec eux qu'il est possible de procéder à une collecte de données et d'échantillons complémentaires aux activités normales de l'observateur

3- Récupérer l'ensemble du matériel nécessaire à la collecte et les protocoles

lundi 25 janvier 16

COLLECTE DES DONNÉES ET D'ÉCHANTILLONS POUR PROGRAMME SCIENTIFIQUE

Pendant la marée:

1- Conduire en priorité les missions d'observateur des pêches

2- Réaliser les collectes scientifiques de façon opportuniste ou programmée, sans que cela n'interfère avec la mission principale

3- Procéder aux stockages des échantillons et à la saisie des données et informations associées aux collectes selon les protocoles fournis

lundi 25 janvier 16

COLLECTE DES DONNÉES ET D'ÉCHANTILLONS POUR PROGRAMME SCIENTIFIQUE

Après la marée:

1- Organiser l'acheminement des échantillons et le transfert des données vers le scientifique

2- Faire un bilan succinct des activités réalisées, le transmettre au scientifique et à l'armement pour information

3- Faire remonter vers le scientifique les points positifs et les éventuels problèmes liés à ce travail pour amélioration future. Si nécessaire, cela peut se faire en concertation avec l'armement

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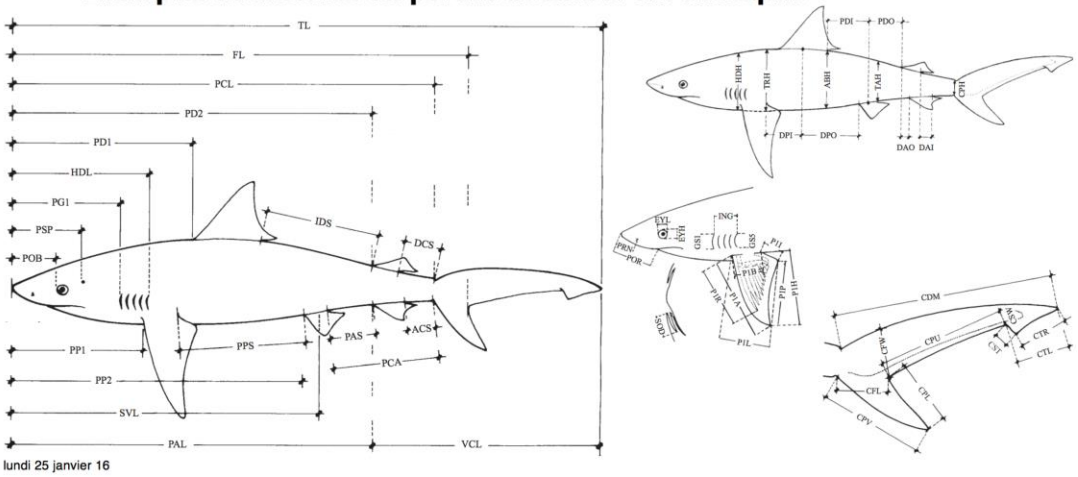
EXEMPLES D'ACTIVITÉS : LES MENSURATIONS

Prise de mesures corporelles pour :

- identification des espèces,
- étude de la croissance et des relations taille/poids
- étude de la condition corporelle des individus,
- étude d'écologie fonctionnelle

Exemples de mesures corporelle à réaliser sur un requin



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EXEMPLES D'ACTIVITÉS : LA REPRODUCTION

Etude externe et/ou interne des organes reproducteurs et prélèvements d'échantillons

- dimorphisme sexuel et sex-ratio,
- taille à première maturité
- période de reproduction,
- fécondité

< Embryons de requins tigre (La Réunion, janvier 2016)

^ Gonades de requin bouledogue, avec ovocytes en formation

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EXEMPLES D'ACTIVITÉS : L'ÉCOLOGIE TROPHIQUE

Etude de l'alimentation, des habitats d'alimentation et des stratégies d'exploitation des ressources

- régime alimentaire à partir des contenus stomacaux,
- sources de carbone exploitées et niveaux trophiques (isotopes stables)
- variation ontogénétique et sexuelle de l'alimentation,
- variations spatiale et temporelle de l'écologie trophique en relation avec l'environnement

Prélèvement de sang dans le coeur d'un requin

Restes alimentaires retrouvés dans l'estomac d'un requin

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EXEMPLES D'ACTIVITÉS : LE COMPORTEMENT

Etude des mouvements, des interactions entre individus et avec l'environnement

- marquages externe ou interne d'individus
- déploiement de caméras sous-marines
- déploiements de stations d'écoute

Station de réception de données acoustiques

Requin tigre équipé d'une marque archive

Marque externe insérée dans l'aileron d'un requin

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EXEMPLES D'ACTIVITÉS : LA GÉNÉTIQUE

Prélèvement de tissus (peau, sang, chair, ...) et extraction de l'ADN pour :

- identification d'espèces (bar-coding)
- étude de la structure génétique des populations
- étude de la connectivité entre populations
- étude de la paternité (polyandrie)
- diversité génétique des espèces et conservation

Echantillon de chair pour analyse génétique

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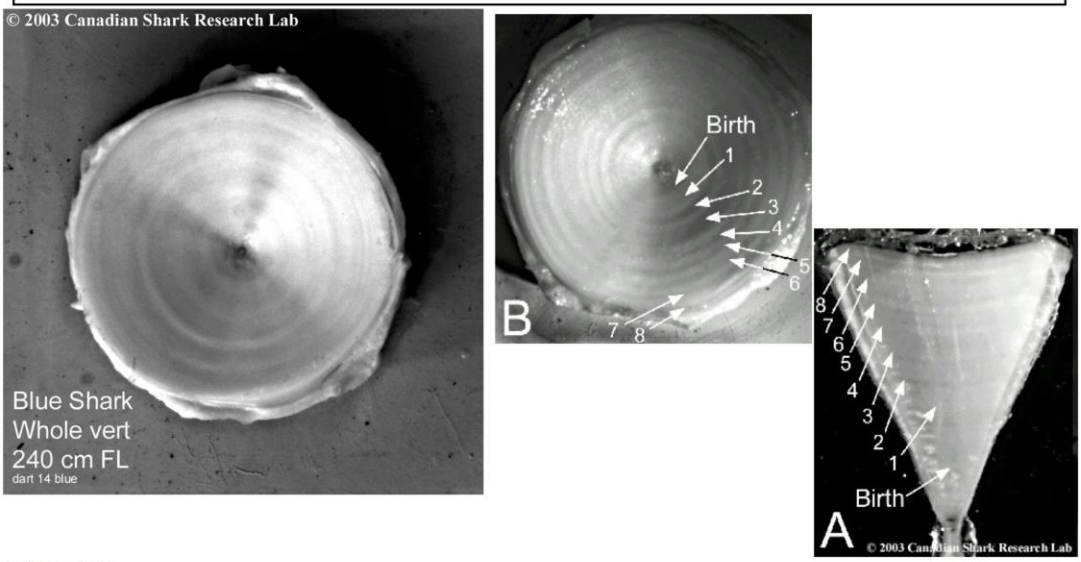
EXEMPLES D'ACTIVITÉS : LA SCLÉROCHRONOLOGIE

Prélèvement de tissus durs (écailles, vertèbres, épines dorsales, otolithes, ...) pour :

- étude de la croissance
- étude de l'histoire de vie des individus



EXEMPLES D'ACTIVITÉS : LE SUIVI ENVIRONNEMENTAL

Les prédateurs de haut niveau trophique sont de bons bio-indicateurs de leur environnement

- contaminants environnementaux (éléments traces, POPs, ...),
- changements dans les assemblages de proies,
- changements de régime de production primaire,
- perturbations climatiques

Global versus local causes and health implications of high mercury concentrations in sharks from the east coast of South Africa

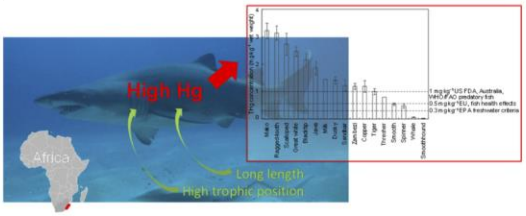
Melissa A. McKinney [a,*], Kylie Dean [a], Nigel E. Hussey [a], Geremy Cliff [b,c], Sabine P. Wintner [b,c], Sheldon F.J. Dudley [b,d], M. Philip Zungu [d], Aaron T. Fisk [a]

[a] Great Lakes Institute for Environmental Research, University of Windsor, Windsor, Ontario N9B 3P4, Canada
[b] KwaZulu-Natal Sharks Board, Umhlanga Rocks 4320, South Africa
[c] Biomedical Resource Unit, University of KwaZulu-Natal, Durban 4000, South Africa
[d] Department of Agriculture, Forestry and Fisheries, Cape Town 8012, South Africa

HIGHLIGHTS

- Hg concentrations in 17 shark species from South Africa's east coast were measured.
- Higher values relative to other regions suggested the importance of local emissions.
- Length and trophic position explained most of the mercury variation among species.
- Hg concentrations were above regulatory guidelines for the majority of species.
- Muscle concentrations are of concern for shark and human health.

GRAPHICAL ABSTRACT



LIMITES ET DIFFICULTÉS

- La collecte de données et d'échantillons scientifiques, aussi simple puisse t'elle paraître, ne l'est pas => méthode, rigueur, compréhension des objectifs du travail et des enjeux

- Nécessité d'une collaboration des équipages et des armements pour une bonne acceptation du programme (poissons «abimés», perte de temps, place dans le congélateur, ...)

- Côté aléatoire de la pêche qui ne va pas forcément capturer les bonnes espèces, les bonnes tailles, dans le bon habitat, etc...

lundi 25 janvier 16

CONCLUSION

- Les programmes des observateurs embarqués sont souvent très chargés, néanmoins, ils peuvent parfois avoir du temps de libre pour contribuer à des programmes scientifiques autres que ceux liés directement à la gestion des ressources exploitées

- Ils représentent alors un potentiel fort pour de la collecte d'informations scientifiques fort pertinentes et rares (plus value et contribution financière?)

- Le recours aux observateurs embarqués doit être programmé et se faire de façon concertée entre les scientifiques, les armements et les observateurs

- L'éthique et conscience professionnelle sont 2 aspects fondamentaux (biaiser les informations)

=> Programme de formation et de sensibilisation des acteurs de la mer fondamental pour contribuer de façon efficace à la connaissance scientifique dont le but ultime est d'aider à pérenniser ressources et activités économiques

lundi 25 janvier 16

SmartFish is a regional fisheries project managed by the Indian Ocean Commission, funded by the European Union and co-implemented by the Food and Agriculture Organization of the United Nations. SmartFish, which operates in 20 countries throughout the East and Southern Africa - Indian Ocean region, focuses on fisheries governance, management, monitoring, control and surveillance, trade, and food security.

Over recent years, awareness and attention have been raised concerning the status of sharks and rays in the South West Indian Ocean. However, significant gaps in knowledge of sharks and rays exist both generally and in the SWIO region, including distribution, ecology, reproductive biology, population status and trends, and the nature, extent, and impact of fisheries on their status. There are also significant gaps in management, technical capacity, and awareness.

In this context, the IOC-SmartFish programme carried out several workshops between 2014 and 2016 to improve recognition of identification keys and to learn additional practices related to biological sampling and research.
This report details the work that was undertaken over the course of these workshops and provides an overview of some of the presentations that were given.

Funded by
the European Union