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REVIEW OF THE STATISTICAL DATA AVAILABLE FOR THE BYCATCH SPECIES

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Abstract

This document reviews the status of the information available on species non-targeted associated and dependent from IOTC fisheries in the databases at the IOTC Secretariat as of September 2011. It covers data on sharks, seabirds and sea turtles.

1. OVERVIEW

This document summarises the standing of a range of information received for non-IOTC species, in accordance with:

All bycatch

- IOTC Resolution 10/02: ***Mandatory statistical requirements*** *for IOTC Members and Cooperating Non-Contracting Parties (CPC's)*
  - *Paragraph 3(end): These* ***provisions***[3]*,* ***applicable to*** *tuna and tuna-like species, shall also be applicable to the most commonly caught* ***shark species*** *and, where possible, to the less common shark species. CPC's are also* ***encouraged*** *to record and provide data on* ***species other than sharks*** *and tunas taken as bycatch.*
- IOTC Resolution 05/05: ***On a Regional Observer Scheme***
  - *Paragraph 2: In order to improve the collection of scientific data, at least 5 % of the number of operations/sets for each gear type by the fleet of each CPC while fishing in the IOTC Area of competence of* ***24 meters overall*** *length and over, and* ***under 24 meters*** *if they fish* ***outside their EEZs*** *shall be covered by this observer scheme. For vessels under 24 meters if they fish outside their EEZ, the above mentioned coverage should be achieved progressively by January 2013.*
  - *Paragraph 4: The number of the* ***artisanal*** *fishing vessels landings shall also be monitored at the landing place by field samplers. The indicative level of the coverage of the artisanal fishing vessels should progressively increase towards 5% of the total levels of vessel activity (i.e. total number of vessel trips or total number of vessels active).*
  - *Paragraph 11: The* ***observer*** *shall, within 30 days of completion of each trip, provide a* ***report*** *to the CPCs of the vessel. The CPCs shall send* ***within 150 days*** *at the latest each report, as far as continuous flow of report from observer placed on the longline fleet is ensured, which is recommended to be provided with* ***1°x1° format*** *to the Executive Secretary, who shall make the report available to the Scientific Committee upon request. In a case where the vessel is fishing in the EEZ of a coastal State, the report shall equally be submitted to that coastal State.*

Sharks

- IOTC Resolution 05/05: *Concerning the conservation of* ***SHARKS*** *caught in association with fisheries managed by IOTC*
  - *Paragraph 1: Contracting Parties, Cooperating non-Contracting Parties (CPCs) shall annually report data for catches of sharks, in accordance with IOTC data reporting procedures, including available historical data.*

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[3] Refers to nominal catch, catch-and-effort, and size frequency data for sharks

- IOTC Resolution 10/12: *On the conservation of **THRESHER SHARKS** (family Alopiidae) caught in association with fisheries in the IOTC area of competence*
    - *Paragraph 1: This measure shall apply to all fishing vessels on the IOTC Record of authorised Vessels.*
    - *Paragraph 4: CPCs shall encourage their fishermen to record incidental catches as well as live releases. These data will be then kept at the IOTC secretariat.*
    - *Paragraph 7: The Contracting Parties, Co-operating non-Contracting Parties, especially those directing fishing activities for sharks, **shall submit data for sharks**, **as required by IOTC data reporting procedures** (**including estimates of dead discard and size frequencies**), in advance of the 2011 Scientific Committee meeting.*

Seabirds

- IOTC Recommendation 05/09 *On incidental mortality of **SEABIRDS***
    - *Paragraph 2: CPCs should be encouraged to **collect and voluntarily provide** Scientific Committee with all available information on interactions with seabirds, including **incidental catches in all fisheries under the purview of IOTC.***
- IOTC Resolution 10/06 *On reducing the incidental bycatch of **SEABIRDS** in **longline fisheries***
    - *Paragraph 7: CPCs shall provide to the Commission, as part of their annual reports, all available information on interactions with seabirds, including **bycatch by fishing vessels** carrying their flag or authorised to fish by them. This is to including **details of species** where available to enable the Scientific Committee to annually estimate seabird mortality in all fisheries within the IOTC area of competence.*

Marine turtles

- IOTC Resolution 09/06 *On **MARINE TURTLES***
    - *Paragraph 2: CPCs shall collect (including through logbooks and observer programs) and **provide to the Scientific Committee all data on their vessels' interactions with marine turtles in fisheries targeting the species covered by the IOTC Agreement**. CPC shall also furnish available information to the Scientific Committee on successful mitigation measures and other impacts on marine turtles in the IOTC Area, such as the deterioration of nesting sites and swallowing of marine debris.*

The document describes the progress achieved in relation to the collection and verification of data, identifies problem areas and proposes actions that could be undertaken to improve them.

A list of actions for the improvement in the standing of the data on non-IOTC species currently available at the secretariat is proposed for the consideration of the Working Party (next page).

The report covers the following areas:

- Overview
- Status of reporting
- Actions proposed to improve the data available on non-IOTC species to IOTC
- Overview of IOTC fisheries and fisheries statistics for main shark species:
    - Main species of sharks caught on IOTC fisheries
    - Data available on the total catches of sharks in the Indian Ocean
- Overview of IOTC fisheries and seabird by-catch levels
    - Main species and fisheries concerned
    - Status of data on seabird by-catches
- Overview of IOTC fisheries and sea turtle by-catch levels
    - Main species and fisheries concerned
    - Status of data on se turtle by-catches

Major data categories covered by the report

Sharks: The same standards as those existing for IOTC species apply to the most common species of sharks, including:

- **Nominal catches** which are highly aggregated statistics for each species estimated per fleet, gear and year for a large area. If these data are not reported the Secretariat attempts to estimate a total catch although this is not possible in many cases. A range of sources is used for this purpose (including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling and data published through web pages or other means).

- **Catch-and-effort data** which refer to the fine-scale data – usually from logbooks, and reported per fleet, year, gear, type of school, month, grid and species. Information on the use of fish aggregating devices (FADs) and supply vessels is also collected.

- **Length frequency data** which refer to individual body lengths of IOTC species per fleet, year, gear, type of school, month and 5 degrees square areas.

- **Observer data** which refer to fine-scale data as collected by scientific observers onboard vessels authorized to operate in the IOTC Area, and reported at the end of each observer trip.

Seabirds and marine turtles: the following standards apply:

- **Total bycatch** which are highly aggregated statistics for all species combined or, where available, by species, estimated per fleet, gear and year for the whole IOTC Area.

- **Observer data:** As in sharks above

2. STATUS OF REPORTING BY TYPE OF DATASET

Tables 1-2 present a summary of the type of datasets that need to be provided for sharks, and other bycatch species, respectively, including, in each case: the parties and time periods concerned; deadlines and status of reporting (obligatory or voluntary); Parties having provided data; and remarks, in particular focusing on areas were reporting standards are considered to be vague.

It is important to note that, at present, it would be difficult to assess which parties have provided complete datasets, as the requirements existing are considered to be vague. For this reason, Table 1 records all parties having provided datasets, irrespective of how complete those datasets might be. The WPEB is invited to look into the issues highlighted in the 'Remarks' and consider if the current requirements need to be made more specific.

Table 1. Types of datasets to be provided for sharks caught on fisheries for IOTC species and parties having provided data in each case.

SHARKS

Historical data on SHARKS according to IOTC reporting requirements

Applies to: All CPC
Time period: All years before 2006
Deadline: June (December) 30th 2006
Report to: IOTC Secretariat
Binding status: Obligatory
Parties having provided data for industrial fleets:

- Surface: EU-France; EU-Spain
- Longline: Australia; Belize; China; Taiwan,China; EU-France; EU-Portugal; EU-Spain; EU-UK; France; Guinea; Indonesia; Republic of Korea; Malaysia; Mauritius; Oman; Senegal; Seychelles; South Africa; Thailand
- Driftnet: Pakistan

Remarks: It is not clear which species of sharks are covered by this requirement (see below).

Nominal catch data for MOST COMMON SHARK species

Applies to: All CPC
Time period: 2006 and later years
Deadline: June (December) 30th of year following that for which data are due
Report to: IOTC Secretariat
Binding status: Obligatory
Parties having provided data for industrial fleets:

- Surface: EU-France; EU-Spain
- Longline: Australia; Belize; China; Taiwan,China; EU-Portugal; EU-Spain; EU-UK; Indonesia; Japan; Kenya; Philippines; Sri Lanka; South Africa; Thailand
- Driftnet: Nil

Remarks: There is no definition for "most common species of sharks" and therefore it is not clear which species are covered by this requirement

Nominal catch data for OTHER SHARK species

SHARKS

Applies to: All CPC
Time period: 2006 and later years
Deadline: June (December) 30th of year following that for which data are due
Report to: IOTC Secretariat
Binding status: Voluntary
Parties having provided data for industrial fleets:

- Surface: EU-France; EU-Spain
- Longline: Australia; Belize; China; Taiwan,China; EU-France; EU-Portugal; EU-Spain; EU-UK; France; Indonesia; Japan; Kenya; Republic of Korea; Malaysia; Mauritius; Oman; Philippines; Seychelles; South Africa; Thailand; Uruguay
- Driftnet: Pakistan

Remarks: As above, there is need to define for which shark species reporting of catch is obligatory so as the remaining species can be inferred

Catch-and-effort data for MOST COMMON SHARK species

Applies to: All CPC
Time period: 2006 and later years
Deadline: June (December) 30th of year following that for which data are due
Report to: IOTC Secretariat
Binding status: Obligatory
Parties having provided data for industrial fleets:

- Surface: Nil
- Longline: China; Taiwan,China; EU-Portugal; EU-UK; Japan; Philippines; Seychelles; South Africa;
- Driftnet: Nil

Remarks: Same as above. Minima requirements for operational catch-and-effort data include provisions for the following species of sharks, by fishery:

- Longline and gillnet: Blue Shark (*Prionace glauca*); Porbeagle Shark (*Lamna nasus*); Mako Sharks (*Isurus spp.*); Oceanic Whitetip Shark (*Carcharhinus longimanus*); Hammerhead Sharks (*Sphyrna spp.*); Other sharks (by species, where possible, in particular: Thresher Sharks (*Alopias spp.*); Tiger Shark (*Galeocerdo cuvier*); Crocodile Shark (*Pseudocarcharias kamoharai*); Other Requiem sharks (*Carcharhinus spp.*); Great White shark (*Carcharodon carcharias*); Pelagic stingray (*Pteroplatytrygon violacea*))
- Purse seine: Not specified; where possible, data by species for: Whale Shark (*Rhincodon typus*); Oceanic Whitetip Shark (*Carcharhinus longimanus*); Silky shark (*Carcharhinus falciformis*)
- Pole-and-line: Not specified; recorded as other species (sharks are seldom caught by baitboats)
- Other gears: There are no requirements for operational catch-and-effort data for gears other than the above.

However, it is not clear if the above species are those for which reporting of catch-and-effort data is due.

Catch-and-effort data for OTHER SHARK species

Applies to: All CPC
Time period: 2006 and later years
Deadline: June (December) 30th of year following that for which data are due
Report to: IOTC Secretariat
Binding status: Voluntary
Parties having provided data for industrial fleets:

- Surface: Nil
- Longline: China; Taiwan,China; EU-France; EU-Portugal; EU-UK; Japan; Republic of Korea; Malaysia; Mauritius; Oman; Seychelles; South Africa; Sri Lanka; Thailand; Uruguay
- Driftnet: Nil

Remarks: As above, there is need to define for which shark species reporting of catch-and-effort data is obligatory so as the remaining species can be inferred

Size frequency data for MOST COMMON SHARK species

Applies to: All CPC
Time period: 2006 and later years
Deadline: June (December) 30th of year following that for which data are due
Report to: IOTC Secretariat
Binding status: Obligatory
Parties having provided data for industrial fleets:

- Surface: Nil
- Longline: Japan; Republic of Korea; Seychelles; South Africa; Sri Lanka;
- Driftnet: Nil

Remarks: There is no definition for "most common species of sharks" and therefore it is not clear which species are covered by this requirement

Size frequency data for OTHER SHARK species

Applies to: All CPC
Time period: 2006 and later years
Deadline: June (December) 30th of year following that for which data are due
Report to: IOTC Secretariat
Binding status: Voluntary
Parties having provided data for industrial fleets:

- Surface: Nil
- Longline: Indonesia; Japan; Republic of Korea; Seychelles; South Africa; Sri Lanka;
- Driftnet: Nil

Remarks: As above, there is need to define for which shark species reporting of size frequency data is obligatory so as the remaining species can be inferred

Estimates of amounts of THRESHER SHARKS discarded dead and size frequency distribution of discards

Applies to: CPC having vessels in the IOTC Record of Authorized vessels
Time period: 2010 and later years
Deadline: IOTC Scientific Committee Meeting in December 2011
Report to: IOTC Scientific Committee
Binding status: Obligatory
Parties having provided data: Not applicable; first report due for December 2011.
Remarks: It is unclear if it is required to collect size data on all discards or only on dead discards; collecting size frequency data on thresher sharks before release may compromise survival of those specimens that are caught alive (rates of mortality at capture have been estimated at around 50% in the Atlantic Ocean)

Reports from scientific observers onboard vessels 24m LOA or greater under the IOTC Regional Observer Scheme

SHARKS

Applies to: CPC having vessels 24m LOA or greater in the IOTC Record of Authorized vessels
Time period: Since July 2010
Deadline: No later than 150 days after the end of each observer trip
Report to: IOTC Secretariat
Binding status: Obligatory
Parties having provided data: None
Remarks: Some of the contents of the observer report will be reviewed by the IOTC Scientific Committee in 2011 but this should not preclude IOTC parties from providing observer reports as per the standards currently in place.

Reports from scientific observers onboard vessels less than 24m LOA under the IOTC Regional Observer Scheme

Applies to: CPC having vessels less than 24m LOA in the IOTC Record of Authorized vessels
Time period: Progressive implementation to achieve recommended levels of coverage by January 2013
Deadline: No later than 150 days after the end of each observer trip
Report to: IOTC Secretariat
Binding status: Obligatory
Parties having provided data: None
Remarks: As above

Table 2. Types of datasets to be provided for other bycatch of fisheries for IOTC species and parties having provided data in each case.

OTHER SPECIES

Estimates of total incidental catches of SEABIRDS from longline fisheries

Applies to: CPC having longline fisheries in the IOTC Area
Time period: 2011 and later years
Deadline: IOTC Scientific Committee Meetings, included in the National Report
Report to: IOTC Scientific Committee each year
Binding status: Obligatory
Parties having provided data for industrial fleets: Not applicable; first report due for December 2012.
Remarks: Requirements do not include reporting of incidental catches by species or area, in particular area fished with respect to the 25°S latitude boundary. There is also need to identify for which species of seabirds, out of the many occurring in the Indian Ocean, reporting of data by species is considered to be a priority. Estimation of total levels of bycatch of seabirds by IOTC longline fisheries will be compromised or not possible unless requirements are extended to account for this.

Estimates of total incidental catches of SEABIRDS, by species, from all years and fisheries

Applies to: All CPC
Time period: All years
Deadline: IOTC Scientific Committee Meetings, included in the National Report
Report to: IOTC Scientific Committee each year
Binding status: Voluntary
Parties having provided data for industrial longline fleets: Australia; China; EU-France; EU-Spain; EU-UK; France; South Africa
Remarks: Same as above.

Estimates of total incidental catches of MARINE TURTLES

Applies to: All CPC
Time period: 2010 and later years
Deadline: IOTC Scientific Committee Meetings
Report to: IOTC Scientific Committee each year
Binding status: Obligatory
Parties having provided data for industrial fleets:

- Surface: EU-France; EU-Spain
- Longline: Australia; China; EU-France; EU-Spain; EU-UK; France
- Driftnet: Nil

Remarks: Requirements do not include reporting of incidental catches by species or area. Estimation of total levels of bycatch of marine turtles by IOTC fisheries will be compromised or not possible unless requirements are extended to account for this.

Estimates of total incidental catches of OTHER SPECIES

Applies to: All CPC
Time period: 2006 and later years
Deadline: June (December) 30th of year following that for which data are due
Report to: IOTC Secretariat
Binding status: Voluntary
Parties having provided data for industrial fleets: Several parties have provided data concerning this requirement.
Remarks: This group refers to species of very different nature, including marine mammals, and other groups of other marine species. For the sake of clarity it would be better to clarify which species or species groups are the focus of this requirement. It would also be better to create specific requirements for marine mammals, along the lines of those created for Seabirds or marine turtles.

Reports from scientific observers onboard vessels 24m LOA or greater under the IOTC Regional Observer Scheme

Reports from scientific observers onboard vessels less than 24m LOA under the IOTC Regional Observer Scheme

Remarks: Refer to Table 1 (SHARKS)

3. ACTIONS PROPOSED TO IMPROVE THE DATA AVAILABLE TO IOTC

The following list is provided by the IOTC Secretariat for the consideration of the WPEB. The list covers the main issues which the Secretariat considers affect the quality of the statistics available at the IOTC, by type of dataset and type of fishery.

SHARKS

1. Catch-and-Effort data from gillnet fisheries:

- **Drifting gillnet** fisheries of **Iran** and **Pakistan**: To date, Iran and Pakistan have not reported catches of sharks, by species, for their gillnet fisheries.
- **Gillnet/longline** fishery of **Sri Lanka**: Sri Lanka has not reported catch-and-effort data for sharks as per the IOTC standards.

2. Catch-and-Effort data from Longline Fisheries:

- **Historical catches of sharks from major longline** fisheries: To date, **Japan**, **Taiwan,China**, **Indonesia** and **Rep. of Korea,** have not provided estimates of catches of sharks, by species, for years before 2006.
- **Fresh-tuna longline** fisheries of **Indonesia** and **Malaysia**: Indonesia and Malaysia have not reported catches of sharks by IOTC standards for longliners under their flag. In addition Indonesia has not reported catch-and-effort data for its longline fishery to date.
- **Deep-freezing longline** fisheries of **EU-Spain**, **India, Indonesia**, **Rep. of Korea, Malaysia**, and **Oman:** These countries have not reported catch-and-effort data of sharks by IOTC standards for longliners under their flag.

3. Catch-and-Effort data from coastal fisheries:

- **Coastal** fisheries of **Comoros**[4], **India, Indonesia, Madagascar, Sri Lanka** and **Yemen**: To date, these countries have not provided detailed catches of sharks to the IOTC, in particular Thresher and other pelagic shark species caught by their coastal fisheries.

4. Discard levels from surface and longline fisheries:

- **Discard levels of sharks from major longline** fisheries: To date, **EU**, **Japan**, **Taiwan,China**, **Indonesia** and **Rep. of Korea,** have not provided estimates of discards of sharks, by species, in particular Thresher sharks.
- **Discard levels of sharks for industrial purse seine** fisheries: To date, the **EU** (excluding 2003–07), **Iran**, **Japan**, **Seychelles**, and **Thailand**, have not provided estimates of discards of sharks, by species, for industrial purse seiners under their flag.

5. Size frequency data:

- **Gillnet** fisheries of **Iran** and **Pakistan:** To date, Iran and Pakistan have not reported size frequency data for their driftnet fisheries.

- **Longline** fisheries of **China**, **Taiwan,China**, **India, Indonesia, Malaysia, Oman** and **Philippines:** To date, these countries have not reported size frequency data for their longline fisheries, including length frequency of discards of thresher sharks.

- **Coastal** fisheries of **Comoros**[5], **India, Indonesia, Madagascar, Sri Lanka** and **Yemen**: To date, these countries have not reported size frequency data for their coastal fisheries.

6. Biological data:

- Surface and longline fisheries, in particular **China**, **Taiwan,China**, **Indonesia** and **Japan**: The Secretariat had to use length-age keys, length-weight keys, ratios of fin-to-body weight, and processed weight-live weight

[4] The "Direction national des resources haléutiques" of the Comoros conducted a fisheries census in 2011, with the assistance of the IOTC-OFCF Project. In addition, the IOTC Secretariat provided support for the implementation of a sampling system. These activities will make it possible for Comoros to estimate catches of tropical tunas and other species for 2011 and following years.

[5] *Ibid.* 7

keys, for sharks from other oceans due to the general paucity of biological data available from the Indian Ocean.

OTHER BYCATCH

1. Incidental catches of SEABIRDS:

- **Longline** fisheries operating in areas with high densities of seabirds, notably **Taiwan,China**, **Japan**, **Indonesia, Rep. of Korea** and **Seychelles:** These parties have not reported incidental catches of seabirds for longliners under their flag.

2. Incidental catches of MARINE TURTLES:

- **Gillnet** fisheries of **Iran** and **Pakistan:** To date, Iran and Pakistan have not reported incidental catches of marine turtles for their driftnet fisheries.
- **Gillnet/longline** fishery of **Sri Lanka**: To date, Sri Lanka has not reported incidental catches of marine turtles for its gillnet/longline fishery.
- **Longline** fisheries of **Taiwan,China**, **India, Indonesia, Japan, Rep. of Korea, Malaysia, Oman, Philippines,** and **Seychelles:** To date, these countries have not reported incidental catches of marine turtles for their longline fisheries.
- **Purse seine** fisheries of the **EU** (excluding 2003–07), **Iran**, **Japan**, **Seychelles**, and **Thailand**: To date these countries have not reported incidental catches of marine turtles for their purse seine fisheries, including incidental catches of marine turtles on Fish Aggregating Devices.

4. STATUS OF FISHERIES STATISTICS FOR SHARKS

Main species of sharks caught in IOTC fisheries

Following standard international practice, the term shark is accepted to include both sharks and rays.

Table 3 below shows the main species of sharks caught on IOTC fisheries as identified by the WPEB in 2010[6].

Table 3. Preliminary listing of Shark species of concern to IOTC.

Common name	Species	Code	Catch*
Manta ray	*Manta birostris*	MAN	nil
Whale shark	*Rhincodon typus*	RHN	nil
Pelagic thresher	*Alopias pelagicus*	PTH	High
Bigeye thresher	*Alopias superciliosus*	BTH	
Thresher	*Alopias vulpinus*	ALV	
Shortfin mako	*Isurus oxyrinchus*	SMA	Med
Longfin mako	*Isurus paucus*	LMA	Med
Crocodile shark	*Pseudocarcharias kamoharai*	PSK	Low
Silvertip shark	*Carcharhinus albimarginatus*	ALS	Low
Silky shark	*Carcharhinus falciformis*	FAL	High
Oceanic whitetip	*Carcharhinus longimanus*	OCS	High
Sandbar shark	*Carcharhinus plumbeus*	CCP	Low
Tiger shark	*Galeocerdo cuvier*	TIG	Low
Blue shark	*Prionace glauca*	BSH	High
Scalloped hammerhead	*Sphyrna lewini*	SPL	Med
Porbeagle	*Lamna nasus*	POR	Low
Great White Shark	*Carcharodon carcharias*	WSH	nil
Other Requiem Sharks	*Carcharhinus* spp.	CWZ	High
Hammerhead Sharks	*Sphyrna* spp.	SPN	Med

* The accumulated catches for 1950–2010 makes up 5% or more out of the total catches of sharks recorded (High); between 1–5% (Medium); less than 1% (Low); no catches recorded (nil).
Note that most of the catches of sharks are not available by species and when available by species they are not considered to be an unbiased sample of the catch in the Indian Ocean

Other species of sharks that have been reported as a bycatch of IOTC fisheries can be found on **Table 4** (page 8).

[6] IOTC–2007–WPEB–R, page 13.

Table 4. Other shark species caught on IOTC fisheries and presumed catch levels[7].

Code	English Name	Source	Catch*	French Name	Scientific Name
AML	Grey Reef Shark	IOTC	Low	Requin dagsit	*Carcharhinus amblyrhynchos*
BLR	Blacktip reef shark	IOTC	Low	Requin pointes noires	*Carcharhinus melanopterus*
BRO	Copper shark	IOTC	Low	Requin cuivre	*Carcharhinus brachyurus*
CCB	Spinner Shark	IOTC	Low	Requin tisserand	*Carcharhinus brevipinna*
CCG	Galapagos shark	IOTC[3]	Low	Requin des Galapagos	*Carcharhinus galapagensis*
DOP	Shortnose spurdog	IOTC	Low	Aiguillat nez court	*Squalus megalops*
DUS	Dusky shark	IOTC	Low	Requin de sable	*Carcharhinus obscurus*
GAG	Tope shark	IOTC	Low	Requin-hâ	*Galeorhinus galeus*
GAM	Mouse Catshark	IOTC	Low	Chien islandais	*Galeus murinus*
NTC	Broadnose sevengill shark	IOTC	Low	Platnez	*Notorhynchus cepedianus*
OXY	Angular rough shark	IOTC	Low	Centrine commune	*Oxynotus centrina*
SBL	Bluntnose sixgill shark	IOTC	Low	Requin griset	*Hexanchus griseus*
SCK	Kitefin shark	IOTC	Low	Squale liche	*Dalatias licha*
SHBC	Banded catshark	IOTC	Low	Holbiche des plages	*Halaelurus lineatus*
SHCW	Cow sharks	IOTC	Low	Requins griset	*Hexanchidae spp.*
SMD	Smooth-hound	IOTC	Low	Emissole lisse	*Mustelus mustelus*
SPZ	Smooth hammerhead	IOTC	Low	Requin marteau commun	*Sphyrna zygaena*
SSQ	Velvet dogfish	IOTC	Low	Squale grogneur velouté	*Scymnodon squamulosus*
SSU	Australian angelshark	IOTC	Low	Ange de mer australien	*Squatina australis*
AGN	Angelsharks, sand devils nei	FAO	nil	Ange de mer commun	*Squatina squatina*
CCD	Whitecheek shark	IOTC[1]	nil	Requin joues blanches	*Carcharhinus dussumieri*
CCM	Hardnose shark	IOTC[1]	nil	Requin nez rude	*Carcharhinus macloti*
CCQ	Spot-tail shark	IOTC[1]	nil	Requin queue tachet	*Carcharhinus sorrah*
CEM	Smallfin gulper shark	FAO[2]	nil	Squale-chagrin cagaou	*Centrophorus moluccensis*
CLD	Sliteye shark	IOTC[3]	nil	Requin sagrin	*Loxodon macrorhinus*
CPU	Little gulper shark	FAO[2]	nil	Petit squale-chagrin	*Centrophorus uyato*
CYT	Ornate dogfish	FAO[2]	nil	Aiguillat élégant	*Centroscyllium ornatum*
MTM	Arabian smooth-hound	IOTC[3]	nil	Emissole d'Arabie	*Mustelus mosis*
ODH	Bigeye sand tiger shark	FAO[2]	nil	Requin noronhai	*Odontaspis noronhai*
ORI	Slender bambooshark	FAO[2]	nil	Requin-chabot élégant	*Chiloscyllium indicum*
ORR	Grey bambooshark	FAO[2]	nil	Requin-chabot gris	*Chiloscyllium griseum*
ORZ	Tawny nurse shark	FAO[2]	nil	Requin nourrice fauve	*Nebrius ferrugineus*
OSF	Zebra shark	FAO[2]	nil	Requin zèbre	*Stegostoma fasciatum*
PWS	Sawsharks nei	FAO	nil	Requins scies nca	*Pristiophorus spp*
RHA	Milk shark	IOTC[3]	nil	Requin museau pointu	*Rhizoprionodon acutus*
SHL	Lanternsharks nei	FAO	nil	Sagres nca	*Etmopterus spp*
SLA	Spadenose shark	IOTC[1]	nil	Requin épée	*Scoliodon laticaudus*

***** The accumulated catches for 1950-2010 makes up 5% or more out of the total catches of sharks recorded (High), between 1–5% (Medium) or less than 1% (Low).
Note that most of the catches of sharks are not available by species and when available by species they are not considered to be an unbiased sample of the catch in the Indian Ocean

1. IOTC–2007–WPEB–13 (Sharks of India)
2. FAO: Case studies of the management of elasmobranch fisheries
3. IOTC: Information collected in Yemen by the IOTC/OFCF Project

Data available on the total catches of sharks in the Indian Ocean

The collection and reporting of catches of sharks caught in association with species managed by the IOTC (tuna and tuna-like species) has been very uneven over time. The information on the bycatch of sharks gathered in the IOTC database is thought, for this reason, to be very incomplete. The catches of sharks, when reported, are thought

[7] Note that the list is not exhaustive; the catches of sharks are not reported by species for most fisheries making it difficult to assess the individual species that make the aggregates

to represent simply the catches of these species that are retained on board. They refer, in many cases, to dressed weights and no indication is given on the type of processing that the different specimens underwent. The weights or numbers of sharks for which only the fins were kept on board are rarely recorded in the vessels' logbooks. This makes it really difficult any attempt to estimate the total catches of sharks in the Indian Ocean.

Catches by species: The main problem areas identified for sharks are indicated below:

- **Some catch data not available**: several countries were not collecting fishery statistics, especially in years prior to the early 1970's, and others have not reported catches of sharks to IOTC (Figures 1–2). It is thought that important catches of sharks might have gone unrecorded in several countries. The catches recorded in other cases might not represent the total catches of sharks but simply the amounts retained on board (e.g. dressed weights instead of live weights). The catches of sharks for which only the fins are kept on board or of sharks usually discarded, because of their size or condition, are seldom, if ever, recorded.

Figure 1: Catches of pelagic sharks recorded in the IOTC nominal catches database versus the total catches of tuna and tuna-like species recorded for fleets presumed to catch pelagic sharks and the catches of tuna and tuna-like species recorded for fleets for which catches of pelagic sharks are available (1950–2010)

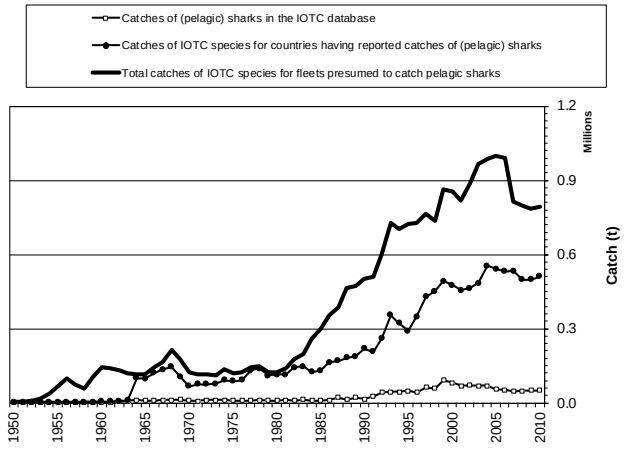
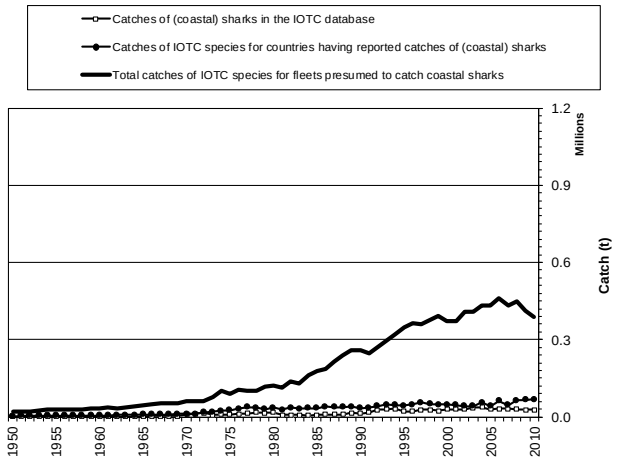


Figure 2: Catches of coastal sharks recorded in the IOTC nominal catches database versus the total catches of tuna and tuna-like species recorded for fleets presumed to catch coastal sharks and the catches of tuna and tuna-like species recorded for fleets for which catches of coastal sharks are available (1950–2010)



The selection of fleets presumed to catch a majority of pelagic shark species versus those presumed to catch mostly coastal shark species was done by using the data in the IOTC database for fleets reporting catches of sharks by species or according to the presumed area of operation for fleets not reporting catches of sharks per species or not reporting catches of sharks at all.

- **Poor resolution of catch data:** The catches of sharks are usually not recorded by species and/or gear (Figure 3–4). Be it sharks caught on the high seas or in coastal areas the amount of species that may occur in these areas is usually high. The estimation of catches by species is highly compromised in these cases due to the paucity of the data available. Miss-identification of shark species is also common. The identification of sharks in port is usually compromised by the way in which the different species of sharks are processed. The identification of shark species unloaded as shark carcasses, shark fins or other shark products is difficult due to the little information available: the majority of the information available on the identification of sharks refers to complete specimens.

The main consequence of this is that, at the moment, the catches of sharks available cannot be used to estimate reliably total catches of sharks in the Indian Ocean, not even for the species for which the catches are partially available.

Figure 3: Proportion of the catches of pelagic sharks that are recorded by species in the IOTC nominal catches database *versus* those recorded in aggregated form (1950–2010) (The total catches of pelagic sharks recorded per year are also shown (blue line, left axis))

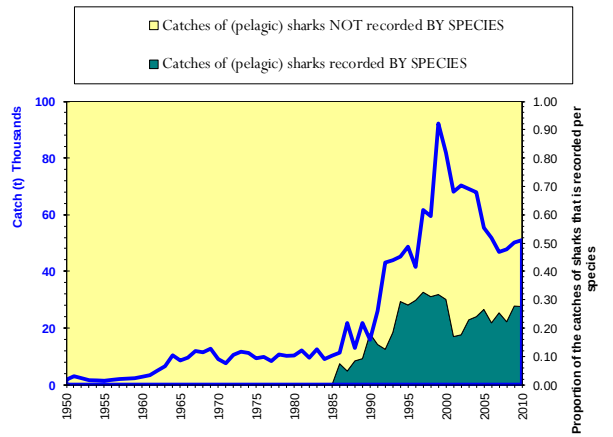
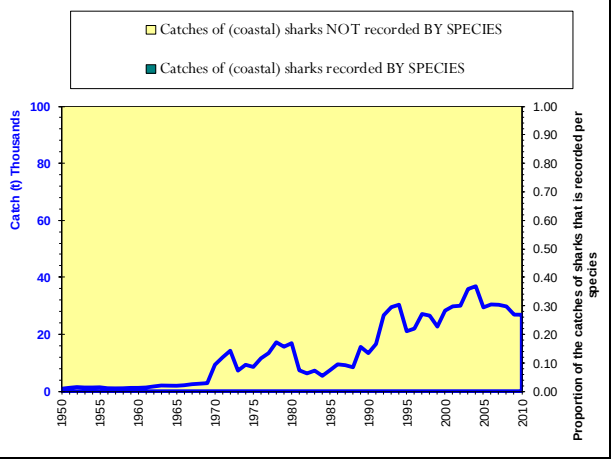


Figure 4: Proportion of the catches of coastal sharks that are recorded by species in the IOTC nominal catches database *versus* those recorded in aggregated form (1950–2010 (The total catches of coastal sharks recorded per year are also shown (blue line, left axis))



<u>Catches by gear type</u>: The catches of sharks that are not recorded by gear do not represent a high proportion of the total catches recorded for these species, especially in recent years (Figures 5–6).

Figure 5: Proportion of the catches of pelagic sharks that are recorded by gear in the IOTC nominal catches database versus those recorded in aggregated form (1950–2010) (The total catches of pelagic sharks recorded per year are also shown (white line, left axis))

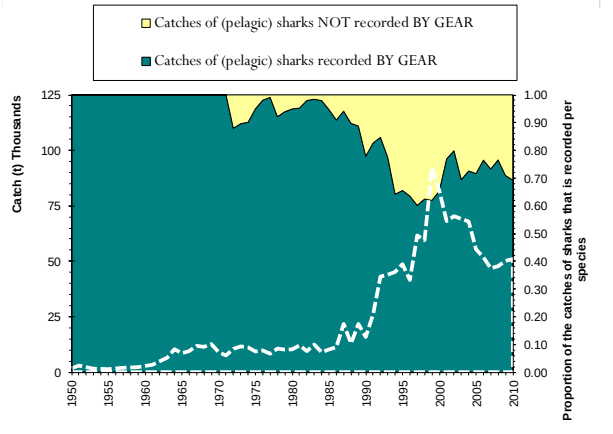
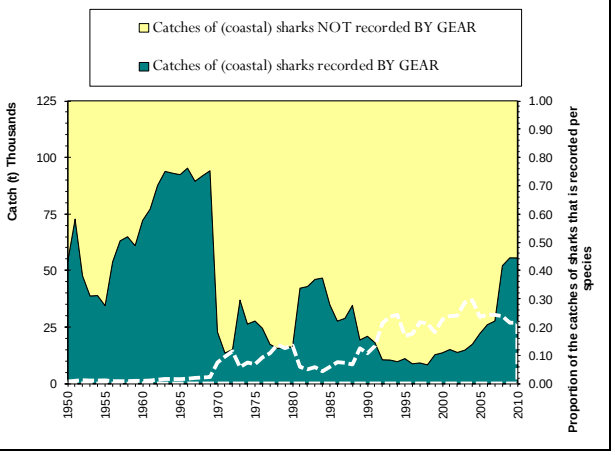


Figure 6: Proportion of the catches of coastal sharks that are recorded by gear in the IOTC nominal catches database versus those recorded in aggregated form (1950–2010) (The total catches of coastal sharks recorded per year are also shown (white line, left axis))



Industrial longliners, gillnets, and, to a lesser extent, industrial purse seiners and other artisanal gears operated in the Indian Ocean are thought to be harvesting important amounts of pelagic sharks.

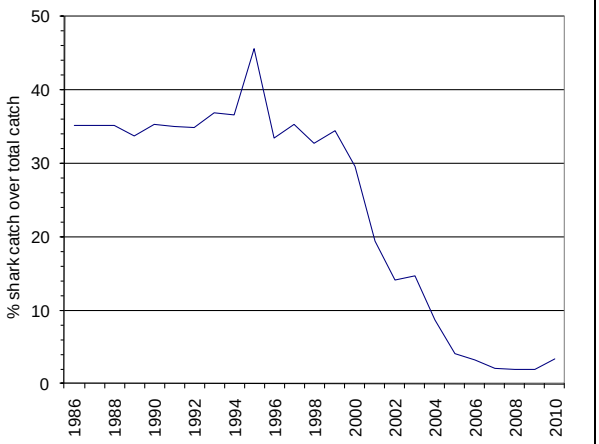
- **Deep-freezing tuna longliners** and **fresh-tuna longliners**: Catches of sharks are thought to represent between 20–40% of the total combined catch for all species. However, the catches of sharks recorded in the IOTC database only make for a small proportion of the total catches of all species over longline fleets. Catches of sharks are, therefore, thought to be very incomplete. The implementation of catch monitoring schemes in different ports of landing of fresh-tuna longliners in recent years[8] has improved the estimates of catches of sharks for these fleets. The catches estimated, however, do not represent the total catches of sharks for this fishery due to the high amount of sharks that are believed to be discarded. In addition, the skippers of fresh-tuna longliners seldom allow that enumerators take samples of sharks during the unloading.

[8] The IOTC-OFCF (Overseas Fisheries Cooperation Foundation of Japan) Project implemented programmes in cooperation with local institutions in Thailand and Indonesia

- **Freezing(fresh) swordfish longliners**: Catches of sharks are thought to represent between 40–60% of the total combined catch for all species. The amounts of sharks caught by longliners targeting swordfish in the Indian Ocean have been constantly increasing since the mid-90's. The catches of sharks recorded for these fleets are thought more realistic than those recorded for other longline fisheries. The high catches are thought to be due to:
    - Gear configuration and time fished: The vessels targeting swordfish use surface longlines and set the lines at dusk or during the night. Many pelagic sharks are thought to be abundant at these depths and most active during dusk or night hours.
    - Area fished: The fleets targeting swordfish have been deploying most of the fishing effort in the Southwest Indian Ocean, in the vicinity of South Africa, southern Madagascar, Reunion and Mauritius. High amounts of sharks are thought to occur in these areas.
    - Changes in the relative amounts of swordfish and sharks in the catches: Some of the vessels targeting swordfish are known to alternate swordfish and sharks, in particular blue shark, as main target, depending on the season, or when catch rates of swordfish are poor.
- **Industrial tuna purse seiners:** Catches of sharks are thought to represent less than 0.5% of the total combined catch for all species (10% of total discards). The **EU** reported preliminary estimates of catches of sharks for EU purse seiners during 2009, as derived from samples collected by observers during 2003–07. The EU has plans to revise the catch series for its purse seine fleet to incorporate catches of sharks, as estimated from data collected from observers and other alternative sources. The Secretariat has not received data from other purse seine fleets concerning bycatch levels of sharks (**Iran**, **Seychelles** or **Thailand**). Catches of sharks
- **Pole and line fisheries:** There are no catches of sharks recorded for the pole and line fisheries of Maldives and India in the IOTC database. The amounts of sharks caught by these fisheries, if any, are not thought significant.
- **Gillnet fisheries:** The species of sharks caught are thought to vary significantly depending on the area of operation of the gillnets:
    - Gillnets operated in areas having low concentrations of pelagic sharks: The gillnet fisheries of most coastal countries operate these gears in coastal waters. The abundance of pelagic sharks in these areas is thought low.
    - Gillnets operated in areas having high concentrations of pelagic sharks: Gillnets operated in **Sri Lanka**, **Indonesia** and **Yemen** (waters around Socotra), in spite of being set in coastal areas, are likely to catch significant amounts of pelagic sharks.
    - Gillnets operated on the high seas: Vessels from **Taiwan,China** were using drifting gillnets (driftnets) from 1982 to 1992, the year in which the use of this gear was banned worldwide. The catches of pelagic sharks were very high during that period, representing around 25% of the total catch of all species. Driftnet vessels from **Iran** and **Pakistan** have been fishing on the high seas since the early-1990ies, initially in waters of the Arabian Sea but covering a larger area in recent years, as they moved to operate also in tropical waters of the western Indian Ocean and Mozambique Channel. The amounts of sharks that are caught by these fleets are thought high, representing between 25-50% of the total combined catches of sharks and other species.

- **Gillnet/longline fishery of Sri Lanka:** Catches of sharks represent between 2% and 45% of the total combined catch for all species, depending on the year. Between 1,200 and 3,200 vessels (average size of 12 m) operating gillnets and longlines in combination have been harvesting important amounts of pelagic sharks since the mid–80's. The longlines are believed to be responsible for most of the catches of sharks. Since the mid–1990's the proportion of sharks, all species combined, in the catches of gillnet and longline vessels has been constantly decreasing (Figure 7), to represent less than 2% of the total catch in recent years (45% of the catch in 1995). Catches of sharks by vessel by year have also decreased markedly since the mid–90's.

Figure 7: Proportion that the combined catches of sharks made out of the total combined catches of sharks and IOTC species for the gillnet and longline fishery of Sri Lanka, by year, for the period 1986–2010



- **Hand line and troll line fisheries:** The majority of hand line and troll line fisheries in the Indian Ocean operate these gears in coastal waters. The amounts of pelagic sharks caught are thought, for this reason, low. The amount that other species of sharks make out of the catches of tuna and tuna-like species might change depending on the area fished and time of the day.

Time-area catches: Maps 1–3 present data available on sharks for deep-freezing longliners flagged in Taiwan,China, by decade (1980's to 2000s) and type of catch data reported, including total numbers of sharks recorded aggregated and by species on each five degree square grid. In addition, Maps 4–7 present total numbers of sharks by grid for major shark species, by species, and combined for other species, for the period 2007-10.

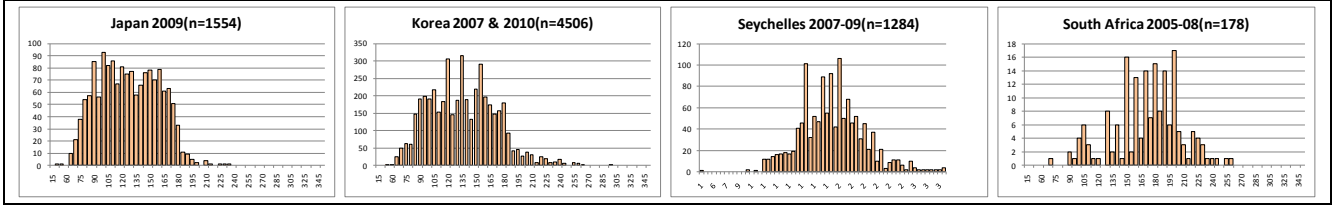
Finally, Maps 8–9 present numbers of shark reported for the longline fleet of Japan, by species for the years 2009–10.

It is important to note that time-area catches of sharks by species are only available since 2007 or 2009 for Japan and Taiwan,China, respectively, while these fleets have been operating in the Indian Ocean since the 1950's. While aggregated catches of sharks are available for Taiwan for previous years, up to the late 1970's, this is not the case with Japan, for which the only catches available are those referred to before. In addition, the catches available are considered to represent a sample of the total, as they do not include numbers of sharks discarded by these fisheries.

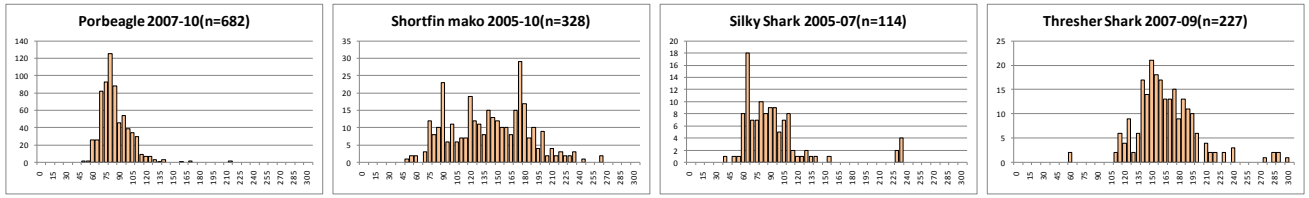
Time area catches of sharks are also available from other fleets, as recorded in Table 1.

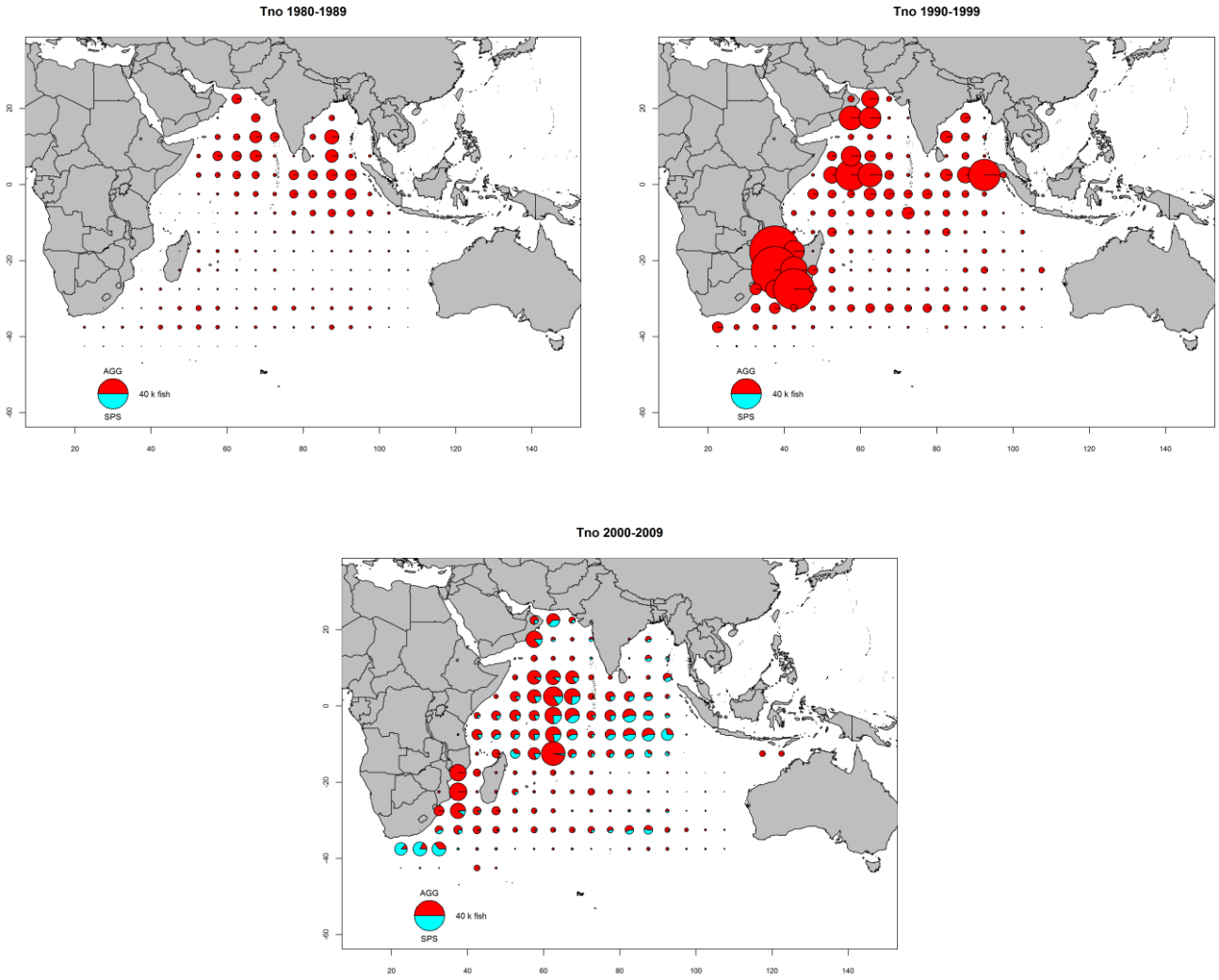
Length frequency data: Figures 8–11 show length frequencies of blue shark as derived from the samples available from longliners flagged in Japan, Republic of Korea, Seychelles, and South Africa, for all periods and areas combined. Figures 12–15 show length frequencies derived from the samples available for other important shark species, for all fleets, periods, and areas combined. Length frequency data of sharks are only available in recent years, for the fleets indicated in Table 1.

Figures 8–11: Length frequency distributions of blue shark derived from the samples available for the longline fleets of Japan (left), Rep. of Korea (mid left), Seychelles (mid right), and South Africa (right)



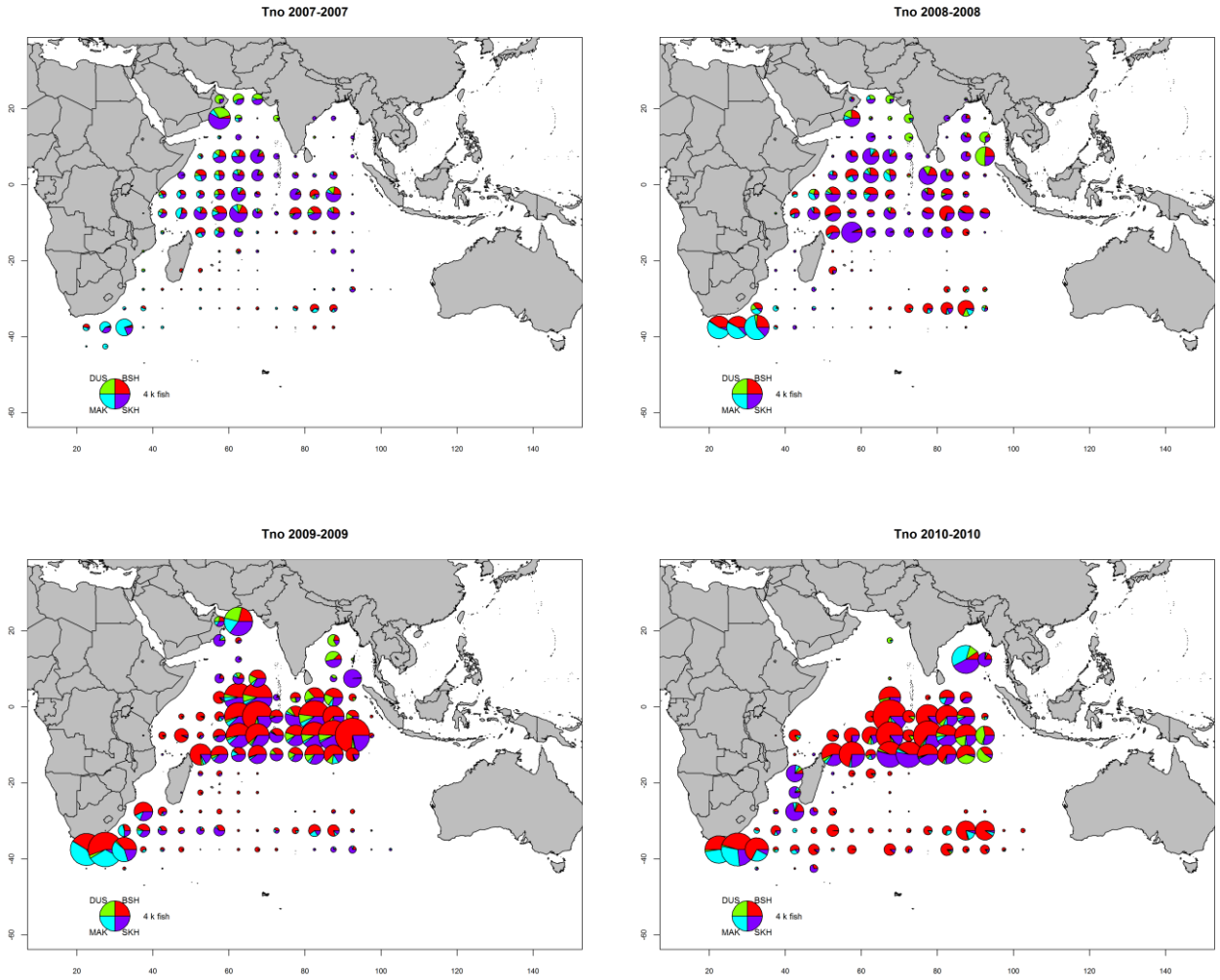
Figures 12–15: Length frequency distributions of porbeagle (top left), shortfin mako (top right), silky shark (bottom left), and thresher sharks (bottom right) derived from the samples available from longline fleets





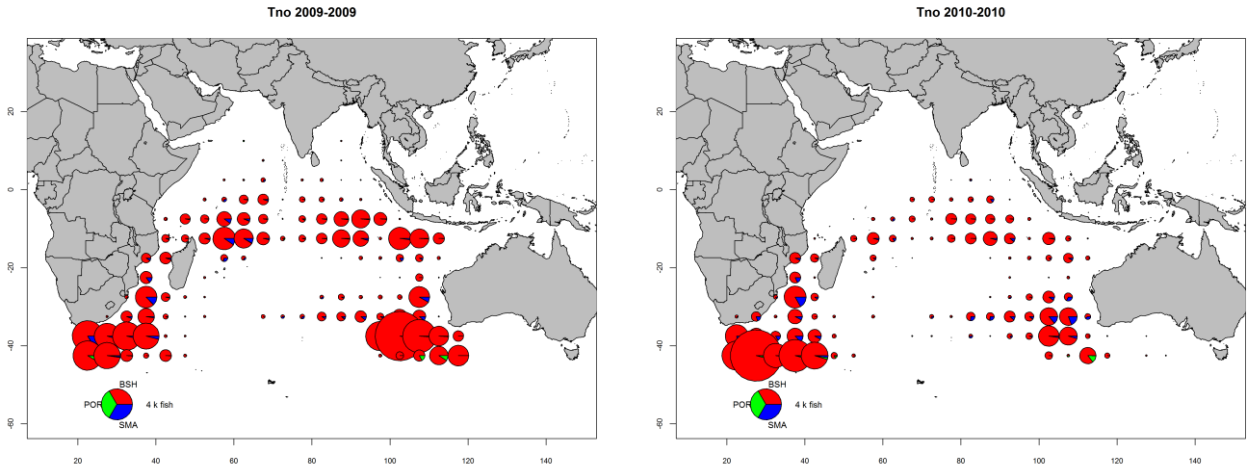
Maps 1–3: Time-area catches (total combined in number) of sharks available for the period 1980–2009 for deep-freezing longliners flagged in Taiwan,China, by decade and type of catch reported:

Catch reported by species (**SPS**, Blue), Catch reported aggregated (**AGG,** Red)



Maps 4–7: Time-area catches (total combined in number) of sharks available for the period 2007–2010 for deep-freezing longliners flagged in Taiwan,China, by year and species:

Blue shark (**BSH**, red); Dusky shark (**DUS,** green); Mako sharks (**MAK**, blue); Other shark species (**SKH**, purple)



Maps 8–9: Time-area catches (total combined in number) of sharks available for the period 2009–2010 for deep-freezing longliners flagged to Japan, by year and species:

Blue shark (**BSH**, red); Porbeagle (**POR,** green); Shortfin mako (**MAK**, blue)

5. OVERVIEW OF IOTC FISHERIES AND SEABIRD BYCATCH LEVELS

Main species and fisheries concerned

The main species of seabirds likely to be bycatch of IOTC fisheries are presented in Table 5 below[9].

Table 5. Main species of seabirds likely to be incidentally caught on longline operations.

Common Name	Status*	Scientific Name
Amsterdam Albatross	Critically Endangered	*Diomedea amsterdamensis*
Antipodean Albatross	Vulnerable	*Diomedea antipodensis*
Black-browed Albatross	Endangered	*Thalassarche melanophrys*
Buller's Albatross	Near Threaten	*Thalassarche bulleri*
Campbell Albatross	Vulnerable	*Thalassarche impavida*
Chatham Albatross	Vulnerable	*Thalassarche eremite*
Grey-headed Albatross	Vulnerable	*Thalassarche chrysostoma*
Light-mantled Albatross	Near Threatened	*Phoebetria palpebrata*
Northern Royal Albatross	Endangered	*Diomedea sanfordi*
Southern Royal Albatross	Vulnerable	*Diomedea epomophora*
Salvin's Albatross	Vulnerable	*Thalassarche salvini*
Shy Albatross	Near Threatened	*Thalassarche cauta*
White-capped Albatross	Near Threatened	*Thalassarche steadi*
Sooty Albatross	Endangered	*Phoebetria fusca*
Tristan Albatross	Criticallly Endangered	*Diomedea dabbenena*
Wandering Albatross	Vulnerable	*Diomedea exulans*
Atlantic Yellow-nosed Albatross	Endangered	*Thalassarche chlororhynchos*
Indian Yellow-nosed Albatross	Endangered	*Thalassarche carteri*
Northern Giant Petrel	Least Concern	*Macronectes halli*
Southern Giant Petrel	Least Concern	*Macronectes giganteus*
White-chinned Petrel	Vulnerable	*Procellaria aequinoctialis*
Westland Petrel	Vulnerable	*Procellaria westlandica*
Short-tailed Shearwater	Least Concern	*Puffinus tenuirostris*
Sooty Shearwater	Near Threatened	*Puffinus griseus*

*****Source IUCN 2006, BirdLife International 2004b.

The interaction between seabirds and IOTC fisheries is likely to be significant only in Southern waters (below 25 degrees South), an area where most of the effort is exerted by longliners. Incidental catches

[9] As in IOTC–2007–WPEB–22, appendix 2, page 24. Paper submitted on behalf of the Agreement for the Conservation of Albatrosses and Petrels (ACAP)

are, for this reason, likely to be of importance only for longline fleets having vessels operating in these areas (**Taiwan,China**, **Japan**, **Rep. of Korea**, the **EU** and **Indonesia**).

Status of data on seabird bycatch

The parties having provided data on interactions of IOTC fisheries with species of seabirds are recorded in Table 2 (page 4). These are Australia, China, EU-France, EU-Spain, EU-UK, France(territories), and South Africa.

To date, the IOTC Secretariat has not received any reports on the activities of scientific observers under the IOTC Scientific Observer Programmes.

Some information on the incidental catches of seabirds by some longline fleets operating in the Southern Indian Ocean is also available with the Secretariat. The data available were provided by the CCSBT and will be completed with more recent information in the future.

The paucity of the information available makes it difficult or impossible to estimate total levels of seabird bycatch by vessels in the IOTC area of competence.

6. OVERVIEW OF IOTC FISHERIES AND MARINE TURTLE BYCATCH LEVELS

Main species and fisheries concerned

The main species of marine turtles likely to be bycatch of IOTC fisheries are presented in Table 6 below.

Table 6. Main species of Indian Ocean marine turtles[10].

Common Name	Scientific Name
Loggerhead turtle	*Caretta caretta*
Olive ridley turtle	*Lepidochelys olivacea*
Green turtle	*Chelonia mydas*
Hawksbill turtle	*Eretmochelys imbricata*
Leatherback turtle	*Dermochelys coriacea*
Flatback turtle	*Natator depressus*

The interaction between marine turtles and IOTC fisheries is likely to be significant only in tropical areas, involving both industrial and artisanal fisheries, notably for:

- Industrial purse seine fisheries using fish aggregating devices (**EU**, **Seychelles**, **Iran**, **Thailand, Japan**)
- Gillnet fisheries operating in coastal waters or on the high seas (**Sri Lanka**, **Iran**, **Pakistan**, **Indonesia**)
- Industrial longline fisheries operating in tropical areas (**China**, **Taiwan,China**, **Japan**, **Indonesia**, **Seychelles**, **India, Oman**)

Both loggerhead and leatherback turtles are caught incidentally on IOTC fisheries, in higher numbers than the other species.

Status of data on marine turtle bycatch

The parties having provided data on interactions of IOTC fisheries with species of marine turtles are recorded in Table 2 (page 5). These are, by type of fishery:

- Surface: EU-France; EU-Spain
- Longline: Australia; China; EU-France; EU-Spain; EU-UK; France
- Driftnet: None

To date, the IOTC Secretariat has received only one report (from China) on the activities of scientific observers under the IOTC Scientific Observer Programmes.

The paucity of the information available makes it difficult or impossible to estimate levels of marine turtle bycatch by species.

[10] Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia