STATUS OF IOTC DATABASES FOR BYCATCH SPECIES

IOTC Secretariat

ABSTRACT

This document describes the status of the information available on sharks, sea birds and sea turtles in the databases at the IOTC Secretariat. It covers data on nominal catches, catch-and-effort, and size-frequency data.

Introduction

The collection and reporting of catches of sharks, sea birds, sea turtles or other fauna that might be incidentally caught in association with species managed by the IOTC (tuna and tuna-like species) has been very uneven overtime. The information on the by-catches of sharks and other species gathered in the IOTC database is thought, for this reason, very incomplete. The catches of sharks, when reported, are thought 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.

Table 1: Species of sharks for which catches are recorded in the IOTC database

Code	English Name	Catch*	French Name	Scientific Name
AML	Grey Reef Shark	Low	Requin dagsit	*Carcharhinus amblyrhynchos*
BLR	Blacktip reef shark	Low	Requin pointes noires	*Carcharhinus melanopterus*
BRO	Copper shark	Low	Requin cuivre	*Carcharhinus brachyurus*
BSH	Blue shark	High	Peau bleue	*Prionace glauca*
BTH	Bigeye thresher	Low	Renard a gros yeux	*Alopias Sperciliosus*
DGZ	Dogfishes *nei*	Low	Aiguillats nca	*Squalus spp.*
DOP	Shortnose spurdog	Low	Aiguillat nez court	*Squalus megalops*
DUS	Dusky shark	Low	Requin de sable	*Carcharhinus obscurus*
FAL	Silky shark	High	Requin soyeux	*Carcharhinus falciformis*
GAG	Tope shark	Low	Requin-hâ	*Galeorhinus galeus*
LMA	Longfin mako	Low	Petite taupe	*Isurus paucus*
MSK	Sharks mackerel, porbeagles *nei*	Low	Requins taupe nca	*Lamnidae*
NTC	Broadnose sevengill shark	Low	Platnez	*Notorhynchus cepedianus*
OCS	Oceanic whitetip shark	Medium	Requin océanique	*Carcharhinus longimanus*
OXY	Angular rough shark	Low	Centrine communes	*Oxynotus centrina*
POR	Porbeagle	Low	Requin-taupe commun	*Lamma nasus*
PTH	Pelagic Thresher Shark	Low	Renard pelagique	*Alopias pelagicus*
RSK	Requiem sharks *nei*	Medium	Requins nca	*Carcharhinidae*
SMA	Shortfin mako	Low	Taupe bleue	*Isurus oxyrinchus*
SMD	Smooth-hound	Low	Emissole lisse	*Mustelus mustelus*
SPL	Scalloped hammerhead	Low	Requin marteau halicorne	*Sphyrna lewini*
SPN	Hammerhead sharks *nei*	Medium	Requins marteau nca	*Sphyrna spp.*
SPY	Bonnethead, hammerhead sharks	Low	Requins marteau	*Sphyrnidae*
SPZ	Smooth hammerhead	Low	Requin marteau commun	*Sphyrna zygaena*
THR	Thresher sharks *nei*	Medium	Renards de mer nca	*Alopias spp.*
TIG	Tiger shark	Low	Requin tigre commun	*Galeocerdo cuvier*
SKH	Sharks various *nei*		Requins divers nca	*Selachimorpha (Pleurotremata)*

* The accumulated catches for 1950-2005 make up 10% or more out of the total catches of sharks recorded (High), between 5-10% (Medium) or less than 5% (Low).
Note that most of the catches of sharks are not available per species and when available per species they are not considered to be an unbiased sample of the catch in the Indian Ocean

To date, the IOTC Secretariat has not received any reports from members or cooperating parties on the total amounts of sea birds, sea turtles or other fauna caught incidentally by their vessels. The information that is available refers to research programmes or data obtained from other Regional Fishery Bodies, as the CCSBT. These data refers in most cases to the catches of seabirds or other species by longline fisheries in specific areas and periods. The adoption during the last two IOTC Sessions of Resolutions intending to mitigate the catches of these species and/or promoting the collection and reporting of data to the IOTC will probably increase the amount of information available in the early future.

The implementation of observer programmes by several IOTC Members and Cooperating parties might also help in the collection of the data needed to carry out estimates of total catches for these species. Although some of the results of the observer programmes have already been published these usually refer to a reduced number of fishing observations and its use to estimate total by-catches for the fleets concerned is not recommended, the least to estimate the by-catches of other fleets.

The catches and other information presented in the following sections are thought, for the above reasons, to refer to a biased sample of the catches of sharks for the fleets concerned having only some value at the qualitative level.

(Nominal) catches of Sharks

Catches per species: Table 1 (page 1) lists the species or species groups of sharks for which catches are available in the IOTC databases. The relative importance that the catches of each species make out of the total catches of sharks recorded is also indicated.

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 sharks recorded in the IOTC nominal catches database versus the total catches of tuna and tuna-like species recorded and the catches of tuna and tuna-like species recorded for fleets for which catches of sharks are available (1950-2005)

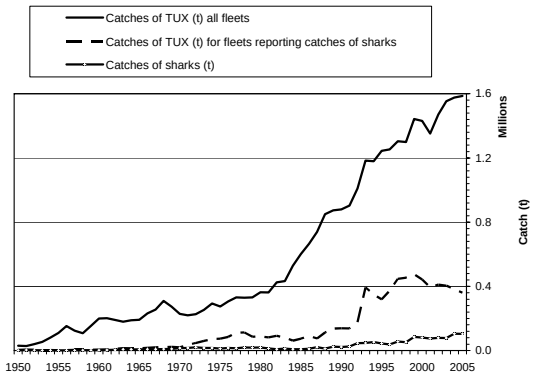
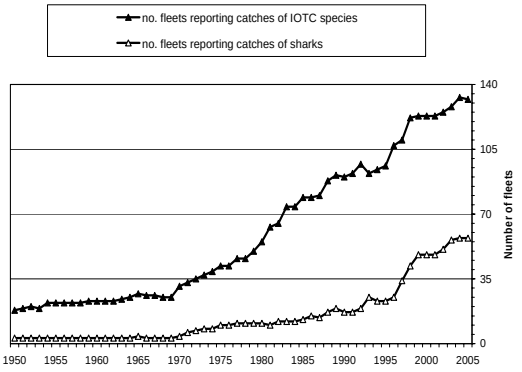


Figure 2: Number of fleets* for which catches of tuna and/or tuna-like species are recorded in the IOTC nominal catches database and number of those for which catches of sharks are recorded (1950-2005)



* The term fleet refers to Fleet-Gear-IOTC Area (Western Indian Ocean or Eastern Indian Ocean)

Note that all fleets have been accounted for in the above charts. It is likely that some of these fleets use gears or operate in areas where little or no catches of sharks are expected to occur (e.g. pole and line fishery of Maldives)

- **Poor resolution of catch data**: The catches of sharks are usually not recorded per species and/or gear (Figures 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 per species is highly compromised in these cases due to the paucity of the data available. The 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 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 sharks that are recorded per species in the IOTC nominal catches database *versus* those recorded in aggregated form (1950-2005) (The total catches of sharks recorded per year are also shown (broken line, left axis))

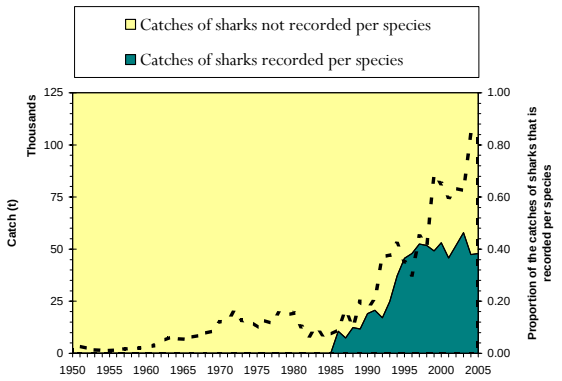
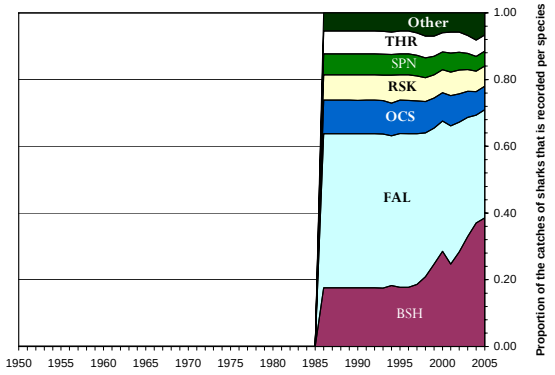


Figure 4: Proportion that the different species of sharks make out of the total catches of sharks that are recorded per species in the IOTC nominal catches database (1950-2005) (see Table 1 for details on the species referred to below)



Note that the catches of sharks recorded under a same genus (e.g. *Isurus spp.*) were accounted for as catches per species

Catches per gear: The catches of sharks that are not recorded per gear do not represent a high proportion of the total catches recorded for these species, especially in recent years (Figure 5).

The proportion that the catches of sharks that are recorded for each gear type make out of the total catches of sharks recorded per gear and year is shown in Figure 6. These proportions are not thought to represent the real amounts of sharks that were harvested for each gear over the time series due to the changing quality of the reports for each gear and among the different gears over time. The catches of sharks reported for the gill net and longline fishery of Sri Lanka (recorded as gillnet), for instance, are thought more complete than those relating to longline fleets, the reason being that no sharks are discarded in Sri Lanka while this is common practice in most longline fisheries. The amounts discarded are seldom recorded.

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 (Figure 7) and fresh-tuna longliners (Figure 8): The catches of sharks recorded make up a small proportion of the catches of tuna and tuna-like species recorded for these fleets. The catches of sharks are, nevertheless, thought to be very incomplete. The implementation of catch monitoring schemes in different ports of landing of fresh-tuna longliners in recent years[1] 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 discarded for which

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

only the fins are kept on board. The skippers of the longliners do seldom allow that the enumerators take samples of shark fins during the unloading.

Figure 5: Proportion of the catches of sharks that are recorded per gear in the IOTC nominal catches database *versus* those recorded in aggregated form (1950-2005) (The total catches of sharks recorded per year are also shown (white line, left axis))

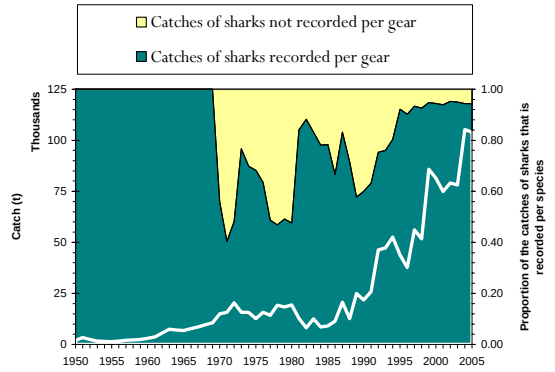
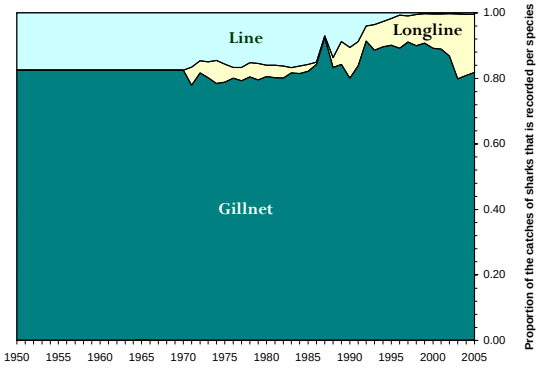


Figure 6: Proportion that the catches of sharks per gear make out of the total catches of sharks that are recorded per gear in the IOTC nominal catches database (1950-2005) (see text for details on the gears referred to below)



Note that the catches of the fishery operating a combination of gillnets and longlines off Sri Lanka has been accounted for as Gillnet

- Freezing(fresh) swordfish longliners (Figure 9): 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: 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, South Madagascar, Reunion and Mauritius. High amounts of sharks are thought to occur in this area.
    - Changes in the relative amounts of swordfish and sharks in the catches: The catch rates of swordfish have been decreasing in some areas, probably due to localised depletion. It is thought that this depletion might be the consequence of a relative increase in the catches of sharks and other species by longliners operating in these areas.
    - Changes in the target species due to bans on imports of swordfish products: Major importers of swordfish (e.g. EC, USA) have issued bans at different times on the imports of swordfish products due to the high amounts of metals (e.g. mercury, cadmium) found in the specimens caught in some areas. It is known that some of the fleets targeting swordfish shifted targeting to sharks at the time the bans were implemented.
- Industrial tuna purse seiners: There are no catches of sharks recorded in the IOTC database, although they are known to occur, mainly in the case of sets by purse seiners on schools that are associated with fish aggregating devices or other natural or artificial logs. The sharks caught by purse seiners are usually discarded, only the fins kept on board.
- 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 thought negligible.

- Gillnet/longline fishery of Sri Lanka: Between 1,200 and 1,500 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. The proportion that the catches of sharks make out of the catches of tuna and tuna-like species is thought reliable. The total amounts of sharks recorded since the mid-90's are thought, however, higher than the real catches for this fishery. This is based on the preliminary results of the catch monitoring programme carried out in Sri Lanka (NARA-IOTC-OFCF): the catches estimated from the new data tend to indicate that the catches estimated in the past are too high.

Proportion that the total catches of sharks make up of the catches of tuna and tuna-like species for fleets for which catches of sharks are recorded, per gear (1950-2005) (The total catches of sharks recorded per year are also shown in each case (broken line, left axis))

Figure 7: (Deep-)freezing tuna longliners

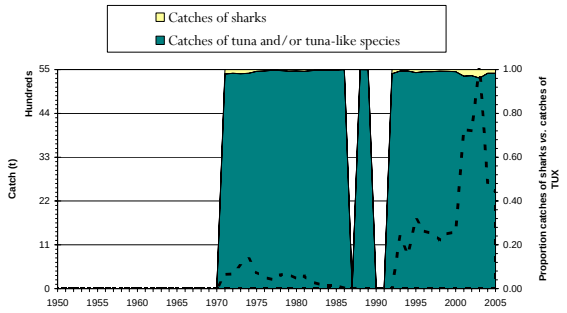


Figure 8: Fresh-tuna longliners

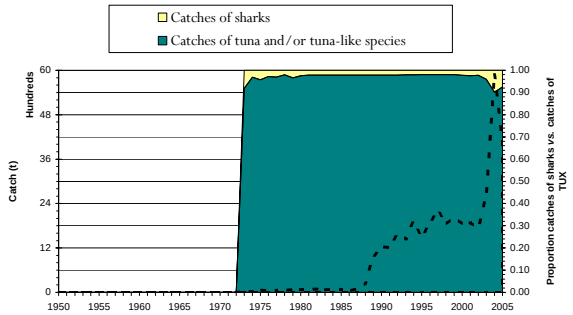


Figure 9: Freezing(Fresh) swordfish longliners

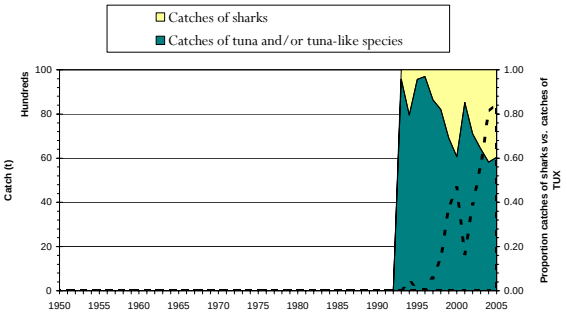


Figure 10: Gillnet fisheries

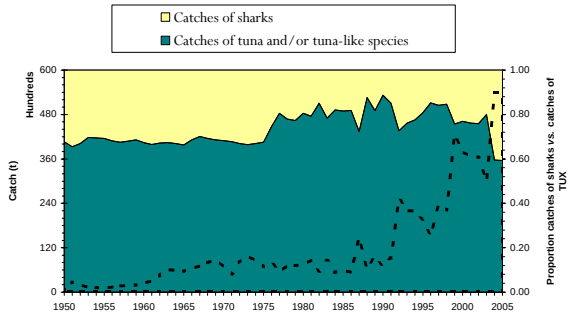


Figure 11: Gillnet/longline fishery Sri Lanka

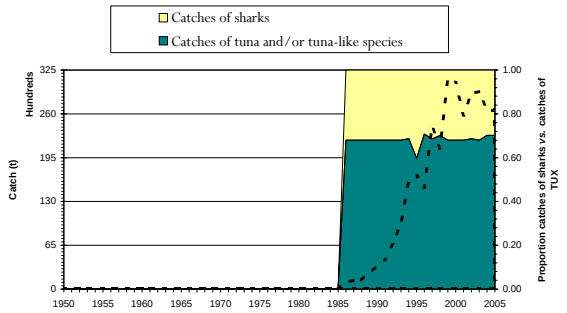
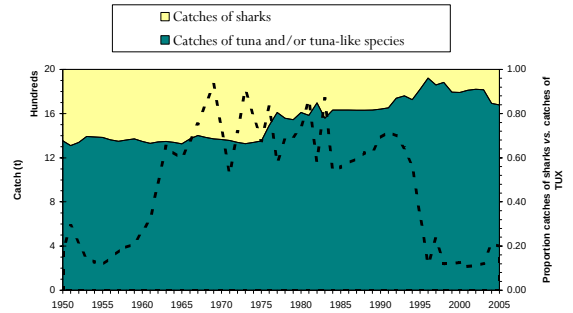


Figure 12: Hand line and troll line fisheries



Note that no catches of sharks are recorded at all for pole and line and industrial tuna purse seine fisheries

- Gillnet fisheries: The amounts of sharks that are caught by some fleets using gillnets are thought high. 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 and Indonesia, in spite of being set in coastal areas, are thought to be catching significant amounts of pelagic sharks.
- Gillnets operated on the high seas: Vessels from Taiwan,China were using drifting gillnets 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. Some artisanal fleets have been operating gillnets on the high seas in recent years being the catches of sharks for those thought high (e.g. Pakistan).

- 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.

The catches of sharks recorded in the IOTC database regarding the artisanal fisheries referred to above and other minor fisheries are recorded in Appendix I, per year. The catches of tuna and tuna-like species recorded for fleets for which catches of sharks are recorded versus the total catches recorded for all fleets are also shown for these gears.

Appendix II shows the proportion (estimated from the accumulated catches for 1950-2005) that the catches of sharks make out of the catches of tuna and tuna-like species (for fleets for which catches of sharks are recorded exclusively) for important industrial and artisanal fleets in the Indian Ocean (e.g. gillnet/longline of Sri Lanka), per fleet. The amounts of sharks that are recorded per species out of the totals recorded (expressed as a percentage) are also indicated.

Alternative sources for data on the catches of sharks: The species of sharks for which catches are recorded in the ***FAO FishStat database*** (1950-2004) are shown in Table 2. Figures 13 and 14 show the amounts of sharks recorded per species *versus* those not recorded per species and the proportion that the different species of sharks make out of the catches that are recorded per species.

Table 2: Species of sharks for which catches are recorded in the FAO database

Code	English Name	Catch*	French Name	Scientific Name
AGN	Angelsharks, sand devils *nei*	Low		*Squatina squatina*
BSH	Blue shark	Low	Peau bleue	*Prionace glauca*
DUS	Dusky shark	Low	Requin de sable	*Carcharhinus obscurus*
	Ghost shark	Low		*Hydrolagus spp*
GSK	Greenland shark	Low		*Somniosus microcephalus*
SPN	Hammerhead sharks, etc. *nei*	Low	Requins marteau nca	*Sphyrna spp.*
	Lanternsharks *nei*	Low		*Etmopterus spp*
	Pacific sleeper shark	Low		*Somniosus pacificus*
POR	Porbeagle	Low	Requin-taupe commun	*Lamma nasus*
RSK	Requiem sharks *nei*	High	Requins nca	*Carcharhinidae*
	Sawsharks *nei*	Low		*Pristiophorus spp*
SMA	Shortfin mako	Low	Taupe bleue	*Isurus oxyrinchus*
FAL	Silky shark	High	Requin soyeux	*Carcharhinus falciformis*
SMD	Smooth-hounds *nei*	Low		*Mustelus mustelus*
	Spot-tail shark	Medium		*Carcharhinus sorrah*
GAG	Tope shark	Low	Requin-hâ	*Galeorhinus galeus*
	Sharks, rays, skates, etc. *nei*			

* The accumulated catches for 1950-2004 make up 10% or more out of the total catches of sharks recorded (High), between 5-10% (Medium) or less than 5% (Low).
Note that most of the catches of sharks are not available per species and when available per species they are not considered to be an unbiased sample of the catch in the Indian Ocean

The catches of sharks in the FAO FishStat database are not recorded per gear. This makes it very difficult to assess the amounts of sharks that are caught by fisheries catching tuna and/or tuna-like species out of the total amounts of sharks recorded.

As with the IOTC database, most of the catches are not recorded per species (80%). Furthermore, the catches of sharks, rays and skates are combined when they are not recorded per species making it very difficult to assess the proportion that the catches of sharks make out of the total catches recorded.

The catches in the FAO database cannot be fully used, for the above reasons, to correct or complete the catches in the IOTC database. The proportions that the different species of sharks make out of the total catches of sharks that are recorded per species in the IOTC and FAO databases are significantly different. This is likely to be due to the inconsistent reports of catches of sharks from the different fleets catching them over time and the low amounts of catches that are recorded per gear. The catches per species are not thought to be a reliable sample, for this reason, of the total catches of sharks in the Indian Ocean. The disaggregation of catches per species is highly compromised for the above reasons.

Figure 13: Proportion of the catches of sharks that are recorded per species in the FAO FishStat database *versus* those recorded in aggregated form (1950-2004) (The total catches of sharks recorded per year are also shown (broken line, left axis))

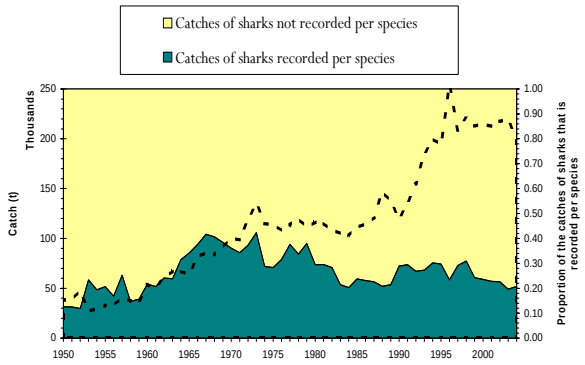
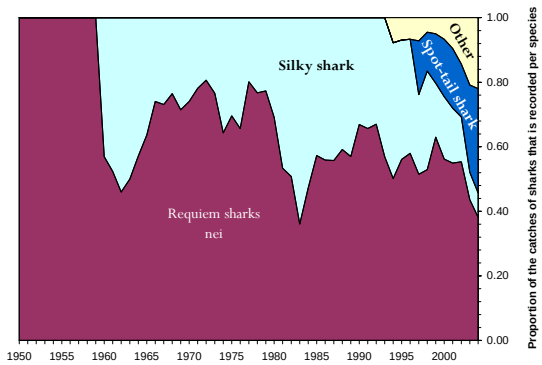


Figure 14: Proportion that the different species of sharks make out of the total catches of sharks that are recorded per species in the FAO FishStat database (1950-2004) (see Table 2 for details on the species referred to below)



Note that the catches of sharks recorded under a same genus (e.g. *Isurus spp.*) were accounted for as catches per species

Observer programmes: The IOTC Secretariat has been compiling information on species making up the by-catch of several fisheries. The majority of the data available come from observer programmes that have been implemented in recent years, most of them still ongoing. The amount of fishing effort covered through observers in relation with the total effort exerted by the different fisheries is generally very low. For this reason, the Secretariat did not attempt to raise the catches of sharks or other bycatch species collected from observers for the fisheries for which these data are available.

The amount of effort covered through observers in some areas and for some periods is, however, thought sufficient to make it possible to obtain the total amounts of fish, other than tunas, caught by industrial fleets in those areas at the time the data were collected. This is the case with the Observer Programme implemented by the UK on industrial longliners and purse seiners operating within the British Indian Ocean Territory. Data from this programme is available for 1996-2004.

Estimates of incidental catches of sharks by industrial purse seine fisheries in the Indian Ocean for the period 1985-94 from data collected by observers[2] on board these vessels is presented in Table 3. The total catches of tropical tunas recorded in the IOTC database for those fisheries are also shown. The catches of oceanic sharks estimated for that period made up less than 1% of

[2] Insert reference to E.Romanov paper

the catches of tropical tunas and sharks recorded for these fisheries. The catches of sharks by these fisheries since 1995 have not been estimated.

Table 3: Catches of pelagic sharks (in thousands of tons) estimated from data collected through observers on industrial purse seine vessels (1985-94)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Pelagic sharks	0.944	1.077	1.318	1.755	1.730	1.683	1.749	2.270	2.247	2.068
Tropical tunas	136.4	150.6	176.2	226.5	228.4	229.6	243.8	275.5	308.3	312.5

Catch-and-Effort (CE) data for sharks

Catch-and-effort records are seldom available for the fleets for which catches of sharks are recorded. When available, the catches of sharks are not recorded per species. As with the nominal catches, the catches recorded are thought incomplete, referring only to the amounts of sharks or shark products that are retained on board.

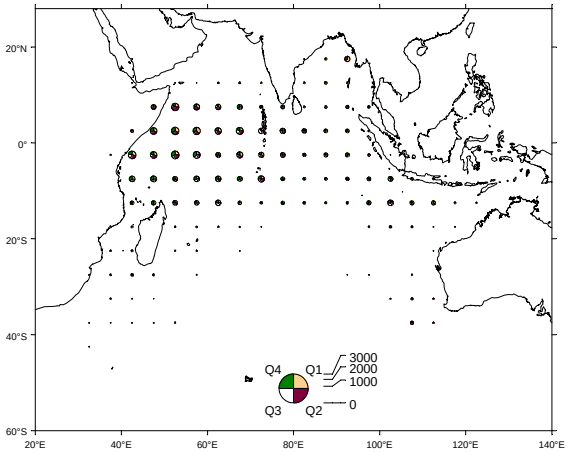
Long series of catches and effort are only available for longliners of South Korea (1979-93; 1998-2004) and Taiwan,China (1977-2004). The catches of sharks are recorded in aggregated form in both cases. Figures 15-24 show the catches of sharks (in kilograms) per unit of effort (expressed as 1,000 hooks) per quarter and five degrees square grid estimated for five different periods. The catch rates of sharks have been highest in the Mozambique Channel (between 15°S-30°S and 35°E-45°E) in recent years according to the available data (Taiwan,China). The decrease in the CPUE's recorded for South Korea since the early 90's are probably due to the poor quality of the CE data reported by South Korea in recent years, not to a real decrease in the catch rates.

Long catches and effort series for some species of sharks are also thought to exist for the commercial longline fishery of Japan. Detailed data on the catches of sharks and other fauna have been collected onboard the several Japanese training vessels that have operated, and still do, in the Indian Ocean. This information is not available with the Secretariat.

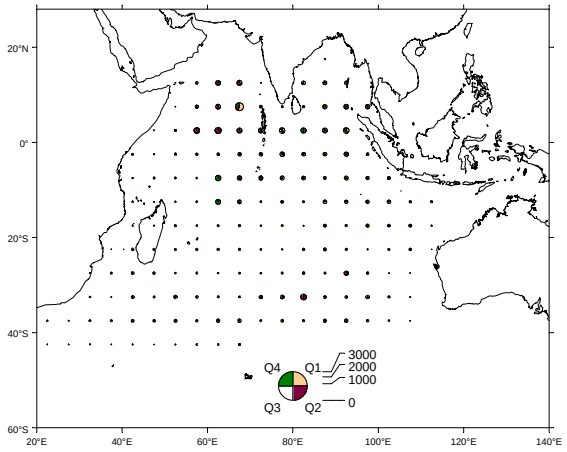
Although some catches and effort are available for the drifting gillnet fishery of Taiwan,China (1987-91) the data are thought poor quality and need further verification. The species targeted was the albacore and therefore it is likely that most of the effort was exerted in southern areas, where the catch rates of sharks are presumed high.

Figures 15-24: Catches of sharks (all species combined) per unit of effort (expressed as average kg of sharks caught per 1,000 hooks) per quarter and 5 degrees square grid for longliners of South Korea (left) and Taiwan,China (right) during five different periods of the fishery

1979-1986 KORLLCPUE ,mean, yearly total catch/CPUE

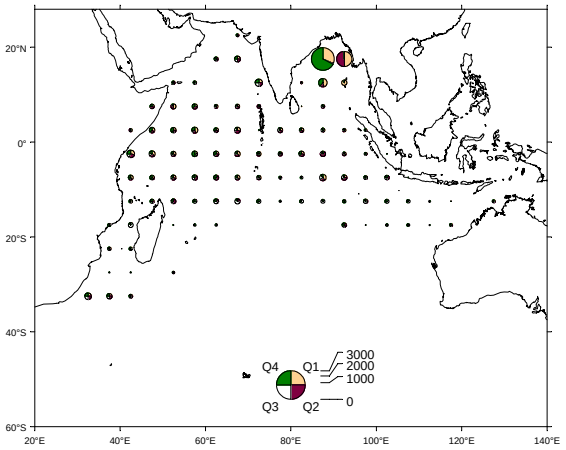


1979-1986 TWNLLCPUE ,mean, yearly total catch/CPUE

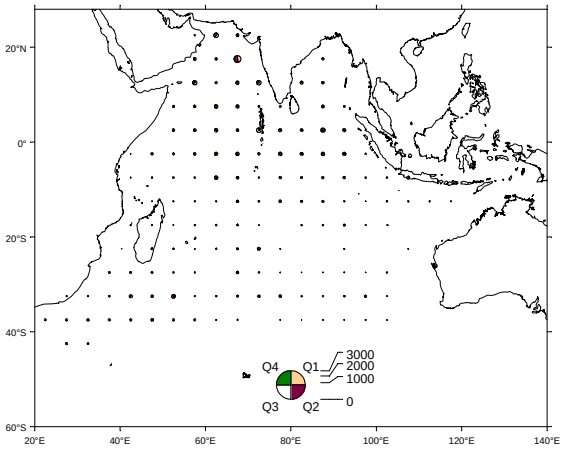


Figures 15-24: Catches of sharks (all species combined) per unit of effort (expressed as average kg of sharks caught per 1,000 hooks) per quarter and 5 degrees square grid for longliners of South Korea (left) and Taiwan,China (right) during five different periods of the fishery

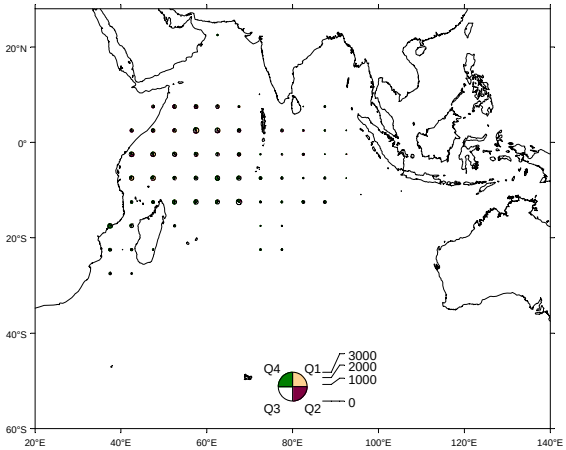
1987-1991 KORLLCPUE ,mean, yearly total catch/CPUE



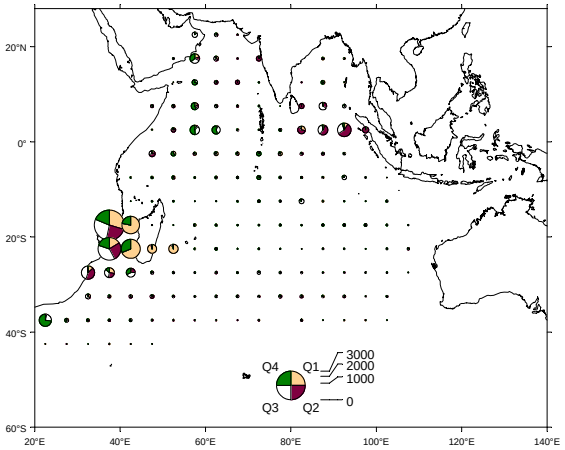
1987-1991 TWNLLCPUE ,mean, yearly total catch/CPUE



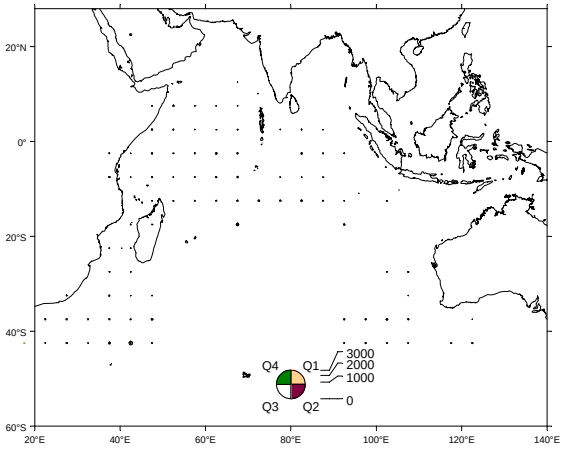
1992-1993 KORLLCPUE ,mean, yearly total catch/CPUE



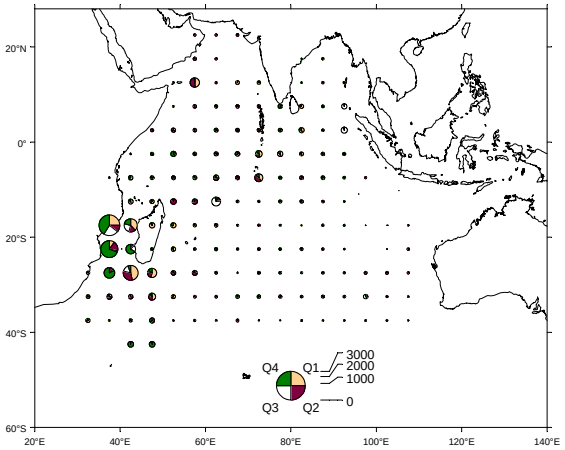
1992-1997 TWNLLCPUE ,mean, yearly total catch/CPUE



1998-2002 KORLLCPUE ,mean, yearly total catch/CPUE

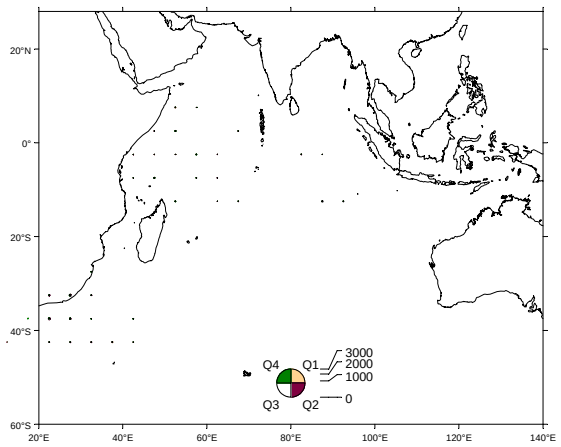


1998-2002 TWNLLCPUE ,mean, yearly total catch/CPUE

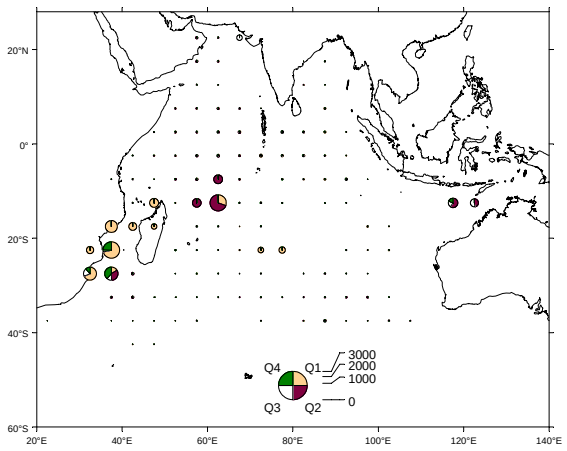


Figures 15-24: Catches of sharks (all species combined) per unit of effort (expressed as average kg of sharks caught per 1,000 hooks) per quarter and 5 degrees square grid for longliners of South Korea (left) and Taiwan,China (right) during five different periods of the fishery

2003-2004 KORLLCPUE ,mean, yearly total catch/CPUE



2003-2004 TWNLLCPUE ,mean, yearly total catch/CPUE

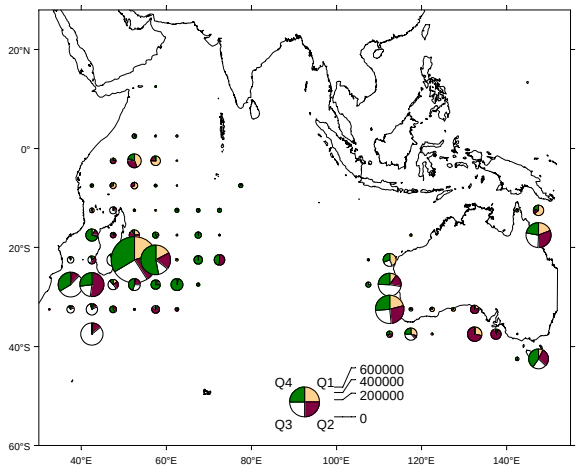


The amounts of sharks unloaded by fresh tuna longliners in different ports of the Indian Ocean are also known thanks to the catch monitoring schemes implemented in these ports (IOTC-OFCF and other local and foreign institutions). Catches and effort are available since 2000 for the fleets based in Phuket and since 2002 for those based in Indonesia. Data are also available from the Seychelles Fishing Authority on the activities and catches of fresh-tuna longliners from Taiwan,China and Indonesia at the time they were based in Victoria (Seychelles; 2001-03).

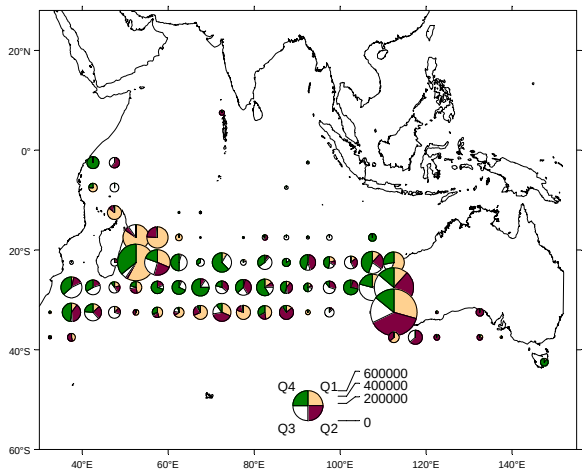
Catches and effort are available for other fleets having high catches of sharks recorded in the nominal catches database but, unfortunately, the catches of sharks have seldom been included in the reports. Figures 25-26 show the average number of hooks set by longliners targeting swordfish in the Indian Ocean per quarter and five degrees square grid during two different periods. The catches of sharks are likely to be higher in the Southwest Indian Ocean than in other areas.

Figures 25-26: Amount of effort (expressed as number of hooks set) exerted per quarter and five degrees square grid for several longline fleets targeting swordfish in the Indian Ocean (Australia, Seychelles, Reunion(France), Spain) during two different periods of the fishery

1992-2001 EFFORT



2002-2004 EFFORT



Catches and effort are also available for industrial tuna purse seiners but, as in the above case, no catches of sharks are available. The catches of sharks are thought to be higher off Somalia on purse seine sets to schools associated with fish aggregating devices. The average catches of tropical tunas (in tons) per fishing day on sets to schools associated with fish aggregating devices, per quarter, for two different periods, are shown in Figures 27 and 28.

Figures 27-28: Catches of tropical tunas associated with fish aggregating devices (all species combined) per unit of effort (expressed as catches in tons per number of fishing days) per quarter and 5 degrees square grid for several industrial purse seine fleets (Spain, France, Seychelles and related fleets) during two periods of the fishery	
To be inserted (Nishan)	*To be inserted (Nishan)*

The IOTC-OFCF Project has implemented recently a Programme in Kenya[3] being the main objective the collection of historical data on the activities and catches of sport vessels operating from different ports in this country. The data collected will probably allow to build CPUE series for all the species caught by this fishery, including sharks.

No data or very incomplete catch and effort data are available for other fisheries.

Size-Frequency (SF) data available for sharks

The amount of length or weight data available for sharks is very little:

- UK Observer Programme on foreign purse seiners and longliners operating within the British Indian Ocean Territory (1996-2004).
- IOTC-OFCF catch monitoring schemes implemented in Thailand (2000-2006; fresh-tuna longliners), Indonesia (2002-06; fresh-tuna longliners) and Sri Lanka (2005-06; gillnet/longline and hand line fisheries).
- Training longline vessels from Japan: Long series of data on the lengths of sharks caught by these vessels are thought to exist. This data are not available with the Secretariat.

Other information might be available in the early future from observer programmes implemented recently in the Indian Ocean:

- EC observer programme on domestic purse seiners and longliners
- Observer programmes implemented for the collection of data on the longline fisheries of China, South Korea and Taiwan,China
- Pilot observer programme implemented for the collection of data on the Indonesian fresh-tuna longline fleet (CSIRO-RIMF[4]).

Other biological information on sharks

The amount of biological data other than the above available for sharks is low.

- Factors to convert from processed to round weight: some conversion factors for sharks are available from the FAO[5] but these usually do not include shark fins.
- Regression equations to convert from length to length or length to weight: the IOTC Secretariat has been compiling information on these biological parameters for IOTC species, including sharks[6].

[3] In cooperation with the Fisheries Department of the Ministry of Livestock and Fisheries Development of the Government of the Republic of Kenya

[4] Joint cooperation between the Commonwealth Scientific Industrial Research Organization of Australia and the Research Institute for Marine Fisheries of Indonesia.

[5] FAO Fishery Information, Data and Statistics Unit. Conversion factors – landed weight to live weight. FAO Fisheries Circular No.847,Rev.1. Rome,FAO. 2000. 176p.

[6] Refer to the document WPTT-05-05, "Biological data on tuna and tuna-like species gathered at the IOTC Secretariat: Status Report", for details on the type and amount of information available.

- Little information is available on other biological parameters for sharks, as growth rate, sex ratio, fecundity and age(length) at first maturity.

Incidental catches of sea turtles, sea birds or other associated fauna

The only information available on the incidental catches of sea turtles, sea birds or other fauna by tuna and/or tuna-like fisheries in the Indian Ocean comes from **observer programmes**. The information available is still very preliminary due to the low number of observers that collected it.

Some information on the incidental catches of sea birds 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 early future.

Information required to carry out assessment of key stocks of sharks

It is highly unlikely that the information available at present on the catches, effort and other biological information regarding sharks be sufficient to carry out a reliable assessment on the status of key species of sharks. Trends in the total catches of sharks in the Indian Ocean and one or more indices of abundance for the main species are the minima requirements for scientists to be able to assess the status of one or more species of sharks in the Indian Ocean.

The problems to achieve this by using the data available at present and the information that might be required to improve the quality of it are indicated below:

- Unreliable trends of total catches: The catches of sharks in the IOTC database are thought incomplete due to:
    - No catches of sharks are available for some fisheries:
        - Species of sharks that occur mainly in coastal waters: The catches of coastal shark species are thought very incomplete. Most coastal sharks are caught by artisanal gears (gillnets, hand lines and troll lines) and, to a lesser extent, by industrial gears operated in coastal waters (trawl fisheries). The fisheries catching these species are not necessarily catching tuna and/or tuna-like species and, for this reason, the catches have seldom been reported to the IOTC. It is unlikely that, at this stage, the catches of these species might be completed.
        - Species of sharks that occur mainly on the high seas: The majority of the catches of pelagic shark species are thought to be taken by industrial fisheries catching also tuna and/or tuna-like species. Although the catches are incomplete at present the quality of the present catches estimated might be improved if some alternative data were made available:
            - Data from observer programmes, training vessels or other research programmes: All these data might be used to estimate the amounts of sharks that are likely to be caught on industrial fisheries but not recorded in the logbooks (e.g. amounts that are caught but not unloaded). The information obtained might be used to raise the catches currently recorded to more realistic values.
            - Data on the imports of shark fins from key markets: The historical data on the amounts of shark fins imported from Hong-Kong and Singapore, if available, might be used to estimate the amounts of sharks caught by some fisheries in order to complete or validate the estimates obtained by using other data.
            - Data on the catches of sharks for some fisheries: The catches of sharks available for fisheries for which they are thought complete might be used to estimate the catches of sharks for fisheries for which these data are not available.

- The catches of sharks are seldom available per species: The total catches of sharks estimated for each fishery might be broken per species by using the same information above (observer programmes, research programmes, information collected on training vessels, imports of shark fins).

- Incomplete indices of abundance: Although catches per unit of effort for sharks might be estimated for some fisheries, the catches recorded are thought incomplete and CPUE per species are seldom available. Detailed CPUE series are, however, thought to exist for some fisheries the problem being that these data have never been reported to the IOTC. The most reliable indices refer probably to longline fisheries.

Appendix I
Catches of sharks recorded in the IOTC database per gear and year
Artisanal Fisheries (1950-2005)

GEAR	Data	Ave 01/05	Year																											
			1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
GILLNET	no. Fleets TUX	20	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	7	7	7	7	8	8	8	8
	no. Fleets SKH	4																							1	1	1	1	1	
	AvC(kg)TUX	30,963																							2,557	2,385	2,230	970	548	
	AvC(kg)SKH	16,741																							1,264	1,206	1,103	466	186	
	% SKH	54																							33	34	33	32	25	
HAND LINE / COASTAL LL	no. Fleets TUX	18	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2
	no. Fleets SKH	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	AvC(kg)TUX	30	714	1,061	839	618	556	495	601	708	791	874	1,048	1,221	1,893	2,564	2,403	2,243	2,801	3,360	3,619	3,879	2,997	2,116	2,768	3,370	2,961	2,564	4,392	4,222
	AvC(kg)SKH	84	342	559	414	270	245	220	281	341	371	401	507	614	928	1,242	1,190	1,139	1,288	1,436	1,609	1,781	1,393	1,006	1,368	1,704	1,465	1,232	1,490	1,019
	% SKH	284	32	35	33	30	31	31	32	33	32	31	33	33	33	33	33	34	31	30	31	31	32	32	33	34	33	32	25	19
TROLL LINE	no. Fleets TUX	10	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	5
	no. Fleets SKH	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	AvC(kg)TUX	53	35	52	41	30	27	24	29	35	39	43	51	60	93	126	118	110	137	165	177	190	147	104	136	220	242	254	512	
	AvC(kg)SKH	29	17	27	20	13	12	11	14	17	18	20	25	30	45	61	58	56	63	70	79	87	68	49	67	111	120	122	174	
	% SKH	54	32	35	33	30	31	31	32	33	32	31	33	33	33	33	33	34	31	30	31	31	32	32	33	34	33	32	25	
TRAWL	no. Fleets TUX	3																												
	no. Fleets SKH	2																												
	AvC(kg)TUX	680																												
	AvC(kg)SKH	479																												
	% SKH	71																												
TRAP	no. Fleets TUX	1																												
	no. Fleets SKH	1																												
	AvC(kg)TUX	0																												
	AvC(kg)SKH	4																												
	% SKH	100																												
UNCLASSIFIED	no. Fleets TUX	12	5	6	6	6	5	5	5	5	5	6	6	6	6	6	6	7	7	7	6	6	9	9	9	9	9	10	10	11
	no. Fleets SKH	5																					1	2	2	2	2	3	3	3
	AvC(kg)TUX	1,341																					2,600	2,444	3,762	3,983	4,973	2,620	4,008	5,018
	AvC(kg)SKH	705																					6,600	4,700	5,300	1,850	2,358	1,345	1,917	2,441
	% SKH	53																					72	66	59	47	36	56	53	51

GEAR	Data	Ave 01/05	Year																											
			1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
GILLNET	no. Fleets TUX	20	7	8	10	11	13	14	14	14	14	14	14	14	17	17	17	17	17	17	19	19	19	20	20	20	20	20	20	20
	no. Fleets SKH	4	1	1	1	1		1		2	1	1	1	1	1	2	3	3	3	3	3	4	4	4	5	4	4	4	4	4
	AvC(kg)TUX	30,963	2,949	2,099	2,148	2,178		689		1,284	2,171	2,720	2,826	5,207	7,449	7,773	15,785	17,810	23,220	19,470	24,390	30,115	28,064	33,674	25,171	27,441	27,671	30,153	34,775	34,775
	AvC(kg)SKH	16,741	835	616	520	571		195		308	1,019	1,277	1,327	2,445	3,497	2,589	8,421	8,311	10,188	10,365	9,192	10,964	9,805	17,437	12,901	14,638	15,316	13,884	19,933	19,933
	% SKH	54	22	23	19	21		22		25	32	32	32	32	32	21	27	29	28	31	25	24	23	28	29	29	30	28	40	40
HAND LINE / COASTAL LL	no. Fleets TUX	18	2	3	5	6	6	6	7	9	8	8	8	10	10	10	10	11	12	12	13	16	16	16	17	17	18	18	18	18
	no. Fleets SKH	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
	AvC(kg)TUX	30	4,181	4,052	5,109	5,410	5,417	4,950	3,830	3,863	1,951	1,983	2,027	4,023	2,258	2,380	2,469	2,367	2,151	45	13	36	100	44	28	40	11	85	6	6
	AvC(kg)SKH	84	1,183	1,189	1,238	1,418	945	1,380	848	855	433	441	451	890	493	495	470	428	400	129	10	114	78	82	83	53	56	71	120	120
	% SKH	284	22	23	19	21	15	22	18	18	49	39	28	18	26	34	39	33	50	74	43	57	39	77	82	72	87	67	95	95
TROLL LINE	no. Fleets TUX	10	5	4	5	6	6	6	7	8	9	9	11	12	11	11	11	9	9	9	9	9	9	9	10	10	10	10	10	10
	no. Fleets SKH	1	1	1		1		1																1	1	1	1	1	1	1
	AvC(kg)TUX	53	642	701		1,157		1,165																2	45	28	40	30	108	62
	AvC(kg)SKH	29	182	206		303		356																1	12	33	23	37	32	19
	% SKH	54	22	23		21		23																33	21	55	36	56	23	23
TRAWL	no. Fleets TUX	3	1	2																	1	1	1	3	4	4	3	3	3	2
	no. Fleets SKH	2																						1	2	2	2	2	2	2
	AvC(kg)TUX	680																						2,311	1,441	962	874	833	846	846
	AvC(kg)SKH	479																						597	617	485	561	448	470	433
	% SKH	71																						21	32	34	38	36	44	43
TRAP	no. Fleets TUX	1																				1	2	1	1	1	1	1	1	1
	no. Fleets SKH	1																				1	1	1	1	1	1	1	1	1
	AvC(kg)TUX	0																				0	0	0	0	0	0	0	0	0
	AvC(kg)SKH	4																					3	3	3	3	3	3	7	7
	% SKH	100																					100	100	100	100	100	100	100	100
UNCLASSIFIED	no. Fleets TUX	12	11	11	11	12	12	13	12	12	12	11	13	12	12	11	14	12	12	11	12	11	14	13	11	11	12	12	12	12
	no. Fleets SKH	5	4	4	4	3	2	2	3	3	4	5	5	6	4	5	4	4	4	5	4	3	4	6	5	5	5	5	5	5
	AvC(kg)TUX	1,341	2,528	2,250	2,883	944	2,313	1,391	664	984	6,512	4,844	2,832	2,403	1,503	957	1,204	937	1,187	1,219	1,250	1,591	1,187	1,068	1,050	1,315	1,383	1,687	1,159	1,160
	AvC(kg)SKH	705	2,559	2,333	2,539	681	444	1,019	619	647	960	697	721	1,754	2,164	1,902	2,839	2,799	2,533	690	891	1,128	854	621	631	697	505	574	876	876
	% SKH	53	67	57	55	35	26	49	60	41	26	37	37	49	56	53	56	54	55	44	40	39	47	44	43	44	42	42	60	49

Note that only the catches of fleets for which catches of sharks are recorded in the IOTC database have been accounted for. The row %SKH records the proportion that the catches of sharks make up of the catches of tuna and/or tuna-like species for fleets having catches of sharks recorded (the proportion is higher than 100 when the catches of sharks are higher than those of TUX)

Appendix II

Catches of sharks recorded in the IOTC database per fleet, gear and year

Industrial Fisheries (average 1950-2005)

PURSE SEINE				
FLEETS	No. Years SKH reported	Av. Catch SKH	Av. Catch TUX	% catch per species (SKH)
Australia	0			
France	0			
France-Territories	0			
Iran, Islamic Republic	0			
Japan	0			
Mauritius	0			
NEI-Ex-Soviet Union	0			
NEI-Other	0			
Seychelles	0			
Soviet Union	0			
Spain	0			
Thailand	0			

LONGLINE (LL Targeting SWO; Distance LL)				
FLEETS	No. Years SKH reported	Ave Catch SKH	Ave Catch TUX	% catch per species (SKH)
Australia	11	42	1,430	91
France-Reunion	13	47	1,820	100
France-Territories	5	11	229	100
Guinea	5	672	480	0
Kenya	1	342	465	100
Mauritius	4	10	110	100
Portugal	2	1,405	938	0
Senegal	3	118	165	100
Seychelles	7	31	253	100
Spain	13	2,147	2,157	33

LONGLINE (Fresh Tuna Longline)				
FLEETS	No. Years SKH reported	Ave Catch SKH	Ave Catch TUX	% catch per species (SKH)
Indonesia	33	838	22,723	38
Malaysia	4	11	1,341	0
Oman	2	0	176	100
Taiwan,China	10	67	8,233	26

LONGLINE (Longline Targeting Shark)				
FLEETS	No. Years SKH reported	Ave Catch SKH	Ave Catch TUX	% catch per species (SKH)
Portugal	1	94	104	100
South Africa	8	211	8	1

LONGLINE (Longline Targeting Tunas)				
FLEETS	No. Years SKH reported	Ave Catch SKH	Ave Catch TUX	% catch per species (SKH)
China	3	95	4,030	0
Taiwan,China	29	1,679	63,030	0
Spain	1	662	739	100
India	10	68	130	0
Iran, Islamic Republic	2	1	291	0
Korea, Republic of	31	324	22,457	0
Mauritius	4	181	535	0
Philippines	8	27	2,890	100
Portugal	8	666	385	100
Seychelles	7	95	6,008	0
South Africa	8	29	662	93

DRIFTING GILLNETS				
FLEETS	No. Years SKH reported	Ave Catch SKH	Ave Catch TUX	% catch per species (SKH)
China				
Taiwan,China	5	3,184	16,997	0

GILLNET AND LONGLINE COMBINATION				
FLEETS	No. Years SKH reported	Ave Catch SKH	Ave Catch TUX	% catch per species (SKH)
Sri Lanka	20	16,123	35,010	96

Note that only the catches of fleets for which catches of sharks are recorded in the IOTC database have been accounted for. The Column 'Ave Catch TUX' refers to the average catches of tuna and tuna-like species that are recorded for fleets having also catches of sharks