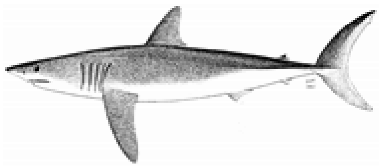
DRAFT: EXECUTIVE SUMMARY: SHORTFIN MAKO SHARK

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



Status of the Indian Ocean shortfin mako shark (SMA: *Isurus oxyrinchus*)

TABLE 1. Shortfin mako shark: Status of shortfin mako shark (*Isurus oxyrinchus*) in the Indian Ocean

Area[1]	**Indicators**		**2014 stock status determination**
Indian Ocean	Reported catch 2013: Not elsewhere included (nei) sharks[2]: Average reported catch 2009–2013: Not elsewhere included (nei) sharks[2]:	1,572 t 46,728 t 1,364 t 49,318 t	**Uncertain**
	MSY (1000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1000 t) (80% CI): F_{2013}/F_{MSY} (80% CI): SB_{2013}/SB_{MSY} (80% CI): SB_{2013}/SB_0 (80% CI):	unknown	

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species.

Colour key	Stock overfished($SB_{year}/SB_{MSY} < 1$)	Stock not overfished ($SB_{year}/SB_{MSY} \geq 1$)
Stock subject to overfishing($F_{year}/F_{MSY} > 1$)		
Stock not subject to overfishing ($F_{year}/F_{MSY} \leq 1$)		
Not assessed/Uncertain		

TABLE 2. Shortfin mako shark: IUCN threat status of shortfin mako shark (*Isurus oxyrinchus*) in the Indian Ocean

Common name	**Scientific name**	**IUCN threat status**[1]		
		Global status	**WIO**	**EIO**
Shortfin mako shark	*Isurus oxyrinchus*	Vulnerable	–	–

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean
SOURCES: IUCN 2007, Cailliet 2009

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty about the relationship between abundance, the standardised CPUE series, and total catches over the past decade (Table 1). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2012 (IOTC–2012–SC15–INF10 Rev_1) consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type. Shortfin mako sharks received the highest vulnerability ranking (No. 1) in the ERA rank for longline gear because it was characterised as one of the least productive shark species, and with a high susceptibility to longline gear. Shortfin mako shark was estimated as the third most vulnerable shark species in the ERA ranking for purse seine gear, but with lower levels of vulnerability compared to longline gear, because the susceptibility was lower for purse seine gear. The current IUCN threat status of 'Vulnerable' applies to shortfin mako sharks globally (Table 2). Trends in the Japanese standardised CPUE series from its longline fleet suggest that the biomass has declined from 1994 to 2003, and has been increasing since then. Trends in EU,Portugal longline standardised CPUE series suggest that the biomass has declined from 1999 to 2004, and has been increasing since then. There is a paucity of information available on this species, but this situation has been improving in recent years. Shortfin mako sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (over 30 years), females mature at 18–21 years, and have relativity few offspring (<25 pups every two or three years), the shortfin mako shark can be vulnerable

[1] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

to overfishing. There is no quantitative stock assessment currently available for shortfin mako shark in the Indian Ocean therefore the stock status is **uncertain**.

Outlook. Maintaining or increasing effort can result in declines in biomass, productivity and CPUE. The impact of piracy in the western Indian Ocean has resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into certain areas in the southern and eastern Indian Ocean. It is therefore unlikely that catch and effort on shortfin mako shark will decline in these areas in the near future, and may result in localised depletion. The following should be noted:

- The two primary sources of data that drive the assessment, total catches and CPUE are uncertain and should be investigated further as a priority.
- Noting that current reported catches are estimated (probably largely underestimated) at an average ~1,364 t over the last five years, ~1,572 t in 2013, maintaining or increasing effort can result in declines in biomass, productivity and CPUE.
- Mechanisms need to be developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.

SUPPORTING INFORMATION

(Information collated from reports of the Working Party on Ecosystems and Bycatch and other sources as cited)

CONSERVATION AND MANAGEMENT MEASURES

Shortfin mako shark in the Indian Ocean are currently subject to a number of Conservation and Management Measures adopted by the Commission:

- Resolution 13/03 *on the recording of catch and effort by fishing vessels in the IOTC area of competence* sets out the minimum logbook requirements for purse seine, longline, gillnet, pole and line, handline and trolling fishing vessels over 24 metres length overall and those under 24 metres if they fish outside the EEZs of their flag States within the IOTC area of competence. As per this Resolution, catch of all sharks must be recorded (retained and discarded).
- Resolution 13/06 *on a scientific and management framework on the conservation of shark species caught in association with IOTC managed fisheries* prohibits, as an interim pilot measure, the retention onboard, transhipment, landing or storing any part or whole carcass of oceanic whitetip sharks (*Carcharhinus longimanus*) (and requests for all other species) by all vessels on the IOTC record of authorised vessels or authorised to fish for tuna or tuna-like species, with the exception of observers who are permitted to collect biological samples (vertebrae, tissues, reproductive tracts, stomachs) from oceanic whitetip sharks that are dead at haulback and artisanal fisheries for the purpose of local consumption, and will conduct a review and an evaluation of the interim measure in 2016.
- Resolution 11/04 *on a Regional Observer Scheme* requires data on shark interactions to be recorded by observers and reported to the IOTC within 150 days. The Regional Observer Scheme (ROS) started on 1st July 2010.
- Resolution 05/05 *Concerning the conservation of sharks caught in association with fisheries managed by IOTC* includes minimum reporting requirements for sharks, calls for full utilisation of sharks and includes a ratio of fin-to-body weight for shark fins retained onboard a vessel.
- Resolution 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating Non-Contracting Parties (CPC's)* indicated that the provisions, applicable to tuna and tuna-like species, are applicable to shark species.

Extracts from Resolutions 13/03, 13/06, 11/04 and 05/05

RESOLUTION 13/03 ON THE RECORDING OF CATCH AND EFFORT BY FISHING VESSELS IN THE IOTC AREA OF COMPETENCE

Para. 1. Each flag CPC shall ensure that all purse seine, longline, gillnet, pole and line, handline and trolling fishing vessels flying its flag and authorized to fish species managed by IOTC be subject to a data recording system.

Para. 8 (start). The flag State and the States which receive this information shall provide all the data for any given year to the IOTC Secretariat by June 30th of the following year on an aggregated basis.

RESOLUTION 13/06 ON A SCIENTIFIC AND MANAGEMENT FRAMEWORK ON THE CONSERVATION OF SHARK SPECIES CAUGHT IN ASSOCIATION WITH IOTC MANAGED FISHERIES

Para. 8. CPCs, especially those targeting sharks, shall submit data for sharks, as required by IOTC data reporting procedures.

RESOLUTION 11/04 ON A REGIONAL OBSERVER SCHEME

Para. 10. Observers shall:

b) Observe and estimate catches as far as possible with a view to identifying catch composition and monitoring discards, by-catches and size frequency

Resolution 10/02 MANDATORY STATISTICAL REQUIREMENTS FOR IOTC MEMBERS AND COOPERATING NON-CONTRACTING PARTIES (CPC'S)

Para. 3. The provisions, 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.

RESOLUTION 05/05 CONCERNING THE CONSERVATION OF SHARKS CAUGHT IN ASSOCIATION WITH FISHERIES MANAGED BY IOTC

Para. 1. CPCs shall annually report data for catches of sharks, in accordance with IOTC data reporting procedures, including available historical data.

Para. 3. CPCs shall take the necessary measures to require that their fishermen fully utilise their entire catches of sharks. Full utilisation is defined as retention by the fishing vessel of all parts of the shark excepting head, guts and skins, to the point of first landing.

FISHERIES INDICATORS

Shortfin mako shark: General

Shortfin mako shark (*Isurus oxyrinchus*) is widely distributed in tropical and temperate waters warmer than 16°C (Fig. 1) and is one of the fastest swimming shark species. It is known to leap out of the water when hooked and is often found in the same waters as swordfish. This species is at the top of the food chain, feeding on fast-moving fishes such as swordfish and tunas and occasionally on other sharks. Table 3 outlines some of the key life history traits of shortfin mako shark in the Indian Ocean.

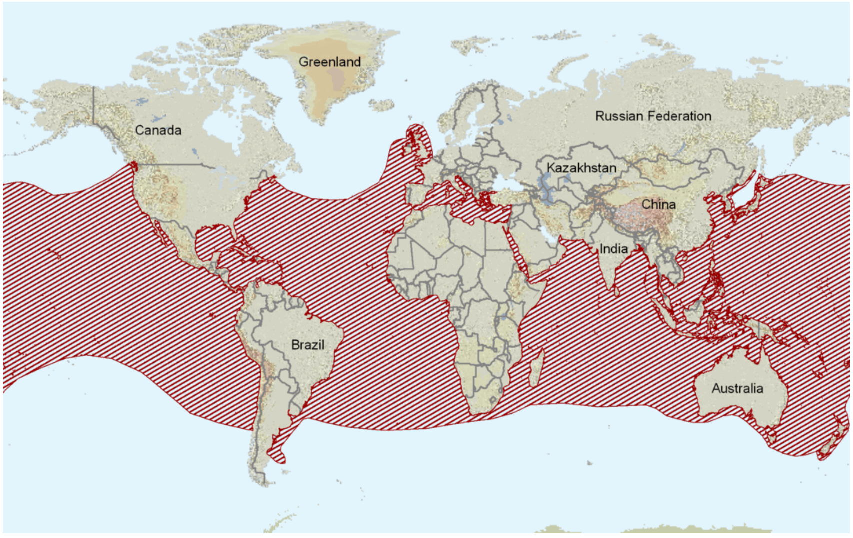


Fig. 1. Shortfin mako shark: The worldwide distribution of the shortfin mako shark (source: www.iucnredlist.org)

TABLE 3. Shortfin mako shark: Biology of Indian Ocean shortfin mako shark (*Isurus oxyrinchus*)

Parameter	Description
Range and stock structure	Widely distributed in tropical and temperate waters warmer than 16°C. Makos prefer epipelagic and littoral waters from the surface down to depths of 500 meters. Shortfin mako is not known to school. It has a tendency to follow warm water masses polewards in the summer. Tagging results from the North Atlantic Ocean showed that makos migrated over long distances and this suggests that there is a single well-mixed population in this area. Area of overlap with IOTC management area = high. No information is available on stock structure of shortfin mako sharks in the Indian Ocean.
Longevity	Maximum lifespans reported for this species are 32 years for females and 29 years for males in the western North Atlantic.
Maturity (50%)	In the western South Indian Ocean, individuals were estimated to mature at about 250 cm FL or 15 years for females and 190 cm FL or 7 years for males. In other oceans sexual maturity is estimated to be reached at 18-19 years or 290-300 cm TL for females and 8 years or about 200 cm TL for males in the western North Atlantic and 19-21 years or 207-290 cm TL for females and 7-9 years or 180-190 cm TL for males in the western South Pacific. The length at maturity of female shortfin mako sharks differs between the Northern and Southern hemispheres.
Reproduction	Female shortfin mako sharks are aplacental viviparous. Developing embryos feed on unfertilized eggs in the uterus during the gestation period, whose length is subject to debate but is believed to last 15-18 months. Litter size ranges from 9 to 14 pups, with larger sharks producing more offspring. The nursery areas are apparently in deep tropical waters. The length of the reproductive cycle is up to three years. • Fecundity: medium (<25 pups) • Generation time: 23 years • Gestation Period: 15–18 months • Reproductive cycle is biennial or triennial
Size (length and weight)	Maximum size of shortfin mako sharks in Northwest Atlantic Ocean is 4 m and 570 kg. In South African waters females reached 311.3 cm FL (not aged) compared with 299 cm for males (17 years). In the tropical Indian Ocean a female individual of 248 cm FL and 130 kg TW was aged as 18 years old. Length–weight relationship for both sexes combined in the Indian Ocean is $TW=0.349*10-4 * FL^{2.76544}$. In South Africa von Bertalanffy growth model parameters were estimated as L_0=90.4 cm, L_∞=285.4 cm, and $k=0.113y^{-1}$. New-born pups are around 70 cm (TL).

Sources: Bass et al. 1973, Mollet et al. 2000, Mejuto et al. 2005, White 2007, Romanov & Romanova 2009, Groeneveld et al. 2014

Shortfin mako shark: Fisheries

Shortfin mako sharks are often targeted by some semi-industrial, artisanal and recreational fisheries and are a bycatch of industrial fisheries (pelagic longline tuna and swordfish fisheries and anecdotally by the purse seine fishery) (Table 4). In other Oceans, due to its energetic displays and edibility, the shortfin mako shark is considered one of the great gamefish of the world. There is little information on the fisheries prior to the early 1970s, and some countries continue not to collect shark data while others do collect it but do not report it to IOTC. It appears that significant catches of sharks have gone unrecorded in several countries. Furthermore, many catch records probably under-represent the actual catches of sharks because they do not account for discards (i.e. do not record catches of sharks for which only the fins are kept or of sharks usually discarded because of their size or condition) or they reflect dressed weights instead of live weights. FAO also compiles landings data on elasmobranchs, but the statistics are limited by the lack of species-specific data and data from the major fleets.

The practice of shark finning is considered to be regularly occurring for this species (Clarke et al. 2006, Clarke 2008) and the bycatch/release injury rate is unknown but probably high.

Preliminary estimations of at-vessel haulback mortality showed that 56% of the shortfin mako shark specimens captured in longline fisheries targeting swordfish in the Indian Ocean are dead at the time of haulback (Table 4). The effects of size on the mortality rates have not been studied in the Indian Ocean, but were significant in the Atlantic Ocean with larger specimens having higher changes of surviving after capture (at-haulback) (Coelho et al. 2012).

TABLE 4. Shortfin mako shark: Estimated frequency of occurrence and bycatch mortality in the Indian Ocean pelagic fisheries

Gears	PS	LL		BB/TROL/HAND	GILL	UNCL
		SWO	TUNA			
Frequency	rare	common		rare–common	unknown	unknown
At-vessel mortality	unknown	13 to 56 %	0 to 31%	unknown	unknown	unknown
Post release mortality	unknown	19%		unknown	unknown	unknown

Sources: Romanov 2002, 2008, Ariz et al. 2006, Dudley & Simpfendorfer 2006, Peterson et al. 2008, Romanov et al. 2008

Shortfin mako shark: Catch trends

The catch estimates for shortfin mako shark (Table 5) are highly uncertain as is their utility in terms of minimum catch estimates. Five CPCs have reported detailed data on sharks (i.e. Australia, EU (Spain, Portugal and United Kingdom), I.R. Iran, South Africa, and Sri Lanka while thirteen CPCs have reported partial data or data aggregated for all species (i.e. Belize, China, Indonesia, Japan, Rep. of Korea, Malaysia, Mozambique, Oman, Seychelles, Mauritius, Philippines, UK-territories, Vanuatu). For CPCs reporting longline data by species (i.e. Australia, Spain, Portugal, United Kingdom and South Africa), 11.4% of the catch of sharks by longliners, all targeting swordfish, were shortfin mako sharks.

TABLE 5. Shortfin mako shark: Catch estimates for shortfin mako shark in the Indian Ocean for 2011 to 2013.

Catch		**2011**	**2012**	**2013**
Most recent catch (report)	Shortfin mako shark	1,489 t	1,426 t	1,572 t
	nei-sharks	53,658 t	42,793 t	46,728 t
Mean catch (reported) over the last 5 years (2009–2013)	Shortfin mako shark		1,300 t	1,364 t
	nei-sharks		48,708 t	49,318 t

Note that the catches recorded for sharks are thought incomplete. The catches of sharks are usually not reported and when they are they might not represent the total catches of this species but simply those retained on board. It is also likely that the amounts recorded refer to weights of processed specimens, not to live weights. In 2013, ten countries reported catches of shortfin mako sharks in the IOTC region.

Shortfin mako shark: Nominal and standardised CPUE Trends

Statistics not available at the IOTC Secretariat.

Historical data shows an overall decline in nominal CPUE and mean weight of mako sharks (Romanov et al. 2008). Nominal CPUE in South African protection net has been fluctuating without any trend (Holmes et al. 2009). The standardised CPUE series of shortfin mako catches by the Portuguese longline fleet in the Indian Ocean showed some significant variability between 1999–2012, with a declining trend from 1999 to 2004 and an increasing trend in more recent years until 2012 (Fig. 2; Coelho et al. 2013).

The Japanese standardised CPUE series (Fig. 2) suggest that the biomass declined from 1994 to 2003, and increased until 2010 with substantial fluctuations. (Kimoto et al. 2011).

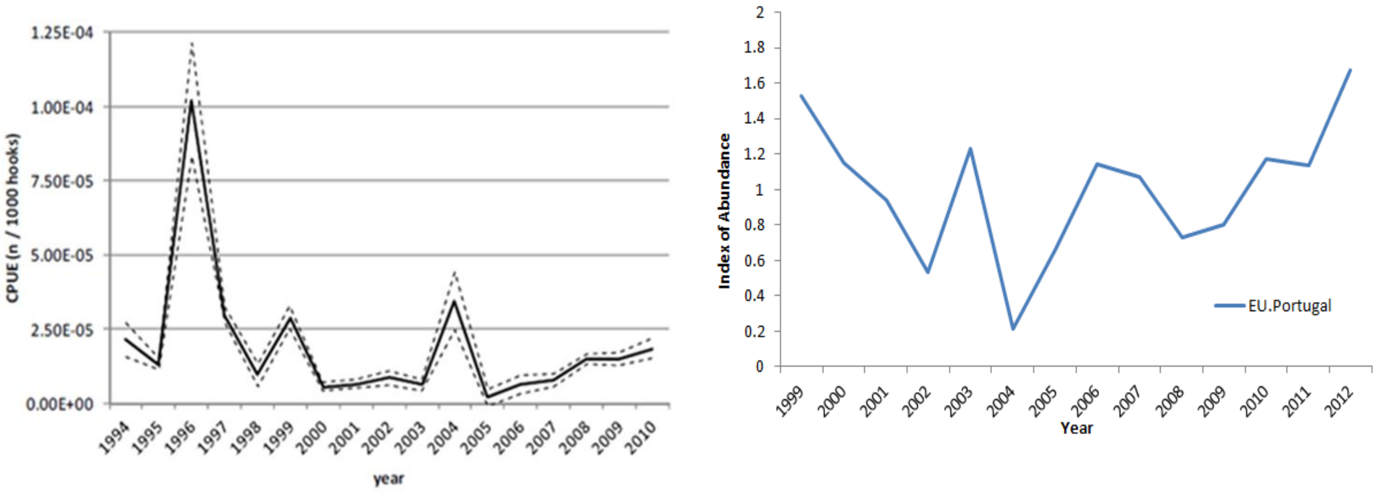


Fig. 2. Shortfin mako shark: Standardised longline CPUE series for shortfin mako shark in the Indian Ocean for the Japanese fleet (1994–2010) (left) and the EU,Portugal fleets (1999–2012) (right).

Shortfin mako shark: Average weight in the catch by fisheries

Data not available.

Shortfin mako shark: Number of squares fished

Catch and effort data not available.

Stock Assessment

No quantitative stock assessment for shortfin mako has been undertaken by the IOTC Working Party on Ecosystems and Bycatch.

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