

SILKY SHARK

SUPPORTING INFORMATION

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

CONSERVATION AND MANAGEMENT MEASURES

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

- Resolution 15/01 *on the recording of catch and effort data 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 sharks silky sharks must be recorded by longline and purse seine fleets (retained and discarded).
- Resolution 15/02 *Mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs)* indicated that the provisions, applicable to tuna and tuna-like species, are applicable to shark species.
- 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.

Extracts from Resolutions 15/01, 15/02, 11/04 and 05/05

RESOLUTION 15/01 ON THE RECORDING OF CATCH AND EFFORT DATA 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. 10 (start). The Flag State 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 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 15/02 MANDATORY STATISTICAL REPORTING REQUIREMENTS FOR IOTC CONTRACTING PARTIES AND COOPERATING NON-CONTRACTING PARTIES (CPCS)

Para. 2. Estimates of the total catch by species and gear, if possible quarterly, that shall be submitted annually as referred in paragraph 7 (separated, whenever possible, by retained catches in live weight and by discards in live weight or numbers) for all species under the IOTC mandate as well as the most commonly caught elasmobranch species according to records of catches and incidents as established in Resolution 15/01 *on the recording of catch and effort data by fishing vessels in the IOTC area of competence* (or any subsequent superseding Resolution).

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

Silky sharks: General

Silky sharks (*Carcharhinus falciformis*) are one of the most abundant large sharks inhabiting warm tropical and subtropical waters throughout the world (**Fig. 1**). TABLE 1 outlines some of the key life history traits of silky shark in the Indian Ocean.

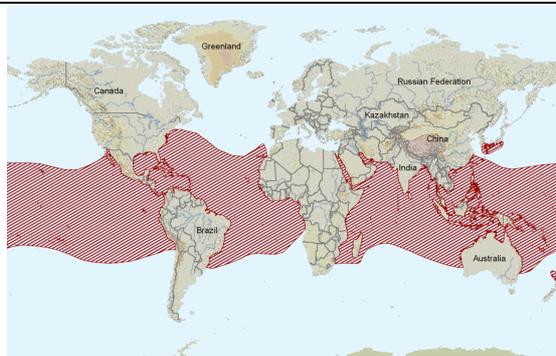


Fig. 1. The worldwide distribution of the silky shark (source: www.iucnredlist.org).

TABLE 1. Silky shark: Biology of Indian Ocean silky sharks (*Carcharhinus falciformis*).

Parameter	Description
Range and stock structure	Essentially pelagic, the silky shark is distributed from slopes to the open ocean. It also ranges to inshore areas and near the edges of continental shelves and over deepwater reefs. It also demonstrates strong fidelity to seamounts and natural or man-made objects (like FADs) floating at the sea surface. Silky sharks live down to 500 m. Typically, smaller individuals are found in coastal waters. Small silky sharks are also commonly associated with schools of tuna, particularly under floating objects. Large silky sharks associate with free-swimming tuna schools. Silky sharks often form mixed-sex schools containing similar sized individuals. Area of overlap with IOTC management area = high. No information is available on stock structure.
Longevity	20+ years for males; 22+ years for females in the southern Gulf of Mexico and maximum size can reach 350 cm long. In the Pacific area it was estimated to be around 25 years. Generation time was estimated to be between 11 and 16 years in the Gulf of Mexico years.
Maturity (50%)	The age of sexual maturity is variable. In the Indian Ocean it has been estimated to be around 15 years for females and 13 years for males. In the Atlantic Ocean, off Mexico, silky sharks mature at 10–12+ years. By contrast in the Pacific Ocean, males mature at around 5–6 years and females mature at around 6–7 years. Size: 215 cm TL for females; 207 cm TL for males in the Eastern Indian Ocean. 239 cm TL for males; 216 cm TL for females in Aldabra atoll. In South Africa: 240cm TL for males and 248–260cm TL for females.
Reproduction	The silky shark is a placental viviparous species with a gestation period of around 12 months. Females give birth possibly every two years. The number of pups per litter ranges from 9–14 in the Eastern Indian Ocean, and 2–11 in the Pacific Ocean. <ul style="list-style-type: none"> • Fecundity: medium (<20 pups) • Generation time: 11–16 years • Gestation period: 12 months • Reproductive cycle is biennial
Size (length and weight)	Maximum size is around 350 cm long FL. New-born pups are around 75–80 cm TL or less at birth. Reported as 56–63 cm TL in the Maldives. 78–87 cm TL in South Africa. Length–weight relationship for both sexes combined in the Indian Ocean is $TW=0.160*10^{-4} * FL^{2.91497}$.

Sources: Strasburg 1958, Bass et al. 1973, Stevens 1984, Anderson & Ahmed 1993, Compagno & Niem 1998, Smith et al. 1998, Mejuto et al. 2005, Matsunaga 2007, Romanov & Romanova 2009, Hall et al. 2012

Silky sharks: Fisheries

Silky 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 purse seine fishery) (TABLE 2). Sri Lanka has had a large fishery for silky shark for over 40 years.

There is little information on the fisheries prior to the early 1970s, and some countries do not collect shark data while others 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 and on the increase for this species (Clarke et al. 2006, Clarke 2008) and the bycatch/release injury rate is unknown but probably high.

TABLE 2. Silky 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	common	abundant		common	abundant	abundant
Fishing Mortality	study in progress	study in progress	study in progress	unknown	unknown	unknown
Post release mortality	81% (85% brailed individuals, 18% meshed individuals).	unknown	unknown	unknown	unknown	unknown

Sources: Romanov 2002, 2008, Ariz et al. 2006, Peterson et al. 2008, Romanov et al. 2008, Poisson 2014

Silky sharks: Catch trends

The nominal catches for silky shark reported to the IOTC Secretariat are highly uncertain as is their utility in terms of minimum catch estimates (**TABLE 3**). For CPCs reporting longline data by species, between 0 and 2% of the catch of sharks were silky sharks. For CPCs reporting gillnet data by species, I.R. Iran and Sri Lanka, 23% and 11% of the catches of shark were silky sharks respectively.

TABLE 3. Silky shark: Catch estimates for silky shark in the Indian Ocean for 2013 to 2015.

Catch		2013	2014	2015
Most recent catch (reported)	Silky shark	3,627 t	2,896 t	3,232 t
	nei-sharks	50,274 t	41,453 t	57,032 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 2015, seven countries reported catches of silky sharks in the IOTC region.

A recent project estimated possible silky shark catches for fleets/countries based on the ratio of shark catch over target species by metier (Murua et al 2013). This estimation was based on nominal catches of target species from the IOTC database under the assumption that target catches are declared correctly. The study highlighted that the catch data on oceanic whitetip sharks in the IOTC database may be a considerable underestimate (i.e. total estimated catches were approximately 10 times higher than that declared in the IOTC database). Another study estimated that the number of silky sharks entangled in the nets beneath FADs is much higher than previously thought, ranging between 480,000 and 960,000 individuals per year, assuming a presence of between 3,750 and 7,500 active FADs (Filmater et al. 2013). The authors also acknowledged that solutions exist to mitigate the problem through the exclusion of meshed materials in the subsurface structure of the FAD, as is currently being implemented by the European purse seine. FAD management plans must be submitted to the IOTC and guidelines are set out in IOTC Resolution 15/08 *Procedures on a fish aggregating devices (FADs) management plan, including a limitation on the number of FADs, more detailed specifications of catch reporting from FAD sets, and the development of improved FAD designs to reduce the incidence of entanglement of non-target species.*

Silky sharks: Nominal and standardised CPUE trends

Data not available at the IOTC Secretariat. However, Maldivian shark fishermen have reported significant declines in silky shark abundance (Anderson 2009). In addition, Indian longline research surveys, in which silky sharks contributed 7% of catch, demonstrate declining nominal catch rates over the period 1984–2006 (John & Varghese 2009). No long-term data for purse-seine CPUE are available; however there is anecdotal evidence of a five-fold decrease in silky shark catches per set between 1980s and 2005.

Silky sharks: Average weight in the catch by fisheries

Data not available.

Silky sharks: Number of squares fished

Catch and effort data not available.

STOCK ASSESSMENT

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

LITERATURE CITED

- Anderson RC (2009) Opinions count: decline in abundance of silky sharks in the central Indian Ocean reported by Maldivian fishermen. IOTC–2009–WPEB–08
- Ariz J, Delgado de Molina A, Ramos ML, Santana JC (2006) Check list and catch rate data by hook type and bait for bycatch species caught by Spanish experimental longline cruises in the south-western Indian Ocean during 2005. IOTC–2006–WPBy–04
- Bass AJ, D'Aubrey JS, Kistnasamy N (1973) Sharks of the East coast of Southern Africa 1- The genus *Carcharhinus* (Carcharhinidae). Ocenogr Res Inst Durban Report No.33
- Clarke S (2008) Use of shark fin trade data to estimate historic total shark removals in the Atlantic Ocean. *Aquat Living Res* 21:373-381
- Clarke SC, McAllister MK, Milner-Gulland EJ, Kirkwood GP, Michielsens CGJ, Agnew DJ, Pikitch EK, Nakano H, Shivji MS (2006) Global estimates of shark catches using trade records from commercial markets. *Ecol Lett* 9:1115-1126
- Compagno L, Niem V (1998) Carcharhinidae. Requiem sharks. Pp. 1312-1360. In: Carpenter K., Niem V. (eds.) *FAO Identification Guide for Fishery Purposes. The Living Marine Resources of the Western Central Pacific*. FAO, Rome
- Filmalter JD, Capello M, Deneubourg JL, Cowley PD, Dagorn L (2013) Looking behind the curtain: quantifying massive shark mortality in fish aggregating devices. IOTC–2013–WPEB09–21
- Hall N, Bartron C, White W, Dharmadi, Potter I (2012) Biology of the silky shark *Carcharhinus falciformis* (Carcharhinidae) in the eastern Indian Ocean, including an approach to estimating age when timing of parturition is not well defined. *J. Fish Biol.*, 80: 1320–1341
- IUCN (2007) IUCN Species Survival Commission's Shark Specialist Group. Review of Chondrichthyan Fishes
- IUCN (2012) IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Downloaded on 12 November 2012
- John ME, Varghese BC (2009) Decline in CPUE of oceanic sharks in the Indian EEZ: urgent need for precautionary approach. IOTC–2009–WPEB–17
- Mejuto J, Garcia-Cortes B, Ramos-Cardelle A (2005) Tagging-recapture activities of large pelagic sharks carried out by Spain in collaboration with the tagging programs of other countries. *SCRS/2004/104 Col Vol Sci Pap ICCAT* 58(3): 974-1000
- Murua H, Santos MN, Chavance P, Amande J, Seret B, Poisson F, Ariz J, Abascal FJ, Bach P, Coelho R, Korta M (2013) EU project for the provision of scientific advice for the purpose of the implementation of the EUPOA sharks: a brief overview of the results for Indian Ocean. IOTC–2013–WPEB09–19
- Petersen S, Nel D, Ryan P, Underhill L (2008) Understanding and mitigating vulnerable bycatch in southern African trawl and longline fisheries. *WWF South Africa Rep Ser* 225 p
- Poisson F, Filmalter JD, Vernet AL, Laurent D (2014) Mortality rate of silky sharks (*Carcharhinus falciformis*) caught in the tropical tuna purse seine fishery in the Indian Ocean. *Can. J. Fish. Aquat. Sci.* In press. doi: 10.1139/cjfas-2013-0561
- Romanov EV (2002) Bycatch in the tuna purse-seine fisheries of the western Indian Ocean. *Fish Bull* 100:90-105
- Romanov EV (2008) Bycatch and discards in the Soviet purse seine tuna fisheries on FAD-associated schools in the north equatorial area of the Western Indian Ocean. *Western Indian Ocean J Mar Sci* 7:163-174
- Romanov E, Bach P, Romanova N (2008) Preliminary estimates of bycatches in the western equatorial Indian Ocean in the traditional multifilament longline gears (1961-1989) IOTC Working Party on Ecosystems and Bycatch (WPEB) Bangkok, Thailand. 20-22 October, 2008. 18 p
- Strasburg DW (1958) Distribution, abundance, and habits of pelagic sharks in the central Pacific Ocean. *Fish Bull U.S. Fish Wildl Serv* 58:335-61
- Stevens JD (1984) Life-history and ecology of sharks at Aldabra Atoll, Indian Ocean. *Proc Roy Soc London Ser B* 222: 573–590.