

**DRAFT: EXECUTIVE SUMMARY: SILKY SHARK****Status of the Indian Ocean silky shark (FAL: *Carcharhinus falciformis*)****TABLE 1.** Silky shark: Status of silky shark (*Carcharhinus falciformis*) in the Indian Ocean

Area <sup>1</sup>	Indicators	2013 stock status determination
Indian Ocean	Reported catch 2012: 4,177 t Not elsewhere included (nei) sharks: 42,793 t Average reported catch 2008–2012: 3,443 t Not elsewhere included (nei) sharks: 48,708 t	Uncertain
	MSY: unknown $F_{2012}/F_{MSY}$ : unknown $SB_{2012}/SB_{MSY}$ : unknown $SB_{2012}/SB_0$ : unknown	

<sup>1</sup>Boundaries for the Indian Ocean = IOTC area of competence

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.** Silky shark: IUCN threat status of silky shark (*Carcharhinus falciformis*) in the Indian Ocean

Common name	Scientific name	IUCN threat status <sup>1</sup>		
		Global status	WIO	EIO
Silky shark	<i>Carcharhinus falciformis</i>	Near Threatened	Near Threatened	Near Threatened

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean

Sources: IUCN 2007, 2012

**INDIAN OCEAN STOCK – MANAGEMENT ADVICE**

**Stock status.** There remains considerable uncertainty about the relationship between abundance and the nominal CPUE series from the main longline fleets, and about the total catches over the past decade (Table 1). The current IUCN threat status of ‘Near Threatened’ applies to silky sharks in the western and eastern Indian Ocean and globally (Table 2). There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. There is no quantitative stock assessment or basic fishery indicators currently available for silky shark in the Indian Ocean therefore the stock status is highly uncertain. Silky 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 20 years), mature relatively late (at 6–12 years), and have relatively few offspring (<20 pups every two years), the silky shark is vulnerable to overfishing. Despite the lack of data, it is clear from the information that is available that silky shark abundance has declined significantly over recent decades. Therefore stock status remains **uncertain** (Table 1).

**Outlook.** Maintaining or increasing effort will probably 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 silky shark will decline in these areas in the near future, and may result in localised depletion. The following should be noted:

- The available evidence indicates considerable risk to the stock status at current effort levels.
- Total catches are highly uncertain and should be investigated further as a priority.
- Noting that current reported catches (probably largely underestimated) are estimated at an average ~3,443 t over the last five years, ~4,177 t in 2012, maintaining or increasing effort will probably result in further declines in biomass.

<sup>1</sup> The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

- 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

Silky 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, transshipment, 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 1<sup>st</sup> 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 30<sup>th</sup> 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

*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 3 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](http://www.iucnredlist.org))

**TABLE 3.** 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"> <li>• Fecundity: medium (&lt;20 pups)</li> <li>• Generation time: 11–16 years</li> <li>• Gestation period: 12 months</li> <li>• Reproductive cycle is biennial</li> </ul>
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 4). 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 1970's, 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 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 4.** 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	study in progress	unknown	unknown	unknown	unknown	unknown

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

#### **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 5). 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, Philippines, Seychelles, Mauritius, UK-territories, Vanuatu). For CPCs reporting longline data by species (i.e. Australia, EU (Spain, Portugal), United Kingdom and South Africa), 0.1% of the catch of sharks by longliners, all targeting swordfish, were silky sharks, and for CPCs reporting gillnet data by species, I.R. Iran 25% and Sri Lanka 11% of the catches of shark were silky sharks.

**TABLE 5.** Silky shark: Catch estimates for silky shark in the Indian Ocean for 2010 to 2012.

Catch		2010	2011	2012
Most recent catch (reported)	Silky shark	5,141 t	4,490 t	4,177 t
	nei-sharks	51,581 t	53,658 t	42,793 t
Mean catch (reported) over the last 5 years (2008–2012)	Silky shark			3,443 t
	nei-sharks			48,708 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 2012, six 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). The estimation was done using target species nominal catch from the IOTC database and assuming that target catches have been accurately declared. The estimated catch from this study highlighted that the possible underestimation of silky shark in the IOTC database is considerable (i.e. the estimated catch is around 10 times higher than the declared/report and contained in the IOTC database). Another study estimated the amount of silky shark entanglement in the nets underneath FADs is much higher than previously thought, in a range between 480,000 and 960,000 individuals per year, assuming a presence of between 3,750 and 7,500 active FADs (Filmatier et al. 2013). The authors also acknowledged that solutions exist to mitigate the problem excluding meshed materials in the subsurface structure of the FAD as the European purse seine fleet is being implementing currently and it is agreed by IOTC Commission with the Resolution 13/08 *Procedures on a fish aggregating devices (FADs) management plan*, including 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 report significant declines in silky shark abundance over past 20 years (Anderson 2009). In addition, Indian longline research surveys, in which silky sharks contributed 7% of catch, demonstrate declining catch rates over the period 1984–2006 (John & Varghese 2009). No long-term data for purse-seine CPUE are available; however there is anecdotal evidences of five-fold decrease of 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](http://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
- Matsunaga H (2007) Standardized CPUE for blue sharks caught by the Japanese tuna longline fishery in the Indian Ocean, 1971-2005. IOTC–2007–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
- 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