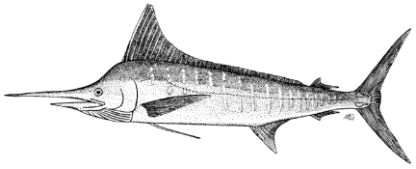
Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
iotc ctoi



EXECUTIVE SUMMARY: STATUS OF THE INDIAN OCEAN STRIPED MARLIN (*TETRAPTURUS AUDAX*) RESOURCE

TABLE 1. Status of striped marlin (*Tetrapturus audax*) in the Indian Ocean.

Area[1]	**Indicators – 2011 assessment**		**2011 stock status determination**
			2010[2]
Indian Ocean	Catch 2010:	1,921 t	Uncertain
	Average catch 2006–2010:	2,542 t	
	MSY (range):	unknown	
	F_{2010}/F_{MSY} (range):	unknown	
	SB_{2010}/SB_{MSY} (range):	unknown	
	SB_{2010}/SB_0 (range):	unknown	

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]The stock status refers to the most recent years' data used for the assessment.

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No quantitative stock assessment is currently available for striped marlin in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used. Therefore stock status remains *uncertain* (Table 1). However, aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment are a cause for considerable concern. Research emphasis on improving indicators and exploration of stock assessment approaches for data poor fisheries are warranted.

Outlook. The decrease in longline catch and effort in recent years has lowered the pressure on the Indian Ocean stock as a whole, however there is not sufficient information to evaluate the effect this will have on the resource.

The Scientific Committee considers the following:

- the Maximum Sustainable Yield estimate for the whole Indian Ocean is unknown.
- annual catches of striped marlin urgently need to be reviewed.
- improvement in data collection and reporting is required to assess the stock.

SUPPORTING INFORMATION

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

CONSERVATION AND MANAGEMENT MEASURES

Striped marlin (*Tetrapturus audax*) in the Indian Ocean is currently subject to a number of conservation and management measures adopted by the Commission, although none are species specific:

- Resolution 08/04 *concerning the recording of catch by longline fishing vessels in the IOTC area*.
- Resolution 09/02 *On the implementation of a limitation of fishing capacity of contracting parties and cooperating non-contracting parties*.
- Resolution 10/02 *mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*.
- Resolution 10/03 *concerning the recording of catch by fishing vessels in the IOTC area*.
- Resolution 10/08 *concerning a record of active vessels fishing for tunas and swordfish in the IOTC area*.
- Recommendation 11/06 *Concerning the Recording of Catch by Fishing Vessels in the IOTC Area of Competence*.

FISHERIES INDICATORS

General

Striped marlin (*Tetrapturus audax*) is a large oceanic apex predator that inhabits tropical and subtropical Indo-Pacific oceans. Table 2 outlines some key life history parameters relevant for management. There is limited reliable information on the catches of this species and no information on the stock structure or growth and mortality in the Indian Ocean.

TABLE 2. Biology of Indian Ocean striped marlin (*Tetrapturus audax*).

Parameter	*Description*
Range and stock structure	A large oceanic apex predator that inhabits sub-tropical waters of the Indian and Pacific oceans, and is rarely found in the Atlantic Ocean. Its distribution is different from other marlins in that it prefers more temperate or cooler waters and tends to be less migratory. In the Indian Ocean seasonal concentrations of striped marlin occur in four main regions: off the east African coast (0º-10ºS), the south and western Arabian Sea, the Bay of Bengal, and north-western Australian waters. The stock structure of striped marlin in the Indian Oceans is uncertain.
Longevity	~10 years. Females and males n.a.
Maturity (50%)	Age: 2–3 years. Females and males n.a.
Spawning season	Highly fecund batch spawner. Females may produce up to 20 million eggs. Unlike the other marlins which are serial spawners, striped marlin appear to spawn once per season.
Size (length and weight)	Maximum: 300+ cm FL; 240 kg total weight. Young fish grow very quickly in length then put on weight later in life. Striped marlin is the smallest of the marlin species; but unlike the other marlin species, striped marlin males and females grow to a similar size.

n.a. = not available. SOURCES: Nakamura (1985); Froese & Pauly (2009).

Catch trends

Striped marlin are caught almost exclusively under drifting longlines (98%) with remaining catches recorded under gillnets and troll lines (Fig. 1). Striped marlin are generally considered to be a bycatch of industrial fisheries. Catch trends for striped marlin are variable; however, this may reflect the level of reporting. The catches of striped marlin under drifting longlines have been changing over time, between 2,000 t and 8,000 t (Fig. 1).

Catches under drifting longlines have been recorded under Taiwan,China, Japan, Republic of Korea fleets and, recently, Indonesia and several NEI fleets (Fig. 2). Taiwan,China and Japan have reported large drops in the catches of striped marlin for its longline fleets in recent years. The reason for such decreases in catches is not fully understood. Between the early-50s and the late-80s part of the Japanese fleet was licensed to operate within the EEZ of Australia, reporting relatively high catches of striped marlin in the area, in particular in waters off northwest Australia. High catches of the species were also reported in the Bay of Bengal during this period, by both Taiwan,China and Japanese longliners. The distribution of striped marlin catches has changed since the 1980‘s with most of the catch now taken in the western areas of the Indian Ocean. In recent years, the fleets of Taiwan,China (longline) and to a lesser extent Indonesia (longline) are attributed with the highest catches of striped marlin.

In recent years, deep-freezing longliners from Japan and Taiwan,China have reported lower catches of striped marlin, mostly in the northwest Indian Ocean (Fig. 3). The minimum average annual catch estimated for the period 2006 to 2010 is around 2,542 t. These changes of fishing area and catches over the years are thought to be related to changes in the type of access agreements to EEZs of coastal countries in the Indian Ocean, rather than changes in the distribution of the species over time. Discards are believed to be low although they are unknown for most industrial fisheries, mainly longliners. Discards of striped marlin may also occur in the driftnet fishery of Iran, as this species has no commercial value in this country.

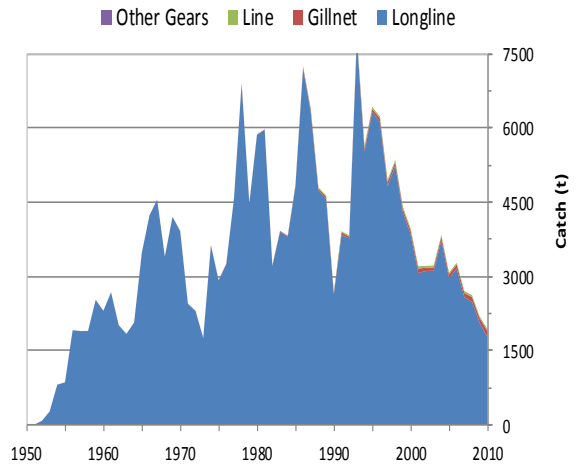


Fig. 1. Catches of striped marlin per gear and year recorded in the IOTC Database (1960–2010).

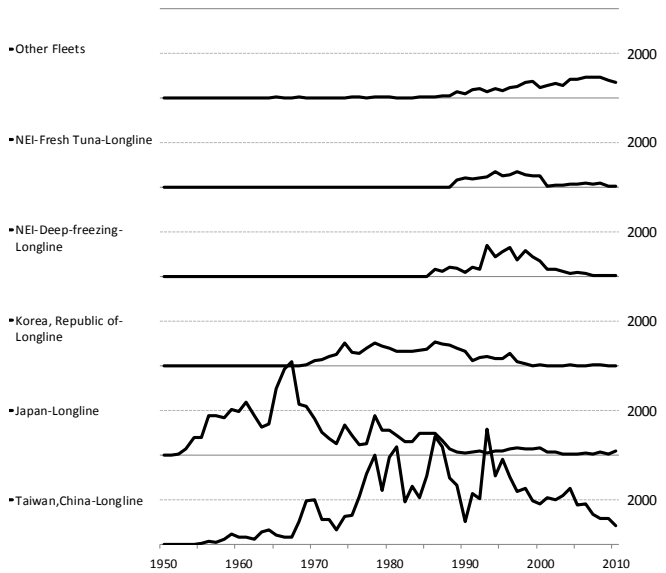


Fig. 2. Catches of striped marlin by fleet recorded in the IOTC Database (1960–2010).

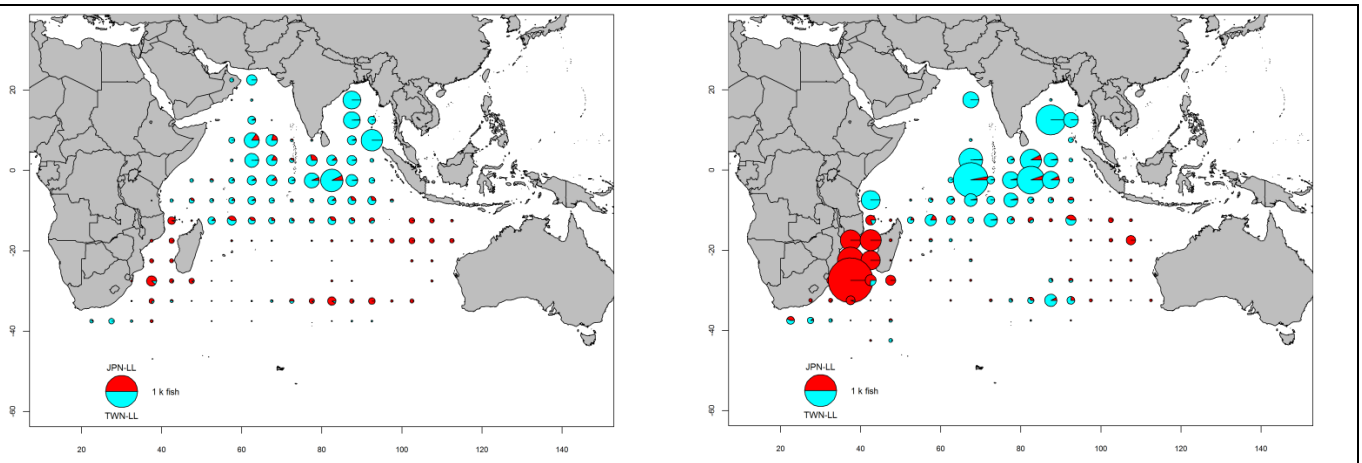


Fig. 3a–b. Time-area catches (in number of fish) of striped marlin as reported for the longline fisheries of Japan (JPN) and Taiwan,China (TWN) for 2009 and 2010 by fleet.

TABLE 3. Best scientific estimates of the catches of striped marlin by type of fishery for the period 1950–2009 (in metric tonnes). Data as of October 2011.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Longline	1,024	3,077	3,614	5,042	5,040	3,849	3,069	3,112	3,115	3,730	2,966	3,153	2,582	2,485	2,057	1,773
Gillnet	2	3	6	25	60	83	92	65	66	75	78	89	81	96	96	120
Line	0	0	1	11	35	44	46	38	38	35	36	36	41	41	29	29
Other	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0
Total	**1,026**	**30,80**	**3,625**	**5,079**	**5,135**	**3,975**	**3,207**	**3,216**	**3,219**	**3,839**	**3,079**	**3,279**	**2,705**	**2,622**	**2,182**	**1,921**

Uncertainty of time–area catches

Retained catches are reasonably well known (Fig. 4) although they remain uncertain for some fleets:

- Catch reports refer to total catches of all three marlin species; catches by species have to be estimated by the IOTC Secretariat for some industrial fisheries (longliners of Indonesia and Philippines).
- Catches of non-reporting industrial longliners (India, NEI) estimated by the IOTC Secretariat using alternative information. As they are not reported by the countries concerned, catches are likely to be incomplete for some industrial fisheries for which the striped marlin is seldom the target species.
- Conflicting catch reports: The catches for longliners flagged to the Republic of Korea, reported as nominal catches and catches and effort, are conflicting with higher catches recorded in the catch and effort table. For this reason, the IOTC Secretariat revised the catches of striped marlin over the time-series using both datasets. Although the new catches estimated by the IOTC Secretariat are thought to be more accurate, catches of striped marlin remain uncertain for this fleet.

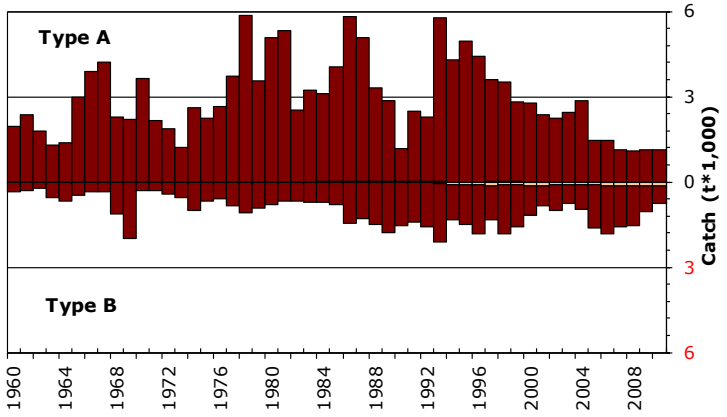


Fig. 4. Uncertainty of time-area catches for striped marlin (Data as of October 2011).
Catches below the zero-line (Type B) refer to fleets that do not report catch-and-effort data to the IOTC, do not report catch-and-effort data by gear and/or species or any of the other reasons provided in the document. Catches over the zero-line (Type A) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets.

Effort trends

Total effort from longline vessels flagged to Japan, Taiwan,China and EU,Spain by five degree square grid from 2007 to 2010 are provided in Fig. 5, and total effort from purse seine vessles flagged to the EU and Seychelles (operating under flags of EU countries, Seychelles and other flags), and others, by five degree square grid and main fleets, for the years 2007 to 2010 are provided in Fig. 6.

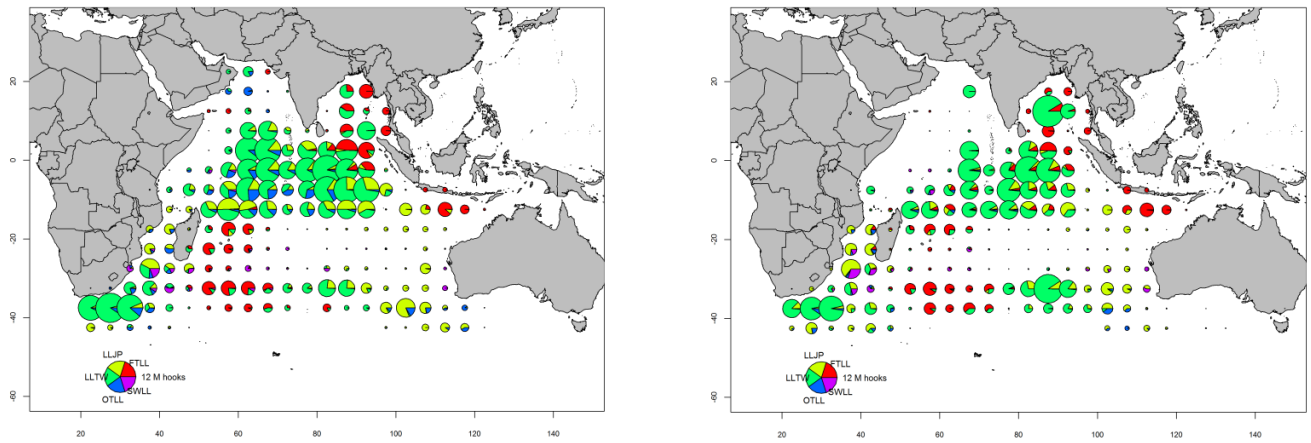


Fig. 5. Number of hooks set (millions) from longline vessels by five degree square grid and main fleets, for the years 2009 (left) and 2010 (right) (Data as of August 2011).
LLJP (light green): deep-freezing longliners from Japan
LLTW (dark green): deep-freezing longliners from Taiwan,China
SWLL (turquoise): swordfish longliners (Australia, EU, Mauritius, Seychelles and other fleets)
FTLL (red) : fresh-tuna longliners (China, Taiwan,China and other fleets)
OTLL (blue): Longliners from other fleets (includes Belize, China, Philippines, Seychelles, South Africa, Rep. of Korea and various other fleets)

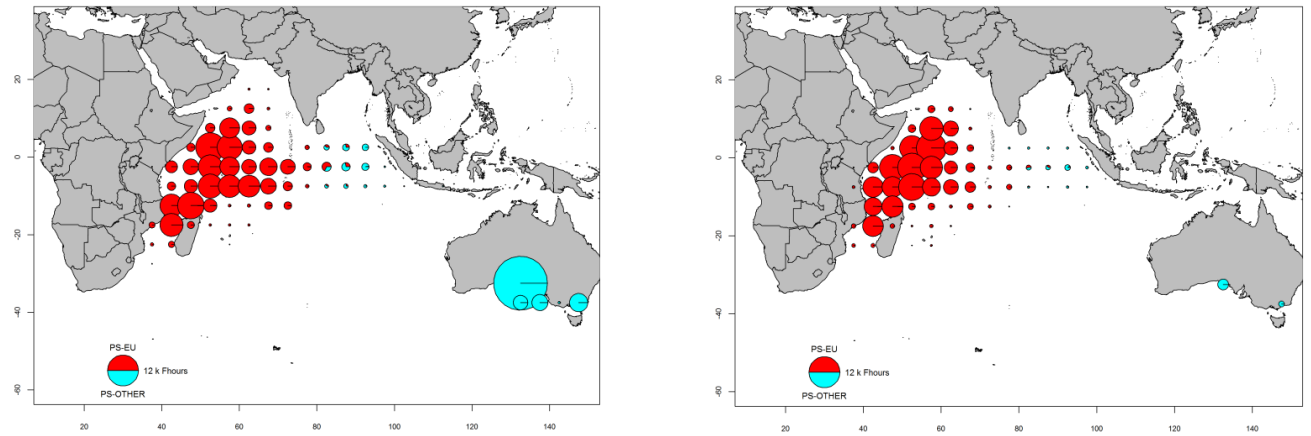


Fig. 6. Number of hours of fishing (Fhours) from purse seine vessels by 5 degree square grid and main fleets, for the years 2009 (left) and 2010 (right) (Data as of August 2011).
PS-EU (red): Industrial purse seiners monitored by the EU and Seychelles (operating under flags of EU countries, Seychelles and other flags)
PS-OTHER (green): Industrial purse seiners from other fleets (includes Japan, Mauritius and purse seiners of Soviet origin) (excludes effort data for purse seiners of Iran and Thailand)

Catch–per–unit–effort (CPUE) trends

Standardised CPUE series have not yet been developed. Nominal CPUE series are however available from some industrial longline fisheries (primarily the Japanese longline fleet; Figs. 7 and 8) although catches are thought to be incomplete (catches of non-target species are not always recorded in logbooks). No catch and effort data are available from sports fisheries, other than for partial data from the sports fisheries of Kenya; or other artisanal (gillnet fisheries of I.R. Iran and Pakistan, gillnet/longlines of Sri Lanka, gillnets of Indonesia) or industrial fisheries (NEI longliners and all purse seiners).

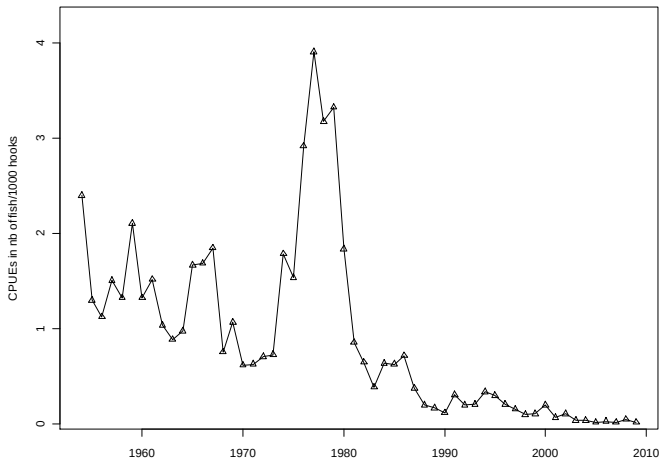


Fig. 7. Nominal CPUE (number of fish by 1,000 hooks) of striped marlin caught by Japanese longliners off-Somalia.

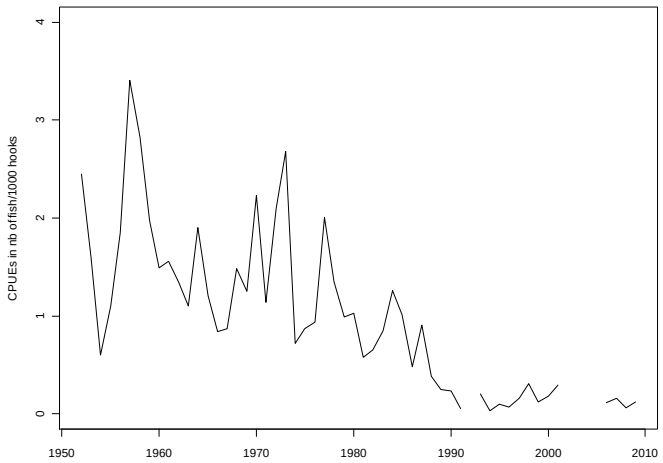


Fig. 8. Nominal CPUE (number of fish by 1,000 hooks) of striped marlin caught by Japanese longliners northwest Australia.

Fish size or age trends (e.g. by length, weight, sex and/or maturity)

Average fish weight can only be assessed for the longline fishery of Japan since 1970 and Taiwan,China since 1980. The number of specimens measured on Japanese longliners in recent years is, however, very low.

Catch-at-Size(Age) tables have not been built for this species due to a lack of information reported by CPCs. Fish size is derived from various length and weight information, however the reliability of the size data is reduced when relatively few fish out of the total catch are measured.

Sex ratio data have not been provided to the Secretariat by CPCs.

STOCK ASSESSMENT

No quantitative stock assessment for striped marlin in the Indian Ocean is known to exist and no such assessment has been undertaken by the IOTC Working Party on Billfish. However, a preliminary estimation of stock indicators was attempted on the longline catch and effort datasets from Japan and Taiwan,China that represent the best available information. Nominal CPUE exhibited declines since the beginning of the fishery in two major fishing grounds (West Equatorial and north-west Australia) (Figs. 7 and 8) and catches in the initial core areas have also decreased substantially. However, there is considerable uncertainty about the degree to which these indicators represent abundance as factors such as changes in targeting practices, discarding practices, fishing grounds and management practices are likely to interact in the depicted trends. Further work must be undertaken to derive additional stock indicators for this species, because in the absence of a quantitative stock assessment, such indicators represent the only means to monitor the status of the stock and assess the impacts of fishing.

TABLE 4. Striped marlin (*Tetrapturus audax*) stock status summary.

Management Quantity	Aggregate Indian Ocean
2010 catch estimate (1000 t)	1.9
Mean catch from 20065–2010 (1000 t)	2.5
MSY (1000 t) (80% CI)	unknown
Data period used in assessment	–
F_{2010}/F_{MSY} (80% CI)	–
B_{2010}/B_{MSY} (80% CI)	–
SB_{2010}/SB_{MSY}	–
B_{2010}/B_{1980} (80% CI)	–
SB_{2010}/SB_{1980}	–
$B_{2010}/B_{1980,\ F=0}$	–
$SB_{2010}/SB_{1980,\ F=0}$	–

LITERATURE CITED

Froese R & Pauly DE, 2009. FishBase, version 02/2009, FishBase Consortium, <www.fishbase.org>.

Nakamura I, 1985. FAO species catalogue. Billfish of the world. An annotated and illustrated catalogue of marlins, sailfishes, spearfishes, and swordfishes known to date. FAO Fish. Synop. 125(5), 65 p.