DRAFT EXECUTIVE SUMMARY: INDO-PACIFIC SAILFISH

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

Status of the Indian Ocean Indo-Pacific sailfish (SFA: *Istiophorus platypterus*) resource

TABLE 1. Indo-Pacific sailfish: Status of Indo-Pacific sailfish (*Istiophorus platypterus*) in the Indian Ocean.

Area[1]	Indicators		2016 stock status determination
Indian Ocean	Catch 2015: Average catch 2011–2015:	28,455 t 28,543 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): B_{MSY} (1,000 t) (80% CI): F_{2014}/F_{MSY} (80% CI): B_{2014}/B_{MSY} (80% CI): B_{2014}/B_0 (80% CI):	25.00 (17.20–36.30) 0.26 (0.15–0.39) 87.52 (56.30–121.02) 1.05 (0.63–1.63) 1.13 (0.87–1.37) 0.57 (0.44–0.69)	

[1]Boundaries for the Indian Ocean = IOTC area of competence

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. In 2015, data poor methods for stock assessment using Stock reduction analysis (SRA) techniques indicate that the stock is not yet overfished, but is subject to overfishing (Table 1). In using the SRA method for comparative purposes with other stocks, the use of the target reference points may be possible for the approach. In addition, a Bayesian Surplus Production Model indicated that the stock could be severely overfished so this is a less pessimistic outlook on the stock status. The stock appears to show a continued increase in catch rates which is a cause of concern, indicating that fishing mortality levels may be becoming too high (Fig. 1). Aspects of the biology, productivity and fisheries for this species combined with the data poor status on which to base a more formal assessment are a cause for concern. Research emphasis on further developing possible CPUE indicators from gillnet fisheries, and further exploration of stock assessment approaches for data poor fisheries are warranted. Given the limited data being reported for coastal gillnet fisheries, and the importance of sports fisheries for this species, efforts must be made to rectify these information gaps. Records of stock extirpation in the Gulf should also be examined to examine the degree of localised depletion in Indian Ocean coastal areas. On the weight-of-evidence available in 2016, the stock is determined to be still **not overfished** but **subject to overfishing**.

Outlook. The estimated increase in coastal gillnet catch and effort in recent years is a substantial cause for concern for the Indian Ocean stock as a whole, however there is not sufficient information to evaluate the effect this will have on the resource.

Management advice. The same management advice for 2016 (catches below a MSY of 25,000 t) is kept for the next year (2017).

The following key points should be noted:

- **Maximum Sustainable Yield (MSY)**: estimate for the whole Indian Ocean is 25,000 t.
- **Provisional reference points**: Although the Commission adopted reference points for swordfish in Resolution 15/10 *on target and limit reference points and a decision framework*, no such interim reference points, nor harvest control rules have been established for I.P. sailfish.
- **Main fishing gear** (2012–15): Gillnet: 75%; Troll and handlines: 18% (of the total estimated I.P. sailfish catch).

- **Main fleets** (2012–15): I.R. Iran (gillnet): 31%; Pakistan (gillnet): 18%; India (gillnet and troll): 17%; Sri Lanka (gillnet and fresh longline): 10% (of the total estimated I.P. sailfish catch).

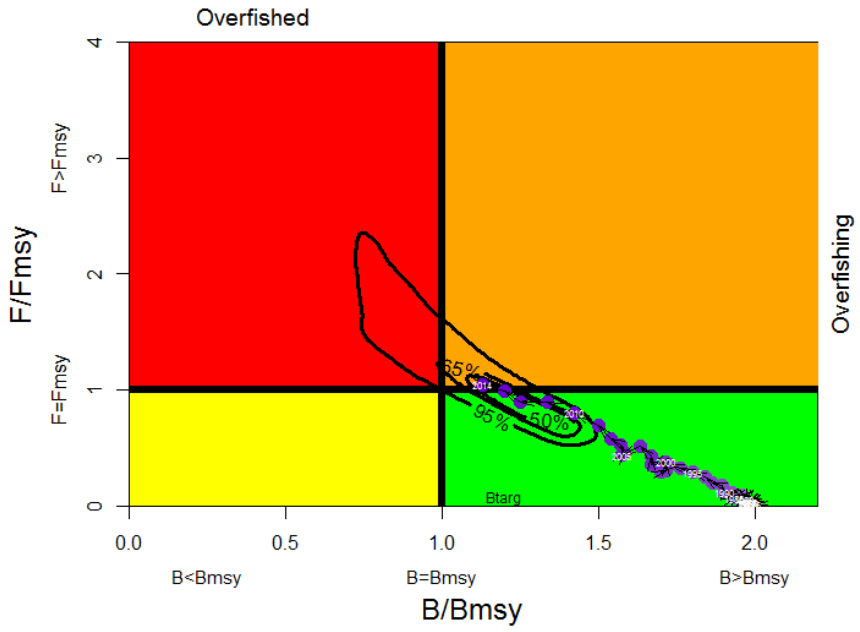

Fig. 1. Indo-Pacific sailfish: Stock reduction analysis (Catch MSY Method) of aggregated Indian Ocean assessment Kobe plot (contours are the 50, 65 and 90 percentiles of the 2014 estimate). Black lines indicate the trajectory of the point estimates (blue circles) for the B ratio and F ratio for each year 1950–2014.

Table 2. Indo-Pacific sailfish: Indian Ocean stock reduction analysis Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based target reference points for nine constant catch projections (average catch level from 2012–2014 (29,164 t), ± 10%, ± 20%, ± 30% ± 40%) projected for 3 and 10 years.

Reference point and projection timeframe	**Alternative catch projections (relative to the average catch level from 2012–14, 29,164 t) and probability (%) of violating MSY-based target reference points (B_{targ} = B_{MSY}; F_{targ} = F_{MSY})**								
	60%	**70%**	**80%**	**90%**	**100%**	**110%**	**120%**	**130%**	**140%**
	17,498 t	20,415 t	23,331 t	26,248 t	29,164 t	32,080 t	34,997 t	37,913 t	40,830 t
B_{2017}<B_{MSY}	10	15	20	25	30	35	41	47	53
F_{2017}> F_{MSY}	16	27	38	49	61	72	83	94	99
B_{2024}<B_{MSY}	6	16	28	41	55	68	81	91	97
F_{2024}> F_{MSY}	12	23	36	52	68	84	97	100	100

APPENDIX I

SUPPORTING INFORMATION

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

CONSERVATION AND MANAGEMENT MEASURES

Indo-Pacific sailfish (*Istiophorus platypterus*) 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 15/01: *On the recording of catch and effort by fishing vessels in the IOTC area of competence*
- Resolution 15/02: *Mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non Contracting Parties (CPC's)*
- Resolution 15/11: *On the implementation of a limitation of fishing capacity of Contracting Parties and Cooperating Non Contracting Parties*
- Resolution 14/05: *Concerning a record of licensed foreign vessels fishing for IOTC species in the IOTC area of competence and access agreement information*
- Resolution 11/04: *On a regional observer scheme*
- Resolution 10/08: *Concerning a record of active vessels fishing for tunas and swordfish in the IOTC area*

FISHERIES INDICATORS

Indo-Pacific sailfish: General

Indo-Pacific sailfish (*Istiophorus platypterus*) is a large oceanic apex predator that inhabits tropical and subtropical Indo-Pacific oceans (**Fig. 2**). **Table 3** 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.

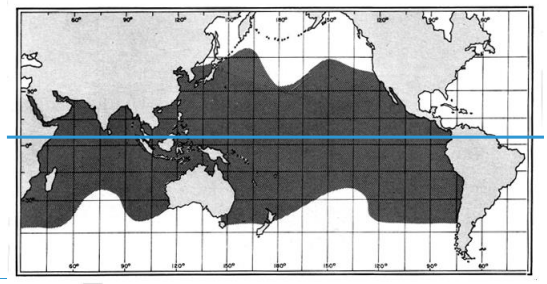

Fig. 2. Indo-Pacific sailfish: The worldwide distribution of Indo-Pacific sailfish (Source: Nakamura, 1984).

TABLE 3. Indo-Pacific sailfish: Biology of Indian Ocean Indo-Pacific sailfish (*Istiophorus platypterus*).

Parameter	Description
Range and stocks	Found throughout the tropical and subtropical regions of the Pacific and the Indian Oceans. It is mainly found in surface waters above the thermocline, close to coasts and islands in depths from 0 to 200 m. Indo–Pacific sailfish is a highly migratory species and renowned for its speed and (by recreational fishers) for its jumping behaviour — one individual has been reported burst swimming at speeds in excess of 110 km/h. The stock structure of Indo-Pacific sailfish in the Indian Oceans is uncertain: apparently there are local reproductively isolated stocks. At least one stock was reported in the Persian Gulf with no or very little intermixing with open Indian Ocean stocks. However outside of the Gulf no stock differentiation has been determined; thus for the purposes of assessment, one pan-ocean stock is assumed. However, spatial heterogeneity in stock indicators (catch-per-unit-effort trends) for other billfish species indicates that there is potential for localised depletion.

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tructure	
Longevity	Females: 11–13 years; Males: 7–8 years
Maturity (50%)	**Age**: females n.a.; males n.a. **Size**: females n.a.; males n.a.
Spawning season	Spawning in Indian waters occurs between December to June with a peak in February and June. In subtropical waters of the southern hemisphere spawning is associated with warmer months: in Mozambique Channel and around Reunion Island high percentage of ripe females occurs in December.
Size (length and weig	Maximum: 350 cm FL and weight 100 kg total weight. The Indo-Pacific sailfish is one of the smallest-sized billfish species, but is relatively fast growing. Individuals may grow to over 3 m and up to 100kg, and live to around 7 years. Young fish grow very quickly in length then put on weight later in life. Sexual dimorphism in size, growth rates and size and age at maturity – females reach larger sizes, grow faster and mature later than males. Females: 300 cm LJFL, 50+ kg total weight; Males: 200 cm LJFL, 40+ kg total weight in the Indian Ocean. Recruitment into the fishery: varies by fishing method, apparently at age 0+ and size less than 100 cm LJFL for artisanal fleets. The average weight of fish caught in the Kenyan sports fishery is ~25 kg whole weight.

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h t)	

n.a. = not available. Sources: Nakamura 1985, Hoolihan 2003, 2004, 2006, Speare 2003, Hoolihan & Luo 2007, Sun et al. 2007, Froese & Pauly 2009, Ndegwa & Herrera 2011

Fisheries and main catch trends

- Main fishing gear (2012–2015): gillnets account for around 75% of total catches in the Indian Ocean, followed by troll and hand lines (18%), with remaining catches recorded under longlines and other gears (**Fig. 3**).
- Main fleets (and primary gear associated with catches): percentage of total catches (2012–15):

Three quarters of the total catches of Indo-Pacific sailfish are accounted for by four countries situated in the Arabian Sea: Iran (gillnet): 31%; Pakistan (gillnet): 18%; India (gillnet and troll): 17%; and Sri Lanka (gillnet and fresh longline): 10% (**Fig. 4**).

This species is also a popular catch for sport fisheries (e.g. Kenya, Mauritius, and Seychelles).

- Main fishing areas: Primary: north-west Indian Ocean (Arabian Sea).
- Retained catch trends:

Catches have increased sharply since the mid-1990's (from around 5,000 t in the early 1990s to nearly 30,000 t from 2011 onwards) (**Table 4**) – largely due to the development of a gillnet/longline fishery in Sri Lanka and, especially, the extension of Iranian gillnet vessels operating in areas beyond the EEZ of I.R. Iran. In the case of I.R. Iran, gillnet catches have increased from less than 1,000 t in the early 1990's to between 7,000 t and over 11,000 t since 2014.

Catches from drifting longline fleets have also likely increased, but have been under-reported as the species has little commercial value. In recent years, deep-freezing longliners from Japan have reported catches of Indo-Pacific sailfish in the central western Indian Ocean, between Sri Lanka and the Maldives and the Mozambique Channel.

- Discard levels: Moderate to high, however discard levels are largely unknown for most industrial fisheries, mainly longliners.

Changes to the catch series: no major changes to the catch series since the WPB meeting in 20142015[1].

TABLE 4: Indo-Pacific sailfish: best scientific estimates of catches by type of fishery for the period 1950–2015 (in metric tons). Data as of August 2016.

	By decade (average)						By year (last ten years)									

Fisheries: Longline (**LL**); Gillnet (**GN**); Hook and Line (includes handline, trolling, baitboat, and sport fisheries) (**HL**); Other gears (includes coastal purse seine, Danish purse seine, beach seine, and purse seine) (**OT**).

[1] Any differences in the data series since the last WPB are changes to the nominal catch as a result of reallocation of catches reported as other billfish species or as aggregated billfish species groups reported by, e.g., Sri Lanka, and Pakistan to a lesser extent. These changes, however, did not lead to very significant changes in the total catch estimates for Indo-Pacific sailfish.

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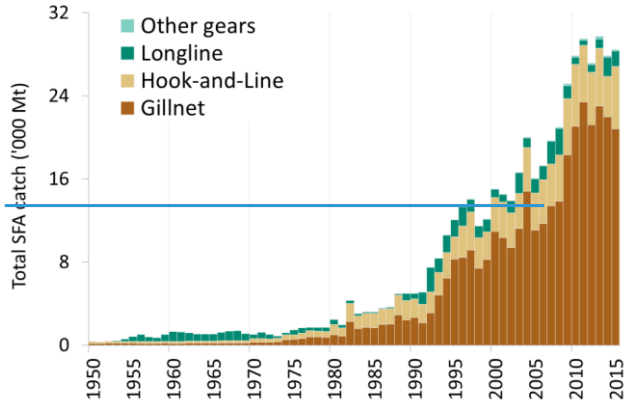
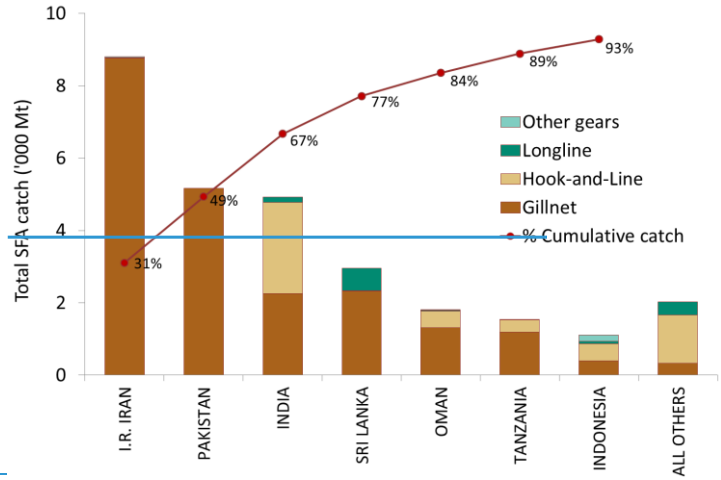


~~**Fig. 3.** Indo-Pacific sailfish: catches by gear and year recorded in the IOTC Database (1950–2015). Other gears includes: coastal purse seine, Danish purse seine, beach seine and purse seine.~~



~~**Fig.4:** Indo-Pacific sailfish: average catches in the Indian Ocean over the period 2012–15, by fleet and gear. Fleets are ordered from left to right, according to the volume of catches reported. The red line indicates the (cumulative) proportion of catches of Indo-Pacific sailfish for the fleets concerned, over the total combined catches reported from all fleets and gears.~~

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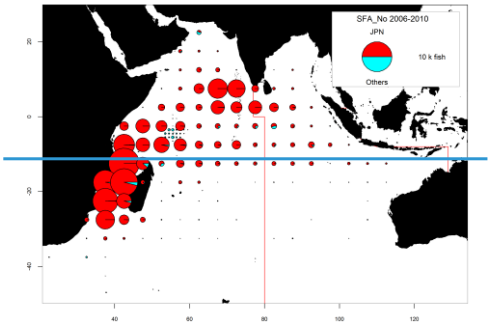
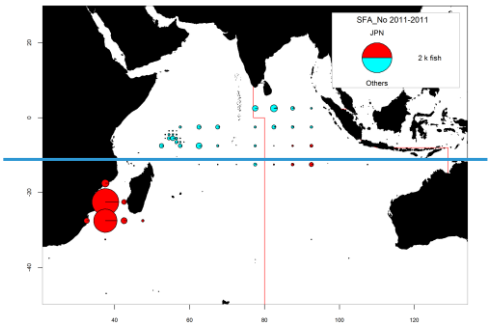

SFA_No 2006-2010
JPN
10 k fish
Others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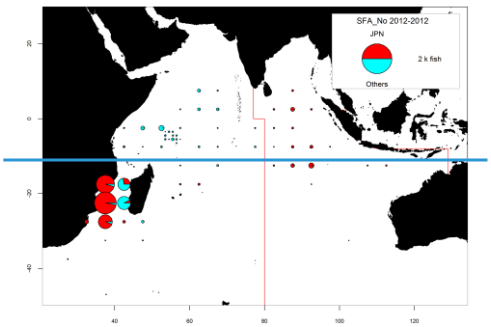
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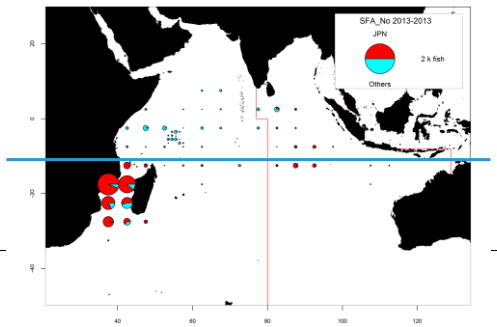
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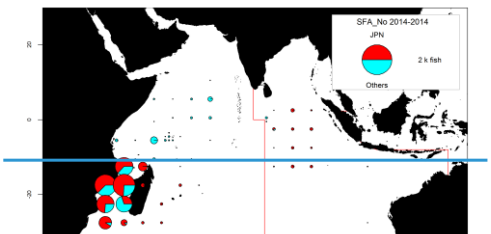
SFA_No 2014-2014
JPN
2 k fish
Others

~~**Fig. 5a-f.** Time-area catches (in number of fish) of Indo-Pacific sailfish as reported for the longline fisheries of Japan (JPN) and Taiwan,China (TWN) for the period 2006–10, by fleet and for 2011–15, by year and fleet. Red lines represent the IOTC Areas.~~

~~Source: IOTC catch and effort data (unraised).~~

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Indo-pacific sailfish: estimation of catches – data related issues

Retained catches – a very high proportion of the catches of Indo-Pacific sailfish are estimated, or adjusted, by the IOTC Secretariat are (**Fig.6**), due to a number of uncertainties in the catches listed below. However, unlike the other billfish species, Indo-Pacific sailfish are more reliably identified because of the large and distinctive first dorsal fin that runs most of the length of the body:

- Species aggregates: catch reports often refer to total catches of all billfish species combined; catches by species are estimated by the Secretariat for some artisanal fisheries (e.g., gillnet/longline fishery of Sri Lanka and artisanal fisheries of India and Pakistan) and industrial fisheries (e.g., longliners of Indonesia and Philippines).

Catches of Indo-Pacific sailfish reported for some fisheries may also refer to the combined catches of more than one species of billfish, in particular marlins and shortbill spearfish (i.e., in the case of coastal fisheries).

- Non reporting fleets: catches of non reporting industrial longliners (e.g., India, NEI) and the gillnet fishery of Indonesia are estimated by the Secretariat using alternative information.
- Non target species: catches are likely to be incomplete for industrial fisheries for which Indo-Pacific sailfish is not a target species.
- Missing or incomplete catches: catches are likely to be incomplete for some artisanal fisheries (e.g. gillnets of Pakistan, pole and lines of Maldives) due to under reporting.

There is also a lack of catch data for most sport fisheries.

Indo-Pacific sailfish – Nominal catch per unit effort (CPUE) trends

- Availability: Standardized and nominal CPUE series have not yet been developed. No catch and effort data are available from sports fisheries, other than partial data from the sports fisheries of Kenya; or other artisanal fisheries (e.g., I.R. Iran and Pakistan (gillnet), Sri Lanka (gillnet longline), Indonesia (gillnet)) or industrial fisheries (NEI longliners and all purse seiners).

Indo-Pacific sailfish – 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 the gillnet/longline fishery of Sri Lanka since the late 1980s (**Appendix I**). The number of specimens measured on Japanese longliners in recent years is, however, very low. Furthermore, specimens discarded might be not accounted for in industrial fisheries, where they are presumed to be of lower size (leading to possible bias of existing samples).

- Catch-at-Size (Age) table: not available, due to lack of size samples and uncertainty over the reliability of retained catch estimates, or conflicting catch and effort data. Fish size is derived from various length and weight information, however the reliability of the size data is reduced for some fleets and when relatively few fish out of the total catch are measured.
- Sex ratio data: have not been provided to the Secretariat by CPCs.

	Fig. 6a-c. Indo-Pacific sailfish: data reporting coverage (1976–2015).

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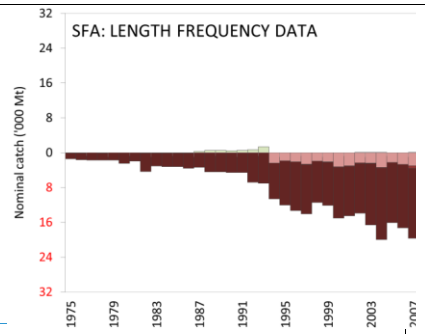

~~*Each IOTC dataset (nominal catch, catch-and-effort, and length-frequency) are assessed against IOTC reporting standards, where:*~~

- ~~*Score 0: indicates the amount of nominal catch associated with each dataset that is fully reported according to IOTC standards;*~~
- ~~*Scores: 2 – 6 refers to the amount of nominal catch associated with each dataset that is partially reported by gear and/or species (i.e., adjusted by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document;*~~
- ~~*Score: 8 refers to the amount of nominal catch associated with catch-and-effort or size-frequency data that is not available.*~~

~~*Data as of August 2016.*~~

Key to IOTC Scoring system

Nominal Catch	By species	By gear
Fully available	0	0
Partially available (part of the catch not reported by species/gear)*	2	2
Fully estimated (by the IOTC Secretariat)	4	4

*Catch assigned by species/gear by the IOTC Secretariat; or 15% or more of the catches remain under aggregates of species

Catch-and-Effort	Time-period	Area
Available according to standards	0	0
Not available according to standards	2	2
Low coverage (less than 30% of total catch covered through logbooks)	2	
Not available at all	8	

Size frequency data	Time-period	Area
Available according to standards	0	0
Not available according to standards	2	2
Low coverage (less than 1 fish measured by metric ton of catch)	2	
Not available at all	8	

Key to colour coding

Total score is 0 (or average score is 0-1)
Total score is 2 (or average score is 1-3)
Total score is 4 (or average score is 3-5)
Total score is 6 (or average score is 5-7)
Total score is 8 (or average score is 7-8)

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~~***Indo-Pacific sailfish: Effort trends***~~

~~Total effort from longline vessels flagged to Japan, Taiwan,China and EU,Spain by five degree square grid in 2014 and 2015 are provided in **Fig. 7**, and total effort from purse seine vessels 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 2014 and 2015 are provided in **Fig.8**.~~

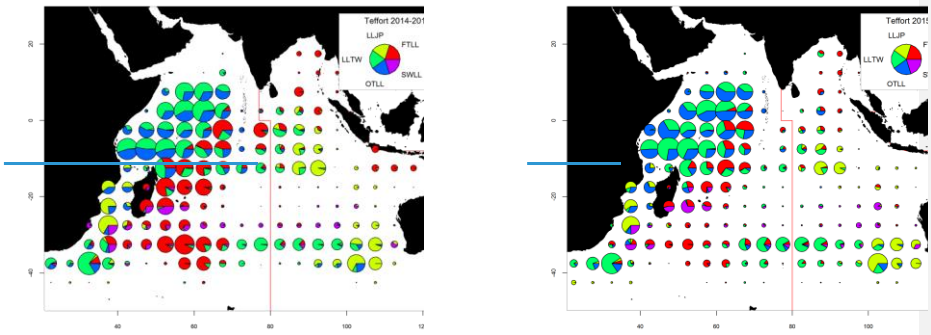

Fig. 7. Number of hooks set (millions) from longline vessels by five degree square grid and main fleets, for the years 2014 (left) and 2015 (right) (data as of September 2016). **LLJP** (light green): deep freezing longliners from Japan **LLTW** (dark green): deep freezing longliners from Taiwan,China; **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).

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ig. 8. Number of hours of fishing (Fhours) from purse seine vessels by 5 degree square grid and main fleets, for the years 2014 (left) and 2015 (ri
f September 2016). **PS EU** (red): Industrial purse seiners monitored by the EU and Seychelles (operating under flags of EU countries, Seychell
lags); **PS OTHER** (light blue): Industrial purse seiners from other fleets (includes Japan, Mauritius and purse seiners of Soviet origin) (excludes c
urse seiners of Iran and Thailand).

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Indo-Pacific sailfish: Standardised catch-per-unit-effort (CPUE) trends

The approaches examined in 2015 on gillnet catchability and CPUE are important, and even if not accurate at the time due to reported fishery effort, they give a good idea of what may be happening within the fishery. Further analysis on the gillnet component of the I.P. sailfish fishery should be undertaken, and such indices should be developed across all marlins in the Indian Ocean. While the longline fishery is useful for examining CPUE given the distribution of I.P. sailfish, it may not be the best index to use as an index of abundance to use in an assessment.

The following should be noted regarding the state of CPUE analysis for fleets with important catches of I.P. sailfish in the IOTC area of competence:

- Data used in CPUE calculations for artisanal fleets needs to improve so we have an index from a largest component of the catch for I.P. sailfish.
- In addition nominal CPUE from the gillnet component of the fleet should be standardised (e.g. using vessel days, or size of vessels operating, etc.).
- Trends in nominal CPUE differ considerably among fleets that operate in the same area, and efforts should be made to understand this difference.

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- Alternative models to assess zeros should be used in the standardisation process for longline fleets, as well as possibly using area effects rather than environmental effects.

Of the I.P. sailfish CPUE series available for assessment purposes, separate index from the gillnet fleets, and Japan and Rep. of Korean longline series were used in the final stock assessment models investigated in 2015, for the reasons discussed above (**Fig. 9**).

- IOTC Rep. of Korea longline data (1974–1987) from document IOTC–2015–WPB13–24.
- IOTC gillnet data (1983–2013) from document IOTC–2015–WPB13–25.
- Japan longline data (1994–2014) from document IOTC–2015–WPB13–26.

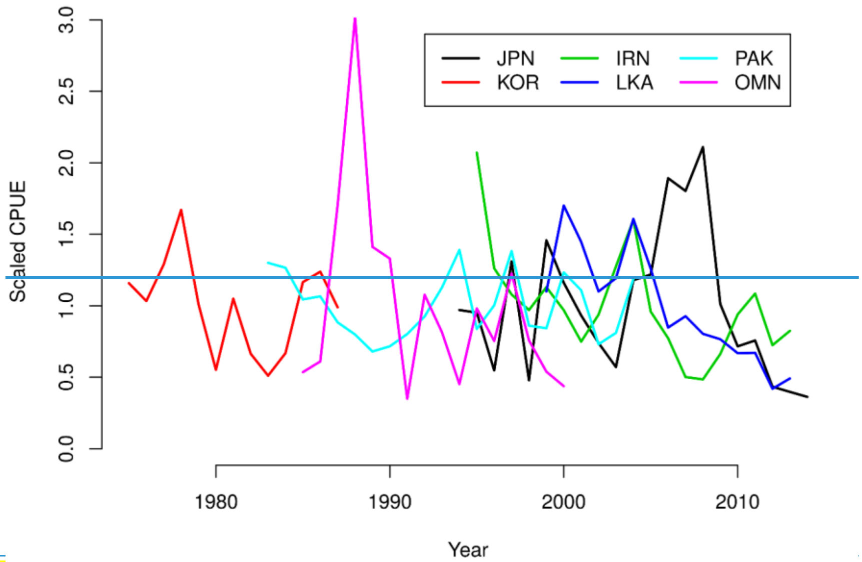

Fig. 9. I.P. sailfish: Catch rates of I.P. sailfish for Rep. of Korea (standardised KOR), I.R. Iran (IRN), Sri Lanka (LKA), Oman (OMN) and Pakistan (PAK) as calculated based on the IOTC catch and effort aggregated dataset (whole Indian Ocean), and for Japan (standardised JPN) as calculated using detailed dataset. Values were scaled with respect to their overall means.

STOCK ASSESSMENT

Since 2015 was the first year the BSPM model was applied, the Stock Reduction Analysis (SRA) has been kept as the basis for current stock status advice. This was primarily due to the following reasons:

- the data was highly uncertain on both the catch and effort series for the gillnet fleet, and
- the Japan longline CPUE was from a fleet that catches a small portion of I.P. sailfish.

The key assessment results for the SRA are shown in **Table 5**. The following should be noted with respect to the SRA modelling approach presented at the meeting:

- The method being assumption based would create difference if the assumptions changed.
- The results were consistent with the assessment done in 2014, though they give a different picture than what the longlines CPUE series indicates.
- The use of this method is useful to estimate target yield but may not be a good indicator of current biomass level.

TABLE 5. Indo-Pacific sailfish: Key management quantities from the SRA approach used in 2015.

Management Quantity	Aggregate Indian Ocean
2014 catch estimate (t)	29,860
Mean catch from 2010–2014 (t)	28,980
MSY (1000 t) (80% CI)	25.00 (16.18–35.17)
Data period (catch)	1950–2014
F_{MSY} (80% CI)	0.26 (0.15–0.39)

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SB_{MSY} or $^{*}B_{MSY}$ (1,000 t) (80% CI)	87.52 (56.3–121.02)
F_{2014}/F_{MSY} (80% CI)	1.05 (0.63–1.63)
B_{2014}/B_{MSY} (80% CI)	1.13 (0.87–1.37)
SB_{2014}/SB_{MSY} (80% CI)	n.a.
B_{2014}/B_{1950} (80% CI)	0.56 (0.44–0.67)
SB_{2014}/SB_{1950} (80% CI)	n.a.
$B_{2014}/B_{1950,\ F=0}$ (80% CI)	n.a.
$SB_{2014}/SB_{1950,\ F=0}$ (80% CI)	n.a.

n.a. = not available

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