

**DRAFT EXECUTIVE SUMMARY: BLACK MARLIN****Status of the Indian Ocean black marlin (BLM: *Makaira indica*) resource****TABLE 1.** Black marlin: Status of black marlin (*Makaira indica*) in the Indian Ocean.

Area <sup>1</sup>	Indicators		2015 stock status determination
Indian Ocean	Catch 2014:	17,966 t	
	Average catch 2010–2014:	13,539 t	
	MSY (1,000 t) (80% CI):	10.2 (7.6–13.8)	
	F <sub>MSY</sub> (80% CI):	0.25 (0.08–0.45)	
	B <sub>MSY</sub> (1,000 t) (80% CI):	37.8 (14.6–62.3)	
	F <sub>2013</sub> /F <sub>MSY</sub> (80% CI):	1.06 (0.39–1.73)	
B <sub>2013</sub> /B <sub>MSY</sub> (80% CI):	1.13 (0.73–1.53)		
B <sub>2013</sub> /B <sub>1950</sub> (80% CI):	0.57 (0.37–0.76)		

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

Colour key	Stock overfished (B <sub>year</sub> /B <sub>MSY</sub> < 1)	Stock not overfished (B <sub>year</sub> /B <sub>MSY</sub> ≥ 1)
Stock subject to overfishing (F <sub>year</sub> /F <sub>MSY</sub> > 1)		
Stock not subject to overfishing (F <sub>year</sub> /F <sub>MSY</sub> ≤ 1)		
Not assessed/Uncertain		

**INDIAN OCEAN STOCK – MANAGEMENT ADVICE**

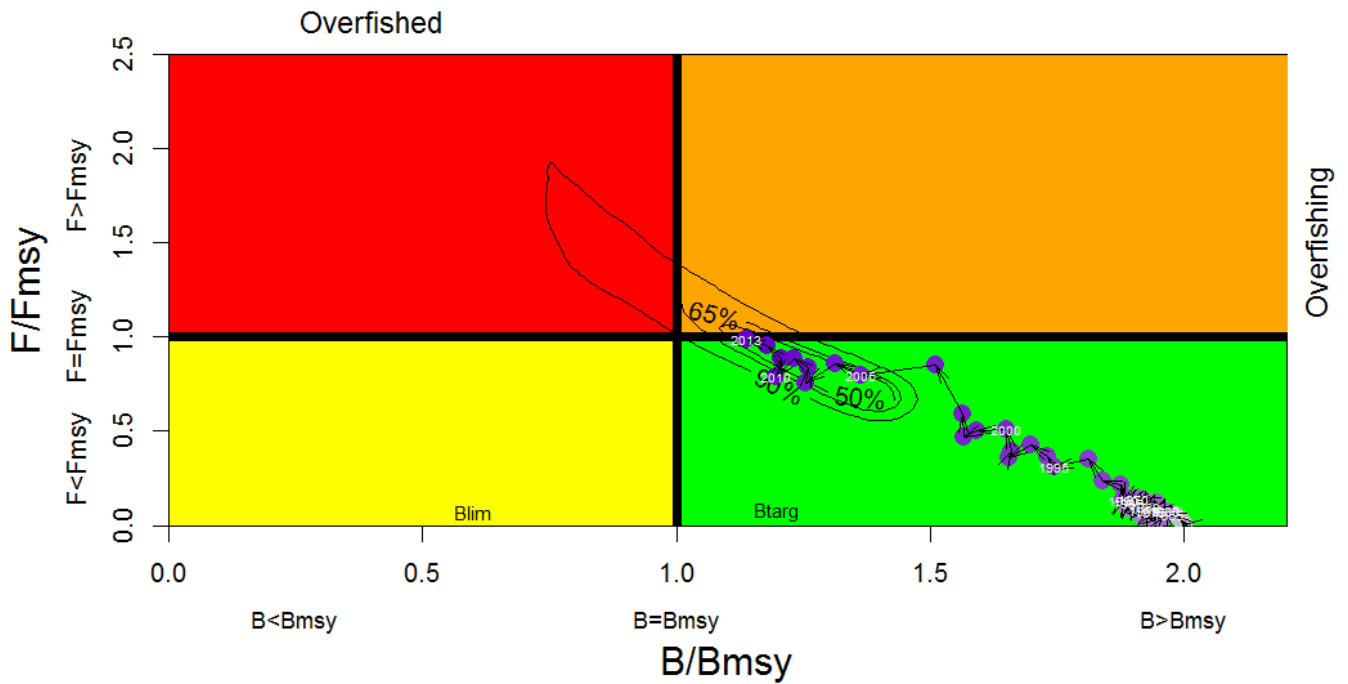
**Stock status.** No stock assessment undertaken in 2015. Thus, the models used in 2014 (using data up until the end of 2013) is used for stock status advice, as well as indicators available in 2015. A Stock reduction analysis (SRA) technique (data poor method) was used for the second time in 2014 on black marlin. The assessment is the best information currently available and as such, is used to determine stock status, with the intention that alternative techniques be applied to further validate the results in 2016. Total catches have continued to increase, with 17,948 t landed in 2014, up by almost 22% from 2013 levels (14,776 t). Thus, the stock status for black marlin in the Indian Ocean is **not overfished** but **subject to overfishing** (Table 1, Fig. 1). The fishery appears to show an increase in catch rates which is a substantial cause of concern, indicating that fishing mortality levels are unsustainable (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 major cause for concern. Research emphasis on developing possible CPUE indicators and further exploration of alternative stock assessment approaches for data poor fisheries are warranted to validate these findings. 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.

**Outlook.** Total catch for black marlin in recent years has continued to increase substantially to a total of 17,948 t in 2014 (Note: MSY estimate ~10,000 t). There is a high to very high risk of exceeding MSY-based reference points by 2016 if catches remain at 2014 levels (≈ 56% risk that B<sub>2016</sub> < B<sub>MSY</sub>, and ≈ 99% risk that F<sub>2016</sub> > F<sub>MSY</sub>) (Table 2).

**Management advice.** A precautionary approach to the management of black marlin should be considered by the Commission, to reduce catches below MSY estimates (~10,000 t), thereby ensuring the stock does not fall below B<sub>MSY</sub>, and become overfished.

The following key points should be noted:

- **Maximum Sustainable Yield (MSY):** estimate for the whole Indian Ocean is between 10,200 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 black marlin.
- **Main fishing gear** (2011–14): gillnet: ~59%; Longline: ~19% (take of the total estimated black marlin catch).
- **Main fleets** (2011–14): I.R. Iran: 24%; Sri Lanka: 23%; India: 23%; Indonesia: 18% (take of the total estimated black marlin catch).



**Fig. 1.** Black marlin: Stock reduction analysis (Catch MSY Method) aggregated Indian Ocean assessment Kobe plots for black marlin (contours are the 50, 65 and 90 percentiles of the 2013 estimate). Black line indicates the trajectory of the point estimates (blue circles) for the spawning biomass (B) ratio and F ratio for each year 1950–2013.

**TABLE 2.** Black Marlin: Indian Ocean stock reduction analysis (SRA) Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based target reference points for nine constant catch projections (average catch level from 2011–13 (12,940 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 2011–13) and probability (%) of violating MSY-based target reference points ( $B_{targ} = B_{MSY}$ ; $F_{targ} = F_{MSY}$ )								
	60% (7,764 t)	70% (9,058 t)	80% (10,352 t)	90% (11,646 t)	100% (12,940 t)	110% (14,234 t)	120% (15,528 t)	130% (16,822 t)	140% (18,116 t)
$SB_{2016} < SB_{MSY}$	17	n.a.	24	n.a.	33	n.a.	44	n.a.	56
$F_{2016} > F_{MSY}$	12	n.a.	30	n.a.	53	n.a.	78	n.a.	99
$SB_{2023} < SB_{MSY}$	10	n.a.	28	n.a.	60	n.a.	95	n.a.	100
$F_{2023} > F_{MSY}$	7	n.a.	28	n.a.	63	n.a.	100	n.a.	100

## APPENDIX I

## SUPPORTING INFORMATION

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

## CONSERVATION AND MANAGEMENT MEASURES

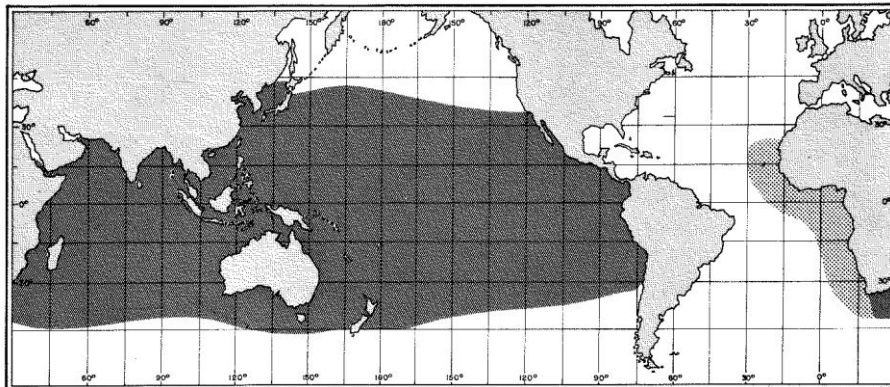
Black marlin (*Makaira indica*) in the Indian Ocean is currently subject to a number of Conservation and Management Measures adopted by the Commission, although none are species specific:

- 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 14/05 concerning a record of licensed foreign vessels fishing for IOTC species in the IOTC area of competence and access agreement information
- Resolution 15/11 on the implementation of a limitation of fishing capacity of Contracting Parties and Cooperating Non-Contracting Parties
- 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

**Black marlin: General**

Black marlin (*Makaira indica*) 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 black marlin and no information on the stock structure or growth and mortality in the Indian Ocean.



**Fig. 2.** Black marlin: The worldwide distribution of black marlin (Source: Nakamura 1984).

**TABLE 3.** Black marlin: Biology of Indian Ocean black marlin (*Makaira indica*).

Parameter	Description
Range and stock structure	Little is known on the biology of the black marlin in the Indian Ocean. Black marlin is a highly migratory, large oceanic apex predator that inhabits tropical and subtropical waters of the Indian and Pacific oceans. Some rare individuals have been reported in the Atlantic Ocean but there is no information to indicate the presence of a breeding stock in this area. Black marlin inhabits oceanic surface waters above the thermocline and typically near land masses, islands and coral reefs; however rare excursions to mesopelagic waters down to depths of 800 m are known. Thought to associate with schools of small tuna, which is one of its primary food sources (also reported to feed on other fishes, squids and other cephalopods, and large decapod crustaceans). No information on stock structure is currently available in the Indian Ocean; thus for the purposes of assessment, one pan-ocean stock is assumed. Long distance migrations at least in the eastern Indian Ocean (two black marlins tagged in Australia were caught off east Indian coast and Sri Lanka) support a single stock hypothesis. It is known that black marlin forms dense nearshore spawning aggregations, making this species vulnerable to exploitation even by small-scale fisheries. Spatial heterogeneity in stock indicators (catch-per-unit-effort trends) for other billfish species indicates that there is potential for localised depletion.
Longevity	No data available for the Indian Ocean. In the Pacific (Australia) 11–12 years.
Maturity (50%)	<b>Age:</b> unknown <b>Size:</b> females around 100 kg; males 50 to 80 kg total weight
Spawning	No spawning grounds have been identified in the Indian ocean. Spawning hotspot off eastern Australia apparently has no

season	links with Indian Ocean stock. Spawning individuals apparently prefer water temperatures above 26–27°C. Highly fecund batch spawner. Females may produce up to 40 million eggs.
Size (length and weight)	<p>Maximum: In other oceans can grow to more than 460 cm FL and weigh 800 kg total weight. In the Indian Ocean it reach at least 360 cm LJFL.</p> <p>Young fish grow very quickly in length then put on weight later in life. In eastern Australian waters black marlin grows from 13 mm long at 13 days old to 180 cm and around 30 kg after 13 months. Sexual dimorphism in size, growth rates and size and age at maturity - females reach larger sizes, grow faster and mature later than males.</p> <p>In the Indian Ocean documented maximum size for females: 306 cm LJFL, 307 kg total weight; males: 280 cm LJFL, 147 kg total weight. Most black marlin larger than 200 kg are female.</p> <p>Recruitment into the fishery: varies by fishing method; ~60 cm LJFL for artisanal fleets and methods. The average size of black marlin taken in Indian Ocean longline fisheries is not available.</p> <p>L-W relationships for the Indian Ocean are: females <math>TW=0.00000010*LJFL^{**3.7578}</math>, males <math>TW=0.00002661*LJFL^{**3.7578}</math>, both sexes mixed <math>TW=0.00000096*LJFL^{**3.35727}</math>, TW in kg, LJFL in cm. However these relationships were obtained from small sample sizes (n=75), therefore it should be treated with caution.</p>

Sources: Nakamura 1985, Cyr et al. 1990, Gunn et al. 2003, Speare 2003; Sun et al. 2007, Froese & Pauly 2009, Romanov & Romanova 2012, Domeier & Speare 2012

### ***Black marlin: Fisheries and main catch trends***

- **Main fishing gear (2011–14):** black marlin are largely considered to be a non-target species of industrial and artisanal fisheries. Gillnets account for around 59% of total catches in the Indian Ocean, followed by longlines (19%), with remaining catches recorded under troll and handlines. (**Fig. 3**)
- **Main fleets (and primary gear associated with catches): percentage of total catches (2011–14):** Iran (gillnet): 24%; Sri Lanka (gillnet and fresh longline): 23%; India (gillnet and troll): 23%; Indonesia (fresh longline and hand lines): 18% (**Fig. 4**).
- **Main fishing areas:** Primary: between the early-1950s and the late-1980s part of the Japanese fleet was licensed to operate within the EEZ of Australia, and reported very high catches in that area, in particular in waters off northwest Australia. Secondary: in recent years, deep-freezing longliners from Japan and Taiwan, China have reported catches of black marlin off the western coast of India and the Mozambique Channel (**Figs. 5, 6**)
- **Retained catch trends:**  
Catches have increased steadily since the 1990s, from 2,800 t in 1991 to over 10,000 t since 2008. The highest catches were recorded in 2014, at nearly 18,000 t (**Table 4**) – largely due to increases reported by the offshore gillnet fisheries of I.R. Iran.  
  
Catches in Sri Lanka have also risen steadily since the mid-1990's as a result of the development of the fishery using a combination of drifting gillnets and longlines, from around 1,000 t in the early 1990s to over 3,000 t in recent years.
- **Discard levels:** Low, although estimates of discards are unknown for most industrial fisheries, mainly longliners. Discards may also occur in some gillnet fisheries.

***Changes to the catch series:*** no major changes to the catch series since the WPB meeting in 2014, when catches were revised substantially following new reports of catches-by-species for drifting gillnet fleets by Iran<sup>1</sup>.

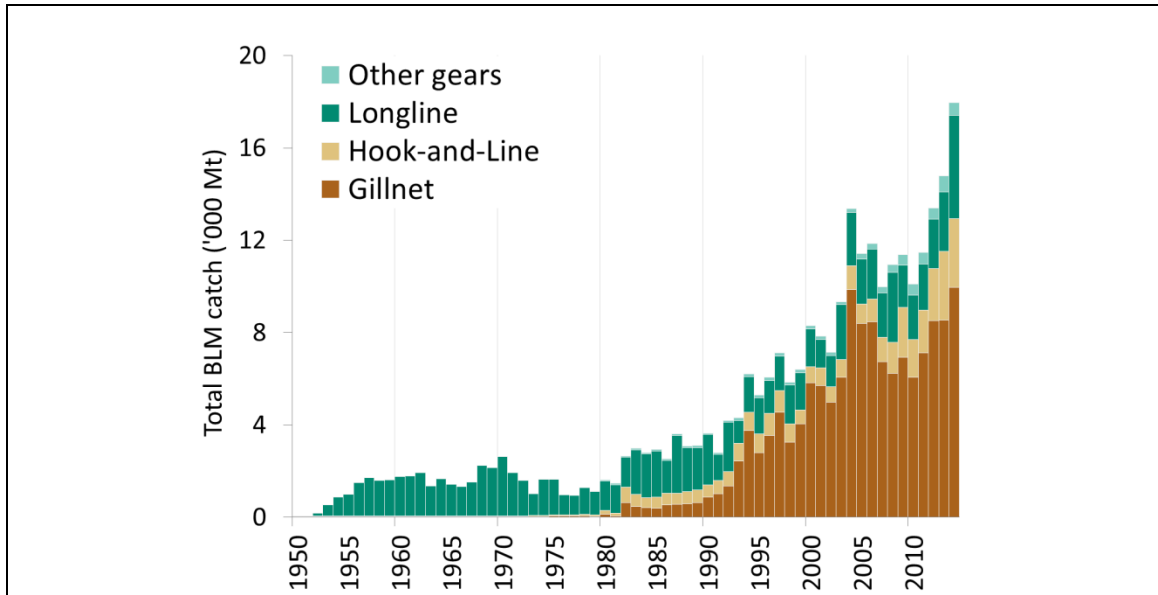
Any differences in the data series since the last WPB are changes to the nominal catch as a result of reallocation of catches reported as other billfish species or as aggregated billfish species groups reported by, e.g., Sri Lanka, and Pakistan to a lesser extent. These changes, however, did not lead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

<sup>1</sup> Prior to 2013 I.R. Iran reported aggregated catches for all billfish species, which were estimated by species and gear by the IOTC Secretariat. Iran has provided catches by billfish species for the first time, from 2012 onwards, which significantly revised the catch-by-species previously estimated by the Secretariat: the main change being the higher proportions of black marlin, rather than blue marlin reported by I.R. Iran, assigned to the offshore gillnet fishery. As a result of changes in the catch series total catches of black marlin for I.R. Iran were revised upwards by as much as 30% to 50% for a number of years around the mid-2000's.

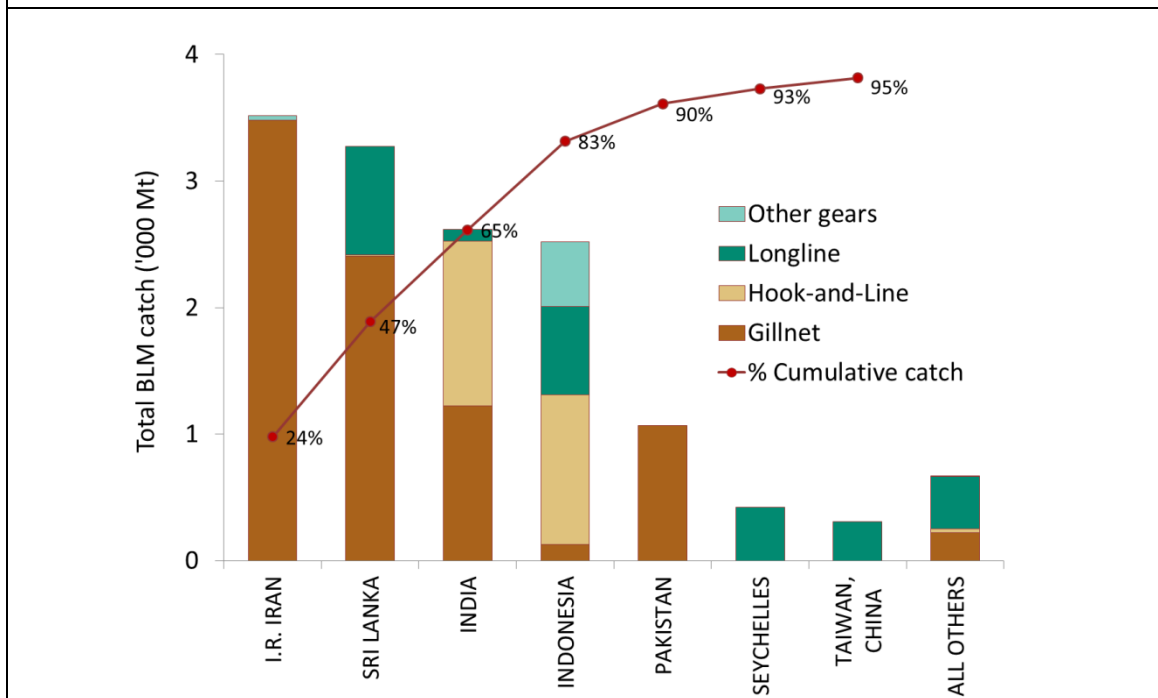
**TABLE 4.** Black marlin: best scientific estimates of catches by type of fishery for the period 1950–2014 (in metric tons). Data as of November 2015.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
LL	862	1,661	1,391	1,727	1,571	1,979	1,953	2,169	1,920	3,025	1,834	1,929	1,989	2,134	2,554	4,676
GN	26	31	44	439	2,761	6,917	8,390	8,458	6,738	6,227	6,936	6,071	7,115	8,517	8,530	9,936
HL	24	27	42	447	742	1,032	840	983	1,060	1,357	2,146	1,629	1,865	2,261	3,000	2,865
OT			4	65	112	226	227	237	257	329	460	472	490	483	693	490
<b>Total</b>	<b>912</b>	<b>1,719</b>	<b>1,480</b>	<b>2,679</b>	<b>5,186</b>	<b>10,154</b>	<b>11,411</b>	<b>11,847</b>	<b>9,975</b>	<b>10,938</b>	<b>11,376</b>	<b>10,101</b>	<b>11,459</b>	<b>13,395</b>	<b>14,776</b>	<b>17,966</b>

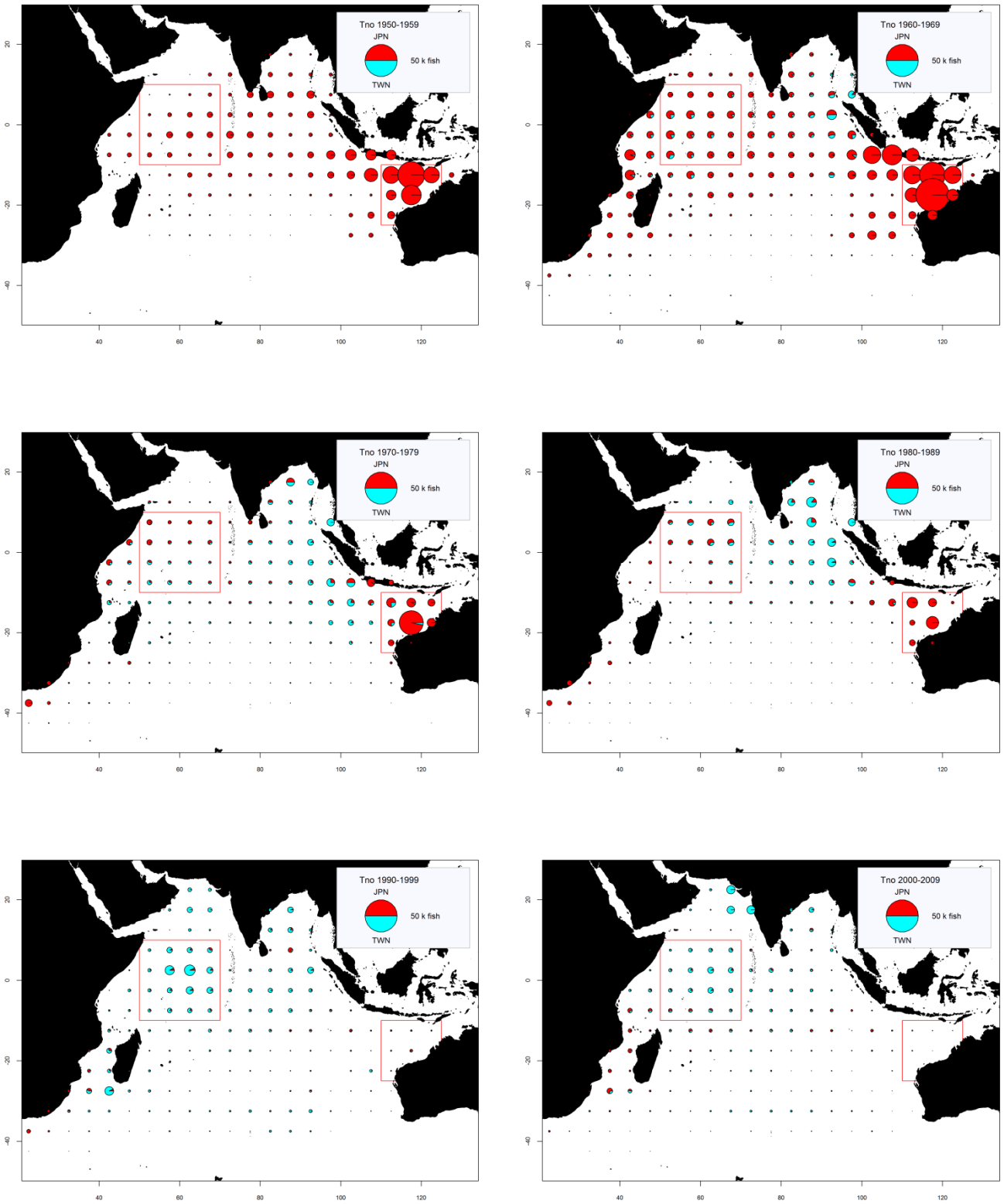
**Fisheries:** Longline (LL); Gillnet (GN); Hook-and-Line (includes handline, trolling, baitboat, and sport fisheries) (HL); Other gears (includes coastal purse seine, Danish purse seine, beach seine, and purse seine) (OT).



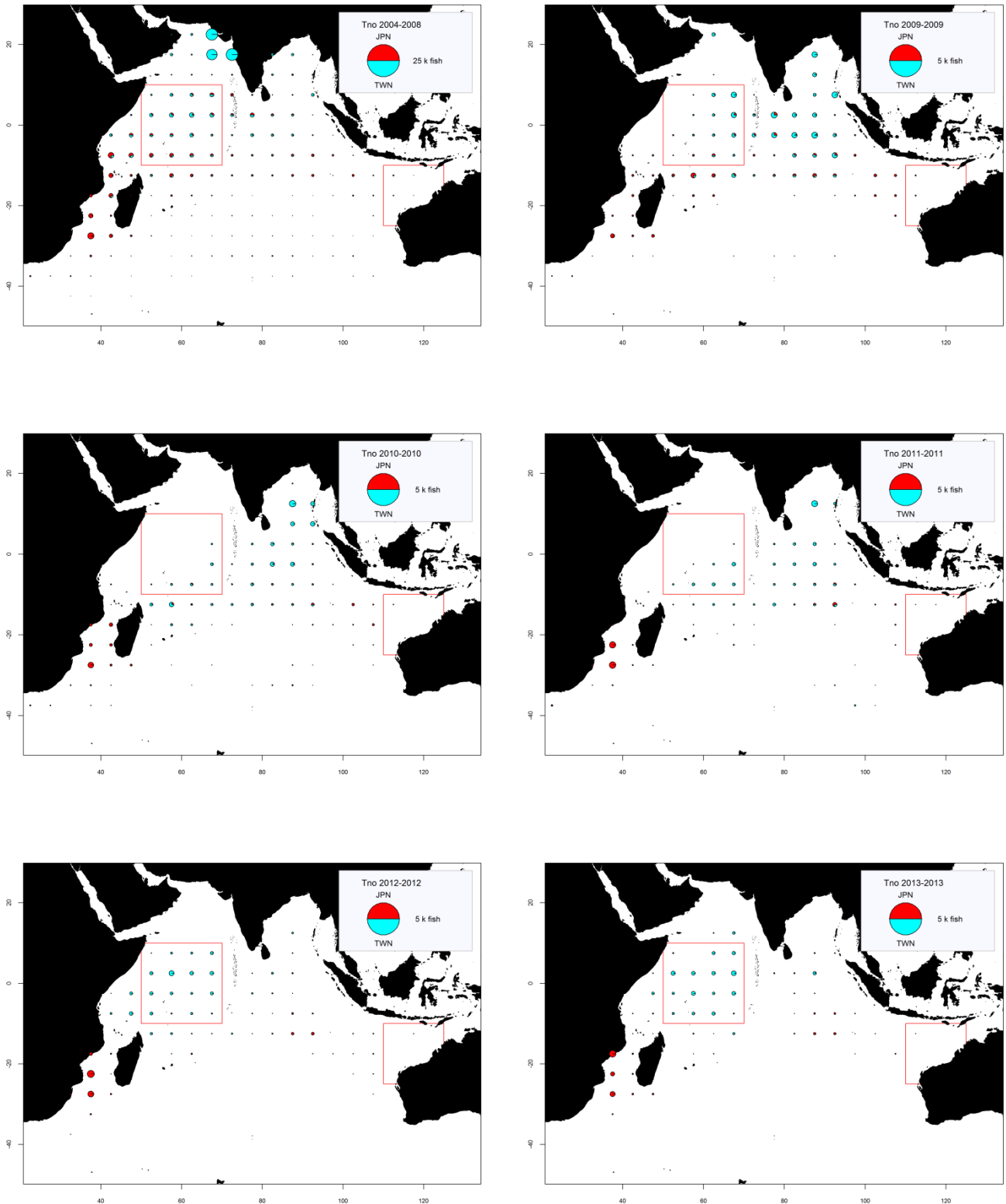
**Fig. 3.** Black marlin: catches by gear and year recorded in the IOTC Database (1950–2014). Other gears includes: coastal purse seine, Danish purse seine, beach seine and purse seine.



**Fig. 5.** Black marlin: average catches in the Indian Ocean over the period 2011–14, 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 black marlin for the fleets concerned, over the total combined catches reported from all fleets and gears.



**Fig. 5a-f.** Time-area catches (in number of fish) of black marlin as reported for the longline fisheries of Japan (JPN) and Taiwan,China (TWN) for the period 1950–2009, by decade and fleet. Red lines represent the marlin hotspots identified by the IOTC WPB.



**Fig. 6a-f.** Time-area catches (in number of fish) of black marlin as reported for the longline fisheries of Japan (JPN) and Taiwan,China (TWN) for the period 2004–08 by fleet and for 2009–13, by year and fleet. Red lines represent the marlin hotspots identified by the IOTC WPB.

#### *Black marlin: estimation of catches – data related issues*

**Retained catches** – a very high proportion of the catches of black marlin are estimated, or adjusted, by the IOTC Secretariat are (**Fig. 7a**), due to a number of uncertainties in the catches:

- Species aggregates: catch reports often refer to total catches of all three marlin species combined or as an aggregate of all billfish species; catches by species are estimated by the IOTC Secretariat for some years and artisanal fisheries (e.g., gillnet/longline fishery of Sri Lanka and artisanal fisheries of India, Iran and Pakistan) and industrial fisheries (e.g., longliners of Indonesia and Philippines).
- Non-reporting fleets: catches of non-reporting industrial longliners (e.g., India, NEI) and the gillnet fishery of Indonesia are estimated by the IOTC Secretariat using alternative information.
- Non-target species: catches are likely to be incomplete for industrial fisheries for which black marlin is not a target species.
- Conflicting catch reports: longline catches from the Republic of Korea reported as nominal catches, and catch and effort reports are conflicting, with higher catches recorded in the catch and effort table. For this reason, the IOTC Secretariat revised the catches of black marlin for the Republic of Korea over the time-series using both datasets. Although the new catches estimated by the IOTC Secretariat are thought to be more accurate, catches of blue marlin remain uncertain for this fleet.
- Lack of catch data for most sport fisheries.
- Species mis-identification: difficulties in the identification of marlins also contribute to uncertainties in the catch estimates of black marlin available to the IOTC Secretariat.

#### ***Black marlin – Nominal catch-per-unit-effort (CPUE) trends***

- Availability: Standardized CPUE series have not yet been developed for black marlin. Nominal CPUE series are available for some industrial longline fisheries, although catches are likely to be incomplete (as catches of non-target species are not always recorded in logbooks).

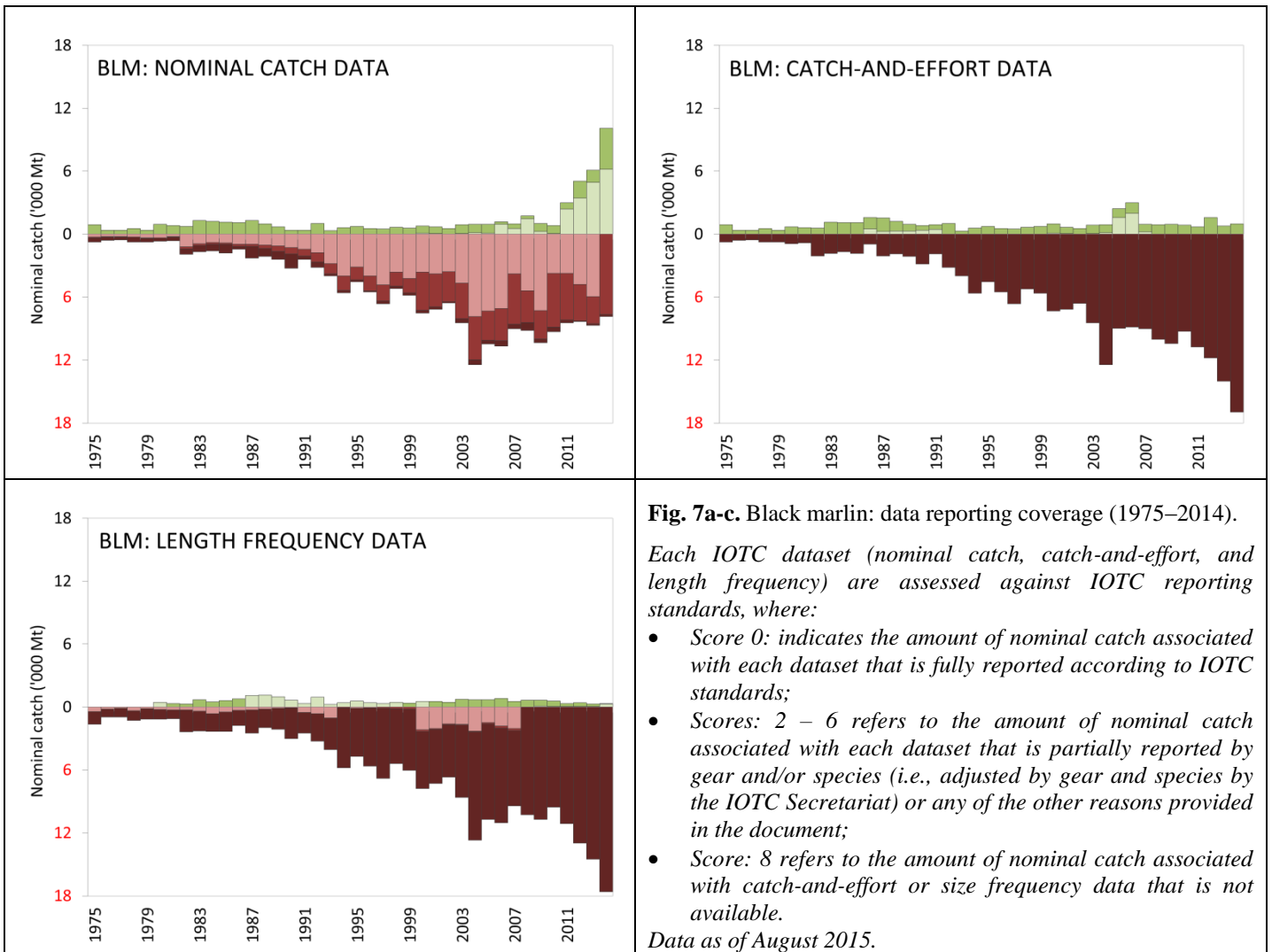
No catch-and-effort data are available from sports fisheries, other than for partial data from the sports fisheries of Kenya; likewise no data are available for other artisanal fisheries (gillnet fisheries of I.R. Iran and Pakistan, gillnet/longlines of Sri Lanka, gillnets of Indonesia) or other industrial fisheries (NEI longliners and all purse seiners).

- Main CPUE series available: Japanese longline fleet.

#### ***Black marlin – 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. However, the number of specimens measured on Japanese longliners in recent years is very low. Also the length frequency distributions derived from samples collected by fishermen on Taiwanese longliners are likely to be biased.
- 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 IOTC Secretariat by CPCs.





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	

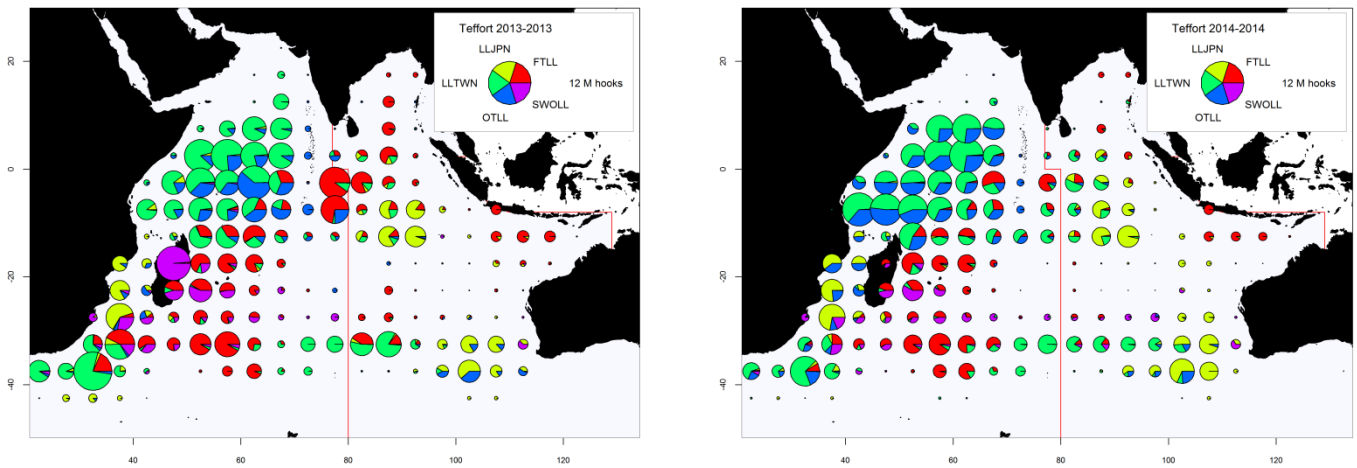
Size frequency data	Time-period	Area
Available according to standards	0	0
Not available according to standards	2	2
Low coverage (less than 1 fish measured by metric ton of catch)	2	
Not available at all	8	

Key to colour coding

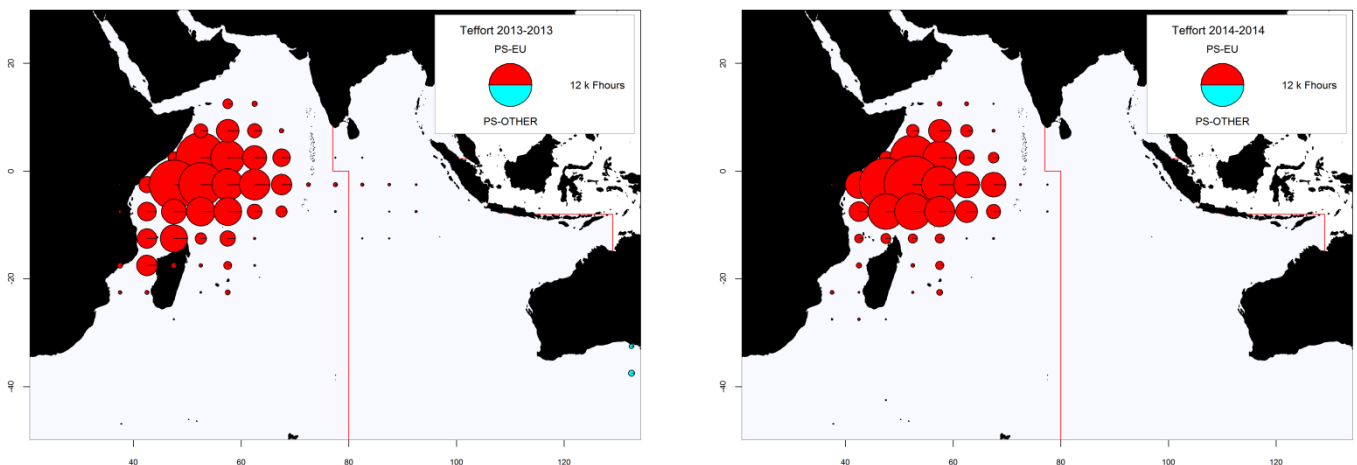
	Total score is 0 (or average score is 0-1)
	Total score is 2 (or average score is 1-3)
	Total score is 4 (or average score is 3-5)
	Total score is 6 (or average score is 5-7)
	Total score is 8 (or average score is 7-8)

**Black marlin: Effort trends**

Total effort from longline vessels flagged to Japan, Taiwan,China and EU,Spain by five degree square grid in 2013 and 2014 are provided in **Fig. 8**, 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 2013 and 2014 are provided in **Fig. 9**.



**Fig. 8.** Number of hooks set (millions) from longline vessels by five degree square grid and main fleets, for the years 2013 (left) and 2014 (right) (Data as of October 2015). **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).

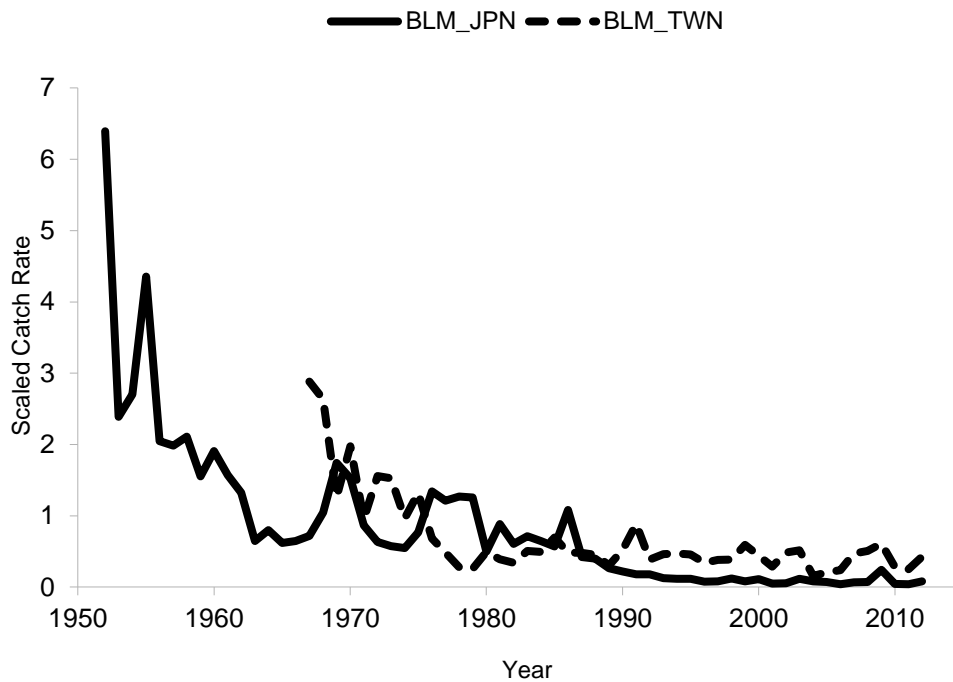


**Fig. 9.** Number of hours of fishing (Fhours) from purse seine vessels by 5 degree square grid and main fleets, for the years 2013 (left) and 2014 (right) (Data as of October 2015). **PS-EU** (red): Industrial purse seiners monitored by the EU and Seychelles (operating under flags of EU countries, 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).

**Black marlin: Standardised catch–per–unit–effort (CPUE) trends**

Catch rate time series for the longline fleets of Japan and Taiwan,China (**Fig. 10**) show a similar decreasing trend from 1960's until the end of 2000's. There is no available data for the longline fleet of Taiwan,China for the 1950's and part of the 1960's. Catch rates as calculated based on Japanese dataset show a strong decreasing trend in the early 1950's, in the very beginning of the commercial fisheries. Nevertheless it is important to highlight the doubts on the reliability of

the results based on aggregated data sets not fully reviewed by experts on Japanese longline fisheries. The sharp decline between 1952 and 1958 in the Japanese black marlin CPUE series does not reflect the trend in abundance.



**Fig. 10.** Black marlin: Standardised catch rates of black marlin for Japan (JPN) and Taiwan,China (TWN) as calculated based on the IOTC catch and effort aggregated dataset. Values were scaled with respect to the mean of 1970–1979 period.

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 Iran and Pakistan, gillnet/longlines of Sri Lanka, gillnets of Indonesia) or industrial fisheries (NEI longliners and all purse seiners).

#### STOCK ASSESSMENT

Alternative approaches should continue to be explored using the following:

- More effort should be made in examining the standardised CPUE data for use in the assessments as these are the basis for assessments without any age/length data available.
- More attention should be paid to the amount of effective hooks at the depth where the marlins are abundant.
- Age/Length data over time should be collected so that alternative approaches could be examined.
- Further examination of the data poor approaches along with a further developed Bayesian SP Model should be focussed on in 2015 when marlin are next assessed. Since the State-Space model developed is still in beta mode, further work needs to be done on this before endorsing the method.

A sensitivity analysis should be performed using Stock Reduction Analysis methodology, using different series of catch data to assess how robust the estimation of reference points for management are, and how the stock status determination performs.

The results of the stock assessment of black marlin (**Table 5**) are based on very limited information and in particular are compromised by the uncertainty in the estimates of catches for this species, over the time series. For this reason, the status of the stock is considered to have a high degree of uncertainty. The precautionary approach calls for a more conservative approach for data poor stocks. Thus, the stock status summary for black marlin reflects the results of the assessment but at the same time incorporates information about the approach used.

**TABLE 5.** Black marlin (*Makaira indica*): Key management quantities from the Stock Reduction Analysis model, for the Indian Ocean Black marlin.

Management Quantity	Indian Ocean
2013 catch estimate	11,443 t
Mean catch from 2009–2013	10,803 t
MSY (1,000 t) (80% CI)	10.20 (8.40–12.30)
Data period used in assessment	1950–2013
F <sub>MSY</sub> (80% CI)	0.25 (0.14–0.38)
B <sub>MSY</sub> (1,000 t) (80% CI)	37.80 (22.90–52.04)
F <sub>2013</sub> /F <sub>MSY</sub> (80% CI)	1.06 (0.62–1.50)
B <sub>2013</sub> /B <sub>MSY</sub> (80% CI)	1.13 (0.87–1.39)
SB <sub>2013</sub> /SB <sub>MSY</sub> (80% CI)	n.a.
B <sub>2013</sub> /B <sub>1950</sub> (80% CI)	0.57 (0.44–0.70)
SB <sub>2013</sub> /SB <sub>1950</sub> (80% CI)	n.a.
B <sub>2013</sub> /B <sub>1950, F=0</sub> (80% CI)	n.a.
SB <sub>2013</sub> /SB <sub>1950, F=0</sub> (80% CI)	n.a.

**LITERATURE CITED**

- Cyr EC, Dean JM, Jehangeer I, Nallee M (1990) Age, growth, and reproduction of blue marlin and black marlin from the Indian Ocean. In: Stroud RH (ed) Planning the future of billfishes. Research and management in the 90s and beyond. National Coalition for Marine Conservation, Savannah, GA, pp 309–316
- Froese R, Pauly DE (2009) FishBase, version 02/2009, FishBase Consortium, <www.fishbase.org>
- Gunn JS, Patterson TA, Pepperell JG (2003) Short-term movement and behaviour of black marlin *Makaira indica* in the Coral Sea as determined through a pop-up satellite archival tagging experiment. Mar Freshw Res 54: 515–525
- 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
- Romanov EV (2002) Bycatch in the tuna purse-seine fisheries of the western Indian Ocean. Fish Bull 100 (1): 90–105
- Romanov E, Romanova N (2012) Size distribution and length-weight relationships of some billfish (marlins, spearfish and swordfish) in the Indian Ocean. IOTC–WPB–2012–18
- Speare P (2003) Age and growth of black marlin, *Makaira indica*, in east coast Australian waters. Mar Freshw Res 54(4): 307–314
- Sun C, Liu C, Yeh S (2007) Age and growth of black marlin (*Makaira indica*) in the waters off eastern Taiwan. Paper presented to the WCPFC Scientific Committee, WCPFC-SC3-BI SWG/WP-2