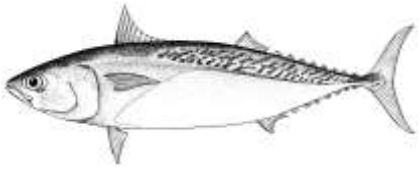
DRAFT: EXECUTIVE SUMMARY: FRIGATE TUNA

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



Status of the Indian Ocean frigate tuna (FRI: *Auxis thazard*) resource

TABLE 1. Frigate tuna: Status of frigate tuna (*Auxis thazard*) in the Indian Ocean

Area[1]	Indicators		2013 stock status determination
Indian Ocean	Catch[2] 2012: Average catch[2] 2008–2012:	83,029t 90,221t	
	MSY: F_{2012}/F_{MSY}: SB_{2012}/SB_{MSY}: SB_{2012}/SB_0:	unknown unknown unknown unknown	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2]Nominal catches represent those estimated by the IOTC Secretariat. If these data are not reported by CPCs, the IOTC Secretariat estimates total catch from a range of sources including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; data reported by other parties on the activity of vessels; and data collected through sampling at the landing place or at sea by scientific observers.

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		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty about stock structure and the total catches. No quantitative stock assessment is currently available for frigate tuna 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 fisheries for this species combined with the lack of data on which to base a more formal assessment are a cause for considerable concern.

Outlook. The continued increase of annual catches for frigate tuna is likely to have further increased the pressure on the Indian Ocean stock as a whole, however there is not sufficient information to evaluate the effect that this increase may have had on the resource. Research emphasis on improving indicators and exploration of stock structure and stock assessment approaches for data poor fisheries are warranted. The following should be noted:

- the Maximum Sustainable Yield estimate for the whole Indian Ocean is unknown.
- annual catches 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 Neritic Tunas and other sources as cited)

CONSERVATION AND MANAGEMENT MEASURES

Frigate tuna (*Auxis thazard*) in the Indian Ocean is 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
- Resolution 13/07 concerning a record of licensed foreign vessels fishing for IOTC species in the IOTC area of

competence and access agreement information
- Resolution 12/11 *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 10/08 *concerning a record of active vessels fishing for tunas and swordfish in the IOTC area*

FISHERIES INDICATORS

Frigate tuna: General

Frigate tuna (*Auxis thazard*) is a highly migratory species found in both coastal and oceanic waters. It is highly gregarious and often schools with other Scombrids. Table 2 outlines some key life history parameters relevant for management.

TABLE 2. Frigate tuna: Biology of Indian Ocean frigate tuna (*Auxis thazard*)

Parameter	Description
Range and stock structure	Little is known on the biology of frigate tuna in the Indian Ocean. Highly migratory species found in both coastal and oceanic waters. It is highly gregarious and often schools with other Scombrids. Frigate tuna feeds on small fish, squids and planktonic crustaceans (e.g. decapods and stomatopods). Because of their high abundance, frigate tuna are considered to be an important prey for a range of species, especially the commercial tunas. No information is available on the stock structure of frigate tuna in Indian Ocean.
Longevity	Females n.a; Males n.a.
Maturity (50%)	**Age**: n.a.; females n.a. males n.a. **Size:** females and males ~29–35 cm FL.
Spawning season	In the southern Indian Ocean, the spawning season extends from August to April whereas north of the equator it is from January to April. Fecundity ranges between 200,000 and 1.06 million eggs per spawning (depending on size).
Size (length and weight)	Maximum: Females and males 60 cm FL; weight n.a.

n.a. = not available. Sources: Froese & Pauly 2009

Frigate tuna – Fisheries and catch trends

Frigate tuna is taken from across the Indian Ocean area using gillnets, handlines and trolling, and pole-and-lines (Table 3; Fig. 1). This species is also an important bycatch (byproduct) for industrial purse seiners and is the target of some ring net fisheries (recorded as purse seine in Table 3). The catch estimates for frigate tuna were derived from very small amounts of information and are therefore highly uncertain[1] (Fig. 3).

TABLE 3. Frigate tuna: Best scientific estimates of the catches of frigate tuna by type of fishery for the period 1950–2012 (in metric tonnes) (Data as of October 2013).

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Purse seine	0	13	931	4,835	7,449	9,811	10,135	10,331	10,093	10,983	9,649	10,054	9,498	12,038	11,235	10,105
Gillnet	479	1,234	2,848	6,973	14,508	19,718	18,660	19,250	18,316	21,521	21,941	25,218	23,452	30,872	30,095	30,027
Line	1,270	2,413	4,421	7,423	13,751	26,043	22,750	25,692	22,587	25,987	27,864	33,651	34,037	37,801	38,145	28,897
Other	1,441	2,007	2,349	3,683	9,279	13,239	12,238	12,229	12,204	11,997	13,725	16,531	17,887	18,535	19,027	13,999
Total	**3,190**	**5,668**	**10,548**	**22,914**	**44,988**	**68,812**	**63,783**	**67,502**	**63,201**	**70,488**	**73,179**	**85,454**	**84,873**	**99,246**	**98,501**	**83,029**

[1] The uncertainty in the catch estimates has been assessed by the IOTC Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of non-reporting fleets for which catches had to be estimated.

The catches provided in Table 3 are based on the information available at the IOTC Secretariat and the following observations on the catches cannot currently be verified. Estimated catches have increased steadily since the late 1970's reaching around 30,000 t in the mid 1980's and over 60,000 t by the 2000's. Catches increased substantially from the mid-2000's reaching around 100,000 t in 2010 (Table 3; Fig. 2). The catches of frigate tuna have been higher in the east since the late 1990's, with three quarters of total catches of frigate tuna taken in the eastern Indian Ocean in recent years.

Following several major reviews of artisanal fisheries in 2012–13 by the IOTC Secretariat – in particular for Indonesia, Sri Lanka and India – catches of frigate have been increased for all years from the 1950s onwards (on average by around 10%-30%), compared to previous estimates published by IOTC.

In recent years (2010-2012), the countries attributed with the highest catches are Indonesia (60%), India (14%), Sri Lanka (11%) and Iran (7%) (Table 3; Fig. 2).

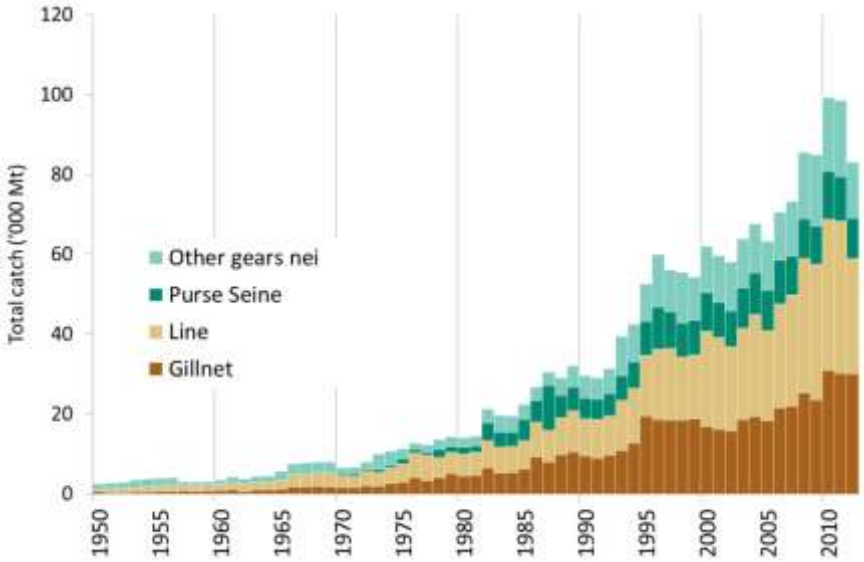


Fig. 1. Frigate tuna: Annual catches of frigate tuna by gear recorded in the IOTC Database (1950–2012) (Data as of October 2013).

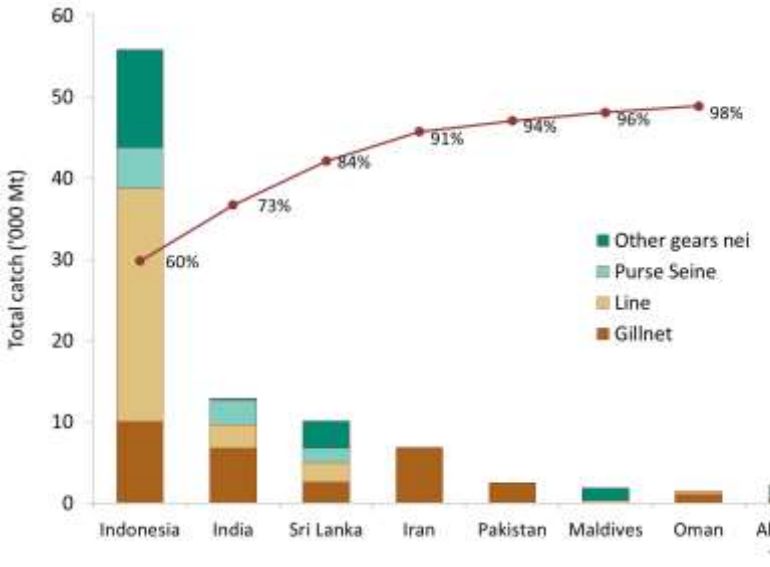


Fig. 2. **Frigate tuna**: average catches in the Indian Ocean over the period 2010–12, by country. Countries are ordered from left to right, according to the importance of catches of frigate tuna reported. The red line indicates the (cumulative) proportion of catches of frigate tuna for the countries concerned, over the total combined catches of this species reported from all countries and fisheries (Data as of October 2013).

Frigate tuna – uncertainty of catches

Retained catches are highly uncertain (Fig. 3) notably for the following fisheries:

- Artisanal fisheries of Indonesia: Indonesia did not report catches of frigate tuna by species or by gear for 1950–2004; catches of frigate tuna, bullet tuna and other species were reported aggregated for this period. In the past, the IOTC Secretariat used the catches reported since 2005 to break the aggregates for 1950–2004, by gear and species. However, in a recent review it was indicated that the catches of frigate tuna had been underestimated by Indonesia. While the new catches estimated for frigate tuna in Indonesia remain uncertain, representing around 60% of the total catches of this species in the Indian Ocean in recent years (2010–12), the new estimates are considered more reliable.
- Artisanal fisheries of India and Sri Lanka: Although these countries report catches of frigate tuna until recently, the catches have not been reported by gear. The catches of both countries were also reviewed and assigned by gear on the basis of official reports and information from various other alternative sources. The new catches estimated for Sri Lanka are as much as three times higher than previous estimates. In recent years, the combined catches of frigate tuna for both countries have represented 25% of the total catches of this species in the Indian Ocean.
- Artisanal fisheries of Myanmar (and Somalia): None of these countries have reported catches of frigate tuna to the IOTC Secretariat. Catch levels are unknown.
- Other artisanal fisheries: The catches of frigate tuna and bullet tuna are seldom reported by species and, when reported by species, they usually refer to both species (due to mislabeling, with all catches assigned as frigate tuna).
- Industrial fisheries: The catches of frigate tuna recorded for industrial purse seiners are thought to be a fraction of those retained on board. Due to this species being a bycatch, its catches are seldom recorded in the logbooks, nor can they be monitored in port. The EU recently reported catch levels of frigate tuna for its purse seine fleet, for 2003–07, estimated using observer data.
- Discard levels are moderate for industrial purse seine fisheries. The EU recently reported discard levels of frigate tuna for its purse seine fleet, for 2003–07, estimated using observer data.
- Changes to the catch series: The catch series of frigate tuna has changed substantially since the WPNT meeting in 2012, following major reviews of catch time series for Indonesia, India, and Sri Lanka.

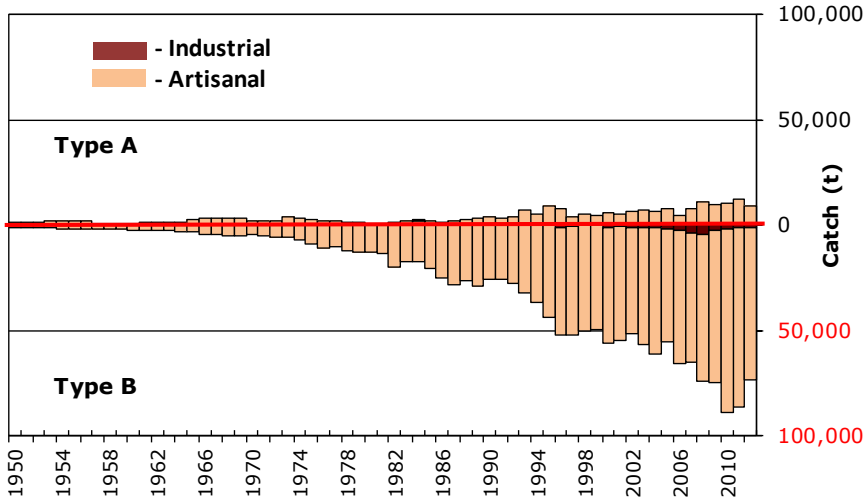


Fig. 3. Frigate tuna: Uncertainty of annual catch estimates for frigate tuna (1950–2012). Catches below the zero-line (Type B) refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat), do not report catch data by gear and/or species (broken by gear and species by the IOTC Secretariat) 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 (Data as of October 2013).

Frigate tuna – Effort trends

Effort trends are unknown for frigate tuna in the Indian Ocean.

Frigate tuna – Catch–per–unit–effort (CPUE) trends

Standardised CPUE series have not yet been developed. Catch-and-effort series are available from some fisheries but they are considered highly incomplete (Fig. 4). In most cases catch-and-effort data are only available for short periods. Reasonably long catch-and-effort series (extending for more than 10 years) are only available for Maldives baitboats and hand and troll lines (Table. 4) and Sri Lanka gillnets. The catches and effort recorded for Sri Lankan gillnets are, however, thought to be inaccurate due to the dramatic changes in CPUE recorded between consecutive years.

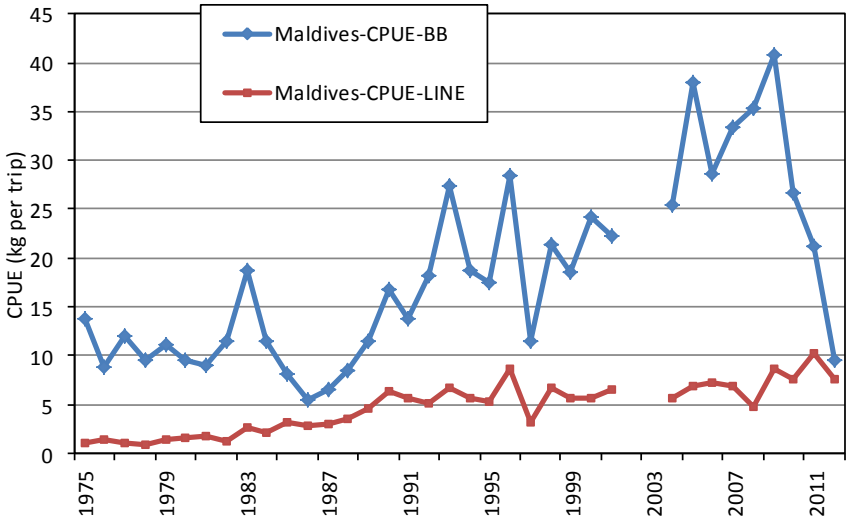
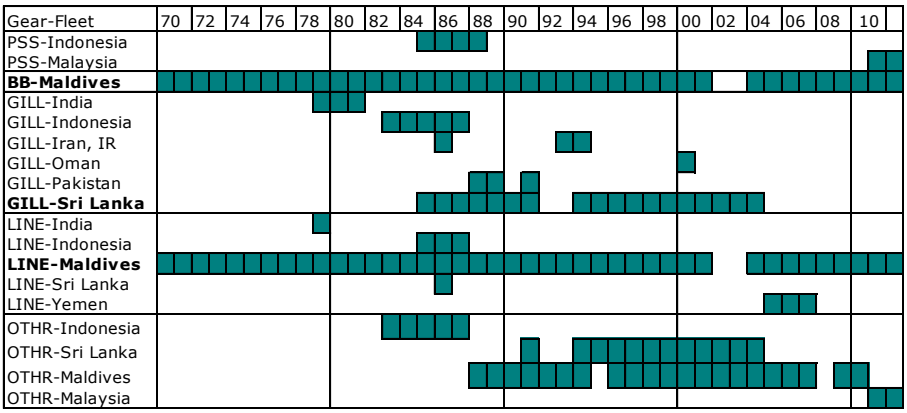


Fig. 4. Frigate tuna: Nominal CPUE series for the baitboat (BB using mechanied boats) and line (LINE, including handlines and trolling using mechanized boats) fisheries of Maldives derived from the available catches and effort data (1975–2012)

TABLE 4. Frigate tuna: Availability of catches and effort series, by fishery and year (1970–2012)[2]. Note that no catches and effort are available for the period 1950–69 in the IOTC Secretariat databases

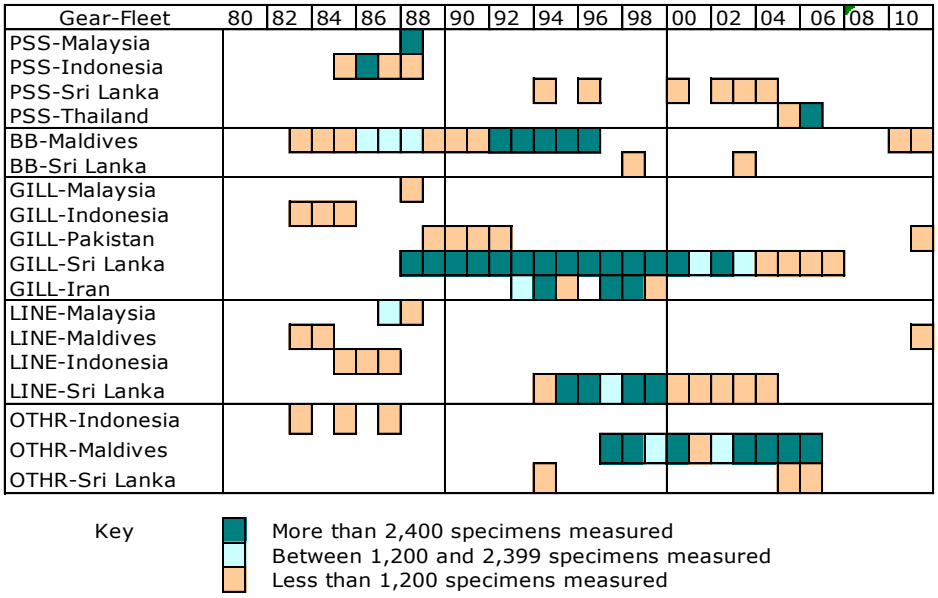


Frigate tuna – Fish size or age trends (e.g. by length, weight, sex and/or maturity)

- Trends in average weight can only be assessed for Sri Lankan gillnets and Maldivian pole-and-lines but the amount of specimens measured has been very low in recent years (Table 5). The length frequency data available from the mid-eighties to the early nineties was obtained with the support of the IPTP (Indo-Pacific Tuna Programme). Unfortunately, data collection did not continue in most countries after the end of the IPTP activities

[2] Note that the above list is not exhaustive, showing only the fisheries for which catches and effort are available in the IOTC database. Furthermore, when available catches and effort may not be available throughout the year existing only for short periods

TABLE 5: Frigate tuna: Availability of length frequency data, by fishery and year (1980–2012)[3]. Note that no length frequency data are available for the period 1950–82



- The size of frigate tunas taken by the Indian Ocean fisheries typically ranges between 20 and 50 cm depending on the type of gear used, season and location (Fig. 5). The fisheries operating in the Andaman Sea (coastal purse seines and troll lines) tend to catch frigate tuna of small to medium size (15–40 cm) while the gillnet, baitboat and other fisheries operating in the Indian Ocean catch usually larger specimens (25–50 cm).
- Catch-at-Size(Age) data are not available for the frigate tuna due to the paucity of size data available from most fleets (Table 5) and the uncertain status of the catches for this species (Fig. 3). Length distributions derived from the data available for some selected fisheries are shown in Fig. 5.
- Sex ratio data have not been provided to the Secretariat by CPCs.

[3] Note that the above list is not exhaustive, showing only the fisheries for which size data are available in the IOTC database. Furthermore, when available size data may not be available throughout the year existing only for short periods

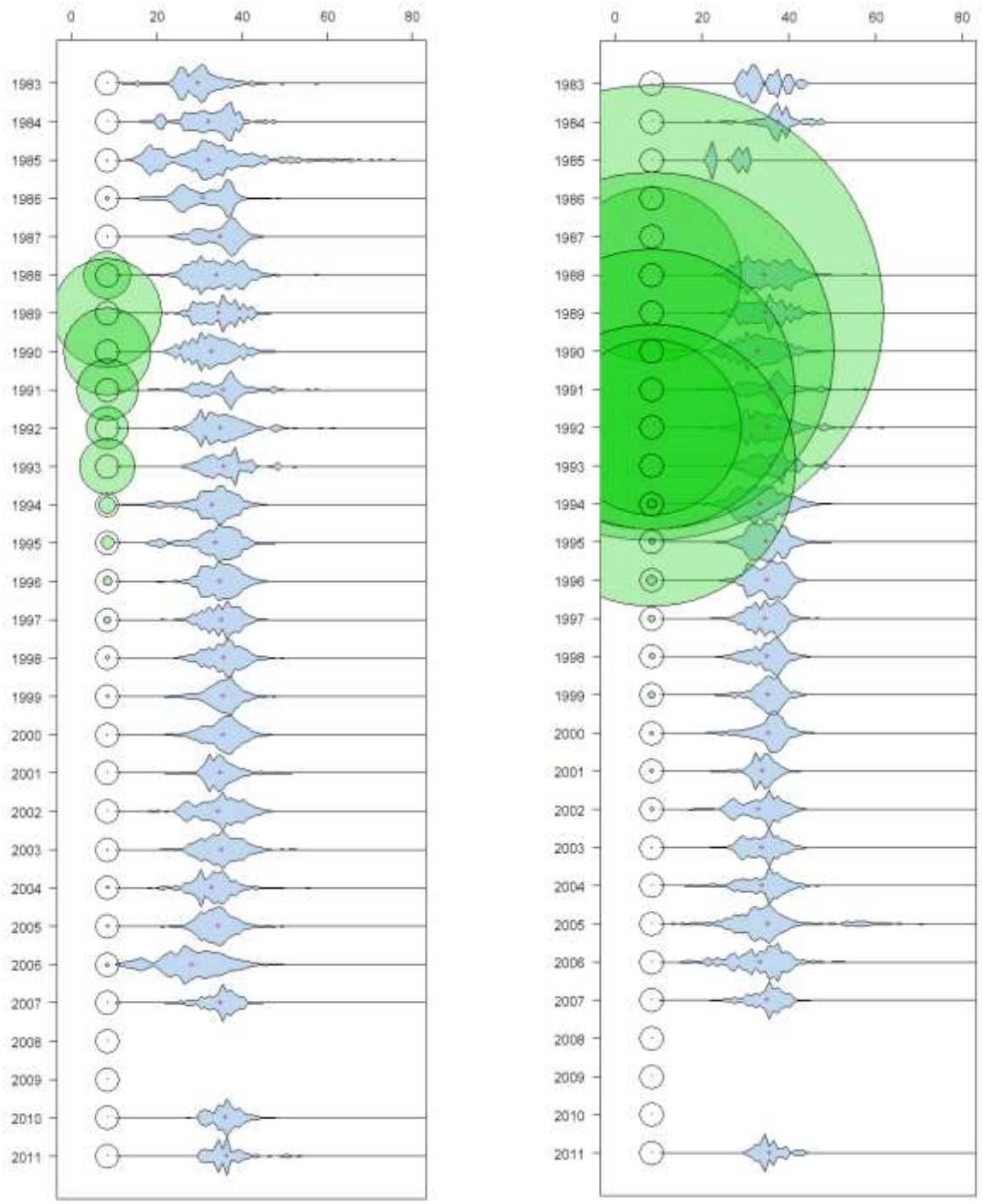


Fig. 5. Frigate tuna: Length frequency distributions (total amount of fish measured by 1cm length class) derived from the data available at the IOTC Secretariat for selected fisheries, by gear and year. The black outline circles (to the left of each chart) indicate the minimum sampling standard set by IOTC of one fish per metric tonne; the green proportional circles indicate the relative sampling coverage in each year (i.e., circles with areas greater than the minimum sampling standard indicate relatively high sampling coverage in a given year).

STOCK ASSESSMENT

No quantitative stock assessment for frigate tuna in the Indian Ocean is known to exist and no such assessment has been undertaken by the IOTC Working Party on Neritic Tunas. However, a preliminary estimation of stock indicators was attempted on the catch and effort datasets from the Maldives baitboat and line fisheries (described above). However, there is considerable uncertainty about the degree to which this and other 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 6).

TABLE 6. Frigate tuna (*Auxis thazard*) stock status summary

Management Quantity	**Aggregate Indian Ocean**
2012 catch estimate	83,029t
Mean catch from 2008–2012	90,221 t
MSY (80% CI)	unknown
Data period used in assessment	–
F_{2012}/F_{MSY} (80% CI)	–
B_{2012}/B_{MSY} (80% CI)	–
SB_{2012}/SB_{MSY}	–
B_{2012}/B_0 (80% CI)	–
SB_{2012}/SB_0	–
$B_{2012}/B_{0,\ F=0}$	–
$SB_{2012}/SB_{0,\ F=0}$	–

LITERATURE CITED

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