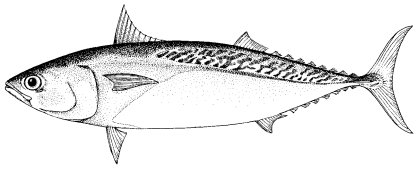
DRAFT: EXECUTIVE SUMMARY: FRIGATE TUNA

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		2014 stock status determination
Indian Ocean	Catch[2] 2013: Average catch[2] 2009–2013:	88,974 t 91,974 t	
	MSY: F_{MSY}: B_{MSY}: F_{2012}/F_{MSY}: SB_{2012}/SB_{MSY}: SB_{2012}/SB_0:	unknown unknown 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. 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 status indicators can be used. Aspects of the fisheries for frigate tuna combined with the lack of data on which to base a more formal assessment are a cause for considerable concern. Stock status in relation to the Commission's B_{MSY} and F_{MSY} target reference points remains **uncertain** (Table 1), indicating that a precautionary approach to the management of frigate tuna should be applied.

Outlook. Total annual catches for frigate tuna have increased substantially in recent years with peak catches taken in 2010/11 (~99,500), although a decrease was recorded in 2012 (Table 1). There is insufficient information to evaluate the effect that this level of catch, or a further increase in catch may have on the resource. Research emphasis on improving indicators and exploration of stock structure and stock assessment approaches for data poor fisheries should be considered a high priority for this species. The following should be noted:

- The Maximum Sustainable Yield estimate for the whole Indian Ocean is unknown.
- Species identification, data collection and reporting urgently need to be improved.
- Reconstruction of the catch history needs to occur before a reliable assessment can be attempted.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.

APPENDIX I
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 14/05 *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 for industrial purse seine vessels 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].

[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 fisheries for which catches had to be estimated.

TABLE 3. Frigate tuna: Best scientific estimates of the catches of frigate tuna by type of fishery for the period 1950–2013 (in metric tonnes). (Data as of October 2014)

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Purse seine	-	13	932	4,854	7,549	10,021	10,341	11,384	11,320	10,337	9,501	9,663	11,961	10,849	8,942	9,453
Gillnet	479	1,234	2,848	6,980	14,522	20,103	19,251	20,911	22,160	23,328	24,102	23,766	30,719	30,136	27,262	26,702
Line	1,270	2,413	4,420	7,423	13,751	27,188	25,692	29,977	27,797	31,814	31,067	34,918	37,728	37,349	34,995	35,618
Other	1,441	2,007	2,349	3,683	9,279	13,682	12,229	15,317	12,760	15,389	15,193	18,112	18,350	18,727	17,421	17,201
Total	**3,190**	**5,667**	**10,548**	**22,940**	**45,102**	**70,993**	**67,513**	**77,589**	**74,036**	**80,869**	**79,863**	**86,459**	**98,757**	**97,060**	**88,619**	**88,974**

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 late-1980's to between 55,000 and 60,000 t by the mid-1990's, and remaining at the same level in the following ten years. Since 2006 catches have increased, rising to nearly 100,000 t in 2010 and 2011, with current catches at around 89,000 t. The catches of frigate tuna have been higher in the east since the late 1990's, with three quarters of the catches of frigate tuna taken in the eastern Indian Ocean in recent years.

In recent years, over 90% of catches of frigate tuna have been concentrated in four countries: Indonesia (64%), Sri Lanka (11%), India (10%), and I.R. Iran (7%) (Table 3; Fig. 2).

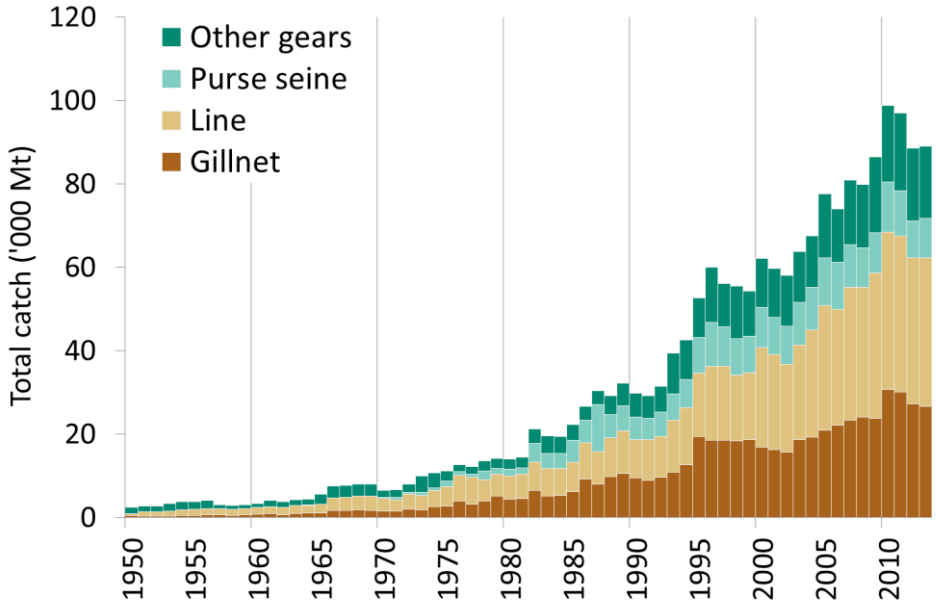


Fig. 1. Frigate tuna: Annual catches of frigate tuna by gear recorded in the IOTC Database (1950–2013). (Data as of October 2014)

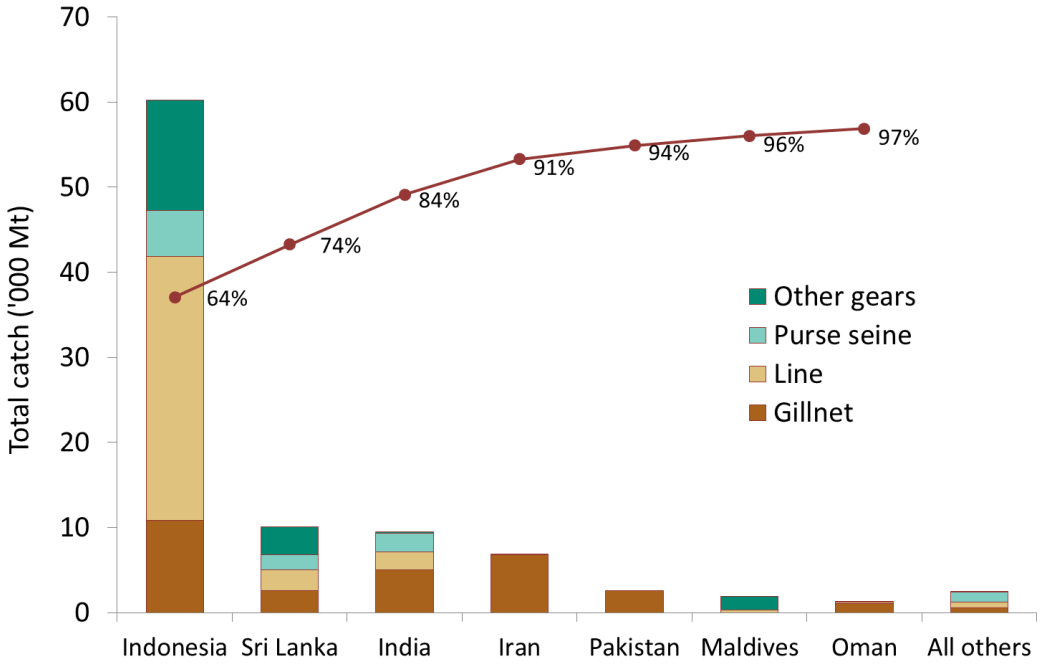


Fig. 2. Frigate tuna: average catches in the Indian Ocean over the period 2010–12, by country. Countries are ordered from left to right, according to the importance of catches of frigate tuna reported. The red line indicates the (cumulative) proportion of catches of frigate for the countries concerned, over the total combined catches of this species reported from all countries and fisheries. (Data as of November 2014)

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 by the IOTC Secretariat conducted by an independent consultant in 2012 he indicated that the catches of frigate tuna had been underestimated by Indonesia. While the new catches estimated for the frigate tuna in Indonesia remain uncertain, representing around 64% of the total catches of this species in the Indian Ocean in recent years (2010–12), the new figures are considered more reliable than those existing in the past.
- 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 by an independent consultant in 2012 and assigned by gear on the basis of official reports and information from various other alternative sources. The new catch series was previously presented to the WPNT in 2013, in which 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 21% of the total catches of this species in the Indian Ocean.
- Artisanal fisheries of Myanmar and Somalia: None of these countries have ever 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 they are reported by species, usually refer to both species (due to misidentification, with all catches assigned to the 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, and 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 overall catch series of frigate tuna has not changed substantially since the WPNT meeting in 2012. The IOTC Secretariat is currently undertaking reviews of the catch series for Indonesia, Malaysia and Thailand which are likely revise the catch estimates for the next WPNT in 2015; however at present the total catches of frigate remain at similar levels when compared to previous estimates.

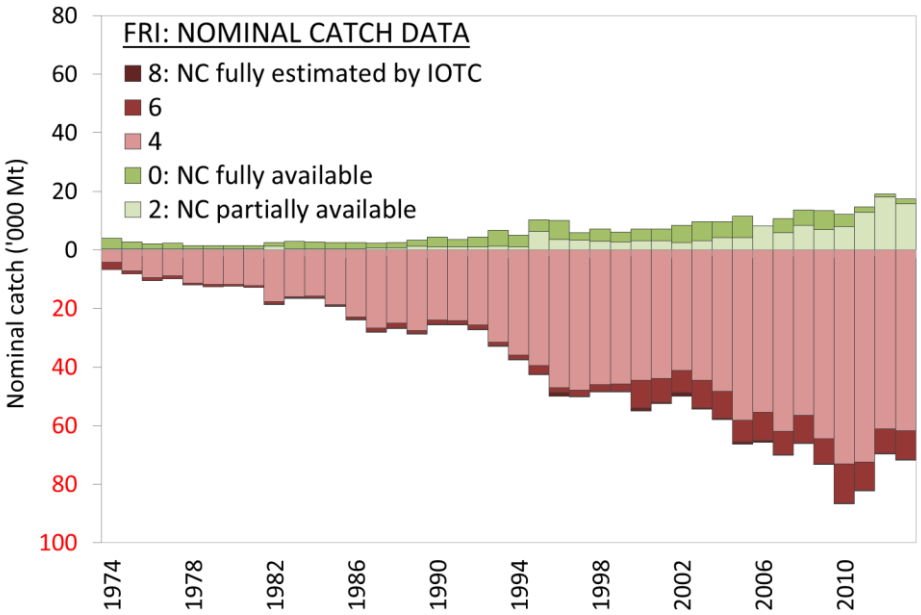


Fig. 3. Frigate tuna: nominal catch; uncertainty of annual catch estimates (1950–2013).

Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data fully by gear and/or species (i.e., partially adjusted by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document; catches with a score of 8 refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat). (Data as of October 2014)

Frigate tuna – Effort trends

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

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

Catch-and-effort series are available from some fisheries but they are considered highly incomplete (Table 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 (Fig. 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.

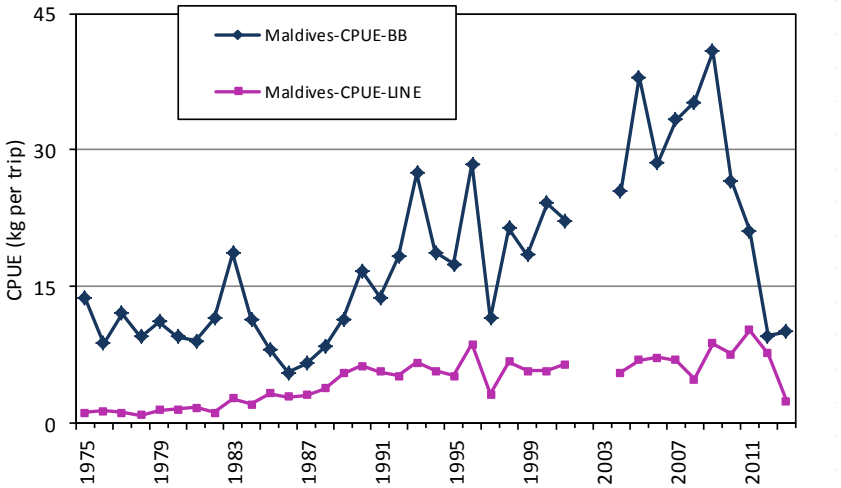
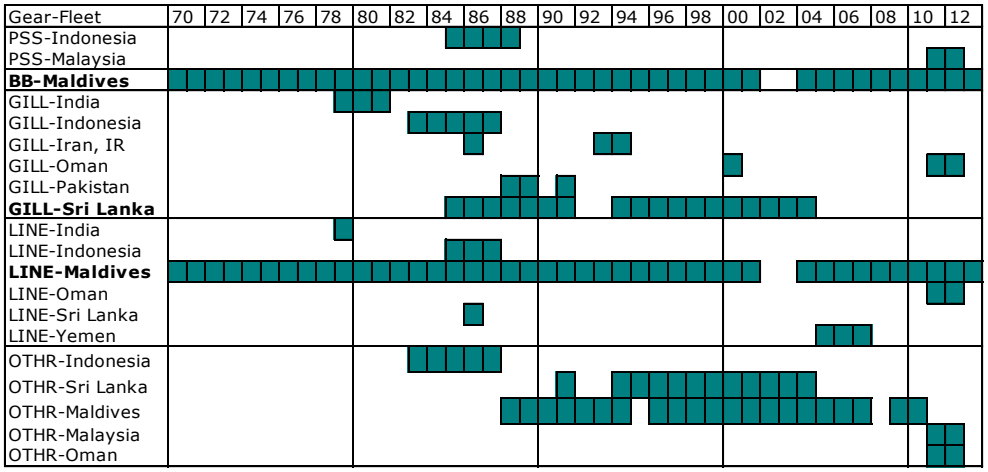


Fig. 4. Frigate tuna: Nominal CPUE series for the baitboat (BB using mechanized boats) and line (LINE, including handlines and trolling using mechanized boats) fisheries of Maldives derived from the available catches and effort data (1975–2013).

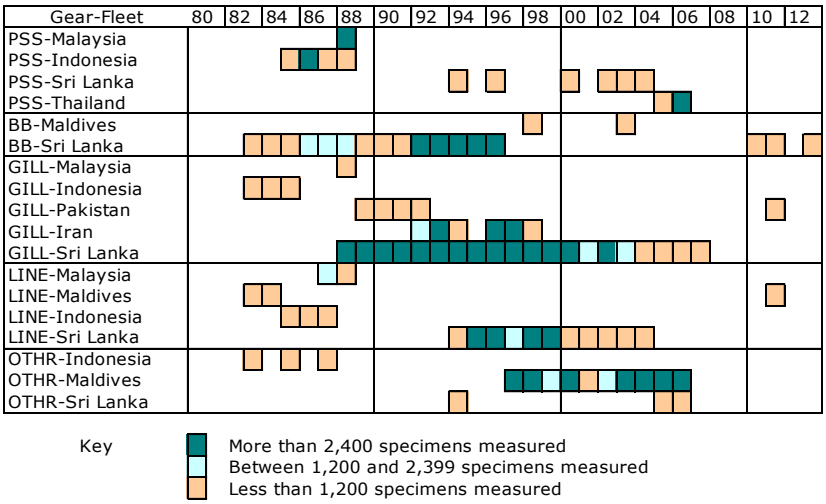
TABLE 4. Frigate tuna: Availability of catches and effort series, by fishery and year (1970–2013). Note that no catches and effort are available at all for 1950–69.



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, the data collection did not continue in most countries after the end of the IPTP activities.

TABLE 5: Frigate tuna: Availability of length frequency data, by fishery and year (1980–2013). Note that no length frequency data are available at all for 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) table: Catch-at-Size 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 gillnet fisheries are shown in Fig. 5. No data available for all other fisheries.Sex ratio data have not been provided to the Secretariat by CPCs.

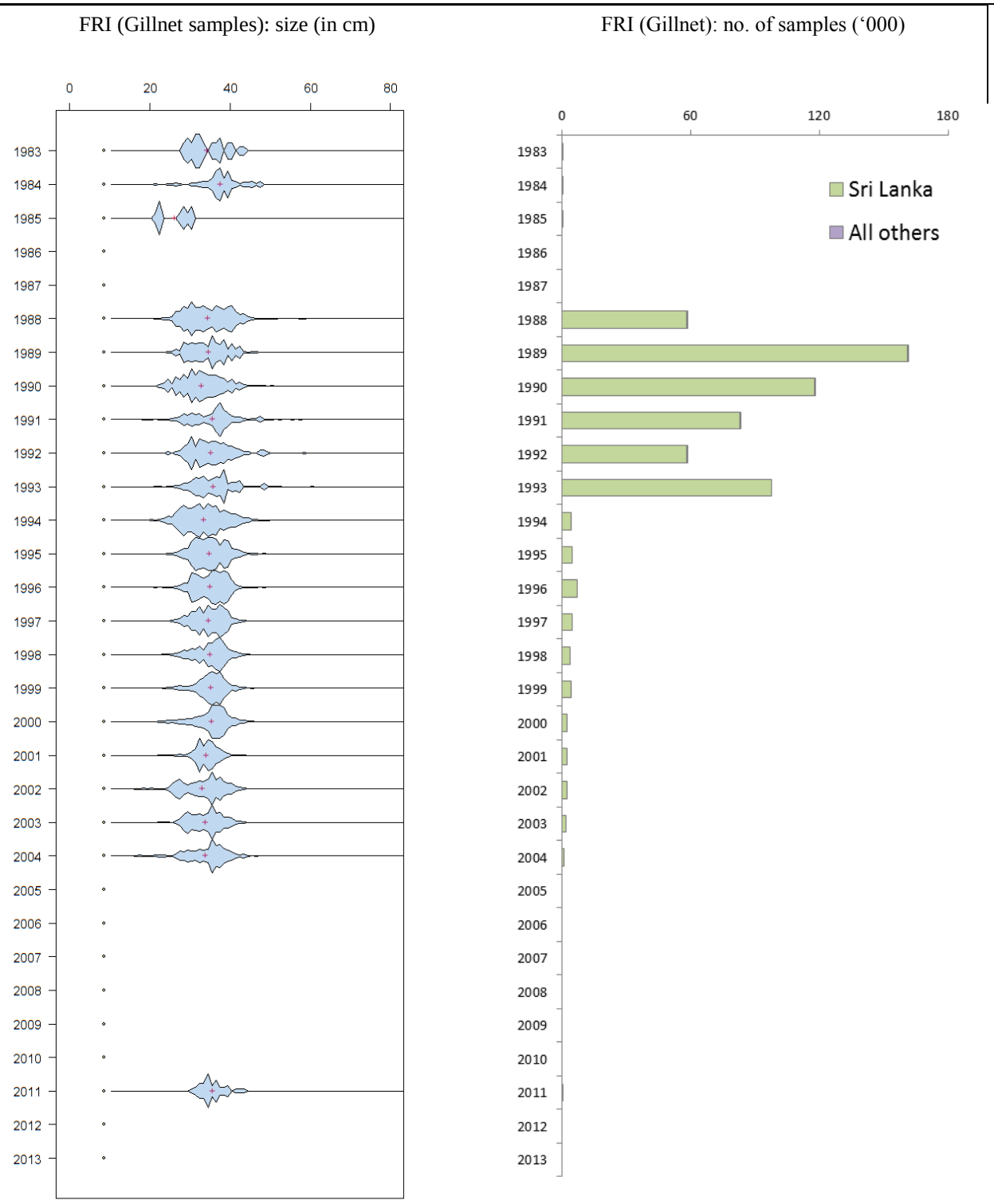


Fig. 5. Frigate tuna: Left - Frigate tuna (gillnet fisheries): Length frequency distributions (total amount of fish measured by 1cm length class) derived from data available at the IOTC Secretariat. Right - number of frigate tuna specimens (gillnet fisheries) sampled for lengths, by fleet and year.

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	88,974 t
Mean catch from 2008–2012	91,974 t
MSY (80% CI)	unknown
Data period used in assessment	–
F_{MSY}	–
B_{MSY}	–
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>.