

## FRIGATE TUNA

## 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 15/01 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 15/11 on the implementation of a limitation of fishing capacity of Contracting Parties and Cooperating Non-Contracting Parties
- Resolution 15/02 mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating non-Contracting Parties (CPCs)
- 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 1** outlines some key life history parameters relevant for management.

**TABLE 1.** 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%)	<b>Age:</b> n.a.; females n.a. males n.a. <b>Size:</b> 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 2; 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 2**). The catch estimates for frigate tuna were derived from very small amounts of information and are therefore highly uncertain<sup>1</sup>.

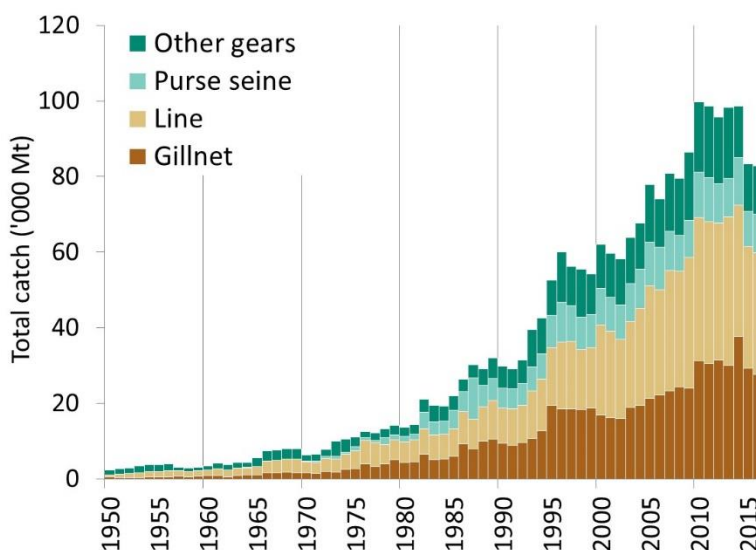
<sup>1</sup> The uncertainty in the catch estimates has been assessed by the IOTC Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of non-reporting fisheries for which catches have been estimated.

**TABLE 2.** Frigate tuna: Best scientific estimates of the catches of frigate tuna by type of fishery for the period 1950–2016 (in metric tonnes) (data as of October 2017).

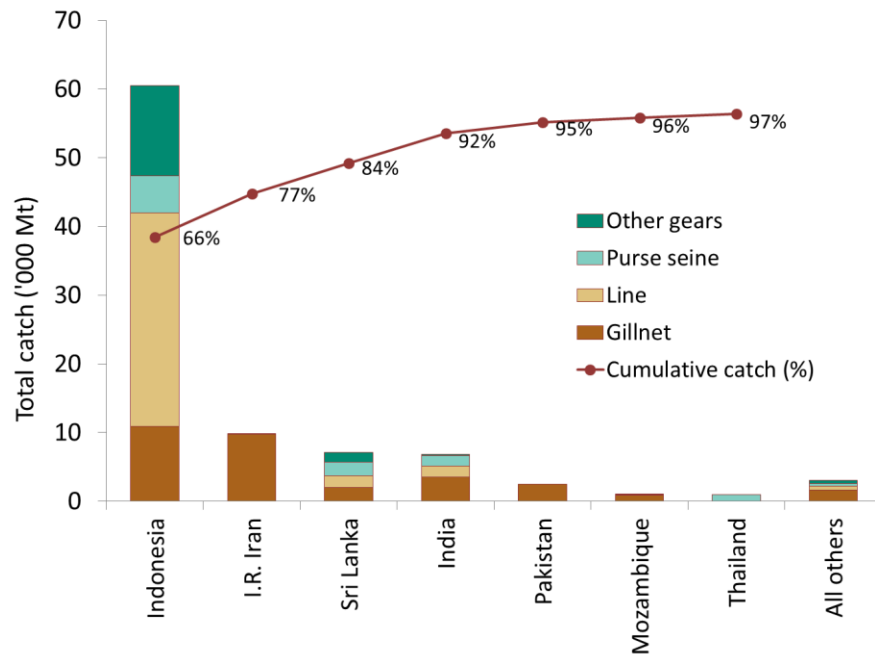
Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Purse seine	-	15	824	4,664	7,550	10,021	10,337	9,501	9,663	12,044	11,636	10,362	10,264	12,682	9,135	10,192
Gillnet	486	1,241	2,837	6,948	14,519	20,257	23,322	24,414	24,082	31,277	30,524	31,470	29,924	37,707	29,253	27,999
Line	1,264	2,407	4,419	7,432	13,753	27,083	31,820	30,474	34,591	37,840	37,510	36,245	39,331	34,693	32,323	32,326
Other	1,441	2,007	2,349	3,683	9,276	13,670	15,382	15,193	18,112	18,550	18,934	17,649	18,766	13,492	12,626	12,783
<b>Total</b>	<b>3,191</b>	<b>5,671</b>	<b>10,428</b>	<b>22,728</b>	<b>45,098</b>	<b>71,031</b>	<b>80,862</b>	<b>79,582</b>	<b>86,448</b>	<b>99,710</b>	<b>98,604</b>	<b>95,725</b>	<b>98,284</b>	<b>98,574</b>	<b>83,338</b>	<b>83,300</b>

The catches provided in **Table 2** 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 1970s, reaching around 30,000 t in the late-1980s to between 55,000 and 60,000 t by the mid-1990s, and remaining at the same level in the following ten years. Since 2006 catches have increased, rising to nearly 100,000 t in 2010, with current catches at around 81,441 t. The catches of frigate tuna have been higher in the east since the late 1990s, 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 (66%), I.R. Iran (11%), Sri Lanka (8%) and India (7%) (**Table 2; Fig. 2**).



**Fig. 1.** Frigate tuna: Annual catches of frigate tuna by gear recorded in the IOTC Database (1950–2016).



**Fig. 2.** Frigate tuna: average catches in the Indian Ocean over the period 2012–16, 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.

#### *Frigate tuna: estimation of catches – data related issues*

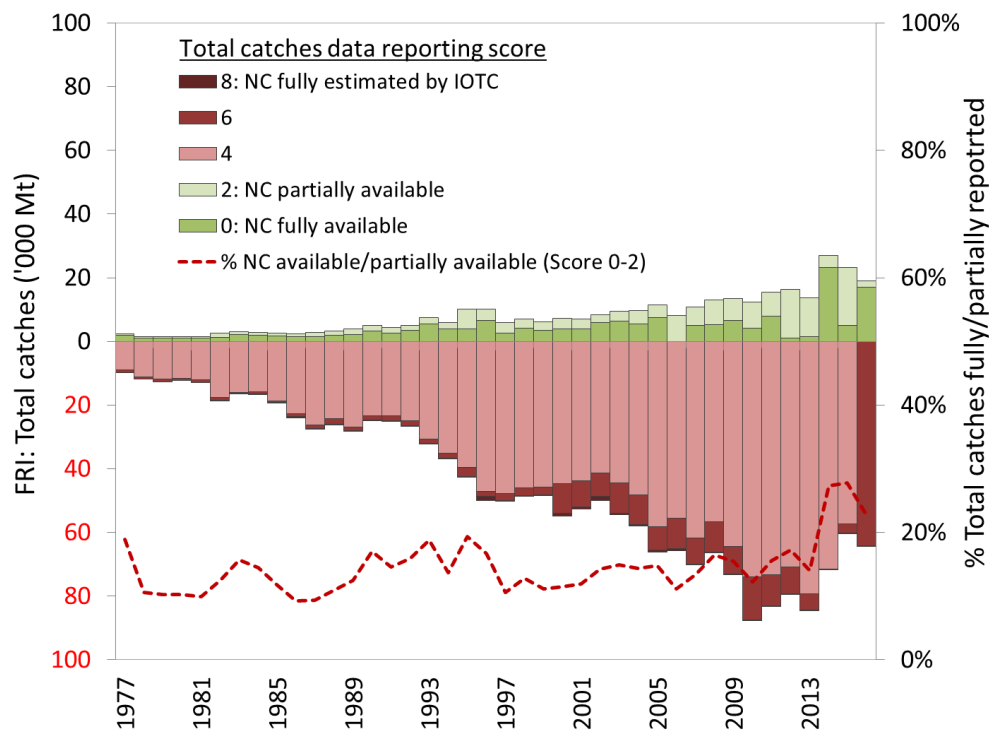
**Retained catches** for frigate tuna were derived from incomplete information, and are therefore uncertain<sup>2</sup> (Fig.3), notably for the following fisheries:

- **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, 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 compared to previous estimates.
- **Artisanal fisheries of Myanmar and Somalia:** None of these countries have ever reported catches of frigate tuna to the IOTC Secretariat, and catch levels are highly uncertain. In the case of Myanmar, catches are taken from FAO and SEAFDEC (various years).
- **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, its catches are seldom recorded in the logbooks, nor

<sup>2</sup> The uncertainty in the catch estimates has been assessed by the 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.

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.



**Fig. 3.** Frigate tuna: nominal catch; uncertainty of annual catch estimates (1977–2016).

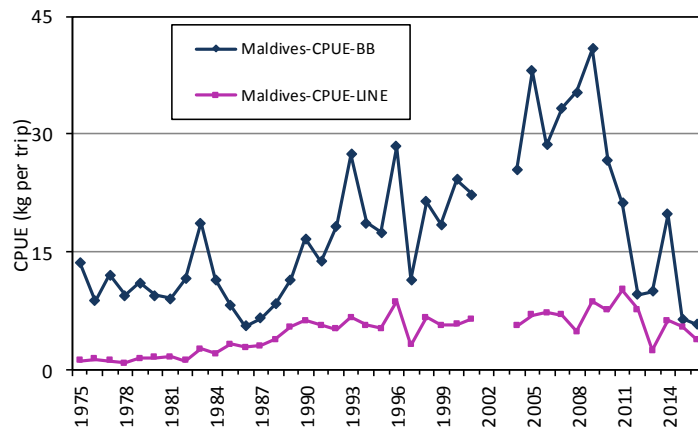
Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data fully by gear and/or species (e.g., partially adjusted by gear and species by the IOTC Secretariat; catches with a score of 8 refer to fleets that do not report catch data to the IOTC and are fully estimated by the IOTC Secretariat. The red dotted line indicates the proportion of total catches fully or partially reported to the IOTC Secretariat.

### *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 3**). 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 (1975–2016).

**TABLE 3.** Frigate tuna: Availability of catches and effort series, by fishery and year (1970–2016)<sup>3</sup>. Note that no catches and effort are available at all for 1950–69.

Gear-Fleet	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	00	02	04	06	08	10	12	14	16	
PSS-Indonesia																									
PSS-Malaysia																									
PSS-Sri Lanka																									
LL-Sri Lanka																									
<b>BB-Maldives</b>																									
Gill-Comoros																									
GILL-India																									
GILL-Indonesia																									
GILL-Iran, IR																									
GILL-Oman																									
GILL-Pakistan																									
<b>GILL-Sri Lanka</b>																									
LINE-Comoros																									
LINE-India																									
LINE-Indonesia																									
LINE-Maldives																									
LINE-Mozambique																									
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LINE-Sri Lanka																									
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OTHR-Oman																									

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

- **Sizes:** the sizes of frigate tunas taken by Indian Ocean fisheries typically range between 20 – 50 cm depending on the type of gear used, season and location. 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).
- **Size frequency data:** highly incomplete, with data only available for selected years and/or fisheries (**Table 4**).

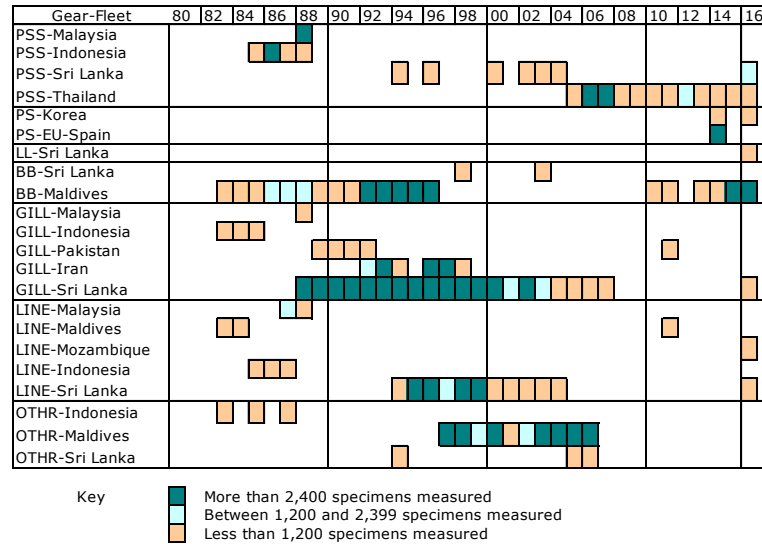
**Main sources for size samples:** Sri Lanka (gillnet), and Maldives (pole-and-line).

Length distributions derived from data available for gillnet fisheries are shown in **Fig. 5**. Generally speaking total numbers of samples are below the minimum sampling standard of 1 fish per tonne of catch recommended by the IOTC Secretariat to reliably assess changes in average weight – with the exception of samples recorded for Sri Lanka gillnets during the mid-1980s to early-1990, which were obtained with the support of IPTP funding.

<sup>3</sup> Note that the above list is not exhaustive, showing only the fisheries for which catch-and-effort are available in the IOTC database. In addition, catch-and-effort may not be available for all months for years shown in the table for each fishery.

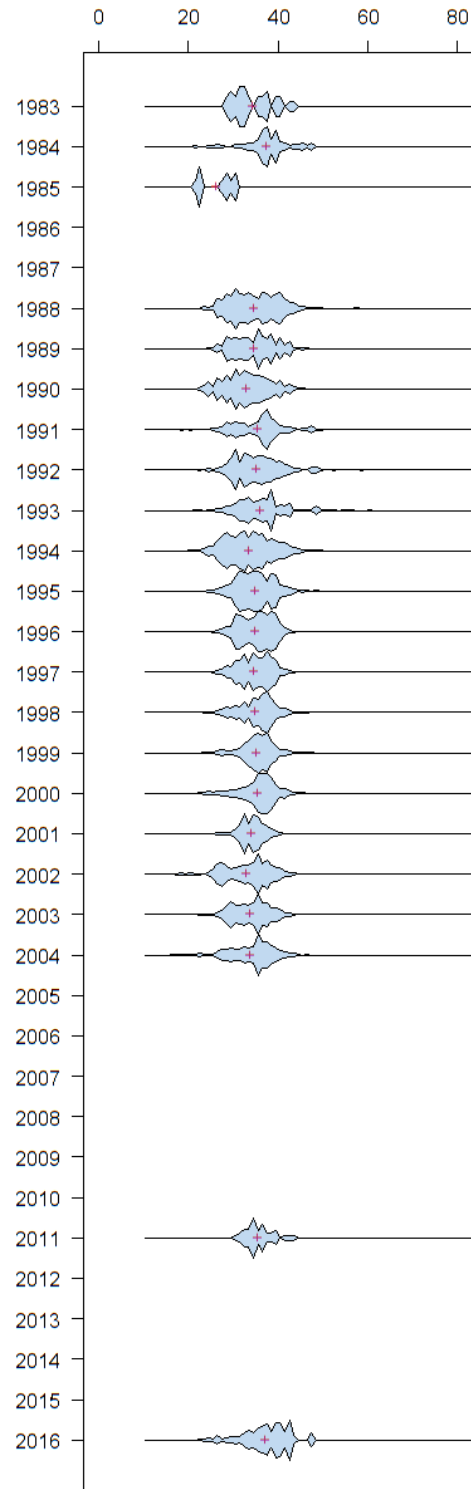
- Catch-at-Size (Age) table: Not available, due to lack of size samples and uncertainty over the reliability of retained catch estimates.
- Sex ratio data: have not been provided to the Secretariat by CPCs.

**TABLE 4:** Frigate tuna: Availability of length frequency data, by fishery and year (1980–2016). Note that no length frequency data are available at all for 1950–82<sup>4</sup>.



<sup>4</sup> Note that the above list is not exhaustive, showing only the fisheries for which size data are available in the IOTC database. In addition, size data may not be available for all months for years shown in the table for each fishery.

Frigate tuna (Gillnet samples): size (in cm)



**Fig. 5.** Frigate tuna: (gillnet fisheries): Length frequency distributions (total amount of fish measured by 1cm length class) derived from data available at the IOTC Secretariat.

**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 5**).

**TABLE 5.** Frigate tuna (*Auxis thazard*) key management quantities.

<b>Management Quantity</b>	<b>Aggregate Indian Ocean</b>
2016 catch estimate	83,300 t
Mean catch from 2012-2016	91,844 t
MSY (80% CI) (1,000 t)	unknown
Data period used in assessment	–
$F_{MSY}$ (80% CI)	–
$B_{MSY}$ (80% CI) (1,000 t)	–
$F_{2015}/F_{MSY}$ (80% CI)	–
$B_{2015}/B_{MSY}$ (80% CI)	–
$SB_{2015}/SB_{MSY}$ (80% CI)	–
$B_{2015}/B_0$ (80% CI)	–
$SB_{2015}/SB_0$ (80% CI)	–
$B_{2015}/B_{0, F=0}$ (80% CI)	–
$SB_{2015}/SB_{0, F=0}$ (80% CI)	–

**LITERATURE CITED**

Froese R & Pauly DE, 2009. FishBase, version 02/2009, FishBase Consortium, <[www.fishbase.org](http://www.fishbase.org)>.