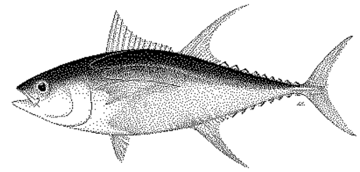
EXECUTIVE SUMMARY: YELLOWFIN TUNA

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



Status of the Indian Ocean yellowfin tuna (YFT: *Thunnus albacares*) resource

TABLE 1. Yellowfin tuna: Status of yellowfin tuna (*Thunnus albacares*) in the Indian Ocean.

Area[1]	**Indicators**		**2016 stock status determination**
Indian Ocean	Catch 2015[2]:	407,575 t	**67.6%***
	Average catch 2011–2015:	390,185 t	
	MSY (1000 t) (80% CI):	422 (406-444)	
	F_{MSY} (80% CI):	0.151 (0.148-0.154)	
	SB_{MSY} (1,000 t) (80% CI):	947 (900-983)	
	F_{2015}/F_{MSY} (80% CI):	1.11 (0.86-1.36)	
	SB_{2015}/SB_{MSY} (80% CI):	0.89 (0.79-0.99)	
	SB_{2015}/SB_0 (80% CI):	0.29 (n.a.-n.a.)	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2]Proportion of catch estimated or partially estimated by IOTC Secretariat in 2015: 23%
* Estimated probability that the stock is in the respective quadrant of the Kobe plot (shown below), derived from the confidence intervals associated with the current stock status. The confidence intervals for SB_{2015}/SB_0 were not estimated for the models used.

Colour key	Stock overfished ($SB_{year}/SB_{MSY} < 1$)	Stock not overfished ($SB_{year}/SB_{MSY} \geq 1$)
Stock subject to overfishing($F_{year}/F_{MSY} > 1$)	67.6%	3.7%
Stock not subject to overfishing ($F_{year}/F_{MSY} \leq 1$)	27.3%	1.4%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. In 2016, two models were applied to the yellowfin tuna stock in the IOTC area of competence to update the assessment of yellowfin undertaken in 2015: a Biomass Dynamic Model (BDM) and Stock Synthesis III (SS3) model, which gave qualitatively similar results. Stock status and management advice was based on the SS3 model formulation. Spawning stock biomass in 2015 was estimated to be 28.9% of the unfished levels (Table 1) and 89% (79–99%) of the level which can support MSY. The assessment is somewhat more optimistic than the 2015 assessment mainly due to the use of a new composite LL CPUE series, which results in a lower estimate of fishing mortality in the NE Indian Ocean. In addition, the catch series revised in 2016 reduced the catch data for 2014 by 5.1% (from 430,327 to 408,497, although the impact of this revision on status determination was minor. According to the information available for the stock assessment, the total catch has remained relatively stable at levels somewhat lower than the estimated MSY since 2012 (407,575 t in 2015, 408,497 in 2014, 405,048 in 2013 and 400,502 in 2012). The inclusion of revised and new data into the updated assessment using the model structure applied in the 2015 assessment, resulted in a higher estimated biomass in 2014 and lower estimated F/F_{MSY} than the corresponding estimates from the 2015 stock assessment. Nonetheless, the updated assessment estimates SB_{2015}/SB_{MSY} at 0.89 (0.79-0.99) and F_{2015}/F_{MSY} at 1.11 (0.86-1.36). The quantified uncertainty in these estimates is an underestimate of the underlying uncertainty of the assessment. On the weight-of-evidence available in 2016, the yellowfin tuna stock is determined to remain **overfished** and subject to **overfishing** (Table 1 and Fig. 2).

Outlook. The increase in longline, gillnet, handline and purse seine effort and associated catches in recent years has substantially increased the pressure on the Indian Ocean stock as a whole (Fig. 1), with recent fishing mortality exceeding the MSY-related levels. There is a risk of continuing to exceed the MSY-based biomass reference point if catches increase or remain at current levels (2015) until 2018 (88% risk that $SB < SB_{MSY}$) (Table 2). The modelled probabilities of the stock attaining levels consistent with the Commission's current management objective (e.g. $SB > SB_{MSY}$) are shown in the

K2MSM, which provides a range of options for reducing catches and the probabilities of the yellowfin tuna stock recovering to the MSY target levels (Table 2) after 3 and 10 years.

Management advice. The stock status determination did not change in 2016, but does give a somewhat more optimistic estimate of stock status than the 2015 assessment as a direct result of the use of more reliable information on catch rates of longline fisheries and updated catch up to 2015. The stock status is driven by unsustainable catches of yellowfin tuna taken over the last four (4) years, and the relatively low recruitment levels estimated by the model in recent years. The Commission has an interim plan for the rebuilding of this stock (Resolution 16/01), with catch limitations beginning January 1 2017. The possible effect of this measure can only be assessed once estimates of abundance in 2018 would be available at the 2019 asessement. The projections produced to advise on future catches are, in the short term, driven by the below average recruitment estimated for in recent years since these year classes have yet to reach maturity and contribute to the spawning biomass (see Table 2).

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY):** estimate for the whole Indian Ocean is estimated at 422,000 t with a range between 406,000-444,000 t (Table 1). The 2011-2015 average catches (390,185 t) were below the estimated MSY level.
- **Interim reference points**: Noting that the Commission in 2015 agreed to Resolution 15/10 *on target and limit reference points and a decision framework*, the following should be noted:
  - **Fishing mortality**: Current fishing mortality is considered to be 11% above the interim target reference point of F_{MSY}, and below the interim limit reference point of $1.4*F_{MSY}$ (Fig. 2).
- **Biomass**: Current spawning biomass is considered to be 11% below the interim target reference point of SB_{MSY}, however above the interim limit reference point of $0.4*SB_{MSY}$ (Fig. 2).
- **Main fishing gear** (Average catch 2012–15): Purse seine ≈34% (FAD associated school ≈20%; free swimming school ≈13%); Longline ≈19%; Handline ≈19%; Gillnet ≈16%; Trolling ≈7%; Pole-and-line ≈5%; ≈Other 2%).
- **Main fleets** (Average catch 2012–15): European Union ≈21% (EU,Spain ≈15%; EU,France ≈7%); Maldives ≈12%; Indonesia ≈10%; I.R. Iran ≈10%; Sri Lanka ≈9%; Yemen ≈8%; India ≈7%.

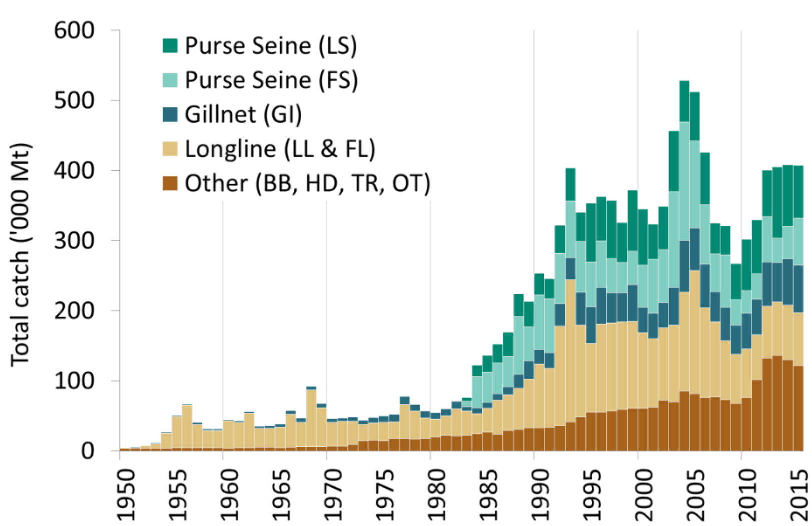


Fig. 1. Annual catches of yellowfin tuna by gear (1950–2015). Data as of September 2016.

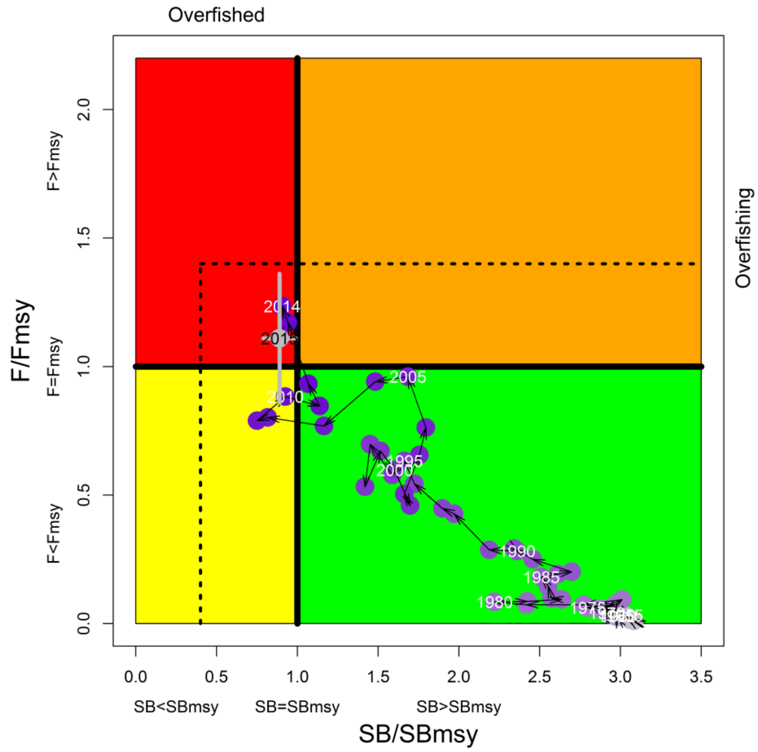


Fig. 2. Yellowfin tuna: Stock synthesis Kobe plot. Blue dots indicate the trajectory of the point estimates for the B/B_{MSY} ratio and F_{MSY} proxy ratio for each year 1950–2015. The grey line represents the 80% confidence interval associated with the 2015 stock status. Dotted black lines are the interim limit reference points adopted by the Commission via Resolution 15/10.

TABLE 2. Yellowfin tuna: Stock synthesis assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based target (top) and limit (bottom) reference points for constant catch projections (relative to the catch level from 2015 (407,575t), -30%, - 25%, ± 20%, -15%,± 10%, -5%), projected for 3 and 10 years), projected for 3 and 10 years.

Reference point and projection timeframe	**Alternative catch projections (relative to the catch level from 2015) and probability (%) of violating MSY-based target reference points ($B_{targ} = B_{MSY}$; $F_{targ} = F_{MSY}$)**								
	70% (285,302t)	75% (305,680t)	80% (326,059t)	85% (346,438t)	90% (366,816t)	95% (387,195t)	100% (407,574t)	110% (448,331t)	120% (489,089t)
$B_{2018} < B_{MSY}$	53	61	67	77	80	88	88	97	99
$F_{2018} > F_{MSY}$	2	7	23	47	65	73	100	100	100
$B_{2025} < B_{MSY}$	6	n.a.	20	37	60	100	100	100	100
$F_{2025} > F_{MSY}$	0	n.a.	10	40	57	100	100	100	100
Reference point and projection timeframe	**Alternative catch projections (relative to the catch level from 2015) and probability (%) of violating MSY-based limit reference points ($B_{lim} = 0.4\ B_{MSY}$; $F_{Lim} = 1.4\ F_{MSY}$)**								
	70% (285,302t)	75% (305,680t)	80% (326,059t)	85% (346,438t)	90% (366,816t)	95% (387,195t)	100% (407,574t)	110% (448,331t)	120% (489,089t)
$B_{2018} < B_{Lim}$	2	1	2	4	6	6	12	21	38
$F_{2018} > F_{Lim}$	0	0	1	10	32	52	100	100	100
$B_{2025} < B_{Lim}$	0	n.a.	1	7	30	>30*	>30*	>30*	>30*
$F_{2025} > F_{Lim}$	0	n.a.	0	11	53	>30*	>30*	>30*	>30*

** At least one fishery not able to take the catch due to absence of vulnerable fish in the projection period. The probability levels are not well determined, but likely progressively exceed 30% as the catch level increases beyond 90%.*