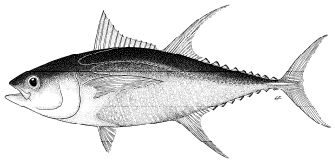
Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
iotc ctoi



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		2018 stock status[3] determination
Indian Ocean	Catch 2017[2]:	409,567t	
	Average catch 2013–2017:	399,830 t	
	MSY (1000 t) (80% CI)[3]:	403 (339–436)	
	F_{MSY} (80% CI):	0.15 (0.13–0.17)	
	SB_{MSY} (1,000 t) (80% CI):	1069 (789–1387)	
	F_{2017}/F_{MSY} (80% CI):	1.20 (1.00–1.71)	
	SB_{2017}/SB_{MSY} (80% CI):	0.83 (0.74–0.97)	
	SB_{2017}/SB_0 (80% CI):	0.30 (0.27 – 0.33)	

[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 for catches in 2017: 24%
[3] Median and quantiles calculated from the uncertainty grid taking into account of weighting on models

Colour key	Stock overfished ($SB_{year}/SB_{MSY} < 1$)	Stock not overfished ($SB_{year}/SB_{MSY} \geq 1$)
Stock subject to overfishing ($F_{year}/F_{MSY} > 1$)	94	2
Stock not subject to overfishing ($F_{year}/F_{MSY} \leq 1$)	4	0
Not assessed/Uncertain		

The percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. In 2018 a new stock assessment was carried out for yellowfin tuna in the IOTC area of competence to update the stock status undertaken in 2016. The stock assessment was carried out using Stock Synthesis III (SS3), a fully integrated model that is currently used to provide scientific advice for the three tropical tunas stocks in the Indian Ocean. The model used in 2018 is based on the model developed in 2016 with a series of revisions that were noted during the WPTT. The model uses four types of data: catch, size frequency, tagging and joint longline CPUE indices. The SS3 stock assessment gave overall similar results to the 2015/2016 assessment but is somewhat more pessimistic than the stock assessment undertaken in 2016 (but similar to the one done in 2015) due to the steeper declining trend of the composite longline CPUE series and sustained large catches in the most recent years. The assessment results were only based on a grid of 24 SS3 model runs which are recognized as insufficient to explore the spectrum of uncertainties and scenarios, noting the large uncertainty associated with data quality (e.g., spatial representativeness of CPUE coverage, estimation of catch and inconsistency in length-frequency) and lack of considering model statistical uncertainty. Spawning stock biomass in 2017 was estimated to be 30.0% of the unfished levels (Table 1). According to the information available for the stock assessment, the total catch has remained relatively stable at levels around the estimated MSY since 2012 (i.e., between 390,000 t and 410,000 t). The 2018 stock assessment estimates SB_{2017}/SB_{MSY} at 0.83 (0.74-0.97) and F_{2017}/F_{MSY} at 1.20 (1.00 -1.71). However, it is noted that the quantified uncertainty in stock status is likely underestimating the underlying uncertainty of the assessment. On the weight-of-evidence available in 2018, the yellowfin tuna stock is determined to remain **overfished** and subject to **overfishing** (Table 1 and Fig. 1).

Outlook. The increase in catches in recent years has substantially increased the pressure on the Indian Ocean stock, resulting in fishing mortality exceeding the MSY-related levels. The results of projections of the Stock Synthesis are provided in the form of K2SM (Table 2). There is a high risk of continuing to violate the MSY-based reference points if catches remain at around current levels (≈409,000 t in 2017) (Table 2). However, the projections shown in K2SM results do not adequately reflect known sources of uncertainty due to a series of issues with data and model performance, and should be taken with caution given the issues identified by the Committee.

Management advice. The decline in stock status to below MSY reference level is not well understood due to various uncertainties. As a precautionary measure, the Commission should ensure that catches are reduced to end overfishing and allow the SSB to recover to SSB_{MSY} levels. At this stage, specific catch limits are not provided.

A workplan has been developed to address the issues identified in the assessment review, aimed at increasing the Committee's ability to provide more concrete and robust advice by the 2019 meeting of the Scientific Committee. The workplan is scheduled to start in January 2019 and aims at addressing the issues identified by the WPTT and the external reviewer. The draft workplan is attached as Appendix 38 of the 2018 Scientific Committee Report (IOTC-2018-SC21-R). The Commission should ensure that this workplan is budgeted appropriately.

The Commission has an interim plan for the rebuilding the yellowfin stock, with catch limitations based on 2014/2015 levels (Resolution 18/01). Some of the fisheries subject to catch reductions had fully achieved a decrease in catches in 2017 in accordance with the levels of reductions specified in the Resolution; however, these reductions were offset by increases in the catches from CPCs exempt and some CPCs subject to limitations on their catches of yellowfin tuna (see table 3 in IOTC-2018-SC21-R). Thus, the total catches of yellowfin in 2017 increased by around 3% from 2014/2015 levels. The Commission should ensure that any revision of the management measure can effectively achieve any prescribed catch reduction to ensure the effectiveness of the management measure.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY):** estimate for the Indian Ocean stock is 403,000 t with a range between 339,000-436,000 t (Table 1). The 2013-2017 average catches (399,830 t) were below the estimated MSY level. However, the last two years of catches were slightly higher than the median MSY.
- **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 20% 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 17 % below the interim target reference point of SB_{MSY} and above the interim limit reference point of $0.4*SB_{MSY}$ (**Fig. 2**).
- **Main fishing gear** (average catches 2013–17): Purse seine ≈35% (FAD associated school ≈23%; free swimming school ≈12%); Longline ≈16%; Gillnet ≈17%; All other gears ≈31% (**Fig. 1**).
- **Main fleets** (average catches 2013–17): European Union ≈22% (EU-Spain ≈14%; EU-France ≈8%); Maldives ≈13%; I.R. Iran ≈11%; Seychelles ≈9%; Sri Lanka ≈9%; All other fleets ≈37%.

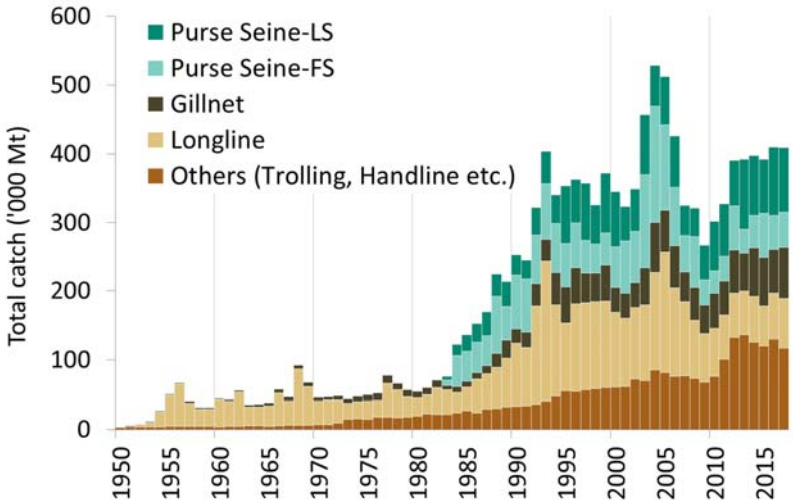


Fig. 1. Annual catches of yellowfin tuna by gear (1950–2017)[2].

[2] **Definition of fisheries**: Gillnet, including offshore gillnet (**GI**); Purse seine free-school (**FS**); Purse seine associated school (**LS**); Deep-freezing longline (**LL**); Fresh-tuna longline (**FL**); Other gears (including, Pole-and-Line (**BB**); Hand line (**HD**); Trolling (**TR**); Other gears nei (**OT**)).

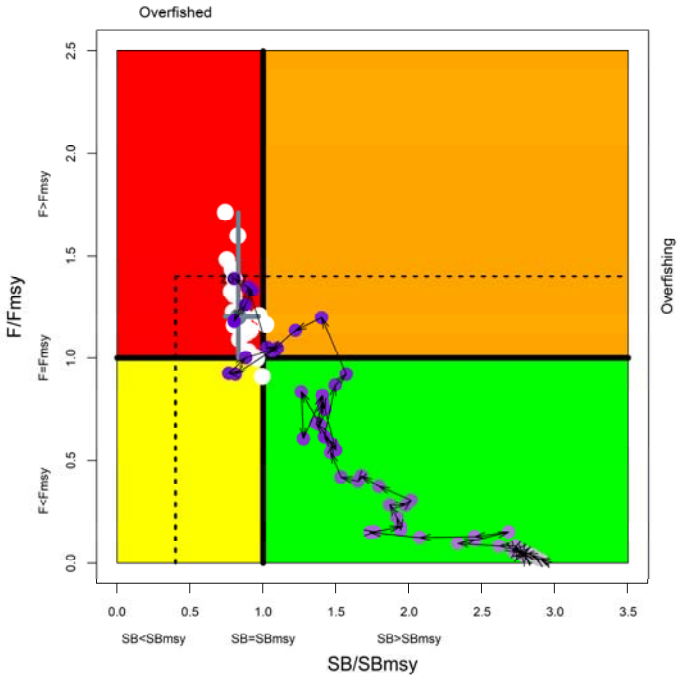


Fig. 2. Yellowfin tuna: Stock synthesis Kobe plot. Blue dots indicate the trajectory of the point estimates for the SB/SB_{MSY} ratio and F/F_{MSY} ratio for each year 1950–2017. The grey line represents the 80% confidence interval associated with the 2017 stock status. Dotted black lines are the interim limit reference points adopted by the Commission via Resolution 15/10. The white circles represent 2017 stock status for each grid run.

TABLE 2. Yellowfin tuna: Stock synthesis assessment Kobe II Strategy Matrix. Probability of violating the MSY-based target (top) and limit (bottom) reference points for constant catch projections (relative to the catch level from 2017 (409,567t), -35%, - 30%, -25%, -20%, -15%, ± 10%, -5%) projected for 3 and 10 years.

Reference point and projection timeframe	**Alternative catch projections (relative to the catch level from 2017) and probability (%) of violating MSY-based target reference points ($B_{targ} = B_{MSY}$; $F_{targ} = F_{MSY}$)**								
	65% (266,218t)	70% (286,697t)	75% (307,175t)	80% (327,654t)	85% (348,132t)	90% (368,610t)	95% (389,089t)	100% (409,567t)	110% (450,523t)
$B_{2020} < B_{MSY}$	0.48	0.48	0.73	0.85	0.85	0.96	0.98	0.98	1.00
$F_{2020} > F_{MSY}$	0.08	0.23	0.25	0.48	0.56	0.79	0.96	0.98	1.00
$B_{2027} < B_{MSY}$	0.08	0.08	0.25	0.42	0.56	0.79	0.98	1.00	1.00*
$F_{2027} > F_{MSY}$	0.06	0.08	0.23	0.42	0.63	0.85	1.00	1.00	1.00*
Reference point and projection timeframe	**Alternative catch projections (relative to the catch level from 2017) and probability (%) of violating MSY-based limit reference points ($B_{lim} = 0.4\ B_{MSY}$; $F_{Lim} = 1.4\ F_{MSY}$)**								
	65% (266,218t)	70% (286,697t)	75% (307,175t)	80% (327,654t)	85% (348,132t)	90% (368,610t)	95% (389,089t)	100% (409,567t)	110% (450,523t)
$B_{2020} < B_{Lim}$	0.00	0.00	0.00	0.00	0.00	0.06	0.15	0.23	0.42
$F_{2020} > F_{Lim}$	0.00	0.06	0.08	0.21	0.23	0.42	0.56	0.63	0.92
$B_{2027} < B_{Lim}$	0.00	0.06	0.08	0.27	0.42	0.50	0.83	0.90	1.00*
$F_{2027} > F_{Lim}$	0.00	0.08	0.23	0.42	0.50	0.65	0.94	0.94	1.00*

** stock crashed or at least one fishery not able to take the catch due to absence of vulnerable fish in the projection period for all models. The probability levels are not well determined, but likely progressively high as the catch level increases beyond 100%.*