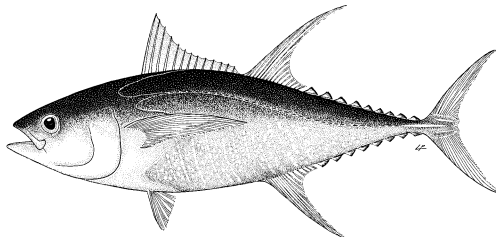# DRAFT RESOURCE STOCK STATUS SUMMARY

YELLOWFIN TUNA (YFT: *Thunnus albacares*)

Table 1. Status of yellowfin tuna (*Thunnus albacares*) in the Indian Ocean

Area[1]	Indicator	Value	Status[3]
Indian Ocean	Catch in 2019 (MT)[2]	427,240[4]	94%[*]
	Average catch 2015-2019 (MT)	424,103[4]	
	MSY (1,000 MT) (80% CI)	403 (339-436)	
	F_{MSY} (80% CI)	0.15 (0.13-0.17)	
	SSB_{MSY} (1,000 MT) (80% CI)	1,069 (789-1,387)	
	F_{2017} / F_{MSY} (80% CI)	1.20 (1.00-1.71)	
	SSB_{2017} / SSB_{MSY} (80% CI)	0.83 (0.74-0.97)	
	SSB_{2017} / SSB_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 2019: 14%

[3]The stock status refers to the most recent years' data used in the assessment conducted in 2018, i.e. 2017

[4]Considering the alternative purse seine log-associated catch composition for the EU fleet in 2018 as per IOTC-2019-WPTT21-R[E]

[*]Estimated probability that the stock is in the respective quadrant of the Kobe Plot (shown below). Median and quantiles calculated from the uncertainty grid taking into account of weighting on models

Colour key	Stock overfished (SSB_{2017} / SSB_{MSY}<1)	Stock not overfished (SSB_{2017} / SSB_{MSY}≥ 1)
Stock subject to overfishing (F_{2017} / F_{MSY}≥ 1)	94%	4%
Stock not subject to overfishing (F_{2017} / F_{MSY}≤ 1)	2%	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. No new stock assessment was carried out for yellowfin tuna in 2019, thus, stock status is determined on the basis of the 2018 assessment and other indicators presented in 2019. The 2018 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 2018 assessment results were 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-composition) and lack of considering model statistical uncertainty. Some of these uncertainties have were explored in 2019 following the Workplan the Scientific Committee adopted in 2018. However, due to the complexity of the work, lack of agreement on key model aspects and time constraints, no new management advice is provided in 2019. According to the 2018 stock assessment, spawning stock biomass in 2017 was estimated to be 30.0% of the unfished levels (**Table 1**). According to the information available in 2019, the total catch has remained relatively stable at levels around the estimated MSY since 2012 (i.e., between 390,000 MT and 436,000 MT), with the 2018 catch being the largest since 2010 (437,422 MT), and exceeding the MSY range considering the best catch estimate by the Scientific Committee (for details see WPTT report). The 2018 stock assessment estimates SSB_{2017} / SSB_{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 and 2019, 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 2017 levels (~409,000 MT in 2017) (**Table 2**). Subsequent investigation has shown some critical errors in the projections and estimations for computing probabilities in the K2SM developed in 2018. As such the K2SM is not suitable for use to provide management advice~~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 SSBMSY levels. At this stage, specific catch limits are not provided.

In the 2018 Scientific Committee a Workplan was 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 started in January 2019 which aimed at addressing the issues identified by the WPTT and the external reviewer in 2018. 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. Despite the progress made to reduce the uncertainties inherent to this fishery, the WPTT agreed that no new advice could be provided in 2019.

The Commission has an interim plan for the rebuilding the yellowfin stock, with catch limitations based on 2014/2015 levels (Resolution 19/01, which superseded 17/01 and 18/01). Some of the fisheries subject to catch reductions had fully achieved a decrease in catches in 2018 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 9 in IOTC-2019-WPTT21-R). Thus, the total catches of yellowfin in 2018 increased by around 9% 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 MT with a range between 339,000-436,000 MT (**Table 1**). The 2014-2018 average catches (404,655 MT) were just above the estimated MSY level. The last year (2018), catch has been substantially 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 SSB_{MSY} and above the interim limit reference point of 0.4*SSB_{MSY} (**Fig. 2**).

- **Main fishing gears** (average catches 2015-19): Purse seine ~35% (FAD associated school ~23%; free swimming school ~10%); Line: 31%; Gillnet ~20%; Longline ~9%; All other gears ~5% (**Fig. 1**).

- **Main fleets** (average catches 2015-19): European Union ~19% (EU-Spain ~12%; EU-France ~7%); I.R. Iran ~12%; Maldives ~12%; Seychelles ~10%; Sri Lanka ~9%; All other fleets ~38%.
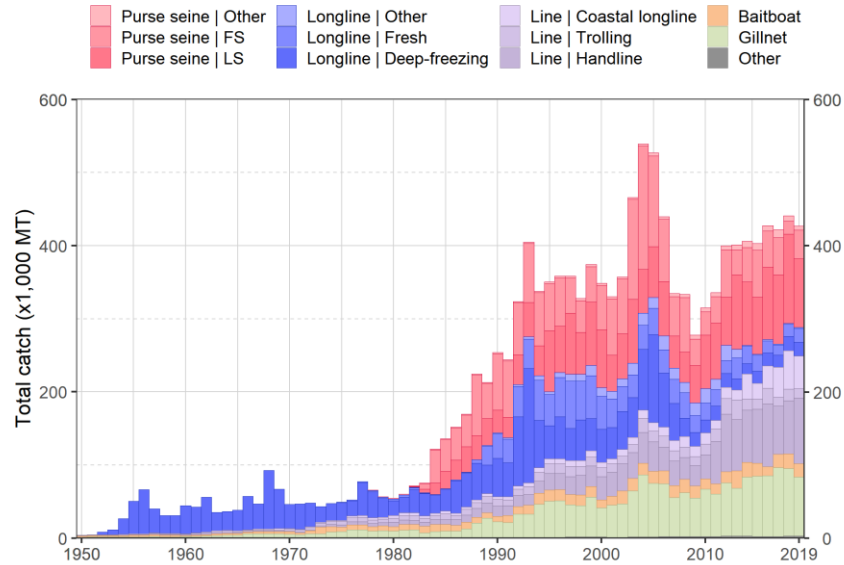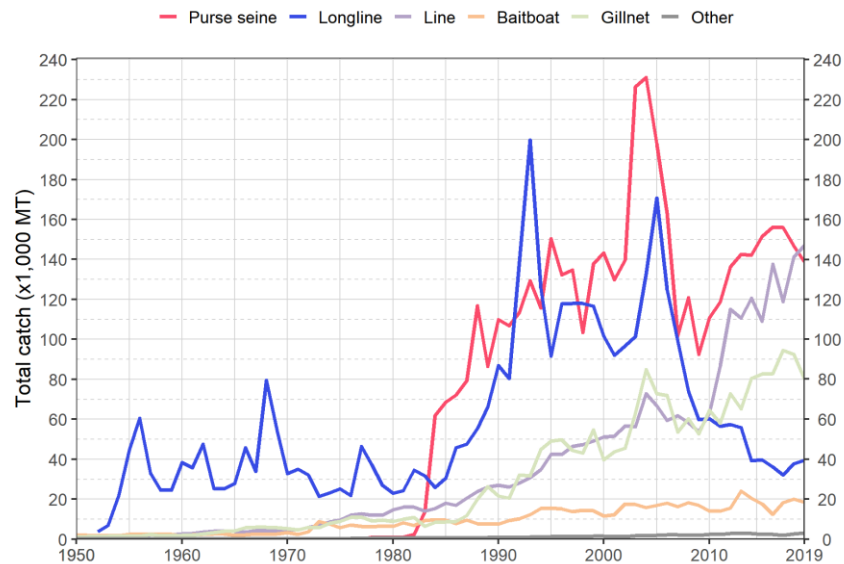
Fig. 1a-b. Annual time series of (a) cumulative nominal catches (MT) by gear and (b) individual nominal catches (MT) by gear group for yellowfin tuna during 1950–2019. LS = drifting log or FAD-associated school and FS = free-swimming school. <u>Purse seine</u>: coastal purse seine, purse seine, ring net; <u>Longline</u>: deep-freezing and fresh longlines, swordfish and sharks-targeted longlines; <u>Line</u>: coastal longline, trolling and handline; <u>Baitboat</u>: coastal and offshore baitboats; <u>Gillnet</u>: coastal and offshore gillnets, driftnet; <u>Other</u>: all remaining fishing gears
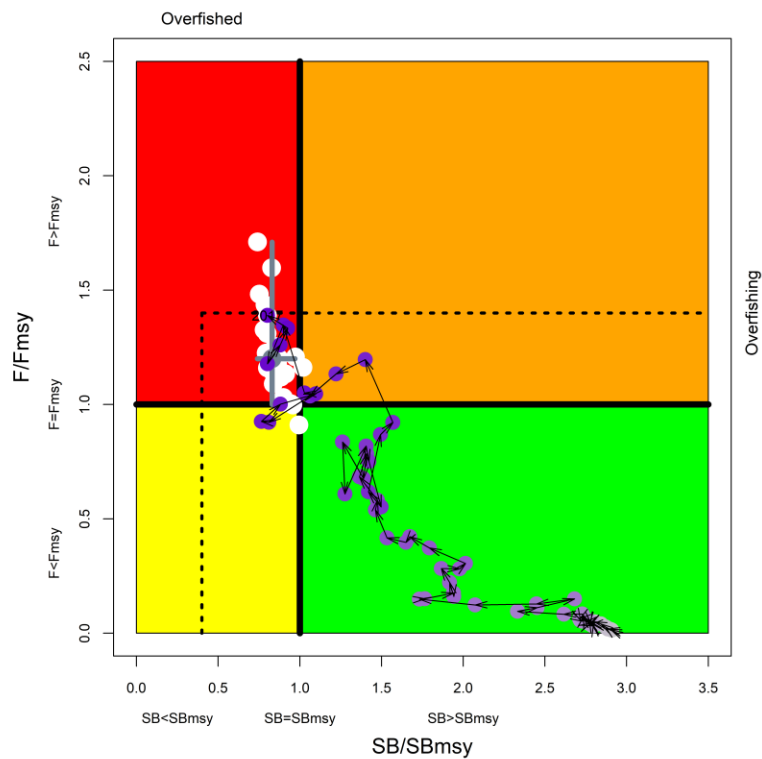
Fig. 2. Yellowfin tuna: Stock synthesis Kobe plot. Blue dots indicate the trajectory of the point estimates for the SSB/SSB_{MSY} ratio and F/F_{MSY} ratio for each year 1950–2017. The grey line represents the 80% confidence interval associated with the 2017 stock status. Dotted black lines are the interim 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 (409,567 MT), -35%, -30%, -25%, -20%, -15%, - 10%, -5%, +10%) projected for 3 (2020) and 10 years (2027). Catch levels are given between brackets

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% (266,218)	70% (286,697)	75% (307,175)	80% (327,654)	85% (348,132)	90% (368,610)	95% (389,089)	100% (409,567)	110% (450,523)
$B_{2020} < B_{MSY}$	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% (266,218)	70% (286,697)	75% (307,175)	80% (327,654)	85% (348,132)	90% (368,610)	95% (389,089)	100% (409,567)	110% (450,523)
$B_{2020} < B_{Lim}$	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%.