

APPENDIX 1 EXECUTIVE SUMMARY: ALBACORE (2021)



Table 1. Status of albacore (*Thunnus alalunga*) in the Indian Ocean

Area	Indicators – 2019 assessment		Status ³
Indian Ocean ¹	Catch 2020 ² (MT)	38,082	
	Average catch 2016–2020 (MT)	38,781	
	MSY (1,000 MT) (95% CI)	35.7 (27.3–44.4)	
	F _{MSY} (95% CI)	0.21 (0.195–0.237)	
	SB _{MSY} (1,000 MT) (95% CI)	23.2 (17.6–29.2)	
	F ₂₀₁₇ /F _{MSY} (95% CI)	1.346 (0.588–2.171)	
	SB ₂₀₁₇ /SB _{MSY} (95% CI)	1.281 (0.574–2.071)	
	SB ₂₀₁₇ /SB ₁₉₅₀	0.262	

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 2020: 15%

³ The stock status refers to the most recent years' data used in the last assessment conducted in 2019. i.e. 2017

Colour key	Stock overfished (SB _{year} /SB _{MSY} < 1)	Stock not overfished (SB _{year} /SB _{MSY} ≥ 1)
Stock subject to overfishing (F _{year} /F _{MSY} > 1)		
Stock not subject to overfishing (F _{year} /F _{MSY} ≤ 1)		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new stock assessment was carried out for albacore in 2019 to update the assessment undertaken in 2016. The stock assessment was carried out using Stock Synthesis III (SS3), a fully integrated model that is currently also used to provide scientific advice for the three tropical tunas stocks in the Indian Ocean. The model used in 2019 is based on the model developed in 2016 with a series of revisions that were noted during the WPTmT data preparatory meeting held in January 2019. There are some noticeable changes in spatial distribution of longline catches compared to the previous assessment data set, with historical catch shifted to equatorial regions (LL1 and LL2) from southern fisheries (LL3 and LL4). This is due to revisions in the historical catch data carried out since the last assessment.

The current assessment has utilised CPUE series that are significantly different from the last assessment. In particular a revised approach to the analysis of the joint LL CPUE series was conducted and the resulting indices were included in the SS3 model. The final set of model options included alternative models using the northwest and southwest CPUE indices. Both sets of indices show a considerable decline from 1979 to current. The two sets of indices effectively monitor different components of the albacore stock. The CPUE in the southwest area (LL3) is mostly likely to represent the abundance of albacore tuna at the time, as the indices were primarily based on a main target fishery with more consistent fishing operations. The southwest area also represents a significant proportion of the albacore biomass in the Indian Ocean. The

LL1 CPUE indices largely represent bycatch of the tropical tuna fisheries. The assessment results were sensitive to the influence of the length composition data sets in the models. There is concern regarding the information content of these data. Consequently, the final set of model options included alternative treatments of these data including down-weighting or excluding these data.

Trends in the CPUE series suggest that the longline vulnerable biomass has declined to around 45-50% of the levels observed in 1980–82. Prior to 1980 there was 20 years of moderate fishing, after which total catches of albacore tuna in the Indian Ocean have more than doubled in subsequent years (**Fig. 1**). Catches have also increased substantially since 2007 for some fleets (i.e., Indonesian and Taiwan, China longline fisheries), although there is substantial uncertainty regarding the reliability of the catch estimates. Catches in 2017 were marginally above the MSY level of the SS3 model. Fishing mortality represented as F_{2017}/F_{MSY} is 1.346 (0.588–2.171). Biomass is estimated to be above the SB_{MSY} level (1.281 (0.574–2.071)) from the SS3 model (**Table 1, Fig. 2**). These changes in stock status since the previous assessment are possibly due to decreases in the CPUE in recent years, while catches have remained relatively stable. Also, there has been a large redistribution of catch to the southern regions which impacts on small fish (and therefore influences the computation of F_{MSY}). In addition, the latest assessment uses a revised growth curve which also impacts F_{MSY} . Thus, the stock status in relation to the Commission's B_{MSY} and F_{MSY} target reference points indicates that the stock is **not overfished** but is **subject to overfishing** (**Table 1**).

Outlook. Maintaining or increasing effort in the core albacore fishing grounds is likely to result in further decline in the albacore tuna biomass, productivity and CPUE. The impacts of piracy in the western Indian Ocean resulted in the displacement of a substantial portion of longline fishing effort into the traditional albacore fishing areas in the southern and eastern Indian Ocean. However, in recent years the effort distribution in the Indian Ocean has been rather dynamic. Projections indicate that under current catch assumptions, the biomass will continue to decline as recent recruitment levels are estimated to be low. The recruitment in the terminal years of the assessment model are estimated to be well below average levels and this is projected to cause the stock to decline considerably over the short term. However, these recruitment estimates are poorly determined. Therefore, it is cautioned that the short-term projections are more influenced by the recent low recruitment levels, whereas the long-term projections are more determined by the assumptions of average recruitment levels over the longer-term period.

Management advice. Although considerable uncertainty remains in the SS3 assessment conducted in 2019, particularly due to the conflicts in key data inputs, a precautionary approach to the management of albacore tuna should be applied. The K2SM indicates that catch reductions are required in order to prevent the biomass from declining to below MSY levels in the short term, due to the low recent recruitment levels. Although there is considerable uncertainty in the projections, current catches are exceeding the estimated MSY level (35,700 MT; **Table 2**).

The following should be noted:

- The primary sources of data that drive the assessment, total catches, CPUE and length data, are highly uncertain and should be developed further as a priority.
- The catch estimates for 2019 (39,876 MT) are above the current estimated MSY levels (**Table 1**).
- A Kobe 2 Strategy matrix was calculated to quantify the risk of different future catch scenarios, using the projections from the SS3 model (**Table 2**).

- Provisional reference points: noting that the Commission in 2015 adopted Resolution 15/10 *On interim target and limit reference points and a decision framework*, the following should be noted:
 - **Fishing mortality:** Current fishing mortality is considered to be above the provisional target reference point of F_{MSY} , but below the provisional limit reference point of $1.4 * F_{MSY}$ (**Fig. 2**).
 - **Biomass:** Current spawning biomass is considered to be above the target reference point of SB_{MSY} , and therefore above the limit reference point of $0.4 * SB_{MSY}$ (**Fig. 2**).
- **Main fishing gear (average catches 2015-2019):** albacore tuna are currently caught almost exclusively using drifting longliners, with the remaining catches recorded using purse seines and other gears. Catches from the longline fisheries are split between deep-freezing longliners and fresh-tuna longliners (**Fig. 1**).
- **Main fleets (average catches 2015-2019):** the majority of albacore catches are attributed to vessels flagged to distant water fishing nations (i.e., Taiwan, China and Japan), followed by coastal countries such as Indonesia and Malaysia.

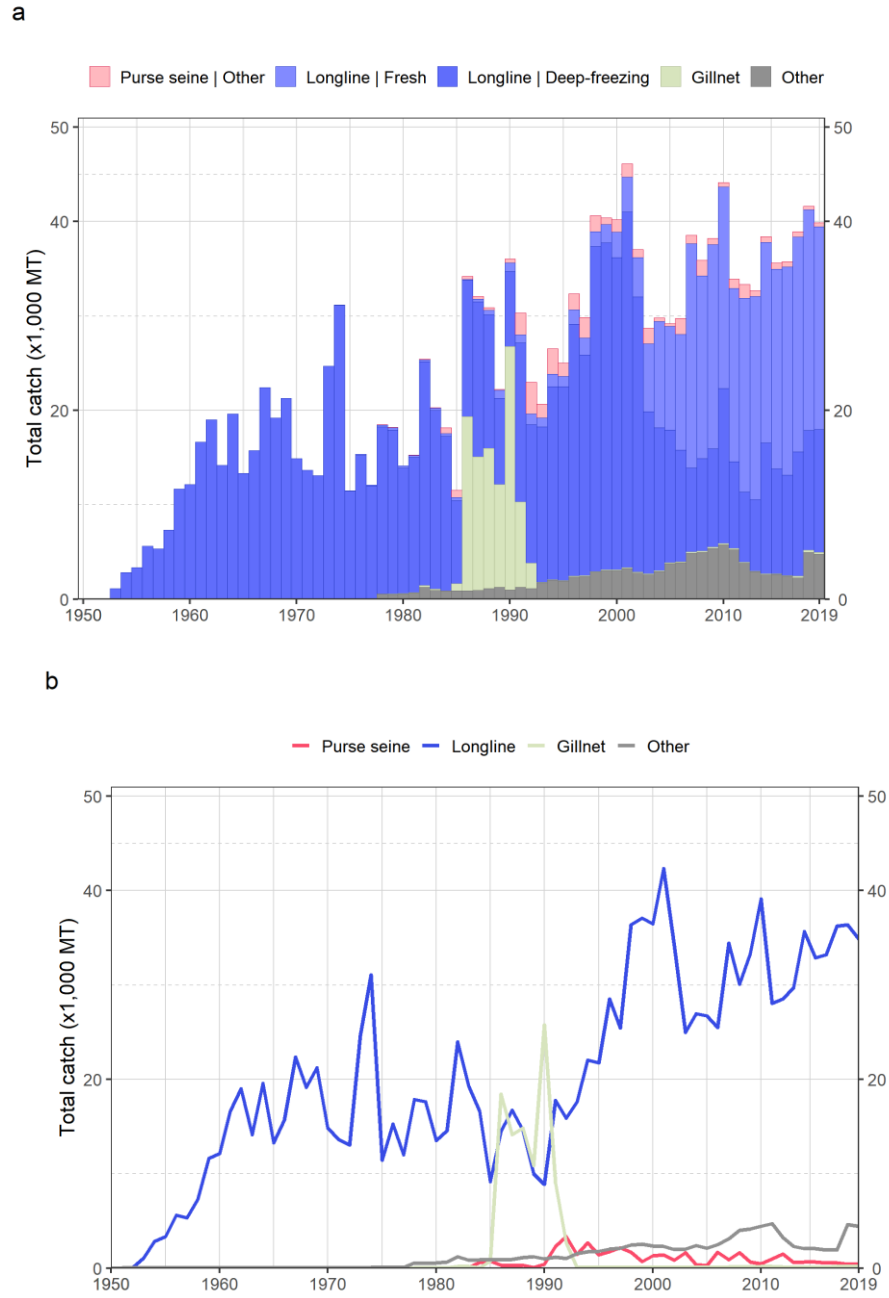


Fig. 1. Annual time series of (a) cumulative and (b) individual nominal catches (MT) by gear group for albacore tuna during 1950–2019. Purse seine: coastal purse seine, purse seine, ring net; Longline: fresh and deep-freezing longline; Gillnet: gillnet, including offshore gillnet and driftnets from Taiwan, China; Other: all remaining fishing gears

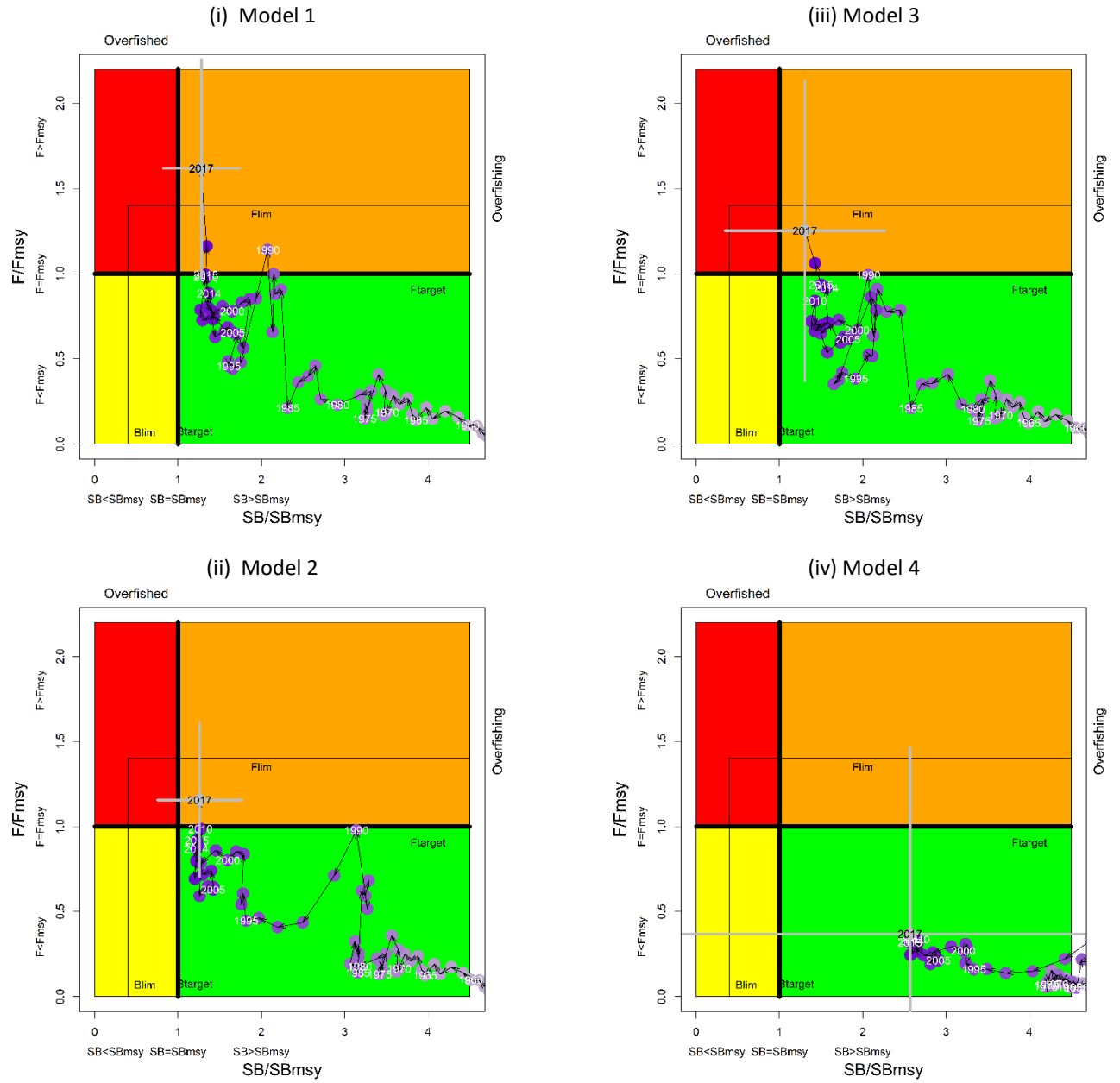


Fig. 2. Albacore: SS3 Indian Ocean assessment Kobe plot for the four model options considered: (i) Model 1 (ii) Model 2 (iii) Model 3 (iv) Model 4. Purple circles indicate the trajectory of the point estimates for the spawning biomass (SB) ratio and fishing mortality (F) ratio for each year 1950–2017 (the grey lines represent the 95 percentiles of the 2017 estimate). Target (F_{target} and SB_{target}) and limit (F_{lim} and SB_{lim}) reference points are shown

Table 2. Albacore: SS3 aggregated Indian Ocean assessment Kobe II Strategy Matrix based on the model options (i) Model 1 (ii) Model 2 (iii) Model 3 (Model 4 was not used for management advice). Probability (percentage) of violating the MSY-based target (top) and limit (bottom) reference points for constant catch projections (2017 catch level, $\pm 10\%$, $\pm 20\%$, $\pm 30\%$ $\pm 40\%$) projected for 3 and 10 years

Reference point and projection timeframe	Alternative catch projections (relative to the catch level for 2017) and probability (%) of violating MSY-based target reference points ($SB_{\text{targ}} = SB_{\text{MSY}}$; $F_{\text{targ}} = F_{\text{MSY}}$)								
	60% (22,901)	70% (26,718)	80% (30,534)	90% (34,351)	100% (38,168)	110% (41,985)	120% (45,802)	130% (49,618)	140% (53,435)
SB ₂₀₂₀ < SB _{MSY}	0.614	0.678	0.715	0.769	0.818	0.828	0.87	0.883	0.898
F ₂₀₂₀ > F _{MSY}	0.074	0.224	0.4	0.556	0.654	0.731	0.766	0.788	0.782
SB ₂₀₂₇ < SB _{MSY}	0.176	0.307	0.456	0.572	0.713	0.823	0.898	1	1
F ₂₀₂₇ > F _{MSY}	0.002	0.085	0.287	0.473	0.718	0.878	1	1	1

Reference point and projection timeframe	Alternative catch projections (relative to the catch level for 2017) and probability (%) of violating MSY-based target reference points ($SB_{\text{targ}} = SB_{\text{MSY}}$; $F_{\text{targ}} = F_{\text{MSY}}$)								
	60% (22,901)	70% (26,718)	80% (30,534)	90% (34,351)	100% (38,168)	110% (41,985)	120% (45,802)	130% (49,618)	140% (53,435)
SB ₂₀₂₀ < SB _{Lim}	0.039	0.065	0.084	0.124	0.161	0.19	0.253	0.314	0.373
F ₂₀₂₀ > F _{Lim}	0.003	0.037	0.129	0.277	0.414	0.537	0.629	0.696	0.712
SB ₂₀₂₇ < SB _{Lim}	0.059	0.12	0.22	0.325	0.462	0.648	0.749	1	1
F ₂₀₂₇ > F _{Lim}	0	0.006	0.127	0.309	0.622	0.843	1	1	1