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IOTC–2025–WPTmT09(AS)–R

Report of the Ninth Session of the IOTC Working Party on Temperate Tunas: Assessment Meeting

Seychelles, 21–25 July 2025

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Contact details:

Indian Ocean Tuna Commission
ABIS Center
PO Box 1011
Victoria, Mahé, Seychelles
Email: iotc-secretariat@fao.org
Website: http://www.iotc.org

ACRONYMS

ALB	Albacore
ASAP	Age structured assessment program
ASPIC	A Stock-Production Model Incorporating Covariates
ASPM	Age-structured production model
B	Biomass (total)
BBDM	Bayesian biomass dynamics model
B_{MSY}	Biomass which produces MSY
BSPM	Bayesian State-Space Production Model
CMM	Conservation and Management Measure (of the IOTC; Resolutions and Recommendations)
CPCs	Contracting parties and cooperating non-contracting parties
CPUE	Catch per unit of effort
current	Current period/time, i.e. $F_{current}$ means fishing mortality for the current assessment year.
EEZ	Exclusive Economic Zone
F	Fishing mortality; F_{2011} is the fishing mortality estimated in the year 2011
F_{MSY}	Fishing mortality at MSY
HBF	Hooks between floats
HCR	Harvest control rule
IO	Indian Ocean
IOTC	Indian Ocean Tuna Commission
LL	Longline
LRP	Limit reference point
M	Natural mortality
MPF	Meeting participation fund
MSE	Management strategy evaluation
MSY	Maximum sustainable yield
n.a.	Not applicable
PS	Purse-seine
SC	Scientific Committee of the IOTC
SB	Spawning biomass (sometimes expressed as SSB)
SB_{MSY}	Spawning stock biomass which produces MSY
SS3	Stock Synthesis III
SST	Sea surface temperature
TAC	Total allowable catch
TRP	Target reference point
VB	Von Bertalanffy (growth)
WPTmT	Working Party on Temperate Tunas of the IOTC

STANDARDISATION OF IOTC WORKING PARTY AND SCIENTIFIC COMMITTEE REPORT TERMINOLOGY

SC16.07 (para. 23) The SC **ADOPTED** the reporting terminology contained in Appendix IV and **RECOMMENDED** that the Commission considers adopting the standardised IOTC Report terminology, to further improve the clarity of information sharing from, and among its subsidiary bodies.

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

Level 1: ***From a subsidiary body of the Commission to the next level in the structure of the Commission:***
RECOMMENDED, RECOMMENDATION: Any conclusion or request for an action to be undertaken, from a subsidiary body of the Commission (Committee or Working Party), which is to be formally provided to the next level in the structure of the Commission for its consideration/endorsement (e.g. from a Working Party to the Scientific Committee; from a Committee to the Commission). The intention is that the higher body will consider the recommended action for endorsement under its own mandate, if the subsidiary body does not already have the required mandate. Ideally this should be task specific and contain a timeframe for completion.

Level 2: ***From a subsidiary body of the Commission to a CPC, the IOTC Secretariat, or other body (not the Commission) to carry out a specified task:***
REQUESTED: This term should only be used by a subsidiary body of the Commission if it does not wish to have the request formally adopted/endorsed by the next level in the structure of the Commission. For example, if a Committee wishes to seek additional input from a CPC on a particular topic, but does not wish to formalise the request beyond the mandate of the Committee, it may request that a set action be undertaken. Ideally this should be task specific and contain a timeframe for the completion.

Level 3: ***General terms to be used for consistency:***
AGREED: Any point of discussion from a meeting which the IOTC body considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 or level 2 above; a general point of agreement among delegations/participants of a meeting which does not need to be considered/adopted by the next level in the Commission's structure.
NOTED/NOTING: Any point of discussion from a meeting which the IOTC body considers to be important enough to record in a meeting report for future reference.

Any other term: Any other term may be used in addition to the Level 3 terms to highlight to the reader of and IOTC report, the importance of the relevant paragraph. However, other terms used are considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3, described above (e.g. **CONSIDERED**; **URGED**; **ACKNOWLEDGED**).

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EXECUTIVE SUMMARY

The 9th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Temperate Tunas: Assessment Meeting (WPTmT08(AS)) was held in a hybrid format at Eden Bleu hotel, Seychelles, from 21 to 23 July 2025. A total of 22 participants (42 in 2022, 23 in 2019) including 10 in-person participants attended the Session.

The WPTmT **RECALLED** the recommendations contained in the Working Party on Temperate Tunas: Data Preparatory Meeting (WPTmT09(DP)) Report.

The following are a subset of the complete recommendations from the WPTmT09(AS) to the Scientific Committee,

STOCK ASSESSMENTS

WPTMT09.01 (para 79) The WPTmT **DISCUSSED** in detail the outstanding issues in the updated NW and SW models. In particular, the SW model produced very high biomass estimates with large uncertainty when the selectivity for LL3 and LL4 was unconstrained (allowed to be domed-shaped), while the NW model showed bias in the predicted length composition for the LL1 fishery. Despite several investigative model runs during the meeting, the exact causes of these issues and potential solutions remain unclear. Given the changes in input data and the late availability of the CPUE indices, the WPTmT **AGREED** that, while the updated assessment model in its current configuration is sufficient for estimating stock status, further scrutiny is needed to improve its reliability and ensure robust management advice. As such, the WPTmT **RECOMMENDED** that assessment work continue next year and that the SC convene another WPTmT assessment meeting in 2026 to review progress.

Selection of Stock Status indicators

WPTMT09.02 (para 80) The WPTmT **NOTED** that only SS3 models were updated this year and no alternative assessment models (e.g., SCAA, JABBA, etc.) were developed. After extensive discussion, the WPTmT concluded that, although the updated assessment model can be used to estimate stock status, additional work is required to address the identified issues and provide robust management advice. The WPTmT **RECOMMENDED** that, in the short term (one year), management advice from the 2022 assessment could be used as a precautionary approach. This recommendation is supported by the fact that the new CPUE indices are broadly similar to the previous ones, and changes in the main input observations did not unexpectedly alter the model outcomes. It is anticipated that, once the assessment is improved and accepted at the proposed WPTmT meeting next year, management advice can be updated using the new assessment.

Revision of the WPTmT Program of Work

WPTmT09.03 (Para 85) The WPTmT **RECOMMENDED** that the SC consider and endorse the WPTmT Program of Work (2026–2030), as provided at Appendix V.

Date and place of the 10th Sessions of the WPTmT

WPTmT09.04 (Para 88) The WPTmT **AGREED** that the assessment work on albacore will continue in 2026 (see Para xx). The WPTmT **RECOMMENDED** that the 10th Session of the WPTmT be convened in 2026 to refine the 2025 assessment, and that the meeting be held in late July for a duration of three days in a virtual format.

WPTmT09.05 (Para 89) The WPTmT **RECOMMENDED** that the 11th Session of the WPTmT be held in 2028, as originally planned.

WPTmT09.06 (Para 90) The WPTmT **NOTED** that there has been a lower response to WPTmT meetings (both data preparation and assessment meetings), and consequently, the assessment meeting has been reduced from five days to three days. The WPTmT **NOTED** that with low participation, the meeting is unlikely to be productive or cost-efficient. The WPTmT encourages CPCs' scientists to actively engage and participate in future WPTmT meetings to contribute to albacore research. The WPTmT **RECOMMENDED** that only one combined meeting (in person, five days) be held in July 2028.

Review of the draft, and adoption of the Report of the 9th Session of the WPTmT

WPTmT09.07 (para 91) The WPTmT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPTmT09(AS), provided at Appendix VI, as well as the management advice provided in the draft resource stock status summary for albacore (Appendix IV).

1. OPENING OF THE MEETING

1. The 9th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Temperate Tunas: Assessment Meeting (WPTmT08(AS)) was held in a hybrid format at Eden Bleu hotel, Seychelles, from 21 to 23 July 2025. A total of 22 participants (42 in 2022, 23 in 2019), including 10 in-person, attended the Session. The list of participants is provided at Appendix I. The meeting was opened by the Chairperson, Dr Toshi Kitakado (Japan).

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

2. The WPTmT **ADOPTED** the Agenda provided at Appendix II. The documents presented to the WPTmT09 (AS) are listed in Appendix III.

3. The WPTmT **NOTED** the main discussion points and recommendations arising from the report of the WPTmT Data Preparatory meeting (IOTC-2025-WPTmT09(DP)-R), held online in April 2025.

4. The WPTmT **NOTED** a summary of the parameters, configuration and results of the stock assessment conducted in 2022 and the changes that were agreed to for this year's assessment during the data preparatory meeting.

5. The WPTmT **NOTED** that in the 2022 assessment, estimates of reference points (including F and B ratios) were obtained by combining the estimates from the two final models which were adopted, with the median derived from the range estimates across the two models.

3. UPDATE OF ANY NEW DATA AVAILABLE AT THE SECRETARIAT FOR ALBACORE TUNA SINCE THE DATA PREPARATORY MEETING

6. The WPTmT **NOTED** paper IOTC-2025–WPTmT09-04, which provides a review of the statistical data and fishery trends for Indian Ocean albacore.

7. The WPTmT **THANKED** the Secretariat for presenting an overview of albacore fisheries in the Indian Ocean. The WPTmT also **NOTED** the global increase in albacore tuna catches, with the Indian Ocean contributing approximately 13% to the total.

8. The WPTmT **NOTED** that albacore tuna catches are predominantly from industrial longline fisheries, with a recent increase from coastal longline operations. **NOTING** that Taiwan, China's longline fleet accounted for approximately 55% of recent albacore catches, followed by Indonesia, which contributed around 20% from multiple fisheries.

9. The WPTmT further **NOTED** that the recent historical re-estimation of Indonesian catches across all fisheries led to an upward revision of historical albacore catch figures, particularly in 2013, where an increase of 17,000 tonnes was recorded.

10. The WPTmT **EXPRESSED** concern about the uncertainty in the available data for albacore tuna. Although the chart for retained catches indicates improvements in data quality and availability, the analysis does not adequately assess the actual quality of the data or the reliability of its sources.

11. The WPTmT also **NOTED** the uncertainty of geo-referenced catch and effort, and size frequency data, which remain limited relative to retained catches, particularly for the years prior to 2000. It was further **NOTED** that geo-referenced data are more comprehensive for distant-water industrial fleets than for coastal countries catching albacore tuna.

12. The WPTmT **NOTED** the lack of spatial information associated with the size frequency data available for Indonesia between 2004 and 2006. It was further **NOTED** that these data were collected under the OFCF-IOTC sampling programme, primarily at factories or landing sites, making it difficult to determine the corresponding fishing areas.

13. The WPTmT also **NOTED** the distribution of average weight of albacore from fresh tuna longline fisheries, observing that larger fish were caught in the southwest Indian Ocean between 2010 and 2019. Given that the map presented data aggregated over multiple years, the WPTmT **REQUESTED** that the distribution of average weight be illustrated by year and by fleet to better understand temporal and spatial trends.

14. The WPTmT **NOTED** that Taiwanese size frequency data collected from logbooks in some years were not used due to discrepancies when compared to data from the Regional Observer Scheme (ROS). For assessment purposes, the ROS data were considered more reliable.

15. The WPTmT further **NOTED** that scientists from Taiwan,China are monitoring both datasets to evaluate the quality of the size frequency information. It was also **NOTED** that recent analyses indicate similar trends between the two datasets.

16. The WPTmT **NOTED** that the Secretariat is collaborating with the Seychelles Fishing Authority (SFA) to obtain historical size frequency data for the Taiwanese fleet that previously operated within the Seychelles EEZ.

17. The WPTmT **NOTED** the comparison between the size frequency data used in the 2022 and 2025 stock assessments, following a request made during the meeting after experts observed discrepancies between the datasets. The WPTmT **ACKNOWLEDGED** that minor differences were identified, primarily due to updates in data from the longline fisheries of China, Seychelles, and South Africa between 2015 and 2020.

18. Although the changes were minor, the WPTmT **NOTED** that they could still influence the assessment outcomes. The WPTmT, therefore **REQUESTED** that such comparisons be systematically included as part of the data update review process.

4. ALBACORE STOCK ASSESSMENT

4.1 REVIEW NEW INFORMATION ON ALBACORE BIOLOGY, STOCK STRUCTURE, FISHERIES AND ASSOCIATED ENVIRONMENTAL DATA SINCE THE DATA PREPARATORY MEETING

19. The WPTmT **NOTED** paper IOTC-2025–WPTmT09-05 which provided the preliminary observations of albacore Tuna catches in Sri Lanka including the following abstract provided by the authors:

"This study presents preliminary observations on the catch trends of Albacore Tuna (Thunnus alalunga) within the Sri Lankan tuna fishery to identify emerging patterns and highlight critical data gaps. Although Albacore is not a primary target species in Sri Lanka, it contributes notably to total tuna landings, especially from multiday fishing vessels operating in coastal and offshore areas. Analysis of available catch and effort data from selected landing sites revealed a modest but increasing trend in Albacore landings in recent years, potentially influenced by shifts in oceanographic conditions or changes in fishing effort distribution. Between 2015 and 2020, fisheries logbook data from the Department of Fisheries and Aquatic Resources indicate that gillnet, longline, and ring net gear types accounted for approximately 42%, 24%, and 34%, respectively, of the total Albacore catch by multiday vessels. 74% of the Albacore catch originated from within Sri Lanka's Exclusive Economic Zone (EEZ), while the remaining 26% was caught in high seas. Regionally, 37%, 34%, and 28% of Albacore landings were attributed to vessels operating from the southern, western, and eastern harbors, respectively." See the paper for the full abstract.

20. The WPTmT **THANKED** Sri Lanka for presenting the trend of albacore catches from the Sri Lankan fisheries.

21. The WPTmT **NOTED** that albacore tuna is not commonly landed in Sri Lanka, although recent records indicate increasing catches from Sri Lankan fisheries.

22. The WPTmT further **NOTED** that since the introduction of logbooks in 2015, there are low report of albacore catches. **ACKNOLEDGING** that albacore may have been caught in the past, but earlier port sampling data collection using paper forms did not include specific fields for albacore, or the species may have been misidentified. **NOTING** that catches in the last two years are unusually high.

23. The WPTmT **NOTED** that the recent increase in reported albacore catches may be attributed to several factors, including changing oceanic conditions and improved species identification. It was further **NOTED** that the recent increase in albacore catches from gillnet and ring net fisheries may also be attributed to improved logbook coverage within those fisheries.

24. The WPTmT further **NOTED** that although albacore catches have increased in recent years, overall fishing effort has not shown a corresponding increase. Furthermore, the WPTmT **NOTED** that this may be due to changes in the spatial or temporal distribution of effort; however, no analysis has yet been conducted to confirm this.

25. The WPTmT **NOTED** paper IOTC-2025–WPTmT09-06 which examined temperate tuna imports to Thailand during 2020-2024 including the following abstract provided by the authors:

    "*Thailand is a major producer of tuna products in the world, with most of the tuna imported from both the Indian and Pacific Oceans. Temperate tuna is one of the raw materials in the tuna industry, with frozen bluefin tuna mostly imported by sea and air. During 2020-2024, the highest import volume in 2020 was 89,563,791.26 tons, with the highest import volumes by fishing area in the Indian Ocean are EEZ Malaysia, EEZ Indonesia and FAO 51, respectively. This study examines the trends in the import of temperate tuna in Thailand, the import volume and value, and the tuna fishing grounds in the Indian Ocean*"

26. The WPTmT **THANKED** Thailand for its presentation on the importance of albacore tuna to the Thai canning industry. **NOTING** that Thailand is a major global importer of albacore tuna, which is used by its processing industry in both fresh and frozen forms.

27. The WPTmT further **NOTED** that while the volume of imported albacore is high, its market value varies. The WPTmT further **OBSERVED** that higher values are associated with larger fish during certain seasons, whereas the value declines when smaller albacore are imported.

28. The WPTmT also **NOTED** that Malaysia is the primary source of albacore for Thailand's tuna industry, accounting for over 44% of total albacore imports.

29. The WPTmT **NOTED** paper IOTC-2025-WPTmT09-07 which summarises The Status of Tuna Stocks with Special Reference to Temperate Tunas in Pakistan including the following abstract provided by the authors:

    "Pakistan's tuna fisheries primarily target yellowfin, skipjack, and longtail tuna, with these three species making up about 70% of the total catch. While Pakistan has eight tuna species in its waters, these three are the most commercially significant. Tuna fishing is still largely an artisanal activity, but there's a growing emphasis on developing the tuna fishery within the country's Exclusive Economic Zone. While bluefin tuna are not a major catch in Pakistan, they are occasionally found in Pakistani waters, particularly the Pacific bluefin .'' see the paper for the full abstract.

30. The WPTmT **THANKED** Pakistan for presenting an overview of its fisheries, which provided information on the main species, fishing operations, and issues related to data collection.

31. The WPTmT **NOTED** that Pakistan has three main fishing zones, where five major tuna species are caught, primarily tropical and neritic tunas, but not temperate tunas. It was further **NOTED** that catches dropped significantly in 1994 following high catches in 1993.

32. The WPTmT also **NOTED** that some Taiwanese vessels operated in Pakistani waters between 2005 and 2006, targeting yellowfin tuna. **NOTING** that the Pakistan National Jurisdiction Area (NJA) is considered a low-yield zone for temperate tunas, with only a few recorded catches of bluefin tuna.

33. The WPTmT **NOTED** that while observer coverage is mandatory in Pakistan, it is currently not feasible on gillnet vessels. However, it was **NOTED** that WWF is implementing a crew-based observer programme to support data collection efforts.

34. The WPTmT **NOTED** existing data gaps from Pakistan, particularly in the period before 2015, and expressed concern over the reliability of this historical data. The WPTmT **NOTED** the urgent need to revisit and improve these data records.

35. The WPTmT **NOTED** paper IOTC-2025-WPTmT09-11 which summarises how to age albacore tuna using epigenetic clocks including the following abstract provided by the authors:

    "Accurately determining the age of individuals is a cornerstone of ecological and biological research. Age information underpin a wide range of applications, from assessing population dynamics to evaluating ecosystem health (Ono et al., 2015). Reliable age estimates are essential for inferring key life-history traits such as growth rates, age at sexual maturity, and age-specific fecundity (Schaffer, 1974; Western, 1979; Frisk et al., 2001). Consequently, the ability to estimate age enables more robust monitoring of demographic parameters, including population structure and reproductive potential. Despite its central role, chronological age remains difficult to determine in wild animal populations, particularly in species lacking clear aging markers in hard structures or with limited access to long-term observational data"

36. The WPTmT **NOTED** that temperate tunas can be aged using otoliths, however the pelagic nature of albacore, along with the fragility and size of the otoliths mean that accurate ageing can be difficult. The WPTmT also **NOTED** this presentation provided information on a newer genetic method, using epigenetic data from methylated DNA that provides a tissue age for individual tuna. When combined with the otolith age for that individual, a genetic 'clock' or 'epigenetic clock' can be determined for a representative sample of tuna across the Indian Ocean. Once the 'clock' is ready to use, tissue samples can be collected from a individual albacore, and genetic analyses can provide an age for that individual. As tissue samples are easier to collect than otoliths (which require detailed dissection from the head of the tuna), this method has potential for providing stock assessments with yearly ages to inform age-at-length, and growth parameters, both lacking for albacore in the Indian Ocean.

37. The WPTmT further **NOTED** the time required to collect and analyse tissue samples for aging, **ACKNOWLEDGING** that results may not be immediately available to the Secretariat. Furthermore, The WPTmT **NOTED** that genetic variations may influence the outcomes of age assessments, reiterating the importance of understanding genetic stock structure within any modelled population.

38. The WPTmT **NOTED** that for an epigenetic clock to be accruate, tissue samples need to come from the same type of tissue (e.g. flank muscle, liver, pectoral fin etc.) rather than varying the tissue types as methylation occurs at different rates across an individual. The WPTmT **NOTED** that tissue samples from larval tuna were taken from the eyes due to the very small size of the individuals, and the difficulty in selecting one particular tissue if sampling from the flank of the fish. The WPTmT **NOTED** that although this is less than ideal, it did allow for some data from larval fish to allow the model to root close to age "0". The WPTmT **NOTED** that in future, samples from juvenile albacore tuna from the same tissue type of the adults would help verify the accuracy of the epigenetic clock at these young ages.

39. The WPTmT **ACKNOWLEDGED** that these efforts aimed to include smaller individuals in the sampling, in order to better understand age variation across size classes.

40. The WPTmT **NOTED** that a leave-one-out cross-validation (LOOCV) was performed during the selection of optimal methylated (CpG) sites.

41. The WPTmT further **NOTED** that future analyses are planned to incorporate age-at-length models, **NOTING** that the genetic samples taken may also be used to predict sex. Additionally, the WPTmT **HIGHLIGHTED** the need for more samples from across the length distribution of albacore in the Indian Ocean. The WPTmT **NOTED** that samples with representative spatial and temporal variation (e.g. across the Indian Ocean, and from different cohorts of albacore), and different gear – e.g. to consider samples from industrial purse seine fisheries, to improve the epigenetic clock, and the understanding of both age-at-length, and growth in albacore tuna.

4.2 UPDATED NOMINAL AND STANDARDISED CPUE INDICES

42. The WPTmT **NOTED** paper 9IOTC-2025-WPTmT09-08 which describes a preliminary study of CPUE standardization of albacore tuna in the Eastern Indian Ocean including the following abstract provided by the authors:

> "Albacore tuna (*Thunnus alalunga*) is one of key species in Indonesian longline fishery, important for economic income and exports in the eastern Indian Ocean. This study assesses its stock status using standardized catch per unit effort (CPUE) based on data from 121 trips and 2,863 sets (2005–2021), collected by the Research Institute for Tuna Fisheries of Indonesia. Fishing occurred between 0°–33° South and 75°–130° East, with ~1,300 hooks per set. A generalized linear model standardized CPUE, accounting for hooks, year, month, latitude, and longitude. Both nominal and standardized CPUE peaked in 2008 then showed a declining trend afterwards, with standardized CPUE showing greater fluctuations. These results suggest the need for ongoing monitoring and sustainable management."

43. The WPTmT **NOTED** that albacore is a bycatch species in the Eastern Indian Ocean with decreasing catches over time.

44. The WPTmT **NOTED** that the CPUE showed a large peak in 2008 and to a lesser extent in 2012, and that similar trends were noted between the standardised and nominal CPUE indices.

45. The WPTmT **ACKNOWLEDGED** that the data in the CPUE were from observers and represented less than 5 % of the total catch of albacore in the region, presenting issues regarding the representativeness of the index.

46. The WPTmT **REQUESTED** that the observed length frequency in the logbook dataset in this region be compared to the length frequency data collected by the observers and be presented to the WPTmT at the next meeting.

47. The WPTmT **DISCUSSED** the very high CPUE in 2008, and whether the contributing factor was the much higher number of hooks between floats (HBF) in 2008 compared to other years. The WPTmT **NOTED** that the higher CPUE was likely due to the fleet accessing different fishing grounds in this year, but that it could also be due to differences in gear used in that year.

48. The WPTmT **DISCUSSED** the structure of the CPUE model. The use of latitude and longitude in the standardised CPUE model was discussed, **NOTING** that to avoid spatial autocorrelation, latitude and longitude are normally included as a 5 x 5 grid (factor) or using a spline (s(lat+lon)). The WPTmT also **DISCUSSED** the use of a gaussian distribution in the model, when many boats are likely to have provided zero catches, necessitating the use of a two-step model process to account for the likely binomial distribution of the residuals. These potential improvements to the standardised CPUE were **NOTED** by the authors and will be presented at the next WPTmT.

49. The WPTmT **NOTED** paper IOTC-2025-WPTmT09-09 which provides an Update of the joint CPUE indices for Albacore tunas in the Indian Ocean based on Japanese, Korean and Taiwanese longline fisheries data up to 2024 including the following abstract provided by the authors:

    "Joint CPUE standardization was conducted for the Indian Ocean albacore tuna based on Japanese, Korean and Taiwanese longline fisheries data up to 2023 to provide the WPTmT with information on abundance indices for use in the 2025 stock assessment for this stock. The intention was to produce combined indices by increasing the spatial and temporal coverage of fishery data. To account for the inter-annual changes of the target in each fishery, information on clustering results was used in each region. For standardizing the catch-per-unit-effort data, the conventional linear models and delta-lognormal linear models were employed for the shared operational data in each region. "

50. The WPTmT **NOTED** the apology from the chair of WPTmT that the CPUE was not ready in time for the DP meeting, noting that originally, Japan had only provided aggregated data for the CPUE workshop. This provided additional issues when attempting to combine the operational data from TWN,China, KOR and JPN. Combined with scheduling issues, and estimating three CPUE series in one year (ALB, BET, YFT) provided a work schedule that was potentially too high for one year.

51. The WPTmT **NOTED** the use of two models: the delta lognormal using all the data, then lognormal to understand which 'cluster' of data to use for the CPUE by region, based on the ratio of catch of different species.

52. The WPTmT **NOTED** that previously, the indices from R2 and R4 have not been included in the assessment model due to difficulties standardising the CPUE in these areas. These difficulties arise from targeting / bycatch issues (albacore is not a target species in these regions) and in R4 there are issues with identifying SBT and ALB in JPN and KOR data. The WPTmT **AGREED** that only the indices from R1 and R3 should be used in the stock assessment, **NOTING** that two methods were used (r0r1: the same configuration as 2022, but with different methods; r0r0: updated configuration and updated methods).

53. The WPTmT **DISCUSSED** the clustering analyses and the associated timeframes. Due to non-homogeneous data between quarters and years, and the catch composition changing, data were aggregated within a 10-day unit from which the species clusters were extracted.

54. The WPTmT **NOTED** the differences in the indices between 2022 and 2025, noting that although there were slight differences between individual data points, the general trends between the three years of CPUE indices were similar. The WPTmT also **NOTED** the dramatic increase in CPUE in the final two years for all quarters in region 3

55. The WPTmT **AGREED** to use the "r0r0" CPUE standardisations within the stock assessment model, but to also test the r0r1 index in sensitivity runs, if time permits.

56. The WPTmT **AGREED** to not use the indicies from R4 or R2. The WPTmT **NOTED** that in 2019, the assessment was conducted using indices from R1, R3, and another model with R1+R3. The WPTmT **AGREED** to use the same approach this time, however the WPTmT also **NOTED** that there was insufficient time to complete all scenarios, and so to focus on one model with the R1 index and associated data, and a second model using the R3 index and associated data, similar to the 2022 assessment.

4.3 STOCK ASSESSMENTS

57. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(AS)–10 which provided a stock assessment for albacore in the Indian Ocean by Stock Synthesis III (SS3) model, including the following abstract provided by the author:

> *"This paper presents a stock assessment of albacore tuna (Thunnus alalunga) in the Indian Ocean using Stock Synthesis (version 3.30.23.02 https://nmfs-ost.github.io/ss3-website/). The albacore tuna assessment model is an age structured (14 years), spatially aggregated (1 region) and two sex model. The catch, effort, and size composition of catch are grouped into 23 fisheries covering the time period from 1950 through 2023. Fifteen indices of abundance, fourteen of which are from longline fisheries were considered for this analysis. At the time of publication of this document, these indices of abundance have not been updated since the 2022 assessment and so span the time period 1975-2020. Therefore, the indices of abundance do not contain data for the final three years of the assessment. As these are the major component predicting biomass within the stock assessment model, this represents a major point of uncertainty within the model outputs. Updated indices of abundance may become available at the time of, or prior to, the assessment meeting, at which point the model may be updated to include these indices" – see the paper for the full abstract*

58. The WPTmT **THANKED** the authors for their significant effort and highlighted the important findings from the preliminary SS3 models. Based on the results presented in the paper, the WPTmT **NOTED** the following regarding the modeling approach discussed at the meeting.

59. The WPTmT **NOTED** that, as the Joint CPUE indices became available only shortly before this meeting (see Section 4.2), the preliminary assessment proceeded using the same set of indices as the 2022 assessment. The initial plan was to conduct diagnostic and sensitivity analyses on this preliminary model to evaluate performance and explore uncertainty, and then to update the model with the new indices once they are finalized.

60. The WPTmT **NOTED** that catch and length composition data have been updated through 2023 (the final year of the model), while the previous CPUE indices covered 1975–2020. The WPTmT **NOTED** that if the model lacks abundance indices for the most recent years, recent abundance estimates will be primarily determined by catch removals and recruitment (informed by the length composition data)

61. The WPTmT **RECALLED** that key management quantities from the 2022 assessment were based on the median of the combined outputs of two model options:

    i. Based on NW CPUE regional indices (R1 region / LL1 fishery) only (NW model)

    ii. Based on SW CPUE regional indices (R3 region / LL3 fishery) only (SW model)

62. The WPTmT further **RECALLED** that these model options were selected based on the evaluation of consistency and representativeness of the regional indices. In short, the NW and SW indices are likely more representative of relative albacore abundance, as these regions account for most catches and have more consistent targeting practices. The use of independent models addresses potential conflicts between these two sets of indices. The WPTmT **AGREED** to retain the same model options for the current assessment.

63. The WPTmT also **AGREED** to retain the same model configuration as the previous assessment, including the spatial and fleet structure (**Fig 1**). Specifically, longline fisheries in each region are separated by season, with independent selectivity and catchability in each quarter. This enables the model to better account for seasonal variation in length compositions and catch rates. The WPTmT **NOTED** that biological and population parameters were agreed upon at the Data Preparation meeting.

64. The WPTmT **NOTED** that sequential updates (nominal catches, length compositions, selectivity parameterizations, and data weighting) were made to update the previous model. It appears that some updates had a substantial impact on the scale of the biomass estimate (R0), although they did not alter the trend in abundance estimates.

65. In particular, the WPTmT **NOTED** that down-weighting the weight-at-age data (from the Farley 2019 age and growth study) had a significant impact on the estimates of R0. The WPTmT **NOTED** that this dataset was included to assess the validity of the growth curve, but it was unclear why it had such a large influence on the model,

given that the growth parameters were fixed. The WPTmT **REQUESTED** further investigation of this issue in future assessment.

66. The WPTmT **NOTED** that relaxing the constraint on the selectivity of LL3 and LL4 fisheries (so that they are now estimated to be dome-shaped) also significantly increased the scale of R0. The WPTmT **NOTED** that this decision was based on the consideration that juveniles are mainly distributed in the high-latitude region of the Southern Ocean, and a dome-shaped selectivity would account for the potential northward migration of mature adults. The increase in biomass was likely due to the estimation of fish invulnerable to the fishery.

67. The WPTmT **NOTED** changes in the updated length composition data in the assessment. For some years and regions, length frequency observations were present in the 2022 assessment dataset but not in the 2025 dataset, and vice versa. The WPTmT **NOTED** that the IOTC Secretariat has been working on improving the data processing routines.

68. Given the large influence of length data on the model (see Para), the Secretariat further assessed the changes in length composition data by comparing the 2022 and 2025 datasets. The WPTmT **NOTED** that the difference is partly due to the recent submission of historical data by some fleets and CPCs (see Para 17). While the changes are not significant, but as size data are influential, even small changes may have a large impact on the assessment.

69. The WPTmT **NOTED** that length composition samples are characterized by very large inter-annual and inter-seasonal variability. This could reflect sampling variability or changes in the fishery targeting different components of the population (small juveniles vs. large mature fish). The variability tends to be greater in the southern regions (R3), where juveniles are more prevalent. The WPTmT **SUGGESTED** that time-varying selectivity may be considered in the future. Structuring the fishery by season and estimating independent selectivity per region and quarter may help account for some of the seasonal variation in the length data.

70. Both the preliminary NW and SW models were subsequently updated with the new CPUE indices for the NW (R1) and SW (R3) regions, respectively. The results were examined and discussed by the WPTmT as follows.

71. The WPTmT **NOTED** that the updated SW model estimated very high biomass (or the scaling parameter R0) with substantially wide confidence bounds. The model appears to be mainly driven by the relatively flat trend in some quarterly CPUE (e.g., quarters 2 and 3) and fitted poorly to the declining trend in other quarters (e.g., quarter 1). As a result, the model estimated very low fishing mortality, with current biomass exceeding 70% of the unfished level. This was considered biologically implausible.

72. The WPTmT **NOTED** that the updated NW model appears to estimate a more reasonable range of biomass. The model also fitted the declining trend in CPUE in most quarters reasonably well, although there were poor fits in some periods.

73. However, in the NW model, the fit to the length composition in the LL1 fishery (NW region) in quarters 2 and 3 was poor, with the model predicting a length distribution much smaller than observed. The same length composition data, however, appeared to fit better in the SW model. This difference seems to be due to the two models estimating somewhat different selectivity for the LL1 fishery in Q2 and Q3. One possible explanation is that the SW model estimated a much higher biomass and lower fishing mortality, enabling it to predict more large fish in the population.

74. The WPTmT **NOTED** that there are many small fish in the samples from the mid-2000s in the LL1 fishery (NW), which may not be representative of the fishery. It was suggested that these small fish samples should be excluded in future analyses.

75. Considering that the new, updated CPUE index is overall very similar to the previous indices, the reasons for these significant changes in the updated models are unclear. The WPTmT **SUGGESTED** several alternative model configurations to better understand these issues and proposed

- Run the SW model with the same catch and length frequency data from the 2022 assessment, updating only the CPUE (with the 2022 assessment assumptions of constraining LL3 and LL4 selectivity to be fully asymptotic).

- Run the SW model with only the updated CPUE index in quarters 1 and 4, with updated catch and length composition data (with the 2025 assessment assumptions of not constraining LL3 and LL4 selectivity).
- Run the SW model by further adjusting the CV for the CPUE index.
- Run the NW model with a simple logistic selectivity for LL1 and LL2 fisheries.
- Run the NW model by imposing the selectivity estimated from the SW model onto the LL1 and LL2 fisheries.
- Run the NW model by increasing the weight of the CPUE series for recent years.

76. The modeller was able to complete some of the proposed model runs during the meeting, with the following main findings:

- For the SW model, using the previous catch and length composition data with the new CPUE produced biomass estimates very similar to those from the previous assessment. This suggests that the updated CPUE is not responsible for the high R0 estimate in the revised model. Initial investigations indicated that the high R0 was likely due to updates in the catch and length composition data (with the latter being more influential). However, further analysis revealed that the primary driver was the change in selectivity assumptions—specifically, the decision during the DP meeting to remove the constraint for LL3 and LL4 selectivity to be asymptotic.
- For the NW model, applying logistic selectivity did not improve the fits to the length frequency (LF) data in LL1, and selectivity estimates for quarters 2–4 remained poor. The WPTmT also noted that similar issues were present in the 2022 assessments.

77. Based on these investigations, the WPTmT **AGREED** to use the updated NW and SW models (with revised catch, length composition, and CPUE data) to estimate management quantities. For the SW model, the selectivity for the LL3 and LL4 fisheries will use the same assumption as in the 2022 assessment (constrained to be asymptotic).

78. The WPTmT **NOTED** the key assessment results for the Stock Synthesis III model (SS3) as shown below (**Tables 1**; **Figs. 2– 4**).

79. The WPTmT **DISCUSSED** in detail the outstanding issues in the updated NW and SW models. In particular, the SW model produced very high biomass estimates with large uncertainty when the selectivity for LL3 and LL4 was unconstrained (allowed to be domed-shaped), while the NW model showed bias in the predicted length composition for the LL1 fishery. Despite several investigative model runs during the meeting, the exact causes of these issues and potential solutions remain unclear. Given the changes in input data and the late availability of the CPUE indices, the WPTmT **AGREED** that, while the updated assessment model in its current configuration is sufficient for estimating stock status, further scrutiny is needed to improve its reliability and ensure robust management advice. As such, the WPTmT **RECOMMENDED** that assessment work continue next year and that the SC convene another WPTmT assessment meeting in 2026 to review progress.

Table 1. Key management quantities from the 2025 SS3 assessment for Indian Ocean albacore. Values for the Indian Ocean results are based on the median of the combined outputs of 2 model options: Models NW and SW

Management Quantity	Indian Ocean	NW model run	SW model run
2023 catch estimate (t)	41 806		
Mean catch from 2019–2023 (t)	39 943		
MSY (1000 t) (95% CI)	44 (37–52)	41 (32–51)	47 (36–58)
Data period used in assessment	1950–2023	1950–2023	1950–2023
F_{MSY} (95% CI)	0.16 (0.15–0.17)	0.17 (0.16–0.18)	0.15 (0.14–0.16)
SB_{MSY} (1000 t) (95% CI)	26 (22 – 31)	25 (19 – 31)	28 (22 – 35)
F_{2021}/F_{MSY} (95% CI)	0.97 (0.52–1.42)	1.41 (0.56–2.25)	0.54 (0.27–0.8)
SB_{2021}/SB_{MSY} (95% CI)	1.33 (0.9–1.78)	1.14 (0.56–1.72)	1.53 (0.88–2.19)
SB_{2021}/SB_{1950} (95% CI)	0.29 (0.15–0.49)	0.24 (0.06–0.41)	0.33 (0.11–0.56)

* For SS3 SB is defined as mature female biomass.

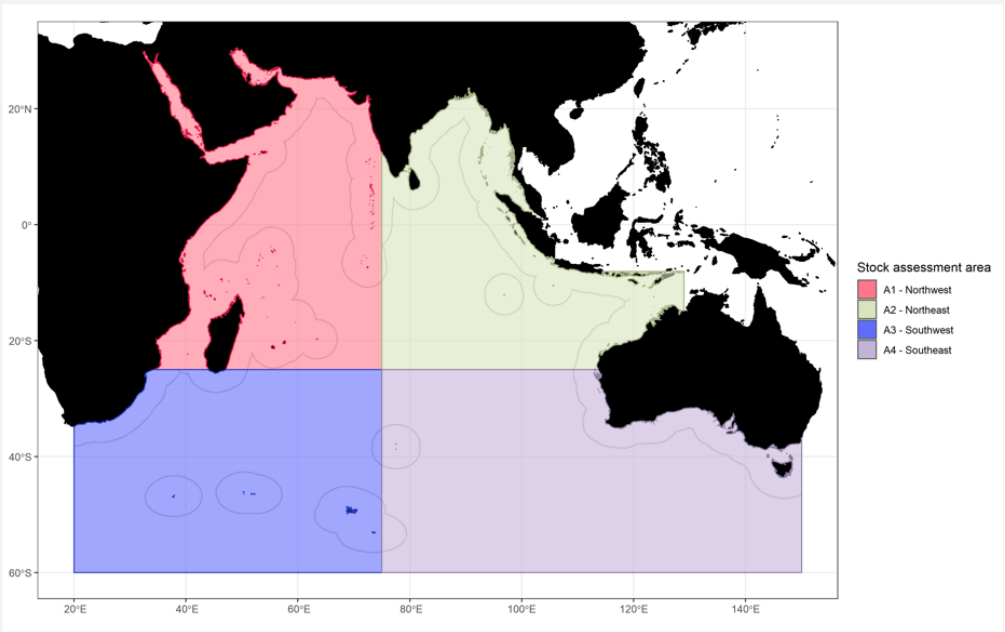

Fig. 1: Spatial stratification of the Indian Ocean for the definition of the fisheries.

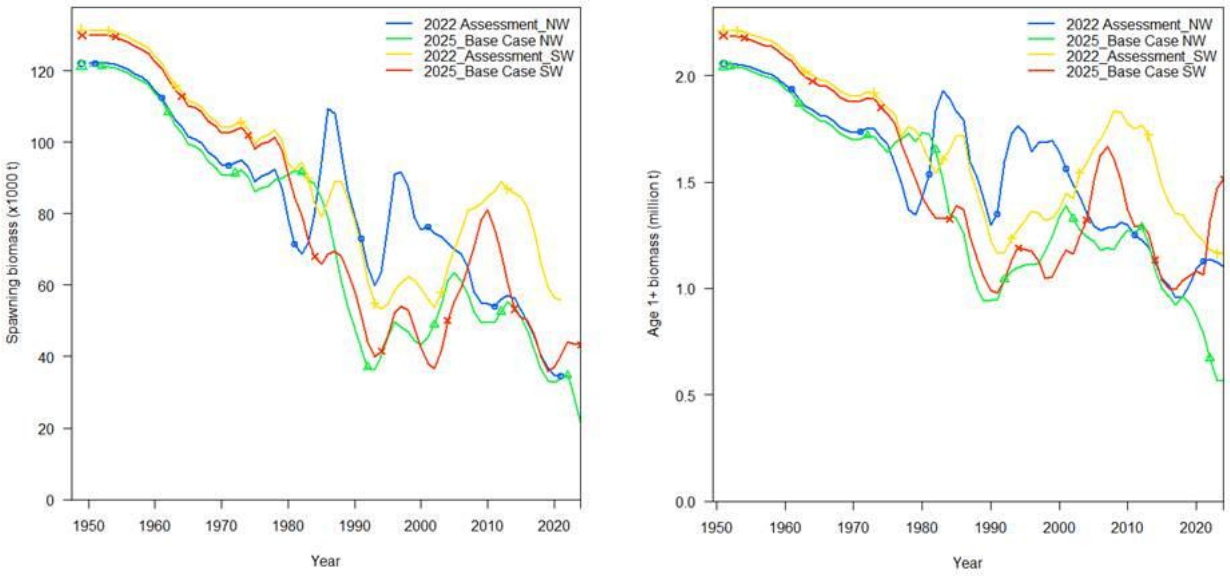

Fig. 2: Estimates of spawning stock biomass (left) and Age 1+ biomass (right) from the 2025 NW and SW models (overlaid with the estimates from the NW and SW models from the 2022 assessment).

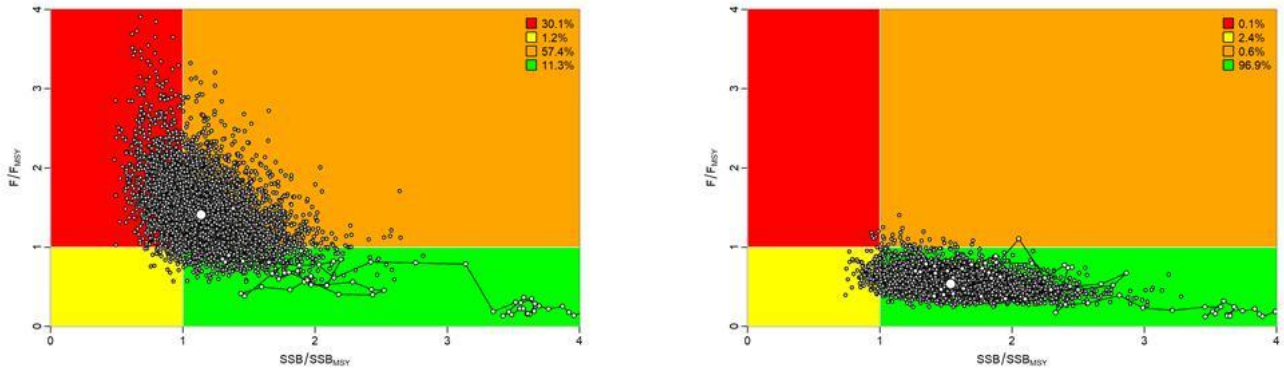

Fig. 3. Albacore: SS3 Indian Ocean assessment Kobe plot for the two model options: (left) Model NW_CPUE (right) Model SW_CPUE. Purple circles indicate the trajectory of the point estimates for the spawning biomass (SB) ratio and fishing mortality (F) ratio for each year 1950–2023 (the grey lines represent the 95 percentiles of the 2020 estimate).

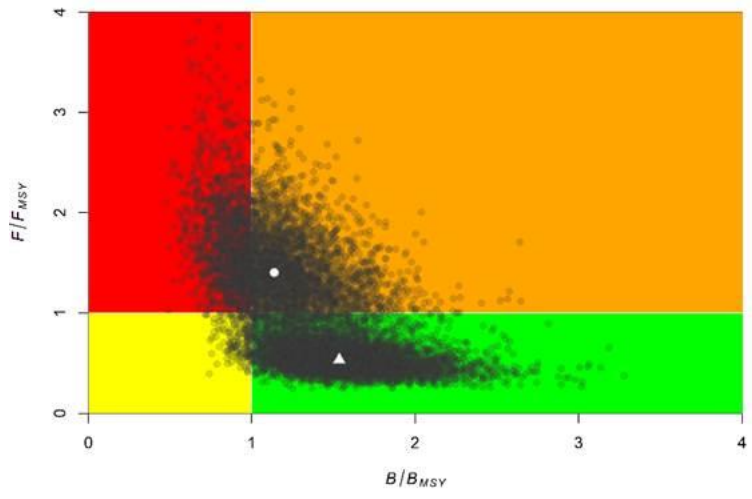

Fig. 4. Albacore: SS3 Indian Ocean assessment Kobe plot for the final two model options combined: current stock status relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points. Black symbols represent Maximum posterior density (MPD) estimates from individual models: square represents NW_CPUE model and triangle represents SW_CPUE model. Grey dots represent uncertainty from individual models.

4.4 SELECTION OF STOCK STATUS INDICATORS

80. The WPTmT **NOTED** that only SS3 models were updated this year and no alternative assessment models (e.g., SCAA, JABBA, etc.) were developed. After extensive discussion, the WPTmT concluded that, although the updated assessment model can be used to estimate stock status, additional work is required to address the identified issues and provide robust management advice. The WPTmT **RECOMMENDED** that, in the short term (one year), management advice from the 2022 assessment could be used as a precautionary approach. This recommendation is supported by the fact that the new CPUE indices are broadly similar to the previous ones, and changes in the main input observations did not unexpectedly alter the model outcomes. It is anticipated that, once the assessment is improved and accepted at the proposed WPTmT meeting next year, management advice can be updated using the new assessment.

4.5 UPDATE ON MANAGEMENT STRATEGY EVALUATION PROGRESS (OM FORMULATION)

81. The WPTmT **NOTED** that the albacore MSE is ongoing and **RECALLED** that the WPB and SC have endorsed the Operating Model. The developers are working on the evaluation of Management Procedures (MP) through the MSE. The developers organized an informal session in December 2024 to discuss the OM and MP development with major fishing nations and stakeholders. The WPTmT **NOTED** that the developers intend to present the MP to the WPM later this year, with the aim of recommending the MP to the TCMP next year.

4.6 Development of technical advice on the status of the albacore tuna stock

82. The WPTmT **ADOPTED** the management advice developed for albacore as provided in the draft Executive Summary and **REQUESTED** that the IOTC Secretariat update the draft stock status summary for albacore with the latest 2023 catch data:
    - Albacore (*Thunnus alalunga*) – Appendix IV

5. RESEARCH RECOMMENDATIONS AND PRIORITIES

5.1 REVISION OF THE WPTMT PROGRAM OF WORK

83. The WPTmT **NOTED** paper IOTC–2025–WPTmT09(AS)–03 which provided an opportunity to consider and revise the Program of Work for 2023–27 to align with the requests and directives from the Commission and Scientific Committee.

84. The WPTmT **RECALLED** that the SC, at its 16th Session, requested that all Working Parties provide their work plans with items prioritised based on the requests of the Commission or the SC. (SC16. para. 194). Similarly, at the 18th Session of the Commission, the Scientific Committee was requested to provide its Program of Work on a multi-year basis, with project priorities clearly identified. In doing so, the SC should consider the immediate and longer term needs of the Commission.

85. The WPTmT **RECOMMENDED** that the SC consider and endorse the WPTmT Program of Work (2026–2030), as provided at Appendix V.

5.2 DEVELOPMENT OF PRIORITIES FOR AN INVITED EXPERT AT THE NEXT WPTMT MEETING

86. The WPTmT also **NOTED** the critical work carried out by Mr Joel Rice, IOTC Consultant, who conducted the SS3 assessment.

87. The WPTmT **AGREED** to the following core areas of expertise and priority areas for contribution that need to be enhanced for the next meeting of the WPTmT, should an Invited Expert be necessary:
    i. Expertise: experience with CPUE analysis and standardisation for albacore.

ii. Expertise: stock assessment experience, particularly with fully integrated models.

6. OTHER BUSINESS

6.1 DATE AND PLACE OF THE 10TH SESSIONS OF THE WPTMT

88. The WPTmT **AGREED** that the assessment work on albacore will continue in 2026 (see Para xx). The WPTmT **RECOMMENDED** that the 10th Session of the WPTmT be convened in 2026 to refine the 2025 assessment, and that the meeting be held in late July for a duration of three days in a virtual format.

89. The WPTmT **RECOMMENDED** that the 11th Session of the WPTmT be held in 2028, as originally planned.

90. The WPTmT **NOTED** that there has been a lower response to WPTmT meetings (both data preparation and assessment meetings), and consequently, the assessment meeting has been reduced from five days to three days. The WPTmT **NOTED** that with low participation, the meeting is unlikely to be productive or cost-efficient. The WPTmT encourages CPCs' scientists to actively engage and participate in future WPTmT meetings to contribute to albacore research. The WPTmT **RECOMMENDED** that only one combined meeting (in person, five days) be held in July 2028.

7. REVIEW OF THE DRAFT, AND ADOPTION OF THE REPORT OF THE 9TH SESSION OF THE WPTMT(AS)

91. The WPTmT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPTmT09(AS), provided at Appendix VI, as well as the management advice provided in the draft resource stock status summary for albacore (Appendix IV).

92. The report of the 9th Session of the Working Party on Temperate Tunas (IOTC–2025–WPTmT09(AS)–R) was **ADOPTED** intersessionally.

APPENDIX I
LIST OF PARTICIPANTS

Title	First name	Last name	Affiliation	Contracting Parties & Cooperating Non-Contracting Parties (CPC)	E-mail
CHAIRPERSON					
Mr	Toshi	Kitakado	Tokyo University of Marine Science and Technology	JAPAN	kitakado@kaiyodai.ac.jp
VICE CHAIRPERSON					
Mr	Jiangfeng	Zhu	Shanghai Ocean University	CHINA	jiangfeng-zhu@yeah.net
Mr	Abdul	Rasheed	Ministry of Maritime Affairs	PAKISTAN	arasheed.mfd@gmail.com
Mr	Sheng-Ping	Wang	National Taiwan Ocean University (Invited Experts)	TAIWAN	nsp@gmail.intou.eduitw
Ms	Orawan	Prosertsook	Department of Fisheries	THAILAND	orawanp.dof@gmail.com
Mr	Irwan	Jatmiko	Ministry of Marine Affairs and Fisheries CFR-Brin	INDONESIA	irwan.jatmiko@gmail.com
Mr	Sisira	Haputhantri	National Aquatic Resources Research and Development Agency (NARA)	SRI LANKA	sisirahaputhantri@yahoo.com

Mr	Don	Bromhead	Australian Bureau of Agricultural and Resource Economics and Sciences	Austrailia	Don.Bromhead@aff.gov.au
Mr	Glen	Holmes	Pew Charitable Trusts	OBSERVERS	gholmes@pewtrusts.org
Mr	Hassan	Kasim Ali			
Mr	Sylvain	Bonhommeau	IFREMER	OBSERVERS	sylvain.bonhommeau@ifremer.fr
Mr	Farhad	Kaymaram	Iran Fisheries Organization	IRAN	farhadkaymaram@gmail.com
Mr	Yuichi	Tsuda	Fisheries Resources Institute	JAPAN	tsuda_yuichi58@fra.go.jp
Mr	Y	Uozumi		JAPAN	
Mr	Heewon	Park		KOREA	
Mr	Mi	Kyung Lee		KOREA	
Mr	Thomas	Chevrier			
Mr	Rui	Coelho		EUROPEAN UNION	
Mr	Joel	Rice	FAO Consultant		Joel.Rice@fao.org

APPENDIX II
AGENDA FOR THE 9TH WORKING PARTY ON TEMPERATE TUNAS (AS)

Date: 21 - 23 July 2025

Location: Eden Bleu Hotel, Seychelles

Time: 9:00 – 17:00 daily (Seychelles time)

Chair: Dr Toshihide Kitakado (Japan); **Vice-Chair** Dr Jiangfeng Zhu (People's Republic of China)

1. **OPENING OF THE MEETING** (Chair)

2. **ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION (**Chair**)**

3. **UPDATE OF ANY NEW DATA AVAILABLE AT THE SECRETARIAT FOR ALBACORE TUNA SPECIES SINCE THE DATA PREPARATORY MEETING (**IOTC Secretariat**)**

4. **ALBACORE STOCK ASSESSMENT** (Chair)
   - 4.1 Review new information on albacore biology, stock structure, fisheries and associated environmental data since the data preparatory meeting (all)
   - 4.2 Updated nominal and standardised CPUE indices
   - 4.3 Stock assessments
     - Stock Synthesis (SS3)
     - Others
   - 4.4 Selection of Stock Status indicators for albacore
   - 4.5 Update on Management Strategy Evaluation Progress (OM formulation)
   - 4.6 Development of management advice for albacore tuna (all)
   - 4.7 Update of albacore tuna Executive Summary for the consideration of the Scientific Committee (all)

5. **WPTmT PROGRAM OF WORK**
   - 5.1 Revision of the WPTmT Program of Work (2026–2030)
   - 5.2 Development of priorities for an Invited Expert at the next WPTmT meeting

6. **OTHER BUSINESS**
   - 6.1 Date and place of the 10th and 11th Sessions of the WPTmT (Chair and IOTC Secretariat)

7. Review of the draft, and adoption of the Report of the 9th Session of the WPTmT(AS) (Chair)

APPENDIX III
LIST OF DOCUMENTS

Document	Title
IOTC-2025-WPTmT09-01a	Draft Agenda of the 9th Working Party on Temperate Tunas
IOTC-2025-WPTmT09-01b	Draft Annotated agenda of the 9th Working Party on Temperate Tunas
IOTC-2025-WPTmT09-02	Draft List of documents
IOTC-2025-WPTmT09-03	Revision of the WPTmT Program of Work (2026-2030) (IOTC Secretariat)
IOTC-2025-WPTmT09-04	Overview of Indian Ocean albacore fisheries (Secretariat)
IOTC-2025-WPTmT09-05	Preliminary observations of Albacore Tuna (Thunnus alalunga) catches in Sri Lanka (Haputhantri S)
IOTC-2025-WPTmT09-06	Temperate tuna imports to Thailand during 2020-2024 (Prasertsook O, Sanboonpeng J)
IOTC-2025-WPTmT09-07	The Status of Tuna Stocks with Special Reference to Temperate Tunas in Pakistan (Rasheed A, Hassan S, Tariq M, Wassan N, Khan M)
IOTC-2025-WPTmT09-08	Preliminary study of CPUE standardization of albacore tuna (Thunnus alalunga) in the Eastern Indian Ocean (Jatmiko I, Sadiyah L, Satria F, Roup S, Slamet D, Januar A)
IOTC-2025-WPTmT09-09	Update of joint CPUE indices for Albacore tunas in the Indian Ocean based on Japanese, Korean and Taiwanese longline fisheries data up to 2024 (Kitakado T et al.)
IOTC-2025-WPTmT09-10	Stock assessment of albacore tuna (*Thunnus alalunga*) in the Indian Ocean using Stock Synthesis (Rice J, Phillips G)

APPENDIX IV
DRAFT RESOURCE STOCK STATUS SUMMARY – ALBACORE

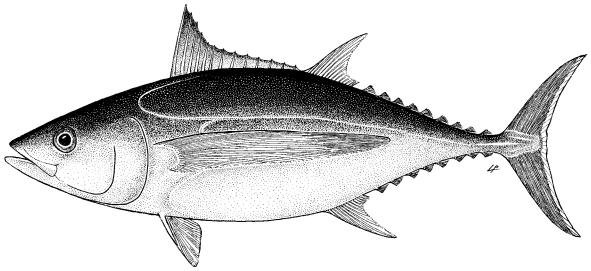

Table 1. Status of albacore (*Thunnus alalunga*) in the Indian Ocean

Area	Indicators – 2025 assessment		2025 stock status determination[3]
Indian Ocean[1]	Catch (2023) (t)[2]	41,790	54%
	Mean annual catch (2019-2023) (t)	40,027	
	MSY (x1,000 t) (95% CI)	44.31 (37.15-51.64)	
	F_{MSY} (95% CI)	0.16 (0.15-0.17)	
	SB_{MSY} (x1,000 t) (95% CI)	26.75 (22.34-31.29)	
	F_{2023} / F_{MSY} (95% CI)	0.97(0.52-1.42)	
	SB_{2023} / SB_{MSY} (95% CI)	1.33 (0.90-1.78)	
	SB_{2023} / SB_0 (95% CI)	0.285 (0.085-0.485)	

[1]Stock boundaries defined as the IOTC area of competence;
[2]Proportion of catch fully or partially estimated for 2023: 16.5%
[3]2023 is the final year that data were available for this assessment

Table 2: Probability of stock status with respect to each of four quadrants of the Kobe plot. Percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account

	Stock overfished (SB_{2020} / SB_{MSY}<1)	Stock not overfished (SB_{2020} / SB_{MSY}≥ 1)
Stock subject to overfishing (F_{2020} / F_{MSY}≥ 1)	15.1 %	29.0 %
Stock not subject to overfishing (F_{2020} / F_{MSY}≤ 1)	1.76 %	54.1 %
Not assessed/Uncertain / Unknown		

Indian Ocean stock – Management Advice

Stock status. The stock status for albacore tuna has been assessed for 2025. 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 models used in 2025 are based on the models developed in 2019 and 2022 with a series of revisions that were noted during the 9th WPTmT data preparatory and assessment meetings held in April and July 2025 respectively. There are some noticeable changes compared to the previous data sets used as inputs into the assessment models: the CPUE indices have been estimated using updated methods (described during the 9th WPTmT assessment meeting); the length-frequency data have been updated and include additional data not available for the 2022 assessment.

A series of new joint CPUE indices from JPN, TWN,China, and KOR were only made available at the start of the assessment meeting. These indices are used as the main abundance indices within the assessment models. The methodology for the standardisation of the CPUE is again different from that used in the 2019, and 2022 assessments. In this iteration of the CPUE standardisation, similar methods were followed (as in 2022), to identify suitable sets from which to standardise the CPUE indices. The main difference between the 2022 and 2025 CPUE indices is the omission of positive spatio-temporal interactions in the 2025 analyses. This was tested, but results suggested omitting this aspect was a better update for the indices.

The 2025 CPUE series follow similar trends to the indices in 2019 and 2022, noting that there is a significant increase in CPUE in the final years in all quarters in the southwest (R3), compared to the last iteration.

The two sets of indices from the northwest and southwest Indian Ocean monitor different components of the albacore stock. The CPUE in the western area (LL1+3) may best represent the abundance of albacore at this time. The western area also represents a significant proportion of the albacore biomass in the Indian Ocean. The eastern indices are affected by changes in targeting and are not used in the assessment of the stock.

Trends in the northwest CPUE (R1) series suggest that the biomass vulnerable to longline fishing has declined significantly compared to levels observed in 1980-82, whereas a much smaller decline was observed in the southwest CPUE series for the same period (R3). Prior to 1980 there were 20 years of moderate fishing, after which total catches of albacore tuna in the Indian Ocean have more than doubled (**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.

The final set of assessment model options included alternative models using the northwest and southwest CPUE indices. Both northwestern (NW) and southwestern (SW) models show similar trends in biomass estimates as the 2022 assessment models, however there are some outstanding issues with the updated NW and SW models in 2025.

In particular, the SW model produced very high biomass estimates with large uncertainty when the selectivity for LL3 and LL4 was unconstrained (allowed to be domed-shaped), while the NW model showed bias in the predicted length composition for the LL1 fishery. Despite several investigative model runs during the meeting, the exact causes of these issues and potential solutions remains unclear.

Although there were changes to the input data and the CPUE indices were available later than expected, the updated assessment models in their current configuration are considered sufficient to estimate stock status. However, further scrutiny is needed to improve their reliability and ensure robust management advice into the future. As such, continued refinement of the assessment is required.

Based on outputs from the combined stock assessment models, catches in 2023 (41,790 t) were marginally below the MSY level estimated by the SS3 model in 2025 (44,310 t). Fishing mortality represented as F_{2023}/F_{MSY} is 0.97 (0.52-1.42). Biomass is estimated to be above the SB_{MSY} level (1.33 (0.90-1.78), **Table 1**, **Fig. 3**). The stock status in relation to the Commission's interim B_{MSY} and F_{MSY} target reference points indicates that the stock is **not overfished** and is **not subject to overfishing** (**Table 1**).

Outlook. 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 dynamic. Based on the previous advice current catch appears to be sustainable in the short term although the advice is based on model assumptions that may be associated with high levels of uncertainty (see management advice below for more detail).

Management advice. Considerable uncertainty remains in the SS3 assessment conducted in 2025, however the trends in key model outputs align relatively well with the 2022 assessment. For this year, due to the uncertainty in the model outputs, the management advice from 2022 would be carried over for one year (1 year) to allow time to update the SS3 assessment to provide updated management advice in 2026. It is anticipated that, once the assessment is improved and accepted at the proposed WPTmT meeting next year, management advice can be updated using the new assessment.

Therefore, based on the 2022 management advice, the K2SM indicates that there is low risk of violating the target and limit reference points with current and moderate increases in catch in the short term. Current catches (41,790 t for the statistical year 2023; **Table 1**) are just below the estimated level of MSY.

It should be noted that as in 2022, neither CPUE series or other model assumptions account for any change in catchability/effort creep over the time series.

The following should be noted:

- The primary sources of data that drive the assessment, total catches, CPUE and length data, are uncertain and should be developed further as a priority;
- The catch estimates for 2023 (41,790 t) are below the current estimated MSY levels (**Table 1**);

- 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**: the fishing mortality at the time of the assessment was considered to be below the interim target reference point of F_{MSY}, and therefore below the interim limit reference point of $1.4*F_{MSY}$ (**Fig. 3**)
  - **Biomass**: the spawning biomass at the time of the assessment was considered to be above the target reference point of SB_{MSY}, and therefore above the limit reference point of $0.4*SB_{MSY}$ (**Fig. 3**)
- **Main fisheries (mean annual catch 2019-2023)**: The majority of albacore are caught using longline (83%), followed by line (14.9%) and purse seine (0.8%). The remaining catches taken with other gears contributed to 1.2% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2019-2023)**: the majority of albacore catches are attributed to vessels flagged to Taiwan,China (54.7%) followed by Indonesia (21.9%) and China (9.2%). The 26 other fleets catching albacore contributed to 14% of the total catch in recent years (**Fig. 2**).

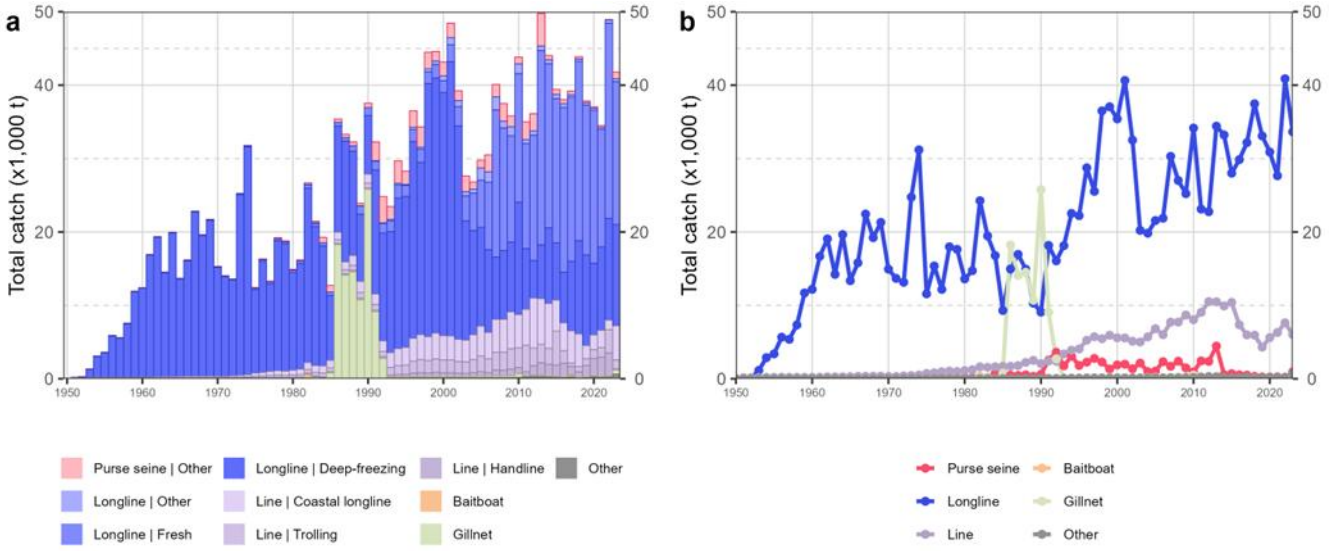

Fig. 1. Annual time series of (a) cumulative nominal catches (metric tonnes; t) by fishery and (b) individual nominal catches (metric tonnes; t) by fishery group for albacore during 1950-2023. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

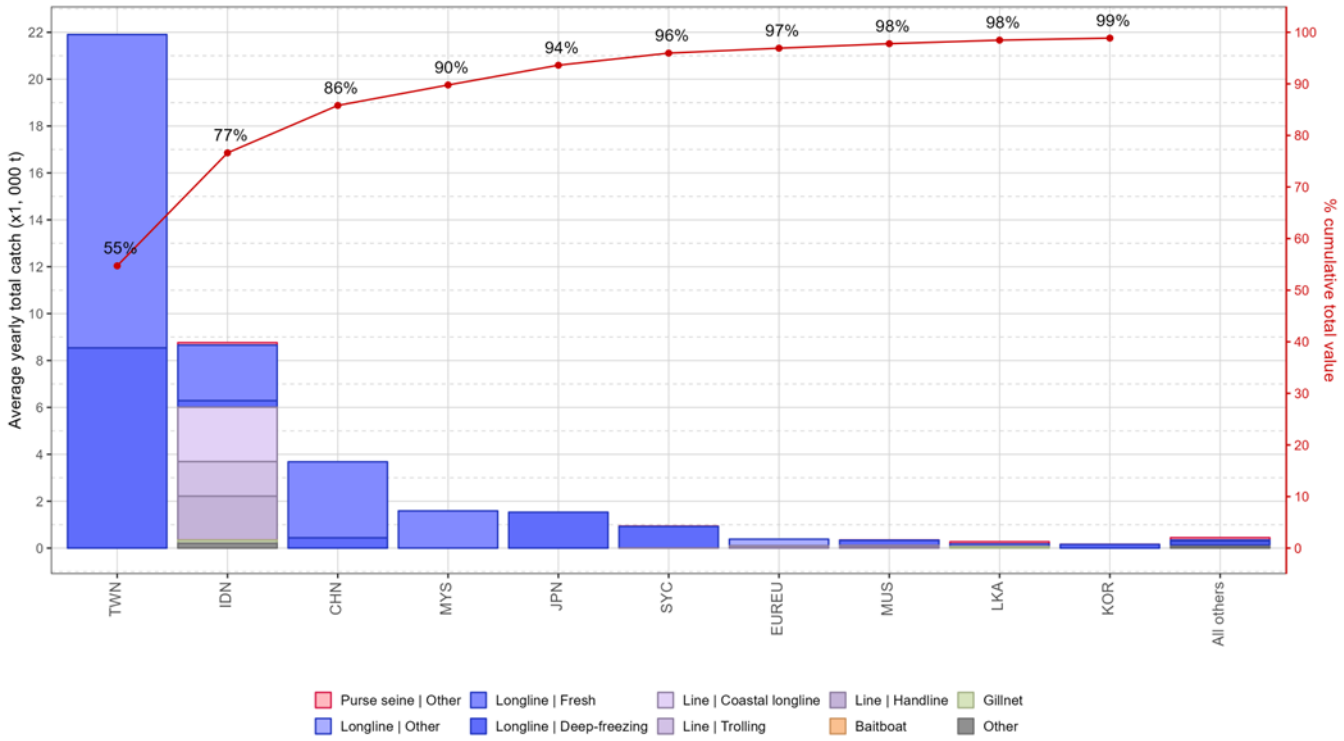

Fig. 2. Mean annual catches (metric tonnes; t) of albacore by fleet and fishery between 2019 and 2023, with indication of cumulative catches by fleet. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

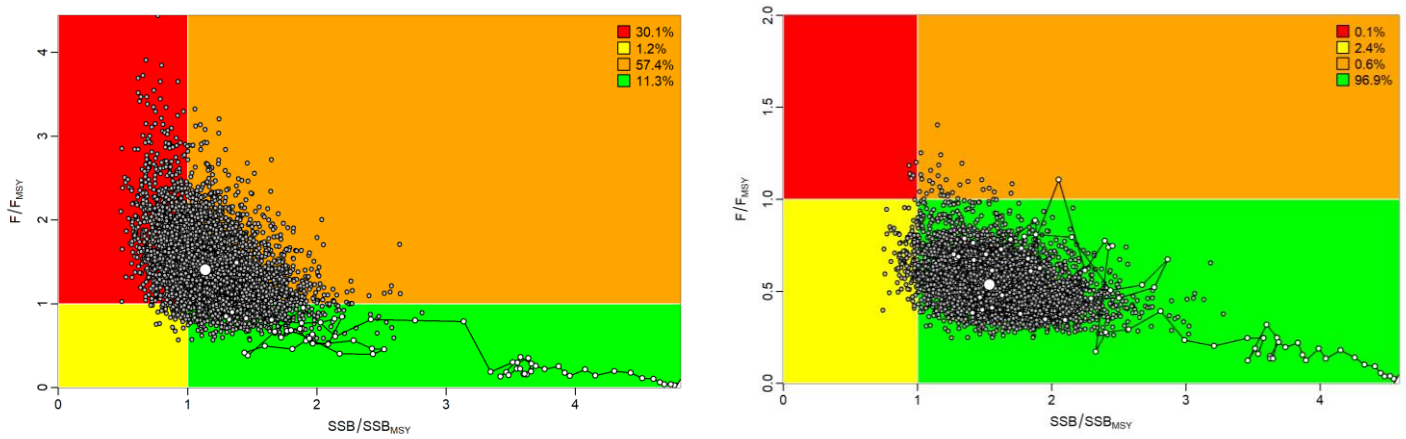

Fig. 3. Albacore: SS3 Indian Ocean assessment Kobe plot for the two model options considered: (i) Model fitted to the North-western CPUE; (ii) Model fitted to the South-western CPUE. White circles indicate the trajectory of the point estimates for the spawning biomass (SB) ratio and fishing mortality (F) ratio for each year 1950–2023 (the grey lines represent the 95 percentiles of the 2023 estimate). Target (F_{target} and SB_{target}) and limit (F_{lim} and SB_{lim}) reference points are shown

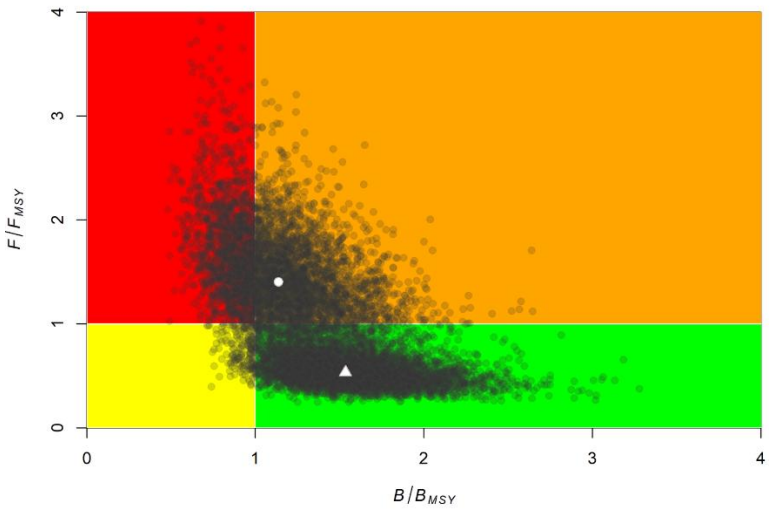

Fig. 4. Albacore: SS3 Indian Ocean assessment Kobe plot for the two model options considered plotted on the same figure. Black circles indicate the trajectory of the point estimates for the spawning biomass (SB) ratio and fishing mortality (F) ratio for each year 1950–2023. Target (F_{target} and SB_{target}) and limit (F_{lim} and SB_{lim}) reference points are shown (white triangle is southwest; white circle is northwest).

Table A2. Albacore: SS3 aggregated Indian Ocean assessment Kobe II Strategy Matrix based on the 2022 Assessment model options (i) Model 1 and (ii) Model 2. Probability (percentage) of violating the MSY-based target (top) and limit (bottom) reference points for constant catch projections (2020 catch level, ± 10%, ± 20%, ± 30% ± 40%) projected for 3 and 10 years

Reference point and projection timeframe	**Alternative catch projections (relative to the catch level for 2020) and probability (%) of violating MSY-based target reference points (SB_{targ} = SB_{MSY}; F_{targ} = F_{MSY})**								
	60% (24,644)	70% (28,751)	80% (32,858)	90% (36,966)	100% (41,073)	110% (45,180)	120% (49,288)	130% (53,395)	140% (57,502)
$SB_{2023} < SB_{MSY}$	0.006	0.016	0.022	0.036	0.045	0.069	0.097	0.123	0.154
$F_{2023} > F_{MSY}$	0	0	0.003	0.029	0.1	0.204	0.326	0.434	0.529
$SB_{2030} < SB_{MSY}$	0.03	0.047	0.087	0.135	0.19	0.28	0.395	0.505	0.603
$F_{2030} > F_{MSY}$	0	0	0.001	0.037	0.141	0.3	0.453	0.565	0.618
Reference point and projection timeframe	**Alternative catch projections (relative to the catch level for 2020) and probability (%) of violating MSY-based target reference points (SB_{Lim} = 0.4*SB_{MSY}; F_{Lim} = 1.4*F_{MSY})**								
	60% (24,644)	70% (28,751)	80% (32,858)	90% (36,966)	100% (41,073)	110% (45,180)	120% (49,288)	130% (53,395)	140% (57,502)
$SB_{2023} < SB_{Lim}$	0	0	0	0	0.001	0.002	0.005	0.006	0.012
$F_{2023} > F_{Lim}$	0	0	0	0	0.001	0.011	0.056	0.117	0.213
$SB_{2030} < SB_{Lim}$	0.004	0.009	0.022	0.042	0.074	0.118	0.169	0.243	0.344
$F_{2030} > F_{Lim}$	0	0	0	0	0.008	0.073	0.21	0.374	0.496

APPENDIX V
WORKING PARTY ON TEMPERATE TUNAS PROGRAM OF WORK (2026–2030)

The Program of Work consists of the following, noting that a timeline for implementation would be developed by the SC once it has agreed to the priority projects across all of its Working Parties:

- **Table 1**: Priority topics for obtaining the information necessary to develop stock status indicators for albacore in the Indian Ocean;
- **Table 2**: Stock assessment schedule.

Table 1. Priority topics for obtaining the information necessary to develop stock status indicators for albacore in the Indian Ocean (2026–2030)

Topic		Sub-topic and project	Priority	Timing				
				2026	2027	2028	2029	2030
1	Stock structure (connectivity and diversity)	1.1 Genetic research to determine the connectivity of albacore throughout its distribution and the effective population size.	high (1)					
		1.2 Tagging study to understand the migration pattern of albacore in the Indian Ocean	Low (6)					
2	Biological information (parameters for stock assessment)	2.1 Biological research (collaborative research to improve understanding of spatio-temporal patterns in age and growth and reproductive parameters by sex)	High (2)					
		2.1.1 Age and growth studies: Uncertainty about the growth curve is a primary source of uncertainty in the stock assessment. A preliminary growth curve was developed in 2019, but there is substantial work to be done to ensure that growth curves include data from smaller size classes, and that spatio-temporal patterns in growth are quantified for use in the stock assessment. Collaborative sampling programs, involving a combination of observer- and port-based sampling, are required to ensure that adequate samples are collected.						
		2..1.2 Quantitative biological studies are necessary for albacore throughout its range to determine spatio-temporal patterns in key reproductive parameters including sex ratio; female length- and age-at-maturity; spawning location, periodicity and frequency; batch fecundity at length and age; spawning fraction and overall reproductive potential, to inform future stock assessments.						

3	CPUE standardisation	3.1 Continue the development of standardized CPUE series for each albacore fishery for the Indian Ocean, with the aim of developing appropriate CPUE series for stock assessment purposes. 3.1.1 Spatio-temporal structure and target changes need to be considered carefully, as fish density and targeting practices can vary in ways that affect CPUE indices. Developments may include changes to fishery spatial structure, new approaches for area weighting, time-area interactions in the model, and/or indices using spatial temporal model.	low (5)					
4	Size frequency data	4.1 Further investigate the size information provided by CPCs in order to better understand the stock dynamics and inputs into the assessment models. This is particularly necessary for the purse seine data.	low (4)					
5	Management strategy evaluation	5.1 Continue to collaborate with the WPM on input to the Management Strategy Evaluation (MSE) process.	High (3)					

Table 2. Assessment schedule for the IOTC Working Party on Temperate tuna 2026–2030.

Working Party on Temperate Tunas					
Species	**2026**	**2027**	**2028**	**2029**	**2030**
Albacore	Stock assessment meeting (3days) (July)	–	A combined data and assessment meeting (5 days July)		–

APPENDIX VI
CONSOLIDATED RECOMMENDATIONS OF THE 9TH SESSION OF THE WORKING PARTY ON TEMPERATE TUNAS: ASSESSMENT MEETING

The following are the complete recommendations from the WPTmT08(AS) to the Scientific Committee.

STOCK ASSESSMENTS

WPTMT09.01 (para 79) The WPTmT **DISCUSSED** in detail the outstanding issues in the updated NW and SW models. In particular, the SW model produced very high biomass estimates with large uncertainty when the selectivity for LL3 and LL4 was unconstrained (allowed to be domed-shaped), while the NW model showed bias in the predicted length composition for the LL1 fishery. Despite several investigative model runs during the meeting, the exact causes of these issues and potential solutions remain unclear. Given the changes in input data and the late availability of the CPUE indices, the WPTmT **AGREED** that, while the updated assessment model in its current configuration is sufficient for estimating stock status, further scrutiny is needed to improve its reliability and ensure robust management advice. As such, the WPTmT **RECOMMENDED** that assessment work continue next year and that the SC convene another WPTmT assessment meeting in 2026 to review progress.

Selection of Stock Status indicators

WPTMT09.02 (para 80) The WPTmT **NOTED** that only SS3 models were updated this year and no alternative assessment models (e.g., SCAA, JABBA, etc.) were developed. After extensive discussion, the WPTmT concluded that, although the updated assessment model can be used to estimate stock status, additional work is required to address the identified issues and provide robust management advice. The WPTmT **RECOMMENDED** that, in the short term (one year), management advice from the 2022 assessment could be used as a precautionary approach. This recommendation is supported by the fact that the new CPUE indices are broadly similar to the previous ones, and changes in the main input observations did not unexpectedly alter the model outcomes. It is anticipated that, once the assessment is improved and accepted at the proposed WPTmT meeting next year, management advice can be updated using the new assessment.

Revision of the WPTmT Program of Work

WPTmT09.03 (Para 85) The WPTmT **RECOMMENDED** that the SC consider and endorse the WPTmT Program of Work (2026–2030), as provided at Appendix V.

Date and place of the 10th Sessions of the WPTmT

WPTmT09.04 (Para 88) The WPTmT **AGREED** that the assessment work on albacore will continue in 2026 (see Para xx). The WPTmT **RECOMMENDED** that the 10th Session of the WPTmT be convened in 2026 to refine the 2025 assessment, and that the meeting be held in late July for a duration of three days in a virtual format.

WPTmT09.05 (Para 89) The WPTmT **RECOMMENDED** that the 11th Session of the WPTmT be held in 2028, as originally planned.

WPTmT09.06 (Para 90) The WPTmT **NOTED** that there has been a lower response to WPTmT meetings (both data preparation and assessment meetings), and consequently, the assessment meeting has been reduced from five days to three days. The WPTmT **NOTED** that with low participation, the meeting is unlikely to be productive or cost-efficient. The WPTmT encourages CPCs' scientists to actively engage and participate in future WPTmT meetings to contribute to albacore research. The WPTmT **RECOMMENDED** that only one combined meeting (in person, five days) be held in July 2028.

Review of the draft, and adoption of the Report of the 9th Session of the WPTmT

WPTmT09.07 (para 91) The WPTmT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPTmT09(AS), provided at Appendix VI, as well as the management advice provided in the draft resource stock status summary for albacore (Appendix IV).