Report of the Eighth Session of the IOTC Working Party on Temperate Tunas (Data Preparatory Session)

Online, 13–15 April 2022

DISTRIBUTION:	**BIBLIOGRAPHIC ENTRY**
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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 8th Session (Data Preparatory) of the Indian Ocean Tuna Commission's (IOTC) Working Party on Temperate Tunas (WPTmT08(DP)) was held was held online using Zoom from 13-15 April 2022. A total of 51 participants (19 in 2019 and 29 in 2016) attended the Session.

The following a subset of the complete list of recommendations from the WPTmT08(DP) to the Scientific Committee, which are provided in Appendix 6.

WPTmT08(DP).01 (para 99) The WPTmT **NOTED** that the fork length-round weight relationship for albacore was derived in the early 1990s in the Atlantic Ocean and much new data has been collected since then, e.g., those collected by the University of Mauritius, the French national Research Institute for Sustainable Development, and Ifremer across the western Indian Ocean from different fleets and fishing gears as well as data collected through the IOTC Regional Observer Scheme. The WPTmT **RECOMMENDED** that the IOTC Secretariat coordinate a small project in the coming few months (with a deadline of the end of May) utilising the open-source platform (e.g., GitHub, Markdown) to allow interested researchers to access the data and work collaboratively on the new datasets, including a thorough investigation of the spatial and temporal effects on the length-weight parameters, and differences between sexes. If successful, updated parameters could be used in the new assessment.

WPTmT08(DP).02 (para 106) The WPTmT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPTmT08(DP), provided at Appendix 6.

1. Opening of the meeting

1. The 8th Session (Data Preparatory) of the Indian Ocean Tuna Commission's (IOTC) Working Party on Temperate Tunas (WPTmT08(DP)) was held online using the Zoom platform, from 13–15 April 2022. A total of 51 participants (19 at the DP meeting in 2019, 29 in 2016 and 27 in 2014) attended the Session. The list of participants is provided at Appendix 1. The meeting was opened by the Vice Chairperson, Dr Toshihide Kitakado (Japan), who welcomed participants.

2. Adoption of the agenda and arrangements for the session

2. The WPTmT **ADOPTED** the Agenda provided at Appendix 2. The documents presented to the WPTmT08(DP) are listed in Appendix 3.

3. The IOTC process: outcomes, updates and progress

3.1 Outcomes of the 24th Session of the IOTC Scientific Committee

3. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–03 which outlined the main outcomes of the 22nd, 23rd and 24th Sessions of the Scientific Committee, specifically related to the work of the WPTmT.

4. The WPTmT **RECALLED** that the SC adopted a set of standardised *IOTC Working Party and Scientific Committee reporting terminology*, contained in Appendix IV of the SC16 Report (para. 23 of the SC16 Report), and **AGREED** that the terminology (which is provided in the opening pages of this WPTmT08(DP) Report) will provide greater clarity and remove some of the ambiguity in the way advice is provided to the next level in the Commission's structure.

5. The WPTmT **NOTED** that the recommendation by the SC to hold a WPTmT Data preparatory meeting in either 2020 or 2021 had not been possible to facilitate and that it had been agreed to defer the meeting to early 2022, hence the current meeting schedule.

3.2 Outcomes of the 25th Session of the Commission

6. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–04 which outlined the main outcomes of the 23rd, 24th and 25th Sessions of the Commission, specifically related to the work of the WPTmT and **AGREED** to consider how best to provide the Scientific Committee with the information it needs, in order to satisfy the Commission's requests, throughout the course of the current WPTmT meeting.

7. The WPTmT **NOTED** the 3 Conservation and Management Measures (CMMs) adopted at the 25th Session of the Commission (consisting of 3 Resolutions and 0 Recommendation):

IOTC Resolutions

- Resolution 21/01 On an Interim Plan for Rebuilding the Indian Ocean Yellowfin Tuna Stock in the IOTC Area of Competence
- Resolution 21/02 On Establishing a Programme for Transhipment by Large-Scale Fishing Vessels
- Resolution 21/03 On Harvest Control Rules for Skipjack Tuna in the IOTC Area of Competence

IOTC Recommendations

  - Nil

8. The WPTmT **RECALLED** the importance of standardising the way in which the subsidiary bodies of the Commission provide advice. Recommendation 14/07, adopted at the 18th Session of the Commission, details a range of options for further standardising the way in which advice may be presented in the IOTC Executive Summaries.

3.3 Review of Conservation and Management Measures (CMMs) relevant to temperate tunas

9. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–05 which aimed to encourage participants at the WPTmT08(DP) to review existing Conservation and Management Measures (CMM) related to temperate tunas, noting the CMMs contained in document IOTC–2022–WPTmT08(DP)–04; and as necessary to 1) provide recommendations to the Scientific Committee on whether modifications may be required; and 2) recommend whether other CMMs may be required.

10. The WPTmT **NOTED** that Resolution 13/09 *On the conservation of albacore caught in the IOTC area of competence*, requires the Scientific Committee to assess the coverage and the quality of catch and effort data made available by CPCs targeting albacore, and to advise the Commission before the end of 2014 on target and limit reference points (LRPs, TRPs) which may be used when assessing the albacore stock status and when evaluating potential management measures. In addition, the Scientific Committee, through its Working Parties on Temperate Tunas (WPTmT) and on Methods (WPM), is required to examine and evaluate potential management measures which would allow the achievement of the conservation and optimal utilization of the albacore stock.

11. The WPTmT **NOTED** Resolution 15/10 *On target and reference points and a decision framework*, introduces amendments to Resolution 13/10 by including a possibility for the IOTC Scientific Committee to use possible alternatives to MSY-based reference points when they are considered to be insufficiently robust. The proposal refers to B_0-based reference points, where B_0 is generally considered either as the historical biomass before the beginning of the fishing activities or as the biomass under the assumption of a termination of any fishing activities. In addition, considering these reference points, the Resolution introduces management objectives and a work program which would allow the IOTC Scientific Committee to discuss projections and outlooks associated with possible management options, more particularly when implementing Management Strategy Evaluations.

12. The WPTmT **NOTED** Resolution 16/09 *On establishing a Technical Committee on Management Procedures* aims at enhancing the dialogue and mutual understanding between the Scientific Committee and the Commission on matters relating to management procedures, and the decision making response of the Commission in relation to management procedures, The Resolution addresses the priorities identified in Resolutions 14/03 *On enhancing the dialogue between fisheries scientists and managers*, and 15/10 *On target and limit reference points and a decision framework* or any subsequent resolutions addressing Management Strategy Evaluation and Management Procedures. This Resolution supersedes Resolution 14/03 *On enhancing the dialogue between fisheries scientists and managers*.

3.4 Progress on the recommendations of WPTmT07

13. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–06 which provided an update on the progress made in implementing the recommendations from the previous WPTmT meeting which were endorsed by the Scientific Committee and **AGREED** to provide alternative recommendations for the consideration and potential endorsement by participants as appropriate given any progress. A summary of the status of the previous meeting's recommendations is provided in Appendix 4.

14. The WPTmT **NOTED** the response provided by Japanese scientists to the recommendation *WPTmT07(DP).02*, which confirmed the availability of georeferenced size-frequency data at a grid resolution of 5 x 5 degrees, improving on the resolution (10 x 20 degrees grids) of data currently held by the IOTC Secretariat for years until 2008.

15. The WPTmT **ACKNOWLEDGED** Japan's intention to provide this information to the IOTC Secretariat as soon as the workload on national data managers gives them the opportunity to process the data in accordance with IOTC requirements.

16. The WPTmT **REQUESTED** that the IOTC Secretariat continue to prepare a paper on the progress of the recommendations arising from the previous WPTmT, incorporating the final recommendations adopted by the Scientific Committee and endorsed by the Commission.

4. Review of the data available at the Secretariat for temperate tuna species

17. The WPTmT **NOTED** paper IOTC-2022-WPTmT08(DP)-07 with the following abstract provided by the authors:

"This document provides an overview on the consolidated knowledge of fisheries catching albacore (Thunnus alalunga) in the Indian Ocean since the early 1950s, based on a range of data sets collected by the Contracting Parties and Cooperating Non-Contracting Parties (CPCs) of the IOTC and curated by the IOTC Secretariat. The available fisheries statistics indicate that over the last decade albacore has been essentially caught by large-scale longline fisheries, which are composed of a combination of deep-freezing longliners (also targeting bigeye tuna and yellowfin for the sashimi market) and "fresh" longliners (mostly targeting albacore for the canning market). Catches showed an increasing trend over time and reached about 40,000 t in recent years. Little information is available on discarding practices of albacore in industrial longline fisheries but the literature and few data sets collected through the IOTC Regional Observer Scheme suggest that discard levels are small regarding the high market value of the species. Furthermore, discarding is considered to be negligible in the coastal line fisheries interacting with the species. The information available on geo-referenced catch, effort, and size composition shows strong, consistent spatial patterns in the distribution of the fisheries across the Indian Ocean. During the last decade (2010-2019), hotspots appeared to have emerged in the fishing grounds east of Mozambique (including their adjacent high seas), in the southeastern waters of Indonesia, and in the high seas south of 25°S in the southwestern Indian Ocean. This latter area now represents the main fishing grounds of Indian Ocean albacore, with most of the catch coming from longline fisheries operating between 40-80°E and 10-40°S. Size data mainly collected onboard longliners flagged by Taiwan,China show that the larger individuals are mostly caught in tropical waters while their smaller counterparts mostly occur in the south of the Indian Ocean."

18. The WPTmT **RECALLED** the materials and methods used by the Secretariat to produce the *best scientific estimates* of nominal catches for all 16 IOTC species, and **NOTED** that this process consists of: i) estimation of catch levels for non-reporting CPCs; ii) breakdown of catches reported for aggregates of gears and species; and c) re-estimation of catches for important artisanal fisheries which are known to have outstanding issues with data quality and accuracy, and **AGREED** that the uncertainties introduced by this process should be duly taken into account when using the produced estimates for assessment purposes.

19. The WPTmT **NOTED** the main albacore data issues, by type of dataset and fishery, that are considered to negatively affect the quality of the statistics available at the IOTC Secretariat which are provided in Appendix 5 of this report, and **REQUESTED** that the CPCs listed in the Appendix make efforts to remedy the data issues identified and to report back to the WPTmT at its next meeting.

20. The WPTmT **NOTED** with interest the incorporation of socio-economic data in the analysis, and specifically data on average prices of frozen (canning-grade) and fresh (sashimi-grade) albacore in the Thailand and US markets, respectively, as well as the trend in average fuel prices during the same timeframe. The WPTmT **ACKNOWLEDGED** that the presented data is sourced from external organisations (e.g., the Pacific Islands Forum Fisheries Agency, FFA) which are routinely collecting and collating this type of information, and **NOTED** that the IOTC Secretariat is also liaising with FAO / GLOBEFISH to get real-time access to their sets of socio-economic indicators. In this regard, the WPTmT **NOTED** that a recommended form for the voluntary submission of average annual fish price by market and type of product is available to IOTC CPCs, and **RECALLED** how this very valuable information is currently only provided to the IOTC on a regular basis by Oman.

21. The WPTmT **NOTED** how the Secretariat is coordinating efforts to implement a public regional morphometric database (inspired by similar works recently presented at other IOTC working parties) and is engaging with national stakeholders to define a standardised format for data submission and is recovering historical data on lengths and weights for all IOTC species and the most commonly caught elasmobranch species.

22. The WPTmT **ACKNOWLEDGED** that accurate morphometric data on albacore are of great importance to complement and validate the measurements reported by those fisheries (deep-freezing longline in particular) that are known to process fish onboard, thus hindering the possibility of deriving accurate length-weight relationships from data recorded on logbooks or collected at landing sites.

23. The WPTmT **ACKNOWLEDGED** the increasing number of CPCs consistently reporting data through the recommended IOTC forms contributed to increasing the level of reporting quality for the three major albacore datasets (i.e., nominal catches, geo-referenced catch-and-efforts, and size-frequency data).

24. The WPTmT further **NOTED** that the overall reporting quality of nominal catch data for albacore has been positively affected, since 2016, by the decline in estimated NEI catches (mostly attributed to vessels flying flags of convenience) and by the improved reporting from vessels offloading catches in foreign ports, which are both consequences of the entry in force of the Port State Measures of IOTC.

25. The WPTmT **NOTED** with concern that for some important datasets, such as the one on total discards, the available information continues to remain generally lacking, sparse and of sub-par quality, not being consistently raised to total discards for the fleet as requested by IOTC Resolution 15/02. Also, the WPTmT **NOTED** that, due to its high market value, industrial longline fisheries only discard albacore when it is depredated, and that for the same reason the practice of "*high-grading*" is unlikely to occur, as also confirmed by the (limited) data on the size of discarded individuals available through the ROS.

26. The WPTmT **ACKNOWLEDGED** that some CPCs with fisheries subject to the requirements of the IOTC Regional Observer Scheme (ROS) are still providing scientific observer data in a highly aggregated form that prevents their incorporation in the IOTC ROS Regional Database, and therefore **AGREED** that further actions should be undertaken to ensure that regular as well as historical ROS data submissions are provided to the IOTC Secretariat in a standardised format.

27. The WPTmT **NOTED** the trend in total catches of albacore in recent years, and in particular the increased contribution of catches from artisanal and small-scale fisheries to the total, together with the decrease of catches reported by industrial purse seiners operating in tropical waters in the northwestern Indian Ocean. Also, the WPTmT **NOTED** the substantial contribution of the large-mesh driftnet fisheries of Taiwan,China to catches of the species in years between mid-1980s and mid-1990s, which suddenly disappeared after the entry into force of UN Resolution 46/215 which called for a global moratorium on high seas driftnet fisheries.

28. The WPTmT **NOTED** that the declining trend in reported catches of albacore from the deep-freezing component of the industrial longline fishery (which often also targets bigeye and yellowfin tuna) is complemented by the development of a "fresh" tuna longline component of the same fishery (still industrial in nature) which began in the early 2000s, and mostly comprises vessels flying the flags of Indonesia and Taiwan,China, targeting both albacore and swordfish.

29. For the reasons above, the WPTmT **ACKNOWLEDGED** that catches of albacore in the Indian Ocean during the last five years are basically accounted for by a few key players (namely Taiwan,China, Indonesia, China, and Japan) whose fisheries combined are responsible for on average 90% of total annual catches for the species.

30. In this regard, the WPTmT **NOTED** the rapid growth in catches of albacore attributed to the artisanal line fisheries of Indonesia (using coastal longline and troll line gears) which in 2020 have reached almost four times the catch levels recorded for 2018 and previous years. The WPTmT **ACKNOWLEDGED** that this phenomenon is a consequence of the re-estimation of Indonesian artisanal catches (performed by the Secretariat under advice from the IOTC Scientific Committee) which introduces marked changes in total catches of albacore compared to what was officially reported by Indonesia through form 1-RC. The WPTmT **RECALLED** that this re-estimation only affects Indonesian catches from artisanal and (partially, until 2017) industrial longline fisheries, and that catches from industrial purse seine and longline fisheries of Indonesia from 2018 onwards are kept as originally reported.

31. The WPTmT **RECALLED** how artisanal fisheries using "*coastal longline*" gears are categorised as "*line*" rather than "*longline*" fisheries, and **AGREED** that - considering the nature and importance of these fisheries - it might be necessary to further rediscuss their categorization also outside the context of this group.

32. The WPTmT **ACKNOWLEDGED** that albacore size-frequency data represent the most incomplete of the three main datasets available for the species, with information of relatively good quality only available from 1980 onwards.

33. The WPTmT **NOTED** that albacore average weights can be reasonably estimated only for a subset of the fisheries (industrial longline and purse seine fisheries, in particular) due to the limited catches of the species reported by all other fisheries, and more in general to the unavailability of their size-frequency data. For this reason, the WPTmT also **ACKNOWLEDGED** that the estimated average weight for all fisheries combined is dominated by

individuals caught by industrial longline fisheries, and also by the increasing average weight of fish caught by the "fresh" longline fisheries.

34. Nevertheless, the WPTmT **ACKNOWLEDGED** that the IOTC target requirement of sampling for size at least one fish per metric ton of catch is not consistently reached by the major industrial fisheries targeting the species, with the exception of the Taiwanese deep-freezing and fresh longline (the latter, only from 2011 onwards).

35. The WPTmT **NOTED** a sudden decrease (and marked fluctuations) in the median length of albacore sampled by the Japanese deep-freezing longline fishery starting from 1990, and **ACKNOWLEDGED** that this might be explained by changes in sampling protocols, which initially favoured individuals caught in the northern Indian Ocean (generally larger) and eventually smaller individuals recorded by observers deployed on vessels operating far south, and specifically in southern bluefin tuna fishing grounds. For this reason, the WPTmT **ACKNOWLEDGED** that the representativeness of more recent size data from the Japanese deep-freezing longline fishery might be negatively affected by the strong spatio-temporal patterns in the underlying sampling protocols, and **REQUESTED** that this be taken into due consideration when incorporating length information in the stock assessment.

36. The WPTmT also **NOTED** that albacore fisheries operate in fishing grounds in southeastern Indonesian and northwestern Australian coastal waters, which scientists have identified as spawning grounds for the species and **ACKNOWLEDGED** that size information available from those fishing grounds (and adjacent waters) comes almost exclusively from industrial longliners, despite the presence of important coastal fisheries in the area.

37. More generally, the WPTmT **ACKNOWLEDGED** that albacore size-frequency data sensibly vary with the season and area of collection, and that fish caught in equatorial waters are generally larger than fish caught in southern temperate waters, which in recent years has become the principal fishing grounds for fisheries targeting the species.

38. The WPTmT **NOTED** that the determination of length-weight relationships is influenced by the condition of the fish and by the area of capture, to the point that ideally multiple length-weight relationships should be determined to account for these distinct influencing factors, and eventually *averaged* for scientific purposes.

5. NEW INFORMATION ON BIOLOGY, ECOLOGY, FISHERIES AND ENVIRONMENTAL DATA RELATING TO TEMPERATE TUNAS

5.1 Review new information on the biology, stock structure, their fisheries and associated environmental data

Japanese LL fleet information

39. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–11 which provided a review of Japanese longline fishery and its albacore catch in the Indian Ocean, including the following abstract provided by the authors:

> "*Status of effort, albacore catch and CPUE were summarized for Japanese longline fishery operating in the Indian Ocean including recent trends. Japanese longline vessels had been targeting albacore until late 1960s, albacore became non-target after that, but it appears to be one of target species in recent years. Fishing effort fluctuated and it sharply decreased in recent years due to the effects of piracy activities. Albacore catch was high in 1960s, sharply decreased in 1970s, gradually increased with fluctuation after that, and then is decreasing after mid 2000s. In the early period, the effort was deployed mainly in the tropical area, and then expanded to the south. Fishing effort in the northwestern part (around Somalia) sharply decreased after 2009 due to piracy activities. During 1960s albacore was main component of the catch in the western part between 10˚S and 35˚S, and is recently main component in the southern part including west off Australia and around Madagascar.*"

40. The WPTmT **THANKED** the authors for providing this useful information and presenting it in a clear format for discussion by the participants.

41. The WPTmT **NOTED** that the fate of the majority of catches of albacore caught by Japanese deep-freezing vessels is now the sashimi market but until recently albacore was mostly sold for canning.

42. The WPTmT **NOTED** that generally albacore tuna is distributed in relatively deep waters (shallower than bigeye tuna but deeper than yellowfin tuna). The WPTmT further **NOTED** that in past analyses of the year effect for CPUE series, deeper longline fisheries were generally assigned higher levels of catchability for albacore.

43. The WPTmT **NOTED** the different size structure of the albacore stock in different areas of the Indian Ocean with larger fish being caught further north in subtropical waters while smaller fish are caught further south in temperate waters.

44. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–09 which provided a review of size data and fish size for Indian Ocean albacore caught by Japanese longline fishery, including the following abstract provided by the authors:

> ***"****Status of data collection and fish size was summarized for the size of albacore caught by Japanese longline fishery operating in the Indian Ocean. Size sampling of albacore is mainly conducted on board of commercial vessels by fishermen, by training vessels and by scientific observers. Annual number of fish sampled and main sampling area differed depending on periods. The fish mainly ranged between 60cm and 120cm FL. Information on sex is not available for most of the fish, but the proportion of male increased between around 100cm and 115cm. Fish size became smaller as latitude got higher and large difference was observed between north of and south of 30S. There was no clear difference of fish size by sampling method."*

45. The WPTmT **THANKED** the authors for providing this useful information and presenting it in a clear format for discussion by the participants.

46. The WPTmT **NOTED** there is little data available from 2020 due to the fact that most of the data is coming from observers and that the data processing and quality controls for these data are time consuming and so not all of the data are included yet.

47. The WPTmT **NOTED** the size composition by area and season is very interesting and shows seasonality especially in the South. The WPTmT **NOTED** that this information will be very useful for the stock assessment.

48. The WPTmT **NOTED** that the delineation between the types of samples was done visually rather than by using a model for the different sizes, further **NOTING** that the sample size was too small to be able to inform such a model.

49. The WPTmT **QUERIED** whether the data collection by observers includes other types of weight (different dressings) or length. The WPTmT **NOTED** that in the observer scheme, only one type of weight or length is required but it could be possible that observers collect more morphometric data (e.g., different weight and dressing types). The WPTmT **NOTED** that these data would be useful for conversion factors for different types of weight (dressing).

- **Catch at size**

50. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–08 which provided an analysis of length data of albacore (*Thunnus alalunga*) caught by Taiwanese large-scale longline fishery in the Indian Ocean, including the following abstract provided by the authors:

> ***"****In this study, historical length-frequency data of albacore caught by Taiwanese large-scale longline fishery in the Indian Ocean were explored by temporal and spatial factors. A comparison between the data recorded by the logbook data system and the scientific observer program was also conducted. Apparent different length compositions reported by logbook data were observed before and after 2003. sample sizes tended to shift from the western area to the eastern area through the years and the length distributions tended to shift to larger fishes since 2003. The length distributions from logbook data revealed greater variabilities than those from observer data, but systematic differences in the major central and dispersion tendencies by temporal and spatial factors were not significantly identified from the two data sources."*

51. The WPTmT **THANKED** the authors for providing this useful information and presenting it in a clear format for discussion by the participants.

52. The WPTmT **NOTED** the sample size map presented to the group is an important plot, however, the WPTmT **SUGGESTED** that it would be useful to provide information on the size of the sample in relation to the catch to provide a better understanding of the level of coverage rather than absolute sample size. The author confirmed that this analysis can be done.

53. The WPTmT **ACKNOWLEDGED** that the analyses presented are very useful for the stock assessment, in particular, the boxplot of observer/logbook size data as a function of longitude/latitude/month is very interesting for providing a visual insight into the evolution of size composition in the fishery. The WPTmT **SUGGESTED** that quantitative models such as Generalized Additive Models (GAM) could be used to investigate the spatial effect on size composition and to test the significance of these effects. The author confirmed that this type of analysis can be performed in the future.

54. The WPTmT **QUERIED** whether it would be possible to compare the size composition data provided here with size composition data from China, Malaysia and the Seychelles as many of these vessels are owned by Taiwan,China and the gear configuration is thought to be similar meaning that comparisons between size and weight compositions could be made across logbook and observer data across the same strata. The WPTmT **NOTED** that many of the data from these other fleets are not thought to be available and in fact the vessels are not all of the same type (i.e., vessels from China and Malaysia are not deep-freezing longliners) and so comparisons would not be possible.

55. The WPTmT **NOTED** that the representativeness of the commercial data compared to the observer data is a very important point for the stock assessment and **NOTED** that the observer program coverage is around 5-10%. The WPTmT **NOTED** that the sample size by area and season from the observer program data has not yet been analysed.

- **Biological indicators, including age-growth curves and age–length keys**

56. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–10 which provided an updated review on the Indian Ocean albacore biological parameters for stock assessment, including the following abstract provided by the author:

> ***"****IOTC will conduct stock assessments for ALB (albacore) in the WPTmP08 (July 25-29, 2022). Before the July assessment meeting, IOTC will take place the on-line "data preparatory meeting (April 13-15, 2022)" and will discuss input data for stock assessments. In this regard, I reviewed the updated information on the stock structure and seven biological parameters of ALB to be used for the stock assessments. Seven types of biological parameters are (1) sex ratio, (2) LW relation, (3) growth equation, (4) life span (plus group), (5) natural mortality, (6) fecundity and (7) maturity-at-age. In this review, I referred to parameters used in ICCAT, WCPFC, ISC and IOTC. Then plausible parameters for the ALB stock assessments are evaluated then suggested for both base case and sensitivity. As a result, the same stock structure and seven parameters used in the 2019 ALB stock assessments are suggested again as a base case to apply for the 2022 ALB stock assessments. We need to confirm this and also discuss options of sensitivities during this data preparatory meeting. Some future works to improve biological parameters are suggested."*

57. The WPTmT **ACKNOWLEDGED** the comprehensive review of the biological parameters that could be used for the stock assessment and **NOTED** that this information will be compared to the stock parameters defined by the expert modeler and complement the final selected parameters. The WPTmT **NOTED** that the inclusion of the separate growth curves by sex could be useful. The discussions about the model specifications are included in section 7 of the report.

58. The WPTmT **RECALLED** the attempt made at its previous session to derive an Indian Ocean specific length-weight relationship based on data available from the ROS and **AGREED** that the work should be continued by potentially including new morphometric data available from other sources.

59. The WPTmT **NOTED** that there are several sources of data that could be used to derive spatial and time-specific length-weight relationships. The WPTmT **NOTED** that the Secretariat has initiated work to collate all these data and it could be useful to provide the stock assessment group in July 2022 with these specific length-weight relationships. The WPTmT **NOTED** that this work should be done intersessionally before the July meeting to leave time for the stock assessment modelers to perform their analyses (see section 7.3).

60. The WPTmT **NOTED** that the life span can be considered as a maximum age which is useful not only for the number of age classes of the model but also for the natural mortality estimates. The WPTmT **NOTED** that in paper IOTC-2019-WPTmT07(DP)-21_Rev1, the oldest individual was 16 years whereas in the South Pacific, an individual has been aged at 15 years old. The WPTmT further **NOTED** that in other areas, scientists have proposed methods using maximum age for estimating natural mortality which are thought to be the best methods for this

purpose. The WPTmT **NOTED** that it would be important to agree on these maximum age estimates for the stock assessment.

61. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–18 which provided an investigation into natal origin and trans-oceanic migrations of albacore tuna (*Thunnus alalunga*) from the West Indian Ocean using otolith chemistry, including the following abstract provided by the authors:

"Variation in otolith elemental fingerprints was investigated in albacore tunas (Thunnus alalunga) sampled in the southwest Indian Ocean (SWI) and along the Atlantic coast of South Africa (SA). A total of 72 otoliths were selected, from 46 adult fish captured around the Reunion Island (SWI) and 26 juvenile and sub-adults sampled at two locations off the South African coast (SA-N and SA-S, n = 13 per location). LA-ICP-MS was used to assess the signatures in 15 chemical elements at all otolith cores (to investigate potential differences in fish spawning origin among regions) and along all otolith edges (to characterize the chemical signatures of fish capture areas). Among the 15 chemical elements analysed, only Mg, P, Zn, Sr, Ba, B and Cu were above detection limits and significantly contributed to the variation in otolith composition. Based on differences in these elements, two groups of distinct multi-elemental signatures, denoting potentially discrete spawning origins (SpO), were identified at the otolith cores using hierarchical clustering based on Euclidian distances. Each of the two potential SpO contributed to the tuna sampled in all three areas, suggesting a common origin in some fish caught in the Atlantic and in the Indian Ocean and important trans-oceanic migrations between these two Oceans. The possible location of the two spawning areas is discussed based on the signatures recorded on the otolith edges before the final capture of the fish, in both oceans. This study was part of a collaborative project on the population structure of tuna, billfish and sharks of the Indian Ocean (PSTBS-IO)."

62. The WPTmT **NOTED** that the two spawning origins identified in the study are well discriminated statistically and have different chemical signatures. However, the location of these spawning origins is not geographically defined and requires more analysis, especially on young fish which could limit the interest of this approach for stock identification and **NOTED** that similar issues have been observed with this type of analysis on the Atlantic bluefin tuna at ICCAT. The WPTmT **NOTED** that more samples are needed from different locations to increase the discrimination power of this kind of analysis and **NOTED** that these samples would ideally be from young fish to provide the clearest chemical signature of these trace elements.

63. The WPTmT **NOTED** that the Southwestern Indian Ocean chemical signature can also differ across different seasons. For example, the chemical fingerprints are different in February and December which is linked to different patterns in water masses in the region or different origins of the fish that are captured on this site according to the seasons. The WPTmT further **NOTED** that there could be different spawning timings and that as the patterns of the water masses change over these different spawning times, it can have an impact on the analyses.

64. The WPTmT **NOTED** the 90°E separation between two albacore populations in the Indian Ocean and **NOTED** that this separation stems from a study from the 1990s[1].

65. The WPTmT **QUERIED** whether the results from this analysis could be compared to the work on trace element profiles that has been performed by AZTI on yellowfin tuna. The WPTmT **NOTED** that this comparison has not been performed yet but could be interesting to conduct.

66. The WPTmT **NOTED** that only samples from La Réunion Island have been used due to the difficulty of collecting samples in Indonesia. The WPTmT further **NOTED** that collecting samples in the Eastern Indian Ocean will be very useful for further analyses but currently there is no follow-up project planned on this topic.

67. The WPTmT **NOTED** the map of albacore spawning areas in the Indian Ocean and queried whether these proposed sites were published and if the WPTmT can consider albacore to have one main spawning area or an additional separate spawning area off the coast of Australia and Indonesia. The WPTmT **NOTED** that the map provided stems from paper IOTC–2014–WPTmT05–13 Rev_2 and further analyses (using this type of trace elements) could be done to test the single/multiple spawning ground(s) hypotheses.

68. The WPTmT **ENCOURAGED** the continuation of this type of analysis.

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[1] Yeh SY, Hui CF, Treng TD, Kuo CL (1995) Indian Ocean albacore stock structure studies by morphometric and DNA sequence methods. FAO IPTP/TWS/95/2/25. IPTP Collective Volume 9(3): 258-263. Collective Volume of Working Documents presented at the Expert Consultation on Indian Ocean Tunas, Colombo, Sri Lanka, 25 - 29 September, 1995.

6. Review of new information on the status of temperate tunas

6.1 Nominal and standardised CPUE indices

CPUE Standardisations

Area definitions for CPUE standardisation were those defined during the IOTC joint CPUE analysis in 2018 (“regA4”, Figure 1). These regions were used in the last stock assessment.

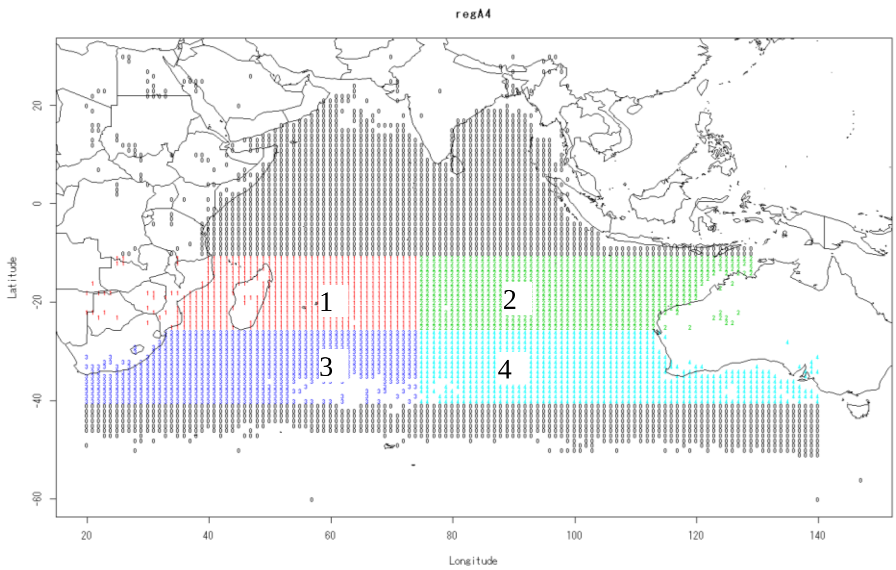

Figure 1: Map of the regional structure used to estimate albacore CPUE indices

Japanese LL – Catch-per-unit-effort (CPUE)

69. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–16 which provided the standardization of albacore CPUE by Japanese longline fishery in the Indian Ocean, including the following abstract provided by the authors:

    “Standardization of albacore CPUE by Japanese longline fishery in the Indian Ocean was conducted using the Generalized Linear Model (GLM) with lognormal or delta lognormal error structure. Cluster analysis was conducted before standardization, and cluster number was used for main effect as well as year, quarter, vessel ID and five degree latitude/longitude block and several interactions. Area definition is the same as that for 2019 IOTC albacore stock assessment. CPUEs slightly increased from early 1990s to early 2010s, and the trend was different among areas after that. The trend of CPUE was usually similar to that in the previous study.”

70. The WPTmT **NOTED** that there was little effort in the first and (particularly) the fourth quarters of the southeastern region and this fact could cause problems with the delta-lognormal model, so the WPTmT **SUGGESTED** omitting the data from one or both of these quarters.

71. The WPTmT **NOTED** the suggestion to consider the interaction between quarter and spatial effects, which may be able to better explain the behaviour of seasonal movement for albacore tuna.

72. The WPTmT **NOTED** the inclusion of vessel IDs in the Japanese dataset for the period 1975-1978, whereas in the past vessel IDs were only available from 1979 and **NOTED** that this extension of the data is a very useful improvement to this important dataset.

Taiwanese large-scale LL Catch-per-unit-of-effort (CPUE)

73. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–12 which described CPUE standardisation of albacore (*Thunnus alalunga*) caught by Taiwanese large-scale longline fishery in the Indian Ocean, including the following abstract provided by the authors:

    “The cluster analysis was adopted to explore the targeting of fishing operations of vessels operating in the albacore fishing areas of the Indian Ocean. In addition, the CPUE standardizations were conducted using

the regular generalised linear model (GLM) and delta-GLM for accounting for the trend in the zero catches. In general, the clustering approach was able to explicitly and clearly identify the targeting of each set. Based on the diagnostic statistics and trend of model fits, the standardised CPUE series obtained based on the regular GLM with gamma error distribution would be recommended by this study".

74. The WPTmT **NOTED** that due to data quality issues, the analysis excluded pre-2005 data (decision agreed in previous analysis). The WPTmT also **NOTED** that most of the catch and effort came from the southern part of the Indian Ocean, where more targeted fishing for albacore tuna is carried out.

75. The WPTmT **NOTED** that CPUE analyses by national scientists need not focus on developing indices, but should instead provide opportunities to explore alternative modelling approaches, and to explore factors that affect catch rates in order to better understand the fishery. The WPTmT **NOTED** that National scientists may not have full data access without the resolution limitations of the joint analyses.

76. The WPTmT **NOTED** that a hierarchical cluster analysis on species composition was used to categorise effort into groups representing different target species and **NOTED** that this seems very effective in identifying some of the known targeting practiced in some areas.

77. The WPTmT **NOTED** that in the southwestern region, the standardised index of the delta lognormal model differs significantly from the index of the lognormal / gamma model, which is more similar to the nominal index. This shows that the percentage of positive albacore sets increases over time. However, WPTmT **NOTED** that the number of shallow sets has decreased in recent years compared to deep sets. This may indicate a shift of target from albacore tuna to other species.

78. The WPTmT **NOTED** that the lognormal model used the catch as the response variable and a log link function. It was suggested that modelling the log-transformed catch with a natural link function instead may improve the diagnostics. However previous studies have shown the two approaches to have similar results with respect to convergence. The WPTmT also **NOTED** that the explanatory variables for the delta model do not include a measure of effort (such as the number of hooks) and suggested considering this in the future, as it is included in the joint analyses. Similarly, the model could also consider vessel effects and longitude-latitude interactions.

79. The WPTmT **NOTED** that the poor performance of the delta-lognormal model in the southeast region is likely to be due to the sparse data. The WPTmT **NOTED** that as the fishery in the region is very seasonal it may be advisable to omit data from season 4 and possibly season 1 when fitting the standardisation model.

Korea LL – Catch-per-unit-of-effort (CPUE)

80. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–13 which provided information on the CPUE standardization of albacore tuna caught by Korean tuna longline fishery in the Indian Ocean, 1979-2020, including the following abstract provided by the authors:

"*In this study the CPUE of albacore tuna caught by Korean tuna longline fishery in the Indian Ocean was standardized using lognormal constant model and delta lognormal model with added cluster factor as a categorical variable for addressing target changes over time. The data used for the CPUE standardization were catch in number, hooks used, fishing location (5° cell), and vessel identifier by year, quarter, and region. The standardized CPUE in the western subtropical region (R1) decreased from the early 1980s to the early 1990s, after that showed at low level with a fluctuation, and has increased since the 2010s. In the western temperate region (R3), since the early 2000s it has shown an increasing trend. However, we could not estimate the recent trend of the indices for the eastern subtropical region (R2) and the eastern temperate region (R4), because there was no fishing information or missing data."*

81. The WPTmT **NOTED** that effort has substantially reduced since 2010 and suggested that it may be better to apply some filtering to the data to avoid random "pulses" (e.g., minimum of sets per vessel or trip). The WPTmT further **NOTED** that the reduced effort in recent years may be due to the effect of piracy, which peaked in western tropical areas during 2008-2012, as well as due to market conditions. The WPTmT **NOTED** that there has been a shift of target species from tropical tunas to temperate tunas, especially southern bluefin tuna because of commercial interest.

Dependence survey abundance index

82. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–14 which provided information on the index of abundance and density prediction of albacore (*Thunnus alalunga*) in The Eastern Indian Ocean using dependence survey, including the following abstract provided by the authors:

> "*Worldwide, the management of fish stocks is based on stock assessment models. One of the most critical inputs in most stock assessment models is a relative abundance index of the species of interest. The main problem in determining the abundance index occurs in a dependence survey where the catchability covariates are very influential on a species abundance index to cover the actual reality in nature. This study uses the Vector Autoregressive Spatiotemporal Model (VAST) on Albacore species in the Indonesian longline tuna fisheries in the Eastern Indian Ocean. The results indicate that the resulting abundance index is better with low residuals, excluded catchability, and included habitat covariates make the results better than the conventional GLM model. The population density is well illustrated in the VAST model, where the VAST model can impute the population density in unfished areas to obtain a weighted area index. It is a distinct advantage considering many unfished areas in our research survey. This information is expected to benefit stakeholders in decision-making in the field.*"

83. The WPTmT **NOTED** the author was not available to present the paper.

Joint CPUE analysis

84. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–15 which provided joint CPUE indices for the albacore *Thunnus alalunga* in the Indian Ocean based on Japanese, Korean and Taiwanese longline fisheries data, 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 2020 to provide the WPTmT with information on abundance indices for use in the coming stock assessment for this stock. The intention was to produce reliable indices by increasing the spatial and temporal coverage of fishery data. Due to the limitation of remote data access, an approach adopted among the three counties for the previous analyses of tropical tunas for IOTC and ICCAT was used to share only aggregated data. As an underlying analysis, a clustering approach was applied to account for the inter-annual changes of the target in each fishery in each region. For this purpose, a hierarchical clustering method with "fastcluster" was used, and the outputs of the finalized cluster were then used to assign the cluster label on fishery target to each catch-effort data. For standardizing the catch-per-unit-effort data, the conventional linear models and delta-lognormal linear models were employed for the shared aggregated data of monthly and 1° grid resolution in each region. The models were diagnosed by the standard residual plots and influence analysis.*"

85. The WPTmT **NOTED** that since 2019, the Japanese, Korean, and Taiwanese scientists have started to work collaboratively to develop joint CPUE indices for tropical and temperate tuna under a data confidentially agreement, using a similar approach to the previous joint CPUE standardization work carried out by a consultant.

86. The WPTmT **NOTED** that each spatial grid is effectively weighted by the number of observations in the standardized model and **NOTED** that this can lead to bias as fishing effort shifts from one area to another. The WPTmT **SUGGESTED** that it would be beneficial to consider equal statistical weights in each grid, as has been shown to work well in simulations. The WPTmT **NOTED** that this may have not have a large effect on the final results, given that catch and effort are aggregated (at the 1x1 grid level). The WPTmT further **NOTED** that data aggregation reduces the compliance of the data with the statistical assumption of homoscedasticity (uniform variance), and may affect indices to some degree.

87. The WPTmT **NOTED** that Region 4 (southeast) is an important region for albacore tuna. The sharp increase in CPUE is clearly due to a sharp increase in catch, which appears likely to be mainly caused by changes in targeting. However, it seems very difficult to separate the effects of changes in targeting and changes in abundance for the standardization. The WPTmT **ACKNOWLEDGED** that further work is needed to better understand what causes the changes, but a thorough analysis would require access to operational data.

88. The WPTmT **NOTED** that catches in the southern region were very low in the fourth quarter. Since most of that quarter's efforts were focused on southern bluefin tuna, and particularly in the SW region, it was suggested to

remove the fourth quarter data from standardization of the SE region. The WPTmT further **NOTED** there has been an increase of southern bluefin tuna catches in the southern region due to the TAC increase and so more effort has been directed to SBT in the southern region.

89. The WPTmT **AGREED** that the Joint CPUE indices should be used in the current assessment. However, the WPTmT **NOTED** that there are major concerns over the reliability of the Taiwanese component in the Northeast region (Region 2), and the target effect in the Southeast (Region 4) for the Japanese catch effort series remains unsolved. The WPTmT **AGREED** that the assessment should use indices from area 1 and 3 in the base model and explored the utility of area 2 in sensitivity analysis. The WPTmT **ENCOURAGED** the continuation of work on improving the Region 4 indices.

90. The WPTmT **NOTED** the Joint CPUE indices for regions 1 – 4 shown in Figure 2.

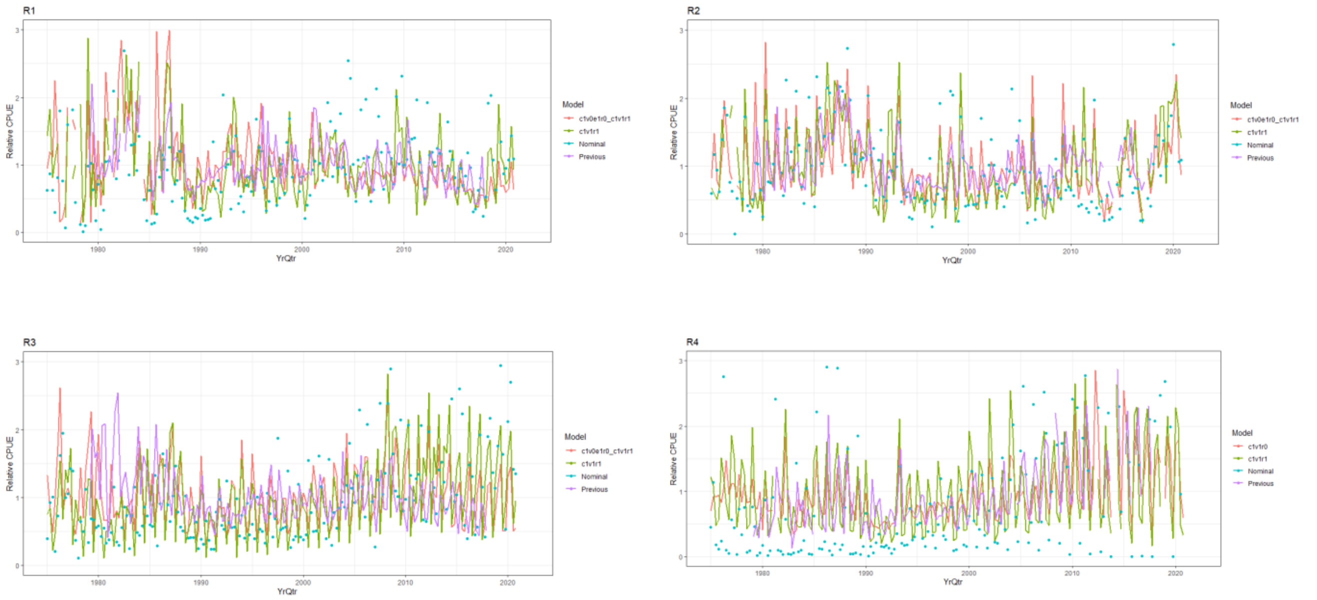

Figure 2: Estimated ALB CPUE indices by region from the joint analysis. For Regions 1-3, the recommended index to be included for the assessment was “c1v0e1r0_c1v1r1”.

7. ALBACORE STOCK ASSESSMENT

7.1 Discussion on albacore assessment models to be developed and their specifications

91. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–17 which provided a review of the data availability, model configuration and parameterization of the 2019 Indian Ocean albacore tuna (*Thunnus alalunga*), stock assessment in the Indian Ocean, including the following abstract provided by the authors:

> “*This paper presents a review of the data availability, model configuration and parameterization of the 2019 Indian Ocean albacore tuna (Thunnus alalunga), stock assessment in the Indian Ocean. This review covers the basics of the 2019 assessment, for details concerning the history of the fishery and the assessment history the reader is referred to the actual assessment document (IOTC–2019–WPTmT07(AS)–11). The conclusions, stock status and findings presented here are directly from the Report of the Seventh Session of the IOTC Working Party on Temperate Tunas: Assessment Meeting (IOTC–2019–WPTmT07(AS)–R[E])*”

92. The WPTmT **ACKNOWLEDGED** that one of the main objectives of the current data preparatory meeting is to discuss and determine the model specifications to be used for the assessment.

93. The WPTmT **NOTED** the assumptions used in the previous assessment with regards to the input data as well as the assumed parameters. Taking into account updated studies and information, many of which are discussed

under sections 4, 5 and 6 of this report, the WPTmT **AGREED** on initial parameter values advisory model specifications defined in Table 1 and the fleet definitions were also revisited. The advisory decisions are provided in Table 2.

94. The WPTmT **NOTED** that the model specifications in Table 1 & 2 aim to provide guidance to the modeler for creating the initial models further **NOTING** that the modeler could explore alternative configurations to determine an internally consistent model configuration based on further examination of the data, model fits, and diagnostics.

95. The WPTmT compared estimates of length-at-maturity by Farley et al. (2014)[2] and Dhurmeea et al. (2016)[3], and **NOTED** there is about 8 cm (or 1.8 years) difference in the estimated 50% female length at maturity between the two studies. The WPTmT **NOTED** that the Farley et al. (2014) estimate, which is based on samples from the south Pacific Ocean, has taken into account seasonal and spatial difference between samples and is presumably better for representing the length-at-maturity at population level. The WPTmT further **NOTED** that the unweighted estimates by Farley et al. (2014) from raw samples are similar to the Indian Ocean estimates. The WPTmT **SUGGESTED** that both estimates are explored in the assessment, i.e., the Farley et al. (2014) ogive for the base case and the Dhurmeea et al. (2016) ogive for sensitivity.

96. The WPTmT **NOTED** that there is well known seasonal movement (S-N) for albacore which may be better explained in a suitably structured spatial model. However, previous assessments had extensively investigated a number of spatial structures (including four-region and 2-region models) but they did not work well. It is very likely that the single region, fleet-as-area approach will be the best model in the new assessment. However, the WPTmT **AGREED** that as time permits, alternative spatial configurations should continue to be explored in the new assessment.

7.2 Identification of data inputs for the different assessment models and advice framework

97. The WPTmT **NOTED** the plan to apply a Statistical-Catch-At-Size (SCAS) (or Statistical-Catch-At-Length) model as a reference to Stock Synthesis. The SCAS model is based on catch-at-size and will use the same length composition dataset prepared for the Stock Synthesis model. The difference between SCAS and Stock Synthesis is that SCAS is the season aggregated (annual basis) model without incorporating movements. The SCAS differs from the previous model (Statistical-Catch-At-Age) (SCAA) that is based on catch-at-age which needs to be provided by the Secretariat by applying an age slicing method, which may include classification errors across ages.

98. The WPTmT **NOTED** if time permits, an Age-Structured Production Model (ASPM) and an aggregated biomass dynamic model (JABBA) will be implemented. The WPTmT also **ENCOURAGED** CPC scientists to explore other modelling platforms/structures to complement the Stock Synthesis model.

7.3 Other data or priorities relevant to the albacore stock assessment and preparation of the WPTmT08 stock assessment meeting

99. The WPTmT **NOTED** that the fork length-round weight relationship for albacore was derived in the early 1990s in the Atlantic Ocean and much new data has been collected since then, e.g., those collected by the University of Mauritius, the French national Research Institute for Sustainable Development, and IFREMER across the western Indian Ocean from different fleets and fishing gears as well as data collected through the IOTC Regional Observer Scheme. The WPTmT **RECOMMENDED** that the IOTC Secretariat coordinate a small project in the coming few months (with a deadline of the end of May) utilising the open-source platform (e.g., GitHub, Markdown) to allow interested researchers to access the data and work collaboratively on the new datasets,

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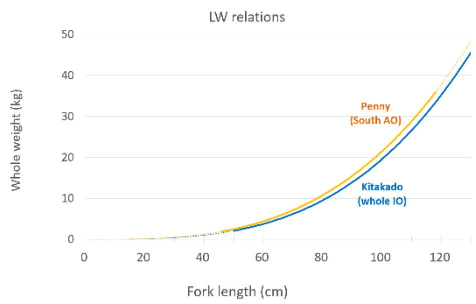
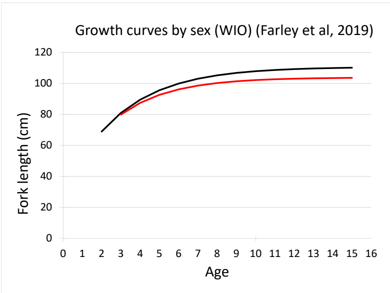
[2] Farley, J. H., S. D. Hoyle, J. P. Eveson, A. J. Williams, C. R. Davies and S. J. Nicol (2014). Maturity Ogivesfor South Pacific Albacore Tuna (Thunnus alalunga) That Account for Spatial and Seasonal Variation in the Distributions of Mature and Immature Fish. PLoS one 9(1): e83017.

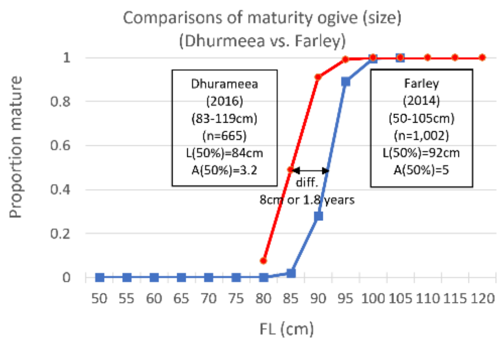
[3] Dhurmeea, Z.; Zudaire, I.; Chassot, E.; Cedras, M.; Nikolic, N.; Bourjea, J. et al. (2016) Reproductive Biology of Albacore Tuna (Thunnus alalunga) in the Western Indian Ocean. PLoS ONE 11(12): e0168605.

including a thorough investigation of the spatial and temporal effects on the length-weight parameters, and differences between sexes. If successful, updated parameters could be used in the new assessment.

Table 1. Summary of agreed stock structure and seven biological parameters (base case and sensitivities) to be used for 2022 ALB stock assessments in the Indian Ocean. (note) (*) same as in the last stock assessments in 2019.

<table>
<tr><th>Parameters</th><th>Base case</th><th>Sensitivity</th></tr>
<tr><td>Stock structure</td><td>Single (*)</td><td>Optional (to be explored)</td></tr>
<tr><td colspan="3">Biological parameters</td></tr>
<tr><td>(1) Sex ratio at birth</td><td colspan="2">1:1 (*)</td></tr>
<tr><td>(2) LW relation</td><td colspan="2">[A] Revised estimates to be explored intersessionally based on IOTC data holdings, potentially estimating an alternative LW relationship for the IOTC region. Target completion by May 30th. Potentially investigate the differences by sex. Describe data provenance (date & location). The revised estimates shall be used in the assessment if accepted by the WPTmT (see Para 99)
[B] Kitakado et al (2019) (IO) $W = (0.69 \times 10^{-5}) * L^{3.2263}$
[C] Penny (1994) (S. Atlantic) $W = (1.3718 \times 10^{-5}) * L^{3.0973}$


(Note)When [A] is developed and evaluated intersessionally, base case and sensitivities from [A], [B] and [C] will be decided by the WPTmT.</td></tr>
<tr><td>(3) Growth equation</td><td>Farley et al (2019)
based on Von Bertalanffy (*)
♂ $L(t)=110.06\ [1-e^{-0.34\ (t+0.87)}]$
♀ $L(t)=103.80\ [1-e^{-0.38\ (t+0.86)}]$


</td><td>Growth equation estimated by SS3
Investigate a higher CV than currently assumed for old and young age class</td></tr>
<tr><td>(4) Life span</td><td colspan="2">Age 14+ (equivalent quarterly age for SS3) (*)</td></tr>
<tr><td>(5) M by age</td><td>0.3 by Watanabe et al (2006)
(North Pacific)</td><td>Use a Lorenzen curve
(to be developed, make the avg. M for mature fish = 0.3)</td></tr>
<tr><td>(6) Fecundity</td><td colspan="2">Fecundity is proportional to female weight at age (by individual) (*)</td></tr>
<tr><td rowspan="2">(7) Maturity schedule at length</td><td>Farley et al (2012) (South Pacific)
(refer to page 9 and Fig. 23 used in the last SS, IOTC–2019–WPTmT07(AS)–11)</td><td>Dhurmeea et al (2016) (Western Indian Ocean)
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0168605</td></tr>
<tr><td colspan="2">


</td></tr>
</table>

Table 2. Summary of agreed model configurations (base case and sensitivities) to be used for 2022 ALB stock assessments (SS3) in the Indian Ocean

Category	Assumptions (base case)	Sensitivity	Parameters (The specifications of the contrasting 2 region model are in grey italics)
Spatial Structure	Single Region (comments: fisheries as areas with different selectivity assumptions & length data)	Optional 2 region model noting that previous work on 2 and 4 region models did not work well	
Recruitment	Occurs at the start of fourth quarter as 0 age fish. Recruitment is a function of Beverton-Holt stock-recruitment relationship (SRR). Temporal recruitment deviates from SRR, 1975-2015.	Overall regional recruitment distribution. Temporal variation in regional recruitment distribution 1980-2015	LNR0 No prior; h = 0.80 SigmaR = 0.3, 41 deviates. *4 parameters (3 estimated, 1 fixed)* *108 parameters*
Initial population	A function of the equilibrium recruitment assuming population in an unexploited state prior to 1950. Initial fishing mortality fixed at zero for all fisheries.		
Age and growth	Two sexes with 14 age-classes, with the last representing a plus group. Growth parameterized using VonBert growth model. CV of length-at-age based varies as a linear function of age. Mean weights from the weight-length relationship $W = a*L^b$.		a and b: TBD (base case and sensitivities) (pending based on the revised analysis, see Para 99 and Table 1) CVyoung =TBD, CVold =TBD
Natural mortality	Invariant with age (0.3)	a Lorenzen curve (to be developed, make the avg. M for mature fish = 0.3).	0.30
Reproductive potential	Length based female reproductive potential. Fecundity is directly related to female biomass (Wt) i.e. eggs=Wt*(a+b*Wt) with		Specified by length class

	a=0 and b=1.		
Movement		Age specific	Estimated
Selectivity	Length based selectivity, parameterised with double normal function. LL3 and LL4 fisheries (and CPUE) share a common double normal selectivity. LL1 and LL2 fisheries share a common double normal selectivity constrained to approximate full selectivity for the largest length classes. Drift net fisheries have common selectivity. Double normal. Purse seine double normal selectivity. Other (1-4) fisheries fixed selectivity, equivalent to DN.	Seasonal selectivity All LL fisheries (and CPUE) share a common selectivity. Constrained to approximate full selectivity for the largest length classes	4 estimated parameters, no priors. 4 estimated parameters, no priors. 3 estimated parameters, no priors. 3 estimated parameters, no priors. *4 estimated parameters, no priors*.
Catchability	No seasonal variation in catchability for LL CPUE. LL CPUE indices have CV of 0.2. Shared base catchability estimated for four sets of LL CPUE indices.		1 base parameter estimated
Fishing mortality	Hybrid approach (method 3, see Methot & Wetzel 2013).		
Fleets	Same 11 as in 2019		# Fishery Nationality Gear Area 1 LL1 All Longline 2 1 2 LL2 All Longline 2 2 3 LL3 All Longline 3 3 4 LL4 All Longline 4 4 5 DN3 CN-TW Drift net 3 6 DN4 CN-TW Drift net 4 7 PS1 All Purse seine 1 8 Other1 All Other gears 1

			9 Other2 All Other gears 2 10 Other3 All Other gears 3 11 Other4 All Other gears 4

8. Other Business

8.1 Review of information relevant to the Albacore management strategy evaluation process

100. The WPTmT **NOTED** a brief update on the albacore management strategy evaluation process that was provided on behalf of the lead modeller. This update presented the latest iteration in the development of the operating model (OM) for Indian Ocean albacore tuna, constructed as a grid of Stock Synthesis (SS3) stock assessment runs. The base case is the model run conducted by WPTmT in 2016, and considers a number of sources of uncertainty, as identified by WPTmT and WPM, in the estimation of population trajectories and dynamics. Tuning of candidate management procedures, according to the objectives put forward by TCMP in 2018, has been carried out and the results show some of the trade-offs involved in achieving those objectives.

101. The WPTmT **WELCOMED** the progress that had been made on the MSE process and **NOTED** that this process is also being undertaken in the WPM.

102. The WPTmT **AGREED** that further discussion on these issues should take place at the July Assessment meeting, and that the update provided to the data preparatory meeting was informative.

8.2 Any other matters

103. The WPTmT **NOTED** paper IOTC–2022–WPTmT08(DP)–19 which presented information on an unusual Presence of Bluefin Tuna in the Gulf of Aden and in the Indian Ocean, including the following abstract provided by the authors:

“*The unusual presence of an adult bluefin tuna individual, fished off the coast of Yemen in May 2021, stimulated a discussion among several fishery scientists. This is the third event in the Indian Ocean concerning vagrant adult bluefin tunas in recent times and this paper is proposing various hypotheses about the possible species concerned. The most probable seems the Pacific bluefin tuna, but this is not the only possible option, at least for the latter event. This paper also reports some old catches of bluefin tuna juveniles between the Gulf of Aden and the Arabian Sea, in the NW Indian Ocean. All these events should induce initiatives by the IOTC for improving the knowledge on recent distribution changes of bluefin tunas in the Indian Ocean.*”

104. The WPTmT **THANKED** the authors for this very interesting paper. The WPTmT **NOTED** the importance of keeping an eye on the catches of potential bluefin tuna in the northern part of the Indian Ocean and investigating the possible reasons (potentially environmental) for the presence of these specimens in the region.

105. The WPTmT **ENCOURAGED** all CPCs to collect and provide information on potential catches of bluefin tuna (and other unusual tuna specimens) in the Indian Ocean to the Secretariat in the future. To achieve this, the WPTmT further **ENCOURAGED** scientists to maintain communications with the fishing industry so that these exceptional events can be detected.

9. Review of the draft, and adoption of the Report of the 8th Session of the WPTmT(Data Preparatory)

106. The WPTmT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPTmT08(DP), provided at Appendix 6.

107. The report of the 8th Session of the Working Party on Temperate Tunas (*IOTC–2022–WPTmT08(DP)–R*) was **ADOPTED** by correspondence.

APPENDIX 1
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APPENDIX 2

AGENDA FOR THE 8TH WORKING PARTY ON TEMPERATE TUNAS (DATA PREPARATORY MEETING)

Date: 13 - 15 April 2022

Location: Online

Time: 12:00 – 16:00 Seychelles time daily

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

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

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

3. **THE IOTC PROCESS: OUTCOMES, UPDATES AND PROGRESS**

4. **REVIEW OF THE DATA AVAILABLE AT THE SECRETARIAT FOR TEMPERATE TUNA SPECIES (**IOTC Secretariat**)**

5. **NEW INFORMATION ON BIOLOGY, ECOLOGY, FISHERIES AND ENVIRONMENAL DATA RELATING TO TEMPERATE TUNAS** (Chair)

   5.1 Review new information on the biology, stock structure, their fisheries and associated environmental data:

   - Catch data
   - Catch and effort
   - Observer data
   - Catch at size
   - Catch at age
   - Biological indicators, including age-growth curves and age–length keys

6. **REVIEW OF NEW INFORMATION ON THE STATUS OF TEMPERATE TUNAS** (Chair)

   5.1 Review of fishery dynamics by fleet (CPCs)

   5.2 Nominal and standardised CPUE indices

7. **ALBACORE STOCK ASSESSMENT** (Chair)

   7.1 Discussion on albacore assessment models to be developed and their specifications

   7.2 Identification of data inputs for the different assessment models and advice framework

   7.3 Other data or priorities relevant to the albacore stock assessment and preparation of the WPTmT08 stock assessment meeting

8. **OTHER BUSINESS** (Chair)

   8.1 Selection of Stock Status indicators

   8.2 Review of information relevant to the Albacore management strategy evaluation process

   8.3 Any other matters

9. **REVIEW OF THE DRAFT, AND ADOPTION OF THE REPORT OF THE 8th SESSION OF THE WORKING PARTY ON TEMPERATE TUNAS (DATA PREPARATORY)** (Chair)

APPENDIX 3
LIST OF DOCUMENTS

Document	Title
IOTC–2022–WPTmT08(DP)–01a	Draft Agenda of the 8th Working Party on Temperate Tunas (DP)
IOTC–2022–WPTmT08(DP)–01b	Draft Annotated agenda of the 8th Working Party on Temperate Tunas (DP)
IOTC–2022–WPTmT08(DP)–02	Draft List of documents
IOTC–2022–WPTmT08(DP)–03	Outcomes of the 24th Session of the Scientific Committee (IOTC Secretariat)
IOTC–2022–WPTmT08(DP)–04	Outcomes of the 25th Session of the Commission (IOTC Secretariat)
IOTC–2022–WPTmT08(DP)–05	Review of Conservation and Management Measures relevant to temperate tuna (IOTC Secretariat)
IOTC–2022–WPTmT08(DP)–06	Progress made on the recommendations of WPTmT07 (IOTC Secretariat)
IOTC–2022–WPTmT08(DP)–07	Review of the statistical data and fishery trends for albacore (IOTC Secretariat)
IOTC–2022–WPTmT08(DP)–08	Analysis of length data of albacore (*Thunnus alalunga*) caught by Taiwanese large-scale longline fishery in the Indian Ocean (Wang S-P)
IOTC–2022–WPTmT08(DP)–09	Review of size data and fish size for Indian Ocean albacore caught by Japanese longline fishery (Matsumoto T)
IOTC–2022–WPTmT08(DP)–10	Indian Ocean albacore biological parameters for stock assessments (update) (Nishida T)
IOTC–2022–WPTmT08(DP)–11	Review of Japanese longline fishery and its albacore catch in the Indian Ocean (Matsumoto T)
IOTC–2022–WPTmT08(DP)–12	CPUE standardization of albacore (*Thunnus alalunga*) caught by Taiwanese large-scale longline fishery in the Indian Ocean (Wang S-P)
IOTC–2022–WPTmT08(DP)–13	CPUE standardization of albacore tuna caught by Korean tuna longine fishery in the Indian Ocean, 1979-2020 (Lee SI, Lee MK, Lim J and Kwon Y)
IOTC–2022–WPTmT08(DP)–14	The index of abundance and density prediction of albacore (*Thunnus alalunga*) in The Eastern Indian Ocean using dependence survey (Rochman F)
IOTC–2022–WPTmT08(DP)–15	Joint CPUE indices for the albacore *Thunnus alalunga* in the Indian Ocean based on Japanese, Korean and Taiwanese longline fisheries data (Kitakado T *et al*.)
IOTC–2022–WPTmT08(DP)–16	Standardization of albacore CPUE by Japanese longline fishery in the Indian Ocean (Matsumoto T)
IOTC–2022–WPTmT08(DP)–17	A review of the data availability, model configuration and parameterization of the 2019 Indian Ocean albacore tuna (*Thunnus alalunga*), stock assessment in the Indian Ocean. (Rice J)
IOTC–2022–WPTmT08(DP)–18	Investigating natal origin and trans-oceanic migrations of Albacore tuna (*Thunnus alalunga*) from the West Indian Ocean using otolith chemistry (Labonne M, Darnaude A, Fily T, Petit C, Médieu A, Pernak M, Nikolic N, Clear N, Farley J, Eveson P, Lozano-Montes H, Davies C and Marsac F
IOTC–2022–WPTmT08(DP)–19	Unusual Presence of Bluefin Tuna in the Gulf of Aden and in the Indian Ocean (Di Natale A, Al Mabruk S, Zava B)

APPENDIX 4
PROGRESS MADE ON THE RECOMMENDATIONS OF WPTMT07

Extracts from IOTC–2022–WPTmT08(DP)–06

WPTmT07 Rec. No.	Recommendation from WPTmT07	SC Rec. No.	Recommendation adopted by the SC (2019, 2020 0r 2021)	Progress / Comments
WPTmT07(DP).01	**Review of data available at the Secretariat for temperate tuna species** (para 20) **NOTING** that observer data for the Taiwanese deep-freezing longline fleet in the period 2012-2017 has been submitted to the IOTC Secretariat as highly aggregated *observer trip reports*, and **ACKNOWLEDGING** that no length-frequency information is available within said data, the WPTmT **RECOMMENDED** (see Resolution 11-04) Taiwan,China to provide more detailed information (as per IOTC ROS specifications) to its earliest convenience, as this data is considered of particular importance for the validation and understanding of recent changes detected in the length-frequency of albacore tuna (among others) reported by the Taiwanese fleet and could contribute to explain the decline in the proportion of smaller fish sampled for lengths by this same fleet.			To be provided by the CPC
WPTmT07(DP).02	(para 23) **ACKNOWLEDGING** that the levels of coverage for length frequency data reported by Japan for its longline fleet exceed – in recent years – the minimum threshold of one sampled fish per metric ton (as per IOTC Resolution 15/02) the WPTmT also **NOTED** that length frequency data for years prior to 2008 were reported by Japan as			To be provided by the CPC

	10x20 degrees grids, which is well below the minimum resolution of 5x5 degrees grids, and therefore further **RECOMMENDED** Japan to ensure that historical data to the expected level of resolution is provided to the IOTC Secretariat in the near future.			
WPTmT07(DP).03	**Biological indicators, including age-growth curves and age–length keys** (para 45) The WPTmT **NOTED** that the new LW relation derived by Dhurmeea et al (2016) is likely biased due to lack of small size data, thus the LW relation by Penny (1994) (South Atlantic) should be used again as a base case for stock assessments. As for the sensitivity, other LW relations including official IOTC observer data will be explored and the results provided by the middle of February 2019. These data, which are sourced from the Japanese observer program, cover a wider range of fish sizes and have larger sample sizes. The WPTmT **RECOMMENDED** that CPCs submit length-weight data to the IOTC secretariat, so that they may compile a database that represents spatial, seasonal, and sex-based variability in LW.			To be provided by the CPCs
WPTmT07(DP).04	(para 108) The WPTmT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPTmT07(DP), provided at Appendix 7.			The recommendations from the WPTmT07(DP) were discussed at the WPTmT assessment meeting and noted in the appendix of that meeting report (IOTC-2019-WPTmT07(AS)-R)

WPTmT07.01	**Revision of the WPTmT Program of Work** (Para 83) The WPTmT **RECOMMENDED** that the SC consider and endorse the WPTmT Program of Work (2020–24), as provided at Appendix V.		(para. 138)The SC **NOTED** the proposed Program of Work and priorities for the SC and each of the working parties and **AGREED** to a consolidated Program of Work as outlined in Appendix 35a-g. The Chairpersons and Vice-Chairpersons of each working party will ensure that the efforts of their respective working party is focused on the core areas contained within the appendix, taking into account any new research priorities identified by the Commission at its next Session.	The program of work has been incorporated into all SC meeting reports from 2019 – 2021.
WPTmT07.02	**Date and place of the 8th and 9th Sessions of the WPTmT** (para 89) The WPTmT **RECOMMENDED** that a data preparatory meeting (DP) and stock assessment meeting (AS) be held in the same year, with the data preparatory meeting being held between April and June and the assessment meeting in August or September. This would facilitate the provision of CPUE series using data from the previous year to the data preparatory meeting, while ensuring catch data for the previous year, which is due to be submitted to the IOTC Secretariat by the end of June each year, is available for use in the stock assessments. The exact dates and meeting locations will be confirmed and communicated by the IOTC Secretariat to the SC for its consideration. i. WPTmT08(DP): Host to be decided. Meeting to be held between April and June 2022 (TBC). ii. WPTmT08(AS): Host to be decided. Meeting to be held between August and September 2022 (TBC).	SC22.16	(para. 80) The SC **NOTED** that the 2020 and draft 2021 calendars of working party meetings were approved by the Commission in June 2019, and the WPTmT is not scheduled to meet in either of these years. The SC **NOTED** the request by the chairs of the WPTmTs to hold an assessment meeting in April 2020 but **AGREED** that this would not be appropriate as the SC would not have an opportunity to review the WPTmT outputs prior to the Commission meeting in June 2020. The SC **AGREED** that it would be beneficial to hold an assessment preparatory meeting in 2020 or 2021; and to this end, the SC **RECOMMENDED** that the Commission consider approving an assessment preparatory meeting for the WPTmT in either of these years.	The meetings requested for 2022 have been accommodated in the current meeting agenda. The recommendation by the SC to have meetings in 2020 and 2021 were ultimately postponed due to the Covid-19 pandemic.

WPTmT07.03	**Review of the draft, and adoption of the Report of the 7th Session of the WPTmT** (para 90) The WPTmT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPTmT07, provided in Appendix VI, as well as the management advice provided in the draft resource stock status summary for albacore (Appendix IV).	SC22.01	(para. 117) The SC **RECOMMENDED** that the Commission note the management advice developed for each tropical and temperate tuna species as provided in the Executive Summary for each species, and the combined Kobe plot for the four species assigned a stock status in 2019 (Fig. 1): Albacore (*Thunnus alalunga*) – Appendix 8	The advice from the WPTmT07 was taken into account when developing the stock status summary for albacore tuna from 2019 - 2021

APPENDIX 5

MAIN DATA ISSUES IDENTIFIED RELATING TO THE STATISTICS OF ALBACORE

Extract from IOTC–2022–WPTmT08(DP)–07

The following section provides a summary of the main issues that the IOTC Secretariat considers to negatively affect the quality of the statistics available at the IOTC for albacore, by type of dataset.

Nominal catch data

In 2020, 78% of the nominal catches of albacore was fully reported to the Secretariat, while the rest had to be partially or fully estimated. Part of the nominal catches was derived from alternative data sources, and specifically the fraction attributed to CPCs and non-members of the IOTC that did not report data to the Secretariat. In addition, a re-estimation process was applied to catches of the artisanal fisheries of Indonesia which have been known to be affected by data quality issues for some time (Proctor et al. 2003, 2011; Moreno et al. 2012).

In addition to well-known issues in data reporting, several other key issues need to be noted when considering the historical time series of nominal catches of albacore:

- Catches of albacore from longliners operating under flags of non-reporting countries (e.g., Belize, Honduras, Indonesia, Malaysia) have been estimated by the Secretariat between 1985 and 2016 based on some strong assumptions on the numbers of vessels and their annual catch rates (Herrera 2002a, 2002b). While the estimates of non-reported catches were moderately high during the 1990s and early 2000s (up to almost 10,000 t in 1999), they have substantially decreased from the mid-2000s and have been considered nil in recent years in consequence of the reduced practice of reflagging, the implementation of port state measures, and the improved monitoring of vessels activities and data reporting by the concerned CPCs (such as Malaysia);

- In the past, catches of albacore from the longline fisheries of Philippines (1999-2010), India (2004-2011), and Oman (2017-2018) were re-estimated by the Secretariat as they appeared only partially reported based on i) the inconsistencies observed between the levels of bigeye tuna reported in the catches and monitored through the IOTC Statistical Document Programme in the case of Philippines, and ii) to the number of vessels available in the Record of Authorized vessels (RAV) and the Active List of Vessels (AVL) for India, and also because of the lack of detailed catch by species reported by Oman;

- Catches of albacore for both the artisanal and industrial fisheries of Indonesia have been estimated by the Secretariat in collaboration with Indonesia to overcome some major issues in data collection and reporting identified for the country (Herrera 2002a; Proctor et al. 2003; IOTC 2013; Yuniarta et al. 2017). The estimation methodology developed for Indonesian fresh longliners in the early 2010s and revised in 2018 is considered to have improved the nominal catch statistics between 2013 and 2018 while estimates prior to 2013 continue to remain highly uncertain (Moreno et al. 2012; Geehan 2018). It is useful to note that the estimation method has not been applied to the industrial longline and purse seine fisheries in recent years but is still in use for Indonesian artisanal fisheries;

- The catches of albacore estimated for the fresh-tuna longline fishery of Taiwan,China are only available from 2001 onward: prior to 2001, catches for the Taiwanese fleet remain relatively uncertain.

Discard data

The total amount of albacore discarded at sea remains unknown for most fisheries and time periods despite the obligation to report these data as per IOTC Res. 15/02. Information available in the ROS regional database for longline fisheries covers the period 2009-2019 and only a fraction of the Indian Ocean fishing grounds, as data are limited to vessels flagged by EU,France, Japan, and Sri Lanka. Almost no information on discarding of albacore is available for coastal line fisheries, although the phenomenon is supposed to be negligible.

Geo-referenced catch and effort data

The reporting of geo-referenced catch and effort data for albacore has substantially improved since the mid-2000s and the reporting quality was estimated to be good for more than 90% of the nominal catch in 2020. The following uncertainties in catch and effort data for albacore should be noted:

- Very little information on catch and effort has been reported for the industrial longline fishery of Indonesia over the last decades. In 2015 an IOTC-OFCF mission was conducted to assist Indonesia with the reporting of catch and effort data, and some information has been received for the period 2018-2020 following the implementation of the One Data Initiative in 2017. The coverage remains however quite low with the geo-referenced catch representing about 17% of the nominal catch of albacore caught between 2018 and 2020 in the Indonesian longline fishery;

- Catch and effort data for the fresh-tuna longline fishery from Taiwan,China are only available since 2007, compared to nominal catches from 2001. Estimates of total catches, and time-area catches, prior to these periods therefore remain highly uncertain;

- Although some catch and effort data are available for the longline fisheries of India, Malaysia, Oman, and Philippines, they are usually incomplete and fall short of the IOTC data reporting standards of Resolution 15/02.

Geo-referenced size data

The following points of uncertainty in the size-frequency data of albacore should be noted:

- Although some size data are available for the large-mesh size driftnet fishery of Taiwan,China that operated over the period 1982–92, the sampling coverage was low and well below the sampling target of 1 fish per metric ton for all years of activity of the fishery;

- Size data for the fresh-tuna longline fishery of Indonesia have been reported for a limited number of years, during the mid-2000s. However samples, where available, cannot be fully disaggregated by month and fishing area (5x5 grid) and refer mostly to the component of the catch that was unloaded fresh. For this reason, the quality of the samples in the IOTC database is considered low;

- A large data set of size samples is available for the deep-freezing longline fishery of Taiwan,China since 1980. However, the length distributions of albacore available from 2003 have been found to be different when compared to earlier years (Geehan and Hoyle 2013). In addition, since 2003 higher average weights derived from length data have also been reported, compared to average weights from catch and effort (for the same time-periods and areas), which suggests changes in the sampling protocols of specimens measured for lengths – particularly the proportion of smaller sized fish (Hoyle et al. 2021). Size data collected by observers since 2002 are considered to be of better quality and have been given preference over the size data collected by the crews since the early 2000s;

- The number of size samples available for the Japanese deep-freezing longline fleet has shown large fluctuations over the years following a large decline in the late 1980s and was well below the sampling target between 1994 and 1996;

- No size data have been reported to the Secretariat for the longline fisheries of India (2004-2011), Oman (2014-2020), and Philippines (1998-2014) while Malaysia (2005-2020) only started reporting data in 2018.

References

Geehan, J. 2018. Revision to the IOTC scientific estimates of Indonesia's fresh longline catches. IOTC, Cape Town, South Africa, 04-08 September 2018. p. 13. https://iotc.org/documents/revision-iotc-scientific-estimates-indonesias-fresh-longline-catches-0

Herrera, M. 2002a. Catches of artisanal and industrial fleets in Indonesia: An update. IOTC, Shanghai, China, 03-11 June 2002. pp. 105–124. https://iotc.org/documents/catches-artisanal-and-induatrial-fleets-indonesia-update

Herrera, M. 2002b. Catches of industrial fleets operating under flags of non-reporting countries in the IOTC area of competence: an update. In IOTC Proceedings. IOTC, Shanghai, China, 03-11 June 2002. pp. 125–157. https://iotc.org/documents/catches-industrial-fleets-operating-under-flags-non-reporting-countries-iotc-area

IOTC. 2013. Report and documentation of the Indian Ocean tuna fisheries of Indonesia albacore catch. Estimation workshop: Review of issues and considerations. IOTC, Bogor-Jakarta. https://www.iotc.org/documents/report-and-documentation-indian-ocean-tuna-fisheries-indonesia-albacore-catch-estimation-0

Moreno, G., Herrera, M., and Pierre, L. 2012. Pilot project to improve data collection for tuna, sharks and billfish from artisanal fisheries in the Indian Ocean. Part II: Revision of catch statistics for India, Indonesia and Sri Lanka (1950-2011). Assignment of species and gears to the total catch and issues on data quality. IOTC, Victoria, Seychelles, 10-15 December 2012. p. 6. http://www.iotc.org/sites/default/files/documents/2019/02/IOTC-2012-SC15-38E_-_Revision_of_catch_stats_0.pdf

Proctor, C.H., Merta, I.G.S., Sondita, M.F.A., Wahju, R.I., Davis, T.L.O., Gunn, J.S., and Andamari, R. 2003. A review of Indonesia's Indian Ocean tuna fisheries. Australian Centre for International Agricultural Research, Canberra, Australia. https://aciar.gov.au/publication/books-and-manuals/review-indonesias-indian-ocean-tuna-fisheries

Yuniarta, S., van Zwieten, P.A.M., Groeneveld, R.A., Wisudo, S.H., and van Ierland, E.C. 2017. Uncertainty in catch and effort data of small- and medium-scale tuna fisheries in Indonesia: Sources, operational causes and magnitude. Fisheries Research 193: 173–183. doi:10.1016/j.fishres.2017.04.009

APPENDIX 6
CONSOLIDATED RECOMMENDATIONS OF THE 8TH SESSION OF THE WORKING PARTY ON TEMPERATE TUNAS (DATA PREPARATORY SESSION)

Other data or priorities relevant to the albacore stock assessment and preparation of the WPTmT08 stock assessment meeting

WPTmT08(DP).01 (para 99) The WPTmT **NOTED** that the fork length-round weight relationship for albacore was derived in the early 1990s in the Atlantic Ocean and much new data has been collected since then, e.g., those collected by the University of Mauritius, the French national Research Institute for Sustainable Development, and Ifremer across the western Indian Ocean from different fleets and fishing gears as well as data collected through the IOTC Regional Observer Scheme. The WPTmT **RECOMMENDED** that the IOTC Secretariat coordinate a small project in the coming few months (with a deadline of the end of May) utilising the open-source platform (e.g., GitHub, Markdown) to allow interested researchers to access the data and work collaboratively on the new datasets, including a thorough investigation of the spatial and temporal effects on the length-weight parameters, and differences between sexes. If successful, updated parameters could be used in the new assessment.

WPTmT08(DP).02 (para 106) The WPTmT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPTmT08(DP), provided at Appendix 6.