Report of the 4th IOTC Technical Committee on Management Procedures

Held by video-conference, 4–5 June 2021

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IOTC–TCMP04 2021. Report of the 4th IOTC Technical Committee on Management Procedures. Held Online 4–5 June 2021. *IOTC–2021–TCMP04–R[E]: 22 pp.*

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ACRONYMS

BET	Bigeye Tuna
BMSY	Biomass that achieves maximum sustainable yield
CMM	Conservation and Management Measure (of the IOTC; Resolutions and Recommendations)
CPCs	Contracting parties and cooperating non-contracting parties
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FAO	Food and Agriculture Organization of the United Nations
IOTC	Indian Ocean Tuna Commission
MP	Management Procedure
MPD	Management Procedures Dialogue
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
SC	Scientific Committee, of the IOTC
SSB	Spawning stock biomass
SPC	Secretariat of the Pacific Community
tRFMO	tuna Regional Fisheries Management Organization
TAC	Total Allowable Catch
TCMP	Technical Committee on Management Procedures
WP	Working Party of the IOTC
WPB	Working Party on Billfish of the IOTC
WPEB	Working Party on Ecosystems and Bycatch of the IOTC
WPM	Working Party on Methods of the IOTC
WPNT	Working Party on Neritic Tunas of the IOTC
WPDCS	Working Party on Data Collection and Statistics of the IOTC
WPTmT	Working Party on Temperate Tunas of the IOTC
WPTT	Working Party on Tropical Tunas of the IOTC
YFT	Yellowfin Tuna

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 Indian Ocean Tuna Commission has established a dedicated Technical Committee of Management Procedures (TCMP) as a formal communication channel between science and management to enhance decision-making response of the commission in relation to Management Procedures (MPs). The fourth Technical Committee on Management Procedures meeting was held on the 4–5 June 2021 and was held online. Dr. Toshihide Kitakado, the Chair of the Scientific Committee, opened the meeting and welcomed attendees. Dr. Kitakado emphasized the importance of a formal forum for engaging both scientists and decision makers in the process of developing Management Procedures for key IOTC species. The meeting was co-chaired by Ms Jung-re Riley Kim (Ad interim chair of the IOTC Commission). The Chairs welcomed 86 delegates from 20 Contracting Parties of the Commission and 12 Observers (including six invited experts) to the session. The list of participants is provided in Appendix1.

- (Para. 24) The TCMP **RECOMMENDED** that the WPM and Ad-hoc Reference Points Working Group continue to have discussions in order to provide advice on the most suitable and robust types of reference points to be used for stock status determination.
- (Para. 31) The TCMP **NOTED** that there are likely to be major revisions to the CPUE indices in the albacore tuna assessment in 2022 and discussed whether the OM needs to be reconditioned to the new assessment model by then. The TCMP **NOTED** that this is the third iteration of the OM development for albacore tuna and the OM is currently based on an assessment endorsed by the SC. However, the TCMP **AGREED** that although changes of past data and time series do not necessarily invalidate the OM, concrete guidelines and criteria need to be established to decide when reconditioning of the OM is required.
- (Para. 65) The TCMP **NOTED** the implementation of a lag inherent in the MSE processes. There is often a lag of two to three years between the latest data available and the year for which a TAC is being estimated. In addition, there is a lag between the time the scientific advice is formulated and a possible CMM is formulated and implemented. The TCMP **RECOMMENDED** that the Commission take note of this issue and provide feedback as to whether this is acceptable or to review different options to reduce this lag in data reporting for management advice.
- (Para. 85) The TCMP **NOTED** that there have been delays in the MSE development and that this will require a revision to the timetable for the development of management procedures. The TCMP **RECOMMENDED** that the Commission endorse a request that a revised timetable to be developed by CPCs with assistance from the SC and WPM chairs along with the Secretariat and this could be presented to the SC in 2021.
- (Para. 87) The TCMP **RECOMMENDED** that the Commission continue to support capacity building initiatives through the TCMP to improve understanding and participation in the MSE process.

1. OPENING OF THE SESSION AND ARRANGEMENTS

1. The fourth Technical Committee on Management Procedures meeting was held on the 4–5 June 2021 and was held online.

2. Dr. Toshihide Kitakado, the Chair of the Scientific Committee, opened the meeting and welcomed attendees. Dr. Kitakado emphasized the importance of a formal forum for engaging both scientists and decision makers in the process of developing Management Procedures for key IOTC species.

3. The meeting was co-chaired by Ms Jung-re Riley Kim (Ad interim chair of the IOTC Commission). The Chairs welcomed 86 delegates from 20 Contracting Parties of the Commission and 12 Observers (including six invited experts) to the session. The list of participants is provided in Appendix I.

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

4. The Scientific Committee Chair **NOTED** that the TCMP was established to enhance the effective communication and mutual understanding between science and management, and to facilitate decision-making response of the commission on matters related to management procedures. To this aim, scientists presented progress in developing and evaluating management procedures for the key tuna stocks in the Indian Ocean, in accordance with the decision framework as prescribed in Resolution 15/10 and associated workplan agreed by the Commission.

5. The adopted agenda for the meeting is presented in Appendix II. The documents presented to the TCMP are listed in Appendix III.

3. ADMISSION OF OBSERVERS

6. The TCMP **NOTED** that the applications by new Observers should continue to follow the procedure as outlined in Rule XIV of the IOTC Rules of Procedure (2014).

Non-governmental Organisations (NGO)

7. In accordance with Rule VI.1 and XIV.5 of the IOTC Rules of Procedure (2014), the TCMP **ADMITTED** the following Non-governmental organisations (NGO) as observers to the 4th Session of the TCMP.

- International Pole and Line Foundation (IPNLF)
- International Seafood Sustainability Foundation (ISSF)
- The Pew Charitable Trusts (PEW)
- Sustainable Fisheries Partnership (SFP)
- The Ocean Foundation (TOF)

Invited experts

8. In accordance with Rules VI.1 and XIV.9 of the IOTC Rules of Procedure (2014), the Commission may invite consultants or experts, in their individual capacity, to attend the meetings or participate in the work of the Commission as well as the Scientific Committee and the other subsidiary bodies of the Commission. The TCMP **ADMITTED** the following invited experts as observers to the 4th Session of the TCMP.

- Taiwan, Province of China

4. DECISIONS OF THE COMMISSION RELATED TO THE WORK OF THE TCMP

4.1 RESOLUTION 16/09 – TERMS OF REFERENCE

9. The TCMP **NOTED** paper IOTC–2021–TCMP04–06 which outlined the objectives, tasks and priorities of the Technical Committee on Management Procedures as established by the Commission through Resolution 16/09. This

Resolution calls for the TCMP to focus on the presentation of results and exchange of information, and to emphasize the aspects of the Management Strategy Evaluation process that require a decision by the Commission, when undertaking the evaluation and discussion of management procedures for the IOTC fisheries.

10. The TCMP **RECALLED** that the Resolution required that the *"(Para. 9) The need for a continuation of the Technical Committee on Management Procedures shall be reviewed no later than at the Annual Session of the Commission in 2019*" and that this had been done and approval for the continuation of the TCMP was given by the Commission at its 23rd session.

4.2 OUTCOMES OF THE 3RD SESSION OF TCMP

11. The TCMP **NOTED** paper IOTC–2021–TCMP04–03 which summarised the main outcomes of the 3rd Technical Committee on Management Procedures. The Report of the 3rd TCMP provided the recommendations as below:

- *The TCMP **NOTED** the Operating Models (OM) based on the 2016 WPTmT stock assessment, with data until 2014, and that there is a plan for a new stock assessment for albacore in 2019. The results of the new assessment in 2019 might require, if the results are outside the bounds of the current OM, to recondition the OM and to repeat the simulation of the Management Procedures based on the new OM. The TCMP **REQUESTED** WPM and Scientific Committee to review the results of the 2019 Albacore assessment and discuss on the need, or not, of reconditioning the OM and repeat the simulations of the Management Procedures based on the new OM, depending on the stock assessment results.*
- *The TCMP **NOTED** that the desired Management Procedure (MP) would be one that recovers the stock and keeps it around the target. Most of the MPs tested to date tend to overshoot the target. This may be because the MPs are too simple or the data not sufficiently informative. Additional complexity could be added to the MP design but it is difficult to design a single MP that will achieve the desired MP behaviour with certainty. Another option would be to develop one MP for rebuilding and another one for the time that stock is recovered. The TCMP **AGREED** to develop an MP for the rebuilding period, which will be updated once recovery is achieved, but the TCMP also **REQUESTED** that performance statistics are shown for the two periods: tuning objective recovery period, and the 20 years projected period when tuning to the recovery target.*
- *The TCMP **REQUESTED** that the first rebuilding time period (5 years) is not used as a tuning objective and instead, 10 and 15 year recovery objectives are used for tuning (Y2 and Y3).*
- *The TCMP also **REQUESTED** results that demonstrate how long rebuilding will take if TAC change constraints are limited to 15% (and alternative options of TAC change constraints such as 10% and 20% with some flexibility on the values for the technical developing team).*
- *The TCMP **REQUESTED** the Scientific Committee to develop a revised workplan for Management Procedure development as the current plan is due to expire in 2020.*
- *The TCMP **RECOMMENDED** that the TCMP should continue to function in order to progress on MSE matters and advise on these issues to the Commission.*
- *The TCMP **REQUESTED** that Intersessional capacity building on MSE be conducted. Additionally attendance at the IOTC Working Party on Methods by national scientists will facilitate the increased understanding of the MSE processes by all CPCs.*
- *The TCMP **ENCOURAGED** that the deadline for the submission of documents for the TCMP be extended to one month to allow participants to fully consider the information prior to the onset of the meeting. The TCMP also **REQUESTED** that the questions that require decisions for the progress of the MPs for each species, be distributed prior to the meeting.*
- *The TCMP **REQUESTED** that a "shiny app" such as that demonstrated during the meeting be developed specifically for the IOTC.*

12. The TCMP **NOTED** that the format for the Executive Summary in the last TCMP report differed from that utilised in other Technical Committees and that the lack of paragraph numbering made the text ambiguous and difficult to follow. The Secretariat **CONFIRMED** that this will be rectified in subsequent TCMP meeting reports.

4.3 OUTCOMES OF THE 24TH SESSION OF THE COMMISSION AND THE 4TH SPECIAL SESSION OF THE COMMISSION

13. The TCMP **NOTED** paper IOTC–2021–TCMP04–04 which outlined the main outcomes of previous sessions of the Commission as well as the Special Session of the Commission (held in 2021), specifically related to the work of the TCMP and **AGREED** to consider, throughout the course of the current meeting, how best to provide the Scientific Committee with the information it needs in order to satisfy the Commission's requests.

4.4 OUTCOMES OF THE 23RD SESSION OF THE SCIENTIFIC COMMITTEE

14. The TCMP **NOTED** paper IOTC–2021–TCMP04–05 which outlined the main outcomes of 23rd Session of the Scientific Committee that specifically related to the work of the TCMP.

5. INTRODUCTION TO MSE

5.1 MANAGEMENT PROCEDURES AND MSE:

5.1.1 Basic principles, Roles and responsibilities, dialogue tools and feedback mechanism

15. The TCMP **NOTED** a presentation by the SC Chair which provided an introduction to the basic principles of the MSE process and the history of MSE activities in the IOTC. The presentation also highlighted several important aspects of the MSE processes, such as 1) the difference between "projections based on stock assessments" and "projections in an MSE process"; 2) the difference between "management procedure (MP)" and "harvest control rule (HCR)" as this is particularly relevant for the ongoing Skipjack tuna MSE work; and 3) the difference between an "operating model (OM)" and an "assessment model". The TCMP **THANKED** the SC chair for his clear and informative presentation that was useful for the subsequent discussions held during the TCMP04.

16. The TCMP **NOTED** a suggestion to streamline the technical terms used in the IOTC MSE process into one glossary to avoid confusion between the different definitions used across the RFMOs and other fora. The TCMP further **NOTED** that since 2019, the MSE task force have been making minor modifications to the glossary provided by the joint RFMO working group in order to make it relevant to the IOTC, however this has not been officially adopted and should therefore be reviewed by the Scientific Committee for approval by the Commission.

17. The TCMP **NOTED** that standardised CPUE series are the best indicators for us in an OM when available but in some cases, such as when only poorly standardised CPUE series are available, a nominal CPUE may need to be used instead.

18. The TCMP **CLARIFIED** that data used in MSE are the same as those used in stock assessments, but for projections, the MSE will generate the future data based on the MP being applied. The TCMP further **CLARIFIED** that the source of input data and CPUE series for the MSE will depend on the species being assessed and the availability of data from all the fisheries catching that species.

19. The TCMP **NOTED** that it may be possible to include a grid with several CPUE series giving each different weighting in the model, it is not necessary to use just one CPUE series.

5.2 SC PROPOSAL FOR THE STANDARD PRESENTATION OF MSE RESULTS

20. The TCMP **NOTED** paper IOTC–2021– TCMP04–12 which defined stock status against conservation and management reference points: a global review for informing the process of status determination for key IOTC stocks, including the following abstract provided by the authors:

> "*The Kobe Plot has been widely used as a practical, user-friendly method for presenting stock status information and to characterize the status of stocks as "overfished" (B < BMSY) and "subject to overfishing" (F > FMSY). When providing advice on stock status relative to MSY-based reference points, IOTC stocks are currently considered to be overfished and subject to overfishing when the target MSY-based reference points are breached (i.e., SSB < SSBMSY and F > FMSY). However, there is no further change to stock status when the limit reference points are breached; which may not consistent with the*

intended application of target and limit reference points. For example, when managing stocks to MSY-based target reference points (the agreed/desired state of the stock) it is expected that the stock will fluctuate around that target, sometimes above and sometimes below, due to natural fluctuation in recruitment, stock abundance or other sources of variability." – see paper for full abstract.

21. One CPC **EXPRESSED** the need to take into account both management (i.e. target) and conservation-based (i.e. limit) reference points and to make a distinction between them for the interpretation/determination of the stock status. The reference points should be both Depletion and MSY based.

22. The TCMP **NOTED** the importance of including a sufficient buffer in the definition/interpretation the target and limit reference points to mitigate situations which may put the stock at risk of breaching the target reference points simply due to natural fluctuation of the stock.

23. The TCMP **NOTED** that while the concept of MSY is clearly defined by science, there are still a range of ways to define reference points as well as the definitions of 'overfished' and 'overfishing'.

24. The TCMP **RECOMMENDED** that the WPM and Ad-hoc Reference Point Working Group continue to have discussions in order to propose the most suitable and robust types of reference points to be used for stock status determination.

25. The TCMP **NOTED** that there are also multiple options for presenting information relating to the reference points including Kobe and Majuro plots and **NOTED** that it could be helpful to produce both of these plots or alternatively merge information from the two plots into one single plot.

26. The TCMP **NOTED** that the timeframe for recovery of a stock is an important factor in setting management objectives and **SUGGESTED** that the TCMP could provide guidance in the form of scientific information such as the lifespan of a stock and average generation time to inform managers when developing these management objectives.

27. The TCMP **NOTED** that the coefficients defining reference points should be defined based on scientific evidence and the precautionary approach, and as such should ensure that a level below which recruitment success is impaired is avoided

6. STATUS OF THE MANAGEMENT PROCEDURE EVALUATION/OPERATING MODELS

6.1 ALBACORE TUNA.

28. The TCMP **NOTED** paper IOTC–2021–TCMP04–11 which provided an Indian Ocean Albacore Tuna Management Procedures Evaluation Status Report.

29. The TCMP **NOTED** the Operating Models (OM) were reconditioned on the 2019 albacore stock assessment, with data until 2017. The TCMP further **NOTED** that the OM implemented a partial factorial grid (i.e. the model grid does not include all interactions between all possible combinations of model parameters) with weighting of the individual models in the grid based on the estimated predictive capability of the models.

30. The TCMP **NOTED** the MP tuning objectives Pr(Kobe = green) = 50%, 60%, or 70%, computed over the 2030-2034 period, with implementation constraints including 3-year TAC setting, 15% maximum TAC change, and two-year data lags. The tuning objectives and implementation constraints were recommended by the previous TCMP meeting.

31. The TCMP **NOTED** that there are likely to be major revisions to the CPUE indices in the albacore tuna assessment in 2022 and discussed whether the OM needs to be reconditioned to the new assessment model by then. The TCMP **NOTED** that this is the third iteration of the OM development for albacore tuna and the OM is currently based on an assessment endorsed by the SC. However, the TCMP **AGREED** that although changes of past data and time series

do not necessarily invalidate the OM, concrete guidelines and criteria need to be established to decide when reconditioning of the OM is required.

32. The TCMP **NOTED** that the current data lag assumed for CPUE is two years and queried the potential impact of alternative data lags (e.g., one year). It was **NOTED** that the data lag has more to do with MP evaluation than the OM itself. Furthermore, the influence of the data lag may not be as important to a relatively long-lived tuna species such as albacore, compared to some other short-lived pelagic species. However, the TCMP **AGREED** that the specific impact of data lags on MP performance can be addressed through simulations.

33. The TCMP **QUERIED** if there is any convergence issues on the model-based MP for albacore tuna. It was suggested that a model-based MP based on a surplus production function may encounter estimation problems in the cases where there is an increasing F corresponding with a decreasing biomass (a "one-way trip") as estimations are more precise when the model is informed by this one way trip as well as a subsequent stock recovery situation (where F decreases and biomass increases). However, the TCMP **NOTED** that this has not been an issue for the albacore tuna MSE. The TCMP further **NOTED** the random-effects Pella-Tomson model developed for the bigeye/yellowfin tuna MSE which appeared to have better estimation performance.

34. The TCMP **NOTED** the final OM and simulation is expected to be reviewed for adoption at the WPM and SC meeting in 2021. The funding for the current albacore tuna MSE is until December 2021.

6.2 BIGEYE TUNA

35. The TCMP **NOTED** paper IOTC–2021–TCMP04–08 which provided an IOTC Bigeye Tuna Management Procedure Evaluation Update.

36. The TCMP **NOTED** that there have been no major revisions to the bigeye MSE by the WPTT and WPM since 2019 and the MSE is set to be presented to the SC in 2021 for endorsement.

37. The TCMP **NOTED** that MP tuning objectives for bigeye MPs are Pr(Kobe green zone 2030:2034) = 0.6 or 0.7, and implementation constraints include frequency of TAC setting (every 3 years), Maximum 15% TAC change, and 2 year data lag, as agreed during the previous TCMP.

38. The TCMP **NOTED** that the constraint on the maximum TAC change does not need to be symmetric (for example, the constraint can be 15% on the increase and 10% on the decrease). The TCMP **REQUESTED** the issue be discussed in more detail at the WPM prior to the SC.

39. The TCMP **NOTED** that CPUE-based MPs tend to have unstable biomass trends and larger catch variability in the long term than model-based MPs. This may be due to the fact that Model-based MP estimates stock productivity and reference points based on abundance indices, thus allowing more flexibility and feedback in the MP loop. However, this doesn't mean the CPUE based MP should yet be excluded as the control parameters for CPUE-based MPs may not have been fully explored to improve their performance.

40. The TCMP **NOTED** that the newly developed MP that is based on K2SM metrics generated from constant catch projections has the lowest catch variability compared to other MPs. It was clarified that the internal projection-based MP does not imply constant catch for the whole evaluation period, and was applied every three years (same as other MPs).

41. The TCMP **NOTED** that all tested MPs for this stock tend to have a low risk of the stock falling below the reference points and are likely to recommend average catches that are higher than recent levels over the medium term. The TCMP **DISCUSSED** whether this is because the tuning objectives are "forcing" the declines of the biomass to achieve the target of 60% (or 70%) in the Kobe green zone, and queried whether it wouldn't be better to set the tuning objectives to be above 60% (or 70%) instead. It was suggested that the tuning objectives needs to be precise in order to allow comparisons of different MPs on other management objectives.

42. The TCMP **NOTED** that the overall performance of the MPs tends to decline in the final years, and this is related to

the issue of the catch having to be increased, in order to reduce the stock biomass to target biomass given the fact that the stock is currently above the target biomass. This could be addressed if the MP can be revised to be more responsive to changes in the stock status.

43. The TCMP **NOTED** that the current bigeye tuna MSE project (phase 3) ends in June 2021 and Australia has pledged to fund the next phase of the project to June 2023.

44. The TCMP **NOTED** a general comment that MSE work in other t-RFMOs has been focusing on rebuilding stocks/species, and discussed whether priority should be given to stocks that are more depleted for the MSE in IOTC. The TCMP **ACKNOWLEDGED** that the MSE for bigeye tuna is at an advanced stage and the MP evaluation is close to completion, and it would require fewer resources to apply and monitor the MP once adopted.

6.3 YELLOWFIN TUNA

45. The TCMP **NOTED** paper IOTC–2021– TCMP04–09 which provided an IOTC Yellowfin Tuna Management Procedure Evaluation Update.

46. The TCMP **NOTED** that the current MSE project for yellowfin (phase 3) ends in June 2021 and Australia has pledged to fund the next phase of the yellowfin MSE to June 2023.

47. The TCMP **NOTED** that there are critical issues in the current OM which are closely associated with the problems encountered in the yellowfin stock assessment model. Specifically, most models in the OM cannot account for the actual observed yellowfin catches from 2018-2020 and are overly pessimistic with respect to the productivity estimates.

48. The TCMP discussed how this issue may impact or delay the yellowfin MSE. The TCMP **NOTED** that although the yellowfin modelling team is working on improving this assessment model, the problem is difficult to resolve as it may be related to potential inconsistencies between the input data series (e.g., catches vs. CPUE). Looking further into the future, there may be other approaches, such as the innovative close-kin mark recapture methods, that could also potentially provide more robust estimates of stock abundance for yellowfin tuna and potentially be incorporated to a Management Procedure.

6.4 SKIPJACK TUNA

49. The TCMP **NOTED** paper IOTC–2021– TCMP04–07 which provided the initial developments of an empirical MP for Indian Ocean skipjack tuna.

50. The TCMP **RECALLED** that Resolution 16/02 requires the review of the skipjack HCR through further Management Strategy Evaluation (MSE) by 2021. The TCMP **NOTED** a consultancy was initiated in 2020 with an MSE expert to start the skipjack tuna MSE workstream, with the aim to expand the current skipjack Harvest Control Rule to a full Management Procedure.

51. The TCMP **NOTED** the good progress made so far for the skipjack MSE which included the development of an OM based on existing Stock Synthesis models, the development of a biomass dynamic model that can be fitted to simulated data, and simulation testing of both model-based and empirical MPs based on indicators estimated from the Maldivian Pole and Line (PL) and European Purse Seine Log-School (PSLS) fisheries.

52. The TCMP **NOTED** the MSE has assumed a positive bias in catch implementation errors and consequently realised catches in the projection exceeded the TAC. It was suggested the positive bias in implementation errors help identify MPs which are more robust to the model assumptions. The TCMP **SUGGESTED** that symmetric implementation errors should be considered that allow both over- and under-catch of TAC to also be considered.

53. The TCMP **NOTED** that for a few instances of the simulations there are drastic reductions in catches in the long term even when the biomass remains high. It was clarified that the observation error of the indices could potentially result in the HCR requiring a closure of the fisheries by chance.

54. One CPC queried whether MSY-based reference points could be used instead of depletion-based Reference Points

in the MP. The TCMP **NOTED** that the BMSY is a fixed proportion (eg. 50% for a Schaefer model) of B0 for MPs that are based on the surplus production model, thus the depletion-based and MSY-based MP would be equivalent and both could be presented if necessary.

55. The TCMP **NOTED** that both Purse seine and Pole and Line CPUE indices were included in the OM and they are consistent with each other. The TCMP **SUGGESTED** the CPUE could be weighted according to the contribution of catch or effort of the respective fishery.

6.5 SWORDFISH

56. The TCMP **NOTED** paper IOTC–2021– TCMP04–10 which provided information on an Indian Ocean Swordfish Management Procedure.

57. The TCMP **NOTED** the MP evaluations used the tuning objectives P(Kobe = green) = 50%, 60%, or 70%, computed over the 2030-2034 period, with constraints including 3-year TAC setting, 15% maximum TAC change, and three-year data lags, as recommended from the previous TCMP meeting.

58. The TCMP **SUGGESTED** the upcoming WPB meeting should include an agenda item to discuss the swordfish OM configurations.

7. DISCUSSION ON THE ACTIONS NEEDED FOR THE ADOPTION OF MANAGEMENT PROCEDURES, INCLUDING BUDGET

59. The TCMP **THANKED** the chair for an ad-hoc presentation providing a comprehensive overview of the common and species-specific issues raised by the WPM and for which feedback is needed by the developers to move forward with the Management Procedures (MPs) development.

60. The TCMP **NOTED** the issues that are common to the five species of interest, i.e. accounting for uncertainty in historical catch data in the conditioning of the operating model (OM), consideration of multi-species OMs for tropical tunas, definition of objective criteria to trigger model reconditioning, update of OMs when catch data are updated, definition of exceptional circumstances when the procedure should not be applied, development of internal and external review process, and definition of tuning objectives which may vary with species.

61. The TCMP **NOTED** that some of the issues raised by the WPM cannot be fully addressed during the TCMP due to their complexity and the shortness of the meeting, and **AGREED** to focus on some of the key aspects of the MPs for each species, i.e. tuning objectives and level of TAC change constraint.

62. The TCMP **NOTED** that the values considered for the tuning objectives (50%, 60% and 70% with the percentages corresponding to the percentage of time the stock status is in the Kobe green quadrant over the reference years (i.e. 2030-2034 or 11 – 15 years from model terminal year)) and TAC change constraint (15%) were empirically determined from previous discussions held at the TCMP with the different stakeholders and considered to be a good trade-off between the diverging requirements and objectives.

63. The TCMP **RECALLED** that the TAC change constraint aims at maintaining some stability in the catches for the industry and **NOTED** that the value of 15% has been used by other regional bodies such as the International Council for the Exploration of the Sea (ICES) for the Management Strategy Evaluation of some North Atlantic stocks, **NOTING** that other values for a TAC change constraint could be explored within the MSE if this was of interest.

64. The TCMP **NOTED** that across all species, a TAC change constraint of 15% is implemented. The TCMP **REQUESTED** that the developers investigate the possibility of including variable constraints based on current stock status **ACKNOWLEDGING** that current stock status in the MP process is not the same as the status estimated from traditional stock assessment models. An additional constraint option of 20% could be investigated for stocks above MSY. The TCMP **NOTED** that this would need to be implemented differently for model-based MPs as opposed to empirical MPs.

65. The TCMP **NOTED** the implementation lag inherent in the MSE processes. There is often a lag of two to three years

between the latest data available and the year for which a TAC is being estimated. In addition, there is a lag between the time the scientific advice is formulated and a possible CMM is formulated and implemented. The TCMP **RECOMMENDED** that the Commission take note of this issue and provide feedback as to whether this is acceptable or to review different options to reduce this lag in data reporting for management advice.

66. The TCMP **NOTED** that delays in the MSE developments have resulted in projection time windows being too close to the current terminal year of the MP. The TCMP **REQUESTED** that the developers remove the reference years of 2030-2034 and replace them with relative placeholders (such as 11-15 years from model terminal year).

67. The TCMP **NOTED** the high level of uncertainty in the catches used to condition the operating models. The TCMP further **NOTED** that this uncertainty is not consistent over time. The TCMP therefore **REQUESTED** that the WPM review this problem and potential solutions to reduce this problem in the OM conditioning.

68. The TCMP **AGREED** to leave several of the technical options, such as the tuning criteria as well as the frequency of quota setting as they currently are applied by the developers. Additional revisions to these options will be deferred to the WPM and SC, **NOTING** that these will again be reviewed by the TCMP in 2022.

7.1 ALBACORE TUNA

69. The TCMP **NOTED** that the current terminal year considered for the albacore operating model is 2017 and that CPUE and size frequency data were not available for 2018 and 2019, preventing the application of the Management Procedure to these years.

70. The TCMP **NOTED** that uncertainty in the historical catches is currently only included in the first year of the model projection, propagating from there to subsequent years.

71. The TCMP **NOTED** that a reconditioning of the albacore operating model was made following the 2019 stock assessment that showed SSB trajectories outside the uncertainty envelope considered with the Operating Model developed from the 2016 assessment.

72. The TCMP **NOTED** that model reconditioning may require a lot of work and time and **AGREED** that clear criteria should be developed inter-sessionally to define under which circumstances reconditioning would take place.

73. The TCMP **ENDORSED** the values of 50%, 60%, and 70% for the tuning objectives of the albacore Management Procedure with the percentages corresponding to the percentage of time the stock status is in the Kobe green quadrant over the reference years (i.e. 2030-2034 or 11 – 15 years from model terminal year).

74. The TCMP **REQUESTED** the albacore OM developer to explore the effects of having values different than 15% in TAC change constraint, including some values varying with stock status, and report to the WPM and SC.

7.2 YELLOWFIN TUNA

75. The TCMP **AGREED** to defer discussions on the YFT management procedure due to the pending updated assessment due in 2021 which will provide the basis for the updated OMs for the species.

7.3 SKIPJACK TUNA

76. The TCMP **NOTED** that while some technical problems have been encountered with the estimation of the fishing mortality at MSY for skipjack tuna within the stock assessment model, and that reliably estimating MSY is in general very difficult, generating an estimate of catch and biomass at MSY for Skipjack is now technically possible.

77. The TCMP **REQUESTED** that the developer consider the same tuning criteria as proposed for other stocks (50%, 60% and 70% with the percentages corresponding to the percentage of time the stock status is in the Kobe green quadrant over the reference years (i.e. 2030-2034 or 11 – 15 years from model terminal year) for consistency. One CPC suggested that the initial tuning criteria should be depletion based, but additional tuning criteria, including MSY based criteria, should also be investigated, and discussed by the WPM and SC and presented to the TCMP in 2022.

78. The TCMP **AGREED** that the current methodology to generate the CPUE for the MP should be maintained with more

comprehensive discussions on this process to occur at the WPM and SC.

79. The TCMP **PROPOSED** that the new HCR should be based on the exploitable biomass instead of only the spawning stock biomass as is currently implemented

7.4 BIGEYE TUNA

80. The TCMP **ENDORSED** the values of 60% and 70% for the tuning objectives (probability of being in the Kobe green zone 11-15 years from model terminal year) for the bigeye tuna Management Procedure, **RECALLING** that the value of 50% is not considered for bigeye tuna following discussions held at previous sessions of the TCMP.

81. The TCMP **ENDORSED** the value of 15% of TAC change constraint for the bigeye tuna Operating Model but **REQUESTED** the modeler to explore the impact of alternative values on the results as this value is often hit in the simulations and this could have an important effect on the Management Procedure assessment.

82. The TCMP **ENDORSED** the implementation lag of two years for the Management Procedure, e.g. the CPUE data available for 2021 are used for setting the Total Allowable Catch in 2023.

7.5 SWORDFISH

83. The TCMP **NOTED** the continued application of the current values for the tuning objectives (50%, 60%, 70%) and constraints on the Management Procedure for swordfish (i.e. TAC set every 3 years, maximum of 15% TAC change constraint, and 3-year lag between data and TAC implementation), **NOTING** that these will be reviewed by the TCMP in 2022.

8. FUTURE DIRECTION OF THE TECHNICAL COMMITTEE ON MANAGEMENT PROCEDURES

8.1 WORKPLAN

84. The TCMP **ACKNOWLEDGED** the importance extra-budgetary contributions from the European Union and Australia in accelerating the MSE work since 2016.

85. The TCMP **NOTED** that there have been delays in the MSE development and that this will require a revision to the timetable for the development of Management Procedures. The TCMP **RECOMMENDED** that the Commission endorse a request that a revised timetable to be developed by CPCs with assistance from the SC and WPM chairs along with the Secretariat and this could be presented to the SC in 2021.

8.2 PRIORITIES

86. The TCMP **NOTED** that simultaneous work is being conducted on several species and that prioritising one species over another is difficult. The TCMP **ACKNOWLEGED** that an MP for BET is close to completion and consideration by the SC, TCMP and Commission, but that there is a great deal if interest in the completion of the YFT and SKJ MSE as well. The TCMP **NOTED** that further work is required to advance ALB and SWO MSE and that resources should also be dedicated to these species.

8.3 PROCESS AND FUTURE MEETINGS OF TCMP

87. The TCMP **RECOMMENDED** that the Commission continue to support capacity building initiatives through the TCMP to improve understanding and participation in the MSE process.

88. The TCMP **NOTED** that several delegations expressed their concern that the presentations at the TCMP were highly technical and not easily digestible for managers. The TCMP further **NOTED** the request from these delegations that presentations be kept clear and simple in the future.

89. The Meeting was closed by the chair who informed the participants that the report would be adopted by correspondence.

APPENDIX I
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APPENDIX II
AGENDA FOR 4TH IOTC TECHNICAL COMMITTEE ON MANAGEMENT PROCEDURE

Date: 4-5 June 2021
Location: Virtual
Co-Chairs: Ms. Riley Kim Jung-re (Commission Vice-Chair) and Dr. Toshihide Kitakado (SC Chair)

1. OPENING OF THE SESSION AND ARRANGEMENTS (Co-Chairs)

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION (Co-Chairs)

3. ADMISSION OF OBSERVERS (Co-Chairs)

4. DECISIONS OF THE COMMISSION RELATED TO THE WORK OF THE TECHNICAL COMMITTEE ON MANAGEMENT PROCEDURES (IOTC Secretariat)

- 4.1 Resolution 16/09 – Terms of Reference
- 4.2 Outcomes of the 3rd Session of TCMP
- 4.3 Outcomes of the 23rd and 24th Sessions of the Commission meeting
- 4.4 Outcomes of the 22nd and 23rd Sessions of the Scientific Committee

5. INTRODUCTION TO MSE (SC Chairperson)

- 5.1 Management Procedures and MSE:
  - 5.1.1 Basic principles
  - 5.1.2 Roles and responsibilities, dialogue tools and feedback mechanism
- 5.2 SC proposal for the standard presentation of MSE results

6 STATUS OF THE MANAGEMENT PROCEDURE EVALUATION/OPERATING MODELS (Developers)

- 6.1 Albacore tuna (Iago Mosqueira)
- 6.2 Bigeye tuna (Dale Kolody)
- 6.3 Yellowfin tunas (Dale Kolody)
- 6.4 Skipjack tuna (Charlie Edwards)
- 6.5 Swordfish (Daniela Rosa)

7 DISCUSSION ON THE ACTIONS NEEDED FOR THE ADOPTION OF MANAGEMENT PROCEDURES, INCLUDING BUDGET (Co-Chairs and Secretariat)

- 7.1 Albacore tuna
- 7.2 Yellowfin tuna
- 7.3 Skipjack tuna
- 7.4 Bigeye tuna
- 7.5 Swordfish

8 FUTURE DIRECTION OF THE TECHNICAL COMMITTEE ON MANAGEMENT PROCEDURES (Co-Chairs)

- 8.1 Workplan (Including new timelines/budget and resources needed)
- 8.2 Priorities
- 8.3 Process and future meetings of TCMP

9 ADOPTION OF REPORT (CO-CHAIRS)

APPENDIX III
LIST OF DOCUMENTS

Document	Title
IOTC–2021– TCMP04–01a	Draft: Agenda of the 4th Technical Committee on Management Procedure Meeting
IOTC–2021– TCMP04–01b	Draft: Annotated agenda of the 4th Technical Committee on Management Procedure Meeting
IOTC–2021– TCMP04–02	Draft: List of documents of the 4th Technical Committee on Management Procedure (TCMP04)
IOTC–2021– TCMP04–03	Outcomes of the 3rd Technical Committee On Management Procedure
IOTC–2021– TCMP04–04	Outcomes of the 24th Session of the Commission and the 4th Special Session of the Commission
IOTC–2021– TCMP04–05	Outcomes of the 23rd Session of the Scientific Committee
IOTC–2021– TCMP04–06	Resolution 16/09 ON ESTABLISHING A TECHNICAL COMMITTEE ON MANAGEMENT PROCEDURES
IOTC–2021– TCMP04–07	Initial developments of an empirical MP for Indian Ocean skipjack tuna
IOTC–2021– TCMP04–08	IOTC Bigeye Tuna Management Procedure Evaluation Update June 2021
IOTC–2021– TCMP04–09	IOTC Bigeye Tuna Management Procedure Evaluation Update June 2021
IOTC–2021– TCMP04–10	Indian Ocean Swordfish Management Procedure - Status Report
IOTC–2021– TCMP04–11	Indian Ocean Albacore Tuna Management Procedures Evaluation: Status Report
IOTC–2021– TCMP04–12	Defining stock status against conservation and management reference points: a global review for informing the process of status determination for key IOTC stocks