Report of the 16th Session of the IOTC Working Party on Methods (Management Strategy Evaluation Task Force)

Online, 24 February 2025

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ACRONYMS

ABNJ	Areas Beyond National Jurisdiction
ALB	Albacore
B	Biomass (total)
B_0	Unfished biomass
BET	Bigeye tuna
B_{MSY}	Biomass which produces MSY
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.
F	Fishing mortality
FAD	Fish aggregating device
F_{MSY}	Fishing mortality at MSY
IOTC	Indian Ocean Tuna Commission
MP	Management Procedure
MPD	Management Procedures Dialogue
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
OM	Operating Model
P	Probability
SC	Scientific Committee, of the IOTC
SB	Spawning biomass (sometimes expressed as SSB)
SB_{MSY}	Spawning stock biomass which produces MSY (sometimes expressed as SSB_{MSY})
TCMP	Technical Committee on Management Procedures
WPM	Working Party on Methods
WPNT	Working Party on Neritic Tunas
WPTT	Working Party on Tropical Tunas of the IOTC
YFT	Yellowfin tuna

GLOSSARY OF TERMS

The WPM decided to utilise the MSE Glossary developed by the Joint Tuna RFMO MSE Working Group in 2018**.**

Average Annual Variation - (in catch/TAC) The absolute value of the proportional TAC change each year, averaged over the projection period.

Biomass - Stock biomass, which may refer to various components of the stock. Often spawning stock biomass (SSB) of females is used, as the greatest conservation concern is to maintain the reproductive component of the resource.

Candidate Management Procedure - An MP (defined below) that has been proposed, but not yet adopted.

Conditioning - The process of fitting an Operating Model (OM) of the resource dynamics to the available data on the basis of some statistical criterion, such as a Maximum Likelihood. The aim of conditioning is to select those OMs consistent with the data and reject OMs that do not fit these data satisfactorily and, as such, are considered implausible.

Error - Differences, primarily reflecting uncertainties in the relationship between the actual dynamics of the resource (described by the OMs) and observations. Four types of error may be distinguished, and simulation trials may take account of one or more of these:

- Estimation error: differences between the actual values of the parameters of the OM and those provided by the estimator when fitting a model to the available data;
- Implementation error: differences between intended management actions (as output by an MP) and those actually achieved (e.g. reflecting over-catch);
- Observation error (or measurement error): differences between the measured value of some resource index and the corresponding value calculated by the OM;
- Process error: natural variations in resource dynamics (e.g., fluctuations about a stock-recruitment curve or variation in fishery or survey selectivity /catchability).

Estimator - The statistical estimation process within a population model (assessment or OM); in a Management Strategy Evaluation (MSE) context, the component that provides information on resource status and

productivity from past and generated future resource-monitoring data for input to the Harvest Control Rule (HCR) component of an MP in projections.

Exceptional circumstances - Specifications of circumstances (primarily related to future monitoring data falling outside the range covered by simulation testing) where overriding of the output from a Management Procedure should be considered, together with broad principles to govern the action to take in such an event.

Feedback Control - Rules or algorithms based, directly or indirectly, on trends in observations of resource indices, which adjust the management actions (such as a TAC change) in directions that will change resource abundance towards a level consistent with decision makers' objectives.

Harvest Control Rule - (also Decision Rule) A pre-agreed and well-defined rule or action(s) that describes how management should adjust management measures in response to the state of specified indicator(s) of stock status. This is described by a mathematical formula.

Harvest Strategy - Some combination of monitoring, assessment, harvest control rule and management action designed to meet the stated objectives of a fishery. Sometimes referred to as a Management Strategy (see below). A fully specified harvest strategy that has been simulation tested for performance and adequate robustness to uncertainties is often referred to as a Management Procedure.

Implementation - The practical application of a Harvest Strategy to provide a resource management recommendation.

Kobe Plot - A plot that shows the current stock status, or a trajectory over time for a fished population, with abundance on the horizontal axis and fishing mortality on the vertical axis. These are often shown relative to BMSY and to FMSY, respectively. A Kobe plot is often divided into four quadrants by a vertical line at B=BMSY and a horizontal line at F=FMSY.

Limit Reference Point - A level of biomass below, or fishing mortality above, which an actual value would be considered undesirable, and which management action should seek to avoid.

Management Objectives - The social, economic, biological, ecosystem, and political (or other) goals for a given management unit (i.e. stock). These typically conflict, and include concepts such as maximising catches over time, minimising the chance of unintended stock depletion, and enhancing industry stability through low inter-annual variability in catches. For the purposes of Management Strategy Evaluation (MSE) these objective need to be quantified in the form of Performance statistics (see below).

Management Plan - In a broad fisheries governance context, a Management Plan is the combination of policies, regulations and management approaches adopted by the management authority to reach established societal objectives. The management plan generally includes the combination of policy principles and forms of management measures, monitoring and compliance that will be used to regulate the fishery, such as the nature of access rights, allocation of resources to stakeholders, controls on inputs (e.g. fishing capacity, gear regulations), outputs (e.g. quotas, minimum size at landing), and fishing operations restrictions (e.g. closed areas and seasons). Ideally, the Management Plan will also include the Harvest Strategy for the fishery or a set of principles and guidelines for the specification, implementation and review of a formal Management Procedure for target and non-target species.

Management Procedure - A management procedure has the same components as a harvest strategy. The distinction is that each component of a Management Procedure is formally specified, and the combination of monitoring data, analysis method, harvest control rule and management measure has been simulation tested to demonstrate adequately robust performance in the face of plausible uncertainties about stock and fishery dynamics.

Management Strategy - Synonymous with harvest strategy. (But note that this is also used with a broader meaning in a range of other contexts.)

Management Strategy Evaluation - A process whereby the performances of alternative harvest strategies are tested and compared using stochastic simulations of stock and fishery dynamics against a set of performance statistics developed to quantify the attainment of management objectives.

Maximum Economic Yield - The (typically annual) yield that can be taken continuously from a stock sustainably (i.e. without reducing its size) that maximizes the economic yield of a fishery in equilibrium. This yield occurs at the effort level that creates the largest positive difference between total revenues and total costs of fishing (including the cost of labor, capital, management and research etc.), thus maximizing profits.

Maximum Sustainable Yield - The largest (typically annual) yield that can be taken continuously from a stock sustainably (i.e. without reducing its size). In real, and consequently stochastic situations, this is usually estimated as the largest average long-term yield that can be obtained by applying a constant fishing mortality F, where that F is denoted as FMSY.

Observation Model - The component of the OM that generates fishery-dependent and/or fishery-independent resource monitoring data from the underling true status of the resource provided by the OM, for input to an MP.

Operating Model(s) - A mathematical–statistical model (usually models) used to describe the fishery dynamics in simulation trials, including the specifications for generating simulated resource monitoring data when projecting forward in time. Multiple models will usually be considered to reflect the uncertainties about the dynamics of the resource and fishery.

Performance statistics/measures - A set of statistics used to evaluate the performance of Candidate MPs (CMPs) against specified management objectives, and the robustness of these MPs to important uncertainties in resource and fishery dynamics.

Plausibility (weights) - The likelihood of a scenario considered in simulation trials representing reality, relative to other scenarios also under consideration. Plausibility may be estimated formally based on some statistical approach, or specified based on expert judgement, and can be used to weight performance statistics when integrating over results for different scenarios (OMs).

Precautionary Approach - An approach to resource management in which, where there are threats of serious irreversible environmental damage, lack of full scientific certainty is not used as a reason for postponing cost-effective measures to prevent environmental degradation.

Reference case - (also termed reference scenario or base case) A single, typically central, conditioned OM for evaluating Candidate MPs (CMPs) that provides a pragmatic basis for comparison of performance statistics of the CMPs.

Reference set - (also termed base-case or evaluation scenarios) A limited set of scenarios, with their associated conditioned OMs, which include the most important uncertainties in the model structure, parameters, and data (i.e. alternative scenarios which have both high plausibility and major impacts on performance statistics of Candidate MPs).

Research-conditional option - Temporary application of an MP that does not satisfy conservation performance criteria, accompanied by both a research programme to check the plausibility of the scenarios that gave rise to this poor performance and an agreed subsequent reduction in catches should the research prove unable to demonstrate implausibility.

Robustness tests - Tests to examine the performance of an MP across a full range (i.e. beyond the range of the Reference Set of models alone) of plausible scenarios. While plausible, robustness test OMs are typically considered to be less likely than the reference set OMs, and often focus on particularly challenging circumstances with potentially negative consequences to be avoided.

Scenario- A hypothesis concerning resource status and dynamics or fishery operations, represented mathematically as an OM.

Simulation trial/test - A computer simulation to project stock and fishery dynamics for a particular scenario forward for a specified period, under controls specified by a HS or MP, to ascertain the performance of that HS or MP. Such projections will typically be repeated a large number of times to capture stochasticity.

Spawning Biomass, initial - Initial spawning biomass prior to fishing as estimated from a stock assessment.

Spawning Biomass, current - Spawning biomass (SSB) in the last year(s) of the stock assessment.

Spawning Biomass at MSY - The equilibrium spawning biomass that results from fishing at FMSY. In the presence of recruitment variability, fishing a stock at FMSY will result in a biomass that fluctuates above and below SSBMSY.

Stationarity - The assumption that population parameter values are fixed (at least in expectation), and not varying systematically, over time. This is a standard assumption for many aspects of stock assessments, OMs and management plans.

Stock assessment - The process of estimating stock abundance and the impact of fishing on the stock, similar in many respects to the process of conditioning OMs.

Target Reference Point - The point which corresponds to a state of a fishery and/or resource which is considered desirable and which management aims to achieve.

Trade-offs - A balance, or compromise, achieved between desirable but conflicting objectives when evaluating alternative MPs. Trade-offs arise because of the multiple objectives in fisheries management and the fact that some objectives conflict (e.g. maximizing catch vs minimizing risk of unintended depletion).

Tuning - The process of adjusting values of control parameters of the Harvest Control Rule in a Management Procedure to achieve a single, precisely-defined performance statistic in a specified simulation test. This reduces confounding effects to allow the performance of different candidate MPs to be compared more readily with respect to other management objectives. For example, in the case of evaluating rebuilding plans, all candidate MPs might be tuned to meet the rebuilding objective for a specified simulation trial; then the focus of comparisons among MPs is performance and behaviour with respect to catch and CPUE dimensions.

Weight(s) - Either qualitative (e.g. high, medium, low) or quantitative measures of relative plausibility accorded across a set of scenarios.

Worm plot - Time series plots showing a number of possible realizations of simulated projections of, for example, catch or spawning biomass under the application of an MP for a specific OM or weighted set of OMs.

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 16th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Methods Management Strategy Evaluation Task Force (WPM(MSE)) was held online using Zoom on 24 February 2025. A total of 29 participants attended the Session. The list of participants is provided in Appendix I. The meeting was opened by the Chairperson, Dr Hilario Murua (ISSF) who welcomed participants.

The following are the recommendations from the WPM16 to the Scientific Committee, and key outcomes of the WPM, which are provided in Appendix V

WPM(MSE) 16.01 (para. 21): The WPM(MSE) **NOTED** that the application of the bigeye management procedure generated an unconstrained estimated TAC of 175,005 t which is more than 15% higher than the TAC set for 2024 and 2025. The WPM(MSE) **NOTED** that by applying the maximum 15% change in the TAC as per Resolution 22/03, the MP recommended a TAC of 92,670 t. per year for 2026-2028. Therefore, the WPM(MSE) **RECOMMENDED** the SC adopt the TAC advice for Bigeye tuna of 92,670 t resulting from the MP.

WPM(MSE) 16.02 (para. 23): **NOTING** that the CPUE standardisation conducted by the joint CPUE working group differs slightly from the specified methods in the MP (Williams et al., 2022), the WPM(MSE) **RECOMMENDED** that a fixed set of CPUE standardization code is developed for each MP to ensure that it is developed following the specifications of the MP.

1. OPENING AND ADOPTION OF AGENDA

1. The 16th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Methods Management Strategy Evaluation Task Force (WPM(MSE)) was held online using Zoom on 24 February 2025. A total of 29 participants attended the Session. The list of participants is provided in Appendix I. The meeting was opened by the Chairperson, Dr Hilario Murua (ISSF) who welcomed participants.

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

2. REVIEW OF MP PROCESS IN IOTC

2.1 Review outcomes of S28 in 2024

3. The WPM(MSE) **NOTED** a presentation by the Secretariat regarding the updates from the 2024 Session of the Commission (S28). The presentation summarised the information related to MSE found in document IOTC-2024-S28-R.

4. The WPM(MSE) were **INFORMED** that in the Commission report (IOTC-2024-S28-R):

*[Para 85] The Commission **NOTED** the report of the 8th meeting of the Technical Committee on Management Procedures (TCMP) (IOTC-2024-TCMP08-R) and **ENDORSED** the following TCMP recommendations:*

- *Considering that all Skipjack MPs tested show good performance with respect to stock status (e.g., all showing stock biomass above the LRP with high probability) and little difference among them in other performance measures under the reference set, the TCMP **NOTED** that all MPs ensure the skipjack will be managed within safe biological limits. Therefore, the TCMP **RECOMMENDED** the Commission to consider for adoption the EU proposal for the MP that has the following properties: (i) 50% probability of being at the skipjack target reference point in 2034-2038 (i.e., 40% B0), (ii) the stable type MP parameterisation, and (iii) an asymmetric TAC change clause.*
- *The TCMP **NOTED** that increased catches of skipjack will also affect yellowfin and bigeye stocks which are overfished and subject to overfishing. The TCMP **RECOMMENDED** that the SC investigate and incorporate ecosystem effects in the next revision of the skipjack MP since the skipjack fishery often will impact catches of other species, such as yellowfin, bigeye, and sharks.*
- *Moreover, considering that in the past skipjack catches have been greater than the recommended limits, the TCMP **RECOMMENDED** the Commission to take the necessary actions to ensure that catches do not exceed the TAC when the MP is applied.*
- *After considering the performance and trade-off between management objectives of the six candidate management procedures of swordfish, the TCMP **RECOMMENDED** the Commission to consider for adoption the Australian proposal for a swordfish MP: MP1 or MP2. These have the following properties: a fast reacting, data-based type MP, with either 60% (MP1) or 70% (MP2) probability of being at the target reference point in 2034-2038.*
- *The TCMP also NOTED that changes in swordfish catch will also affect other species, particularly shark species. The TCMP **RECOMMENDED** that the SC investigate and incorporate ecosystem effects in the next swordfish revision of the MP.*

*[Para 86] The Commission also **NOTED** the TCMP recommendation on the arrangements for TCMP meetings in 2025:*

- *Considering the progress on MSE for IOTC species, the TCMP **RECOMMENDED** that a virtual TCMP be convened early in 2025 with a special focus on albacore tuna if the SC agrees that sufficient progress*

*has been made, and a one-day TCMP be convened back-to-back with the Commission's Session in 2025. The TCMP also **RECOMMENDED** that the WPM(MSE) be held in March/April, and that the next TCMP meeting should include a capacity building component, taking into consideration the options suggested by the small Working Group.*

*[Para 87] However, **NOTING** that it was unlikely that any Management Procedure would be ready for adoption in 2025, the Commission proposed that the first meeting of the TCMP in February should only be held if deemed necessary by the SC. The Commission **AGREED** that the second meeting of the TCMP could be shortened to one day.*

5. The WPM(MSE) **NOTED** the request from the Commission for the SC to initiate the Management Strategy Evaluation process for blue shark in order to develop a Management Procedure for this species. The WPM **NOTED** that the blue shark MSE has been included in the WPM(MSE) Program of Work as a high priority. The WPM also **NOTED** that blue shark is scheduled to be assessed in 2025 and so this assessment can feed into the MSE process.

2.2 Review outcomes of SC27 in 2024

6. The WPM(MSE) **NOTED** a presentation by the Secretariat regarding the updates from the 2024 Session of the Scientific Committee (S27) as well as a recap of the deliberations during the 2024 TCMP08. The presentation summarised the information related to MSE found in document IOTC-2024-SC27-R.

7. The WPM(MSE) **NOTED** that in 2024, the SC made a number of endorsements and recommendations in relation to the WPM15 report. These are provided below for reference:

*[Para 118] The SC **NOTED** the report of the 15th Session of the Working Party on Methods (IOTC–2024–WPM15–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 46 participants (cf. 42 in 2023). Two participants received funding through the MPF funding.*

*[Para 119] The SC **NOTED** that the WPM has reviewed and discussed a wide range of issues including MSE progress for IOTC species, multi-species MSE, exceptional circumstances considerations for bigeye tuna MSE, joint CPUE standardisations, and close kin mark recapture design study for yellowfin tuna.*

7.5.1 Update on TCMP08

*[Para 120] The SC **NOTED** document IOTC-2023-TCMP08-R on the Report of the 8th session of the TCMP held in May 2024. The SC **NOTED** that the WPM had taken into consideration the recommendations and discussions held at that meeting.*

7.5.2 Management Strategy Evaluation Progress

*[Para 121] The SC **NOTED** that the work of albacore is not mature enough that would require a TCMP in February and, therefore, **RECOMMENDED** that an extra TCMP meeting in February 2025 is not organized.*

7.5.3 Bigeye tuna MP (Resolution 22/03)

*[Para 122] The SC **NOTED** that a standardised CPUE index based on the agreed methodology (as per Resolution 22/03) was not yet available to run the Bigeye Tuna MP, but needs to be available in time for the Scientific Committee to review (as required by Resolution 22/03). However, a member of the joint CPUE group responsible for producing the index indicated that logistically (due to the need to have a physical workshop to share the data) it would not be possible to provide the CPUE index in time for SC, but that it might be possible to provide following a meeting of the group in February 2025. The SC **DISCUSSED** options for ensuring that the WPM is able to review and participate in the running of the MP. Following this discussion, the SC **RECOMMENDED** that:*

- *the joint CPUE working group produce a BET CPUE index, as per the requirements/specifications of Williams et al (2022), at its meeting in early February 2025, and provide this for the WPM(MSE)Taskforce.*

- *the WPM(MSE) Taskforce meet online on 24-25 February 2025 with one day to review and run the BET MP and one day to consider progress on the Albacore Tuna MSE.*
- *The Scientific Committee convene a special session, online (for two hours) on 26 February 2025, to review and if appropriate endorse the BET MP run and its associated BET TAC outcomes.*

7.5.4 Skipjack tuna MP (Resolution 24/07)

*[Para 123] The SC **NOTED** that the skipjack tuna MP will be applied during the WPM for endorsement by the SC in 2025. The SC further **NOTED** that the MP requires the Maldivian pole-and-line and EU FAD CPUEs, including 2024 data, using the methodology assumed in the Management Strategy Evaluation.*

7.5.4 Swordfish tuna MP (Resolution 24/08)

*[Para 124] The SC **RECOMMENDED** that the Commission implement a TAC for 2026-2028 for swordfish based on the amended and retuned MP1 if the Commission wishes to ensure that it achieves the current objective in Res 24/08 to be in the Kobe green zone with at least 60% probability during 2034-2038 period. This would require a minor amendment to the Target CPUE value in Annex I of Res 24/08 from 0.7125 to 0.75. The SC NOTED that should the Commission continue to implement the current MP1, without retuning, it has a lower probability (54%) of being in the Kobe green zone and higher TAC variability, but otherwise similar performance statistics (Table 1 of IOTC–2024–WPM15–R). The TAC derived from running SWO MP1 with or without retuning is 30527 t (i.e. the same and therefore not a severe impact) because the max TAC change constrain is reached in both MPs.*

*[Para 125] Irrespective of the MP chosen by the Commission, the SC **RECOMMENDED** that the Commission endorse the resultant TAC of 30,527 t for swordfish for 2026-2028.*

7.5.5 General MSE issues

*[Para 126] The SC **ENDORSED** the inclusion of the MSE task force meeting in the schedule of meetings for 2025.*

*[Para 127] The SC **ENDORSED** the WPM's **RECOMMENDATION** that the Commission ensure that the IOTC Secretariat is provided with the necessary resources to manage the curation of relevant documents and code to enable users to re-run assessments and other analyses, **NOTING** that the most important information to be curated would be the input file, executables and control files.*

3. STATUS OF WORK ON ALBACORE OMS AND MPS

3.1 Review progress and difficulties

8. The WPM(MSE) **NOTED** the developer's presentation on the progress of the MSE analysis for albacore tuna. A summary was provided on the configuration and conditioning of the Operating Model (OM), which is based on Approximate Bayesian Computation methods. The WPM(MSE) **RECALLED** that in 2024, the WPM agreed to use the reference OM (R2b) and Robustness OMs (R3b) for MP testing.

9. The WPM(MSE) **NOTED** that the OM grid has been finalized and updated to 2023 with projected catch, and both data-based and model-based (JABBA) MPs have been coded. However, the work has not progressed as planned due to some technical difficulties, and there remains an unresolved issue in the MP projection code. The WPM(MSE) **CONSIDERED** that the work has not yet progressed enough to be presented to the TCMP. However, a complete set of simulation testing for the MPs and the full analysis should be ready for the WPM meeting in October 2025. However, the WPM(MSE) **AGREED** to present a high-level summary of the work up to now as well as the progress and challenge and future steps at the TCMP in 2025.

3.2 Future Work

10. The WPM(MSE) also **DISCUSSED** whether the OM requires reconditioning. It was **NOTED** that the Joint CPUE group is close to completing the CPUE standardization for albacore tuna stock assessment this year; including the

investigation of the use of spatial-temporal models, which are important for a migratory species in the temperate region. The WPM(MSE) **AGREED** that the developer will evaluate the differences between the current CPUE and the latest CPUE to decide if reconditioning of the OM is warranted. The WPM(MSE) **NOTED** that the WPTmT assessment meeting in July 2025 provides an opportunity to compare the OM with the latest assessment model.

4. BIGEYE TUNA MP (RESOLUTION 22/03)

4.1 Update on the CPUE standardisation for bigeye tuna

11. The WPM(MSE) **NOTED** the presentation of paper IOTC-2025-WPM16(MSE)-03 on Joint CPUE indices for the bigeye tuna in the Indian Ocean based on Japanese, Korean and Taiwanese longline fisheries for use running the bigeye MP for the 1st Special Session of the Scientific Committee, including the following summary provided by the authors:

    "Joint CPUE standardization for the Indian Ocean bigeye tuna was conducted using longline fisheries data from Japan, Korea, and Taiwan up to 2023. This effort aimed to provide the IOTC Scientific Committee with updated abundance indices for use in the adopted Management Procedure (MP) for this stock. The collaboration sought to enhance the spatial and temporal coverage of fishery data, thereby producing combined indices. To account for inter-annual variations in the target species for each fishery, data on hooks between floats or clustering results were incorporated for each region. Conventional regression models were applied to standardize catch-per-unit-effort data, using shared operational data in each region. Overall, the trend in CPUE was broadly consistent with those used in previous stock assessments and MP applications."

12. The WPM(MSE) **NOTED** that some operational changes have been observed in the Taiwanese fleet. The WPM(MSE) **NOTED** that these are a result of the increased capacity on some small-scale vessels to provide more space for crew, which occurred in around 39 vessels since 2021. The WPM(MSE) **NOTED** that the fishing practices, as well as catch rates of these vessels might have been impacted. Therefore, the joint CPUE workshop suggested not to use the data from these vessels in the CPUE index. The WPM(MSE) **NOTED** that similar decisions will need to be made regarding the inclusion of these vessels in future CPUE analyses.

13. Although there were some minor methodological changes from the agreed CPUE specifications of the MP (the use of lognormal instead of delta model due to time constraints and the exclusion of some Taiwanese vessels due to operational changes since 2021), The WPM(MSE) **AGREED** to use the CPUE in the BET MP. Further differences are documented. Moreover, the WPM(MSE) **NOTED** that the CPUE trend estimated in 2025 for all regions is very similar to the joint CPUE series used in the MSE when the MP was adopted in 2022.

14. The WPM(MSE) **NOTED** that external experts and members of the Secretariat were invited to participate in the CPUE standardization workshop which addresses one of the concerns expressed by the SC in 2024 regarding the transparency of this process.

15. The WPM(MSE) **NOTED** that a joint CPUE workshop will be held in late April 2025 to work on the bigeye and yellowfin CPUE standardisations.

16. The WPM(MSE) **NOTED** that a similar paper on the CPUE standardization is planned for the Indian Ocean albacore but that the analyses are still underway. The WPM(MSE) **NOTED** that some analyses have been conducted with a spatio-temporal model but the internal discussions on the overall analyses have not yet concluded. The WPM(MSE) **NOTED** that these analyses will be made available ahead of the July 2025 albacore stock assessment meeting and for conditioning purposes for the MP.

4.2 Running the Bigeye MP as per Resolution 22/03

17. The WPM(MSE) **NOTED** the presentation of paper IOTC-2025-WPM16(MSE)-02 which provides an update on running the IOTC bigeye tuna management procedure for 2024.

18. The WPM(MSE) **NOTED** that Resolution 22/03 on a bigeye management procedure includes an adopted MP schedule that requires the MP to be run by the IOTC Scientific Committee in 2024, through the Working Party on Methods and Working Party on Tropical Tunas, including a review of exceptional circumstances, to derive a recommended TAC for 2026, 2027 and 2028 for IOTC Commission consideration.

19. The WPM(MSE) **NOTED** that the joint CPUE series derived from Japanese, Korean and Taiwanese longline fisheries was not available at the time of the 2024 working party meetings or SC so the MP could not be run in 2024. This joint CPUE series has now become available and, therefore, the MP was run in 2025 using this index.

20. The WPM(MSE) **NOTED** the two data inputs to run the bigeye MP were catch data and the aggregated and annualised joint CPUE index. The WPM(MSE) **NOTED** the formula used in the MP to determine the recommended TAC. The WPM **NOTED** that three parameters in the MP are derived from the internal estimation model (FMSY ratio, By and HCRmult), and the fourth parameter (Fmult) is a fixed tuning parameter. The WPM further **NOTED** that the Pella-Tomlinson biomass dynamic internal estimation model converged and was robust to the initial parameter values (the full MP specifications is provided in Williams et al., 2022).

21. The WPM(MSE) **NOTED** that the application of the bigeye management procedure generated an unconstrained estimated TAC of 175,005 t which is more than 15% higher than the TAC set for 2024 and 2025. The WPM(MSE) **NOTED** that by applying the maximum 15% change in the TAC as per Resolution 22/03, the MP recommended a TAC of 92,670 t. per year for 2026-2028. Therefore, the WPM(MSE) **RECOMMENDED** the SC adopt the TAC advice for Bigeye tuna of 92,670 t resulting from the MP.

4.3 Review of exceptional circumstances

22. The WPM(MSE) **NOTED** the presentation of paper IOTC-2025-WPM16(MSE)-04 which provides an update on the consideration of exceptional circumstances for the bigeye tuna MP in 2025, including the following summary provided by the authors:

> *"The IOTC's adopted management procedure (MP) for bigeye tuna is used to recommend the Total Allowable Catch (TAC) of bigeye in the Indian Ocean. As part of the implementation schedule, the Commission adopted an annual review of evidence for exceptional circumstances that could make the application of the TAC advice risky to the stock or fishery. A wide range of information was reviewed at the Working Party on Methods (WPM) 2024 to examine if there was evidence for exceptional circumstances, e.g., the data inputs to the Management Procedure (MP), changes in the knowledge of stock or fishery uncertainties against which the MP was tested, and implementation of MP TAC advice. One exceptional circumstance was detected regarding the standardisation of CPUE data for running the MP. The WPM, SC and joint CPUE working group agreed on action to create the CPUE required. This paper examines the CPUE standardisation as an input to the MP, to provide updated advice on exceptional circumstances."*

23. **NOTING** that the CPUE standardisation conducted by the joint CPUE working group differs slightly from the specified methods in the MP (Williams et al., 2022), the WPM(MSE) **RECOMMENDED** that a fixed set of CPUE standardization code is developed for each MP to ensure that it is developed following the specifications of the MP.

24. The WPM(MSE) **NOTED** that the CPUE is within the MSE range investigated for the recent years 2021-2023. However, the WPM(MSE) also **NOTED** a positive exceptional circumstance because the CPUE is above the expected range of values in 2019 and 2020, which may have an impact of a slightly higher TAC resulting from the MP. However, the WPM(MSE) **NOTED** the constraint in the MP on a TAC change of 15% will act to constrain any excessive response to these higher CPUE values.

25. As such, the WPM(MSE) **AGREED** that no further actions are required to proceed with the recommended TAC from the BET MP.

26. The WPM(MSE) **NOTED** that the TAC from the MP is within the range expected, and **NOTED** that the upper bound of the TAC change limit was regularly hit during the tuning runs and further **NOTED** that this helps performance of the MP to keep the TAC more stable.

4.4 External peer-review

27. The WPM(MSE) **NOTED** that a consultant has been hired to review the MSE process for bigeye tuna in 2025 with the aim of presenting the results of the review to the WPM in October. The WPM(MSE) **NOTED** that this process will help to improve the process for bigeye tuna as well as all other species with management procedures.

28. The WPM(MSE) **NOTED** the intent of the consultant to review all the relevant documentation and **ENCOURAGED** members of the WPM to assist with this process in any way possible.

29. The WPM(MSE) **NOTED** that the WPTT data preparatory meeting would be a good opportunity to present on the progress made with the review and receive feedback. The WPM(MSE) **NOTED** that more informal meetings with key members of the WPM MSE task force would also be valuable, which could be organized by the Secretariat as required.

30. The WPM(MSE) **NOTED** that there is insufficient time in the contract to do an extremely thorough review of the code underlying the MPs, but the WPM(MSE) **NOTED** that the consultant will evaluate the reproducibility of the code and ensure that it executes well as well as review the most important code parts if needed.

31. The WPM(MSE) **NOTED** support for the suggestion made by the consultant to write a retrospective report on the MSE adoption process detailing how the current stage in its development has been reached and how to scope and make future review easier.

32. The WPM(MSE) **NOTED** the interest in the review highlighting elements for improvement that could be useful to identify in time to be incorporated in the work ongoing for other stocks.

5. DEVELOPMENT OF BLUE SHARK OMS AND MPS

5.1 Future workplan

33. The WPM(MSE) **NOTED** that the Commission has endorsed the MSE work, and the Scientific Committee has agreed to implement the MSE for blue shark as a high priority. The WPM(MSE) **NOTED** the plan for a scoping study for a blue shark MSE in 2025.

34. The WPM(MSE) **NOTED** that the preliminary scoping study would aim to explore options to develop suitable operating models and relevant MPs for blue shark considering the uncertainties associated with shark species.

35. The WPM(MSE) **NOTED** that the scoping study will be completed by a consultant, who shall identify suitable OMs, considering the main stock assessment model (e.g., Stock Synthesis 3), and possibly an alternative model based on JABBA. The study will also assess appropriate MPs for shark species considering work that has been completed at ICCAT and other fora. The WPM(MSE) **SUGGESTED** that the consultant attend both the WPEB data preparatory meeting and the main stock assessment meeting.

36. The WPM(MSE) **NOTED** that the work will take place between the WPEB (after the stock assessment is complete) and WPM. The WPM(MSE) **ENCOURAGED** participation and inputs to the project from interested members.

37. The WPM(MSE) **NOTED** that the work complements development of shark MSEs and that the Ocean Foundation is planning to convene a cross-RFMO workshop on blue shark MSE in late 2025 or early 2026 and encouraged participation by interested parties.

6. PREPARATION OF THE 9TH SESSION OF TCMP

6.1 Agenda for TCMP09

38. The WPM **DISCUSSED** the agenda for the TCMP09 and AGREED to the version provided in Appendix IV of this report.

6.2 Organization, tasks and responsibilities

39. The WPM(MSE) **DISCUSSED** the organization of TCMP09 meeting with associated tasks and responsibilities prior to and during the meeting and **AGREED** that the bigeye tuna and swordfish MP runs would take priority in the April meeting. A high level, non-technical summary of the progress and status of albacore MSE will also be presented by the developer.

6.3 Format and guidelines for presenting MSE/MP results

40. The WPM(MSE) **NOTED** that while SC adopted guidelines for presenting the evaluation of MP performances to the TCMP, there has not been much guidance on the presentation of the process and results of running the MP. The WPM(MSE) **SUGGESTED** following the format used for the MP run for bigeye tuna (IOTC-2025-WPM16(MSE)-02) and swordfish (IOTC-2024-WPM15-11). Additionally, it was suggested to draw on experiences from work conducted by other RFMOs, particularly ICCAT.

6.4 Capacity building on MSE at IOTC

41. The WPM(MSE) **NOTED** the MSE capacity-building workshop held in the Maldives from August 26 to 28, 2024, which targeted fishery managers in coastal countries and provided training on the basic elements of the MSE process. The WPM(MSE) **AGREED** that insights gained from the workshop should be presented to the TCMP. Additionally, the WPM(MSE) suggested utilizing the online simulation tool (https://github.com/PacificCommunity/ofp-sam-ample) used by the workshop to offer a capacity-building exercise to the TCMP.

42. The WPM(MSE) was also informed that the MP/MSE FAO eLearning series, developed by the Ocean Foundation and Common Oceans FAO project, is nearing completion. This course features an interactive learning game that enables participants to oversee MSE processes and make decisions regarding management objectives and MP selection.

7. OTHER BUSINESS

43. The WPM(MSE) **NOTED** that the IOTC has several management procedures in place (Resolution 22/03, 24/07, 24/08) that require an annual review of Exceptional Circumstances. As requested by the WPM in 2024, the Secretariat has liaised with relevant working party chairs to coordinate tasks of performing the analysis for bigeye tuna, swordfish, and skipjack tuna, with CPCs scientists in advance to ensure that this work could be assigned and undertaken.

44. The WPM(MSE) further **NOTED** that the skipjack tuna MP is scheduled to be implemented this year and will require updates from the EU and Maldives regarding the Purse Seine and Pole & Line CPUE data. The Secretariat has been tasked with running the MP with assistance from the developer.

45. The WPM(MSE) **RECALLED** that the SC in 2024 recommended reinitiating the MSE process for yellowfin tuna, as it has stalled for several years. The WPM(MSE) **NOTED** that AZTI is currently working on conditioning the operating models using the latest assessment and plans to present the progress to the WPM in October 2025.

8. ADOPTION OF REPORT

46. The WPM(MSE) **NOTED** that the report would be adopted via correspondence.

APPENDIX I
LIST OF PARTICIPANTS

Chairpersons						
Title	**First name**	**Last name**	**Affiliation**	**Country**	**E-mail**	**A/P[1]**
Dr.	Hilario	Murua	ISSF		hmurua@iss-foundation.org	P
Ms.	Ann	Preece	CSIRO	AUS	ann.preece@csiro.au	P
Title	**First name**	**Last name**	**Affiliation**	**Country**	**E-mail**	**A/P**
Dr.	Shiham	Adam	IPNLF		shiham.adam@ipnlf.org	P
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Mr.	Mohamed	Shimal	Maldives Marine Research Institute	MDV	mohamed.shimal@mmri.gov.mv	P

[1] A – Attendance in person, P – Presence online

Dr.	Wen-Pei	Tsai	Invited Experts		wptsai@nkist.edu.tw	P
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Dr.	Sheng-Ping	Wang	Invited Experts		wsp@mail.ntou.edu.tw	P
Secretariat consultants						
Title	**First name**	**Last name**	**Affiliation**	**Country**	**E-mail**	**A/P**
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Secretariat Staff						
Title	**First name**	**Last name**	**Role**	**Country**	**E-mail**	**A/P**
Mr.	Dan	Fu	Science Manager		Dan.Fu@fao.org	
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Ms.	Genevieve	Philipps	Fishery Officer		Genevieve.Philipps@fao.org	

APPENDIX II
MEETING AGENDA

Date: 24-25 February 2025
Location: Online
Platform: ZOOM
Time: 12:00 – 16:00 daily (Seychelles time)
Chair: Hilario Murua (ISSF); **Vice-chair**: Dr Ann Preece (CSIRO)

DRAFT AGENDA

1. **Opening and adoption of agenda**
2. **Review of MP process in IOTC**
   2.1. Review outcomes of S28 in 2024
   2.2. Review outcomes of SC27 in 2024
   2.3. Process of MSE development, discussion and adoption at IOTC
3. **Status of work on Albacore OMs and MPs**
   3.1. Review progress and difficulties
   3.2. Future work
   3.3. Preparation of the 9th session of TCMP
4. **Bigeye Tuna MP (Resolution 22/03)**
   4.1. Running the Bigeye MP as per Resolution 22/03
   4.2. Review of exceptional circumstances
   4.3. External peer-review
5. **Development of Blue Shark OMs and MPs**
   5.1. Future workplan
6. **Preparation of TCMP09 and Commission (S29)**
   6.1. Agenda for TCMP09
   6.2. Organization, tasks and responsibilities
   6.3. Format and guidelines for presenting MSE/MP results
   6.4. Capacity building on MSE at IOTC
7. **Other business**
8. **Adoption of Report**

APPENDIX III
LIST OF DOCUMENTS

Document	Title
IOTC–2025–WPM16(MSE)–01a	Agenda of the 16th Working Party on Methods Management Strategy Evaluation Task Force
IOTC–2025–WPM16(MSE)–02	2025 update on running the IOTC Bigeye Tuna Management Procedure for 2024 (William A, Preece A)
IOTC–2025–WPM16(MSE)–03	Joint CPUE indices for the bigeye tuna in the Indian Ocean based on Japanese, Korean and Taiwanese longline fisheries for use in MP application in IOTC–2025–SSC01 (Kitakado T et al.)
IOTC–2025–WPM16(MSE)–04	An update on Consideration of Exceptional Circumstances for the Bigeye Tuna MP 2025 (Preece A, William A)

APPENDIX IV

PROPOSED AGENDA FOR THE TECHNICAL COMMITTEE ON MANAGEMENT PROCEDURES (TCMP)

Date: 12 April 2025

Location: Reunion, France (Hybrid)

Co-Chairs: Ms Riley Kim Jung-re (Commission 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 Outcomes of the 8th Session of TCMP

5. INTRODUCTION TO MSE AND PRESENTATION OF MSE RESULTS

6 STATUS OF THE MANAGEMENT STRATEGY EVALUATION/MANAGEMENT PROCEDURES AND ACTIONS NEEDED FOR ADOPTION/IMPLEMENTATION (Developers)

- 6.1 Albacore tuna
- 6.2 Bigeye tuna
- 6.3 Swordfish
- 6.4 General Issues
  - 6.4.1 MP implementation, actions and regular implementation review

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

- 7.1 Workplan
  - 7.1.1 New timelines
  - 7.1.2 Budget and resources needed for technical developments
  - 7.1.3 External review
- 7.2 Priorities
- 7.3 Process and future meetings of TCMP

8 ADOPTION OF REPORT (Co-chairs)

APPENDIX V
CONSOLIDATED RECOMMENDATIONS OF THE 16TH SESSION OF THE WORKING PARTY ON METHODS (MANAGEMENT STRATEGY EVALUATION TASK FORCE)

NOTE: APPENDIX REFERENCES REFER TO THE REPORT OF THE 16TH SESSION OF THE WORKING PARTY ON METHODS (MANAGEMENT STRATEGY EVALUATION TASK FORCE) (IOTC–2025–WPM16(MSE)–R)

WPM(MSE) 16.01 (para. 21): The WPM(MSE) **NOTED** that the application of the bigeye management procedure generated an unconstrained estimated TAC of 175,005 t which is more than 15% higher than the TAC set for 2024 and 2025. The WPM(MSE) **NOTED** that by applying the maximum 15% change in the TAC as per Resolution 22/03, the MP recommended a TAC of 92,670 t. per year for 2026-2028. Therefore, the WPM(MSE) **RECOMMENDED** the SC adopt the TAC advice for Bigeye tuna of 92,670 t resulting from the MP.

WPM(MSE) 16.02 (para. 23): **NOTING** that the CPUE standardisation conducted by the joint CPUE working group differs slightly from the specified methods in the MP (Williams et al., 2022), the WPM(MSE) **RECOMMENDED** that a fixed set of CPUE standardization code is developed for each MP to ensure that it is developed following the specifications of the MP.