

# Report of the 15<sup>th</sup> Session of the IOTC Working Party on Methods

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Seychelles, 24 - 26 October 2024

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## ACRONYMS

ABNJ	Areas Beyond National Jurisdiction
ALB	Albacore
B	Biomass (total)
B <sub>0</sub>	Unfished biomass
BET	Bigeye tuna
B <sub>MSY</sub>	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 <sub>current</sub> means fishing mortality for the current assessment year.
ETP	Endangered, threatened and protected
F	Fishing mortality
FAD	Fish aggregating device
FOB	Floating Object
F <sub>MSY</sub>	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 <sub>MSY</sub>	Spawning stock biomass which produces MSY (sometimes expressed as SSB <sub>MSY</sub> )
SKJ	Skipjack tuna
SWO	Swordfish
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  $F_{MSY}$ .

**Observation Model** - The component of the OM that generates fishery-dependent and/or fishery-independent resource monitoring data from the underlying 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  $F_{MSY}$ . In the presence of recruitment variability, fishing a stock at  $F_{MSY}$  will result in a biomass that fluctuates above and below  $SSB_{MSY}$ .

**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

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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 an 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 15<sup>th</sup> Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Methods (WPM) was held in Berjaya Beau Vallon Hotel, Seychelles 24-26 October 2024. A total of 42 participants (46 in 2023, 60 in 2022, and 55 in 2021) 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 WPM15 to the Scientific Committee, and key outcomes of the WPM, which are provided in [Appendix V](#).

***Review of intersessional meetings related to the IOTC MSE process***

WPM15.01 (Para 14): The WPM **THANKED** the participants of the Working Party on Methods Management Strategy Evaluation Task Force meeting for their informative discussions and input on the technical aspects of MSE and related topics. The WPM **NOTED** that the output of this meeting remains very important to the WPM as it provides an informal forum for the highly technical discussions necessary to advance the MSE process in IOTC for which there is insufficient time during the WPM meeting. The WPM further **RECOMMENDED** that the SC endorse this meeting being included in the schedule of meetings for 2025.

***Albacore MSE: Update***

WPM15.02 (Para 29): The WPM **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.

***Bigeye tuna MP (Resolution 22/03)***

WPM15.03 (Para 41): The WPM **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 WPM **DISCUSSED** options for ensuring that the SC is able to review and participate in the running of the MP. Following this discussion, the WPM **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

***Swordfish MP (Resolution 24/08)***

WPM15.04 (Para 52): The WPM **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 WPM **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). 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.

WPM15.05 (Para 53): Irrespective of the MP chosen by the Commission, the **WPM RECOMMENDED** that the Commission endorsed the resultant TAC of 30527 t. for swordfish for 2026-2028.

***MSE General***

WPM15.06 (Para 86): The WPM underlined that there is a need to ensure that any code and input files used for developing MPs is housed internally on an accessible platform, so it is available to other users and not lost when developers move on to other tasks. The WPM **NOTED** that ICES uses a Transparency and

Assessment Framework (TAF) which is a useful frontend to direct users to the locations of relevant documents and code (e.g. Github repositories) that enable users to re-run assessments and other analyses, but that a much smaller system would be needed for the IOTC. The WPM NOTED that the most important information to be curated would be the input files, executables, and control files (not the large volume of output files), and **RECOMMENDED** that the Commission ensure that the IOTC Secretariat is provided with the necessary resources to manage the curation of this information

***Revision of the WPM Program of work (2025–2029)***

WPM15.07 (Para 116).: The WPM **RECOMMENDED** that the Scientific Committee consider and endorse the WPM Programme of Work (2025–2029), as provided in [Appendix IV](#).

***Date and place of the 16th and 17th sessions of the WPM***

WPM15.08 (Para 118): The WPM **RECOMMENDED** the SC consider mid-late October 2025 as a preferred time period to hold the WPM16. As usual it was also AGREED that this meeting should continue to be held back-to-back with the WPTT. The Secretariat will continue to liaise with CPCs to determine their interest in hosting these meetings in the future as the SC is encouraging a return to physical meetings since 2023.

***Review of the draft, and adoption of the Report of the 15th Session of the WPM***

WPM15.09 (Para 120): The WPM **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPM15, provided in [Appendix V](#).

## 1. OPENING OF THE MEETING

1. The 15th Session of the Indian Ocean Tuna Commission’s (IOTC) Working Party on Methods (WPM) was held in Berjaya Beau Vallon Hotel, Seychelles 24-26 October 2024. A total of 42 participants (46 in 2023, 60 in 2022, and 55 in 2021) attended the Session either in person or online. The list of participants is provided in [Appendix I](#). The meeting was opened by the Chairperson, Dr Hilario Murua (ISSF) who welcomed participants.

## 2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

2. The WPM **ADOPTED** the Agenda provided at [Appendix II](#). The documents presented to the WPM15 are listed in [Appendix III](#).
3. The WPM **NOTED** the agenda doesn’t include a separate topic on climate change (agenda item 9.1 discusses climate change MSE scenarios). The WPM **RECALLED** that Resolution 24/01 requested “All other Working Parties reporting to the IOTC Scientific Committee shall include climate change as a standing agenda item at their regular meetings and provide any relevant information or advice to the IOTC Scientific Committee in line with their current reporting processes” (para 5c).
4. The WPM **AGREED** that future meetings shall include an explicit standing agenda item for the discussions of climate changes related issues.

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

### 3.1 Outcomes of the 26<sup>th</sup> Session of the Scientific Committee

5. The WPM **NOTED** paper [IOTC–2024–WPM15–03](#) which outlined the main outcomes of the 26<sup>th</sup> Session of the Scientific Committee (SC25), specifically related to the work of the WPM.
6. The WPM **NOTED** that in 2023, the SC made a number of endorsements and recommendations in relation to the WPM14 report. These are provided below for reference:

(Para 115) The SC **NOTED** the report of the 14th Session of the Working Party on Methods (IOTC–2023–WPM14–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 39 participants (cf. 60 in 2023). Three participants received funding through the MPF funding.

(Para 116) 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 TCMP06

(Para 117) The SC **NOTED** document IOTC-2023-TCMP06-R on the Report of the 6<sup>th</sup> session of the TCMP held in May 2023. The SC **NOTED** that the WPM had taken into consideration the recommendations and discussions held at that meeting.

(Para 118) The SC **NOTED** the following requests made on the skipjack MSE: (1) Investigating the model-based MP; (2) revising the tuning window and revisiting the shape of HCR function, and (3) Increasing options for “maximum TAC change” to include a symmetric 15% or 25% (both upward/downward changes) and asymmetric 15% upward and 10% downward, or 25% upward and 15% downward change.

(Para 119) The SC also **NOTED** the requests made on the swordfish MSE: (1) Investigate the model-based MP with MSY-related reference point parameters (in addition to the current depletion reference points); (2) investigating TAC constrains including a symmetric 15% or 10%, and asymmetric 15% upward and 10% downward.

(Para 120) The SC **NOTED** the above requests has been the focus of MSE work led by the modelers. The SC further **NOTED** that the SKJ and SWO MSE is currently thought to be in a relatively advanced stage of development in comparison to other species.

#### 7.5.2 Management Strategy Evaluation Progress

(Para 121) The SC **NOTED** the good progress made in Management Strategy Evaluations exercises for IOTC species in 2023, and the useful discussions of MSE work at the MSE Task Force meeting (a technical expert group of the WPM) and the TCMP meeting in 2023.

### 7.5.3 Albacore MSE

(Para 122) The SC **NOTED** that the challenges encountered when conditioning OMs based on the albacore stock assessment have been resolved when using Approximate Bayesian Computation (ABC) to condition the albacore OMs. ABC can offer a variety of solutions to potential problems that may arise during conditioning (e.g., cannot account for recent observed catches). The SC endorsed this OM procedure and agreed that a final set of OMs be constructed for the MP evaluation.

### 7.5.4 Skipjack tuna MSE

(Para 123) The SC **NOTED** the SKJ MSE focused on addressing the requests made by TCMP06. The SC **NOTED** that the biomass dynamic model (BDM) did not work. The SC further **NOTED** that the TAC changes tested under the MP is shown to be much less than the TAC constraint applied. The SC agreed that these TAC changes scenarios should still be completed.

(Para 124) The SC **NOTED** a few requests made by the WPM15 including reconditioning the OM with the new assessments, and further robustness tests to evaluate autocorrelation in the recruitment deviates comparable to observed recruitment. The SC **REQUESTED** the results to be presented at the TCMP-07 in Feb 2024.

### 7.5.5 Yellowfin tuna MSE

(Para 125) The SC **NOTED** that there has been no further progress on the OM development of yellowfin tuna, pending the results of the new yellowfin stock assessment scheduled in 2024 following the external review of model that took place in February in 2023.

### 7.5.6 Swordfish MSE

(Para 126) The SC **NOTED** that although the two types of MP performed similarly, the data-based MP produced wider inter-annual variability, comparatively higher catches, and increased uncertainty regarding future catches. Additionally, because it is directly linked to the CPUE index, the data-based MP is more responsive. It was also noted that in both robustness trials, the data-based MP outperforms the model-based MP.

### 7.5.7 General MSE issues

(Para 127) The SC **RECALLED** that TCMP and Commission requested to improve the communication of the MSE results by reducing the amount of technical content and for the creation of a small working group to discuss and agree on ways to improve communication between scientists and managers. The SC **NOTED** that the small group has now be convened with the first meeting expected to take place end of the year or early next year.

(Para 128) The SC **NOTED** that a virtual TCMP is planned for February 2024, with the main goal of reviewing the MSE work for skipjack tuna and swordfish. It is anticipated that the WPM(MSE) task force meeting in April will address any requests or recommendations made during that meeting. If the MP can be finalized it then can be presented to the TCMP in May to be ready for consideration by the Commission.

(Para 129) The SC **NOTED** that there is a need to ensure that any code and input files used for developing MPs is housed internally on an accessible platform, so it is available to other users and not lost when developers move on to other tasks. The SC **NOTED** that ICES uses a Transparency and Assessment Framework (TAF) which is a useful frontend to direct users to the locations of relevant documents and code (e.g. Github repositories) that enable users to re-run assessments and other analyses, but that a much smaller system would be needed for the IOTC. The SC **NOTED** that most important information to be curated would be the input files, executables, and control files (not the large volume of output files), and **RECOMMENDED** that the Commission ensure that the IOTC Secretariat is provided with the necessary resources to manage the curation of this information

## 3..2 Outcomes of the 28th Session of the Commission

7. The WPM **NOTED** paper [IOTC-2024-WPM15-04](#) which provided the main outcomes of the 28<sup>th</sup> Session of the Commission specifically related to the work of the WPM.
8. The WPM **NOTED** ([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 performances 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% B<sub>0</sub>), (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 skipjack revision of the MP since the fishery of skipjack will impact catches in 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.

9. The WPM **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 further **NOTED** that the 2024 WPEB meeting requested WPM to start discussions around the MSE process for this species. The WPM **AGREED** to include the blue shark MSE in its program of work so that the Commission could consider allocating resources for this project and the SC could initiate its work plan. The WPM also **NOTED** that blue shark is scheduled to be assessed in 2025 and so this assessment can feed into the MSE process.

### **3..3 Review of Conservation and Management Measures relevant to the WPM**

10. The WPM **NOTED** paper [IOTC–2024–WPM15–05](#) which aimed to encourage participants at the WPM15 to review some of the existing Conservation and Management Measures (CMM) relevant to the WPM and as necessary to 1) provide recommendations to the Scientific Committee on whether modifications may be required; and 2) recommend whether other CMMs may be required.
11. Participants to WPM15 were **ENCOURAGED** to familiarise themselves with the previously adopted Resolutions, especially those most relevant to the WPM and **AGREED** to consider how best to provide the Scientific



Committee with the information it needs, in order to satisfy the Commission's requests, throughout the course of the current WPM meeting.

### 3.4 Progress on the recommendations of WPM14

12. The WPM **NOTED** paper [IOTC-2024-WPM15-06](#) which provided an update on the progress made in implementing the recommendations from the previous WPM meeting which were endorsed by the Scientific Committee and **AGREED** to provide alternative recommendations during the WPM15 as appropriate given any progress.
13. The WPM **NOTED** paper [IOTC-2024-WPM15\(MSE\)-R](#) which provided the report of Report of the 15th Session of the IOTC Working Party on Methods Management Strategy Evaluation Task Force that took place from 10-13 April 2024.
14. The WPM **THANKED** the participants of the Working Party on Methods Management Strategy Evaluation Task Force meeting for their informative discussions and input on the technical aspects of MSE and related topics. The WPM **NOTED** that the output of this meeting remains very important to the WPM as it provides an informal forum for the highly technical discussions necessary to advance the MSE process in IOTC for which there is insufficient time during the WPM meeting. The WPM further **RECOMMENDED** that the SC endorse this meeting being included in the schedule of meetings for 2025.
15. The WPM **NOTED** the recommendation from the WPM14 for the IOTC Secretariat to have the necessary resources to manage code and input files on accessible platforms. This ensures that staff or modeller changes shall not disrupt the application of management procedures. The WPM **NOTED** that there has been some progress: for example, the MSE team for bigeye tuna has developed an R package and Shiny app to allow transparent and reproducible MP applications and to ease the handover of responsibilities to the Secretariat, as agreed by the SC. Similarly, the Swordfish modelling team has used the ICES Transparency and Assessment Framework (TAF) for Management Strategy Evaluation (MSE) work.
16. Additionally, the WPM **NOTED** that the IOTC Secretariat is currently reviewing its IT platforms to meet future needs. This includes considering mechanisms for running interactive Shiny applications through its future website.

## 4. ALBACORE MSE: UPDATE

### 4.1 Review of OM and candidate MP development

17. The WPM **NOTED** paper [IOTC-2024-WPM15-08](#) which presented an update of the Indian Ocean albacore MSE. The paper provides an update on conditioning of the Albacore Operating Models using the Approximate Bayesian Computation (ABC) approach, with the following summary provided by the authors:
 

*“For the IOTC Albacore MSE work, a suite of possible prior states of historical dynamics and current status are defined, using the more recent data within an estimation scheme built on emerging Approximate Bayesian Computation (ABC) and Synthetic Likelihood (SL) concepts. We have conditioned the Indian Ocean Albacore tuna OM to mirror (biologically and structurally) the most recent stock assessment, utilising length composition and longline CPUE data, and we explore a wide range of stock status prior hypotheses, many of them built on information from the results of the stock assessment. These OMs will be used to project the stock into the future, and test the candidate MPs”*
18. The WPM **NOTED** that the paper includes model specifications, fits to data and a proposed set of OMs for reference and robustness tests, and additional robustness scenarios, for testing performance of candidate MPs.
19. The WPM **NOTED** the progress that has been made on development of the operating models using the ABC methodology and **NOTED** that the WPM had **AGREED** at previous meetings that it provides a suitable procedure for conditioning of OMs that are not directly based on the stock assessment model.
20. The WPM **NOTED** that, as agreed in previous meetings, the 16 Longline fleets defined for the stock assessment are aggregated to 4 fleets by combining the quarterly data for each of the 4 fisheries, and the noisy size data are aggregated to give the mean size frequency for each fishery, to better inform selectivity by fishery.

21. The WPM **NOTED** that the overfishing penalty (applied in some model options) acted to reduce occurrence of occasional unrealistic model scenarios with very high harvest rates relative to harvest rate at MSY, without impacting the model dynamics.

#### **4.2 Discussion and feedback on MSE development**

22. The WPM **AGREED** to the proposed reference and robustness set of OMs that gave a spread of conditions that allow for testing performance of MPs.
23. The WPM **NOTED** that the reference OM is defined as the model that includes LL CPUE 1, with SSB priors, recruitment variability, and the overfishing penalty (Model R2b). Robustness OMs include using LL CPUE 3 in place of LL CPUE 1 (Model R2a) and adding 1% effort creep (Models R3b). The WPM **AGREED** to the reference OM but **SUGGESTED** to use CPUE 1 instead of the CPUE 3 in the two robustness OMs suggested.
24. The WPM **NOTED** the additional robustness scenarios in the paper, that would provide a further wide range of conditions for testing performance of candidate MPs, including future recruitment “failure”, catchability “regimes”, trends in growth/ maturity/ natural mortality, alternative precision for CPUE, and implementation error.
25. The WPM **NOTED** that climate change scenarios are addressed by some of the robustness scenarios and other tests could be considered, as described in IOTC-2024-WPM15-INF03.

#### **4.3 Future steps and timelines**

26. The WPM **REQUESTED** that the developers present this work to experts on albacore fisheries at the WPTmT, during a special online session.
27. The **WPM** contacted experts on albacore fisheries and organized a special session for them to discuss the albacore MSE with the developers on the 19 December 2024. Any interested albacore scientist is **ENCOURAGED** to attend to this meeting.
28. The WPM **NOTED** that the next steps are to run the candidate MPs using the conditioned OMs. The initial review of performance of candidate MPs should be available for discussion at the WPM(MSE) in early 2025.
29. The WPM **NOTED** that the work on the albacore MPs is not mature enough to require a TCMP in February and, therefore, **RECOMMENDED** that an extra TCMP meeting in February 2025 is not organized.
30. The WPM **NOTED** that the current contractual arrangement (funded by an EU Grant to IOTC) with the developers is coming to an end and **SUGGESTED** the IOTC Secretariat to work on the extension of this contract so that work can be finalized. The WPM further **NOTED** that the intended plan is to further validate the OM and develop potential management procedures according to the deliverables by the end of 2024 and the next phase will involve further evaluation and comparison of the MPs in 2025.

### **5. SKIPJACK TUNA MP (RESOLUTION 24/07)**

#### **5.1 Tasks, responsibilities and timeline for running the MP as per Resolution 24/07**

31. The WPM **DISCUSSED** the timeline for the next application of the MP for skipjack in 2025. The WPM **NOTED** It is important to ensure that abundance indices for Maldivian pole-and-line and EU purse seine associated schools are produced using the methodology assumed in the Management Strategy Evaluation (MSE) simulations, if possible, with data up to and including 2024. The MP will be applied during the WPM16 for endorsement by the SC in 2025.
32. The WPM **NOTED** that in principle, the application of the MP should be straightforward but it will be necessary to agree on the who (or which team) will be responsible of running the MP in 2025, with potential assistance from the MSE developer if necessary
33. The WPM also **NOTED** the need to develop the review of consideration of Exceptional Circumstances document (starting from 2025) as required by Resolution 24/07 and **REQUEST** the WPM Chair to discuss it with the Maldivian and EU teams to find a suitable scientist to perform this analysis to be presented at WPM16. This responsibility of analysing Exceptional Circumstances is discussed further in Section 9 as it is also pertinent to the MP applications for other species.

## 6. BIGEYE TUNA MP (RESOLUTION 22/03)

### 6..1 Running the Bigeye tuna MP as per Resolution 22/03

34. The WPM **NOTED** paper [IOTC–2024–WPM15–09](#) which described the process of running the Bigeye tuna MP as per resolution 22/03, with the following summary provided by the authors:

*“The Indian Ocean Tuna Commission (IOTC) adopted a Management Procedure (MP) in 2022 to recommend the total allowable catch (TAC) for consideration by the Commission (IOTC Resolution 22/03). The bigeye tuna MP was first run by the IOTC Scientific Committee in 2022, through the Working Party on Methods and Working Party on Tropical Tunas, to derive a recommended TAC for 2024 and 2025. The adopted MP schedule requires the bigeye MP to be run again in 2024 to derive a recommended TAC for 2026, 2027 and 2028. The agreed standardisation of the joint CPUE series derived from Japanese, Korean and China, Taiwan longline fisheries, a key input to the MP, was not available at the time of this meeting. Therefore, this document provides a template that describes the key data inputs to the MP and the TAC calculation given the agreed data, which can be updated when the standardised CPUE series becomes available. The full specification of the MP is provided in Williams et al. (2022), and the consideration of exceptional circumstances is provided in Preece et al. (2024)”* (see the paper for the full summary)

### 6..2 Review of exceptional circumstances

35. The WPM **NOTED** document [IOTC-2024-WPM15-10](#), which discusses the consideration of exceptional circumstances for the Bigeye Tuna MP in 2024, with the following abstract provided by the author:

*“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”* (see the paper for the full summary)

36. The WPM **DISCUSSED** 6.1 and 6.2 together and the paragraphs below reflect the discussions and agreement of both sections
37. The WPM’s discussion focused on the Exceptional Circumstance identified by the paper, noting that the required standardised CPUE index (based on the agreed methodology as per Resolution 22/03) was not available to run the bigeye tuna MP.
38. WPM **NOTED** that the index produced in 2024 differed significantly during some time periods and in some areas from the previous index, and that it is very important to understand the reasons behind the differences. The WPM **NOTED** that differences could have occurred because the CPUE was developed using aggregated data instead of operational data (as required by Res. 22/03) if the same methodology was otherwise applied. A joint CPUE team member stated that the methodologies were basically the same.
39. The WPM also **NOTED** that in relation to the papers finding that there were no exceptional circumstances in relation to implementation of the TAC, it was not yet possible to assess catch against TAC (no catch data for 2024) but that would be possible for the first time in the 2025 EC review.
40. The WPM **NOTED** with concern that the catches in 2023 represented an increase from those in 2021 (the catch levels used to constraint the 2024-2025 TAC when BET MP was run in 2022as calculated) and was around 25,000 t. higher than the TAC set for 2024-25, emphasizing the importance of proper implementation of the 2024-2025 TACs.
41. The WPM **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 WPM **DISCUSSED** options for ensuring that the SC is able to review and participate in the running of the MP. Following this discussion, the WPM **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.
42. WPM **NOTED** that this process will ensure that the SC recommended bigeye tuna TAC is based on the MP run with the correct CPUE index input, and will allow time for the submission of TAC advice to TCMP/Commission and for the submission of TAC implementation proposal(s) by CPCs. The WPM **NOTED** a suggestion that as a very last resort, if the CPUE index could not be produced in early 2025, that the Commission could consider extending the current TAC for a total of 3 years (and then 2 years in next cycle).

### 6.3 External peer-review

43. The WPM **NOTED** that a reviewer has now been identified to undertake the external peer review of the BET MSE and that it is intended that work will be conducted and largely completed early 2025 in time for presentation and discussion at the WPM(MSE) taskforce meeting.

## 7. SWORDFISH MP (RESOLUTION 24/08)

### 7.1 Running the Swordfish MP as per Resolution 24/08

44. The WPM **NOTED** paper [IOTC-2024-WPM15-11rev2](#) which provided information on an issue detected in the MSE of the management procedure adopted for the Indian Ocean swordfish and also described the MP amendment recommended for implementation of the MP, with the following abstract provided by the author:

*“Based on the outcome of the management strategy evaluation presented at the 8th Session of the Technical Committee on Management Procedure, the commission adopted resolution 24/08 on a management procedure for swordfish in the IOTC area of competence. The chosen management procedure corresponds to the MP1 in the working document presented to the TCMP08 (Brunel and Mosqueira, 2024). The adopted MP is a data-based MP, relying on the use of a CPUE index as indicative of the recent development in stock biomass. While inspecting of the simulation results presented at TCMP08, two discrepancies (one technical and one practical) were found concerning the approach used to implement the MP for the first time in the MSE compared to the real-life. In this document, the impact of these issues on the performance of the adopted MP is evaluated. An amendment of the adopted MP is also proposed in order to restore the performance to similar levels as presented at TCMP08”*

45. The WPM **THANKED** the authors for detecting these issues in the MSE simulations and for correcting the MP to provide updated results.
46. The WPM **NOTED** that applying the adopted MP with the current values leads to a 54% probability of the stock being in the Kobe green rather than the agreed target of 60%. However, the WPM also **NOTED** that differences in other performance metrics between the adopted MP and the corrected one that was retuned to the agreed management objective were minor and that both would lead to the same TAC advice being provided for 2025 and 2026.
47. The WPM **NOTED** that only the adopted MP has been retuned with the corrected CPUE series. The WPM **AGREED** that there is no reason to think that the comparison and ranking of the alternative candidate MPs discussed by TCMP would change, as the updated CPUE data series would affect all MPs equally, maintaining the relative differences in performance among MPs.

### 7.2 Review of exceptional circumstances

48. The WPM **NOTED** document [IOTC-2024-WPM15-12](#), which discusses the consideration of exceptional circumstances for the Swordfish Tuna MP in 2024, with the following abstract provided by the author:

*“The IOTC adopted the swordfish management procedure (MP) in 2024 (IOTC 2024a, d), which is to be used to recommend the Total Allowable Catch (TAC) for this stock. The WPM15 will review running of the MP, to check technical aspects, and provide the recommended TAC for consideration at the 27th meeting of the IOTC Scientific Committee in December 2024. As part of the MP schedule, the Commission has adopted an annual review of evidence for exceptional circumstances, to check for conditions that could make the implementation of the TAC advice risky to the stock or fishery”* (see the paper for the full summary)

49. The WPM **THANKED** the authors for the thorough review of evidences for exceptional circumstances for the swordfish MP.

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50. The WPM **AGREED** that there were no exceptional circumstances for the swordfish MP relating to stock status, population dynamics or biology, fishery or fishing operations, catch data inputs or CPUE data inputs
  51. The WPM **NOTED**, however, an issue identified by the developers which WPM **AGREED** represents an exceptional circumstance. Specifically, a discrepancy in the treatment of the CPUE index in the first year of the simulations, resulted in the MP not reaching the management objective of achieving at least 60% probability of being in the Kobe green zone during 2034-2038 period. The WPM **NOTED** that correcting this issue results in an MP that does not reach the objective (i.e. achieves only 54% probability of being in the Kobe green zone). The WPM **SUGGESTED** to produce an MP that corrects the CPUE issue as well as it is retuned to achieve the management objective stipulated in Resolution 24/08
  52. The WPM **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 WPM **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). 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.
  53. Irrespective of the MP chosen by the Commission, the **WPM RECOMMENDED** that the Commission endorsed the resultant TAC of 30527 t. for swordfish for 2026-2028.
  54. The WPM **NOTED** that Res 24/08 specifies that the next swordfish stock assessment will be in 2025, while the assessment schedule for the WPB specifies that the assessment will be done in 2026. The WPM **NOTED** that assessments for both blue marlin and Indo-Pacific sailfish are scheduled for 2025 and **AGREED** that there would be no adverse effects on the MP process to postpone the swordfish stock assessment to 2026. The WPM **REQUESTED** that the WPB maintain the schedule to complete the swordfish stock assessment in 2026.
  55. The WPM **NOTED** the request from the WPB to have the opportunity to review exceptional circumstances for the swordfish MP through the presentation of a paper at the annual meeting of the WPB. The WPM **REQUESTED** that the chair of the WPB (and other relevant WPs) ensure that exceptional circumstances are on the meeting agenda and that scientists are identified prior to the meetings to prepare a paper on exceptional circumstances.

Table 1 (Table 2 of [IOTC-2025-WPM15-11\\_rev2](#)): summary of the performance of the 4 Swordfish MP runs (see list in table 1) with respect to key performance indicators (median across stock replicates, with the limits of the envelop representing 80% of the distribution in parentheses):

- **MP1\_TCMP**: MP1 run presented at TCMP08
- **MP1\_REVISIED**: MP1 run with the revised and corrected index generating function, same parameters as MP1\_TCMP
- **MP1.2**: MP1 run with the corrected index generating function and retuned to 60% of probability of being in green during 2034-2038 (new target CPUE value)
- **MP1.3**: MP1 run with the corrected index generating function and a two-year management lad and retuned 60% of probability of being in green during 2034-2038 (new target CPUE value)

MP	SB/SB <sub>MSY</sub>	P(SB>=SBMSY)	P(SB>SBLIM )	P(GREEN)	MEAN(TAC)	C/MSY	IAC(TAC)	MAX TAC DECREASE	MAX TAC INCREASE	TIMES TAC CHANGES
<b>MP1_TCMP</b>	1.55 (0.79-2.95)	1.00 (0.00-1.00)	1.00 (1.00-1.00)	0.61 (0.00-1.00)	30561.42 (22351.47-36599.21)	0.95 (0.71-1.15)	10.16 (7.55-11.11)	0.00 (-3179.74-0.00)	4845.72 (3186.14-6191.75)	4.00 (4.00-4.00)
<b>MP1_REVISIED.</b>	1.51 (0.68-2.91)	1.00 (0.00-1.00)	1.00 (1.00-1.00)	0.54 (0.00-1.00)	32002.84 (23949.50-36599.22)	0.99 (0.72-1.17)	9.68 (7.03-11.11)	-2365.66 (-3311.82-0.00)	4845.74 (2349.92-6191.75)	4.00 (4.00-4.00)
<b>MP1.2</b>	1.53 (0.70-2.91)	1.00 (0.00-1.00)	1.00 (1.00-1.00)	0.60 (0.00-1.00)	30906.28 (23270.07-36599.20)	0.97 (0.72-1.14)	9.33 (7.01-11.11)	-2714.10 (-3509.68-0.00)	4775.14 (1054.55-6191.75)	4.00 (4.00-4.00)
<b>MP1_3</b>	1.56 (0.70-2.96)	1.00 (0.00-1.00)	1.00 (1.00-1.00)	0.61 (0.00-1.00)	30500.10 (23595.75-35120.69)	0.97 (0.69-1.12)	9.25 (7.07-10.91)	-2714.10 (-3290.35-0.00)	4853.44 (3664.06-6191.75)	4.00 (4.00-4.00)

SB/SB<sub>MSY</sub>: ratio of the spawning biomass over spawning biomass corresponding to MSY (average over 2024-2038)

p(SB>=SBMSY): proportion of the years with spawning biomass larger than the spawning biomass corresponding to MSY (calculated over 2024-2038)

P(SB>SBLIM): proportion of the years with spawning biomass larger than the limit spawning biomass (calculated over 2024-2038)

p(Green): proportion of the years where the stock is in the green quadrant of the Kobe plot (calculated over the tuning period, 2034-2038)

mean(TAC): average TAC in tonnes (average over 2024-2038)

C/MSY: ratio of the annual catch over MSY (average over 2024-2038)

IAC(TAC): percentage of change between successive TACs (average, calculated every 3 years over the period 2024-2038)

MAX TAC DECREASE and MAX TAC INCREASE: largest TAC increase and decrease (in tonnes, over the period 2024-2038)

TIMES TAC CHANGES: number of times the TAC value changes (over the period 2024-2038, varies between 0 and

## 8. YELLOWFIN TUNA MSE: UPDATE

### 8..1 Future Plan

56. The WPM **NOTED** that so far there has been no progress on yellowfin tuna MSE.

## 9. GENERAL MSE ISSUES

### 9..1 Climate change scenarios in MSE

57. The WPM **NOTED** document [IOTC-2024-WPM15-INF02](#), which discusses an open-source MSE software applied to the Atlantic blue shark MSE, with the following abstract provided by the author:

*“Management Strategy Evaluation (MSE) may be perceived as a technically complex process that necessarily takes months or even years of coding and technical development time. Recent advances in open-source MSE software have substantially reduced this technical overhead. I provide a demonstration of the technical components of MSE for Atlantic Blue Shark including operating model specification, management procedure (MP, a.k.a. ‘harvest strategy’) design, MP derivatives, MP tuning, closed-loop MSE calculations, performance metrics, presentation of MSE results and exceptional circumstances protocols. This demonstration is intended to underline the relative ease, accessibility and flexibility of software designed to facilitate rapid and efficient development of MSE frameworks”.*

58. The WPM **NOTED** that the tools available now to greatly streamline the technical work required in the MP development process.
59. The WPM **NOTED** that data is poor for many shark species and that this would need to be incorporated into the MSE approach.
60. The WPM **NOTED** that accounting for any systematic changes in reporting would be crucial and that it is possible to use an uncertainty grid for operating model.
61. The WPM **NOTED** document [IOTC-2024-WPM15-INF03](#), which discusses Developing the Climate Test: Performance Metrics of Climate Robustness, with the following abstract provided by the author:

*“Operating models were developed from the 2021 stock assessment of bigeye tuna. Four types of projected climate impact were simulated: increasing natural mortality rate, and decreases in recruitment strength, somatic growth and condition factor. Defining a robustness threshold enabled the calculation of a performance metric of climate robustness that was calculated for each type of climate impact for three management procedure (MP) archetypes and two MP derivatives. Shifting the focus away from establishing defensible climate forecasts and towards climate robustness performance metrics, provided information that could support the selection of MPs accounting for climate impacts. It was not necessary to know the exact type of impact or the exact level of forecasted impact to identify an MP that clearly and consistently outperformed the rest in terms of climate robustness”*

62. The WPM **NOTED** that whilst there is acknowledgment that the potential climate impacts could cover a range of processes, there is little quantitative information in the literature on the nature of the impacts and predictions of impacts are difficult.
63. The WPM **NOTED** that it was possible to match potential impacts to processes within an assessment model and identify the direction of impact that would be of greatest risk. Potential MPs can then be tested and ranked in terms of their performance under different climate-related scenarios.
64. The WPM **NOTED** that an MSE process will need to evaluate both climate robustness with potential utilization losses.
65. The WPM **NOTED** that retrospective analyses provide an opportunity to assess predictive power and climate-robustness. It is possible to use historical observations to see how resilient MPs would have been to changes in abundance, distribution, and productivity already seen over the period of the assessment.
66. The WPM **NOTED** that if collinearity was likely, e.g., some impacts would likely occur together, then this could reduce the number of simulations to test.

## 9.2 MSE Capacity Building

67. The WPM **NOTED** document [IOTC-2024-WPM15-INF04](#), which is the MSE capacity building workshop summary report.
68. The WPM **NOTED** the MSE capacity building workshop was held in Bandos Island, Maldives, from 26 to 28, August 2024. The workshop was targeted at fishery managers in coastal countries and provided training on basic elements of the MSE process. The objective of the workshop was to increase participation in Commission discussions/decisions and allow them to prepare for discussions about trade-offs between management options. The workshop was funded through the Fisheries Sector Management in South-West Indian Ocean Region and Maldives Project, World Bank, and supported by The Pew Charitable Trusts (Pew), The Ocean Foundation, International Seafood Sustainability Foundation (ISSF), and IOTC.
69. The WPM **NOTED** that these capacity building workshops, together with a focus on simplifying workshop material, will help contribute to increased engagement from CPCs on MSE-related matters in the future.
70. The WPM **NOTED** that while no further workshops were currently planned that there would likely be value in further workshops in 2 or 3 years as the MSE process develops within the IOTC.

## 9.3 General discussion

71. The WPM **NOTED** document [IOTC-2024-WPM15-13](#), which summarises Iran's approaches and actions for promoting and developing longline tuna fishing methods, with the following abstract provided by the author:
- “Given Iran's northern and southern maritime borders, a significant portion of the country's protein consumption is derived from fisheries. Consequently, there has been a concerted effort to enhance the quality of fishery products and align fishing practices with the principles of responsible fishing, adhering to the guidelines and mandates of organizations such as the Indian Ocean Tuna Commission. This includes the adoption of modern fishing techniques like longline fishing”* (see the paper for the full summary)
72. The WPM **NOTED** that the author is absent from the meeting and therefore the paper is not presented.
73. The WPM **NOTED** document [IOTC-2024-WPM15-14](#), which describes a trend analysis of tropical tuna production in Sri Lanka, with the following abstract provided by the author:
- “Tropical tuna in Sri Lanka is one of the important sources of income for the country. Hence, it is necessary to monitor the trend of the production to ensure continuous and sustainable utilization of the resources. In this study, the production trend analysis was performed for the three tropical tuna species, yellowfin tuna (*Thunnus albacares* (YFT)), big eye tuna (*Thunnus obesus* (BET)), and skip jack tuna (*Katsuwonus pelamis* (SKJ)), using the data obtained from the IOTC database from the years 2000 to 2023. The total Sri Lankan tropical tuna production contribution for total production in the Indian Ocean was 8.5%(YFT), 2.9% (BET) and 10.7% (SKJ). The production trends of the three tropical species were analyzed using the Man-Kendal trend test and Sen's innovative trend analysis. There, local production was divided into two categories: production originated from the exclusive economic zone (EEZ) and beyond the exclusive economic zone (BEEZ). The yellow fin tuna production shows a significant positive trend in EEZ ( $\tau=0.319$ ,  $p<0.05$ ) for BEEZ. The Big Eye tuna production shows a significant positive trend in both regions ( $\tau=0.304$  for EEZ and  $\tau=0.636$  for BEEZ,  $p<0.05$ ) while an insignificant negative trend ( $\tau= - 0.127$ ,  $p>0.05$ ) in BEEZ. Also, the analysis was conducted for total Sri Lankan production and production in the Indian Ocean region for three tropical species. An insignificant increase trend was obtained for yellowfin tuna production in Sri Lanka ( $\tau=0.116$ ,  $p>0.05$ ) and the Indian Ocean region ( $\tau=0.181$ ,  $p>0.05$ ).”* (see the paper for the full summary)
74. The WPM **NOTED** that the author explained how the analysis separates production in EEZ from "BEEZ" (international waters). The separation is based on the type of fishing gear used, such as gillnets versus offshore gillnets and longline versus offshore longline, as reported to the Secretariat.
75. The WPM also **NOTED** that many Sri Lankan fishers rely heavily on catching skipjack tuna, the primary species caught. It was noted that the implementation of domestic management measures on the gillnet fishery may have contributed to the recent reduction in SKJ production.
76. The WPM **NOTED** document [IOTC-2024-WPM15-15](#), which summarises the stock assessment for pelagic fish in the Andaman Sea Thailand, with the following abstract provided by the author:

*“The Stock assessment is an important method to indicate the status of resources for restoration and conservation. There are many types of fish stock assessment. Most of them use fishing statistics, which are time series data to indicate the status of fish resource utilization. The maximum sustainable production (MSY) value is determined, which is used as data to determine sustainable resource management measures. For ease of management, Thailand divides aquatic animals into 3 groups: demersal fish, Pelagic fish, and anchovies. The assessment is conducted annually using the Fox surplus production model to estimate the MSY of species groups. The MSY of pelagic fish group in Andaman Sea in 2023 was 125,287 tons at the fishing effort (Fmsy) of 89,664 days. While the catch was 83,023 tons with the fishing effort of 47,997 days. Results showed that pelagic fishing is currently being conducted at fishing effort levels consistent with Fmsy. At the same time, the resource status is assessed using the length-based Tomson and bells model to be monitoring the status of each fish species. This study focuses on economically important pelagic fish and neritic tuna”*

77. The WPM **THANKED** the author for the introduction of the assessment methods for the pelagic species within Thailand waters, which may be useful for other CPCs wishing to apply such methods to the assess their domestic fisheries.

#### **9..4 Feedback on MSE and MP communication to TCMP**

78. The WPM **NOTED** that in 2023 the Commission endorsed the creation of a small working group to discuss and agree on ways to improve communication between scientists and managers. The Small Working Group on MSE presentation took place on 1 February 2024. The group discussions focused on streamlining presentations, improving engagement with managers, and suggested alternative options for capacity building to enhance managers understanding of MSE processes. This included how to develop presentations and documents on species MSE outcomes to facilitate communication and decision-making. The WPM also **NOTED** that the small working group also discussed capacity building possibilities.
79. The WPM also **NOTED** an interest for this working group to continue their meeting in 2025 to further discuss enhancing communication between the scientists and managers.

#### **9..5 Running MPs and traceability**

80. The WPM **NOTED** that there were different tasks involved in an MP application, e.g., (1) preparing input data; (2) assess whether any exceptional circumstances have been triggered; and (3) running the MP.
81. The WPM **NOTED** that as the number of adopted MPs continued to increase, performing those tasks became increasing complex. As such it was important to ensure that roles and accountabilities were clear to CPCs.
82. With regard to the review of exceptional circumstances, The WPM **NOTED** the challenge comes from both finding the necessary resources and experts and the occasional lack of data needed for these analyses. For instance, the WPTmT meeting is run only every three years, which makes it hard to gather enough information for an annual review of exceptional circumstances and would require the support of WPM to perform the review between its meetings.
83. The WPM **SUGGESTED** that CPCs would need to take the lead on the assessment of exceptional circumstances as this task generally required scientific analysis. The Secretariat would liaise with the Working Party Chairs to request this item is included in the annual agenda of the WP and inform CPCs in advance to ensure that this work could be assigned and undertaken.
84. The WPM **AGREED** that while it's ideal to have a lead in the analysis of exceptional circumstances, supported by a detailed paper for discussion at the relevant Working Party, any scientist can put forward evidence or analysis for consideration. The Species Working Party and Working Party on Method can then review and synthesis available information.
85. The WPM **AGREED** that the Secretariat should run the MPs in the future after a transition period between the developers and the secretariat (e.g., first year of running the MP could be assisted by the developers).
86. The WPM **UNERLINED** that there is a need to ensure that any code and input files used for developing MPs is housed internally on an accessible platform, so it is available to other users and not lost when developers move on to other tasks. The **WPM NOTED** that ICES uses a Transparency and Assessment Framework (TAF) which is a useful frontend to direct users to the locations of relevant documents and code (e.g. Github repositories) that enable users to re-run assessments and other analyses, but that a much smaller system would be needed for the IOTC. The **WPM NOTED** that most important information to be curated would be the input files, executables,



and control files (not the large volume of output files), and **RECOMMENDED** that the Commission ensure that the IOTC Secretariat is provided with the necessary resources to manage the curation of this information

## 10. CPUE STANDARDISATION

### 10.1 Update on the development of the joint CPUE indices for 2024/2025.

87. The WPM **NOTED** that the Joint CPUE working group is scheduling a workshop in early February 2025. The plan is to develop CPUE indices for albacore and bigeye tuna, both due for assessment in 2025. For bigeye tuna, an index will also be developed using the specifications in Resolution 22/03 for input for bigeye tuna MP (see Section 6 for the detailed plan).

### 10.2 Advice on CPUE standardisation

88. The WPM **NOTED** document [IOTC-2024-WPM15-INF01](#), which presented a VAST model applied to the yellowfin geo-referenced catch effort data hold at the IOTC Secretariat, with the following abstract provided by the author:

*“Spatial-temporal models of Indian Ocean yellowfin longline (aggregated) catch and effort data were implemented using VAST software. The models were developed to investigate seasonal and annual trends in the spatial distribution of yellowfin. Regional trends in the quarterly indices derived from the VAST models were similar to comparable CPUE indices derived using a GLM approach. The VAST models predicted seasonal patterns in the distribution of yellowfin, probably related to the prevailing seasonal oceanographic conditions associated with the Northeast and Southwest Monsoons. The models also estimated a general southwestern shift in the distribution of yellowfin tuna since 2010”.*

89. The WPM **NOTED** that the VAST models have the potential to provide alternative regional scaling factors for inclusion in the yellowfin stock assessment. The estimates of relative abundance of yellowfin among regions are broadly comparable with the current regional scaling factors in the current assessment.

90. The WPM **NOTED** that there are limited longline catch and effort data available from the western tropical region and Arabian Sea from the last 15-20 years. Predictions of yellowfin abundance from VAST for those areas differed substantially depending on whether or not spatial temporal variation (random effects) was being estimated by the model. This highlights the considerable uncertainty in the regional longline CPUE indices incorporating this area. A single model test indicated that the VAST model was able to provide good predictions of abundance in the southwestern region. Further evaluation of the accuracy of the VAST model predictions should be conducted.

91. The WPM expressed appreciation for the comprehensive exploration analysis presented for yellowfin tuna. The WPM **ACKNOWLEDGED** that the data used were sourced from the IOTC website and thus did not include vessel, hook number between floats, or size information.

92. The WPM **NOTED** that, based on the exercises using publicly available data for yellowfin tuna, spatial models could produce standardized CPUE estimates comparable to those derived from standard GLM approaches in regions 1, 2, and 4. However, the WPM highlighted several advantages of the spatial model, including: its potential to address gaps in spatial coverage during recent periods for certain fisheries; its ability to extrapolate missing density data due to piracy effects; and its capacity to produce comparable CPUE indices without requiring regional scaling factors, unlike traditional region-specific analyses

93. The WPM further **DISCUSSED** that, while the use of random effects in the model effectively captures temporal changes in spatial distribution and conveniently aligns with the data, it does not provide insight into the underlying drivers of these changes, which may likely be environmental. To address this limitation, as seen in other fisheries studies, incorporating environmental indicators could help explain inter-seasonal and inter-annual changes in yellowfin tuna distribution, potentially aiding in forecasting future patterns affected by climate change. It was also pointed out that the response to environmental indicators might exhibit seasonal variability.

94. The WPM **NOTED** that the VAST model was designed for analysing high-resolution data. However, the Joint CPUE Working Group has faced challenges such as convergence issues and very long running times when applying the VAST model to operational-level data. Using aggregated data can help solve some of these problems, but it also risks losing detailed information. Therefore, it's important and useful to assess how much information might be lost and any potential bias caused by various levels of data aggregation. This will help find a good balance between accuracy and efficiency.

95. The WPM **NOTED** the suggestion of using a functional form on SST. This approach allows for flexibility since the effect of SST might not be linear and could vary across different regions.
96. The WPM **NOTED** out that the model didn't extrapolate high population density for areas affected by piracy, unlike other regions. This is surprising given piracy's clear impact on fishing activities. This warrants further investigation, e.g., checking how other factors in the area could be influencing the results.
97. The WPM **NOTED** that the regional weights estimated by the model differ somewhat from those estimated by the previous GLM model. It would be useful to compare these estimates with the regional biomass distribution from the assessment model

### 10.3 Future workplan

98. The WPM **NOTED** the recommendation from WPM14 to hold a cross-cutting CPUE standardisation workshop focusing on billfish amongst the involved longline fleets. The WPM **NOTED** that there has been some keen interest in having focused discussions on standardising methods and processes for the billfish species but there are logistical challenges in scheduling this workshop before the WPB meeting. Additionally, arranging data sharing and access agreements poses difficulties. The WPM further **NOTED** that the WPB is exploring different ways to move forward, including the option of data preparation meetings.

## 11. STOCK ASSESSMENT AND STOCK STATUS GUIDANCE (CHAIRPERSON)

### 11.1 Review the approach used to provide stock status and management advice relative to reference points

99. The WPM **NOTED** a presentation on a proposed method to set projections and update benchmark, with the following summary provided by the author:

*"In the presentation, the reasons behind the need to update the method currently used in the IOTC were presented, with data from the Indian Ocean yellowfin assessment. These include the identification of recent recruitment deviate trends in stock assessments (see Merino et al., 2022) and the inability of the model to fit the decrease in the Joint LL CPUE in the period when longline catch peaked (1980-1990) and the stability on the abundance index when the purse seine catches increased to much higher levels (average 400 tons in the last 20 years). The model uses the decrease in CPUE to scale the recruitment at pristine state (R0) and benchmarks (BMSY, MSY) and the recent catch increase is fitted by the with increased recruitment deviates in recent years. The main hypothesis is that this recruitment deviates do not represent an anomaly or process error of the system but they are underestimated productivity of the stock. For this reason, it is proposed to scale up the stock-recruitment relationship using the average rec devs of the last 10 years as a scaling factor for the projections. The same scaling factor is proposed to level-up the management benchmarks (SBMSY, SBF=0 and MSY)"*

100. The WPM **NOTED** that questions were raised about the factors driving recruitment in the model, specifically whether CPUE or other elements could play a significant role. It was clarified that recent high catches could not be supported without above-average recruitment, as indicated by the model results.
101. The WPM **NOTED** also an inquiry into how much the size data influences recruitment, including smaller fish size data that became an increasingly significant input with the growth of the purse seine fishery. Early analyses suggested that while size data from some fleets may affect estimates of recruitment strength or variability, they do not seem to be the main cause of observed trends in recruitment.
102. The WPM **NOTED** that concerns on the estimates of low productivity (or MSY) in some of the models used to develop management advice in 2021, which appeared to be linked to specific combinations of natural mortality and growth. Additionally, there seems to be some evidence of incompatible dynamics, where large decreases in abundance are associated with lower catches in some years. These issues might lead to overestimations of recruitment to compensate for recent high catches. It was noted that increasing effort creep in longline CPUE wouldn't solve this issue, nor would the use of a higher steepness value (one-third of the models have already used a steepness value of 0.9). It was suggested to use a simple surplus model as a method to assess if there is enough data over a long period to reliably estimate productivity or MSY.
103. The WPM **NOTED** that the trend in recruitment is evident both in the total number of recruits and their regional distribution. It was noted there has been some recent progress in developing criteria for determine if a regime shift has occurred, which could significantly affect stock assessment advice. It was noted that suggestion to use



recent average recruitment for both projection and MSY calculation does not necessarily indicate a regime shift, which would require more evidence, such as the impact of climate change. The goal is to maintain consistency in projections and calculations of benchmarks for the recent period (10 years) and short-term forecast (up to 10 years).

104. The WPM **SUGGESTED** that separating short-term and long-term projections might be beneficial, especially for the MSE. Using recent average recruitment makes sense for short-term forecasts but may not be justified for long-term projection (which are often used in the operating models).
105. The WPM **NOTED** the suggestion to incorporate recent recruitment information (i.e., recruitment deviations) in the projections and **AGREED** that it deserves further consideration. However, the possibility that the recruitment trend could be an artifact of the model configuration, rather than an actual temporal trend in productivity, cannot be ruled out. Therefore, the WPM **SUGGESTED** further investigation into this matter.
106. The WPM **NOTED** document [IOTC-2024-WPM15-INFO5](#), which presented the method and application of the Bayesian Length Interval Catch Curve Model (BLICC).
107. The WPM **NOTED** that this method uses length-frequency data (similar to LBSPR with variable growth) and fits a catch curve model through Bayesian estimation using MCMC in Stan. It allows for flexible selectivity functions and accommodates multiple gears. The method has been implemented in the R package “fishblicc” (<https://github.com/PaulAHMedley/fishblicc>). The presentation explained the model, presented some simulation testing results and an illustrative example applied to Indian Ocean yellowfin tuna. The package performs similarly to LBSPR with logistic selectivity, but is able to estimate different selectivities to different gears demonstrated with the yellowfin assessment.
108. The WPM **NOTED** that the method is potentially useful for neritic species assessed under the WPNT, where the “catch-only method” is currently the main stock assessment approach. However, the catch-only method requires high-quality time series of catch data, which may be lacking for some species. Therefore, it is useful to evaluate whether the signals from these two different methods are consistent.
109. The WPM also **NOTED** that a similar and commonly used method, LBSPR, has served as a complement to the catch-only method but has limitations, such as assuming only logistic selectivity for a single gear. The fishblicc method offers more flexibility, making it a promising option for neritic tunas in testing alternative selectivity models and scenarios.
110. The WPM raised the question of whether the method can be extended to accommodate growth models other than the von Bertalanffy curve. This extension would be feasible if numerical integration for likelihood calculation remains viable. The WPM further **DISCUSSED** the possibility of using length compositions over multiple years to gather information on fishing intensities over time and encouraged the author to explore the feasibility of this approach. The author indicated that development was ongoing and that a finished version with this capability should be available in 2025.

## 12. WPM PROGRAM OF WORK

### 12.1 Revision of the timeline of the MSE development

111. The WPM **NOTED** that the most recent timeline for MSE development was provided in the draft WPM Programme of Work ([IOTC–2024–WPM15–07](#)) that will need to be updated. The WPM discussed and reviewed the timeline for MSE development and the updated schedule of MSE work is provided in [Appendix IV](#) (as part of the WPM Program of Work)
112. The WPM **NOTED** that the updated schedule of MSE work needs to be reviewed and endorsed by the SC in 2024 and the Commission in 2025.

### 12.2 Revision of the WPM Program of work (2025–2029)

113. The WPM **NOTED** paper [IOTC–2024–WPM15–07](#) presenting the draft WPM Programme of Work (2025–2029).
114. The WPM **RECALLED** that the SC, at its 17<sup>th</sup> Session, made the following request to its working parties:

*“The SC REQUESTED that during the 2015 Working Party meetings, each group not only develop a Draft Program of Work for the next five years containing low, medium and high priority projects, but that all High Priority projects are ranked. The intention is that the SC would then be able to review the rankings and develop*

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*a consolidated list of the highest priority projects to meet the needs of the Commission. Where possible, budget estimates should be determined, as well as the identification of potential funding sources.” (SC17, Para. 178)*

115. The WPM **REQUESTED** that the Chairperson and Vice-Chairperson of the WPM, in consultation with the IOTC Secretariat, develop Terms of Reference (ToR) for each of the projects detailed on the WPM Programme of Work (2025–2029) that are yet to be funded, for circulation to potential funding bodies.
116. The WPM **RECOMMENDED** that the Scientific Committee consider and endorse the WPM Programme of Work (2025–2029), as provided in [Appendix IV](#).
117. The WPM reviewed the progress of the MSE work conducted to date, and subject to the comments held in this report, endorsed the MSE conducted thus far and **REQUESTED** additional work to address the comments made.

### **13. OTHER BUSINESS**

#### **13..1 Date and place of the 16th and 17th sessions of the WPM**

118. The WPM **RECOMMENDED** the SC consider mid-late October 2025 as a preferred time period to hold the WPM16. As usual it was also **AGREED** that this meeting should continue to be held back-to-back with the WPTT. The Secretariat will continue to liaise with CPCs to determine their interest in hosting these meetings in the future as the SC is encouraging a return to physical meetings since 2023.
119. The WPM also **NOTED** the MSE task force meeting to be held in 2025 should continue to take place, however, considering the contents and related MSE work, the WPM **AGREED** to hold it online for 2 days (24-25 February, 2025). The WPM **AGREED** that this task force meeting is crucial for providing technical feedback to the TCMP.

#### **13..2 Review of the draft, and adoption of the Report of the 15th Session of the WPM**

120. The WPM **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPM15, provided in [Appendix V](#).
121. The WPM **THANKED** the Chair for his excellent running of the meeting as well as his contributions to the intersessional work conducted to expedite the MSE of the Indian Ocean stocks.
122. The Chair **THANKED** all the participants for their dedicated discussion during the session. The Chair also expressed his appreciation to the rapporteurs and Secretariat for their hard work.
123. The report of the 15<sup>th</sup> Session of the Working Party on Methods (IOTC–2024–WPM15–R) was **ADOPTED** via correspondence.

**APPENDIX I**  
**LIST OF PARTICIPANTS**

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**APPENDIX II**  
**AGENDA FOR THE 15<sup>TH</sup> WORKING PARTY ON METHODS**

**Date:** 24-26 October 2024

**Location:** Hybrid

**Venue:** Berjaya Beau Vallon Hotel, Seychelles

**Time:** 09:00 – 17:00 daily

**Chairperson:** Dr Hilario Murua; **Vice-Chairperson:** Dr Ann Preece

- 1. OPENING OF THE MEETING** (Chairperson)
- 2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION** (Chairperson)
- 3. THE IOTC PROCESS: OUTCOMES, UPDATES AND PROGRESS**
  - 13.1. Outcomes of the 26th Session of the Scientific Committee (IOTC Secretariat)
  - 13.2. Outcomes of the 8th Session of the Technical Committee on Management Procedures (IOTC Secretariat)
  - 13.3. Outcomes of the 28th Session of the Commission (IOTC Secretariat)
  - 13.4. Review of Conservation and Management Measures relevant to the WPM (IOTC Secretariat)
  - 13.5. Progress on the recommendations of WPM14 (IOTC Secretariat and Chairperson)
- 4. ALBACORE MSE: UPDATE** (Developers)
  - 13.1. Review of OM and candidate MP development
  - 13.2. Discussion and feedback on MSE development
  - 13.3. Future workplan
- 5. SKIPJACK TUNA MP (Resolution 24/07)**
  - 13.1. Tasks, responsibilities and timeline for running the MP as per Resolution 24/07
- 6. BIGEYE TUNA MP (Resolution 22/03)**
  - 13.1. Running the Bigeye MP as per Resolution 22/03
  - 13.2. Review of exceptional circumstances
  - 13.3. External peer-review
- 7. SWORDFISH MP (Resolution 24/08)**
  - 13.1. Tasks, responsibilities, and timeline for running the MP
  - 13.2. Running the Swordfish MP as per Resolution 24/08
  - 13.3. Review of Exceptional Circumstances
- 8. YELLOWFIN TUNA MSE: UPDATE** (Developers)
  - 13.1. Future workplan
- 9. GENERAL MSE ISSUES** (Chairperson and Vice-chairperson)
  - 13.1. Climate change scenarios in MSE
  - 13.2. MSE capacity building
  - 13.3. General discussion (e.g. catch uncertainty)
  - 13.4. Feedback on MSE and MP communication to TCMP
- 10. CPUE STANDARDISATION** (Chairperson)
  - 13.1. Update on the development of the joint CPUE indices for 2025/2026.

- 13.2. Advice on CPUE standardisation
- 13.3. Future workplan

**11. STOCK ASSESSMENT and STOCK STATUS GUIDANCE (Chairperson)**

- 13.1. Review the approach used to provide stock status and management advice relative to reference points

**12. WPM PROGRAM OF WORK (Chairperson and IOTC Secretariat)**

- 13.1. Revision of the timeline of the MSE development
- 13.2. Revision of the WPM Program of Work (2025–2029) and research priorities

**13. OTHER BUSINESS**

- 13.1. Date and place of the 16<sup>th</sup> and 17<sup>th</sup> Sessions of the WPM (Chairperson and IOTC Secretariat)
- 13.2. Development of priorities for Invited Expert(s) at the next WPM meeting (Chairperson)
- 13.3. Review of the draft, and adoption of the Report of the 15<sup>th</sup> Session of the WPM (Chairperson)

**APPENDIX III**  
**LIST OF DOCUMENTS FOR THE 15<sup>TH</sup> WORKING PARTY ON METHODS**

Document	Title
IOTC-2024-WPM15-01a	Agenda of the 15th Working Party on Methods
IOTC-2024-WPM15-01b	Annotated agenda of the 15th Working Party on Methods
IOTC-2024-WPM15-02	List of documents of the 15th Working Party on Methods
IOTC-2024-WPM15-03	Outcomes of the 26 <sup>th</sup> Session of the Scientific Committee (IOTC Secretariat)
IOTC-2024-WPM15-04	Outcomes of the 28 <sup>th</sup> Session of the Commission (IOTC Secretariat)
IOTC-2024-WPM15-05	Review of Conservation and Management Measures relating to methods (IOTC Secretariat)
IOTC-2024-WPM15-06	Progress made on the recommendations and requests of WPM14 and SC26 (IOTC Secretariat)
IOTC-2024-WPM15-07	Revision of the WPM Program of Work (2025-2029) (IOTC Secretariat & Chairpersons)
IOTC-2024-WPM15-08	Conditioning of Indian Ocean albacore OMs using the ABC approach. (Hillary R, Mosqueira I)
IOTC-2024-WPM15-09	Running the IOTC bigeye tuna management procedure for 2024 (Williams A, Hilary R, Preece A)
IOTC-2024-WPM15-10	Consideration of exceptional circumstances for the IOTC bigeye tuna management procedure for 2024 (Preece A, Williams A)
IOTC-2024-WPM15-11	Application of the management procedure for Indian Ocean swordfish (Brunel T, Mosqueira I)
IOTC-2024-WPM15-12	Consideration of exceptional circumstances for the IOTC Swordfish tuna management procedure for 2024 (Bromhead D, Preece A, Williams A, Brunel T, Mosqueira I)
IOTC-2024-WPM15-13	Iran's Approaches and Actions for Promoting and Developing Longline Tuna Fishing Methods (Joint Collaboration with UNIDO) (Roshan J)
IOTC-2024-WPM15-14	Trend analysis of tropical tuna production in Sri Lanka (Ayeshya H, Jayasinghe R)
IOTC-2024-WPM15-15	Stock Assessment for Pelagic Fish in the Andaman Sea Thailand (Prasertsook O)
IOTC-2024-WPM15-INF01	Exploratory analysis of yellowfin tuna longline catch and effort data using VAST (Langley A)
IOTC-2024-WPM15-INF02	Technical MSE Demonstration for Atlantic Blue Shark (Carruthers T)
IOTC-2024-WPM15-INF03	Developing the Climate Test: Performance Metrics of Climate Robustness (Carruthers T)
IOTC-2024-WPM15-INF04	MSE Capacity Building Workshop Summary Report
IOTC-2024-WPM15-INF05	A Bayesian length-based catch curve for multigear fisheries

**APPENDIX IV**  
**WORKING PARTY ON METHODS PROGRAM OF WORK (2025–2029)**

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

**Table 1.** Priority topics for obtaining the information necessary to deliver the necessary advice to the Commission. Resolution 15/10 elements have been incorporated as required by the Commission.

Topic	Sub-topic and project	Timing				
		2025	2026	2027	2028	2029
1. Management Strategy Evaluation	Continuation of Management Strategy Evaluation for Albacore and Yellowfin tunas as well as Blue shark					
MP Implementation	Monitoring the implementation of SKJ, BET and SWO Management Procedures					
	Peer review of SKJ/SWO MSE/MPs as required by MP resolutions					
<b>Future Research Requirements (not in order of priority)</b>						
	1.1 Albacore					
Management Strategy Evaluation	1.1.1 Revision of Operating Models based on WPALB, WPM and SC feedback, including possible robustness tests					
	1.1.2 Implementation of simulation runs and presentation of results at the TCMP					



<p>1.1.3 Revision and evaluation of new set of Management Procedures after presentation of MP runs to TCMP and Commission (as needed)</p>					
<p>1.2 Skipjack tuna</p>					
<p>1.2.1 Run MP using the catch and CPUE standardisation input data, consider exceptional circumstances*, and provide the TAC advice</p>					
<p>1.2.2 Presentation of MP application and exceptional circumstances* and resulting TAC to the TCMP and Commission meeting for adoption of the TAC</p>					
<p>1.2.3 Stock assessment to provide information on stock status</p>					
<p>1.2.4 External peer review (2026-2028)</p>					
<p>1.3 Bigeye tuna</p>					
<p>1.3.1 Run MP using the catch and CPUE standardisation input data, consider exceptional circumstances*, and provide the TAC advice</p>					
<p>1.3.2 External peer review</p>					
<p>1.3.3 Presentation of MP application and exceptional circumstances* and resulting TAC to the TCMP and Commission meeting for adoption of the TAC</p>					
<p>1.3.4 Stock assessment to provide information on stock status</p>					
<p>1.4 Yellowfin tuna</p>					
<p>1.4.1 Update OM &amp; present preliminary MP results to TCMP, WPTT/WPM review of new OM</p>					

<p>1.4.2 Present revised MP results to TCMP; iteratively update development if required)</p> <p>1.4.3 additional iterations if required</p>					
<p>1.5 Swordfish</p> <p>1.5.1 Run MP using the catch and CPUE standardisation input data, consider exceptional circumstances*, and provide the TAC advice</p> <p>1.5.2 Presentation of MP application and exceptional circumstances* and resulting TAC to the TCMP and Commission meeting for adoption of the TAC</p> <p>1.5.3 Stock assessment to provide information on stock status Stock assessment to provide information on stock status</p> <p>1.5.4 External peer review</p>					
<p>Stock status guidance and reference points.</p>	<p>Review IOTC stock status characterization against reference points and the framework for the provision of management advice (Resolution 15/10) to address the TORs of ad hoc reference point WG.</p>				
<p>CKMR pilot project</p>	<p>Implementation of a CKMR pilot project for Indian Ocean yellowfin tuna to evaluate the logistics and feasibility of sampling, and levels of cross contamination of DNA.</p>				

Capacity Building	Ongoing development of tools, materials and courses to continue Capacity Building for increasing participation in the MSE process and develop improved MSE communication to fishery managers.				
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\* Exceptional Circumstances should be reviewed every year at each WP and WPM.

**SCHEDULE OF WORK FOR THE DEVELOPMENT OF MANAGEMENT PROCEDURES FOR KEY SPECIES IN THE IOTC AREA**

*A more detailed explanation of the roles of the Working Parties (WPs), Scientific Committee (SC), Technical Committee on Management Procedures (TCMP) and the Commission are provided below*

<b>Year</b>	<b>Albacore</b>	<b>Skipjack</b>	<b>Yellowfin</b>	<b>Bigeye</b>	<b>Swordfish</b>
<b>2024</b>	<p><b>WPs/SC:</b> Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.</p>	<p><b>WPs/SC:</b></p>	<p><b>WPs/SC:</b> Consider recommendations from the Commission and consider outcomes of the 2024 Yellowfin assessment. Discuss and agree on a plan for further development of MSE and candidate MPs.</p>	<p><b>WPs/SC:</b> Run BET MP and Review Exceptional Circumstances and agree in any corrective action, if needed.</p> <p>Provide TAC advice to the TCMP and Commission for 2026-2028.</p>	<p><b>WPs/SC:</b> Run SWO MP and Review Exceptional Circumstances and agree in any corrective action, if needed.</p> <p>Provide TAC advice to the TCMP and Commission for 2026-2028.</p>
<b>2025</b>	<p><b>TCMP:</b> Provide advice to Commission on elements of OMs and, if possible, candidate MPs, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.</p> <p><b>Commission:</b> Consider work and advice from subsidiary bodies and provide direction to the WPs/SC on the need to undertake further MSE of candidate or alternative MPs.</p>	<p><b>TCMP:</b></p> <p><b>Commission:</b></p>	<p><b>TCMP:</b> Provide advice to Commission on elements of OMs and, if possible, candidate MPs, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.</p> <p><b>Commission:</b> Consider work and advice from subsidiary bodies and provide direction to the WPs/SC on the need to undertake further MSE.</p>	<p><b>TCMP:</b> Provide advice to the Commission on BET TAC for 2026-2028</p> <p><b>Commission:</b> Adopt the TAC for 2026-2028</p>	<p><b>TCMP:</b> Provide advice to the Commission on SWO TAC for 2026-2028</p> <p><b>Commission:</b> Adopt the TAC for 2026-2028</p>

	<p><b>WPs/SC:</b> Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.</p>	<p><b>WPs/SC:</b> Run the SKJ MP and Review Exceptional Circumstances.  Provide advice to the Commission on SKJ TAC for 2027-2029</p>	<p><b>WPs/SC:</b> Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.</p>	<p><b>WPs/SC:</b> Consider outcomes of BET MSE review and provide advice to TCMP/Commission. Stock Assessment to monitor MP implementation Review Exceptional Circumstances</p>	<p><b>WPs/SC:</b> Review Exceptional Circumstances</p>
2026	<p><b>TCMP:</b> Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions for an MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.</p> <p><b>Commission:</b> Consider work and advice from subsidiary bodies. Decision and adoption of an MP.</p> <p><b>WPs/SC:</b> Consider recommendations from the Commission</p>	<p><b>TCMP:</b> Provide advice to the Commission on SKJ TAC for 2027-2029</p> <p><b>Commission:</b> Adopt the TAC for 2027-2029</p> <p><b>WPs/SC:</b> Stock Assessment to monitor MP implementation Review Exceptional Circumstances</p>	<p><b>TCMP:</b> Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions for an MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.</p> <p><b>Commission:</b> Consider work and advice from subsidiary bodies and provide direction to the WPs/SC on the need to undertake further MSE of candidate or alternative MPs.</p> <p><b>WPs/SC:</b> Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.</p>	<p><b>TCMP:</b> Provide advice to Commission on the outcomes of the BET MSE peer-review</p> <p><b>Commission:</b> Consider advice from subsidiary bodies on the outcomes of the BET MSE review and provide direction to WP/SC, if required.</p> <p><b>WPs/SC:</b> Consider recommendations from the Commission (if any). Review Exceptional Circumstances</p>	<p><b>TCMP:</b></p> <p><b>Commission:</b></p> <p><b>WPs/SC:</b> Stock Assessment to monitor MP implementation  Review Exceptional Circumstances</p>
2027	<p><b>TCMP:</b></p>	<p><b>TCMP:</b></p>	<p><b>TCMP:</b> Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions</p>	<p><b>TCMP:</b></p>	<p><b>TCMP:</b></p>

	<p><b>Commission:</b></p>	<p><b>Commission:</b></p>	<p>for an MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.</p> <p><b>Commission:</b> Consider work and advice from subsidiary bodies. Decision and adoption of an MP.</p>	<p><b>Commission:</b></p>	<p><b>Commission:</b></p>
	<p><b>WPs/SC:</b> Review Exceptional Circumstances</p>	<p><b>WPs/SC:</b> Review Exceptional Circumstances</p>	<p><b>WPs/SC:</b> Consider recommendations from the Commission</p>	<p><b>WPs/SC:</b> Review Exceptional Circumstances. Run BET MP and provide TAC advice to TCMP and Commission for 2029-2031.</p>	<p><b>WPs/SC:</b> Review Exceptional Circumstances Run SWO MP and provide TAC advice to TCMP and Commission for 2029-2031.</p>

## APPENDIX V

### CONSOLIDATED RECOMMENDATIONS OF THE 15<sup>TH</sup> SESSION OF THE WORKING PARTY ON METHODS

**Note: Appendix references refer to the Report of the 15<sup>th</sup> Session of the Working Party on Methods (IOTC-2024-WPM15-R)**

#### **Review of intersessional meetings related to the IOTC MSE process**

WPM15.01 (Para 14): The WPM **THANKED** the participants of the Working Party on Methods Management Strategy Evaluation Task Force meeting for their informative discussions and input on the technical aspects of MSE and related topics. The WPM **NOTED** that the output of this meeting remains very important to the WPM as it provides an informal forum for the highly technical discussions necessary to advance the MSE process in IOTC for which there is insufficient time during the WPM meeting. The WPM further **RECOMMENDED** that the SC endorse this meeting being included in the schedule of meetings for 2025.

#### **Albacore MSE: Update**

WPM15.02 (Para 29): The WPM **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.

#### **Bigeye tuna MP (Resolution 22/03)**

WPM15.03 (Para 41): The WPM **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 WPM **DISCUSSED** options for ensuring that the SC is able to review and participate in the running of the MP. Following this discussion, the WPM **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

#### **Swordfish MP (Resolution 24/08)**

WPM15.04 (Para 52): The WPM **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 WPM **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). 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.

WPM15.05 (Para 53): Irrespective of the MP chosen by the Commission, the **WPM RECOMMENDED** that the Commission endorsed the resultant TAC of 30527 t. for swordfish for 2026-2028.

#### **MSE General**

WPM15.06 (Para 86): The WPM underlined that there is a need to ensure that any code and input files used for developing MPs is housed internally on an accessible platform, so it is available to other users and not lost

when developers move on to other tasks. The WPM **NOTED** that ICES uses a Transparency and Assessment Framework (TAF) which is a useful frontend to direct users to the locations of relevant documents and code (e.g. Github repositories) that enable users to re-run assessments and other analyses, but that a much smaller system would be needed for the IOTC. The WPM **NOTED** that the most important information to be curated would be the input files, executables, and control files (not the large volume of output files), and **RECOMMENDED** that the Commission ensure that the IOTC Secretariat is provided with the necessary resources to manage the curation of this information

***Revision of the WPM Program of work (2025–2029)***

WPM15.07 (Para 116): The WPM **RECOMMENDED** that the Scientific Committee consider and endorse the WPM Programme of Work (2025–2029), as provided in [Appendix IV](#).

***Date and place of the 16th and 17th sessions of the WPM***

WPM15.08 (Para 118): The WPM **RECOMMENDED** the SC consider mid-late October 2025 as a preferred time period to hold the WPM16. As usual it was also **AGREED** that this meeting should continue to be held back-to-back with the WPTT. The Secretariat will continue to liaise with CPCs to determine their interest in hosting these meetings in the future as the SC is encouraging a return to physical meetings since 2023.

***Review of the draft, and adoption of the Report of the 15th Session of the WPM***

WPM15.09 (Para 120): The WPM **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPM15, provided in [Appendix V](#).