

# Report of the 13<sup>th</sup> Session of the IOTC Working Party on Methods

---

Online, 19 - 21 October 2022

---

**DISTRIBUTION:**

Participants in the Session  
Members of the Commission  
Other interested Nations and International  
Organizations  
FAO Fisheries Department  
FAO Regional Fishery Officers

**BIBLIOGRAPHIC ENTRY**

IOTC–WPM13 2022. Report of the 13<sup>th</sup> Session of the IOTC Working Party on Methods. Online 19-21 October 2022.  
*IOTC–2022–WPM13–R[E]: 34pp.*

---



Food and Agriculture  
Organization of the  
United Nations



Indian Ocean Tuna Commission  
Commission des Thons de l'Océan Indien

iotc ctot

The designations employed and the presentation of material in this publication and its lists do not imply the expression of any opinion whatsoever on the part of the Indian Ocean Tuna Commission (IOTC) or the Food and Agriculture Organization (FAO) of the United Nations concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

This work is copyright. Fair dealing for study, research, news reporting, criticism or review is permitted. Selected passages, tables or diagrams may be reproduced for such purposes provided acknowledgment of the source is included. Major extracts or the entire document may not be reproduced by any process without the written permission of the Executive Secretary, IOTC.

The Indian Ocean Tuna Commission has exercised due care and skill in the preparation and compilation of the information and data set out in this publication. Notwithstanding, the Indian Ocean Tuna Commission, employees and advisers disclaim all liability, including liability for negligence, for any loss, damage, injury, expense or cost incurred by any person as a result of accessing, using or relying upon any of the information or data set out in this publication to the maximum extent permitted by law.

Contact details:

Indian Ocean Tuna Commission  
Blend Building, Providence  
PO Box 1011  
Victoria, Mahé, Seychelles  
Ph: +248 4225 494  
Fax: +248 4224 364  
Email: [secretariat@iotc.org](mailto:secretariat@iotc.org)  
Website: <http://www.iotc.org>

## 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

---

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**).

## TABLE OF CONTENTS

<b>1.</b>	<b>Opening of the Meeting .....</b>	<b>11</b>
<b>2.</b>	<b>Adoption of the Agenda and arrangements for the session .....</b>	<b>11</b>
<b>3.</b>	<b>The IOTC process: Outcomes, updates and progress.....</b>	<b>11</b>
3.1	<i>Outcomes of the 24<sup>th</sup> Session of the Scientific Committee.....</i>	<i>11</i>
3.2	<i>Outcomes of 5<sup>th</sup> Session of the Technical Committee on Management Procedures.....</i>	<i>12</i>
3.3	<i>Outcomes of the 26<sup>th</sup> Session of the Commission .....</i>	<i>13</i>
3.4	<i>Review of Conservation and Management Measures relevant to the WPM.....</i>	<i>13</i>
3.5	<i>Progress on the recommendations of WPM12 .....</i>	<i>14</i>
3.6	<i>Review of intersessional meetings related to the IOTC MSE process .....</i>	<i>14</i>
<b>4.</b>	<b>Albacore MSE: Update.....</b>	<b>14</b>
4.1	<i>Review of OM and candidate MP development.....</i>	<i>14</i>
4.2	<i>Discussion and feedback on MSE development .....</i>	<i>14</i>
4.3	<i>Future steps and timelines .....</i>	<i>14</i>
<b>5.</b>	<b>Skipjack tuna MSE: Update .....</b>	<b>15</b>
5.1	<i>Review of OM and candidate MP development.....</i>	<i>15</i>
5.2	<i>Discussion and Feedback on MSE development.....</i>	<i>15</i>
5.3	<i>Future steps and timeline.....</i>	<i>15</i>
<b>6.</b>	<b>Bigeye tuna MP (Resolution 22/03) .....</b>	<b>15</b>
6.1	<i>Process for running Resolution 22/03 on Bigeye MP .....</i>	<i>15</i>
6.1.1	<i>MP specifications including input data needed (e.g., joint CPUE) .....</i>	<i>16</i>
6.1.2	<i>Tasks, responsibilities and timeline for running the MP.....</i>	<i>16</i>
6.1.3	<i>Exceptional Circumstances.....</i>	<i>16</i>
<b>7.</b>	<b>Swordfish MSE: update .....</b>	<b>17</b>
7.1	<i>Review of OM and candidate MP development.....</i>	<i>17</i>
7.2	<i>Discussion and feedback on MSE development .....</i>	<i>17</i>
7.3	<i>Future steps and timelines .....</i>	<i>18</i>
<b>8.</b>	<b>YELLOWFIN TUNA MSE: UPDATE.....</b>	<b>18</b>
8.1	<i>Review of the progress on development the OM.....</i>	<i>18</i>
8.2	<i>Future steps and timeline.....</i>	<i>18</i>
<b>9.</b>	<b>General MSE Issues.....</b>	<b>20</b>
9.1	<i>General discussion.....</i>	<i>20</i>
9.2	<i>MSE Capacity Building.....</i>	<i>20</i>
9.3	<i>Internal and External Peer Review .....</i>	<i>21</i>
<b>10.</b>	<b>Joint CPUE Standardisation .....</b>	<b>21</b>
<b>11.</b>	<b>WPM Program of Work .....</b>	<b>22</b>
11.1	<i>Revision of the timeline of the MSE development.....</i>	<i>22</i>
11.2	<i>Revision of the WPM Program of work (2023–2027) .....</i>	<i>22</i>
<b>12.</b>	<b>Other business .....</b>	<b>22</b>
12.1	<i>Date and place of the 14th and 15th sessions of the WPM.....</i>	<i>22</i>
12.2	<i>Review of the draft, and adoption of the Report of the 13th Session of the WPM.....</i>	<i>23</i>
	<b>Appendix I List of participants .....</b>	<b>24</b>
	<b>Appendix II Meeting Agenda .....</b>	<b>26</b>
	<b>Appendix III List of documents .....</b>	<b>28</b>
	<b>Appendix IV Working Party On Methods Program Of Work (2023–2027) .....</b>	<b>29</b>
	<b>Appendix V Consolidated recommendations of the 13<sup>th</sup> Session of the Working Party on Methods.....</b>	<b>33</b>



## EXECUTIVE SUMMARY

The 13<sup>th</sup> Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Methods (WPM) was held online on Zoom from 19 - 21 October 2022. A total of 60 participants (55 in 2021, 55 in 2020 and 37 in 2019) 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 WPM13 to the Scientific Committee, and key outcomes of the WPM, which are provided in [Appendix V](#).

***Outcomes of the 26th Session of the Commission***

WPM13.01: The WPM **QUERIED** whether it would be necessary to hold a virtual TCMP meeting early in the year if no MPs are considered ready for presentation to the TCMP that particular year. The WPM **RECOMMENDED** that the SC inform the Commission that no candidate MPs will be ready for consideration for adoption in 2023 and therefore the virtual TCMP meeting should not take place that year (Para 9).

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

WPM13.02: 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 2023 (Para 15).

***Process for running Resolution 22/03 on Bigeye MP***

WPM13.03: The WPM **NOTED** that the application of the bigeye management procedure resulted in a recommended TAC of 80,583t per year for 2024 and 2025, which requires a 15% catch reduction from the 2021 catch level. The WPM **RECOMMENDED** that the SC adopt the TAC advice from the MP (Para 34).

WPM13.04: The WPM also **NOTED** that necessary catch reductions in other stocks have not been successfully implemented and **RECOMMENDED** that the Scientific Committee note this concern and recommend to the Commission that it address this issue to maximize the reliability of the BET MP (Para 35).

***Exceptional Circumstances***

WPM13.05: The WPM **NOTED** that the preliminary stock assessment in 2022, which included new growth data or natural mortality scenarios, did not provide any new or different information about population trends or stock status with these being within the range of estimates from the MSE operating models. There were no major changes in fisheries or fishing operations. The catch data input to the MP is unchanged from past collation methods. The CPUE standardisation (for the series used in the MP) was not completed as specified because the operational data were not available (1 x 1 degree data were used instead), however, the recent CPUE points are within the 90% probability interval of the MSE operating models. Therefore, the WPM **AGREED** these changes were not considered as exceptional circumstances that require changes in the recommended TAC. THE WPM **RECOMMENDED** to the SC that the review of evidence for exceptional circumstances did not identify any reasons to change the advice on the TAC. (Para 40).

***Update on the development of the joint CPUE indices for 2023***

WPM13.06: The WPM **INQUIRED** about the possibility of access to operational-level data be granted again in the future for this exercise. Contacts have been carried out to see if this could be the case next year. **ACKNOWLEDGING** the key role of the joint CPUE time series in the assessment of the stock status for yellowfin tuna, bigeye tuna, and albacore, the WPM **RECOMMENDED** that the SC endorse the use of operational-level data for the standardization of indices of abundance derived from longline CPUE time series (Para 90).

***Revision of the WPM Program of work (2023–2027)***

WPM13.07: The WPM **RECOMMENDED** that the Scientific Committee consider and endorse the WPM Programme of Work (2023–2027), as provided in [Appendix IV](#) (Para 95).

***Date and place of the 14th and 15th sessions of the WPM***

WPM13.08: The WPM **NOTED** that the global Covid-19 pandemic has complicated international travel and it was not possible to finalise arrangements for a physical meeting in 2022. 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 in 2023. The WPM **RECOMMENDED** the SC consider mid October 2023 as a preferred time period to hold the WPM14. As usual it was also **AGREED** that this meeting should continue to be held back-to-back with the WPTT, with the WPM taking place before the WPTT (Para 97).

***Review of the draft, and adoption of the Report of the 13th Session of the WPM***

WPM13.09: The WPM **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPM13, provided in [Appendix V](#) (Para 99).

## 1. OPENING OF THE MEETING

1. The 13<sup>th</sup> Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Methods (WPM) was held online on Zoom from 19 - 21 October 2022. A total of 60 participants (55 in 2021, 55 in 2020 and 37 in 2019) attended the Session. The list of participants is provided in [Appendix I](#). The meeting was opened by the Chairperson, Dr Hilario Murua (ISSF) who welcomed participants.

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

2. The WPM **ADOPTED** the Agenda provided at [Appendix II](#). The documents presented to the WPM13 are listed in [Appendix III](#).

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

### 3.1 Outcomes of the 24<sup>th</sup> Session of the Scientific Committee

3. The WPM **NOTED** paper [IOTC–2022–WPM13–03](#) which outlined the main outcomes of the 24<sup>th</sup> Session of the Scientific Committee (SC24), specifically related to the work of the WPM.
4. The WPM **NOTED** that in 2021, the SC made a number of endorsements and recommendations in relation to the WPM12 report. These are provided below for reference

#### **Management Strategy Evaluation Progress**

*(Para. 111) The SC **NOTED** the good progress made in Management Strategy Evaluations exercises for IOTC species in 2021, 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 2021.*

*(Para. 112) The SC **NOTED** the guidelines included as [Appendix 6a](#) to this report to deal with exceptional circumstances in the MSE process. The SC further **NOTED** that these guidelines are a living document and revisions may still be required in the future. The SC **RECOMMENDED** that the Commission consider and endorse the guidelines.*

*(Para. 113) The SC **NOTED** the revised schedule of MSE work included as [Appendix 6b](#) to this report to provide the timeframe for the development of management procedures for key IOTC species. The SC **NOTED** that the revised MSE schedule is still ambitious but that the technical work could, in principle, be completed within the proposed timeframes with minor adjustments. The SC **RECOMMENDED** that the Commission consider and endorse the revised timetable.*

#### **Albacore MSE**

*(Para. 114) The SC **NOTED** that the ALB operating model (OM) has been constructed from the 2019 assessment model, using a partial factorial design approach. Two different MPs – one based on a surplus production model, and one based on an HCR employed by CCSBT for Southern bluefin tuna, have been tested. The SC also **NOTED** the proposal to test alternative methods in order to have an OM that is not dependent on the stock assessment.*

#### **Skipjack tuna MSE**

*(Para. 115) The SC **NOTED** an MSE expert has been contracted in 2020 to undertake review of the skipjack tuna harvest control rule with a view to review and provide advice on potential revisions to the HCR as required by Res 16/02. The work continued in 2021 including to (1) develop an OM based on Stock Synthesis III; (2) develop a simple stock assessment model that can be fitted to simulated data from the skipjack stock assessment grid, and (3) simulation test model-based Management Procedures (MPs) with input from stakeholders.*

*(Para. 116) The SC **NOTED** that the WPM considered that presenting results on the performance of MPs against different reference points (i.e., MSY and depletion-based) is likely to make communication of the results more difficult but that information on MSY-based reference points could be included in the full table of performance statistics.*

#### **Yellowfin tuna MSE**

*(Para. 117) The SC **NOTED** that there has been no further progress on the yellowfin MSE due to issues with the stock assessment model that have been encountered in recent years and which have not been resolved in time for the MSE work. The SC **NOTED** that these issues are also shared by the current OM which is based on the assessment model.*

(Para. 118) The SC **NOTED** that the WPM had suggested that if the 2021 stock assessment is endorsed by the Scientific Committee, and there are no obvious issues in the projections that appear likely to manifest in the OMs, then the OMs will be reconditioned and the testing of candidate MPs will resume.

(Para. 119) However, although the SC considers the yellowfin tuna assessment to have been significantly improved, there are still some important and highlighted issues in the assessment and projection that may make it not feasible to further utilize the current OM. Therefore, alternative approaches for the redevelopment and reconditioning of the YFT-OM will be explored as part of the ongoing YFT-MSE work should be considered as an option. The SC **NOTED** that the proposed alternatives for OM development would be less dependent on historical data but would make heavy use of the current assessment model. The SC **AGREED** that a more detailed discussion of this approach should take place (at the MSE Working Group meeting earlier next year) before the best course of action was determined.

### **Bigeye tuna MSE**

(Para. 120) The SC **NOTED** that the bigeye tuna OM, which has been developed over the years, has proven to be relatively stable. The SC also **NOTED** that many candidate MPs have been thoroughly evaluated by MSE so far. Following the WPM' recommendation, the SC has determined that the bigeye OM and MSE has appropriately considered the key causes of uncertainty for this stock and that the conditions for applying the "Butterworth guillotine" (stop OM reconditioning) are met. The SC therefore **AGREED** to endorse the bigeye tuna OM.

(Para. 121) The SC **NOTED** two MPs, specifically the Model-based hockey stick (PT-HS) and the Model-based Catch and CPUE projection (PT-PROJ), both tuned against two tuning criteria (60% and 70% probability of being in the Kobe green quadrant over the reference years) are recommended by the WPM, based on their performance indicators. The SC **AGREED** to present the MPs together with their performance indicators to the TCMP/Commission. The SC **NOTED** it will be up to the TCMP/Commission to decide on the final MP.

(Para. 122) The SC **THANKED** the developers of bigeye tuna MSE for their hard work in the development of OM and evaluations of candidate MP over the years, and everyone including the WPM participants that contributed to the revision of the bigeye tuna MSE. The SC further **CONGRATULATED** the developers for achieving key milestones towards the successful adoption of a management procedure for the bigeye tuna stock.

(Para. 123) The SC **NOTED** document [IOTC-2021-SC24-INF06](#) that provides the terms of reference for the proposed external review of the bigeye MSE, which is planned to take place 2022-2024. The SC discussed the timeframes, workplans and deliverables, and provided further refinement on the TOR. The SC **AGREED** that the process of the external review should not impede the adoption of an interim bigeye MP by the Commission prior to completion of the review. The SC also **AGREED** that the number of reviewers required will be determined at a later stage depending on the availability of funding (see also Para. 102 on the YFT Peer review)

### **Swordfish MSE**

(Para. 124) The SC **NOTED** that limited progress had been made on the Swordfish MSE in 2020 but work resumed in early 2021, with good progress made throughout the rest of the year.

### **Update on TCMP04**

(Para. 125) The SC **NOTED** document [IOTC-2021-TCMP04-R](#) on the Report of the 4th session of the TCMP held in June 2021. The SC **NOTED** that the WPM had taken into consideration the recommendations and discussions held at that meeting.

## **3.2 Outcomes of 5<sup>th</sup> Session of the Technical Committee on Management Procedures**

5. The WPM **NOTED** paper [IOTC-2022-TCMP05-R](#) which provided the outcomes of the 5<sup>th</sup> Session of the Technical Committee on Management Procedures (TCMP05).
6. The WPM **NOTED** that in 2022, the TCMP made a number of endorsements and recommendations directly related to the work of the WPM. These are provided below for reference:

### **Discussion on the Actions Needed for the Adoption of Management Procedures, Including Budget Bigeye Tuna**

(Para. 58) The next technical issue discussed by the TCMP related to the choice of MP. Two distinct MPs were included in the proposal for discussion, namely the Model-based hockey stick (PT-HS, MP1\_Harvest) and the Model-based Catch and CPUE projection (PT-PROJ, MP2\_Target). The TCMP **NOTED** that both MPs have very

similar results with subtle differences in the outputs (e.g. catch stability, short term catch levels, population status at the end of the reference years) that require consideration by the Commission and no consensus was reached on which MP was preferable for the TCMP. The TCMP **NOTED** that both candidate MPs for BET, reviewed by the SC, are acceptable and meet the management objectives for the stock. As such the TCMP **RECOMMENDED** that the Commission discuss them both and consider selecting one MP for adoption. (Para. 61) The TCMP **REQUESTED** clarification on the Revised Australian proposal to conduct a preliminary stock assessment in 2022 with a final assessment in 2023. It was clarified that the preliminary assessment would review the latest information and conduct the bulk of the work towards the assessment, but in order to offset the assessment year from the MP run year (something considered best practice for MP implementation in order to separate the assessment and MSE processes), the assessment would be updated in 2023 with only the latest years catch data added to the assessment.

#### **Albacore tuna**

(Para. 65) The TCMP **DISCUSSED** the necessity to constrain the TAC changes, between management periods, even if the stock is below BMSY (but not Blim) to ensure stability for the fishery. Different options for TAC changes could be explored, but not exceed 30%. The developer was also **REQUESTED** to explore asymmetric TAC estimations but not be limited to this option only and continue with symmetric options as well.

(Para. 66) The developer was also **REQUESTED** to include a minimum catch mechanism, not only to support a bycatch and subsistence harvest, but also to ensure the continued availability of data for scientific monitoring purposes.

#### **Process and future meetings of TCMP**

(Para. 77) The TCMP **NOTED** that CPCs require time to process the outputs of the SC in order to fully explore and understand the advice provided using the MSE process. To facilitate this, the TCMP **RECOMMENDED** that the Commission endorse holding a virtual TCMP meeting early each year with a view to discuss or narrow down the alternative candidate MPs proposed by the SC, providing sufficient time for CPCs to discuss the outputs of the SC and consider developing proposals based on them. The TCMP would then meet again physically prior to the Commission.

### **3.3 Outcomes of the 26<sup>th</sup> Session of the Commission**

7. The WPM **NOTED** paper [IOTC-2022-WPM13-04](#) which provided the main outcomes of the 26<sup>th</sup> Session of the Commission specifically related to the work of the WPM.
8. The WPM **NOTED** ([IOTC-2022-S26-R](#)):
 

(Para. 47). The Commission **SUPPORTED** the important work conducted by the TCMP and **ENDORSED** the Recommendation to hold a virtual meeting early in the year. This would be included in the schedule of meetings from 2023.
9. The WPM **QUERIED** whether it would be necessary to hold a virtual TCMP meeting early in the year if no MPs are considered ready for presentation to the TCMP that particular year. The WPM **RECOMMENDED** that the SC inform the Commission that no candidate MPs will be ready for consideration for adoption in 2023 and therefore the virtual TCMP meeting should not take place that year.
10. Participants to WPM13 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 Review of Conservation and Management Measures relevant to the WPM**

11. The WPM **NOTED** paper [IOTC-2022-WPM13-05](#) which aimed to encourage participants at the WPM13 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.
12. The WPM **NOTED** that IOTC Commission adopted Resolution 22/03 On a Management Procedure for Bigeye Tuna in the IOTC Area of Competence, which is the first fully-specified MP to be adopted in the IOTC. The WPM **NOTED** that this resolution requires that review of input data and running of the MP, and any exceptional circumstances,

should be considered by the WPM13 and WPTT to provide advice to the SC in 2022, and the SC would provide advice on the recommended total allowable catch (TAC) for 2024 and 2025 for consideration at the 27th session of the IOTC in 2023.

### **3.5 Progress on the recommendations of WPM12**

13. The WPM **NOTED** paper [IOTC-2022-WPM13-06](#) 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 WPM13 as appropriate given any progress.

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

14. The WPM **NOTED** paper [IOTC-2022-WPM13\(MSE\)-R](#) which provided the report of Report of the 13th Session of the IOTC Working Party on Methods Management Strategy Evaluation Task Force that took place from 7-10 March 2022.
15. 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 2023.

## **4. ALBACORE MSE: UPDATE**

### **4.1 Review of OM and candidate MP development**

16. The WPM **NOTED** paper [IOTC-2022-WPM12-08](#) which presented an update of the Indian Ocean albacore MSE (and Swordfish), with the following summary provided by the authors:

*“A brief summary of current status and recent developments on the work for an MSE analysis for Indian ocean albacore tuna and swordfish is presented here. A new stock assessment for albacore tuna, and an updated grid for the swordfish OM grid, need both to be discussed by WPM to guide the next steps of work for these species.”*

17. The WPM **NOTED** that the new albacore stock assessment carried out in 2022 used 2 model runs, each with a different CPUE index, to provide management advice. An exploratory updated OM grid was constructed based on those two models. The grid is configured along similar sources of uncertainty and levels as the previous one, with a total of 432 model runs which capture a wide range of uncertainty.
18. The WPM **NOTED** that the CPUE indices developed for the 2022 albacore stock assessment were different to previous assessments, and were disaggregated into 4 seasons and 4 areas, giving 16 separate longline indices. The suitability of each OM model run to be included in the OM grid was evaluated using the MASE statistic on the CPUE indices, to evaluate their prediction skill. The choice of CPUE to base the MP decisions on was also carried out using their prediction skill.

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

19. The WPM **NOTED** that estimates of SB2020/SBMSY from the OM grid were asymmetrical for values of  $M=0.3$ , but not for other values. It is not clear why this is the case, but it could be due to interactions between parameters within the OM grid or a result of specific model runs being excluded from the OM grid during the initial screening process.

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

20. The WPM **NOTED** that the previous iterations of albacore OMs, which were conditioned based on the stock assessment model, encountered problems with accounting for recent observed catches. Given that the new albacore stock assessment is quite similar to the previous model, it is anticipated that similar problems are likely to be encountered if the OMs continue to be conditioned using the structure of the stock assessment models.
21. The WPM **NOTED** that alternative approaches for conditioning OMs, such as Approximate Bayesian Computation (ABC), provide a wider range of options to resolve the types of problems encountered with conditioning the

albacore OMs on the stock assessment models, and thus can assist with overcoming some of the current developmental barriers. The WPM also **RECALLED** that it is generally good practice to separate the OM models from the stock assessment models.

22. The WPM **NOTED** that it is generally good practice to only use alternative approaches such as the ABC approach for conditioning when they have been widely tested and there is more literature about them. However, the WPM **NOTED** that albacore would provide a good example case for the application of ABC for OM conditioning, given that the generic model that has already been developed for multiple fleets. As such, the WPM **REQUESTED** that the developers progress with conditioning OMs for albacore using the ABC approach. The WPM further **NOTED** that funding for albacore MSE work is currently only available until the end of 2023 which provides a time constraint on the work going forwards.

## 5. SKIPJACK TUNA MSE: UPDATE

### 5.1 Review of OM and candidate MP development

23. The WPM **NOTED** paper [IOTC-2022-WPM13-09](#) which provided the Evaluation of empirical control rules for Indian Ocean Skipjack. The following abstract was provided by the authors:

*“The objective of this work is to develop a Management Procedure (MP) for Indian Ocean Skipjack tuna (SKJ), which includes specification of the data inputs, harvest control rule (HCR) and management outputs, and that has been fully tested using an appropriate simulation framework. A simulation framework has been proposed to the Working Party on Methods (WPM; Edwards, 2020, IOTC, 2020a) and the Technical Committee on Management Procedures (TCMP; Edwards, 2021b, IOTC, 2021c), and evaluations of an empirical MP were delivered to the WPM (Edwards, 2021a), and the MSE Task Force (Edwards, 2022a). At the TCMP in 2022, a preliminary set of MPs was presented (Edwards, 2022b). The current work is in response to feedback from the TCMP (IOTC, 2022)”*

24. The WPM **THANKED** the author for the comprehensive work of skipjack MSE conducted to date.
25. The WPM **NOTED** the MSE update focused on how to integrate implementation errors in the evaluation framework. It also examined interactions between recruitment failures and implementation errors and evaluated their combined impact in a robustness test.

### 5.2 Discussion and Feedback on MSE development

26. The WPM **NOTED** that MP is designed to be robust to the implementation error, i.e., the TAC recommendation has incorporated the implementation error. The WPM **NOTED** the previous iteration has considered the performance of MP in the presence of reporting errors in catches. Additional analyses could consider that catch limits are exceeded but not reported.
27. The WPM further **NOTED** that reporting error for IOTC skipjack catches is considered low given the low percentage of catches that needs to be estimated by the Secretariat. However, the WPM **NOTED** that there may be overreporting derived from the current process of deciding an allocation criterion, and this could be included in the future work.

### 5.3 Future steps and timeline

28. The WPM **NOTED** that further work requested by the TCMP would be needed before recommending that this work is presented in the TCMP as complete in 2023 and be considered for adoption by the Commission.

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

### 6.1 Process for running Resolution 22/03 on Bigeye MP

29. The WPM **NOTED** paper [IOTC-2022-WPM13-10](#) regarding running the IOTC Bigeye Tuna Management Procedure for 2022. The following abstract was 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 MP is the first fully-specified MP to be adopted in the IOTC. The adopted MP schedule requires the MP to be 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. This document describes the key data inputs to the MP and the TAC calculation given the agreed data. The full specification of the MP is provided in Williams et al. (2022), and the consideration of exceptional circumstances is provided Preece et al. (2022)."*

30. The WPM **NOTED** that the Model-based MP is tuned to achieve 60% probability that the stock will be in Kobe green quadrant by 2034-38 and to avoid breaching LPR with high probability. The WPM further **NOTED** that the MP uses two sets of input data (catch and CPUE) and a hockey-stick shaped HCR.
31. The WPM **DISCUSSED** the formula used in the MP to determine the recommended TAC. The WPM **NOTED** that three parameters in the MP are derived from the internal estimation model (FMSY ratio, By and Hmult), and the fourth parameter (Fmult) is a fixed tuning parameter. The WPM further **NOTED** that the internal model estimates are robust to the initial parameter values.
32. The WPM **NOTED** that in order to draw a clear distinction between running the MP and stock assessment that depletion estimates from the two models should not be compared as they would be different. The biomass depletion is estimated in the formal stock assessment, and this estimate is not used in TAC calculations in the management procedure.
33. The WPM **NOTED** that the four regional CPUE indices were combined using weights determined from regional scaling study to produce the CPUE index used in the MP. The WPM further **NOTED** that the spatial catch effort data were used in the regional scaling study to assess the relative abundance distribution between regions. The WPM **NOTED** that the catch data used in the MP are those collated by the secretariat.
34. The WPM **NOTED** that the application of the bigeye management procedure resulted in a recommended TAC of 80,583t per year for 2024 and 2025, which requires a 15% catch reduction from the 2021 catch level. The WPM **RECOMMENDED** that the SC adopt the TAC advice from the MP.
35. The WPM also **NOTED** that necessary catch reductions in other stocks have not been successfully implemented and **RECOMMENDED** that the Scientific Committee note this concern and recommend to the Commission that it addresses this issue to maximize the reliability of the BET MP.

#### **6.1.1 MP specifications including input data needed (e.g., joint CPUE)**

36. The WPM **NOTED** paper [IOTC-2022-WPM13-11](#) regarding : Specifications of the IOTC Bigeye Tuna Management Procedure. The following abstract was 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 bigeye tuna in the Indian Ocean (Resolution 22/03). The bigeye MP is the first fully-specified MP to be adopted in the IOTC. This paper provides a full technical and non-technical specification of the MP, including the specifications of the data required and a description of the estimation model, the process for calculating the TAC from applying the harvest control rule, the annual evaluation of exceptional circumstances, and the implementation schedule for running the MP and setting TAC. The role of the stock assessment is distinct from the MP and will be offset in the workplan of the Commission."*

37. The WPM **NOTED** that the full specification of the IOTC Bigeye Tuna Management Procedure is provided in this paper.

#### **6.1.2 Tasks, responsibilities and timeline for running the MP**

38. The WPM **AGREED** that the secretariat will be running the MP in the future, with support to be provided by the CPCs scientists.

#### **6.1.3 Exceptional Circumstances**

39. The WPM **NOTED** document IOTC-2022-WPTT24-12, which discusses the consideration of exceptional circumstances for the Bigeye Tuna MP in 2022, with the following abstract provided by the author:

*"The IOTC has adopted a management procedure (MP) which will be used to recommend the Total Allowable Catch (TAC) of bigeye tuna in the Indian Ocean. As part of the MP schedule, the Commission has adopted an annual review of evidence for exceptional circumstances that could make the implementation of the TAC advice risky to the stock or fishery. The Exceptional Circumstances Guidelines specify a three-stage process:*



*(i) examining evidence for exceptional circumstances, (ii) determining severity and impact, and (iii) recommending any management or research action that should be taken. A wide range of information is reviewed to examine if there is evidence for exceptional circumstances, e.g., the data inputs to the MP, changes in the knowledge of stock or fishery uncertainties against which the MP was tested, and implementation of MP TAC advice. The Exceptional Circumstances Guidelines (IOTC-2021-SC24 Appendix 6A) provide a scientific process for developing appropriate management responses to exceptional circumstances and, hence, provide transparency in TAC decision making by the Commission”*

40. The WPM **NOTED** that the preliminary stock assessment in 2022, which included new growth data and natural mortality scenarios, did not provide any new or different information about population trends or stock status with these being within the range of estimates from the MSE operating models. There were no major changes in fisheries or fishing operations. The catch data input to the MP is unchanged from past collation methods. The CPUE standardisation (for the series used in the MP) was not completed as specified because the operational data were not available (1 x 1 degree data were used instead), however, the recent CPUE points are within the 90% probability interval of the MSE operating models. Therefore, the WPM **AGREED** these changes were not considered as exceptional circumstances that require changes in the recommended TAC. The WPM **RECOMMENDED** to the SC that the review of evidence for exceptional circumstances did not identify any reasons to change the advice on the TAC.
41. The WPM **NOTED** that adjustments to the CPUE production process (such as the availability of operational data) may need to be made in the robustness tests or, if permanent, be incorporated into the reference sets. However, The WPM **NOTED** that CPUE standardization is a complex procedure that makes it challenging to achieve complete consistency across years. Therefore, it is important that the range of uncertainty in the MSE testing includes the probable changes and randomness in CPUE.
42. The WPM **RECALLED** that via resolution 22/03, the Scientific Committee is requested to review, and if necessary, further develop and refine (not later than 2024), the exceptional circumstances guidelines (adopted by SC24 and S26), taking into account, inter alia, the need for an appropriate balance between specificity versus flexibility in defining exceptional circumstances, and the appropriate level of robustness to ensure that exceptional circumstances are triggered only when necessary.
43. The WPM **AGREED** that the process of defining exceptional situations may evolve with the accumulation of information and experience, but no changes were recommended at this time.

## 7. SWORDFISH MSE: UPDATE

### 7.1 Review of OM and candidate MP development

44. The WPM **NOTED** paper [IOTC-2022-WPM13-08](#) on the update of the Indian Ocean swordfish operating model. The abstract is provided in Section 4.1.
45. The WPM **NOTED** that there is a wide spread of uncertainty related to stock status in the swordfish OM. However, the WPM further **NOTED** that the developers found that this did not stop the MPs from being tuned to the management objectives requested. A simplified OM was constructed and presented, in which factors and levels were dropped that did not appear to contribute greatly to the uncertainty ranges in the OM. The newly proposed simplified OM grid provides a similar view of uncertainty to the current OM.

### 7.2 Discussion and feedback on MSE development

46. The WPM **RECALLED** that the performance statistics endorsed by the SC included the probability of the stock falling in the green quadrant of the Kobe plot, which is commonly used for tuning. The WPM **NOTED** the bimodal distribution of this statistic for both the current and alternative OMs for swordfish, which was initially taken as an indication that the OM may really be composed of two or more sub-OMs with different standing values for this statistic.
47. The WPM **NOTED** that this statistic is calculated as a mean over a five-year period of the number of model runs that fall inside or outside of the Kobe green quadrant. In this way, a binary statistic is converted into a continuous probability. The WPM **NOTED** that as this calculation is done over five years only, there is a limited number of possible combinations for the statistic of any individual model run (i.e. from 0 to 1 in 0.2 steps). The WPM **SUGGESTED** that an alternative method of calculating this statistic could be explored.

48. The WPM **SUGGESTED** that the developers further explore the reasons for these results and **REQUESTED** them to present this issue back to the WPM and SC, and that the use of other statistics to determine the performance of the OM against the tuning criteria could be investigated.

### 7.3 Future steps and timelines

49. The WPM **NOTED** options for further simplifying the OM grid. The WPM **SUGGESTED** that only 3 values of steepness could be used but across the same range (i.e., 0.6, 0.75 and 0.9). The WPM **NOTED** that the WPB suggested that the steepness value of 0.6 could be used to reflect the lower productivity of swordfish compared with tuna species for which higher steepness values tend to be more appropriate due to their high productivity, but further **NOTED** that the WPB had requested feedback from the WPM on this topic.
50. The WPM also **NOTED** that the 0.2 value of sigmaR that came from the previous grid is quite low and may not be appropriate for an oceanic species like swordfish which is likely to be impacted by a range of environmental factors. The WPM **NOTED** that this value is not thought to be a particularly influential parameter in the conditioning of the OM. Therefore, the WPM **SUGGESTED** that higher values are explored as a robustness test of the OM.
51. The WPM **NOTED** that the CPUE prediction skill is calculated by running the projection from a retrospective of the model e.g., from 5 years back and then this is projected forward using the known catches to generate an observation of the index of abundance. This estimation of the index is then compared with the actual observed index and MASE statistics are then calculated. The WPM **AGREED** with the suggestion of the developers to use the MASE statistics as a filtering tool whereby only projection runs that have a MASE value of less than 1 are included in the OM.
52. The WPM discussed the implementation error values that should be set for this OM. The WPM **NOTED** that 15% is likely to be requested as the maximum TAC change, but further **NOTED** that these values have very different purposes so should not be specifically linked. The WPM **NOTED** that the level of uncertainty in the catch statistics could be linked with implementation error, **NOTING** that approximately 12% of catches of swordfish in 2020 were totally or partially estimated by the Secretariat. The WPM also **NOTED** the suggestion to have a relatively high implementation error value to reduce the chance of exceptional circumstances being triggered. Taking into account these considerations, the WPM **SUGGESTED** that the developers should test implementation error values of 10 and 15%.
53. The WPM **NOTED** that once this new OM is adopted by the group, it will be ready to be run for all simulations for the MPs.

## 8. YELLOWFIN TUNA MSE: UPDATE

### 8.1 Review of the progress on development the OM

54. The WPM **NOTED** there has been no further progress on the OM development of yellowfin tuna, pending the results of the external review of the yellowfin stock assessment model which is scheduled to take place February in 2023.

### 8.2 Future steps and timeline

55. The WPM **NOTED** paper [IOTC–2022–WPM13–12](#) on a work plan for an Indian Ocean yellowfin tuna close-kin mark-recapture design study. The following abstract was provided by the authors:

*“Close-Kin Mark-Recapture (CKMR) is a genetics-based method for estimating key population metrics useful for independent assessment of stock status, or as data inputs for integrated stock assessment models, or as inputs to management procedures. This report evaluates a range of sampling scenarios for Indian Ocean yellowfin tuna to provide estimates of Total Reproductive Output (TRO, similar to spawning stock biomass), depletion in TRO, adult mortality and mean recruitment. This design study evaluates the sample sizes of juveniles and adults required to give precise estimates of these population metrics.*

*The analysis used a simplified population model that reproduced recent yellowfin tuna population dynamics, but in an equilibrium framework. Under these conditions, annual sampling levels of 25,000 to 30,000 samples were predicted to yield useful insights on population metrics with reasonable precision in the estimates. Specifically, the depletion in total reproductive output (TRO), could be estimated with a coefficient of variation (CV) of 15% with 30,000 annual samples over 5 years. After the initial 5 years are complete, a CKMR*

---

*monitoring program would build on the existing data set to provide ongoing information for assessment and management.”*

56. The WPM **NOTED** that while the CKMR study simulated data from both the juvenile and adult populations, the inferences drawn from CKMR would relate to the adult population, including estimates of abundance, reproductive output and mortality.
57. The WPM **NOTED** two types of kin pairs commonly used in CKMR: parent-offspring pairs (POPs), in which the probability of sampling a parent and their offspring is related to population size of the adults; and half-sibling pairs (HSPs), in which the probability of sampling two individuals with one shared parent is related to the mortality and the population size of the adults.
58. The WPM **NOTED** full sibling pairs (FSPs) are uncommon to find in samples and are not particularly useful for CKMR estimates of population metrics. In the CKMR design study, FSPs were not used.
59. The WPM **NOTED** the temporal stratification and accurate ageing of samples needed for estimation of mortality and reproductive output from HSPs. The WPM further **NOTED** that estimating the age from length is likely to be more accurate for juveniles than adults.
60. The WPM **NOTED** that HSPs collected during the same season were omitted from the analysis as they provide no information on adult mortality (as there is no time gap between captures) and there is a potential bias from ‘good years’ that can result in an excess of HSPs from some individuals.
61. The WPM **NOTED** the simulation suggested that the inclusion of spatial reproduction would increase the accuracy of population estimations. The WPM **NOTED** that while the design study model presumes complete knowledge of spatial reproduction, the true spatial heterogeneity in recruitment is mostly unknown.
62. The WPM **NOTED** that the information gathered by the CKMR sample could help understand the spatial variability in movement and reproduction.
63. The WPM **NOTED** that the spatial heterogeneity of the population will determine how many spatial strata (fisheries) need to be sampled. There is no need to sample every fishery if the population is regionally homogeneous.
64. The WPM **NOTED** that the price of the genetic analysis for CKMR implementation is generally declining. The WPM **AGREED** that the CKMR study's budget should focus on project costs, which should also include sampling cost, genotyping, model development, and analysis.
65. The WPM **NOTED** that the expected number of HSPs will increase with the proportion of juveniles sampled, but that the expected number of POPs will be maximized if half the samples are from juveniles. The trade-off between the expected number of HSPs and POPs in the sample design indicated an optimal 70:30 split between samples of juveniles and adults, which would optimize the information content that could be extracted from the CKMR study.
66. The WPM **NOTED** the collection of clean (uncontaminated) samples is the most important consideration for success of the CKMR study. Care is needed to avoid false kinship assignment as a result of cross-contamination between samples.
67. The WPM **NOTED** that the design study suggested that 30,000 samples per year over the course of 5 years would likely be adequate to obtain precise estimates of absolute abundance for yellowfin. The WPM **NOTED** the possibility of adaptive sampling. There may be a need to increase the sample size if the early samples contain less POPs/HSPs than expected. In practice, as more samples are gathered throughout time, refinement to the sampling design may change the number of samples needed in later stages.
68. The WPM **NOTED** that there are more than enough length samples available for yellowfin across all fisheries in the IOTC database to satisfy the sample size requirements of a CKMR study, if tissue samples could also be collected when length sampling. However, it is important to take into account the variations in access and sampling quality between fisheries. Targeting 30,000 samples would be difficult, thus a staged strategy is recommended.

69. The WPM **AGREED** that the design study is technically sound and robust, and that CKMR has a strong potential of improving yellowfin tuna abundance estimates and, consequently, assessment. Given the importance and extent of the fisheries, the WPM **ADVISED** that the project be given consideration for further advance noting the logistical challenges in sampling.

## 9. GENERAL MSE ISSUES

### 9.1 General discussion

70. The WPM **NOTED** paper [IOTC–2022–WPM13–13](#) on Options for Multispecies Catch Limits in Harvest Strategies for Indian Ocean Tropical Tunas. The following abstract was provided by the authors:

*“The Sustainable Indian Ocean Tuna Initiative (SIOTI) is a large-scale Fisheries Improvement Project (FIP) comprising the major purse seine fleets and tuna processors in the region. As part of the activities of the FIP, we have explored options for harvest strategies that account for the technical interactions between the three tropical tuna stocks exploited in the Indian Ocean. For this, we have reviewed the different steps and components of the Management Strategy Evaluation (MSE) process that will need to be developed. As a start of this process, we have developed different multispecies management objectives, we have conditioned a preliminary multispecies operating model and we demonstrate the utility of multispecies management procedures.”*

71. The WPM **THANKED** the authors for their very interesting work that raises many important issues regarding the provision of science-based management advice for multi-species fisheries.
72. The WPM **NOTED** that while it would be desirable to include an economic component in the framework, the current version, unfortunately, does not have such an aspect due to the lack of the necessary data. The WPM also **NOTED** that the current model uses the results of individual assessments for each species in the simulations and has not yet been conditioned for the multi-species framework, but once funding is available, work could begin as has been done in the Atlantic.
73. The WPM **NOTED** that the analysis considered the spatial structure as has been done in the stock assessment and the HCR was used to control effort for fishery. Given the different treatment of the existing MP for bigeye and the HCR for skipjack, the issue was raised that attention could also be paid to fleet structure to see the benefits of changing effort in some fisheries and the effects of changing effort by species.
74. The WPM **NOTED** that fleet definitions between species assessments are not always consistent and that there will be a need to standardise these definitions. The authors invited all interested parties to provide input on this matter to improve the definitions used in the current model.
75. The WPM **NOTED** that these multi-species models will be very useful for investigating the implications of individual species TACs and the associated effort to achieve those levels of catch within a multi-species fishery. The WPM **EXPRESSED** concern that the effort to achieve a TAC for a certain species may result in an unsustainable effort on another species caught by the same fishery. These issues would need to be addressed when TACs are being adopted for single species in multi-species fisheries.

### 9.2 MSE Capacity Building

76. The WPM **NOTED** a presentation by a consultant who developed Educational Materials on MSE for the IOTC webpage (<https://iotc.org/educational-tools>). The following summary was provided by the consultant:

*“Consultants Polina Levontin and Jana Kleineberg presented their work on educational tools for MSE using an illustrative Indian Ocean swordfish example. The presentation, delivered by PL, highlighted the context of the MSEs in the educational materials they created. She expanded on the broader field of tools that are used in strategic decision-making about the future. Shifting from the macro issues of MSE methodology, the presentation focused on visual communication and the specific details that are often lost in standard MSEs presentations, such as the shape of distributions, the relative performance of management procedures in specific situations such as rebuilding, and the actual criteria for judging how satisfied we are with their performance (e.g. low BMSY estimates relative to unfished stock level) that might not align with stakeholders’ values.”*

77. The WPM **THANKED** the consultants for their work to provide useful and clear information in a visually impressive and user-friendly style for use by all CPCs.
78. The WPM **ENCOURAGED** all interested parties to review the educational materials and provide feedback to the Secretariat on any suggestion to improve them.
79. The WPM **SUGGESTED** that colours used when presenting the outputs from these MSE models should be standardised across species to provide a consistent message to managers. This could also be extended to other RFMOs should there be agreement.
80. The WPM **RECALLED** the discussions held by the Commission regarding capacity building initiatives:  
*(Para. 48). The Commission URGED the TCMP to continue with capacity building initiatives to facilitate understanding of the process and increase participation by all parties to facilitate smooth implementation of the MSE process.*  
*(Para. 49). The Commission ACKNOWLEDGED an offer by the PEW Charitable Trusts to support capacity building workshops and activities for MSE. The Commission REQUESTED the Secretariat to liaise with PEW to coordinate these activities.*  
*(Para. 83). The Commission ACKNOWLEDGED further offers to support capacity building workshops and activities for MSE from WWF and ISSF (Refer also to paragraph 49).*
81. The WPM **NOTED** that a MSE Capacity Building workshop for coastal states had been initially planned for November 2022, but no suitable date could be finalised. The WPM were informed that this workshop would likely take place in early 2023 and the WPM **REQUESTED** the Secretariat to keep the WPM informed of any developments.

### 9.3 Internal and External Peer Review

82. The WPM were **INFORMED** that the proposed YFT assessment review arrangements had been finalised and this meeting would take place at the FAO headquarters in Rome from the 6 – 10 February 2023. Four independent experts have been confirmed to conduct the review.
83. The WPM were also **INFORMED** that the proposed BET MSE review had not yet been organised, but that the Terms of Reference for an expert to conduct the review had been endorsed by the SC in 2021 and the Secretariat would liaise with the Chairs of the WPM and WPTT to identify and contract a suitable expert in 2023.

## 10. JOINT CPUE STANDARDISATION

### 10.1 Update on the development of the joint CPUE indices for 2022.

84. The WPM **NOTED** paper [IOTC–2022–WPM13–14\\_Rev1](#) on the Update of the joint CPUE indices for the bigeye tuna in the Indian Ocean based on Japanese, Korean and Taiwan, China longline fisheries data up to 2021. The following abstract was provided by the authors:

*“Joint CPUE standardization was conducted for the Indian Ocean bigeye tuna based on Japanese, Korean and Taiwanese longline fisheries data up to 2021 to provide the WPTT with information on abundance indices for use in the 2021 stock assessment for this stock. The intention was to produce combined indices by increasing the spatial and temporal coverage of fishery data. Due to the limitation of remote access to the data, an approach adopted among the three members for the previous analyses of tropical tunas for IOTC and ICCAT was used to share only aggregated data. To account for the inter-annual changes of the target in each fishery, information on the HBF or clustering result was used in each region. For standardizing the catch-per-unit-effort data, the conventional linear models and delta-lognormal linear models were employed for the shared aggregated data of monthly and 1° grid resolution in each region. Broadly, the trend of CPUE was similar to that for the previous stock assessment with some dissimilarity in Region 3. The models were diagnosed by the standard residual plots and influence analyses.”*

85. The WPM **WELCOMED** the work and **THANKED** the authors for the fruitful collaboration. The methodology presented is being used on different stocks to continue building unified indices of abundance covering the main industrial longline fisheries, an essential data source in multiple stock assessments.
86. The WPM **WELCOMED** that a comparison of the new index with the previous one, based on operational data, did not show large changes in overall trends, except for some areas and periods.

87. However, the WPM **NOTED** that the new time series of standardised abundance index was showing a declining trend in region 3 while the previous series developed for the 2019 assessment was relatively flat, **NOTING** that understanding the causes for such changes would be very useful for the forthcoming bigeye tuna assessment.
88. The WPM **NOTED** that the modelling approach used was similar as previously used but that both (i) the process used for data filtering and (ii) aggregation level of the data (i.e., 1x1 degree spatial resolution and monthly time step due to limitations on access to operational data) could explain the discrepancies observed.
89. The WPM further **NOTED** that the authors used both the clustering category and number of hooks between floats (HBF) as covariates in the models to account for changes in targeting but that the clustering method may not perform well as changes in relative proportion of bigeye tuna (BET) and yellowfin tuna (YFT) in the catch may not always reflect changes of targeting. Therefore, the WPM **ENCOURAGED** the authors to explore the use of a category combining BET and YFT in the clustering approach in future analysis.
90. The WPM **INQUIRED** about the possibility of access to operational-level data be granted again in the future for this exercise. Contacts have been carried out to see if this could be the case next year. **ACKNOWLEDGING** the key role of the joint CPUE time series in the assessment of the stock status for yellowfin tuna, bigeye tuna, and albacore, the WPM **RECOMMENDED** that the SC endorse the use of operational-level data for the standardization of indices of abundance derived from longline CPUE time series.

## 11. WPM PROGRAM OF WORK

### 11.1 Revision of the timeline of the MSE development

91. The WPM **NOTED** that the most recent timeline for MSE development had been endorsed by the SC in 2021 and the Commission in 2022. As such the WPM **AGREED** that there was no need to revise the timetable at this stage.

### 11.2 Revision of the WPM Program of work (2023–2027)

92. The WPM **NOTED** paper [IOTC–2022–WPM13–07](#) presenting the draft WPM Programme of Work (2023–2027).
93. 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 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)*
94. 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 (2022–2026) that are yet to be funded, for circulation to potential funding bodies.
95. The WPM **RECOMMENDED** that the Scientific Committee consider and endorse the WPM Programme of Work (2023–2027), as provided in [Appendix IV](#).
96. 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.

## 12. OTHER BUSINESS

### 12.1 Date and place of the 14th and 15th sessions of the WPM

97. The WPM **NOTED** that the global Covid-19 pandemic has complicated international travel and it was not possible to finalise arrangements for a physical meeting in 2022. 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 in 2023. The WPM **RECOMMENDED** the SC consider mid October 2023 as a preferred time period to hold the WPM14. As usual it was also **AGREED** that this meeting should continue to be held back-to-back with the WPTT, with the WPM taking place before the WPTT.

- 
98. The WPM also **NOTED** the MSE task force meeting to be held in 2023 should continue taking place. This meeting should take place virtually. The WPM **AGREED** that this task force meeting is crucial for providing technical feedback to the TCMP.

***12.2 Review of the draft, and adoption of the Report of the 13th Session of the WPM***

99. The WPM **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPM13, provided in [Appendix V](#).
100. 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.
101. 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.
102. The report of the 13<sup>th</sup> Session of the Working Party on Methods (IOTC–2022–WPM13–R) was **ADOPTED** via correspondence.

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

**Chairperson**

Dr Hilario **Murua**  
International Seafood Sustainability  
Foundation  
[hmurua@iss-foundation.org](mailto:hmurua@iss-foundation.org)

**Vice Chairperson**

Vacant

**Other Participants**

Mr. Siva **Anandhan**  
Fishery Survey of India  
[anandhan.siva@fsi.gov.in](mailto:anandhan.siva@fsi.gov.in)

Mr. Carlos **Barciela Segura**  
La Organización de Palangreros  
Guardeses (OR.PA.GU)  
[cbarciela@orpagu.com](mailto:cbarciela@orpagu.com)

Dr. Don **Bromhead**  
Australian Bureau of Agricultural and  
Resource Economics and Sciences  
(ABARES)  
[Don.Bromhead@agriculture.gov.au](mailto:Don.Bromhead@agriculture.gov.au)

Dr. Ian **Butler**  
Australian Bureau of Agricultural  
Resource Economics and Sciences  
[ian.butler@agriculture.gov.au](mailto:ian.butler@agriculture.gov.au)

Dr. Ansuman **Das**  
Fishery survey of India  
[1006ansu@gmail.com](mailto:1006ansu@gmail.com)

Dr. Charles **Edwards**  
IOTC Consultant  
[cescapecs@gmail.com](mailto:cescapecs@gmail.com)

Dr. Paige **Eveson**  
CSIRO  
[Paige.Eveson@csiro.au](mailto:Paige.Eveson@csiro.au)

Dr. Tadanori **Fujino**  
OFCF  
[ofcf.fujino@gmail.com](mailto:ofcf.fujino@gmail.com)

Dr. Shunji **Fujiwara**  
OFCF  
[roku.pacific@gmail.com](mailto:roku.pacific@gmail.com)

Ms. Hety **Hartaty**  
National Research and  
Innovation Agency of the  
Republic of Indonesia  
[hhartaty@gmail.com](mailto:hhartaty@gmail.com)

Dr. Pradeep **HD**  
Fishery Survey of India,  
Mormugao Zonal Base, Goa  
[hdpradeep@gmail.com](mailto:hdpradeep@gmail.com)

Mr. Miguel **Herrera**  
OPAGAC  
[miguel.herrera@opagac.org](mailto:miguel.herrera@opagac.org)

Dr. Rich **Hillary**  
CSIRO  
[rich.hillary@csiro.au](mailto:rich.hillary@csiro.au)

Dr. Glen **Holmes**  
The Pew Charitable Trusts  
[gholmes@pewtrusts.org](mailto:gholmes@pewtrusts.org)

Mr. Behrooz **Hosseinkhani**  
Iranian fisheries  
[behrooz\\_hkh@yahoo.com](mailto:behrooz_hkh@yahoo.com)

Dr. Simon **Hoyle**  
NIWA  
[simon.hoyle@gmail.com](mailto:simon.hoyle@gmail.com)

Mr. Ashok **Kadam**  
Fishery Survey of India  
[ashoka\\_fsi@rediffmail.com](mailto:ashoka_fsi@rediffmail.com)

Mr. Muhammad Moazzam **Khan**  
WWF-Pakistan  
[mmoazzamkhan@gmail.com](mailto:mmoazzamkhan@gmail.com)

Ms. Beatrice **Kinyua**  
Sustainable Fisheries and  
Communities Trust  
[beatrice.kinyua@sfact.org](mailto:beatrice.kinyua@sfact.org)

Dr. Toshihide **Kitakado**  
Tokyo University of Marine Science  
and Technology  
[kitakado@kaiyodai.ac.jp](mailto:kitakado@kaiyodai.ac.jp)

Dr. Mohammed **Koya**  
CMFRI-India  
[koya313@gmail.com](mailto:koya313@gmail.com)

Mrs. Ane **Laborda**  
AZTI  
[alaborda@azti.es](mailto:alaborda@azti.es)

Dr. Polina **Levontin**  
IOTC Consultant  
[levontin@hotmail.com](mailto:levontin@hotmail.com)

Mr. Xiaodong **Li**  
Shanghai Ocean University  
[lixiaodong2019310@163.com](mailto:lixiaodong2019310@163.com)

Ms. Qinqin **Lin**  
Shanghai Ocean University  
[qinqinlin\\_lucky@yeah.net](mailto:qinqinlin_lucky@yeah.net)

Dr. Qiuyun **Ma**  
Shanghai Ocean University  
[qyma@shou.edu.cn](mailto:qyma@shou.edu.cn)

Mr. Javad **Mahdavi Roshan**  
Iran fisheries organization  
[javadmahdavi51@gmail.com](mailto:javadmahdavi51@gmail.com)

Dr. Takayuki **Matsumoto**  
Fisheries Resources Institute  
[matumot@affrc.go.jp](mailto:matumot@affrc.go.jp)

Dr. Alexandra **Maufroy**  
ORTHONGEL  
[amaufroy@orthongel.fr](mailto:amaufroy@orthongel.fr)

Ms. Shana **Miller**  
The Ocean Foundation  
[smiller@oceanfdn.org](mailto:smiller@oceanfdn.org)

Dr. Iago **Mosqueira**



Wageningen Marine Research  
[iago.mosqueira@wur.nl](mailto:iago.mosqueira@wur.nl)

Mr. Stephen **Ndegwa**  
Kenya Fisheries Service  
[ndegwafish@yahoo.com](mailto:ndegwafish@yahoo.com)

Dr. Tom **Nishida**  
Fisheries Resources Institute  
[aco20320@par.odn.ne.jp](mailto:aco20320@par.odn.ne.jp)

Mr. Pavarot **Noranartragoon**  
Department of Fisheries, Thailand  
[pavarotn@gmail.com](mailto:pavarotn@gmail.com)

Dr. Toby **Patterson**  
CSIRO  
[toby.patterson@csiro.au](mailto:toby.patterson@csiro.au)

Dr. Sujit **Pattnayak**  
Fishery Survey of India  
[sunubeta@gmail.com](mailto:sunubeta@gmail.com)

Ms. Orawan **Prasertsook**  
Department of Fisheries, Thailand  
[fukowindy.sp@gmail.com](mailto:fukowindy.sp@gmail.com)

Ms. Ann **Preece**  
CSIRO  
[ann.preece@csiro.au](mailto:ann.preece@csiro.au)

Dr. Sethuraman **Ramachandran**  
Fishery Survey of India  
[marineramc1974@gmail.com](mailto:marineramc1974@gmail.com)

Ms. Surya **S**  
CMFRI  
[revandasurya@gmail.com](mailto:revandasurya@gmail.com)

Ms. Lilis **Sadiyah**  
National Research and Innovation  
Agency of the Republic of Indonesia  
[sadiyah.lilis2@gmail.com](mailto:sadiyah.lilis2@gmail.com)

Mr. Fayakun **Satria**  
Ministry of Marine Affairs and  
Fisheries of the Republic of Indonesia  
[fsatria70@gmail.com](mailto:fsatria70@gmail.com)

Mr. Bram **Setyadji**  
Ministry of Marine Affairs and  
Fisheries of the Republic of Indonesia  
[bramsetyadji@knp.go.id](mailto:bramsetyadji@knp.go.id)

Ms. Yiqian **Shi**  
Shanghai Ocean University  
[Shiyiqian\\_SHOU@163.com](mailto:Shiyiqian_SHOU@163.com)

Pr. Liming **Song**  
Shanghai Ocean University  
[limsong@shou.edu.cn](mailto:limsong@shou.edu.cn)

Mr. Weerapol **Thitipongtrakul**  
Department of Fisheries,  
Thailand  
[weerapol.t@gmail.com](mailto:weerapol.t@gmail.com)

Ms. Laura **Tremblay-Boyer**  
CSIRO  
[laura.tremblay-boyer@csiro.au](mailto:laura.tremblay-boyer@csiro.au)

Dr. Wen-Pei **Tsai**  
National Kaohsiung University of  
Science and Technology  
[wptsai@nkust.edu.tw](mailto:wptsai@nkust.edu.tw)

Dr. Dewanand **Uikey**  
Fishery Survey of India  
[dewanandfsi@gmail.com](mailto:dewanandfsi@gmail.com)

Dr. Agurtzane **Urtizbera**  
Azti  
[aurtizbera@azti.es](mailto:aurtizbera@azti.es)

Dr. Nicola **Walker**  
Cefas  
[nicola.walker@cefaf.co.uk](mailto:nicola.walker@cefaf.co.uk)

Ms. Yang **Wang**  
Shanghai Ocean University  
[shouwyh@163.com](mailto:shouwyh@163.com)

Dr. Sheng-Ping **Wang**  
National Taiwan Ocean  
University  
[wsp@mail.ntou.edu.tw](mailto:wsp@mail.ntou.edu.tw)

Dr. Ashley **Williams**  
CSIRO  
[ashley.williams@csiro.au](mailto:ashley.williams@csiro.au)

Ms. Shiyu **Yang**  
Shanghai Ocean University  
[yangshiyu\\_shou@163.com](mailto:yangshiyu_shou@163.com)

Dr. Jiangfeng **Zhu**  
Shanghai Ocean University  
[jfzhu@shou.edu.cn](mailto:jfzhu@shou.edu.cn)

## IOTC Secretariat

Dr Paul **De Bruyn**  
Indian Ocean Tuna Commission  
Seychelles  
[Paul.DeBruyn@fao.org](mailto:Paul.DeBruyn@fao.org)

Mr Fabio **Fiorellato**  
Indian Ocean Tuna Commission  
Seychelles  
[Fabio.Fiorellato@fao.org](mailto:Fabio.Fiorellato@fao.org)

Mr Dan **Fu**  
Indian Ocean Tuna Commission  
Seychelles  
[Dan.Fu@fao.org](mailto:Dan.Fu@fao.org)

Dr Emmanuel **Chassot**  
Indian Ocean Tuna Commission  
Seychelles  
[Emmanuel.chassot@fao.org](mailto:Emmanuel.chassot@fao.org)

Ms Lauren **Nelson**  
Indian Ocean Tuna Commission  
Seychelles  
[Lauren.Nelson@fao.org](mailto:Lauren.Nelson@fao.org)

Ms Cynthia **Fernandez-Diaz**  
Indian Ocean Tuna Commission  
Seychelles  
[Cynthia.FernandezDiaz@fao.org](mailto:Cynthia.FernandezDiaz@fao.org)

Ms Lucia **Pierre**  
Indian Ocean Tuna Commission  
Seychelles  
[lucia.pierre@fao.org](mailto:lucia.pierre@fao.org)

**APPENDIX II**  
**MEETING AGENDA**

**Date:** 19-21 October 2022

**Location:** Online

**Venue:** Zoom

**Time:** 12:00 – 16:00 (Seychelles time) daily

**Chairperson:** Dr. Hilario Murua; **Vice-Chairperson:** Vacant

- 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**
  - 3.1 Outcomes of the 24<sup>th</sup> Session of the Scientific Committee (IOTC Secretariat)
  - 3.2 Outcomes of the 5<sup>th</sup> Session of the Technical Committee on Management Procedures (IOTC Secretariat)
  - 3.3 Outcomes of the 26<sup>th</sup> Session of the Commission (IOTC Secretariat)
  - 3.4 Review of Conservation and Management Measures relevant to the WPM (IOTC Secretariat)
  - 3.5 Progress on the recommendations of WPM12 (IOTC Secretariat and Chairperson)
  - 3.6 Review of intersessional meetings related to the IOTC MSE process
- 4. ALBACORE MSE: UPDATE** (Developers)
  - 4.1 Review of OM and candidate MP development
  - 4.2 Discussion and feedback on MSE development
  - 4.3 Future steps and timelines
- 5. SKIPJACK TUNA MSE: UPDATE** (Developers)
  - 5.1 Review of OM and candidate MP development
  - 5.2 Discussion and feedback on MSE development
  - 5.3 Future steps and timelines
- 6. BIGEYE TUNA MP (Resolution 22/03)**
  - 6.1 Process for running Resolution 22/03 on Bigeye MP
    - 6.1.1 MP specifications including input data needed (e.g., joint CPUE)
    - 6.1.2 Tasks, responsibilities and timeline for running the MP
    - 6.1.3 Exceptional circumstances
- 7. SWORDFISH MSE: UPDATE** (Developers)
  - 7.1 Review of OM and candidate MP development
  - 7.2 Discussion and feedback on MSE development
  - 7.3 Future steps and timelines
- 8. YELLOWFIN TUNA MSE: UPDATE** (Developers)
  - 8.1 Review of the progress on development the OM
  - 8.2 Feedback on MSE OM development
  - 8.3 Future steps and timeline
- 9. GENERAL MSE ISSUES** (Chairperson and Vice-chairperson)
  - 9.1 General discussion (e.g. catch uncertainty)
  - 9.2 MSE capacity building
  - 9.3 Internal and External Peer review

**10. JOINT CPUE STANDARDISATION (Chairperson and Consultant)** Update on the development of the joint CPUE indices for 2022.

10.2 Future workplan

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

11.1 Revision of the timeline of the MSE development

11.2 Revision of the WPM Program of Work (2022–2026), research priorities and priorities for invited experts.

**12. OTHER BUSINESS**

12.1 Date and place of the 14<sup>th</sup> and 15<sup>th</sup> Sessions of the WPM (Chairperson and IOTC Secretariat)

12.2 Review of the draft, and adoption of the Report of the 13<sup>th</sup> Session of the WPM (Chairperson)

**APPENDIX III**  
**LIST OF DOCUMENTS**

<b>Document</b>	<b>Title</b>
IOTC-2022-WPM13-01a	Agenda of the 13th Working Party on Methods
IOTC-2022-WPM13-01b	Annotated agenda of the 13th Working Party on Methods
IOTC-2022-WPM13-02	List of documents of the 13th Working Party on Methods
IOTC-2022-WPM13-03	Outcomes of the 24 <sup>th</sup> Session of the Scientific Committee (IOTC Secretariat)
IOTC-2022-WPM13-04	Outcomes of the 26 <sup>th</sup> Session of the Commission (IOTC Secretariat)
IOTC-2022-WPM13-05	Review of Conservation and Management Measures relating to methods (IOTC Secretariat)
IOTC-2022-WPM13-06	Progress made on the recommendations and requests of WPM12 and SC24 (IOTC Secretariat)
IOTC-2022-WPM13-07	Revision of the WPM Program of Work (2023-2027) (IOTC Secretariat & Chairpersons)
IOTC-2022-WPM13-08	Updates on development of MSE analyses for Indian Ocean albacore tuna and swordfish (Mosqueira I, Brunel T)
IOTC-2022-WPM13-09	Evaluations of an empirical MP for Indian Ocean skipjack tuna (Edwards C)
IOTC-2022-WPM13-10	Running the IOTC Bigeye Tuna Management Procedure for 2022 (Williams A, Jumppanen P, Preece A, Hillary R)
IOTC-2022-WPM13-11	Specifications of the IOTC Bigeye Tuna Management Procedure (Williams A, Preece A, Hillary R)
IOTC-2022-WPM13-12	Indian Ocean yellowfin tuna close-kin mark-recapture design study (Hillary R, Tremblay-Boyer L, Williams A, Hill N, Preece A)
IOTC-2022-WPM13-13	Options for Multispecies Catch Limits in Harvest Strategies for Indian Ocean Tropical Tunas (Laborda A, Urtizbera A, Gorka Merino G)
IOTC-2022-WPM13-14	Update of joint CPUE indices for the bigeye tuna in the Indian Ocean based on Japanese, Korean and Taiwanese longline fisheries data up to 2021 (Kitakado T et al)
IOTC-2022-WPM13(MSE)-R	Report of the 13th Session of the IOTC Working Party on Methods Management Strategy Evaluation Task Force (Anon)
IOTC-2022-TCMP05-R	Report of the 5th Session of the Technical Committee on Management Procedures (IOTC Secretariat)

**APPENDIX IV**  
**WORKING PARTY ON METHODS PROGRAM OF WORK (2023–2027)**

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				
		2023	2024	2025	2026	2027
1.	Continuation of Management Strategy Evaluation for Albacore, Skipjack, Yellowfin, Bigeye tunas as well as Swordfish					
	Peer review of BET MSE as per the ToRs endorsed by the SC					
<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 WPM and SC feedback, including possible robustness tests					
	1.1.2 Implementation of simulation runs and presentation of results at the TCMP					
	1.1.3 Revision and evaluation of new set of Management Procedures after presentation of MP runs to TCMP and Commission (as needed)					

1.1.5 External peer review					
1.2 Skipjack tuna					
1.2.1 Implementation of simulation runs and presentation of results at the TCMP					
1.2.2 Revision and evaluation of new set of Management Procedures after presentation of MP runs to TCMP and Commission (as needed)					
1.3 Bigeye tuna					
1.3.1 Presentation of MP application and exceptional circumstances and resulting TAC to the TCMP and Commission meeting					
1.3.2 External peer review					
1.3.3. Run MP, consider exceptional circumstances and provide the TAC advice					
1.3.4 Stock assessment to provide information on stock status					
1.4 Yellowfin tuna					
1.4.1 Update OM & present preliminary MP results to TCMP, WPTT/WPM review of new OM					
1.4.2 Present revised MP results to TCMP; iteratively update development if required)					
1.4.3 additional iterations if required					
1.5 Swordfish					
1.5.1 Revision of Operating Models based on WPM and SC feedback, including possible robustness tests					
1.5.2 Implementation of simulation runs and presentation of results at					

<p>the TCMP</p> <p>1.5.3 Revision and evaluation of new set of Management Procedures after presentation of MP runs to TCMP and Commission (as needed)</p>					
<p>Multiple stock status derived from different model structures</p>	<p>3.1 Develop specific guidance for the most appropriate models to be used or how to synthesize the results when multiple stock assessment models are presented. (see <i>IOTC-2016-WPTT18-R, para.91</i>)</p>				
<p>Presentation of stock status advice for data limited stocks</p>	<p>2.1 Explore potential methods of presenting stock status advice to managers from a range of data limited scenarios, e.g. through the development of a 'Tier' approach for providing stock status advice, based on the type of indicators used to determine stock status (e.g. CPUE series, stock assessment model)</p>				
<p>Peer Review</p>	<p>External peer review based on Terms of Reference agreed to by the WPM and following the schedule recommended in Appendix V of the WPM12 report.</p>				
<p>Capacity Building</p>	<p>Ongoing development of tools, materials and courses to continue Capacity Building for increasing participation in the MSE process</p>				

**Table 2.** Management Strategy Evaluation schedule for the IOTC Working Party on Methods (WPM) 2022-2026

Species	2023	2024	2025	2026	2027
<i>Working Party On Methods</i>					
Albacore	Technical Guidance on MSE development				
Skipjack tuna	Technical Guidance on MSE development				
Bigeye tuna	Technical Review				
Yellowfin tuna	Technical Guidance on MSE development				
Swordfish	Technical Guidance on MSE development				

Note: the assessment schedule may be changed dependant on the annual review of fishery indicators, or SC and Commission requests. ALB: albacore; BET: bigeye tuna; YFT: yellowfin tuna; SKJ: skipjack tuna



## APPENDIX V

### CONSOLIDATED RECOMMENDATIONS OF THE 13<sup>TH</sup> SESSION OF THE WORKING PARTY ON METHODS

*Note: Appendix references refer to the Report of the 13<sup>th</sup> Session of the Working Party on Methods (IOTC–2022–WPM13–R)*

#### *Outcomes of the 26th Session of the Commission*

WPM13.01: The WPM **QUERIED** whether it would be necessary to hold a virtual TCMP meeting early in the year if no MPs are considered ready for presentation to the TCMP that particular year. The WPM **RECOMMENDED** that the SC inform the Commission that no candidate MPs will be ready for consideration for adoption in 2023 and therefore the virtual TCMP meeting should not take place that year (Para 9).

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

WPM13.02: 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 2023 (Para 15).

#### *Process for running Resolution 22/03 on Bigeye MP*

WPM13.03: The WPM **NOTED** that the application of the bigeye management procedure resulted in a recommended TAC of 80,583t per year for 2024 and 2025, which requires a 15% catch reduction from the 2021 catch level. The WPM **RECOMMENDED** that the SC adopt the TAC advice from the MP (Para 34).

WPM13.04: The WPM also **NOTED** that necessary catch reductions in other stocks have not been successfully implemented and **RECOMMENDED** that the Scientific Committee note this concern and recommend to the Commission that it address this issue to maximize the reliability of the BET MP (Para 35).

#### *Exceptional Circumstances*

WPM13.05: The WPM **NOTED** that the preliminary stock assessment in 2022, which included new growth data or natural mortality scenarios, did not provide any new or different information about population trends or stock status with these being within the range of estimates from the MSE operating models. There were no major changes in fisheries or fishing operations. The catch data input to the MP is unchanged from past collation methods. The CPUE standardisation (for the series used in the MP) was not completed as specified because the operational data were not available (1 x 1 degree data were used instead), however, the recent CPUE points are within the 90% probability interval of the MSE operating models. Therefore, the WPM **AGREED** these changes were not considered as exceptional circumstances that require changes in the recommended TAC. THE WPM **RECOMMENDED** to the SC that the review of evidence for exceptional circumstances did not identify any reasons to change the advice on the TAC. (Para 40).

#### *Update on the development of the joint CPUE indices for 2023*

WPM13.06: The WPM **INQUIRED** about the possibility of access to operational-level data be granted again in the future for this exercise. Contacts have been carried out to see if this could be the case next year. **ACKNOWLEDGING** the key role of the joint CPUE time series in the assessment of the stock status for yellowfin tuna, bigeye tuna, and albacore, the WPM **RECOMMENDED** that the SC endorse the use of operational-level data for the standardization of indices of abundance derived from longline CPUE time series (Para 90).

#### *Revision of the WPM Program of work (2023–2027)*

WPM13.07: The WPM **RECOMMENDED** that the Scientific Committee consider and endorse the WPM Programme of Work (2023–2027), as provided in [Appendix IV](#) (Para 95).

#### *Date and place of the 14th and 15th sessions of the WPM*

WPM13.08: The WPM **NOTED** that the global Covid-19 pandemic has complicated international travel and it was not possible to finalise arrangements for a physical meeting in 2022. 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 in 2023. The WPM **RECOMMENDED** the SC consider mid October 2023 as a preferred time period to hold the WPM14. As usual it was also **AGREED** that this meeting should continue to be held back-to-back with the WPTT, with the WPM taking place before the WPTT (Para 97).

***Review of the draft, and adoption of the Report of the 13th Session of the WPM***

WPM13.09: The WPM **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPM13, provided in [Appendix V](#) (Para 99).