

Report of the 6th Session of the IOTC Working Party on Methods

Montpellier, France, 19–21 October 2015

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Contact details:

Indian Ocean Tuna Commission
Le Chantier Mall
PO Box 1011
Victoria, Mahé, Seychelles
Ph: +248 4225 494
Fax: +248 4224 364
Email: secretariat@iotc.org
Website: <http://www.iotc.org>

ACRONYMS

B	Biomass (total)
B_0	Unfished biomass
BET	Bigeye tuna
B_{MSY}	Biomass which produces MSY
CMM	Conservation and Management Measure (of the IOTC; Resolutions and Recommendations)
CPCs	Contracting parties and cooperating non-contracting parties
CPUE	Catch per unit of effort
current	Current period/time, i.e. $F_{current}$ means fishing mortality for the current assessment year.
F	Fishing mortality; F_{2011} is the fishing mortality estimated in the year 2011
FAD	Fish aggregating device
F_{MSY}	Fishing mortality at MSY
IOTC	Indian Ocean Tuna Commission
MP	Management Procedure
MPD	Management Procedures Dialogue
MSE	Management Strategy Evaluation
MSY	Maximum sustainable yield
OM	Operating Model
P	Probability
SC	Scientific Committee, of the IOTC
SB	Spawning biomass (sometimes expressed as SSB)
SB_{MSY}	Spawning stock biomass which produces MSY (sometimes expressed as SSB_{MSY})
WPTT	Working Party on Tropical Tunas of the IOTC
YFT	Yellowfin tuna

GLOSSARY OF TERMS

Control measure: the unit used to control the amount of fishing or resource extraction allowed (e.g. catch or effort) according to some indicator (e.g. stock status)

Harvest control rule (HCR): agreed response that management must make under pre-defined circumstances regarding stock status.

Harvest strategy: Strategy outlining how the catch in a fishery will be adjusted from year to year depending on the size of the stock, the economic or social conditions of the fishery, conditions of other interdependent stocks and uncertainty of biological knowledge. Well-managed fisheries have an unambiguous (explicit and quantitative) harvest strategy that is robust in the unpredictable biological fluctuations to which the stock may be subject. A harvest strategy sets out the management actions necessary to achieve defined biological and economic objectives in a given fishery. Harvest strategies must contain 1) a process for monitoring and conducting assessments of the biological and economic conditions of the fishery, and 2) rules that control the intensity of fishing activity according to the biological and economic conditions of the fishery (as defined by the assessment). These rules are referred to as harvest control rules.

Limit reference point (LRP): a benchmark which defines undesirable states of the system that should be avoided or achieved with very low probability.

Management objectives: the social, economic, biological, ecosystem, and political (or other) goals specified for a given management unit (e.g. stock).

Management options: alternative management procedures from which recommended management actions will be chosen.

Management procedures: a set of formal actions, usually consisting of data collection, stock assessment, and harvest control rules, to iteratively and adaptively manage a fishery.

Management strategy evaluation (MSE): procedure whereby alternative management procedures' performance are tested and compared using stochastic simulations of stock and fishery dynamics against a set of management objectives.

Performance indicators: a set of consistent statistics used to evaluate how well management objectives have been achieved.

Simulation: an imitation of a real world system used to gain insight into how the system operates.

Target reference point (TRP): a benchmark which assesses the performance of management in achieving one or more operational management objectives.

Trigger reference point (TrRP): a particular state of the system that triggers a predefined change in the management response.

STANDARDISATION OF IOTC WORKING PARTY AND SCIENTIFIC COMMITTEE REPORT TERMINOLOGY

SC16.07 (para. 23) The SC **ADOPTED** the reporting terminology contained in Appendix IV and **RECOMMENDED** that the Commission considers adopting the standardised IOTC Report terminology, to further improve the clarity of information sharing from, and among its subsidiary bodies.

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

Level 1: *From a subsidiary body of the Commission to the next level in the structure of the Commission:*

RECOMMENDED, RECOMMENDATION: Any conclusion or request for an action to be undertaken, from a subsidiary body of the Commission (Committee or Working Party), which is to be formally provided to the next level in the structure of the Commission for its consideration/endorsement (e.g. from a Working Party to the Scientific Committee; from a Committee to the Commission). The intention is that the higher body will consider the recommended action for endorsement under its own mandate, if the subsidiary body does not already have the required mandate. Ideally this should be task specific and contain a timeframe for completion.

Level 2: *From a subsidiary body of the Commission to a CPC, the IOTC Secretariat, or other body (not the Commission) to carry out a specified task:*

REQUESTED: This term should only be used by a subsidiary body of the Commission if it does not wish to have the request formally adopted/endorsed by the next level in the structure of the Commission. For example, if a Committee wishes to seek additional input from a CPC on a particular topic, but does not wish to formalise the request beyond the mandate of the Committee, it may request that a set action be undertaken. Ideally this should be task specific and contain a timeframe for the completion.

Level 3: *General terms to be used for consistency:*

AGREED: Any point of discussion from a meeting which the IOTC body considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 or level 2 above; a general point of agreement among delegations/participants of a meeting which does not need to be considered/adopted by the next level in the Commission's structure.

NOTED/NOTING: Any point of discussion from a meeting which the IOTC body considers to be important enough to record in a meeting report for future reference.

Any other term: Any other term may be used in addition to the Level 3 terms to highlight to the reader of an IOTC report, the importance of the relevant paragraph. However, other terms used are considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3, described above (e.g. **CONSIDERED; URGED; ACKNOWLEDGED**).

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EXECUTIVE SUMMARY

The 6th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Methods (WPM) was held in Montpellier, France from 19–21 October 2015. A total of 26 participants (34 in 2014, 22 in 2012) attended the Session. The meeting was opened on 19 October 2015 by the Chairperson, Dr Iago Mosqueira (EU, Spain) who welcomed participants to France. The presence of Dr Clay Porch and Dr Owen Hamel were gratefully acknowledged as Invited Experts for the WPM06.

The following are a subset of the complete recommendations from the WPM06 to the Scientific Committee, which are provided at [Appendix VI](#).

Proposal for a Technical Committee on Management Procedures

WPM06.01 ([para. 11](#)): **NOTING** with concern the lack of adequate communication of the IOTC MSE process between the Scientific Committee and the Commission to date, the WPM **RECOMMENDED** that the Scientific Committee consider, and forward to the Commission (if appropriate), the following draft outline to establish a formal communication channel for the science and management dialogue to enhance decision making. The possible adjustments to the mechanisms of communication between the Commission and the IOTC Scientific Committee to improve efficiency could include the following:

- The progress of the MSE process will benefit from having communication between the Scientific Committee and the Commission more formally structured, for example, through a dedicated Technical Committee on MP that would serve as an effective two-way channel for scientists to communicate the results of the ongoing MSE work. The Technical Committee on MP would require that specific terms of reference in line with the priorities identified in Resolution 14/03, that roles and responsibilities of both fisheries managers and scientists, and possible interactions and feedback, are developed and clarified within this framework. The Technical Committee on MP could meet in conjunction with the annual Commission Session, to facilitate full attendance by CPCs.
- The Technical Committee on MP would augment the ability of the Scientific Committee to communicate the progress of the MSE process.
- The Technical Committee on MP would focus on the presentation of results and exchange of information necessary for the Commission to consider possible adoption of harvest strategies, utilizing standard formats for the presentation of results to facilitate understanding of the material by the non-technical audience.
- It would be advisable that the agenda of the Technical Committee on MP would place an emphasis on the elements of each MP that require a decision by the Commission. To facilitate such decisions, wherever necessary, interim choices should be offered to the Commission, noting that these choices can be modified at a later stage in the review. The MSE is an iterative process that allows for adjustments as the work, and the understanding of the elements involved, progresses.

Presentation and evaluation of MSE results

WPM06.01 ([para. 40](#)): The WPM **RECOMMENDED** a draft list of performance statistics representing a suite of candidate management objectives, provided in [Appendix IV](#) which provides a means of measuring the performance of alternative management procedures against different objectives.

1. OPENING OF THE MEETING

1. The 6th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Methods (WPM) was held in Montpellier, France from 19–21 October 2015. A total of 26 participants (34 in 2014, 22 in 2012) attended the Session. The list of participants is provided at [Appendix I](#). The meeting was opened on 19 October 2015 by the Chairperson, Dr Iago Mosqueira (EU, Spain) who welcomed participants to France. The presence of Dr Clay Porch and Dr Owen Hamel were gratefully acknowledged as Invited Experts for the WPM06.
2. The WPM **NOTED** with thanks, the financial support provided by the Common Oceans (ABNJ) Tuna Project, which funded five (5) participants from developing coastal states to attend the meeting, as well as the two (2) Invited Experts.

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

3. The WPM **ADOPTED** the Agenda provided at [Appendix II](#). The documents presented to the WPM06 are listed in [Appendix III](#).

3. THE IOTC PROCESS: OUTCOMES, UPDATES AND PROGRESS

3.1 Outcomes of the 17th Session of the Scientific Committee

4. The WPM **NOTED** paper IOTC–2015–WPM06–03 which outlined the main outcomes of the 17th Session of the Scientific Committee (SC17), specifically related to the work of the WPM.
5. The WPM **NOTED** that in 2014, the SC made a number of requests in relation to the WPM05 report (noting that updates on Recommendations of the SC17 are dealt with under [Agenda item 3.4](#)). Those requests and the associated responses from the WPM06 are provided below for reference.

- **Tier approach for providing stock status advice**

- (Para. 128) *The SC **CONSIDERED** the proposal from the WPB to adopt a process to determine if a 'Tier' approach to providing stock status advice will likely enable the IOTC working parties to better communicate the levels of uncertainty present in the indicators used for monitoring the condition/status of IOTC stocks by categorising the types of assessments conducted, for the development of management advice/actions. Initial details of how a 'Tier' approach may be constructed are provided in Appendix XII of the WPB12 Report. The SC **REQUESTED** that the Chair of the WPM shall liaise with interested scientists to develop a revised proposal that includes the experience of other bodies, such as ICES, for consideration at the next SC meeting.*
- **Response:** Agenda item 8, with paper IOTC–2015–WPM06–13, will address this request.

- **Glossary of scientific terms, acronyms and abbreviations**

- (Para. 134) **RECALLING** that at its 15th Session in 2012, the SC adopted a glossary of scientific terms, acronyms and abbreviations for the most commonly used scientific terms in IOTC reports and Conservation and Management Measures (CMM), and that the glossary would remain a living document that the SC would modify incrementally in the future, the SC **AGREED** to add/modify the following terms/definitions, which would then be incorporated into the glossary and posted on the IOTC website in English and French:
 - **Management objectives.** *The social, economic, biological, ecosystem, and conservation goals specified for a given management unit (e.g. stock).*
 - **Management procedures.** *A set of formal actions, usually consisting of data collection, stock assessment (or other indicators), and harvest control rules, able to iteratively and adaptively provide robust decisions to manage a fishery.*
 - **Management strategy evaluation (MSE).** *Procedure whereby alternative management procedures' performance are tested and compared using stochastic simulations of stock and fishery dynamics against a set of management objectives.*
 - **Operating model.** *Model simulation of stock and fishery dynamics, including sources of uncertainty, used in management strategy evaluation.*
- **Response:** The IOTC Glossary was updated following the SC16, and is available for download via the 'Quick Links' tabs on the IOTC website: <http://iotc.org/>.

- **Discussion of the Science to Management dialogue**

- (Para. 187) **NOTING** that Resolution 14/03 established clear objectives, terms of reference and a meeting schedule to develop the general framework to guide the establishment, review and update of management objectives and strategies, the SC **REQUESTED** that roles and responsibilities of both fisheries managers and scientists (SC), and possible interactions and feedback, are developed and clarified within this framework.
- **Response:** This matter will be revisited during the WPM06, including via discussion of paper IOTC–2015–WPM06–INF10.
- (Para. 189) **NOTING** that the time allocated to the Scientific Committee report presentations in other tuna RFMOs, such as ICCAT, is substantially longer; the SC **REQUESTED** the Chair of the Commission consider allocating more time for the presentation of the Scientific Committee report, with the aim of ensuring better explanation of the work conducted and the provision of the management advice as requested by the Commission.
- **Response:** The request was made to the IOTC Chairperson and accommodated accordingly. If additional time is required in 2016, a similar request may be made.

3.2 Outcomes of the 19th Session of the Commission

6. The WPM **NOTED** paper IOTC–2015–WPM06–04 which outlined the main outcomes of the 19th Session of the Commission, specifically related to the work of 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.
7. The WPM **NOTED** the 11 Conservation and Management Measures (CMMs) adopted at the 19th Session of the Commission (consisting of 11 Resolutions and 0 Recommendations) as listed below:

IOTC Resolutions

- Resolution 15/01 *On the recording of catch and effort data by fishing vessels in the IOTC area of competence*
 - Resolution 15/02 *On mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs)*
 - Resolution 15/03 *On the vessel monitoring system (VMS) programme*
 - Resolution 15/04 *Concerning the IOTC record of vessels authorised to operate in the IOTC area of competence*
 - Resolution 15/05 *On conservation measures for striped marlin, black marlin and blue marlin*
 - Resolution 15/06 *On a ban on discards of bigeye tuna, skipjack tuna, yellowfin tuna, and a recommendation for non-targeted species caught by purse seine vessels in the IOTC area of competence*
 - Resolution 15/07 *On the use of artificial lights to attract fish to drifting fish aggregating devices*
 - Resolution 15/08 *Procedures on a fish aggregating devices (FADs) management plan, including a limitation on the number of FADs, more detailed specifications of catch reporting from FAD sets, and the development of improved FAD designs to reduce the incidence of entanglement of non-target species*
 - Resolution 15/09 *On a fish aggregating devices (FADs) working group*
 - Resolution 15/10 *On target and limit reference points and a decision framework*
 - Resolution 15/11 *On the implementation of a limitation of fishing capacity of Contracting Parties and Cooperating Non-Contracting Parties*
8. The WPM **NOTED** that pursuant to Article IX.4 of the IOTC Agreement, the above mentioned Conservation and Management Measures became binding on Members, 120 days from the date of the notification communicated by the IOTC Secretariat in IOTC Circular 2015–049 (i.e. **10 September 2015**).
 9. **NOTING** that the Commission also made a number of general comments and requests on the recommendations made by the Scientific Committee in 2014, which have relevance for the WPM (details as follows: paragraph numbers refer to the report of the Commission (IOTC–2015–S19–R): the WPM **AGREED** that any advice to the Commission would be provided in the relevant sections of the report below.

Para. 10. The Commission **CONSIDERED** the list of recommendations made by the SC17 ([Appendix VI](#)) from its 2014 report (IOTC-2014-SC17-R) that related specifically to the Commission. The Commission **ENDORSED** the list of recommendations as its own, while taking into account the range of issues outlined in this Report (S19) and incorporated within Conservation and Management Measures adopted during the Session and as adopted for implementation as detailed in the approved annual budget and Program of Work. (para. 10 of the S19 report)

Consultants

NOTING the Scientific Committee's attempts to prioritise the various projects and consultancies which it had requested funding for in 2016, in particular, that the High priority projects were those which it felt must be undertaken in 2016, the Commission **REQUESTED** that only those High priority projects listed in the Scientific Committee budget be funded by the Commission's regular budget, with exceptions detailed in other areas of the S19 report. (para. 40 of the S19 report)

Outcomes of the Management Procedures Dialogue (MPD02)

Para 157. The Commission **NOTED** that the 2nd Management Procedures Dialogue (MPD02) was held in Busan, Rep. of Korea on 26 and 28 April 2015. The MPD is mandated under Resolution 14/03 on enhancing the dialogue between fisheries scientists and managers. Concepts of what the IOTC is developing to ensure the long term sustainability of the resource and the fishery were discussed, and put in the context of the Precautionary Approach to fisheries. The content of the workshop are available on the IOTC website: <http://iotc.org/meetings/management-procedures-dialogue-mpd02>

Para 158. The Commission **NOTED** that the discussions were aimed at providing clarification of the various elements of a Management Procedure, and how the process of Management Strategy Evaluation is utilised to assess the performance of candidate Management Procedures in fulfilling the management objectives identified in consultation with CPC's. The roles of the managers and scientists in this process were also discussed.

Para. 159. The Commission **NOTED** the overviews of the current status of the Management Strategy Evaluation process for albacore and skipjack tuna, supported by an exercise to illustrate how a Management Procedure can be tuned on the basis of performance measures that evaluate the degree that the different objectives are met.

Para 160. The Commission **NOTED** that the MPD02 workshop summary report would be available in the coming weeks, and that it would include options for the Scientific Committee, and its relevant subsidiary bodies, to use a range of statistics as a first approximation to measure status, yield, safety, and stability in the evaluation of an initial set of candidate management procedures. The summary report would also include next steps in the process which would need to be undertaken over the coming years.

Para. 161. The Commission **NOTED** the summary of the workshop outcomes presented during the Session, as provided in [Appendix XXVIII](#). The Report of the MPD02 will be circulated to participants in the coming weeks.

Proposal for a Technical Committee on Management Procedures

10. The WPM **NOTED** that the elements required for the advancement of the Management Strategy Evaluation (MSE) as mandated by the Commission in Resolution 14/03, were not agreed upon at the 19th Session of the Commission in 2015.
11. **NOTING** with concern the lack of adequate communication of the IOTC MSE process between the Scientific Committee and the Commission to date, the WPM **RECOMMENDED** that the Scientific Committee consider, and forward to the Commission (if appropriate), the following draft outline to establish a formal communication channel for the science and management dialogue to enhance decision making. The possible adjustments to the mechanisms of communication between the Commission and the IOTC Scientific Committee to improve efficiency could include the following:
 - The progress of the MSE process will benefit from having communication between the Scientific Committee and the Commission more formally structured, for example, through a dedicated Technical Committee on MP that would serve as an effective two-way channel for scientists to communicate the results of the ongoing MSE work. The Technical Committee on MP would require that specific terms of reference in line with the priorities identified in Resolution 14/03, that roles and responsibilities of both fisheries managers and scientists, and possible interactions and feedback, are developed and clarified within this framework. The Technical Committee on MP could meet in conjunction with the annual Commission Session, to facilitate full attendance by CPCs.

- The Technical Committee on MP would augment the ability of the Scientific Committee to communicate the progress of the MSE process.
- The Technical Committee on MP would focus on the presentation of results and exchange of information necessary for the Commission to consider possible adoption of harvest strategies, utilizing standard formats for the presentation of results to facilitate understanding of the material by the non-technical audience.
- It would be advisable that the agenda of the Technical Committee on MP would place an emphasis on the elements of each MP that require a decision by the Commission. To facilitate such decisions, wherever necessary, interim choices should be offered to the Commission, noting that these choices can be modified at a later stage in the review. The MSE is an iterative process that allows for adjustments as the work, and the understanding of the elements involved, progresses.

3.3 *Review of Conservation and Management Measures relevant to the WPM*

12. The WPM **NOTED** paper IOTC–2015–WPM06–05 which aimed to encourage participants at the WPM06 to review some of the existing Conservation and Management Measures (CMM) relevant to the WPM, noting the CMMs referred to in document IOTC–2015–WPM06–04, and provided as Information Paper (IOTC–2015–WPM06–INF05); 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.
13. The WPM **AGREED** that it would consider proposing modifications for improvement to the existing CMMs following discussions held throughout the current WPM meeting.

3.4 *Progress on the recommendations of WPM05*

14. The WPM **NOTED** paper IOTC–2015–WPM06–06 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 WPM06 as appropriate given any progress.
15. The WPM **RECALLED** that any recommendations developed during a Session, must be carefully constructed so that each contains the following elements:
 - a specific action to be undertaken (deliverable);
 - clear responsibility for the action to be undertaken (i.e. a specific CPC of the IOTC, the IOTC Secretariat, another subsidiary body of the Commission or the Commission itself);
 - a desired time from for delivery of the action (i.e. by the next working party meeting, or other date);
 - if appropriate, an approximate budget for the activity, so that the IOTC Secretariat may be able to use it as a starting point for developing a proposal for the Commission's consideration.

India data collection methods

16. The WPM **NOTED** paper IOTC–2015–WPM06–14 which detailed the data collection methodology in India and status of its tuna fisheries, including the following abstract provided by the authors:

“The Indian marine fishery consists of two distant segments, the coastal and deep sea fisheries. The coastal fishery around the mainland and islands is of multi-craft and multi-gear and not exclusively for tuna fishery except in Lakshadweep Islands. In Lakshadweep Islands coastal tunas are targeted by pole & line fishery. The Institutes/organizations collecting marine fisheries statistics are (i) Department of Animal Husbandry, Dairying & Fisheries (DAHDF), Ministry of Agriculture & Farmers Welfare through Department of Fisheries of various maritime states/UTs, (ii) Fishery Survey of India (FSI) and (iii) the Central Marine Fisheries Research Institute (CMFRI). The Fishery Survey of India (FSI) has been carrying out routine surveys and assessment of fishery resources in the EEZ for sustainable exploitation and management of marine fishery resources. The Central Marine Fisheries Research Institute (CMFRI), Kochi undertakes land-based samplings to estimate fish landings from the Indian EEZ. Deep sea tuna fisheries statistics are being collected exclusively by tuna long liners owned by Fishery Survey of India (FSI) and Indian owned tuna fishing vessels operating under the Letter of Permission granted by the DAHDF. More than 70% of the catch was still obtained from coastal fisheries. Further to complement the data from the cruises, land-based data collection is vital. It is cost-effective and also provides information of a range of parameters, which at times are constrained from the cruises. India has a strong base in this area.”

I.R. Iran purse seine fishery

17. The WPM **NOTED** paper IOTC–2015–WPM06–15 which provided a review of tuna fisheries in IR Iran by its purse seine fleet, including the following abstract provided by the authors:

“In this article Is mentioned to the overall fishing and caught, in Iran and then tuna catching by purse seine vessels will be discussed. As you know fishing vessels of Iran are activity in three of the region.”

18. The WPM **NOTED** the author was unable to attend the WPM06 due to VISA issues. As such, the paper was provided for information only and not discussed.

4. ALBACORE MSE: UPDATE

19. The WPM **NOTED** paper IOTC–2015–WPM06–08 which detailed the operating model for the Indian Ocean albacore tuna, including the following abstract provided by the authors:
“This document presents the results of the work carried out to develop a reference case Operating Model for Indian Ocean albacore. The model is based around the WPTmT stock assessment and incorporates the main sources of uncertainty identified in the estimation of population trajectories and dynamics according to the data available at IOTC.”
20. The WPM **ENCOURAGED** the authors to explore the impact in the range of estimated population trajectories of a set of model runs that consider higher values for the coefficient of variation of the CPUE series, given the likely levels of observation and process errors in them.
21. The WPM **AGREED** that robustness trials of the Operating Model consider the possible effect on the Indian Ocean albacore stock of the movement of individuals between the Indian and Atlantic oceans, given the observed level of catches on the geographical limit between both RFMO areas of competence.
22. The WPM **AGREED** that the lengths in the catches from the driftnet fleets used in the model should be checked carefully, as past albacore stock assessments have included different estimates of the length classes being taken by this gear.
23. The WPM **AGREED** that a change in the current formulation of the scenario related to the form of the selectivity curve for the longline fleets should be explored. A double normal selectivity curve could be used that transitions from a dome-shaped to a flat-top curve without the need for a switch in selectivity function.
24. The WPM **AGREED** that the procedure for the rejection of biologically implausible population trajectories is acceptable. The Operating Model developed for albacore can be considered sufficient as a reference case, pending minor final revisions following suggestions from both WPM and the invited experts.
25. The WPM **ENDORSED** the current formulation of the albacore Operating Model (taking into account modifications agreed upon during WPM06 and noting the timeline established in Resolution 15/10) and **AGREED** that its use on an initial set of evaluations of management procedures should be presented during the next Scientific Committee meeting for its consideration.

5. SKIPJACK TUNA MSE: UPDATE

26. The WPM **NOTED** paper IOTC–2015–WPM06–09 which detailed the operating model for Indian Ocean skipjack tuna, including the following abstract provided by the authors:
“A simulation model of the Indian Ocean skipjack tuna fishery was developed for the evaluation of alternative fisheries management procedures. The model partitions the population by region, age, and size and the fishery by region and gear (purse seine, pole-and-line, gill net, others). Prior probability distributions and sensitivity ranges are defined for model parameters for use in conditioning and robustness testing. Performance statistics are defined based and linked to broader management objectives. Three contrasting classes of management procedure (MP) are provided as examples: BRule (a generic harvest control rule based on an estimate of stock status), FRange (a MP which adjusts effort when fishing mortality is outside a target range) and IRate (a MP which recommends a total allowable catch using a CPUE-based biomass index).”
27. The WPM **NOTED** the refinements to the model since the previous WPM meeting, including the division of the western region into two separate regions, refinements to the parameterisation of movement, and the use of a two-stanza growth model.
28. The WPM **ENCOURAGED** consideration of an alternative division of the western region, for example at the equator rather than 10 degrees south.
29. The WPM **SUGGESTED** that a mortality-at-age schedule which included an increase in mortality for older fish (i.e. senescence) be incorporated in the model.
30. **NOTING** that the operating model currently pools the spawning stock biomass to calculate recruitment across the four regions, the WPM **ENCOURAGED** consideration of SB/recruitment dynamics according to the spatial structure of the model (including variability in recruitment partitioning among areas).

31. The WPM **NOTED** the work done on internal conditioning of the Operating Model and that the conditioning based on the “feasible stock trajectories” approach appeared to provide a reasonable posterior parameter distribution to use as the basis for evaluations.
32. **NOTING** the example candidate management procedures that have been developed the WPM **ENCOURAGED** development of further procedures which include length data for skipjack tuna.
33. The WPM **ENDORSED** the current formulation of the skipjack tuna Operating Model (taking into account modifications agreed upon during WPM06 and noting the timeline established in Resolution 15/10) and **AGREED** that its use on an initial set of evaluations of management procedures should be presented during the next Scientific Committee meeting for its consideration.

6. BIGEYE TUNA AND YELLOWFIN TUNA MSE: UPDATE

34. The WPM **NOTED** paper IOTC–2015–WPM06–10 which provided an update on the bigeye tuna and yellowfin tuna management strategy evaluation development framework, including the following abstract provided by the authors:
“Recent progress on the development of a Management Strategy Evaluation (MSE, or Management Procedure Evaluation) technical framework for Indian Ocean yellowfin (YFT) and bigeye (BET) tunas is described. This includes i) an outline of the key software features implemented to date, ii) an exploration of YFT Operating Model (OM) options (conditioned using Stock Synthesis software in association with the draft 2015 assessment), and iii) an outline of the software development plan through to mid-2016. We emphasize that this technical project is only one part of a much larger MSE process that requires the engagement and exchange of ideas among many parties, including technical experts that will need to contribute to the review and development of operating models and management procedures, and various stakeholders (including fisheries managers and IOTC Commissioners) that will need to articulate their expectations about management objectives and options. This specific component of the project is scheduled for completion mid-2016, so this presentation represents the primary opportunity to solicit feedback from the general participants of the IOTC WP Methods, WP Tropical Tunas, and Scientific Committee. We welcome feedback about the defined feature set for the projection model, and the approach to Operating Model conditioning.”
35. The WPM **NOTED** that the current project is scheduled to conclude in June 2016 with the release of the software, documentation, demonstration Operating Model cases, and evaluation of candidate Management Procedures for both bigeye tuna and yellowfin tuna. Key points from the discussion are summarised below:
 - The projection software for the yellowfin tuna Operating Model is being adapted from the R-based projection software developed for Atlantic bluefin tuna. The diverse feature set includes age-structure, seasonal dynamics, multiple fleets, multiple regions and multiple populations (i.e. with independent biological parameters). A number of modifications are required for the bigeye tuna and yellowfin tuna application, and a numerically efficient C++ sub-routine is being coded in parallel to reduce memory constraints and computation time.
 - Exploratory yellowfin tuna Operating Models were presented, derived from the MP estimates of a suite of Stock Synthesis assessment models adopted and expanded from the draft yellowfin tuna stock assessment. The core of the exploratory Operating Model was based on a sensitivity trial which did not include environmental covariates for movement parameters (because the value of this feature is unclear, especially in the context of projections). Additional spatial assumptions were also explored including a reduction of spatial complexity to 2 regions, and very low and high imposed migration rates linking western and eastern regions. The exploratory suite of models will be further modified and extended in line with feedback from the WPM and WPTT.
 - Uncertainty encompassed by the yellowfin tuna operating model is expected to greatly exceed the key uncertainties of the assessment. A comparison of the median constant catch projections from the current Operating Model with stochastic recruitment was shown to be consistent with the best point estimates of the central base case assessment projections. However, the uncertainty derived from the assessment inverse Hessian projections (with constant recruitment) is very high and considerably greater than the Operating Model projections. This remains true (to some extent) with an Operating Model consisting of an ensemble of MP estimates from 27 models (encompassing a range of steepness, M, and tag weighting assumptions).
 - The Operating Model uncertainty should also include speculation about system features that are plausible, not necessarily estimable in an assessment context (i.e. given the limits of the available data), and potentially challenging for Management Procedures. These include features such as population structure (including distinct spawning populations with independent biology), and non-stationary parameters, e.g. related to recruitment, M, growth, movement, selectivity and catchability (as might be driven by density-

dependent processes or environmental variability), biased sampling and management implementation errors.

- The current Operating Model software has the capacity to simulate a number of these speculative scenarios, and some will be illustrated in the demonstration cases as part of the current project. However, prioritization of the speculative scenarios is required to focus on those which are likely to represent a meaningful challenge to the candidate MPs. Uncertainties which have very little implication for management performance do not need to be retained in the final Operating Model.
- The option for differentially weighting the suite of models in the Operating Model ensemble will be implemented (i.e. more stochastic realizations will be projected from models given a higher weighting), however, a definitive plan for establishing weighting factors has not been determined.
- The preliminary bigeye tuna Operating model will be developed using a similar process to yellowfin tuna. It is proposed that the bigeye tuna Operating Model should adopt the same spatial and fleet structure as yellowfin tuna (unlike recent assessments) to facilitate multi-species MP evaluation, in recognition that some degree of bycatch among yellowfin tuna and bigeye tuna is probably inevitable (and would have the benefit of simplifying communication with respect to fleets and areas). However, the WPM did not consider it necessary to have the same spatial structure in the data sets and indicated that the Operating Model should be developed as scheduled/contracted.
- The proposed time structure for an MP decision:
 - MP harvest control rule calculation in year y
 - Data are available to year $y-1$
 - Management action is in effect in year $y+1$
- If time permits, functionality for multi-species MSE and MPs will be incorporated into the projection software.

36. The WPM **NOTED** that some RFMOs use the concept of “reference set” and “robustness set” Operating Models to distinguish between scenarios of different plausibility. The reference set typically includes a core set of highly plausible models, which is used for the primary Management Procedure evaluation process, i.e. tuning and Management Procedure performance indicators focus on these scenarios. The robustness set potentially includes more speculative scenarios that may be very challenging for all MPs and outside of the scope of historical observation (e.g. sustained recruitment failure). The robustness set is useful for identifying performance limits of Management Procedures, and potentially choosing among Management Procedures that perform similarly with respect to the reference set.
37. The WPM **ENCOURAGED** continued work on the topic (discussed in paragraphs [34 to 36](#)) particularly noting the timeline requirements outlined in Resolution 15/10.

7. PRESENTATION AND EVALUATION OF MSE RESULTS

38. The WPM **NOTED** that a ‘management objective’ describes the overarching aims of management. [Appendix IV](#) lists five broad management objectives that are commonly used in fisheries management. Each is described as seeking to maximise some aspect of the fishery but often there are trade-offs amongst these objectives and it is not possible to maximise all simultaneously.
39. The WPM **NOTED** that a ‘performance statistic’ is a quantitative expression of a management objective. It translates a management objective into an indicator that can be quantified within the simulation model of the fishery. For each management objective, [Appendix IV](#) suggests a suite of performance statistics that could be used to assess the performance of a ‘management procedure’. This is not intended to be an exhaustive list and additional performance statistics (e.g. proportional increase in spawner biomass over the next 10 years) may be appropriate for particular cases (e.g. for stocks in need of rebuilding).
40. The WPM **RECOMMENDED** a draft list of performance statistics representing a suite of candidate management objectives, provided in [Appendix IV](#) which provides a means of measuring the performance of alternative management procedures against different objectives.

8. TIER APPROACH FOR PROVIDING STOCK STATUS ADVICE

41. The WPM **NOTED** paper IOTC–2015–WPM06–13 which provided a way forward to develop a tier approach for providing stock status advice, including the following abstract provided by the authors:
- “The IOTC Working Party on Billfish, as its 12th session in 2014, made a proposal for the adoption of a ‘tier’ approach for the provision of stock status advice. The text (IOTC, 2014, Appendix XII), in Appendix C of this document, provided a very valuable first attempt at defining such a classification in terms of data quantity*

and quality, and the stock assessments methods to be applied. A third element to be expanded is the kind of management advice that could be provided in each case. Unfortunately, and given the current workload and the limited availability of expertise at the WPM, it was not possible to build upon the WPB proposal and present a more complete proposal. Instead, in this document is the establishment of a small project lead by an expert in stock assessment methods and advice that should also involve the participation of the chairs of the IOTC species Working Parties.”

42. The WPM **NOTED** that tiered approaches can be used to facilitate the selection of appropriate stock assessment methods and encourage consistency in the provision of stock status advice derived from those methods. The specifications of the tiers will depend on their primary purpose. If it is to guide the choice of assessment models, then the ‘tiers’ are probably best structured in the form of a diagnostic key where the appropriate models are determined based on the types and quality of data available. On the other hand, if the primary purpose is to guide the provision of scientific advice, then the tiers should perhaps be structured in terms of the ability to estimate the probability density P that the convention objectives have been met (or will be met under various management strategies). For example:
 - The first tier could be defined in terms of the ideal situation where the assessment and forecast models used are believed to adequately represent the essential dynamics of the fishery as well as the major sources of uncertainty, in which case P , and the Kobe II matrix created from it, would be considered definitive.
 - A second tier might be developed to represent cases where the Scientific Committee is comfortable with a base model (or central tendency based on multiple models), but does not feel that P adequately reflects the major uncertainties. In that case a guiding principle could be that the variance of P should not be less than the variance associated with tier 1 assessments.
 - Subsequent tiers could be created to account for the degree to which the specific management objectives can be addressed. For example, in some cases the data may support reasonable probability densities for quantities related to F_{MSY} , but not SB_{MSY} .
43. The WPM **NOTED** that it may be a non-trivial exercise to generalize the degree of accuracy and precision to be expected from tiers. Experience in other fora has suggested that the assumed relationship between a tier hierarchy and uncertainty has not always translated into the desired level of precautionary management.
44. The WPM **AGREED** that there are of course a number of details that must be addressed in developing these tiers, particularly in relation to the preferred method for estimating P . As a first cut at this task it is probably best accomplished through a small working group that includes the Chairpersons and Vice-Chairpersons of the IOTC species Working Parties.
45. The WPM **NOTED** that the proposal assumes that the main objective of such a system is to guide participants and Chairpersons and Vice-Chairpersons of Working Parties when interpreting and communicating results, and providing advice based on those, for different stock assessment methods.
46. The WPM **AGREED** that it was not clear if the Scientific Committee suggestion shared this objective, and **REQUESTED** that the Scientific Committee clarifies what the motivations and objectives of such a system would be.
47. **NOTING** that depending on the precise content of the Scientific Committee request, the work is likely to require resourcing that is currently unavailable at the WPM, the WPM **AGREED** that such a project be included in the WPM Program of Work.
48. The WPM **AGREED** that any system that classifies the existing continuum of data and method complexity found in fisheries science into discrete categories may limit the ability of scientists to adapt to changing situations.
49. The WPM **AGREED** that the advantages and disadvantages of a tiered system be examined, and that the expected benefits of its implementation be considered carefully before progressing further.

9. WPM PROGRAM OF WORK

9.1 Revision of the WPM Program of work (2016–2020)

50. The WPM **NOTED** paper IOTC–2015–WPM06–07 which provided an opportunity to consider and revise the WPM Program of Work (2016–2020), by taking into account the specific requests of the Commission, Scientific Committee, and the resources available to the IOTC Secretariat and CPCs.
51. The WPM **RECALLED** that the SC, at its 17th 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)*

52. 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 high priority projects detailed on the WPM Program of Work (2016–2020) that are yet to be funded, for circulation to potential funding bodies.
53. The WPM **RECOMMENDED** that the Scientific Committee consider and endorse the WPM Program of Work (2016–2020), as provided at [Appendix V](#).
54. The WPM **NOTED** the request for new work on swordfish identified in Resolution 15/10 and has estimated the associated cost and timeline for this new requirement in the revised WPM Program of Work.

Special Session on MSE at the 18th Scientific Committee meeting

55. **NOTING** paper IOTC–2015–WPM06–INF10 which outlined a draft program for a special session on MSE at the Scientific Committee, the WPM **REQUESTED** that the Chairpersons of the Scientific Committee and WPM, in conjunction with the IOTC Secretariat, consider making such a session part of its agenda for every SC Session.
56. The WPM **SUGGESTED** the session should run for 1 to 2 hours and include a short introduction to MSE, followed by an interactive session based around a simplified MSE that allows participants to understand the dynamics of a management procedure and the necessary trade-offs between management objectives. Specific details will be agreed upon intersessionally.

10. OTHER BUSINESS

10.1 Joint t-RFMO Management Strategy Evaluation working group

57. The WPM **NOTED** that at the 3rd Joint Tuna RFMOs meeting, it was recognised that Management Strategy Evaluation (MSE) needs to be widely implemented in the tRFMOs in order to implement a Precautionary Approach for tuna fisheries management. A Joint MSE Technical Working Group, chaired by the ICCAT Secretariat, was created to work electronically in order to help promote collaboration. To move to the next stage it is proposed to hold an in-person meeting in the 1st quarter of 2016 to develop a detailed long-term work plan for the group.
58. The WPM **AGREED** that the proposed Joint MSE Technical Working Group would provide an excellent avenue for exchanging ideas on MSE development and potential uptake by RFMOs.

10.2 Common Ocean (ABNJ) Tuna Project update

59. The WPM **NOTED** the presentation of the Common Oceans (ABNJ) Tuna Project, a GEF-funded, FAO-coordinated Project that unites 19 partners, including all tuna RFMOs. Aiming at strengthening fisheries management in the five tuna RFMOs, the activities of the project are divided into three components dealing with governance, IUU fishing and reduction of ecosystem impacts. The first component includes facilitating the implementation of the precautionary approach, via the adoption of harvest strategies preceded by MSE, for the major tuna stocks. Support to the MSE process in all RFMOs include organising capacity building workshops to assist in a better understanding by member States, and direct support to the process of developing harvest strategies, including funding science-management dialogues (as it was the case of the MPD02) and, in some cases, the direct development of some harvest strategies.
60. The WPM **NOTED** that the Project is also keen to support global exchange of experiences on the MSE development between RFMOs, by supporting the Joint working group on MSE established by all tRFMOs at the Kobe III meeting. The Project renewed its pledge to support this process, as well as the IOTC MSE process during the five-year life of the Project.

10.3 Election of Chairperson and Vice-Chairperson for the next biennium

Chairperson

61. The WPM **NOTED** that the second term of the current Chairperson, Dr Iago Mosqueira (EU, Spain) is due to expire at the closing of the current WPM meeting and as per the IOTC Rules of Procedure (2014), participants are required to elect a new Chairperson for the next biennium.

62. The WPM **THANKED** Dr Mosqueira (EU,Spain) for his Chairmanship over the past four years and looked forward to his continued engagement in the activities of the WPM in the future.
63. **NOTING** the Rules of Procedure (2014), the WPM **CALLED** for nominations for the newly vacated position of Chairperson of the IOTC WPM for the next biennium. Dr Toshihide Kitakado (Japan) was nominated, seconded and elected as Chairperson of the WPM for the next biennium.

Vice-Chairperson

64. The WPM **NOTED** that the second term of the current Vice-Chairperson, Dr Toshihide Kitakado (Japan) is due to expire at the closing of the current WPM meeting and as per the IOTC Rules of Procedure (2014), participants are required to elect a new Vice-Chairperson for the next biennium.
65. The WPM **THANKED** Dr Kitakado (Japan) for his role in supporting the Chairperson and the WPM, over the past four years and looked forward to his continued engagement in the activities of the WPM in the future.
66. **NOTING** the Rules of Procedure (2014), the WPM **CALLED** for nominations for the newly vacated position of Vice-Chairperson of the IOTC WPM for the next biennium. Dr Iago Mosqueira (EU,Spain) was nominated, seconded and elected as Vice-Chairperson of the WPM for the next biennium.
67. The WPM **RECOMMENDED** that the SC note that Dr Toshihide Kitakado (Japan) and Dr Iago Mosqueira (EU,Spain) were elected as Chairperson and Vice-Chairperson of the WPM for the next biennium.

10.4 Date and place of the 7th and 8th Sessions of the WPM

68. The WPM **THANKED** France for hosting the 6th Session of the WPM and commended IRD on the warm welcome, the excellent facilities and assistance provided to the IOTC Secretariat in the organisation and running of the Session.
69. **NOTING** the importance of the Management Strategy Evaluation process, and following a discussion on who would host the 7th and 8th Sessions of the WPM in 2016 and 2017 respectively, the WPM **REQUESTED** that the IOTC Secretariat liaise with CPCs to determine if they would be able to host the 7th and 8th sessions of the WPM respectively ([Table 1](#)). Ideally, the WPM shall be held in conjunction with the WPTT each year.

Table 1. Draft meeting schedule for the WPM (2016 and 2017)

Meeting	2016			2017		
	No.	Date	Location	No.	Date	Location
Working Party on Methods (WPM)	7 th	15–17 October (3d)/ or mid-November	TBD	8 th	13–15 October (3d) or mid-November	TBD

10.5 Development of priorities for Invited Expert(s) at the next WPM meeting

70. The WPM **AGREED** to the following core areas of expertise and priority areas for contribution that need to be enhanced for the next meeting of the WPM in 2016, by an Invited Expert(s):
- **Expertise:** Management Strategy Evaluation.
 - **Priority areas for contribution:** Evaluation of management procedures, communication of fisheries advice.

2015 Invited Expert MSE Review

71. The WPM **NOTED** that the two (2) invited experts for the WPM06 were tasked with evaluating the quality of the ongoing MSE development processes for albacore and skipjack tuna. The main elements in need of review are the Operating Models that attempt to represent the full range of alternative population and fishery dynamics that can be explained by the current data. The simulation and presentation platform for evaluation of the Management Procedures has also seen some initial development, and feedback was requested.
72. The WPM **NOTED** that the overall objectives for the Invited Expert MSE review were to:
- Carry out an assessment of the IOTC Management Strategy Evaluation process for albacore and skipjack tuna.
 - Review and evaluate the current state of development of the Operating Models for albacore and skipjack tuna.
 - Provide feedback on the simulation platform, including the range of management procedures and harvest control rules being suggested.
 - Make recommendations on how to improve the processes.

-
73. The WPM **NOTED** that the next steps in the Invited Expert MSE review is for them to deliver a combined report of their findings to the Chairperson of the WPM and the IOTC Secretariat, which will be included in the WPM06 Report presentation to the 18th Session of the IOTC Scientific Committee (SC18).

10.6 *Review of the draft, and adoption of the Report of the 6th Session of the WPM*

74. The WPM **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPM06, provided at [Appendix VI](#).
75. The report of the 6th Session of the Working Party on Methods (IOTC–2015–WPM06–R) was **ADOPTED** on 21 October 2015.

APPENDIX I

LIST OF PARTICIPANTS

Chairperson

Dr Iago Mosqueira
European Commission
Joint Research Centre
IPSC G03, Italy
Email: iago.mosqueira@jrc.ec.europa.eu

Vice Chairperson

Dr Toshihide Kitakado
Tokyo University of Marine Science & Technology, Japan
Email: kitakado@kaiyodai.ac.jp

Other Participants

Dr M. Shiham Adam
MRC/Ministry of Fisheries & Agriculture, Maldives
Email: msadam@mrc.gov.mv

Mrs Sumana Andra Hannadige
Department of Fisheries and Aquatic Resources
Sri Lanka
Email: ahsederiweera@gamil.com

Mr Alejandro Anganuzzi
Common Ocean (ABNJ) Tuna Project, FAO, Italy.
Email: alejandro.anganuzzi@fao.org

Dr Pascal Bach
IRD, EU, France
Email: pascal.bach@ird.fr

Mr Nokome Bentley
Trophia Ltd.
Email: nbentley@trophia.com

Dr Alain Fonteneau
IRD, France, European Union
Email: alain.fonteneau@ird.fr

Dr Daniel Gaertner
IRD, France
Email: daniel.gaertner@ird.fr

Dr Adrian Gutteridge
Marine Stewardship Council
Email: adrian.gutteridge@msc.org

Dr Laurie Kell
ICCAT, Spain
Email: laurie.kell@iccat.int

Dr Dale Kolody
CSIRO, Australia
Email: dale.kolody@csiro.au

Dr Rekha Maldeniya
NARA, Sri Lanka
Email: rekhamaldeniya@gmail.com

Dr Francis Marsac
IRD, France
Email: francis.marsac@ird.fr

Dr Takayuki Matsumoto
National Research Institute of Far Seas Fisheries, Japan
Email: matumot@affrc.go.jp

Dr Gorka Merino
AZTI, Spain
Email: gmerino@azti.es

Dr Hilario Murua
AZTI Tecnalia, Spain,
European Union
Email: hmurua@azti.es

Dr Tom Nishida
National Research Institute of Far Seas Fisheries
Email: aco20320@par.odn.ne.jp

Mr Sanjay Pandey
Ministry of Fisheries
India
Email: sanjay_rpandey@yahoo.co.in

Ms Sampan Panjarat
Department of Fisheries
Thailand
Email: spanjarat@yahoo.com

Dr Clay Porch
Southeast Fisheries Science Center,
National Marine Fisheries Service,
USA
Email: clay.porch@noaa.gov

Dr Owen Hamel
Northwest Fisheries Science Center,
National Marine Fisheries Service,
USA
Email: owen.hamel@noaa.gov

Mr Anwar Sheik Mamode
Albion Fisheries Research Centre,
Mauritius
Email: asheik-mamode@govmu.org

Dr Gerald Scott
International Seafood sustainability
Foundation, USA
Email: gpscott_fish@hotmail.com

Dr Ashley Williams
Department of Agriculture and Water
Resources
Australia
Email: ashley.williams@jcu.edu.au

Dr David Wilson
Indian Ocean Tuna Commission
Seychelles
Email: david.wilson@iotc.org

APPENDIX II

AGENDA FOR THE 6TH WORKING PARTY ON METHODS

Date: 19–21 October 2015

Location: Montpellier, France

Venue: Montpellier Aquarium

Time: 09:00 – 17:00 daily

Chairperson: Dr. Iago Mosqueira; **Vice-Chairperson:** Dr. Toshihide Kitakado

- 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 17th Session of the Scientific Committee (IOTC Secretariat)
 - 3.2 Outcomes of the 19th Session of the Commission (IOTC Secretariat)
 - 3.3 Review of Conservation and Management Measures relevant to the WPM (IOTC Secretariat)
 - 3.4 Progress on the recommendations of WPM05 (IOTC Secretariat)
- 4. ALBACORE MSE: UPDATE** (Chairperson)
 - 4.1 Conditioning of operating models
 - 4.2 Simulation platform
 - 4.3 Tentative Harvest Control Rules
- 5. SKIPJACK TUNA MSE: UPDATE** (Chairperson and Consultant)
 - 5.1 Conditioning of operating models
 - 5.2 Simulation platform
 - 5.3 Tentative Harvest Control Rules
- 6. BIGEYE TUNA AND YELLOWFIN TUNA MSE: UPDATE** (Chairperson and Consultant)
- 7. PRESENTATION AND EVALUATION OF MSE RESULTS** (Chairperson)
 - 7.1 Visualisation of MSE results
 - 7.2 Performance indicators
- 8. TIER APPROACH FOR PROVIDING STOCK STATUS ADVICE** (Chairperson)
- 9. WPM PROGRAM OF WORK** (Chairperson and IOTC Secretariat)
 - 9.1 Revision of the WPM Program of Work (2016–2020)
- 10. OTHER BUSINESS**
 - 10.1 Joint t-RFMO Management Strategy Evaluation working group (Kell L)
 - 10.2 Common Ocean (ABNJ) Tuna Project update (FAO)
 - 10.3 Election of Chairperson and Vice-Chairperson for the next biennium (Chairperson and IOTC Secretariat)
 - 10.4 Date and place of the 7th and 8th Sessions of the WPM (Chairperson and IOTC Secretariat)
 - 10.5 Development of priorities for Invited Expert(s) at the next WPM meeting (Chairperson)
 - 10.6 Review of the draft, and adoption of the Report of the 6th Session of the WPM (Chairperson)

APPENDIX III

LIST OF DOCUMENTS

Document	Title	Availability
IOTC–2015–WPM06–01a	Agenda of the 6 th Working Party on Methods	✓ (23 March 2015) ✓ (19 October 2015)
IOTC–2015–WPM06–01b	Annotated agenda of the 6 th Working Party on Methods	✓ (1 October 2015) ✓ (19 October 2015)
IOTC–2015–WPM06–02	List of documents of the 6 th Working Party on Methods	✓ (1 October 2015) ✓ (6, 19 October 2015)
IOTC–2015–WPM06–03	Outcomes of the 17 th Session of the Scientific Committee (IOTC Secretariat)	✓ (8 April 2015)
IOTC–2015–WPM06–04	Outcomes of the 19 th Session of the Commission (IOTC Secretariat)	✓ (29 September 2015)
IOTC–2015–WPM06–05	Review of Conservation and Management Measures relating to methods (IOTC Secretariat)	✓ (8 April 2015)
IOTC–2015–WPM06–06	Progress on the recommendations of WPM05 (IOTC Secretariat & Chair)	✓ (2 October 2015)
IOTC–2015–WPM06–07	Revision of the WPM Program of Work (2016–2020) (IOTC Secretariat, Chairperson & Vice-Chairperson)	✓ (5 October 2015)
IOTC–2015–WPM06–08	Operating model for Indian Ocean albacore tuna (Mosqueira I & Scott F)	✓ (5 October 2015)
IOTC–2015–WPM06–09	An operating model for the Indian Ocean skipjack tuna fishery (Bentley N & Adam MS)	✓ (5 October 2015)
IOTC–2015–WPM06–10	Indian Ocean yellowfin and bigeye tuna management strategy evaluation development framework – Draft progress update (Kolody D, Jumppanen P, Carruthers T & Langley A)	✓ (5 October 2015)
IOTC–2015–WPM06–11	Withdrawn	Withdrawn
IOTC–2015–WPM06–12	Withdrawn	Withdrawn
IOTC–2015–WPM06–13	Base document for the development of a multiple-tier system for stock-assessment-based advice in IOTC (Mosqueira I & Jardim E)	✓ (5 October 2015)
IOTC–2015–WPM06–14	Data collection methodology in India and status on tuna fisheries (Rao PC, Premchand & Pandey S)	✓ (5 October 2015)
IOTC–2015–WPM06–15	A Review of fishing tuna by purse seiner in Iran (Moradi G)	✓ (30 September 2015)
IOTC–2015–WPM06–16	Adoption of a table of performance indicators for the evaluation of Management Procedures for IOTC stocks (Mosqueira I & Kitakado T)	✓ (5 October 2015)
INFORMATION PAPERS		
IOTC–2015–WPM06–INF01	ISSF Technical Report 2015-06: 2015 ISSF Stock Assessment Workshop Characterizing Uncertainty in Stock Assessment and Management Advice.	✓ (30 September 2015)
IOTC–2015–WPM06–INF02	Addressing Uncertainty in Fisheries Science and Management (National Aquarium).	✓ (30 September 2015)
IOTC–2015–WPM06–INF03	Report of the 2015 meeting of the ICCAT Working Group on Stock Assessment Methods (WGSAM).	✓ (30 September 2015)
IOTC–2015–WPM06–INF04	Report of ICCAT Standing Working Group to Enhance Dialogue (SWGSM).	✓ (30 September 2015)
IOTC–2015–WPM06–INF05	Resolution 15/10 <i>On target and limit reference points and a decision framework</i>	✓ (10 September 2015)
IOTC–2015–WPM06–INF06	Proposed Agenda for a Joint Tuna RFMO MSE WG (Kell L)	✓ (7 October 2015)
IOTC–2015–WPM06–INF07	Fisheries management science: an introduction to simulation based methods (Kell L, Levontin PDC, Harley S, Kolody D, Maunder M, Mosqueira I, Pilling G & Sharma R)	✓ (7 October 2015)
IOTC–2015–WPM06–INF08	Report of the 2nd CPUE Workshop on Longline Fisheries, 30 April – 2 May 2015 (Hoyle SD, Okamoto H, Yeh Y-M, Kim ZG, Lee SI & Sharma R)	✓ (7 October 2015)
IOTC–2015–WPM06–INF09	Report of the 4th Meeting of the MSE Development Group of the Working Party on Methods of IOTC (Anon)	✓ (12 October 2015)
IOTC–2015–WPM06–INF10	Proposal for a special session on Management Strategy Evaluation at the 18th Session of the Indian Ocean Tuna Commission Scientific Committee (Mosqueira I & Kitakado T)	✓ (16 October 2015)

APPENDIX IV

CANDIDATE PERFORMANCE STATISTICS AND TYPES OF MANAGEMENT OBJECTIVES FOR
THE EVALUATION OF MANAGEMENT PROCEDURES

Candidate performance statistics	Performance measure/s	Summary statistic
Status: maximize probability of maintaining stock in the Kobe green zone		
Mean spawner biomass relative to unfished	SB/SB_0	Geometric mean over years
Minimum spawner biomass relative to unfished	SB/SB_0	Minimum over years
Mean spawner biomass relative to B_{MSY}	SB/SB_{MSY}	Geometric mean over years
Mean fishing mortality relative to target	F/F_{targ}	Geometric mean over years
Mean fishing mortality relative to F_{MSY}	F/F_{MSY}	Geometric mean over years
Probability of being in Kobe green quadrant	SB, F	Proportion of years that $SB \geq SB_{targ}$ & $F \leq F_{targ}$
Probability of being in Kobe red quadrant	SB, F	Proportion of years that $SB < SB_{targ}$ & $F > F_{targ}$
Safety: maximize the probability of the stock remaining above the biomass limit		
Probability that spawner biomass is above 20% of SB_0	SB	Proportion of years that $SB > 0.2SB_0$
Yield: maximize catches across regions and gears		
Mean catch	C	Mean over years
Mean catch by region and/or gear	C	Mean over years
Mean proportion of MSY	C/MSY	Mean over years
Abundance: maximize catch rates to enhance fishery profitability		
Mean catch rates by region and gear	A	Geometric mean over years
Stability: maximise stability in catches to reduce commercial uncertainty		
Mean absolute proportional change in catch	C	Mean over years of absolute (C_t / C_{t-1})
Variance in catch	C	Variance over years
Variance in fishing mortality	F	Variance over years
Probability of fishery shutdown	C	Proportion of years that $C = 0$

Note: All the candidate performance statistics are summarised using the XX^{th} percentiles (e.g. $XX=5/10/50$) of their distributions over multiple stochastic realisations. The summary will include short and long-term time windows (e.g. 1, 3, 5, 10 and 20 years).

APPENDIX V

WORKING PARTY ON METHODS PROGRAM OF WORK (2016–2020)

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	Priority ranking	Lead	Est. budget (potential source)	Timing				
					2016	2017	2018	2019	2020
1. Management Strategy Evaluation	1.1 Albacore	1	EU (JRC)						
	1.1.1 Implementation of initial set of simulation runs and results			25,000 (TBD)					
	1.1.2 Revision of Operating Models based on WPM and SC feedback, including possible robustness tests			25,000 (TBD)					
	1.1.3 Revision of Management Procedures and Indicators after presentation of initial set to MPD03 and Commission			30,000 (TBD)					
	1.1.4 Evaluation of new set of Management Procedures (if required)			\$?? (TBD)					
	1.2 Skipjack tuna	2	Maldives						
	1.2.1 Implementation of initial set of simulation runs and results			\$?? (TBD)					
	1.2.2 Revision of Operating Models based on WPM and SC feedback, including possible robustness tests			\$?? (TBD)					
	1.2.3 Revision of Management Procedures and Indicators after presentation of initial set to MPD03			\$?? (TBD)					
	1.2.4 Evaluation of new set of Management Procedures (if required)			\$?? (TBD)					

1.3 Bigeye tuna	3	Australia (CSIRO)	\$75,000 (IOC)					
1.3.1 Software tools for model conditioning and evaluation of MPs								
1.3.2 Demonstration of initial OMs and first set of candidate MPs								
1.3.3 Development of Bigeye OM based on new spatial structure				May				
1.3.4 Revision of Operating Models based on WPM and SC feedback, including possible robustness tests			\$?? (TBD)	Dec				
1.4 Yellowfin tuna	4	Australia (CSIRO)	\$75,000 (IOC)					
1.4.1 Software tools for model conditioning and evaluation of MPs								
1.4.2 Demonstration of initial OMs and first set of candidate MPs								
1.4.3 Revision of Operating Models based on WPM and SC feedback, including possible robustness tests				May				
1.4.4 Final Model with MP's			\$?? (TBD)	Dec				
1.5 Effective communication of Management Strategy Evaluation	1	Chair						
1.5.1 Exploration of tools for effective presentation of MSE results			Nil					
1.5.2 Implementation and adaptation of those tools for IOTC needs			\$8,000 (COI)					
1.6 Swordfish	5	TBD	\$?? (TBD)					
1.6.1 Initial OM								
1.6.2 Conditioning and OM set up								
1.6.3 Generic MP tests								

1.6.4 Final Model with MP's								
2. Tier approach for providing stock status advice	2.1 Develop 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)	6	Consult.					
	2.1.1 Review of current practices and recommendation for the consideration at WPM07 and SC19.			\$10,000 (TBD)				

Note that Resolution 14/03 has certain hard deadlines and to achieve them this work needs to be completed. These are noted below.

From Resolution 14/03:

Para. 2 (Point 2): "These Science and Management Dialogue Workshops shall be held in 2015, 2016 and 2017, as needed, prior to the respective Commission Annual Sessions"

Para. 4: The effectiveness of the Science and Management Dialogue Workshops shall be reviewed no later than at the Annual Session of the Commission in 2018.

APPENDIX VI

CONSOLIDATED RECOMMENDATIONS OF THE 6TH SESSION OF THE WORKING PARTY ON METHODS

Note: Appendix references refer to the Report of the 6th Session of the Working Party on Methods (IOTC–2015–WPM06–R)

Proposal for a Technical Committee on Management Procedures

WPM06.01 ([para. 11](#)): **NOTING** with concern the lack of adequate communication of the IOTC MSE process between the Scientific Committee and the Commission to date, the WPM **RECOMMENDED** that the Scientific Committee consider, and forward to the Commission (if appropriate), the following draft outline to establish a formal communication channel for the science and management dialogue to enhance decision making. The possible adjustments to the mechanisms of communication between the Commission and the IOTC Scientific Committee to improve efficiency could include the following:

- The progress of the MSE process will benefit from having communication between the Scientific Committee and the Commission more formally structured, for example, through a dedicated Technical Committee on MP that would serve as an effective two-way channel for scientists to communicate the results of the ongoing MSE work. The Technical Committee on MP would require that specific terms of reference in line with the priorities identified in Resolution 14/03, that roles and responsibilities of both fisheries managers and scientists, and possible interactions and feedback, are developed and clarified within this framework. The Technical Committee on MP could meet in conjunction with the annual Commission Session, to facilitate full attendance by CPCs.
- The Technical Committee on MP would augment the ability of the Scientific Committee to communicate the progress of the MSE process.
- The Technical Committee on MP would focus on the presentation of results and exchange of information necessary for the Commission to consider possible adoption of harvest strategies, utilizing standard formats for the presentation of results to facilitate understanding of the material by the non-technical audience.
- It would be advisable that the agenda of the Technical Committee on MP would place an emphasis on the elements of each MP that require a decision by the Commission. To facilitate such decisions, wherever necessary, interim choices should be offered to the Commission, noting that these choices can be modified at a later stage in the review. The MSE is an iterative process that allows for adjustments as the work, and the understanding of the elements involved, progresses.

Presentation and evaluation of MSE results

WPM06.01 ([para. 40](#)): The WPM **RECOMMENDED** a draft list of performance statistics representing a suite of candidate management objectives, provided in [Appendix IV](#) which provides a means of measuring the performance of alternative management procedures against different objectives.

Revision of the WPM Program of work (2016–2020)

WPM06.01 ([para. 53](#)): The WPM **RECOMMENDED** that the Scientific Committee consider and endorse the WPM Program of Work (2016–2020), as provided at [Appendix V](#).

Election of Chairperson and Vice-Chairperson for the next biennium

WPM06.01 ([para. 67](#)): The WPM **RECOMMENDED** that the SC note that Dr Toshihide Kitakado (Japan) and Dr Iago Mosqueira (EU, Spain) were elected as Chairperson and Vice-Chairperson of the WPM for the next biennium.

Review of the draft, and adoption of the Report of the 6th Session of the WPM

WPM06.01 ([para. 74](#)): The WPM **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPM06, provided at [Appendix VI](#).