Report of the Fourth Session of the IOTC Working Party on Methods

Mauritius, 22–23 October, 2012

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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

ACRONYNS

CMM	Conservation and Management Measure (of the IOTC; Resolutions and Recommendations)
CPUE	Catch per unit of effort
FAD	Fish aggregation device
GIS	Geographic information system
HCR	Harvest control rule
HS	Harvest strategy
IOTC	Indian Ocean Tuna Commission
LRP	Limit reference point
MP	Management procedure
MSE	Management strategy evaluation
MSY	Maximum sustainable yield
OM	Operating model
RFMO	Regional Fisheries Management Organisation
SC	Scientific Committee of the IOTC
TAC	Total allowable catch
TOR	Terms of reference
TRP	Target reference point
TrRP	Trigger reference point
WPM	Working Party on Methods

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: 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): a procedure whereby alternative management strategies are tested and compared using simulations of stock and fishery dynamics.

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.

TABLE OF CONTENTS

1. Election of a Chair and Vice-Chair for the Next Biennium 6

2. Opening of the Meeting 6

3. Adoption of the Agenda and Arrangements for the Session 6

4. Outcomes of the Fourteenth Session of the Scientific Committee and the Sixteenth Session of the Commission 6

5. Reference Points and Harvest Control Rules for IOTC Stocks 6

6. Objectives for IOTC Stocks 8
6.1 Review of relevant IOTC decisions 8
6.2 Implicit and explicit objectives 8

7. Current and Future Work on MSE Steps 8
7.1 Conditioning of Operating Models 8
7.2 Harvest Control Rules 8
7.3 Simulations 9
7.4 Outcomes and performance Indicators 9

8. Presentation of MSE Outputs 9

9. Advances in CPUE Standardisations for Indian Ocean Fleets 9

10. Methods for Synthesis of Stock Assessment Results Across Models 10

11. Advances in Software and Methods for Stock Assessment 10

12. Research Recommendations and Priorities 11

13. Other Business 11
13.1 Date and place of the Fifth Session of the WPM 11
13.2 Development of priorities for an Invited Expert at the next WPM meeting 11
13.3 Review of the draft, and adoption of the Report of the Fourth Session of the WPM 11

Appendix I List of participants 12

Appendix II Agenda for the Fourth Working Party on Methods 13

Appendix III List of documents 14

Appendix IV Draft Workplan for a Management Strategy Evaluation for IOTC Stocks for 2013 15

Appendix V Consolidated recommendations of the Fourth Session of the Working Party on Methods 17

EXECUTIVE SUMMARY

The Fourth Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Methods (WPM) was held in Mauritius, from 22 to 23 October 2012. A total of 22 participants attended the Session.

The following are a subset of the complete recommendations from the WPM04 to the Scientific Committee, which are provided at Appendix V, as well as important agreements made by the WPM.

Capacity building

The WPM **RECOMMENDED** that the IOTC Secretariat coordinate the development and delivery of several training workshops focused on providing assistance to developing CPCs to better understand the MSE process, including how reference points and harvest control rules are likely to function in an IOTC context. The implications of IOTC Resolution 12/01 on the implementation of the precautionary approach and IOTC Recommendation 12/14 on interim target and limit reference points should be incorporated into the workshop. The SC should consider requesting that the Commission's budget incorporate appropriate funds for this purpose. (para. 19)

Review of relevant IOTC decisions

The WPM **NOTED** with concern that the interim LRP contained in IOTC Recommendation 12/14 may not be precautionary (see IOTC Resolution 12/01), or consistent with the FAO Code of Conduct for Responsible Fisheries. The fishing mortality rate which generates MSY should be regarded as a minimum standard for LRP. Thus, the WPM **AGREED** to analyse the robustness of TRPs and LRPs as outlined in the workplan (Appendix IV). (para. 22)

Implicit and explicit objectives

The WPM **AGREED** that the role of managers and stakeholders is to identify management objectives, candidate TRP and LRP (e.g. those contained in Recommendation 12/14 on interim target and limit reference points), acceptable levels of risk of exceeding LRPs, options for HCRs, and the criteria against which their performance should be evaluated. The role of IOTC scientists is to evaluate candidate TRPs and LRPs and the performance of identified candidate HCRs. (para. 23)

The WPM **AGREED** that management objectives should explicitly state the goals for the fishery, and that some of these objectives are likely to conflict with one another (e.g. maximising total allowable catch (TAC) versus minimising the risk of low population levels). Where possible, the Commission should be made aware of any conflicting management objectives which they agree upon so that Commissioners set priorities among objectives throughout the MSE process. (para. 24)

Research recommendations and priorities

The WPM **RECOMMENDED** that the SC consider the draft workplan for the development of the IOTC MSE process, provided at Appendix IV. (para. 43)

Date and place of the Fifth Session of the WPM

The WPM **RECOMMENDED** that the SC note that while the MSE process was still in its early stages of development, there was no pressing need to hold a WPM meeting in 2013, as the work to be undertaken was of a highly technical nature and would require the involvement of a very limited number of experts in the field of development and implementation of population and fishery models for MSE. Thus, as suggested in the MSE workplan (Section 12), one or two workshops composed of experts should be held in 2013 to continue the development of the MSE process. Where possible, these should be held in conjunction with other IOTC meetings to minimise budgetary consequences. (para. 45)

The WPM **RECOMMENDED** that the SC consider the consolidated set of recommendations arising from WPM04, provided at Appendix V. (para. 49)

1. ELECTION OF A CHAIR AND VICE-CHAIR FOR THE NEXT BIENNIUM

1. The IOTC Secretariat notified participants that at the Fourteenth Session of the IOTC Scientific Committee (SC) the SC agreed that Dr. Iago Mosqueira (European Union) and Dr. Toshihide Kitakado (Japan) would act in the roles of co-ordinators for the MSE process until the Working Party on Methods (WPM) can consider candidates for Chair and Vice-Chair at its meeting in 2012.

2. The WPM nominated and **ELECTED** Dr. Iago Mosqueira (European Union) as the Chair, and Dr. Toshihide Kitakado (Japan) as Vice-Chair of the WPM for the next biennium.

2. OPENING OF THE MEETING

3. The Fourth Session of the Indian Ocean Tuna Commission's (IOTC) WPM was held in Mauritius, from 22 to 23 October 2012. A total of 22 participants attended the Session. The list of participants is provided at Appendix I.

4. The meeting was opened on the 22 October, 2012 by the Chair, Dr. Iago Mosqueira who welcomed participants to Mauritius.

3. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

5. The WPM **ADOPTED** the Agenda provided at Appendix II. The documents presented to the WPM are listed in Appendix III.

4. OUTCOMES OF THE FOURTEENTH SESSION OF THE SCIENTIFIC COMMITTEE AND THE SIXTEENTH SESSION OF THE COMMISSION

6. The WPM **NOTED** paper IOTC–2012–WPM04–03 which outlined the main outcomes of the Fourteenth Session of the SC and the Sixteenth Session of the Commission, specifically related to the work of the WPM, and **AGREED** to consider how to progress these issues at the present meeting.

5. REFERENCE POINTS AND HARVEST CONTROL RULES FOR IOTC STOCKS

7. The WPM **NOTED** paper IOTC–2012–WPM04–04 which outlined the process for the evaluation of reference points and harvest control rules for IOTC stocks, including the following abstract provided by the authors:

> "*A fundamental shift in fisheries advice over the last 10 or 15 years has been the stronger role that uncertainty and precaution have been playing in the decision making process on fish stocks. The precautionary approach can be seen as the precise translation in management terms of a trend already present in the scientific advice process, that of moving from single point estimates of stock status and productivity to coherent understanding of the uncertainties involved and their effect on our ability to manage natural populations. This has shifted the emphasis from optimality to robustness, and from attempting to extract the most out of a stock to ensuring as far as possible that the resource, and the industry and livelihoods that depend on it, are not placed at risk.*
>
> *The comprehensive consideration of uncertainty and risk has been greatly helped by recent advances in computational power and technical developments. Management Strategy Evaluation (MSE), also termed the Management Procedure approach, has emerged as the main method by which these ideas are used. A simulation procedure is used to understand the ability of alternative management rules at achieving a set of objectives, under a range of scenarios believed to encompass the most likely sources of noise and bias in a fishery system (Holland, 2010).*
>
> *Recent decisions by the IOTC plenary and the Scientific Committee have endorsed proposals for development of MSE analyses for IOTC stocks, and WPM needs now to start working on the development of the necessary models and simulations. The objective of this document is to provide arguments for discussion of the multiple steps involv*ed in an MSE process, so that WPM can start the necessary work under the widest possible agreement."

8. The WPM **AGREED** that the first step in successfully developing any complex modelling procedure, such as an MSE process, is to identify, explore and agree on what tasks the work precisely involves.

9. The WPM **AGREED** that a simulation process like MSE does not consist of a series of linear steps, but rather feedback and rethinking need to be undertaken at each step in the process. The following steps should be considered:
    1. Specify and prioritise **objective**s, qualitatively/quantitatively
    2. Translate objectives into **performance measures**
    3. Develop **operating models**
    4. Identify possible **management procedures**
    5. **Simulate** the application of management procedures
    6. Compare management procedures **performance** and robustness to uncertainty
    7. **Select** a management procedure that best fits agreed performance criteria.

General discussion

10. The WPM **NOTED** that limit reference points (LRP) set boundaries which are intended to constrain harvesting within safe biological limits within which the stocks can produce maximum sustainable yield (MSY). Precautionary reference points should be stock-specific to account for the reproductive capacity, the resilience of each stock and the characteristics of the fisheries exploiting the stock, as well as other sources of mortality and major sources of uncertainty.

11. The WPM **AGREED** that any fishery management strategies developed as part of the MSE process, should ensure that the risk of exceeding LRPs is very low. If a stock falls below a LRP or is at risk of falling below such a reference point, conservation and management measures would need to be rapidly initiated to facilitate stock recovery.

12. The WPM **AGREED** that the allowable risk of breaching a LRP may be applied on a species-specific basis, for example a higher risk may be acceptable for yellowfin tuna and bigeye tuna, while a more precautionary, lower level of risk could be considered for albacore tuna, based on the known biology and level of uncertainty in stock assessments for each stock.

13. The WPM **AGREED** that as part of the MSE process in 2013, consideration of the quality and robustness of the interim reference points outlined in IOTC Recommendation 12/14, or any subsequent revision, should be undertaken.

14. The WPM **AGREED** that as IOTC fisheries for tuna and tuna-like species are multi-species fisheries, that the MSE process should be advanced by taking into account multi-species/fisheries interactions. A Management Procedure (MP) could be developed for bigeye tuna, skipjack tuna and yellowfin tuna in combination.

15. The WPM **NOTED** that target reference points (TRP) indicate the desired system state and are what a harvest control rule (HCR) would aim to achieve with high probability. Effectively, a stock that is below the target should be harvested at a lower rate than one above the target.

16. The WPM **NOTED** that trigger reference points (TrRP) are used to specify a particular change in management action, often acting as a buffer between the TRP and the LRP. For example, a recovery plan could be built into a HCR as a management action that is 'triggered' as the stock approaches unsafe/undesirable biological limits (i.e. the LRP). The overall performance of the reference point framework and a HCR must be considered within the structure of the IOTC's fishery management system as a whole. For example, information delays from data collection processes and stock assessment evaluations need to be considered when designing a HCR, as do influences on other target species in multi-species fisheries and bycatch levels of non-target species.

17. The WPM **AGREED** that time lags in data reporting, stock assessments and management decisions will need to be taken into consideration when undertaking the MSE process for IOTC stocks.

Capacity building

18. The WPM **RECOMMENDED** that the SC consider making a request to the Chair of the Commission, to include an information session during each Commission meeting, which would provide Commissioner's with annual updates and explanatory material to ensure they are kept abreast of the methods and processes being undertaken as part of the broader IOTC MSE process.

19. The WPM **RECOMMENDED** that the IOTC Secretariat coordinate the development and delivery of several training workshops focused on providing assistance to developing CPCs to better understand the MSE process, including how reference points and harvest control rules are likely to function in an IOTC context. The implications of IOTC Resolution 12/01 *on the implementation of the precautionary*

approach and IOTC Recommendation 12/14 *on interim target and limit reference points* should be incorporated into the workshop. The SC should consider requesting that the Commission's budget incorporate appropriate funds for this purpose.

6. OBJECTIVES FOR IOTC STOCKS

6.1 Review of relevant IOTC decisions

20. The WPM **AGREED** that the interim reference points detailed in IOTC Recommendation 12/14 should act as benchmarks for developing HCRs and theoretical management actions as part of the MSE process, as reference points alone are not sufficient to provide a scientific basis for making management decisions.

21. The WPM **NOTED** that HCRs are the tools used to operationalise management objectives through the use of reference points in an attempt to best meet the Commission's overall objectives. Therefore, clearly stated management objectives from the Commission will be critical because they will guide the refinement of the interim reference points and define the success of a future harvest strategy for IOTC stocks.

22. The WPM **NOTED** with concern that the interim LRP contained in IOTC Recommendation 12/14 may not be precautionary (see IOTC Resolution 12/01), or consistent with the FAO Code of Conduct for Responsible Fisheries. The fishing mortality rate which generates MSY should be regarded as a minimum standard for LRP. Thus, the WPM **AGREED** to analyse the robustness of TRPs and LRPs as outlined in the workplan (Appendix IV).

6.2 Implicit and explicit objectives

23. The WPM **AGREED** that the role of managers and stakeholders is to identify management objectives, candidate TRP and LRP (e.g. those contained in Recommendation 12/14 *on interim target and limit reference points*), acceptable levels of risk of exceeding LRPs, options for HCRs, and the criteria against which their performance should be evaluated. The role of IOTC scientists is to evaluate candidate TRPs and LRPs and the performance of identified candidate HCRs.

24. The WPM **AGREED** that management objectives should explicitly state the goals for the fishery, and that some of these objectives are likely to conflict with one another (e.g. maximising total allowable catch (TAC) versus minimising the risk of low population levels). Where possible, the Commission should be made aware of any conflicting management objectives which they agree upon so that Commissioners set priorities among objectives throughout the MSE process.

7. CURRENT AND FUTURE WORK ON MSE STEPS

7.1 Conditioning of Operating Models

25. The WPM **NOTED** that operating models (OMs) must be 'conditioned' on data, i.e. fitted to the data so that the model predictions of the data are approximately consistent with the observations. This conditioning process can lead to an undesirably narrow range of scenarios, with the result that candidate OMs are only tested against scenarios which are consistent with the stock assessment assumptions or are at least fairly likely given the observed data.

26. The WPM **NOTED** however, that conditioning should not necessarily lead to a narrow range of scenarios since the MPs will be used to manage a stock in the future and should therefore be tested for problematic cases which are possible and may with hindsight prove the assumptions used within the stock assessment to be wrong, i.e. scenarios represent 'justified concerns' to which the MP should be robust.

7.2 Harvest Control Rules

27. The WPM **NOTED** that HCRs identify a pre-agreed course of management action as a function of identified stock status and other economic or environmental conditions, relative to agreed reference points. Key features of HCRs are that they:
    - provide a format to operationalise management objectives
    - integrate management parameters (e.g. TRPs and LRPs)
    - specify pre-agreed management responses to changes in the status of the stock
    - increase transparency in how harvest management decisions are made

- provide a means for the development of rational fisheries management strategies through science-based decision-making.

28. The WPM **NOTED** that an evaluation of alternative HCRs is effectively a comparative analysis, with results highlighting anticipated outcomes, performance trade-offs, and probabilities of achieving (or not achieving) specific objectives among those HCRs examined over longer timeframes.

29. The WPM **AGREED** that the evaluation of alternative HCRs and eventual establishment of a harvest strategy (HS) requires key input from stakeholders and managers before HCR management system evaluations can meaningfully be conducted. For each management unit (e.g. stock) these include the need to:
    - establish a clear set of management objectives
    - define management TRPs and LRPs consistent with those objectives
    - establish a set of performance metrics that correspond to the set of management objectives
    - define key system uncertainties that should be taken into account during analyses
    - identify alternative management options (e.g. type of harvest control measure, data to be used, or stock assessment procedures)
    - formulate candidate HCRs using the above information to be evaluated through simulation analyses.

30. The WPM **NOTED** that HCRs are only likely to work within the range of scenarios considered during testing by MSE. In the event of extraordinary circumstances, the MP should include a series of meta-rules that provide for an assessment of the situation to ensure management decisions are not made that go against the stated objectives.

7.3 Simulations

31. **NOTING** that fisheries systems are uncertain; that there is imperfect knowledge of the status of IOTC stocks and their biology; uncertainty due to potential biases in the data sampled from various fisheries; and uncertainty in the level of implementation of IOTC CMMs, the WPM **AGREED** that it is highly desirable to test the combination of reference points and HCRs prior to implementation, to ensure that their use will achieve the targets on average and avoid the limits that are set for IOTC stocks within a level of risk to be agreed to by the Commission. In effect, to conduct analyses that evaluate whether the proposed management system is robust to the uncertainties inherent within it. Therefore, identifying and quantifying the key management system uncertainties will be critical. Control rules that do not specify an appropriate level of management action could result in a failure to achieve/avoid reference points.

7.4 Outcomes and performance Indicators

32. The WPM **AGREED** that the goal of simulations is not to make actual management decisions, rather it is to provide decision support by quantifying anticipated HCR performance against the suite of objectives adopted, or to be adopted by the Commission. For each management objective, one or more statistics need to be agreed to by the Commission to evaluate the success of achieving the defined objective. These are referred to as performance indicators. For example, if a management objective was to maximise the expected economic value of annual harvests from an IOTC fishery, corresponding performance indicator could be average catch rate over a given time period (e.g. previous five years).

8. PRESENTATION OF MSE OUTPUTS

33. The WPM **AGREED** that the use of the Kobe II management strategy matrix should promote the application of the precautionary approach by explicitly laying out probabilities of meeting specified targets. Results from simulation analyses that evaluate alternative management procedures (e.g. HCRs) can be directly integrated into the Kobe II strategy matrix for setting management measures.

34. The WPM **AGREED** that the Kobe II management strategy matrix could be made more useful when the Commission determines its management objectives (probabilities, targets and time frames).

9. ADVANCES IN CPUE STANDARDISATIONS FOR INDIAN OCEAN FLEETS

35. The WPM **NOTED** paper IOTC–2012–WPM04–INF09 which outlined the main outcomes of the 2012 ISSF Stock Assessment Workshop which examined various issues that make the use of purse seine

catch-per-unit-effort (CPUE) data in stock assessment difficult, including the following abstract provided by the authors:

"*A workshop was held to examine various issues that make the use of purse seine catch-per-unit-effort (CPUE) data in stock assessment difficult. The workshop convened a group of international experts from various fields who discussed possible ways to move forward in better understanding how and why purse seine CPUE may vary independent of stock abundance (or, equivalently, how fishing effort may vary independently of fishing mortality).The workshop carried out several preliminary analyses of the available data and made recommendations for future analyses. Recommendations were also made for the collection of information that may be available to industry but not to scientists. In terms of existing data, a number of analyses were recommended to better understand what makes catchability change over time (catchability is the constant of proportionality between stock abundance and CPUE). In addition, data mining of information about when fishing vessels began using various searching tools was viewed as potentially providing relevant information. Recommendations were made to make better use of the area searched during fishing operations, in addition to search time. In terms of future data collection possibilities, the workshop noted that access to information about the use of floating objects (including fish aggregating devices, FADs) for scientific purposes would likely provide useful insight into how to standardise such data with respect to covariates unrelated to fish abundance, and that FADs could potentially become observatories to monitor tuna densities. The Workshop also examined other potential alternatives to using CPUE, such as the biomass of tunas associated with FADs, and data derived from Vessel Monitoring Systems*."

36. The WPM **ACKNOWLEDGED** the valuable work carried out during the purse seine catch-per-unit-effort workshop and **ENCOURAGED** participants at that workshop to ensure that they address the recommendations agreed upon as soon as possible, given the previously acknowledged importance of purse seine CPUE series to the IOTC stock assessments for skipjack tuna and yellowfin tuna.

Dedicated workshop on CPUE standardisation

37. The WPM **RECOMMENDED** that the IOTC Secretariat work with relevant interested IOTC scientists and the Chairs and Vice-Chairs of the IOTC species working parties, to develop draft terms of reference (TORs) for a dedicated, informal workshop on CPUE standardisation, to be carried out before the next round of stock assessments in 2013. The draft TORs shall be provided to the SC for its consideration and potential endorsement. Where possible the workshop should include a range of invited experts, including those working on CPUE standardisation in other ocean/RFMOs. The TORs shall include an appropriate budget.

10. METHODS FOR SYNTHESIS OF STOCK ASSESSMENT RESULTS ACROSS MODELS

38. No items were discussed under this item in 2012.

11. ADVANCES IN SOFTWARE AND METHODS FOR STOCK ASSESSMENT

Kobe Plot I and II software

39. The WPM **NOTED** paper IOTC–2012–WPM04–05 Rev_1 which provided an overview of the updated Kobe Plot I and II software (ver. 2), including the following abstract provided by the authors:

"*This is the users' manual describing how to use the 2nd version of Kobe I (stock trajectory plots) +Kobe II (risk assessment matrix diagram) software. The software is created by applying our recent technology in "Marine GIS (Geographic Information Systems) (Marine Explorer) software" (http://ocean-info.ddo.jp/mesupport/en/). Kobe I (stock trajectory plot) and Kobe II (risk assessment matrix) were recommended by the 5 tuna-RFMO meeting in 2007 (Kobe, Japan) and 2009 (Barcelona, Spain) respectively. As for the Kobe II, the matrix (table) format was recommended, but the table formats have been difficult to understand its meanings, especially for mangers as it uses mathematical notations. Thus we improved this situation by converting the matrix to the diagram, so that anyone can easily understand its meanings. In the 2 nd version of Kobe I+II software, we improved the graphic components using TeeChart Pro .NET v2010 (Steema Software). We also developed this software applicable for both 32- and 64-bit version OS PC.* – see paper for full abstract."

40. The WPM **ENCOURAGED** interested participants to contact the authors to obtain a copy of the software and for any further suggestions for refinement.

ADMB_ASPM user's guide

41. The WPM **NOTED** paper IOTC–2012–WPM04–06 which provided an overview of the updated AD Model Builder Implemented Age-Structured Production Model (ADMB_ASPM) software Users' Guide (ver. 2.0), including the following abstract provided by the authors:

    "*This is the users' manual describing how to use the 2nd version of the AD Model Builder implemented Age-Structured Production Model (ASPM) software. In the 2nd version, we added the graphical functions to present results of ASPM runs. In this way, users can instantaneously look at major results and diagnostics (residuals), so that users can go to the next step (changing parameters values, seeding values etc.) effectively and efficiently in a very short time. In addition we improved several functions in the software based on the requests made by the world-wide users. This software is free of charge. If someone wants to obtain this software, please contact the corresponding author. After using this software and if any improvements are needed, please DO let us know. We will revise and release the improved version in the (near) future like this 2nd version. This software development project was funded by Fisheries Research Agency (FRA) of Japan (2008 and 2011-2012) for Tuna and Skipjack Division, National Research Institute of Far Seas Fisheries (NRIFSF).*"

42. The WPM **ENCOURAGED** interested participants to contact the authors to obtain a copy of the software and for any further suggestions for refinement.

12. RESEARCH RECOMMENDATIONS AND PRIORITIES

43. The WPM **RECOMMENDED** that the SC consider the draft workplan for the development of the IOTC MSE process, provided at Appendix IV.

44. The WPM **RECOMMENDED** that the SC consider requesting that the Commission allocate funds in the 2013 and 2014 IOTC budgets, for an external expert on MSE to be hired for 30 days per year, to supplement the skill set available within IOTC CPCs.

13. OTHER BUSINESS

13.1 Date and place of the Fifth Session of the WPM

45. The WPM **RECOMMENDED** that the SC note that while the MSE process was still in its early stages of development, there was no pressing need to hold a WPM meeting in 2013, as the work to be undertaken was of a highly technical nature and would require the involvement of a very limited number of experts in the field of development and implementation of population and fishery models for MSE. Thus, as suggested in the MSE workplan (Section 12), one or two workshops composed of experts should be held in 2013 to continue the development of the MSE process. Where possible, these should be held in conjunction with other IOTC meetings to minimise budgetary consequences.

46. The WPM **REQUESTS** that the SC Chair consider including an agenda item for the 2013 SC meeting, which would provide an update on the IOTC MSE process.

47. The WPM **AGREED** that the need to hold the next WPM meeting should be considered by the SC during its 2013 meeting, following the update on the MSE process to be presented by the WPM Chair.

13.2 Development of priorities for an Invited Expert at the next WPM meeting

48. The WPM **AGREED** that there was no need for an Invited Expert in 2013, given the WPM preference not to meet formally until 2014 at the earliest.

13.3 Review of the draft, and adoption of the Report of the Fourth Session of the WPM

49. The WPM **RECOMMENDED** that the SC consider the consolidated set of recommendations arising from WPM04, provided at Appendix V.

50. The report of the Fourth Session of the Working Party on Methods (IOTC–2012–WPM04–R) was **ADOPTED** on the 23 October 2012.

APPENDIX I
LIST OF PARTICIPANTS

Chairperson
Dr. Iago **Mosqueira**
Researcher
European Community
Joint Research Centre
IPSC – Maritime Affairs Unit
Email: iago.mosqueira-sanchez@jrc.ec.europa.eu

Vice-Chairperson
Dr. Toshihide **Kitakado**
Tokyo University of Marine Science and Technology
Japan
Email: kitakado@kaiyodai.ac.jp

Other participants
Dr. Shiham **Adam**
Marine Research centre
Maldives
Email: msadam@mrc.gov.mv

Ms. Chandrani **Baboolall**
Ministry of Fisheries
Mauritius
Email: devina_baboo@hotmail.com

Mr. Sunil Panray **Beeharry**
Ministry of Fisheries
Mauritius
Email: sbeeharry@mail.gov.mu

Mr. Emmanuel **Chassot**
Institut de Recherche pour le Développement
France
Email: emmanuel.chassot@ird.fr

Ms. Zahirah **Dhurmeea**
Ministry of Fisheries
Mauritius
Email: zdhurmeea@mail.gov.mu

Mr. Alain **Fonteneau**
European Union
Email: alain.fonteneau@ird.fr

Mr. James **Geehan**
Fisheries Statistician
Indian Ocean Tuna Commission
Seychelles
Email: james.geehan@iotc.org

Mr. Hirotaka **Ijima**
National Research Institute of far Seas Fisheries
Japan
Email: ijima@affrc.go.jp

Mr. Julien **Million**
Fishery Officer
Indian Ocean Tuna Commission
Seychelles
Email: jm@iotc.org

Mr. Adam **Langley**
Scientist
New Zealand
Email: adam_langley@xtra.co.nz

Ms. Mikyung **Lee**
National Fisheries Research and Development Institute
Republic of Korea
Email: mklee790505@gmail.co.kr

Dr. Sung Il **Lee**
National Fisheries Research and Development Institute
Republic of Korea
Email: k.sungillee@gmail.com

Mr. Takayuki **Matsumoto**
National Research Institute of Far Seas Fisheries
Email: matumot@affrc.go.jp

Dr. Hilario **Murua**
AZTI Tecnalia
Spain
Email: hmurua@azti.es

Dr. Tsutomu (Tom) **Nishida**
National Research Institute of Far Seas Fisheries, Fisheries Research Agency
Japan
Email: tnishida@affrc.go.jp

Mr. Keisuke **Satoh**
National Research Institute of Far Seas Fisheries, Fisheries Research Agency
Japan
Email: kstu21@fra.affrc.go.jp

Dr. Rishi **Sharma**
Fishery Officer (Stock Assessment)
Indian Ocean Tuna Commission
Seychelles
Email: rishi.sharma@iotc.org

Dr. Ruiz María **Soto**
Spanish Institute of Oceanography
Spain
Email: maria.soto@md.ieo.es

Mr. Noel **Wan Sai Cheong**
Ministry of Fisheries
Mauritius
Email: noelwan@mail.gov.mu

Dr. David **Wilson**
Deputy Secretary/Science Manager
Indian Ocean Tuna Commission
Seychelles
Email: david.wilson@iotc.org

APPENDIX II
AGENDA FOR THE FOURTH WORKING PARTY ON METHODS

Date: 22–23 October 2012
Location: Grand Baie International Conference Centre (GBICC)
Royal Road, Grand Baie, Mauritius
Time: 09:00 – 17:00 daily
Chair: Dr. Iago Mosqueira; **Vice-Chair**: Dr. Toshihide Kitakado

1. **ELECTION OF A CHAIR AND VICE-CHAIR FOR THE NEXT BIENNIUM** (Secretariat)

2. **OPENING OF THE MEETING** (Chair)

3. **ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION** (Chair)

4. **OUTCOMES OF THE FOURTEENTH SESSION OF THE SCIENTIFIC COMMITTEE AND THE SIXTEENTH SESSION OF THE COMMISSION** (Secretariat)

5. **REFERENCE POINTS AND HARVEST CONTROL RULES FOR IOTC STOCKS**

6. **OBJECTIVES OF MSE FOR IOTC STOCKS**
   - 6.1 Review of relevant IOTC decisions
   - 6.2 Implicit and explicit objectives

7. **CURRENT AND FUTURE WORK ON MSE STEPS**
   - 7.1 Conditioning of Operating Models
   - 7.2 Harvest Control Rules
   - 7.3 Simulations
   - 7.4 Outcomes and performance indicators

8. **PRESENTATION OF MSE OUTPUTS**

9. **ADVANCES IN CPUE STANDARDISATION FOR INDIAN OCEAN FLEETS**

10. **METHODS FOR SYNTHESIS OF STOCK ASSESSMENT RESULTS ACROSS MODELS**

11. **ADVANCES IN SOFTWARE AND METHODS FOR STOCK ASSESSMENT**

12. **RESEARCH RECOMMENDATIONS AND PRIORITIES**
    - 12.1 Development of a draft work plan for the WPM (Chair)

13. **OTHER BUSINESS**
    - 13.1 Date and place of the Fifth Session of the WPM
    - 13.2 Development of priorities for an Invited Expert at the next WPM meeting
    - 13.3 Review of the draft, and adoption of the Report of the Fourth Session of the WPM.

APPENDIX III
LIST OF DOCUMENTS

Document	Title	Availability
IOTC–2012–WPM04–01a	Draft agenda of the Fourth Working Party on Methods	✓(30 August, 2012)
IOTC–2012–WPM04–01b	Draft annotated agenda of the Fourth Working Party on Methods	✓(18 October, 2012)
IOTC–2012–WPM04–02	Draft list of documents	✓(8 October, 2012)
IOTC–2012–WPM04–03	Outcomes of the Fourteenth Session of the Scientific Committee and the Sixteenth Session of the Commission (Secretariat)	✓(4 October, 2012)
IOTC–2012–WPM04–04	Working towards the evaluation of reference points and harvest control rules for IOTC stocks (I. Mosqueira and T. Kitakado)	✓(17 October, 2012)
IOTC–2012–WPM04–05 Rev_1	Kobe plot I (stock trajectory) + Kobe II (risk assessment matrix diagram) software (Version 2 for 32- and 64-bit PC) Users' manual (T. Nishida, Y. Matsuo, T. Kitakado and K. Itoh)	✓(17 October, 2012) ✓(21 October, 2012)
IOTC–2012–WPM04–06	AD Model Builder implemented Age-Structured Production Model (ASPM) (Version 2 with graphic functions) (R. Rademeyer, T. Nishida, Y. Matsuo and K. Itoh)	✓(17 October, 2012)
INFORMATION PAPERS		
IOTC–2012–WPM04–INF01	Identification of candidate limit reference points for the key target species in the WCPFC (A. Preece, R. Hillary and C. Davies)	✓(8 October, 2012)
IOTC–2012–WPM04–INF02	Evaluation of stock status of bigeye, skipjack, and yellowfin tunas against potential limit reference points (S. Harley and N. Davies)	✓(8 October, 2012)
IOTC–2012–WPM04–INF03	Purse-seine length frequencies corrected for selectivity bias in grab samples collected by observers (T. Lawson)	✓(8 October, 2012)
IOTC–2012–WPM04–INF04	Report on Project 60: Collection and evaluation of purse-seine species composition data	✓(8 October, 2012)
IOTC–2012–WPM04–INF05	Evaluation of stock status of south Pacific albacore, bigeye, skipjack, and yellowfin tunas and southwest Pacific striped marlin against potential limit reference points (S.J Harley, A.M. Berger, G.M. Pilling, N. Davies and J. Hampton)	✓(8 October, 2012)
IOTC–2012–WPM04–INF06	Consideration of target reference points for WCPO stocks with an emphasis on skipjack Tuna (G.M. Pilling, S.J. Harley, A.M. Berger, N. Davies and J. Hampton)	✓(8 October, 2012)
IOTC–2012–WPM04–INF07	Introduction to harvest control rules for WCPO tuna fisheries (A.M. Berger, S.J. Harley, G.M. Pilling, N. Davies and J. Hampton)	✓(8 October, 2012)
IOTC–2012–WPM04–INF08	Review of the implementation and effectiveness of key management measures for tropical tuna (J. Hampton, S. Harley and P. Williams)	✓(8 October, 2012)
IOTC–2012–WPM04–INF09	Report of the 2012 ISSF Stock Assessment Workshop: Understanding Purse Seine CPUE. Rome, Italy, July 16-19, 2012. ISSF Technical Report 2012-10 (International Seafood Sustainability Foundation)	✓(8 October, 2012)
IOTC–2012–WPM04–INF10	Managing fishing capacity in tuna regional fisheries management organisations (RFMOs): Development and state of the art (M. Aranda, H. Murua and P. de Bruyn)	✓(22 October, 2012)
IOTC–2012–WPM04–INF11	The Precautionary approach to fisheries management: How this is taken into account by Tuna regional fisheries management organisations (RFMOs) (P. de Bruyn, H. Murua and M. Aranda)	✓(22 October, 2012)

APPENDIX IV
DRAFT WORKPLAN FOR A MANAGEMENT STRATEGY EVALUATION FOR IOTC STOCKS FOR 2013

The Fourth Session of the IOTC Working Party on Methods (WPM) is proposing a workplan to carry out the tasks on the evaluation of management plans for IOTC stocks, as required by the Scientific Committee (SC). This workplan outlines the main tasks to be carried out over the next year, with a view to present initial results at the 2013 meeting of the SC. It also presents some of the initial ideas on the overall structure of the simulation models to be assembled, an estimate of the workload involved, and a budget covering consultancy work, travel expenses and infrastructure costs.

Tasks

Development of a set of relatively simple operating models will be the main task for the group. Representations of the stock and main fisheries will be assembled, by using the latest stock assessments as a starting point, but simplifying as much as possible some of the dynamics. This should enable the group to obtain in a relatively short time period, a platform for a first set of analyses, that could also be used for demonstration purposes.

Assemblage of Operating Models

Example: Operating Model for Indian Ocean Albacore

An operating model for the Indian Ocean albacore fishery will be constructed by using the estimated population variables from the latest stock assessment from the IOTC Working Party on Temperate Tunas (IOTC–2012–WPTmT04–11). The general structure of the model will include:

- A single area and stock unit
- Age-structured population model
- 5 fleets
- 3 CPUE series

Operating model for Indian Ocean tropical tuna

A set of three operating models will be constructed for the tropical tuna stocks (bigeye tuna, skipjack tuna and yellowfin tuna). These models will not have any link at the population levels, i.e. they will be conditioned independently, but will be exploited by the same fleets, and affected by the same management decisions. The initial models will be simpler than current assessment models, specially by not incorporating any spatial complexity. The initial set of models will cover either the whole Indian Ocean or simply the western area (as a trial), and include only three fleets by aggregating a number of coastal and semi-industrial fisheries.

Setup of simulation infrastructure

The necessary infrastructure to carry out the simulations involved in this work, in terms of a software platform and a set of input and output methods, will be put together, hosted at the EC JRC and available to participants over the web. The framework formulated for the development and testing of the albacore model will then be used for other simulations.

Development of training material on MSE

A set of training material on MSE, targeted at both scientists and managers, will be developed for use at various meetings. This work will be carried out in collaboration with the development of similar training material that the IOTC Secretariat is currently involved in developing for other areas of IOTC science capacity building.

Expected deliverables

Progress by the WPM in the development of MSE analyses will be reported to the IOTC SC in 2013. In addition, a series of deliverables have been set for the next year:

- May 2013
    - Initial operating model for albacore
    - First run of robustness trials for albacore operating model
- October 2013
    - Progress report on tropical tunas operating model

  - First set of runs on albacore MSE
  - Analysis of albacore reference points
- December 2013
  - Progress report of WPM presented at SC meeting
  - Demonstration of simulation framework, albacore operating model and initial results to the SC meeting

Intersessional meetings

Two intersessional meetings should take place in 2013, in the second and fourth quarters of the 2013 calendar year. The meetings are designed to involve the core team that will be carrying out the programming, as the focus will be on reviewing in detail the development carried out, agree on implementation details, and solve problems encountered with models and code. A progress report will be released after each meeting and discussed via the WPM emailing list.

Second quarter meeting. April 2013, EC JRC (Italy)

1. Review and finalize ALB OM
2. Carry out initial tests of ALB RPs
3. Start robustness trials of ALB CPUEs

Fourth quarter meeting. October 2013, WPTT (as applicable)

1. Assess progress on tropical tunas operating models
2. Conduct and examine first set of runs on albacore MSE
3. Assess results of albacore reference points analysis
4. Agree on development for tropical tuna operating models

Budget

The work to be carried out by WPM would require some extra-budgetary contributions from the IOTC. The total estimated extra-budgetary contributions would be approximately US$30,000–$40,000, with the exact figure to be determined by the SC, and would be comprised of the following three types of expenses:

1) Work of a consultant with expertise on population and fisheries models relating to MSE

The work to be carried out relates to the development of operating models of applicable tuna stocks. Initial terms of reference for this contract should include:

- Assistance in the development of operating models from stock assessment results
- Parameterisation of operating models from alternative sources of data
- Design of robustness trials and alternative scenarios
- Participation in the analyses of the robustness and suitability of reference points
- Collaboration in the design and implementation of harvest control rules

Description	***Amount (US$)***
Consultant fees for 30 days ($TBD/day)	TBD
Travel costs	TBD

2) Support for travel to intersessional meeting

The second quarter intersessional meeting might require the provision of travel funds for up to three participants. The Chair and Vice-Chair of the WPM shall act as the selection panel for those to receive the travel assistance funds based on their technical expertise.

Description	***Amount (US$)***
Airfares x 3	6,000
DSA x 3 for 5 days ($327/day)	4,905

3) Access to High Performance Computing facilities

The simulation work involved in this workplan requires the use of High Performance Computing facilities in order to carry out the large number of simulations involved. Although certain facilities exist at various scientific institutions associated with this work, they might not be sufficient, or available when necessary, so provision should be made for funds that would enable access to High Performance Computing facilities elsewhere.

Description	***Amount (US$)***
Annual costs	1,000

APPENDIX V
CONSOLIDATED RECOMMENDATIONS OF THE FOURTH SESSION OF THE WORKING PARTY ON METHODS

Note: Appendix references refer to the Report of the Fourth Session of the Working Party on Methods (IOTC–2012–WPM04–R)

Capacity building

WPM04.01 (para. 18): The WPM **RECOMMENDED** that the SC consider making a request to the Chair of the Commission, to include an information session during each Commission meeting, which would provide Commissioner's with annual updates and explanatory material to ensure they are kept abreast of the methods and processes being undertaken as part of the broader IOTC MSE process.

WPM04.02 (para. 19): The WPM **RECOMMENDED** that the IOTC Secretariat coordinate the development and delivery of several training workshops focused on providing assistance to developing CPCs to better understand the MSE process, including how reference points and harvest control rules are likely to function in an IOTC context. The implications of IOTC Resolution 12/01 on the implementation of the precautionary approach and IOTC Recommendation 12/14 on interim target and limit reference points should be incorporated into the workshop. The SC should consider requesting that the Commission's budget incorporate appropriate funds for this purpose.

Dedicated workshop on CPUE standardisation

WPM04.03 (para. 37): The WPM **RECOMMENDED** that the IOTC Secretariat work with relevant interested IOTC scientists and the Chairs and Vice-Chairs of the IOTC species working parties, to develop draft terms of reference (TORs) for a dedicated, informal workshop on CPUE standardisation, to be carried out before the next round of stock assessments in 2013. The draft TORs shall be provided to the SC for its consideration and potential endorsement. Where possible the workshop should include a range of invited experts, including those working on CPUE standardisation in other ocean/RFMOs. The TORs shall include an appropriate budget.

Research recommendations and priorities

WPM04.04 (para. 43): The WPM **RECOMMENDED** that the SC consider the draft workplan for the development of the IOTC MSE process, provided at Appendix IV.

WPM04.05 (para. 44): The WPM **RECOMMENDED** that the SC consider requesting that the Commission allocate funds in the 2013 and 2014 IOTC budgets, for an external expert on MSE to be hired for 30 days per year, to supplement the skill set available within IOTC CPCs.

Date and place of the Fifth Session of the WPM

WPM04.06 (para. 45): The WPM **RECOMMENDED** that the SC note that while the MSE process was still in its early stages of development, there was no pressing need to hold a WPM meeting in 2013, as the work to be undertaken was of a highly technical nature and would require the involvement of a very limited number of experts in the field of development and implementation of population and fishery models for MSE. Thus, as suggested in the MSE workplan (Section 12), one or two workshops composed of experts should be held in 2013 to continue the development of the MSE process. Where possible, these should be held in conjunction with other IOTC meetings to minimise budgetary consequences.

Review of the draft, and adoption of the Report of the Fourth Session of the WPM

WPM04.07 (para. 49): The WPM **RECOMMENDED** that the SC consider the consolidated set of recommendations arising from WPM04, provided at Appendix V.