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

Seychelles, 5–6 December 2014

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Indian Ocean Tuna Commission
Commission des Thons de l'Ocean Indien
iotc ctoi

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

ASPM	Age-Structured Production Model
B	Biomass (total)
B_0	Unfished biomass
BET	Bigeye tuna
B_{MSY}	Biomass which produces MSY
CE	Catch and effort
CI	Confidence Interval
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.
EEZ	Exclusive Economic Zone
ENSO	El Niño–Southern Oscillation
EU	European Union
F	Fishing mortality; F_{2011} is the fishing mortality estimated in the year 2011
FAD	Fish aggregating device
F_{MSY}	Fishing mortality at MSY
GLM	Generalised linear model
HBF	Hooks between floats
IO	Indian Ocean
IOTC	Indian Ocean Tuna Commission
IWC	International Whaling Commission
K2SM	Kobe II Strategy Matrix
LL	Longline
M	Natural Mortality
MP	Management Procedure
MSC	Marine Stewardship Council
MSE	Management Strategy Evaluation
MSY	Maximum sustainable yield
n.a.	Not applicable
OM	Operating Model
PS	Purse seine
q	Catchability
ROS	Regional Observer Scheme
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})
SKJ	Skipjack tuna
SS3	Stock Synthesis III
Taiwan,China	Taiwan, Province of China
VB	Von Bertalanffy (growth)
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: 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.

STANDARDISATION OF IOTC WORKING PARTY AND SCIENTIFIC COMMITTEE REPORT TERMINOLOGY

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

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

Level 1: ***From a subsidiary body of the Commission to the next level in the structure of the Commission:***
RECOMMENDED, RECOMMENDATION: Any conclusion or request for an action to be undertaken, from a subsidiary body of the Commission (Committee or Working Party), which is to be formally provided to the next level in the structure of the Commission for its consideration/endorsement (e.g. from a Working Party to the Scientific Committee; from a Committee to the Commission). The intention is that the higher body will consider the recommended action for endorsement under its own mandate, if the subsidiary body does not already have the required mandate. Ideally this should be task specific and contain a timeframe for completion.

Level 2: ***From a subsidiary body of the Commission to a CPC, the IOTC Secretariat, or other body (not the Commission) to carry out a specified task:***
REQUESTED: This term should only be used by a subsidiary body of the Commission if it does not wish to have the request formally adopted/endorsed by the next level in the structure of the Commission. For example, if a Committee wishes to seek additional input from a CPC on a particular topic, but does not wish to formalise the request beyond the mandate of the Committee, it may request that a set action be undertaken. Ideally this should be task specific and contain a timeframe for the completion.

Level 3: ***General terms to be used for consistency:***
AGREED: Any point of discussion from a meeting which the IOTC body considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 or level 2 above; a general point of agreement among delegations/participants of a meeting which does not need to be considered/adopted by the next level in the Commission's structure.
NOTED/NOTING: Any point of discussion from a meeting which the IOTC body considers to be important enough to record in a meeting report for future reference.

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

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EXECUTIVE SUMMARY

The 5th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Methods (WPM) was held in Mahe, Seychelles on December 5th and 6th, 2014. The Chair, Dr. Iago Mosqueira (JRC, Ispra, Italy) and Vice-Chair, Dr Toshihide Kitakado (Japan) welcomed the participants. A total of 28 scientists attended the Session. The list of participants is provided at Appendix I.

The role of the WPM

(para. 6)The WPM **AGREED** that the role of the WPM is primarily technical, with a focus on providing appropriate tools for developing management advice. The WPM **RECOMMENDED** the Scientific Committee considers how to best enhance scientific dialogue and communication and utilises the tools developed by the WPM to achieve their objectives.

Albacore

(para. 7)The WPM **NOTED** paper IOTC–2014–WPM05–06 which provided a base operating model for the Indian Ocean albacore tuna and model conditioning results, including the following abstract provided by the author:
"Following the workplan adopted by the last session of the Working Party on Methods (WPM, 2012), work has been carried out for the development of an operating model for Indian Ocean albacore. The current version, presented here, is based on the feedback offered by the last session of the Working Party on Temperate Tuna (WPTmT, 2014) and uses as base population model the current albacore SS3 stock assessment."

Skipjack

(para. 16) The WPM **NOTED** document IOTC-2014-WPM05-08 which provides a description of the simulation model and conditioning developed to conduct management procedure evaluations for the IO skipjack fisheries, 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 skipjack population by three regions, 24 quarterly ages, and forty, 2cm size bins and the fishery by three regions and four gear types (purse seine, pole-and-line, gill net, others). Where possible, parameter estimates from the 2014 stock assessment for skipjack have been used. For those parameters not estimated or assumed in the assessment (e.g. regional recruitment dispersal, movement) prior distributions are used along with constraints to exclude infeasible parameter combinations."

(para. 21)The WPM **NOTED** document IOTC-2014-WPM05-09 which provides a description of management procedure descriptions and evaluations conducted using the simulation model described in IOTC-2014-WPM05-08, including the following abstract provided by the authors: "Three contrasting classes of management procedure (MP) have been implemented: 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). Each MP is evaluated over a twenty five year period against performance statistics that include average annual yield, variability in catch, CPUE for the main region/gear combinations, average stock status and probability of stock status falling to low levels. Evaluations are performed using a range of model parameter values and the sensitivity of MP performance examined."

Yellowfin and bigeye

(para. 28)The WPM **WELCOMED** the project developed regarding BET and YFT MSE. The WPM **ENCOURAGED** the authors to make the work proposed in IOTC-2014-WPM05-07 open sourced and publically available in a similar manner as the work done on ALB and SKJ.

Support to the process of setting management objectives of MSE for IOTC stocks

(para. 33) The WPM **NOTED** this list of management objectives presented in IOTC-2014-WPM05-09 is a starting point to provide an idea of the different possible objectives and means of measuring the performance against these objectives and **RECOMMENDED** the Scientific Committee review and develop this list (Table 1) as appropriate to help dialogue with the Commission (Resolution 14/03 *On Enhancing the dialogue between fisheries scientists and managers*).

Evaluation of current reference points and possible alterative reference points for management

(para. 34)The WPM **NOTED** paper IOTC-2014-WPM05-11 that quantifies the risk of the current target and limit reference points in the context of a simple MP, and assumptions about the stock and stochastic error (process error), and provides a framework for quantifying the inherent risks that are present in a system that is being managed to optimal fishing mortality rates.

1. OPENING OF THE MEETING

1. The 5th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Methods (WPM) was held in Mahe, Seychelles on December 5th and 6th, 2014. The Chair, Dr. Iago Mosqueira (JRC, Ispra, Italy) and Vice-Chair, Dr Toshihide Kitakado (Japan) welcomed the participants. A total of 28 scientists attended the Session. The list of participants is provided at Appendix I.

2. ADOPTION OF THE AGENDA, UPDATE FROM SC16 AND S18 AND PROGRESS FROM WPM 04

2. The WPM **ADOPTED** the Agenda provided at Appendix II. The documents presented to the WPM05 are listed in Appendix III.

3. The WPM **NOTED** document IOTC-2014-WPM05-03 on the outcomes of SC16 and S18 of relevance to WPM work. In particular WPM **NOTED** resolutions 13/10 and 14/03.

4. The WPM **NOTED** document IOTC-2014-WPM05-04 on progress made on the recommendations of WPM04. WPM **NOTED** the substantial progress on MSE development as presented during this meeting. The WPM **NOTED** that the CPUE Workshop conducted in 2013 had made significant progress on issues identified at the 2012 WPM04, and inter-sessional work is further progressing issues identified in the CPUE Workshop Report produced in 2013.

5. The WPM **NOTED** that activities related to the issues identified by SC15 and SC16 on capacity building as related to general scientific advice, and what the MSE process entails, have been conducted, though a lot more training and capacity building needs to occur for coastal states and CPCs involved in the Indian Ocean region.

6. The WPM **AGREED** that the role of the WPM is primarily technical, with a focus on providing appropriate tools for developing management advice. The WPM **RECOMMENDED** the Scientific Committee considers how to best enhance scientific dialogue and communication and utilises the tools developed by the WPM to achieve their objectives.

3. ALBACORE MSE: UPDATE

7. The WPM **NOTED** paper IOTC–2014–WPM05–06 which provided a base operating model for the Indian Ocean albacore tuna and model conditioning results, including the following abstract provided by the author:
"Following the workplan adopted by the last session of the Working Party on Methods (WPM, 2012), work has been carried out for the development of an operating model for Indian Ocean albacore. The current version, presented here, is based on the feedback offered by the last session of the Working Party on Temperate Tuna (WPTmT, 2014) and uses as base population model the current albacore SS3 stock assessment."

8. The WPM **NOTED** that the current operating models (OMs) are based on the new SS3 stock assessment agreed in WPTmT, 2014 and its variants according to the identified uncertainties such as biological parameters and future fishery operations (with consideration of potential ranges/patterns for parameters; the natural mortality, the extent of recruitment deviation, steepness, CV of CPUE series, effective sample size, yearly changes in catchability and selectivity for TWN longline fishery).

9. The WPM **NOTED** that, out of a total of 720 OMs (runs), one-third of runs produced unrealistic behaviors in terms of the spawning stock biomass (SSB).

10. The WPM **NOTED** that some objective judgment criteria to eliminate nuisance/unrealistic OMs and/or provide a weighted average performance were required. It was noted that likelihood weighting via a resampling method used in CCSBT may not provide enough contrast for comparison of OMs for the albacore given the small differences in total likelihood across models.

11. The WPM **NOTED** the apparent difficulties in the estimation of biomass levels a MSY, currently used as a target reference point, while values of fishing mortality at MSY appeared to be better defined. Suggestions were made that biomass reference points based on percentages of the estimated virgin biomass could be used instead, as they are better estimated and are not affected by changes in allocation across gears.

12. The WPM **NOTED** an example run of a CPUE-based management procedure that reacts to CPUE values outside of a probability envelope determined by historical CPUE values. Initial runs showed the MP was able to maintain SSB levels but at the expense of catch variability.

13. The WPM **ENCOURAGED** further refinement of the operating model (OM).

14. The WPM **ENCOURAGED** further development of management procedures (MPs) in addition to the current ones, noting that the MPs developed for the skipjack tuna would potentially be applied to the albacore tuna.

15. The WPM **WELCOMED** the work that has been carried out intersessionally by Mosqueira and Sharma and **ACKNOWLEDGED** them for the progress achieved so far. The models and frameworks developed will allow the evaluation of alternative management procedures and are regarded as a crucial step for completing the MSE process for albacore.

4. SKIPJACK TUNA MSE: UPDATE

16. The WPM **NOTED** document IOTC-2014-WPM05-08 which provides a description of the simulation model and conditioning developed to conduct management procedure evaluations for the IO skipjack fisheries, 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 skipjack population by three regions, 24 quarterly ages, and forty, 2cm size bins and the fishery by three regions and four gear types (purse seine, pole-and-line, gill net, others). Where possible, parameter estimates from the 2014 stock assessment for skipjack have been used. For those parameters not estimated or assumed in the assessment (e.g. regional recruitment dispersal, movement) prior distributions are used along with constraints to exclude infeasible parameter combinations."

17. The WPM **WELCOMED** the contribution and **NOTED** that the approach is appropriate for advising the Commission on trade-offs related to multiple, and at times, conflicting management objectives. It was also **NOTED** that the modelling should encompass the most plausible range of parameters (e.g. growth curve, natural mortality, spatial structure etc) based on expert knowledge and the WPM **REQUESTED** that an intersessional working group of WPTT scientists is held to review and revise this information as necessary, before April 2015. The WPM **ENCOURAGED** the authors to present the results of this work at the next WPTT in 2015.

18. **NOTING** that even the best parameter estimates may be highly uncertain or conflicting, the WPM **ENCOURAGED** the authors to also fully explore the uncertainties, noting that many are already captured based on the use of multiple estimates through the current grid of parameter combinations used for skipjack stock assessment work at WPTT16.

19. The WPM further **NOTED** in the example provided in the document, that the model estimates similar levels of biomass in the 3 different sized areas used in modelling. The flexibility of the simulation structure was demonstrated by showing the impacts of change in movement and recruitment parameters to WPM during the meeting. Subsequently, the simulation model was demonstrated in real-time, to WPM. Based on this demonstration, WPM **NOTED** the benefits of making the simulator more "user friendly" as a mechanism to engage more experts in fully defining the most plausible range of parameter sets to be used in future simulations.

20. The WPM also **NOTED** the difficulty of estimating MSY based reference levels for the most recent skipjack assessment and **RECOMMENDED**, in keeping with other RFMOs experiencing similar difficulties, to base reference points on biomass depletion ratios, which are generally more stable and

less influenced by modelling assumption than MSY based reference points. WPM **NOTED** that other tRFMOs SCs have advised that in circumstances where information is insufficient for precise estimation of MSY based reference points, that a limit biomass reference level of $0.2B_0$ be applied in management procedures and that appropriate alternatives for B_{MSY} are generally in the range of 0.3-$0.4B_0$. The WPM **CONSIDERED** that these reference points were also appropriate for IO Skipjack fisheries and **NOTED** that a value of $0.4B_0$ is commonly applied in other fishery management organizations for stocks which have limited information of use in estimating MSY reference levels.

21. The WPM **NOTED** document IOTC-2014-WPM05-09 which provides a description of management procedure descriptions and evaluations conducted using the simulation model described in IOTC-2014-WPM05-08, including the following abstract provided by the authors: "Three contrasting classes of management procedure (MP) have been implemented: 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). Each MP is evaluated over a twenty five year period against performance statistics that include average annual yield, variability in catch, CPUE for the main region/gear combinations, average stock status and probability of stock status falling to low levels. Evaluations are performed using a range of model parameter values and the sensitivity of MP performance examined."

22. The WPM **WELCOMED** the contribution and **CONGRATULATED** the authors for the work thus far accomplished and **NOTED** that the candidate management objectives and performance statistics applied in the document represent an excellent starting point for further guiding the dialogue for seeking feedback from managers and stakeholders as envisioned in Resolution 14/03 *On Enhancing the Dialogue between fisheries scientists and managers*.

23. In the interest of furthering this idea, the WPM **NOTED** that a short presentation on these concepts and provisional outcomes will be provided to the SC.

24. The WPM **NOTED** the range of potential management objectives presented. The WPM **NOTED** the difficulty in establishing a consolidated, prioritised set of objectives across the heterogeneous set of stakeholders and **AGREED** that the role of the WPM is to clearly demonstrate the trade-offs across the different objectives to assist decision-making.

25. The WPM **ENCOURAGED** the use of implementation uncertainty into the structure of the evaluation, noting that this might be applied as implementation imprecision (e.g. over- and under- catch) and/or bias (e.g. more likely to over catch).

26. The WPM **NOTED** that the model assumes the current distribution of catches among fleets is static and **ENCOURAGED** the authors to consider more realistic scenarios such as the introduction of fleet development plans as far as possible without introducing unnecessary additional complexity.

27. The WPM also **NOTED** that the consultancy that has been used to develop the simulation tools and initial evaluations of some candidate Management Procedures has run to completion. WPM also **NOTED** that additional work is required to support the Commission's desire to implement management approaches that can achieve its Convention Objectives. In this regard, the WPM **RECOMMENDED** that the Commission fully fund the work needed to support its requirement to achieve its Convention Objectives in particular facilitating the implementation of Resolution 12/01.

5. BIGEYE TUNA AND YELLOWFIN TUNA MSE: UPDATE

28. The WPM **WELCOMED** the project developed regarding BET and YFT MSE. The WPM **ENCOURAGED** the authors to make the work proposed in IOTC-2014-WPM05-07 open sourced and publically available in a similar manner as the work done on ALB and SKJ.

29. The WPM also **ENCOURAGED** this MSE work to build on progress already made for SKJ and ALB in the Indian Ocean context to reduce duplication of effort where possible.

6. SUPPORT TO THE PROCESS OF SETTING MANAGEMENT OBJECTIVES OF MSE FOR IOTC STOCKS

30. The WPM **NOTED** that a *management objective* describes the overarching aims of management. The WPM **NOTED** the potential management objectives developed for skipjack and the associated performance statistics, some of which are stock specific whereas other are more generic. Table 1 lists five broad management objectives that are commonly used in fisheries management. Each is described as seeking to maximize some aspect of the fishery but often there are trade-offs amongst these objectives and it is not possible to maximize all simultaneously.

31. 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, Table 1 suggests a suite of performance statistics that could be used to assess the performance of a MP. This is not intended to be an exhaustive list and additional performance statistics (e.g. proportional increase in spawner biomass over next 10 years) may be appropriate for particular cases (e.g. for stocks in need of rebuilding).

32. The WPM **NOTED** the need for specificity when defining performance statistics given the variety of methods for their calculation and the need for a consistent approach to be applied.

33. The WPM **NOTED** this list of management objectives presented in IOTC-2014-WPM05-09 is a starting point to provide an idea of the different possible objectives and means of measuring the performance against these objectives and **RECOMMENDED** the Scientific Committee review and develop this list (Table 1) as appropriate to help dialogue with the Commission (Resolution 14/03 *On Enhancing the Dialogue between fisheries scientists and managers*).

Table1: Performance statistics suggested for the evaluation of management procedures

Management objective and associated performance statistics	Performance measure/s	Summary statistic
Status : maximize probability of maintaining stock in the Kobe green zone		
Mean spawner biomass relative to unfished	$B/B0$	Geometric mean over years
Minimum spawner biomass relative to unfished	$B/B0$	Minimum over years
Mean spawner biomass relative to *Bmsy*	$B/Bmsy$	Geometric mean over years
Mean fishing mortality relative to target	$F/Ftar$	Geometric mean over years
Mean fishing mortality relative to *Fmsy*	$F/Fmsy$	Geometric mean over years
Probability of being in Kobe green quadrant	B,F	Proportion of years that $B \geq Btar \& F \leq Ftar$
Probability of being in Kobe red quadrant	B,F	Proportion of years that $B < Btar \& F > Ftar$
Safety : m*aximize the probability of the stock remaining above the biomass limit*		
Probability that spawner biomass is above 20% of $B0$	B	Proportion of years that $B > 0.2B0$
Yield : maximize catches across regions and gears		
Mean catch	C	Mean over years
Mean catch by region and/or gear	C	Mean over years
Abundance: maximize catch rates to enhance fishery profitability		
Mean catch rates by region and gear	A	Geometric mean over years
Stability: maximize stability in catches to reduce commercial uncertainty		
Mean absolute proportional change (MAPC) in catch	C	Mean over years of $abs(C_t/C_{t-1}-1)$
Variance in catch	C	Variance over years
Probability of shutdown	C	Proportion of years that $C==0$

7. EVALUATION OF CURRENT REFERENCE POINTS AND POSSIBLE ALTERNATIVE REFERENCE POINTS FOR MANAGEMENT

34. The WPM **NOTED** paper IOTC-2014-WPM05-11 that quantifies the risk of the current target and limit reference points in the context of a simple MP, and assumptions about the stock and stochastic error (process error), and provides a framework for quantifying the inherent risks that are present in a system that is being managed to optimal fishing mortality rates.

35. The WPM **WELCOMED** the interesting approach taken and **THANKED** the author for the paper.

36. The WPM **NOTED** the two main assumptions in the analysis: (i) the estimation of reference points with certainty and (ii) the implementation of management without error, both of which are very difficult to achieve as estimating reference points well is highly problematic and some implementation error is also likely given the shared nature of the resources. WPM **NOTED** that violating these assumptions would increase the risks associated with using those reference points.

37. The WPM **AGREED** that reference points are markers against which management procedures are evaluated, and around which they may be designed rather than something to be evaluated themselves. The WPM **NOTED** that the MSE process by itself will not result in new recommendations for limit reference points and, in the case of target reference points more specific guidance on tolerable risks will be required. The WPM **RECOMMENDED** that the SC elicit discussion and subsequent guidance from the Commission.

38. The WPM **NOTED** the inherent risks in a system, and that if fishing at optimal (high) fishing mortality levels, the chances that a stock would drop below a limit a high percentage of the time was inherently high. **NOTING** this feature of the system the WPM **AGREED** that contradictory objectives asked by the Commission in Resolution 13/10 (section 4a "maintaining the stocks in a high probability within this [green] quadrant" and SSB at MSY as target) would be hard to achieve unless the target reference points with respect to fishing mortality were reduced and that F_{MSY} were used as a limit rather than a target. The WPM **NOTED** the inherent risks associated with using F_{MSY} as a target rather than a limit reference point and the inconsistencies with the majority of other tuna RFMOs which treat it as a limit.

39. The WPM **AGREED** that in cases where MSY reference points are difficult to estimate, alternative reference point based on depletion ratios are preferable. Thus the WPM **NOTED** that an alternative would be to use reference points with respect to B_0 (i.e. targets that could be $0.4B_0$ or higher, and F would be the estimated F corresponding to the biomass target, if a precautionary buffer against reaching a biomass limit is desirable). The WPM NOTED that this is similar to what is currently taking place in other RFMOs such as WCPFC and **RECOMMENDED** that the use of this type of reference point is considered by the SC.

8. ADVANCES IN CPUE STANDARDISATION FOR INDIAN OCEAN FLEETS

40. The WPM **NOTED** that significant work had been undertaken since 2012, primarily related to having a CPUE Workshop in October of 2013, followed by inter-sessional work in 2014.

41. The WPM NOTED that while a number of issues were identified and numerous recommendations were made in IOTC-2014-WPM-INF01, the resources required to address these issues were limited. Some member suggested additional human resources to deal with these issues at the Commission. However, given the magnitude of the work, and the importance of the standardized index of abundance in driving the abundance trends in all data-rich stock assessments used at the Commission, more resources need to be allocated by CPCs to address the issues identified in the report.

42. WPM **WELCOMED** the fact that the CPCs who have the operational data, namely Japan and Taiwan,China, have been working inter-sessional to address issues identified in IOTC-2014-WPM05-INF01.

43. The WPM **NOTED** the recommendation from the workshop for simulation to be used at evaluating standardisation procedures and that simulation work of this kind was completed for the Atlantic[1]. The WPM **AGREED** that the potential for using this modelling approach similarly in the Indian Ocean is explored.

9. WPM PROGRAM OF WORK

44. The WPM **RECOMMENDED** that the SC consider and endorse the WPM workplan identified in Appendix IV. In addition to the workplan, the WPM **NOTED** that in order to meet the deadlines set by the Commission, adequate resources to accomplish technical tasks need to be allocated. After that additional resources would be required to train CPCs to understand and agree to certain MPs with clear objectives that could be quantified.

45. The WPM **NOTED** the increased amount of work by the Stock Assessment Scientist at the Secretariat and the additional pieces of work that are currently being undertaken by him in addition to the work of conducting stock assessments.

10. OTHER BUSINESS

10.1 Date and place of the 6th Session of the WPM

46. The WPM AGREED that the WPM06 should be held in conjunction with WPTT17.

Table 2. Draft meeting schedule for the WPM (2015 and 2016)

Meeting	2015		2016	
	Date	Location	Date	Location
MSE Team workshop	May	JRC, Ispra, Italy	TBD	TBD
Working Party on Methods	Fourth week in October (3 d)	TBD	TBD	TBD

10.2 Review of the draft, and adoption of the Report of the 5th Session of the WPM

47. The WPM **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPM05, provided at Appendix V.

48. The report of the 5th Session of the Working Party on Methods (IOTC–2014–WPM05–R) was **ADOPTED** on the 6th December 2014.

[1] Goodyear, C.P. 2004. SEEPA – a data simulator for testing alternative longline CPUE standardisation methods. Coll. Vol. Sci. Pap. ICCAT. 56(1) 136-146. www.iccat.int/Documents/SCRS/Catalog/SEEPA_3_0.pdf

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**
Ministry of Fisheries & Agriculture, Maldives
Email: msadam@mrc.gov.mv

Mr Nokome **Bentley**
Trophia Ltd, New Zealand
Email: nbentley@trophia.com

Dr Rui **Coelho**
IPMA, Portugal
Email: rpcoelho@ipma.pt

Mr Patrick **Daniel**
Commission Europeenne, EC
Email: Patrick.daniel@ec.europa.eu

Dr Wetjens **Dimmlich**
WWF, Seychelles
Email: wdimmlich@wwf.panda.org

Mr Rijasoa **Fanazava**
Centre de Surveillance des Pêches
Ministère de la pêche et des Ressources Halieutiques,
Madagascar
Email: rijafanazava@yahoo.fr

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

Dr Hiromu **Fukuda**
National Research Institute of Far Seas Fisheries
Japan
Email: fukudahiromu@affrc.go.jp

Mr James **Geehan**
IOTC
Email: james.geehan@iotc.org

Ms Kalyani **Hewapanthirana**
Department of Fisheries & Aquatic Resources Development
Sri Lanka
Email: hewakal2012@gmail.com

Ms Donna Leslie **Joachim**
USTA, Madagascar
Email:
joachimdonnaleslie@yahoo.fr

Dr Zang Guen **Kim**
National Fisheries Research & Development Institute, Korea
Email: zgkim@korea.kr

Mr James **Larcombe**
Department of Agriculture, Australia
Email:
james.larcombe@agriculture.gov.au

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

Ms Lidwine Eunicia **Mamilaza**
Unité Statistique Thonière d'Antsiranan, France
Email: mamilazaeunicia@yahoo.fr

Mr Osvaldo **Mario Gaspar**
Ministry of Fisheries, Directorate National of Economics and Policies, Fisheries Department of Statistics,
Mozambique
Email: ogaspar@mozpesca.gov.mz

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

Dr Sarah **Martin**
IOTC
Email: sarah.martin@iotc.org

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

Mr Avelino **Munwane**
Ministry of Fisheries, National Fisheries Administration
Mozambique
Email: avelinoalfiado@hotmail.co.uk

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

Mr Hassan **Mwamzuka**
Marketing
Email: mwafrikahassan@yahoo.com

Mr Stephen **Ndegwa**
State Department of Fisheries, Kenya
ndegwafish@yahoo.com

Dr Heather **Patterson**
Department of Agriculture, Australia
Email:
heather.patterson@agriculture.gov.au

Mr Koichi **Sakonju**
IOTC-OFCF Project
Email: sakonju@iotc.org

Dr Miguel Neves **Santos**
IPMA, Portugal
Email: mnsantos@ipma.pt

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

Dr Rishi **Sharma**
IOTC
Email: rishi.sharma@iotc.org

Mr Ahmed Said **Soilihi**
Direction Generale des Ressources Halieutiques,
Comoros
Email: ahmed_ndevou@yahoo.fr

Mr Kuruppuge **Suraj Chandrakumara**
Department of Fisheries & Aquatic Resources,
Email: ksckdumidi@gmail.com

Mr Ren-Fen **Wu**

Overseas Fisheries Development Council, Taiwan Province of China
Email: fan@ofdc.org.tw

Mr Luixiong **Xu**
Shanghai Ocean University, China
Email: lxxu@shou.edu.cn

Appendix II
AGENDA FOR THE 5TH WORKING PARTY ON METHODS

UPDATED: 4 DECEMBER 2014

Date: 5–6 December 2014
Location: Eden Bleu Hotel, Eden Island, Seychelles
Time: 09:00 – 17:00 daily
Chairperson: Dr. Iago Mosqueira; **Vice-Chairperson**: Dr. Toshihide Kitakado

1. **OPENING OF THE MEETING** (Chair)
2. **ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION** (Chair)
3. **OUTCOMES OF THE 16TH SESSION OF THE SCIENTIFIC COMMITTEE**
4. **OUTCOMES OF THE SESSIONS OF THE COMMISSION**
   - Outcomes of the 18th session of the Commission
   - Review and implementation of Conservation and Management Measures relevant to WPM (IOTC Secretariat)
5. **PROGRESS ON RECOMMENDATIONS OF WPM04**
6. **ALBACORE TUNA MSE: UPDATE** (Chair)
   - Conditioning of operating models
   - Harvest control rules
   - Simulations
   - Outcomes and performance indicators
7. **SKIPJACK TUNA MSE: UPDATE** (Chair and Consultant)
   - Conditioning of operating models
   - Harvest control rules
   - Simulations
   - Outcomes and performance indicators
8. **BIGEYE TUNA AND YELLOWFIN TUNA MSE: UPDATE** (Chair)
9. **EVALUATION OF INTERIM AND TAGRET REFERENCE POINTS** (Secretariat & Consultant)
10. **PROGRESS ON THE SETTING OF MANAGEMENT OBJECTIVES FOR IOTC STOCKS** (Chair)
    - Review of relevant IOTC decisions
    - Review of implicit and explicit objectives
    - Drafting of a submission for the consideration of the SC and Commission on setting management objectives
11. **STANDARDISED PRESENTATION OF MSE RESULTS** (Chair)
12. **ADVANCES IN CPUE STANDARDISATION FOR INDIAN OCEAN FLEETS** (Chair)
13. **ADVANCES IN SOFTWARE AND METHODS FOR STOCK ASSESSMENT** (Chair)
14. **WPM PROGRAM OF WORK** (Chair and IOTC Secretariat)
    - Revision of the WPM Program of Work 2015–2019
15. **OTHER BUSINESS**

- Date and place of the 6th Session of the WPM (Chair and IOTC Secretariat)
- Development of priorities for an Invited Expert at the next WPM meeting (Chair)
- Review of the draft, and adoption of the Report of the 5th Session of the WPM (Chair)

Appendix III
List of documents

Document	Title
IOTC–2014–WPM05–01a	Draft: Agenda of the 5th Working Party on Methods
IOTC–2014–WPM05–01b	Draft: Annotated agenda of the 5th Working Party on Methods
IOTC–2014–WPM05–02	Draft : List of documents of the 5th Working Party on Methods
IOTC–2014–WPM05–03	Scientific Committee and Commission Outcomes
IOTC–2014–WPM05–04	Progress on the recommendations of WPM04 (Chair)
IOTC–2014–WPM05–05	Revision of the WPM Program of Work: Management Strategy Evaluation 2015–2019 (Mosqueira I & Kitakado T)
IOTC–2014–WPM05–06	Base operating model for Indian Ocean albacore tuna: scenarios included and conditioning (Mosqueira I & Sharma R)
IOTC–2014–WPM05–07	Computational framework to support Indian Ocean bigeye and yellowfin Management Strategy Evaluation: a review of software requirements and options (Kolody D, Hillary R, Preece A & Jumppanen P)
IOTC–2014–WPM05–08	Management procedure evaluation for the Indian Ocean skipjack tuna fishery : simulation model description and conditioning (Bentley N & Adam MS)
IOTC–2014–WPM05–09	Management procedure evaluation for the Indian Ocean skipjack tuna fishery: management procedure descriptions and evaluations (Bentley N & Adam MS)
IOTC–2014–WPM05–10	A review of Iran fisheries harvest control rules emphasis tuna fishes (Moradi G)
IOTC–2014–WPM05–11	A simulation approach developed to assess reference points and risk on Indian Ocean Tuna Populations
INFORMATION PAPERS	
IOTC–2014–WPM05–INF02	Management strategy evaluation: best practices. Fish & Fisheries (early view) DOI: 10.1111/faf.12104 (Punt A E, Butterworth DS, de Moor CL, De Oliveira JAA & Haddon M)
IOTC-2014=WPM05-INF01	Report of the IOTC CPUE Workshop

Appendix IV
Working Party on Methods Program of Work (2015)

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. The aim of this workplan is for a first full set of simulations to be presented at SC18 in 2015.

Topic	Subtopic	Days	Allocated	Budget (USD)	Start	End
Albacore	Refinement of OM structure and parameterisation	120	30	72000	Feb 2015	Mar 2015
	Refinement of OM conditioning				Feb 2015	Mar 2015
	Definition and implementation of alternative MPs				Feb 2015	Apr 2015
	Complete set of simulation runs & results				Jun 2015	Sep 2015
	Internal peer review of OM & MPs	10		8000	May 2015	
	External peer review	5		4000	Nov 2015	
Skipjack	Refinement of OM structure and parameterisation	120		96000	Feb 2015	Apr 2015
	Refinement of OM conditioning				Feb 2015	Apr 2015
	Further development of MPs				Feb 2015	Apr 2015
	Run evaluations and produce summaries of results				Jun 2015	Sep 2015
	Internal peer review of OM & MPs	10		8000	May 2015	
	External peer review	5		4000	Nov 2015	
YFT&BET	Initial OM	360	360		May 2015	
	Conditioning and OM set up				Dec 2015	
	Generic MP tests				May 2016	
	Final Model with MP's				Dec 2016	
Presentation	Exploration of tools for effective presentation of MSE results					
	Implementation and adaptation of those tools for IOTC needs	10		8000	Feb 2015	Mar 2015

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 V
Consolidated recommendations of the 5th Session of the Working Party on Methods

Note: Appendix references refer to the Report of the 5th Session of the Working Party on Methods (IOTC–2014–WPM05–R)

Update from the SC16 ad S18

WPM05.01 (para. 6):.The WPM **RECOMMENDED** the Scientific Committee considers how to best enhance scientific dialogue and communication and utilises the tools developed by the WPM to achieve their objectives.

Skipjack tuna MSE update

WPM05.02 (para. 20): The WPM also **NOTED** the difficulty of estimating MSY based reference levels for the most recent skipjack assessment and **RECOMMENDED**, in keeping with other RFMOs experiencing similar difficulties, to base reference points on biomass depletion ratios, which are generally more stable and less influenced by modelling assumption than MSY based reference points. WPM **NOTED** that other tRFMOs SCs have advised that in circumstances where information is insufficient for precise estimation of MSY based reference points, that a limit biomass reference level of $0.2B_0$ be applied in management procedures and that appropriate alternatives for B_{MSY} are generally in the range of $0.3\text{-}0.4B_0$. The WPM **CONSIDERED** that these reference points were also appropriate for IO Skipjack fisheries and **NOTED** that a value of $0.4B_0$ is commonly applied in other fishery management organizations for stocks which have limited information of use in estimating MSY reference levels.

WPM05.03 (para. 27): The WPM also **NOTED** that the consultancy that has been used to develop the simulation tools and initial evaluations of some candidate Management Procedures has run to completion. WPM also **NOTED** that additional work is required to support the Commission's desire to implement management approaches that can achieve its Convention Objectives. In this regard, the WPM **RECOMMENDED** that the Commission fully fund the work needed to support its requirement to achieve its Convention Objectives in particular facilitating the implementation of Resolution 12/01.

Setting management objectives of MSE for IOTC stocks

WPM05.04 (para. 33): The WPM **NOTED** this list of management objectives presented in IOTC-2014-WPM05-09 is a starting point to provide an idea of the different possible objectives and means of measuring the performance against these objectives and **RECOMMENDED** the Scientific Committee review and develop this list (Table 1) as appropriate to help dialogue with the Commission (Resolution 14/03 *On Enhancing the Dialogue between fisheries scientists and managers*).

WPM05.05 para(37): The WPM **AGREED** that reference points are markers against which management procedures are evaluated, and around which they may be designed rather than something to be evaluated themselves. The WPM **NOTED** that the MSE process by itself will not result in new recommendations for limit reference points and, in the case of target reference points more specific guidance on tolerable risks will be required. The WPM **RECOMMENDED** that the SC elicit discussion and subsequent guidance from the Commission.

Evaluation of current reference points and possible alternative reference points for management

WPM05.06 (para. 39): The WPM **AGREED** that in cases where MSY reference points are difficult to estimate, alternative reference point based on depletion ratios are preferable. Thus the WPM **NOTED** that an alternative would be to use reference points with respect to B_0 (i.e. targets that could be $0.4B_0$ or higher, and F would be the estimated F corresponding to the biomass target, if a precautionary buffer against reaching a biomass limit is desirable). The WPM NOTED that this is similar to what is currently taking place in other RFMOs such as WCPFC and **RECOMMENDED** that the use of this type of reference point is considered by the SC.

WPM05.07 (para. 44): The WPM **RECOMMENDED** that the SC consider and endorse the WPM workplan identified in Appendix IV. In addition to the workplan, the WPM **NOTED** that in order to meet the deadlines set by the Commission, adequate resources to accomplish technical tasks need to be allocated. After that additional resources would be required to train CPCs to understand and agree to certain MPs with clear objectives that could be quantified.

WPM05.08 (para. 47): The WPM **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPM05, provided at Appendix V.