REPORT OF THE 7th WORKSHOP on MSE of IOTC WPM Scientists

Lisbon, Portugal, 13-16 March 2018

The 7th workshop on Management Strategy Evaluation (MSE) of the Working Party on Methods (WPM) of IOTC was held at Portuguese Institute for the Ocean and Atmosphere, I.P. (IPMA). The list of participants is given in Annex A. The Group is composed of members of WPM actively involved on the development of MSE simulations for IOTC stocks.

Introductory items

1.1 *Opening remarks*

Kitakado welcomed the participants to the workshop. He noted that the main objectives of the meeting were:

1. To review recent progress and the current status of the development of MSE (OMs, MPs and simulations) for ALB, SKJ, YFT, BET and SWO
2. To agree on how best to present MSE results to IOTC Scientific Committee (SC), Technical Committee on Management Procedures (TCMP), and Commission (COM)
3. To review the plan for the upcoming TCMP02
4. To develop a possible roadmap for the next 4 years of MSE work to guide MP developers

The agreed agenda is given as Annex B.

1.2 *Appointment of chair and rapporteurs*

Kitakado served as Chairman. Rapporteur(s) for each agenda item are shown below.

Item	Rapporteur(s)
1. Introductory items	Kitakado
2. Review of current state of affairs	Kitakado
3. Review of status of work on Albacore OMs and MPs	Merino
4. Review of status of work on Skipjack OMs and MPs	Kolody
5. Review of status of work on Yellowfin and Bigeye OMs and MPs	Mosqueira
6. Work on Swordfish OMs	Fu, Coelho
7. Presentation of MSE	Scott
8. Training and capacity building on MSE at IOTC	Fu
9. Other ISSUES for WPM09	Kolody
10. Peer review process for WPM MSE	Murua
11. 2018-2021 ROADMAP	Murua
12. Other business	Scott
13. Adoption of report	Kitakado

Review of current state of affairs

1.3 *UPDATE on WPM08 and SC20 in 2017*

The group recalled that the 8th Session of the WPM was held in Victoria Seychelles, 13-15 October 2017. The consolidated list of recommendations to the SC20 is shown in the appendix to the WPM08 report.

1.4 *UPDATE on TCMP01 and COM(S21) in 2017*

The group recalled the 1st Session of the Technical Committee on Management Procedures (TCMP01) was held in Yogyakarta, Indonesia, on 20th May 2017. The TCMP is mandated under IOTC Resolution 16/09 [*on establishing a technical committee on management procedure*s], which supersedes Resolution 14/03 [*On enhancing the dialogue between fisheries scientists and managers*]. Main objectives of the TCMP are as follows:

a) Enhance the decision making response of the Commission in relation to management procedures, including recommendations made by the Scientific Committee;
b) Enhance communication and foster dialogue and mutual understanding between the Scientific Committee and the Commission on matters relating to management procedures;
c) Assist the Commission to obtain and promote the effective use of scientific resources and information.

The Commission meeting was held on 22-26 May 2017. A total of 8 Conservation and Management Measures (CMMs) adopted at the 21th Session of the Commission.

Active IOTC Resolutions relevant to MSE works are as follows:

- Resolution 17/01 *On an interim plan for rebuilding the Indian ocean yellowfin tuna stock in the IOTC area of competence* (which supersedes IOTC Resolution 16/01 On an interim plan for rebuilding the Indian Ocean yellowfin tuna stock).
- Resolution 16/02 *On harvest control rules for skipjack tuna in the IOTC area of competence*
- Resolution 16/09 *On establishing a technical committee on management procedures dialogue*
- Resolution 15/10 *On target and limit reference points and a decision framework*
- Resolution 12/01 *On the implementation of the precautionary approach*

1.5 *PROCESS of MSE development, discussion and adoption at IOTC*

The Group noted that the SC concluded that the Workplan for MSE identified in Res 15/10 is unlikely to be achieved since adequate and timely resources for conducting the required work have not been made available. The TCMP01 has provided an updated workplan for the MSE in its most recent

report. The Group noted that TCMP02 could take on the task of refining the Workplan to clarify the process schedule needed for the eventual adoption of Management Procedures within the Commission.

3. REVIEW of status of work on Albacore OMs and MPs

3.1 Progress

The group reviewed the current status of the work on albacore MSE simulations, with special attention to the latest OM grid. The grid is built around the following scenarios:

- M: constant 0.2, 0.3 and 0.4, and decreasing from 0.4 to 0.3 or 0.2
- sigmaR: 0.4 and 0.6
- steepness: 0.7, 0.8 and 0.9
- CV in CPUE: 0.2, 0.3, 0.4 and 0.5,
- ESS in length data; 20, 50 and 100
- Quarterly multiplier for CPUE: 1 or 1.0025
- Form of LL selectivity: Logistic or Double normal

Some of the OMs show reference points and stock status clearly out of the range of values that could be considered reasonable under the light of the recent stock assessment, and therefore they needed filtering.

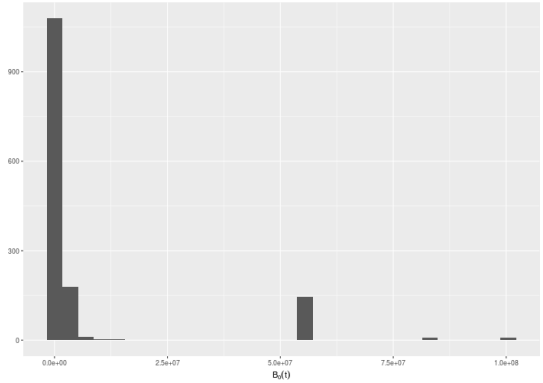

Figure 1: Distribution of estimates of B0 from the full grid of albacore SS3 OM runs.

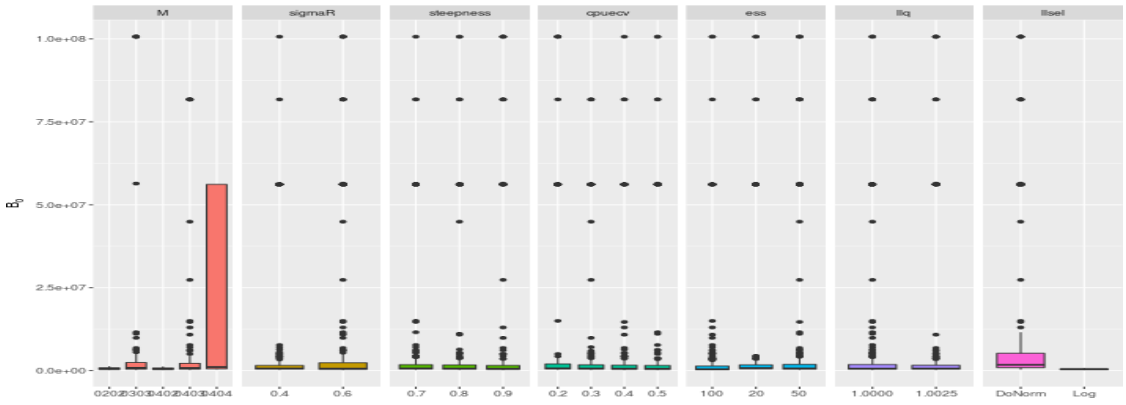

Figure 2: Distribution of estmates of B0 by grid factor and level for the full set of albacore SS3 runs.

For this, a sub-setting method was followed looking first at the convergence of the OMs, then the relation between suitable habitat and carrying capacity, and finally between the most recent catch and estimated vulnerable biomass. This brought to the grid down to a total of 655 runs.

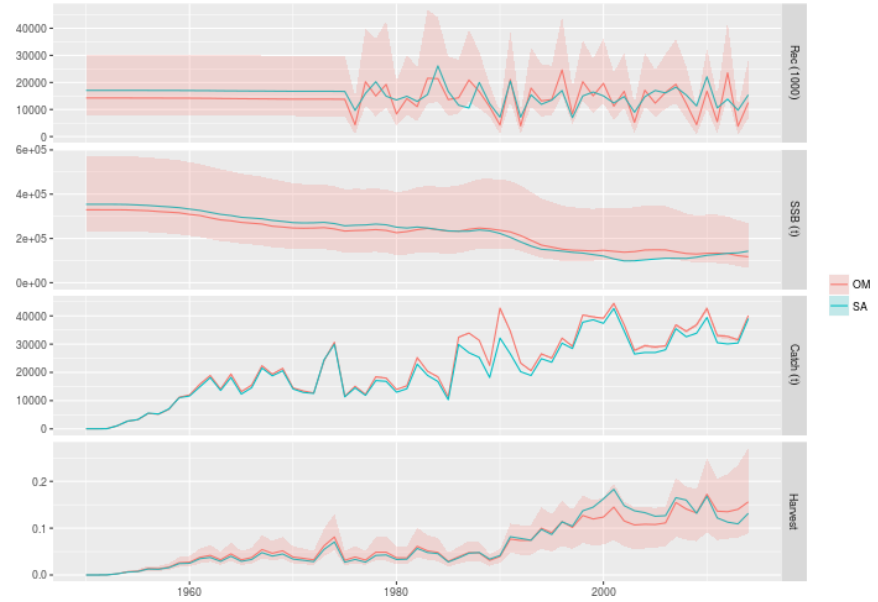

Figure 3: Time series of main quantities (rec, SSB, catch and F) for the filtered OM and the base-case SA model run.

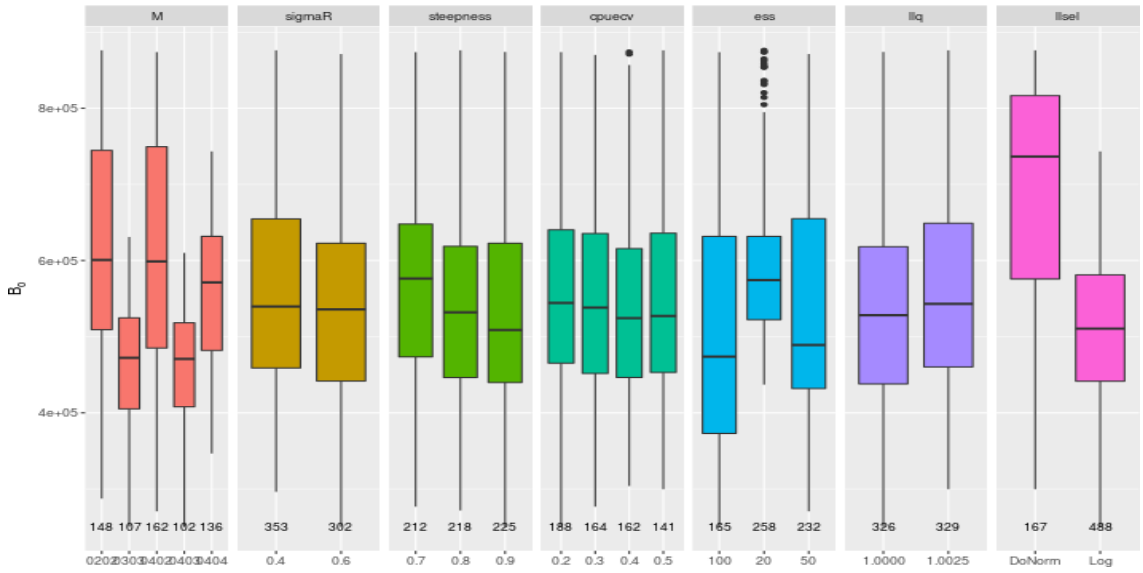

Figure 4: Distribution of estimates of B0 across factors and levels after filtering was applied.

3.2 Discussion and work plan

Discussions were centered on how future recruitment was projected, and how to develop the robustness tests. Tuning of the MPs is being carried out by defining a grid of suitable values for all MP parameters and carrying out the simulations for the uniformly-weighted grid. Although time consuming, this approach generates a database of results that can then be interrogated and used to ask multiple questions without the need to rerun simulations.

WRITE on tuning runs

A draft workplan was also presented to the group which includes the following points

- Review of Pella and Tomlinson index MP implementation to ensure consistency with YFT and BET.
- Test tuning for the Pella shape parameter within a limited range of values.
- Compare the performance of Pella and Tomlison w/Dlim limit vs Pella and Tomlison w/B_{MSY} limit.
- Develop a robustness test for a low recruitment event.

3.3 Other information relevant to ALB MSE in IOTC - Adoption of a HCR for North Atlantic albacore in ICCAT-

The MSE process that led to the recent adoption of a HCR was presented. The sequence of resolutions

requesting research on Reference Points and alternative linear-model based HCRs was parallel to the technical work. The work was periodically presented to ICCAT managers in specific workshops and meetings. In these workshops, the type of HCRs, the performance statistics and the graphical support was agreed. This resulted in the adoption of a HCR for North Atlantic albacore in November 2017.
The WG noted that the HCR adopted for this stock was specifically built within an MP that aimed at mimicking the most recent stock assessment. Thus, ICCAT did not adopt a MP but only a HCR to be used to set TAC for the 2018-2020 period. ICCAT Commission also requested additional analyses of variations to the adopted HCR.
It was noted that the ICCAT albacore HCR included the fitting of a production model with a fairly high (e.g. ~8%) probability of a numerical convergence failure. The group discussed how this should be addressed (in ICCAT and IOTC). The group concluded that MP testing needs to be careful to identify if this is happening and change to a better MP if it is likely to be a problem.

4. Review of status of work on skipjack OMs and MPs

4.1 Review of status and issues

The group reviewed the implementation of the skipjack HCR in 2017, NOTING:

- The HCR definition specified the use of spawning biomass estimates in the decision rule, while reference to exploitation rate created the perception that exploitable biomass might have been intended. HCRs using exploitable biomass and SSB were both tested in the MSE framework. The HRC-MSE developer confirmed that SB was finally adopted as the preferred in Resolution 16/01, and this was used for the 2018-2020 TAC recommendation.

- The group recognized that the adopted HCR implicitly accepted a tuning objective around Pr(SB/SB(MSY)) > 0.6 on average, likely to be conservative when compared to some of the tuning objectives currently being considered by TCMP.

- A visual inspection of the OM projections suggests that the OM is appreciably more optimistic than the 2017 grid-based assessment. This highlights the concern that there is no process or criteria defined for evaluating whether "exceptional circumstances" are occurring, which could undermine the HCR effectiveness.

- The HCR is not a full MP, because the data and form of assessment are not pre-specified and simulation-tested and, therefore, further refinement of the HCR to move towards a full MP is desired in the future

- These issues should be addressed before the next TAC recommendation in 2020, as indicated in the MSE workplan below.

4.2 Workplan

The following elements were SUGGESTED for further skipjack MSE development:
TCMP 2018:

- Provide a brief overview of the skipjack MSE process from development to implementation and guidelines for further refinement of the MSE work as requested in Resolution 16/01.

TCMP & Commission 2018-2019:

- Review MP Performance objectives (i.e. tuning levels)
- Identify the need for financial resources (and appropriate staff) to update the skipjack MSE by 2020, to move it from the current HCR, to a fully-specified Management Procedure.

SC/WPTT/WPM 2018-2019:

- Support further MSE development to move skipjack to a full MP
- Establish a process for identifying "exceptional circumstances" and ensure that the MSE can provide any outputs required to support this process

5. Review of status of work on yellowfin and bigeye OMs and MPs

5.1 Review status and issues for yellowfin

The group was updated on the current status of work for the development of MSE for yellowfin tuna. This work is being conducted by CSIRO, Australia, represented here by D. Kolody. After reviewing the structure and main assumptions of the last stock assessment for the stock, the group looked at the base stock assessment used in the OM grid. The ensemble is derived from the 2016 Stock Synthesis assessment, except for the removal of the environmental co-variate for movement (which was found to have a trivial effect on stock status inferences).

The initial OM grid (proposed in 2016), consisted of 216 models, with varying levels for six model dimensions (M, steepness, tag weighting, CPUE catchability, CPUE series and tag mixing period). The influence of the tag-related parameters was discussed, for example on the SR fits. Most of the implausible models were very productive, suggesting that CPUE declines were driven by recruitment declines, rather than fishing impacts. However, several models also had dubiously low MSY estimates (e.g. less than half of the catch sustained for the past 15-20 years). Most of the plausible results relied on the tagging data (but may be badly biased due to tag mixing assumption violations). A new grid was developed that attempted to include reasonable estimates with and without the tags. The new grid contains the following factor and levels (in an unbalanced design):

- M: 1.0, 0.8, 0.6
- Stock Recruit steepness: 0.7, 0.8, 0.9
- CPUE catchability trends: 0% & 1% per year

- Alternative Tropical tuna CPUE series: HBF & cluster analysis
- Tag mixing periods: 3, 8 quarters
- Tag weighting factors (lambda): 1.0, 0.0001
- sigma(R): 0.4, 0.6, 0.8
- sigma(CPUE): 0.1, 0.3

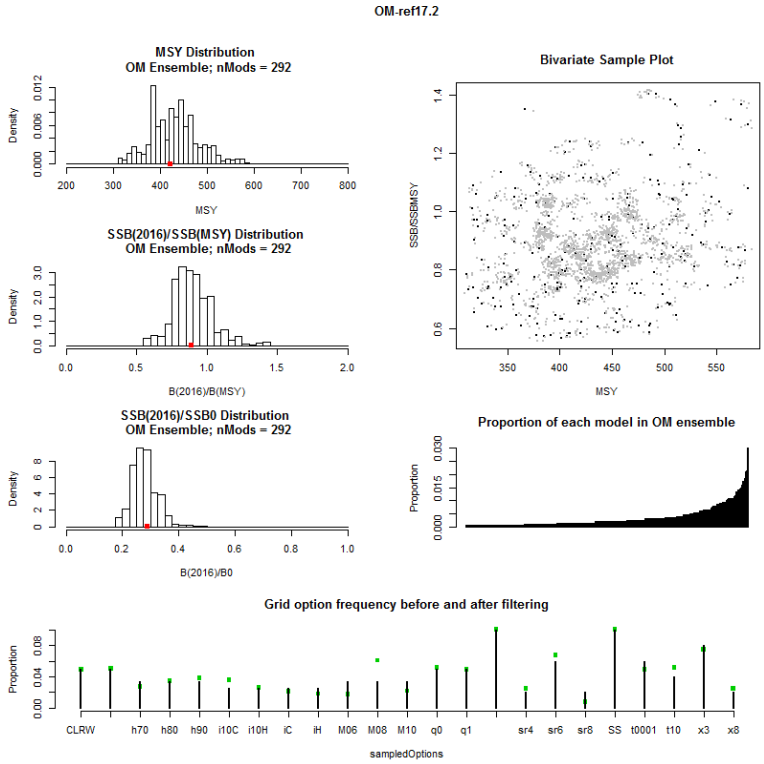

Figure 5: Characteristics of the proposed reference set OM using the bivariate sampling. Red points indicate the point estimates from the 2016 assessment. The top right panel indicates the relationship between MSY and SSBY/SSBMSY (grey points are jitters to emphasize repeat sampling frequency). The middle right panel indicates the relative frequency of the models sampled. The bottom panel indicates the relative proportion of the individual assumptions in the ensemble (green points) relative to the original grid (black lines).

This enlarged model grid was subjected to a filtering process designed around a bi-variate sampling of OMs to ensure (1) the central tendency of the MSY and SB/SBMSY estimates did not deviate greatly from that obtained in the assessment, albeit with an arbitrarily inflated CV, and (2) a pre-specified proportion of runs for 2 factor levels (e.g. 50% with and 50% without tags; 50% with 0% CPUE catchability trend and 50% with 1% per annum trend). This procedure appears to provide a reasonable basis on which the OM for yellowfin can be built. The group endorsed the approach and provided various comments on the CV level to use.

Tuning runs for the two MP types being considered were also presented. The model-based MP has been coded to either output a catch or an F recommendation. Performance seems not to differ in any way, so future evaluations could consider only one of them. Tuning was carried out for two criteria, P(mean(SB(2019-2038))>=SB(MSY)) = 0.5 and P(SB(2024)>=SB(MSY)) = 0.5. These two tuning objectives resulted in very similar MP performance. Both resulted in a high proportion of very high F levels, likely to be much higher that what the fisheries could reasonably achieve, and sensitive to the numerical assumptions about high F dynamics (that are probably not realistic). The very high F levels affect different areas (and fisheries) to a different extent, such that spatial refuges may protect some portion of the stock, while some fisheries fail to meet their quota.

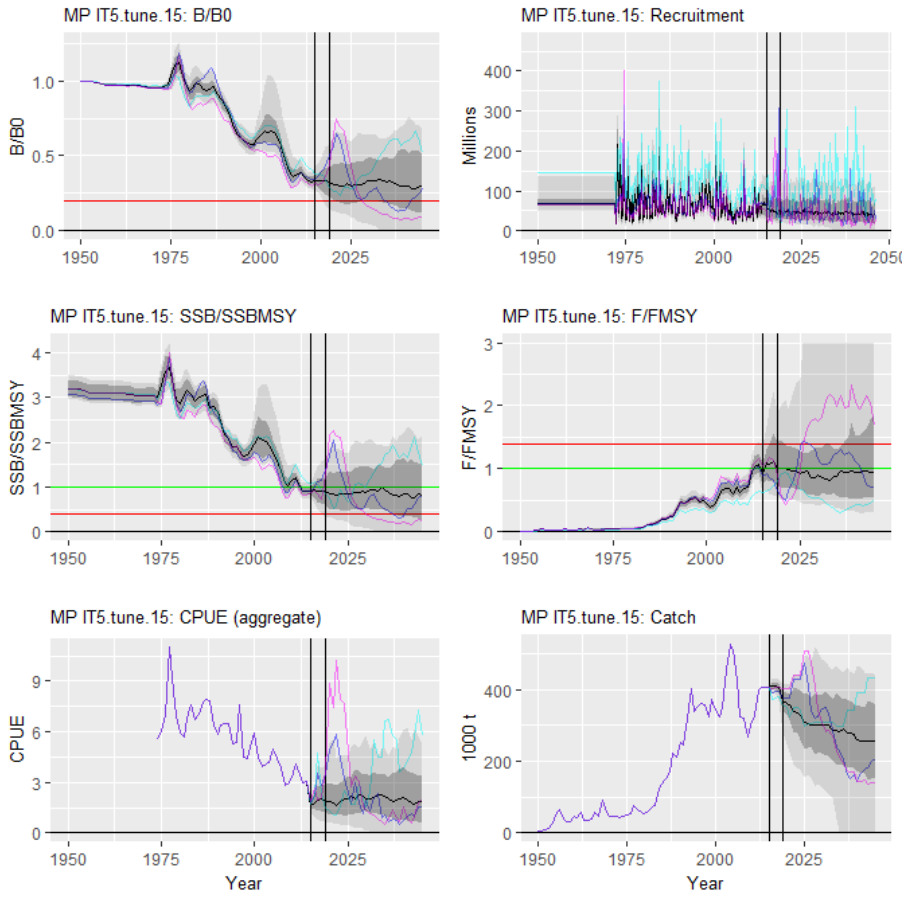

Figure 6: Evaluations of the IT5MP for the TY1 tuning objective 2.

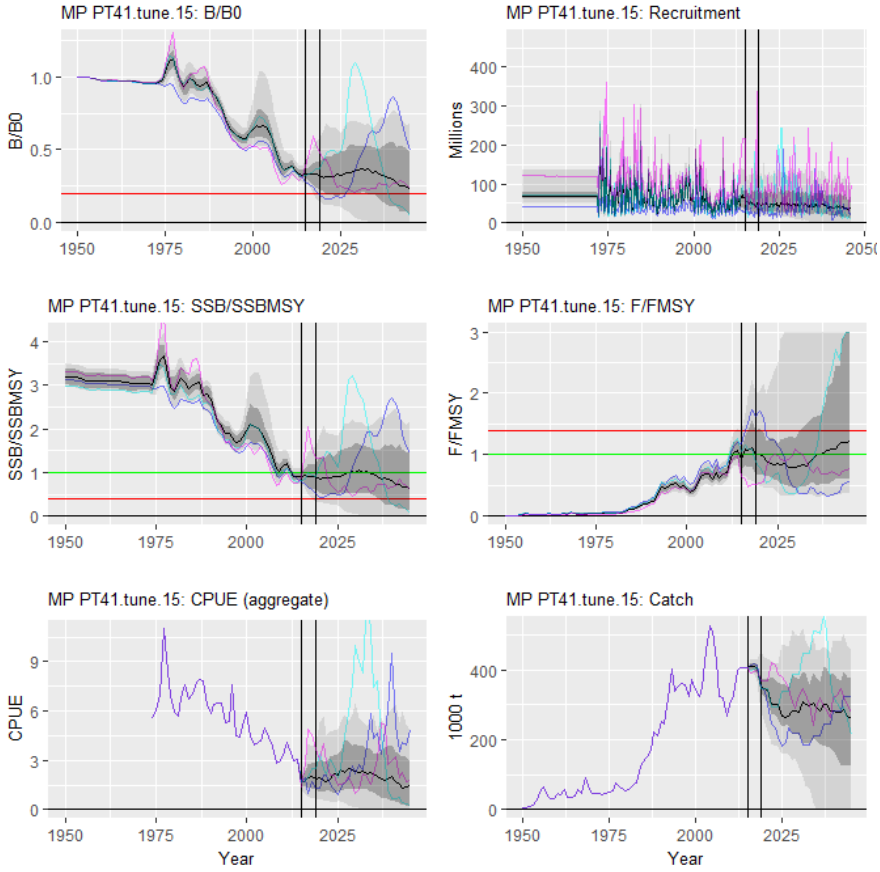

Figure 6: Evaluations of the PT4010 MP using OM ref17.2. for tuning objective 2.

5.2 Discussion and workplan for yellowfin

Possible approaches for dealing with high F situations were discussed. A simple option of increasing mixing rates in projections was considered, with the expectation that the overall production dynamics would be the same as the original model, but fish would be more evenly distributed, reducing F in low abundance areas (and mimicking the possible result of fleets moving to more populous areas). However, this option did not resolve the problem, and may have even made it slightly worse (e.g. perhaps because large numbers of fish were moved from abundant areas into less targeted areas).

The group discussed possible robustness tests to be carried out for this MSE. The agreement was to concentrate in those involving scenarios of low recruitment, e.g. three years of low recruitment at the start of the MP application period. Other possible scenarios have either been identified as not too relevant, like the possible juvenilization of the CPUE, or have not been defined as concrete options that can at this point be applied, like the possible impact of climate change on certain biological processes. Some requests would require re-analysis of tagging data, which will only be possible with the assistance of the secretariat.

The following requests were made for the next iteration of the YFT MSE:

- Compare implementation of MPs and indicators with those being used for albacore tuna.
- Noting that the Hessian CV from the reference case assessment (for MSY and SB/SBMSY) was ~5%, and the CV of the 6 model BET assessment grid (point estimates) was reported at ~13%, it was suggested that a minimum CV to proceed with the OM sampling approach should be ~18% (i.e. assuming additive variances).
- Explore other options for dealing with high F situations if possible (noting that no new suggestions were advanced)
- OM robustness scenario priorities for the WPTT/WPM 2018:
    - Recruitment failure (consistent with YFT estimates in the early 2000s)
    - Explore TAC implementation error and/or bias (undercatch or overcatch) CV
- MP specifications for TCMP presentation:
    - Present only 2 MPs for each tuning objective (PT4010C and CPUETarget)
    - performance with greater flexibility)
    - 4 Tuning Objectives:
        - Pr(mean(SB(2019:2038)/SB(MSY) > 1 = 0.5)
        - Pr(Green Kobe 2019:2038) = 0.5
        - Pr(Green Kobe 2019:2038) = 0.7
        - Pr(SB(2024)/SB(MSY) > 1 = 0.5)
    - triennial TAC with the first application in 2019
    - 15% TAC change constraints (unless MP testing reveals demonstrably better
    - No additional implementation error

5.3 Review status and issues for bigeye

Progress on the development of Operating Models (OMs) and evaluation of candidate Management Procedures (MPs) for IOTC bigeye (BET) tuna was summarized. The new BET Operating Model was updated to recognize the substantial revision to the BET assessment in 2016, including new CPUE analyses, and spatial disaggregation (to facilitate a more appropriate inclusion of the tagging data). Progress on phase 2 BET MSE began with a "mechanical" update of the reference case Operating Model (OM) to address the 2016 IOTC WPTT/WPM requests. This initial grid is composed of an ensemble of 108 stock assessment models, conditioned in relation to the 2016 stock assessment, and representing uncertainty in 5 dimensions in an equally-weighted design:

- 3 X Beverton-Holt stock recruit relationship steepness
- 3 X Natural mortality vectors
- 3 X tag likelihood weighting
- 2 X CPUE standardization method
- 2 X CPUE catchability trend

The 2016 BET SS assessment model was configured with independent CPUE series in the temperate region for each quarter (in an attempt to compensate for a limitation in the representation of seasonal migration). In the interest of simplifying the OM implementation, this was compared with an alternative grid (B.0) in which the temperate seasonal CPUE series were replaced by a single aggregate (consisting of the 4 independently-normalized quarterly series). The change resulted in negligible stock status differences across the full range of grid assumptions. The simplified temperate CPUE assumption was adopted for all subsequent OMs.

The OM grid B.0 was broadly consistent with the assessment, but more optimistic in terms of productivity and SB/SB(MSY) estimates. The quality of fit to the data diagnostics were not very informative for evaluating model plausibility (concerns about non-stationary recruitment from YFT were not very problematic for BET). In the interest of consistency with YFT, an alternative OM based on an expanded grid was proposed (B.2 with additional CPUE CV assumptions and CL size composition effective sample sizes), for a total grid size of 432 models. Grid B.2 was sampled with replacement, to generate OM ensemble B.3, that is consistent with the central tendency of the assessment with respect to B(2015)/B(MSY) and MSY (assumed correlation of 0). The sampling CV (0.13) was consistent with the uncertainty presented for the (6 model) BET assessment ensemble, and (coincidentally) very similar to the YFT sampling approach (in which the CV was arbitrarily chosen to be 3X higher than the YFT reference case assessment). The group had mixed views about adopting the bivariate grid sampling approach for BET, i.e. while B.1 was more optimistic than the assessment and B.3, it did not have obvious problems (like the YFT grid). Grid B.2 was considered to be a plausible intermediate.

Projection assumptions for OMs included:

- Initial states (with added error) and most parameters defined by the SS specifications
- temporal variability in selectivity for all fleets
- CPUE CV = 0.2
- annual recruitment CV = 0.6, autocorrelation = 0.5
- first TAC implemented in 2019; bridging catches 2016:2018 = 93Kt (2015 level)
- catch implementation error CV = 0

Results of 3 candidate MPs (plus constant catch) were presented for two example BET tuning objectives similar to those identified by the TCMP 2017 (including 3 year TAC setting and 15% TAC change constraints)::

- TB1: Pr(mean(SB(2019:2038)) >=SBMSY) = 0.5
- TB2: Pr(Kobe green zone 2019:2038) = 0.75

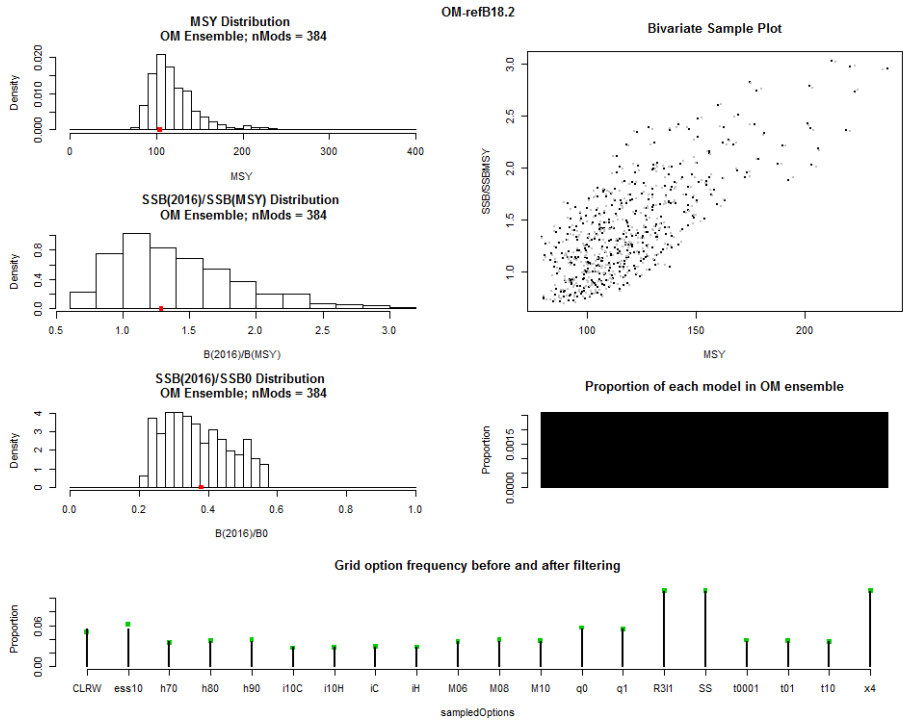

Figure 7: Characteristics of OM B.2. Red circles indicate the point estimates from the 2016 assessment. The top right panel indicates the relationship between MSY and SBY/SBMSY (grey points are jitters to emphasize repeat sampling frequency). The middle right panel indicates the relative frequency of the models sampled (uniform in this case). The bottom panel indicates the relative proportion of the individual assumptions in the ensemble (green points) relative to the original grid (black lines) - essentially identical except for convergence failures.

All of the MPs exhibited undesirable behaviour with the TB1 tuning objective. Given that the current stock status has a high probability of SB > SB(MSY), the MPs must rapidly increase fishing effort in the short-term (which may not be in the interest of industry), so that there is a high probability of SB < SB(MSY) later in the time series, to attain SB = SB(MSY) on average from 2019-2038. Achieving this tuning usually results in a downward biomass trend at the end of the 20y evaluation period. In contrast, with the TB2 tuning objective, all of the MPs tended to support very stable median population and catch trajectories. The TB1 tuning results are presumably affected by the numerical problems of the high F scenarios that were observed for YFT, while the effect was minimal for TB2 tuning. The MSE was repeated for candidate reference case OMs B.0 and B.3. Projected performance of B.3 was more optimistic, but there was considerable overlap in the projection distributions.

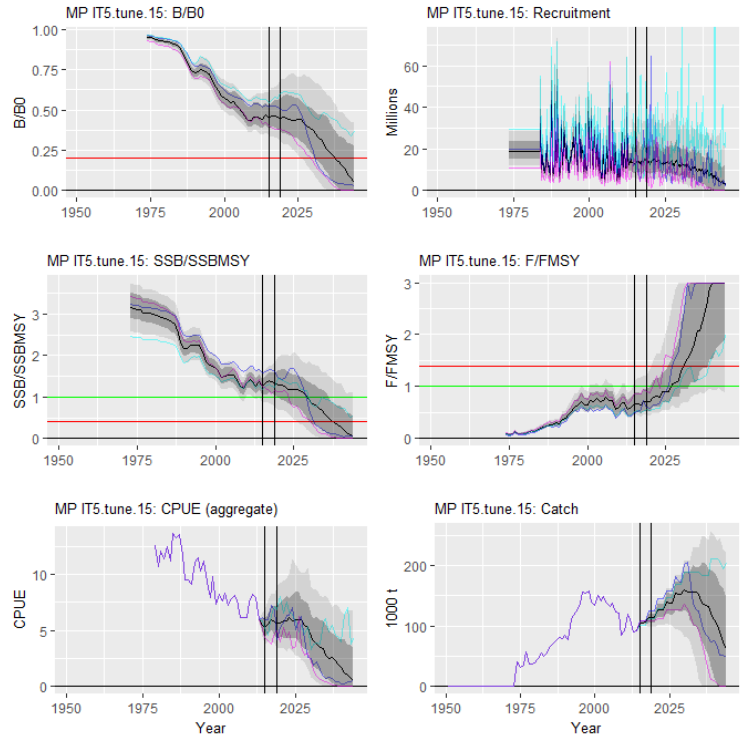

Figure 8: MP IT5 evaluated with OM B.0, tuning level TB1.

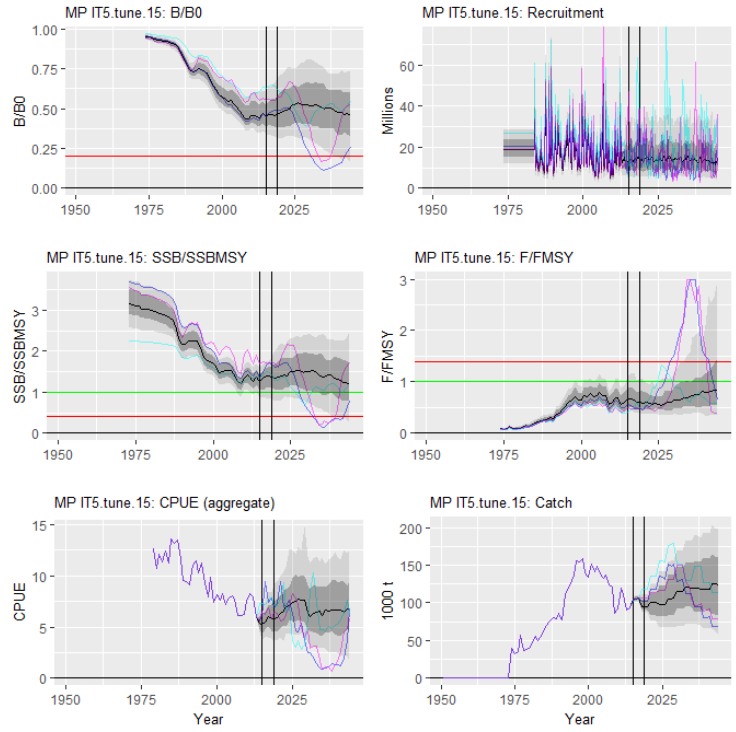

Figure 9: MP IT5 evaluated with OM B.0, tuning level TB2.

5.4 Discussion and workplan for bigeye

Robustness scenarios for BET were not yet explored (none were proposed in the WPTT/WPM 2017, because the MSE had not progressed in the preceding year).

The following requests were made for the next iteration of the YFT MSE:

TCMP 2018

- Adopt B.2 as the new OM (the expanded 432 model grid with uniform weighting, and convergence failures removed). Diagnostics for this ensemble were incomplete at the meeting, but this OM was expected to be intermediate between B.0 and B.3
- MP specifications for TCMP presentation:
  - Present only 2 MPs for each tuning objective (PT4010C and IT5)
  - 3 Tuning Objectives:
    - Pr(mean(SB(2019:2038)>=SB(MSY)) = 0.5
    - Pr(Green Kobe 2019:2038) = 0.5
    - Pr(Green Kobe 2019:2038) = 0.7
  - Triennial TAC with the first application in 2019
  - 15% TAC change constraints (unless MP testing reveals demonstrably better performance with greater flexibility)

WPM/WPTT 2018

  - Recruitment failure (consistent with YFT estimates in the early 2000s)
  - Explore TAC implementation error and/or bias (undercatch or overcatch) CV

5.5 Consider multispecies MSE

The group NOTED that it was premature to explicitly pursue multispecies MSE at this time. It is expected that managing for the lowest common denominator species (currently YFT), may result in lost economic opportunities for SKJ and BET, though the fisheries should have options for selective targeting that can minimize this effect. Combining the current MSEs into a multi-species platform would involve considerable harmonizing of the BET and YFT models (e.g. spatial structure and fishery definitions) with the SKJ MSE (model structure, and the approach used for conditioning).

6. Work on Swordfish OMs

6.1 Review stock assessment results

The Group recalled the SWO assessment carried out by WPB in 2017, especially the various model configuration options explored and used during the stock assessment. Major uncertainties discussed

by the WPB were regarding the CPUEs (4 separate regions - SW, SE, NW and NE with several fleet options), the growth curves (considering either otolith or fin ray-based curves) and alternative catches (considering different options regarding reconstruction of Indonesia catches). The group also noted that there was an error in the specification of the age selectivity option in the ss3 model and changing the option from 11 to 10 resolved the significant discrepancy in biomass estimates amongst model runs with different growth options.

6.2 Discussion and work plan

The Group analyzed the progress in the SWO MSE work, currently at the initial OM conditioning stage. The grid of uncertainties in the parameters was mostly based on the 2017 WPM recommendations. The initial subsetting was done based on model convergence criteria and on inspecting grid combinations that resulted in some very high and unlikely estimates of B0 and Bmsy. The subsetting currently results in 1003 models. The group also discussed issues related with further inspection of the models combinations. It is useful to have several variables that can be analyzed in more detail to explore combinations resulting in implausible results, and also to test sensitivities of particular options such as using age-dependent vs constant M. While it is useful to explore results related to stock status (as SB/SBmsy) it would also be useful to look for example in recruitment deviation trends estimated from over the last 15 years or so as other possible indicator, as in some cases the CPUEs trends might be explained mostly by changes in recruitment.

Overall, the group agreed that the uncertainties considered in the current grid looked comprehensive. The group also acknowledged that the current work is progressing, but still at a relatively slow pace. In the very minimum a one week trip for the people most involved in this work would be needed later in the year (JRC, IOTC and IPMA). Additional resources would be needed in terms of funds and human resources if the work is to progress faster.

7. PRESENTATION of MSE

7.1 REVIEW the presentation styles agreed in WPM08 and SC20 in 2017

The Group reviewed the presentations made at WPM08 and SC20 in 2017 and agreed to update the presentation materials in line with the RECOMMENDATIONS made by WPM08 and ENDORSED by SC20. In this context, the Group AGREED that summary plots and tables used for presentation to TCMP are as reflected in the SC20. For the presentations to be used at TCMP02, updated results from the work conducted since TCMP01 will be reported upon, reflecting the requests made by TCMP01 and as endorsed by SC20. As for TCMP02, the Group RECOMMENDED use of a Facilitator to assist in conduct of the meeting. During the session, the TCMP01 Facilitator was contacted and informed that he has both interest and availability to serve the same role at TCMP02.

7.2 FINALIZE the presentation to be used in TCMP02 in 2018.

A provisional agenda for TCMP02 was drafted by the SC chair and feedback was provided by the Group (Attachment 1). It was agreed to utilize the morning of the first day of the 2 day meeting to review principals and provide a hands- on example of evaluating performance of different Management Procedures. The introductory and background material presented on Day 1 should also reflect on progress being made at other tRFMOs. Subsequent to the introductory/review material, the so-called "Toy Tuna MSE" developed by Andre Punt under the GEF/FAO ABNJ Tuna Project (e.g. https://puntapps.shinyapps.io/tunafijimse/), potentially modified to reflect conditions for a stock requiring rebuilding and a stock in a healthy condition in order to contrast the performance of different management procedures tuned to the objectives identified by TCMP01, will be used to provide hands-on examples to the participants. The possibility of modifying the existing code to reflect both of these possibilities, as well as using the plots in the SC/TCMP guidelines for presentation of MSE results, will be investigated in the near future and reported back to the Group. The Group NOTED that the hands-on example portion of the agenda should be run in a less formal format, with assistance of scientists being offered to small (7-10) groups of TCMP02 participants to promote better understanding of the examples developed.

The balance of Day 1 should be spent providing updated outcomes from the MSE work conducted thus far on the species of interest and reflecting the range of objectives TCMP01 identified. Day 2 should resume with discussion of the materials presented on Day 1, directed toward identifying any additional requirements to promote decisions for adoption of Management Procedures by the IOTC. The provisional agenda allocates time in the afternoon of Day 2 to review and adopt a report on the discussions held at TCMP02.

It was AGREED that the draft presentations to be made at TCMP02 should be circulated to the Group for comment and review by the end of April and finalized by 10 May, after which the materials should be posted to the IOTC TCMP Meeting website to provide CPCs with opportunity to examine the material in advance of the meeting (18-19 May). In addition, the Group agreed that the (revised) example graphics, summary Tables and glossary endorsed by SC20 should be provided to the TCMP participants, also in advance of the Meeting as well as in hard copy form at the meeting.

8. TRAINING and capacity building on MSE at IOTC

The group noted that ABNJ has supported a series of MSE related capacity building initiatives and workshops involving IOTC over the last few years. The funding may not be available in the short term as the phase-1 of ABNJ project is due to end by early 2019. The group noted that the phase 2 ABNJ project is likely to continue to support and fund the MSE Capacity building activities in the future.

9. Other ISSUES for WPM09

While the Group RECOGNIZED the importance of other issues facing WPM09, there was insufficient time at the current meeting to fully address items other than those related to the progress on MSE and preparations for TCMP02. However, the Group NOTED an upcoming ISSF Stock Assessment Workshop which should inform on other issues as addressed at other tRFMOs, such as utilization of a tier approach in guiding assessment stock status determinations, assessment methods for data limited stocks, and the current use of averaging and selection of different stock assessment models or scenarios in providing management advice.

The group was informed of a new research project on the use of model ensembles for combining the results of alternative model formulations and their uncertainty, in a statistically sound manner. This exploratory research project, funded by the EC JRC, is about to start and will report its results in 2019. Further information, and a list of partiviantd, can be found at https://www.researchgate.net/project/NewSciFish-New-approach-to-strengthen-evidence-based-fisheries-management.

10. Peer review process for WPM MSE

10.1 Internal

The group discussed the possibility of an internal peer review process of the IOTC MSE and agreed the following process to be recommended to WPM/WPTT and SC:

- First, that an internal review of the assumptions and inputs used for OM conditioning and MP testing is conducted by WPM/WPTT and SC;
- Then, that the code is reviewed internally by some member of the IOTC WPM/SC;
- And that the analysis is replicated by running the code following the documentation of the process by the MSE analyst. For example, some code was easily run by other scientist following the documentation of MSE analyst.

10.2 External

The group considered that external review is necessary to assure accuracy and transparency of the MSE process. Thus, the group agreed in the following process:

- To develop a plan for external peer-revision to be recommended to and endorsed by WPM/SC.
- This peer-review plan should include (i) the revision of the code for checking accuracy, transparency and documentation; (ii) replicate as close as possible the outcomes of the analysis; and (iii) recommend future options for improvement.
- Once this external peer-review process is agreed by the SC, its implementation should be discussed with COM and Secretariat.

11. 2018-2021 roadmap

The group considered that the MSE work should stick to the timeframe agreed by the TCMP and Commission (IOTC-2017-S21-RE, Appendix 9) . The progress on the established workplan will depend on the discussions and agreement in the TCMP meeting. It was noted that the timing and plan for internal/external peer-review process should be included in the adopted timeframe to be presented in the upcoming TCMP.

12. Other business

The Group NOTED the value of having a preparatory meeting in advance of TCMP in order to develop material for consideration at TCMP meetings. In view of this, the Group AGREED that future meetings should be conducted at least two months in advance of TCMP meetings, and until such time the Commission decides further work is not needed.

13. Adoption of report

The meeting closed at 13:00 on 16 March 2018 after reviewing the draft reports. Kitakado thanked the participants for their cooperative and constructive discussion. He also appreciated the rapporteurs. The meeting thanked the Chair, and it also thanked Coelho for arranging an efficient working environment, and ABNJ and ISSF for providing financial support.

Annex A. LIST OF PARTICIPANTS

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Annex B. AGENDA

1. Introductory items

1.1 Opening remarks

1.2 Appointment of chair and rapporteurs

1.3 REVIEW of available documents

2. REVIEW of current state of affairs

2.1 UPDATE on WPM08 and SC20 in 2017

2.2 UPDATE on TCMP01 and COM(S21) in 2017

2.3 PROCESS of MSE development, discussion and adoption at IOTC

3. REVIEW of status of work on Albacore OMs and MPs

3.1 REVIEW status and issues

3.2 DISCUSSION and work plan

3.3 Other information relevant to ALB MSE in IOTC - Adoption of a HCR for North Atlantic albacore in ICCAT-

4. REVIEW of status of work on Skipjack OMs and MPs

4.1 REVIEW status and issues

4.2 DISCUSSION and work plan

5. REVIEW of status of work on Yellowfin and Bigeye OMs and MPs

5.1 Review status and issues for yellowfin

5.2 DISCUSSION and work plan for yellowfin

5.3 Review status and issues for bigeye

5.4 DISCUSSION and work plan for bigeye

5.5 CONSIDER multispecies issues

6. Work on Swordfish OMs

6.1 Review stock assessment results

6.2 DISCUSSION and work plan

7. PRESENTATION of MSE

7.1 REVIEW the presentation styles agreed in WPM08 and SC20 in 2017

7.2 FINALIZE the presentation to be used in TCMP02 in 2018

8. TRAINING and capacity building on MSE at IOTC

9. Other ISSUES for WPM09

10. PEER REVIEW process for WPM MSE

10.1 Internal

10.2 External

11. 2018-2021 ROADMAP

12. OTHER BUSINESS

13. ADOPTION of report