Availability: 22 July 2014

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
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Report of the 3rd IOTC WPM Small Working Group on Management Strategy Evaluation

JRC Ispra, Italy, 25–28 March 2013

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BIBLIOGRAPHIC ENTRY
IOTC–MSEWS03 2014. Report of the 3rd WPM Small Working Group on Management Strategy Evaluation*: 8 pp.*

3rd Management Procedure Workshop

Working Party on Methods, Indian Ocean Tuna Commission

Ispra, Italy, 25-28 March 2014

The 3rd Workshop on Management Procedure Evaluation of the Working Party on Methods took place at the Joint Research Centre of the European Commission in Ispra, Italy, between 25 and 28 March 2014.

The aims of this workshop were to

- Review progress on development of Management Strategy Evaluation simulations for IOTC stocks, namely Indian Ocean albacore and skipjack.
- Develop a set of material for training on MSE and Management Procedures for IOTC.
- Plan future work, including links to that carried out under the GEF ABNJ project.

REVIEW of the status of work on Albacore Operating Models

An update on the current status of work on the Operating Model (OM) for Indian Ocean albacore was presented to the group. The OM is being based on the same platform used by the current stock assessment carried out by WPTmT, Stock Synthesis 3 (SS3), with the impact of multiple structural assumptions being investigated by fitting the model under a range of alternative values (see Table 1).

The main difficulty found in the procedure is the sensitivity of the model and some of its outputs to certain variables and combinations of values. A number of runs provide estimates of population history and status, e.g. SSB in 1950 and 2010, that are much larger than what could be reasonably expected. This is not then corresponded by a significant change in the quality of the fit (in total and partial likelihoods).

Work was carried out on identifying the parameter or parameter combinations reponsible for this behaviour, and the main effect appeared to come from the

very low value assigned in some runs to the Effective Sample Size (ess) of the length samples in the catch data, which controls the wright of this component in the overall likelihood. This choice gives the CPUE series a much stronger influence in the final results.

A more detailed exploration of these issues is now to be carried out, with a view of explicitely justifying that some runs in the model options grid are going to be set aside from the main OM, based on a quantile of the distribution of biomass estimates.

REVIEW of status of work on Skipjack OMs

Progress on the development of an operating model for skipjack was presented. There have been several refinements to the model since it was presented to the WPM meeting in San Sebastian, October 2013. These changes include using a weight to mortality allometric relationship based on Lorenzen (2000) and using piecewise splines for the selectivity of each fishing method. CPUE, size frequencies and Z-estimates have been integrated into the model for the purpose of conditioning.

Initial fits to data suggest further model refinements such as estimating cathability parameters to reflect the quarterly differences in the Maldive pole and line CPUE. During the workshop, further work was done on the appropriate definition of fishing method categories. Originally, line type gears were aggregated into a separate "LI" method. However, after further examination of nominal catch and size frequency data it was decided that it would be more appropriate to combine "LI" into the "OT" (other) method. This results in four methods in the operating model: "PS" (purse seine), "PL" (pole and line), "GN" (gill net) and "OT" (other).

The next step for the project is to complete model conditioning. This, as well as the evaluation of a simple management procedure (MP) based on reference points is expected to be completed by July. Following that, evaluation of more relatistic MPs, based on indicators such as CPUE or tagging-based Z-estimates, will be done. This work will be presented to the WPTT in October for their input.

FUTURE work on Yellowfin and Bigeye OMs

Within the IOTC, yellowfin and bigeye tuna Management Procedure Evaluation has been a lower priority than skipjack and albacore to date. Some exploratory work has been undertaken (Tong et al. 2011, Zhang et al. 2013), and resources have now been identified to initiate a formal development process under the guidance of the WPM. A number of technical considerations

were discussed, including software requirements, operating model structure and conditioning options in relation to trade-offs among biological realism, computational tractability and the uncertainty quantification required to ensure that Harvest Control Rules would be suitably robust to deliver effective management.

The most challenging issues identified for further investigation included:

1. Population spatial connectivity – there is compelling evidence suggesting that the tropical tunas do not form a single rapidly-mixing panmictic population across the Indian Ocean e.g. Kolody et al. (2013). While it is technically straightforward to simulate different stock structure and movement characteristics in an operating model, current data limitations restrict the ability to directly estimate these features.

2. If effort-based management tools are employed to regulate the fishery (including time-area closures), it may be appropriate to model multiple species simultaneously, with supporting modelling efforts required to understand high resolution spatial processes.

3. The bigeye and yellowfin assessments rely on standardized CPUE as relative abundance indices. We never know how effective standardization is, and in the Indian Ocean, we know that: i) longline species targeting has changed over time, ii) longline effort distributions have changed dramatically, particularly in response to Somalian piracy, and iii) different longline fleets exhibit very different trends despite similar standardization analyses. Most Harvest Control Rules are critically dependent on relative abundance information, and it is difficult to realistically quantify CPUE uncertainty, and worth questioning whether other fisheries independent data options should be evaluated as a priority (e.g. transponding acoustic buoys or genetic tagging techniques (ISSF 2012), such as are used in the CCSBT may represent a genuinely viable alternative (Bravington et al. 2012).

The group recommended that the highest priority should be to develop a simple functioning MPE framework, with foresight to allow future elaboration, as new insight from stock structure studies or demonstrated viability of new fisheries independent monitoring systems becomes available. It was expected that progress would be reviewed at the WPTT.

ANALYSIS of risks associated with current reference points

A simple simulation based approach was presented to the Workshop on WPM evaluating the reference points with respect to certain implicit assumptions on

knowing the targets and fishing with respect to these points. Errors with respect to restricting fisheries unnecessarily and failing to detect overfishing were evaluated. Accounting for process error and auto-correlation in the process error, rebuilding times to the target and limits were evaluated under different harvest scenarios and a simple harvest control rule. Managers eventually have to evaluate a trade-off on the risk to the resource and the optimal catch levels on the long-term for the stock being managed. The approach presented here displays the probability of adverse events occurring and evaluates different outcomes based on the specified thresholds and rates at which the stocks are fished. A concept of type I and type II errors is introduced, primarily defining the probability of taking a management action when it was not needed (a false positive, risk to taking a management action on a fishery) versus failing to take a management action when it is needed (a false negative, risk to fail to protect the resource when needed). For illustrative uses, we demonstrate how well it would work for a theoretical albacore, skipjack, bigeye and yellowfin stocks similar to the ones used in models in the Indian Ocean based on life history parameters.

Risks of falling below 40% of S_MSY are below 7% and 10% for Albacore and Skipjack respectively if fished at optimal levels. For bigeye and yellowfin these risks are less than 1% respectively to fall below 50% of S_MSY and 40% S_MSY respectively. Thus, based on these limit reference points, managers should be willing to take a management action every 15 years for albacore, every 10 years for skipjack, and every 100 years for bigeye and yellowfin respectively provided fishing is kept at optimal levels. Risks of failing to detect an issue with overfishing is less than 2% for albacore at levels exceeding optimal fishing levels, about 40% for skipjack, and about 60% for bigeye andyellowfin at these reference points. If managers wish to minimize the risks of failing to detect overfishing for skipjack, yellowfin and bigeye, these stocks should be managed at levels higher than 40% of S_MSY for SKP and YFT, and >50% of S_MSY for BET. The other reference point, namely F_MSY indicates that when exceeded by a factor of 1.5, all tuna stocks will rarely recover to optimal levels of spawning stock size or yield, unless severe harvest controls are applied on these stocks. Minor controls have insignificant effects on recovery times indicating that when fishing exceeds F_MSY levels, a longer recovery time to both the threshold and limit recovery times can be expected. Based on the results of this study, a more robust approach for critical reference points for management would be in the realm of 0.6-0.8 of S_MSY and not to exceed 1.2 F_MSY for all tuna stocks. This would keep the type II error (risk of overfishing to less between 10-20%) for all Indian Ocean Tuna stocks, and ensure recovery to optimal yield levels within 2-3 generations for all stocks other than skipjack and bigeye tuna with simple harvest control rules.

The group discussed some merits of the approach, and suggested improvements by incorporating uncertainty in the optimal rate of fishing and using a more traditional Harvest control rule. The group cautioned on the conclusions as they are inherently a function of what was assumed on the harvest control rule. After a second iteration, this work could be finalized as an analysis addressing

one of the tasks identified in Resolution 13/10 that deal with evaluation of the reference points and rebuilding to a green area in the Kobe plots with a high probability in as quick a time as possible. Discussions were also alluded to having a more direct and applicable tie in to the resolution and this analysis in teh escond iteration.

- DOCUMENT: presentations/Sharma_2014_MSE_RPs.pdf

FUTURE work on Skipjack and Albacore MPs

- Current IDEAS (TK, NB)
- PLANNING of future work (Timelines, responsabilities)

TRAINING and capacity building on MSE at IOTC

Review of GEF-ABNJ/WWF Management Procedure Capacity Building Training Curriculum

GEF-ABNJ/WWF are planning a series of workshops to increase understanding and capacity of senior policy and management staff with respect to the use of harvest strategies, reference points and management strategy evaluation for the management of tuna stocks. Consultants have proposed a training curriculum for the inaugural workshop to be held in Sri Lanka in April 2014 for coastal developing states. Feedback on the scope and content of the curriculum was provided to the developers, emphasizing the need for standardized terminology and a modular

- CALENDAR of activities (RS, IM)
- ABNJ WK MAY 2014 (DK)
- COM 2014 session (JS, RS, IM)
- MATERIAL to be developed

Terminology

When communicating to other scientists and to managers the work on management objectives and procedures that WPM is carrying out, the choice of language can have a large impact in the dialogue. As a number of activities

on capacity building and communication are taking place at the same, and to partlky the same audience, but run by different people, the group agreed that a common terminology ought to be adopted. The most recent and complete compilation appears to be that compiled in ISSF (2013), which is appended to this report as Annex 1.

The group discussed the best choice of terminology for some of the essential concepts and, for example, agreed thast Management Procedure Evaluation (MPE) is probably the most precise description of the work WPM is carrying out.

STATUS of ABNJ project

The FAO/GEF Areas Beyond National Jurisdiction (ABNJ) Tuna project held an inception workshop amongst the project partners (including the IOTC) at FAO headquarters in Rome from 10-12 March, 2014. The project components and organizational structure for the project were reviewed and funding of the project components should soon start.

A number of the ABNJ project elements relate to the acceleration of evaluation of management procedures and for building understanding of the process and utility of these evaluations amongst developing economy CPCs to the IOTC. In particular, it was noted that based upon a recommendation from the 2013 Scientific Committee, the IOTC Secretariat is organizing a dialogue session on Management Objectives at the 2014, which could be supported under one of the ABNJ project elements. Material for presentations to facilitate this dialogue are under development and the WP reviewed and commented on the current plans.

Another activity noted, which relates to building understanding of the process and utility of management procedure evaluations amongst IOTC developing economy CPCs is a workshop organized under the ABNJ project, which is being organized by WWF, to be held in Sri Lanka in late April, 2014. The curriculum for this workshop is under development and a number of the elements related to management procedure evaluations were reviewed and commented upon by the WP participants.

It was noted that the issues being addressed in these two workshops have a large degree of overlap and, as such, it would be best to try and keep some consistency in messaging across the 2 workshops on similar themes. To the degree possible, the curriculum materials used for the April workshop should be available for use during the dialoge workshop with Commissioners in late May.

OTHER BUSINESS

DEMO of ICCAT HPC grid system (IM)

A quick demo of the High Performance Computing (HPC) system currently in use by ICCAT was carried out. ICCAT was graciously provided access to the system to some WPM members to test and assess its usefulness. The group agreed that ICCAT should be contacted to obtain further information on costs, and possibilities be explored for such a system to be made available to all tRFMOs interested.

FLR demo

Following a request of some participants, a brief demonstration of the FLR libraries in the R statistical language, currently being used for the development on albacore, was carried out. Teaching material for FLR is available online at the FLR website.

COMMUNICATION w/WPs

A short discussiom took place on the best strategies for ensuring sufficient and smo0oth communication wth the species working groups involved in the work currently being carried out by WPM, chiefly WPTT and WPTmT. This was requested by the last meeting of IOTC SC (IOTC-2013-SC16-R[E], paragraph 118).

The agreed strategy is to communicate directly with the chairs and vice-chairs of both working groups when any relevant output is generated. For example, this report will be circulated to them all and open to feedback, specially if extra information is required. The members of the group involved in each part of the work will submit papers to the upcoming meetings of both WPTT and WPTmT, and presentations will be made to obtain feedback and suggestions from WP members to better refine the models and simulations.

WORKPLAN

SKJ (NB)

- REFINE model dynamics and data as discussed (APR-JUN)
- FINALIZE operating model, data, priors and conditioning (JUL-SEP)
- EVALUATE simple harvest control rules (JUL-SEP)

- EVALUATE simple management procedures (CPUE, mean length, tagging based) (OCT)
- MEETING project Advisory Committee (OCT)
- CHANGES as suggested by Advisory Committee (NOV-DEC)
- PRESENTATION at WPTT meeting (NOV)
- PRESENTATION at WPM meeting (DEC)

ALB (IM)

- CARRY OUT in depth exploration of OM dynamics (APR)
- FINALIZE OM (MAY)
- CIRCULATE OM draft document for feedback to WPM & WPTmT (MAY)
- APPLY initial set of MPs (JUN-JUL)
- SUBMIT ALB OM + MP document to WPTmT (JUL)
- PRESENTATION WPM MSE WK4 (OCT)

WPM (IM, TK)

- DEC 2014 - WPM session
- DEC 2014 - WPM report at SC
- DEC 2014 - MSE training at SC

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