Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien

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

Shanghai, People's Republic of China, 3 June, 2002

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Opening of the meeting and adoption of the agenda

Due to logistics, the meeting of the Working Party on methods (WPM) was treated as a sub-group of the WPTT, and it was opened on 3 June 2002 in Shanghai, China by the Chairman of the WPTT, Geoff Kirkwood, who welcomed participants (see Appendix I of the WPTT Report). The WPM adopted the Agenda as listed in Appendix I. The documents presented to the meeting are listed in Appendix II.

Review of existing applications of operating model

Two papers were presented and discussed under this agenda item (WPM-02-01 and WPM-02-02). Several key points were raised in the two papers. An operating model can be used in different ways, and the first point is the importance of distinguishing between an application where an operating model is used to test methods (e.g. assessment methods, CPUE standardisation or construction of stock indicators), and one where an operating model is used to evaluate feedback harvest strategies. Second, this distinction is important since some problems and issues are avoided when only evaluating methods. In particular, conditioning is not required in this case, because there is no need to generate data which match up with a historical series. Third, careful attention should be paid to decisions about the level of detail which need to be included in the operating model. The level of detail in the operating model needs to match up with the level of data required for the method which is being evaluated. It was also noted that the simulation trials need to be carefully designed to ensure that, on the one hand, evaluations cover a wide enough range of parameters and scenarios while, on the other hand, the number of trials remain feasible to do and results from trials feasible to analyse and interpret. Finally, it was noted that an hierarchical approach to construction of an operating model may be useful. This would imply starting with a relatively simple model and adding more features.

During discussion it was agreed that the main priorities for an operating model to be used in the work of the IOTC are currently the evaluation of the robustness of: 1. stock indicators, 2. CPUE standardisation procedures, and 3. assessment methods. It was also agreed that the list of specifications for an operating model, drawn up by the WPM in 2001 should be reviewed and revised if necessary. The WPM noted that there are already several in-house operating models elsewhere (e.g. Pacific, SBT at CSIRO), and that these could be used in two ways. Data could potentially be generated by these models and forwarded to the IOTC for evaluations. Alternatively, if the models are suitable, in other words, meet the specifications for an operating model, consideration can be given to trying to adopt aspects of these models.

A key requirement is that the operating model should be modular so that components can easily be "plugged in" or left out. Such an approach would allow for individuals at different institutions to contribute components. There is, however, a need to define the protocols for programming carefully.

An "operating model" steering committee was set up to make progress on the following items by working intersessionally by correspondence:

1. identify existing operating models

2. evaluate suitability for use in IOTC

3. identify areas for further (or new) development of model(s)

Review of stock status indicators

A list of Stock status indicators previously used and recommended by the species working groups was considered. A few additional candidates were identified, namely, an index based on the number of squares fished and fish condition factor. The possible use of environmental or ecosystem indicators was also raised. The WPM considered that it would only be possible to make strong recommendations once the stock status indicators have been tested for robustness using simulation studies.

There is a need to consider which aspect(s) of stock status is reflected by each indicator and a suite of indicators, reflecting a range of aspects of stock status should be used. It was also noted that there may be a need to standardise indicators, for example, for the effects of area, season and fishery. If such an exercise is undertaken, the same issues that arise with CPUE standardization will, however, arise. The importance of listing all the assumptions made when defining, calculating or estimating each index was underlined. Also, where assumptions are thought not to be met, this should be investigated if possible.

The operating model steering committee was also asked to look at how to start using the operating model to explore the robustness of the candidate stock status indicators.

Review of procedures for raising SF and CE data to the total catch

An information paper prepared by the Secretariat highlighted the severe difficulties associated with the task of raising catch and size frequency data to total catch at size. This task had been requested since catch at size (which can possibly be converted to catch at age) is used in many assessment methods.

It was clear that this task could only be performed by making many assumptions. For example, since SF data for LL fishing are only available for the Japanese fleet, one needs to assume that the SFs for all other LL fleets are the same when raising the data. This is clearly a highly questionable assumption. It was considered unlikely that there would be substantial amounts of previously unreported SF data which could be requested. This means that the situation for historic data is unlikely to change substantially. For future data collection it is clearly important that appropriate levels of sampling are followed.

Given that it is unlikely that the gaps in historic data would be obtained retrospectively, the only alternative is to consider methods. There are two possible ways forward. One option is to consider methods which estimate missing "data" within an assessment. It should, however, be noted that no method can "create" data where none exist, particularly if large amounts of data are missing. The second option which is likely to be more promising is to construct methods which only fit to existing data. Currently, not all the data available are being used in assessments, and there may be scope for considering what data could be incorporated.

The WPM also discussed the importance of transparency and consistency in the treatment of missing data at national level. The WPM recommended that the treatment of missing data and raising procedures at national level should be described and presented to the IOTC and the Working Party on Data Collection and Statistics.

Methods for standardization of catch and effort data

Three documents were considered under this agenda item. Document WPM-02-03 identified several important issues encountered when applying GLMs to CPUE data.

<u>Independent versus integrated analysis</u>

This relates to the question of whether CPUE standardisation is done with the assessment framework, or independent of the assessment. There are advantages and disadvantages for both approaches. It was noted that even if final analysis is performed within the assessment framework, exploratory analyses and model selection are more appropriately performed independent of the assessment.

<u>Significance versus influence</u>

It was noted that the additional inclusion of significant terms in a GLM for CPUE often has a very small effect on the standardised CPUE series. It would therefore be useful to consider other measures for model selection. For example, a measure of 'influence' which quantifies the change in the standardised CPUE series due to the addition of a term or interaction, could be considered.

<u>Dilution of the signal</u>

The potential danger of diluting the signal in a CPUE series due to covariates with time trends was highlighted. There is a need to bear in mind the conceptual model behind the inclusion of covariates and to be aware of correlations between covariates.

<u>Time-area interactions</u>

The scale at which time and area are considered can have a strong effect on results. When time and space are divided into many small components, there is an increasing chance of obtaining many apparently significant interactions (because of the very large number of data points), which may include unnecessary or spurious interactions. The inclusion of such interaction terms increases the problems associated with the reconstruction of standardised CPUE which follows the fitting of the model.

The importance of considering whether covariates (and interactions) are most likely to affect catchability or abundance/density was noted during discussion. If a term in the GLM is considered to affect density rather than catchability, then the factor should be included in the standardised CPUE rather than removed.

The WPM did not have sufficient time to resolve the issues or to come to firm conclusions. Nonetheless, it was considered that the development of an operational model provide the perfect opportunity for exploring these issues by simulation. The Operating model steering committee was asked to also consider how progress can be made in this regard.

Working document WPTT-02-26 reports on attempts to standardise the effort in the purse seine fishery. It was emphasised that the resulting standardised effort series should not be used to calculate CPUE.

Working document WPTT-02-19 describes a procedure for categorising historic data, where hooks per basket (HPB) information is not available, into so-called deep and regular longline sets. The categorisation is based on species ratios in the catches of the subset of historic data which does contain HBP information. It was suggested that a logistic GLM framework be used in future. It was also suggested that yellowfin

catches be included in the species-ratios which are used as categorisation indices, and that area-season interactions be considered.

Ecosystem management

There are increasing pressures in fisheries science and management, worldwide, to adopt an "ecosystem approach" to management. It was noted that, particularly in the case of large migratory pelagics such as tunas and billfish, it is not straightforward to define what "ecosystem management" means. A key problem is how to articulate the ecosystem approach in terms of operational management. Two relatively simple ways in which other components of the ecosystem can be incorporated into management are the consideration of by-catch and ecosystem indicators. Ecosystem indicators are being developed and used in some contexts, and there is a need to consider whether such indicators are in fact appropriate for pelagic fisheries.

It was noted that there are structural problems in stock assessments that can only be resolved by very strong assumptions or very informative priors. It was suggested that including linkages between components in the ecosystem into the assessment framework may provide a more consistent framework for resolving some of the structural problems.

The WPM considered that the IOTC should at least be aware of relevant initiatives in other commissions and fora, and that those with access to information on developments in this regard should continue to bring this information to the attention of the IOTC.

Appendix I. Agenda of the Meeting

1. Opening of the meeting

2. Review of existing applications of operating models.

3. Review of stock status indicators

4. Review of procedures for raising SF and CE data to the total catch (and effort)

5. Methods for standardization of catch and effort data.

6. Any other subjects

Appendix II. List of Documents

WPM-02-01   On the use of operating models in the IOTC context. *A.Anganuzzi*

WPM-02-02   The simulation approach to evaluating fisheries assessment and management tools: what can it do for the work of the IOTC?. *Marinelle Basson*

WPM-02-03   Some considerations on catch and effort data analyses *A.Anganuzzi.*