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Key decisions for managers and scientists under the harvest strategy approach for WCPO tuna stocks and fisheries

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SPC[1]

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1. ABSTRACT

Development of the harvest strategy approach for WCPO fisheries and stocks will require managers and scientists to make decisions on specific harvest strategy elements and issues. In this paper, we highlight key decisions that i) regional fishery managers and stakeholders, and ii) scientists (through the Scientific Committee) will need to consider during this SC meeting and in the near future.

As drivers of the harvest strategy process, fishery managers and the wider stakeholder group will need to define key aspects of the process. These decisions would be supported through the 'science-management dialogue' process, the consultative draft Terms of Reference for which is presented in SC14-MI-WP-06. Key areas and activities for decision making will include the following, which are described within this paper:

- An agreed procedure for selection of the 'best performing' management procedure;
- Approach for implementing the agreed procedure;
- Adopting Target Reference Points (TRPs) that define desirable states of a stock and fishery;
- Definition of fisheries and fishery controls within the harvest strategy;
- Input into candidate harvest control rules (HCRs);
- Feedback on presentational approaches to enhance decision making;
- Development of the monitoring strategy; and
- Definition of exceptional circumstances.

Key decisions for SC14 have been presented within the individual working papers on operating models (Scott et al., 2018a), performance indicators (Scott et al., 2018b) and development of harvest strategy elements for south Pacific albacore (Pilling et al., 2018). The Scientific Committee will also need to consider at future meetings:

- Operating model (OM) refinement and development;
- Define candidate estimation methods (EMs);
- Refine and evaluate performance indicators;
- Provide advice on scientific aspects of candidate HCRs;
- Support TRP definition;
- Review approaches to support the monitoring strategy;
- Evaluate economic indicators;
- Evaluate exceptional circumstances; and
- Develop multi-species approaches.

2. INTRODUCTION

Development of the harvest strategy approach for WCPO fisheries and stocks will require managers and scientists to make decisions on specific harvest strategy elements and issues. In this paper, we highlight key decisions that scientists (through the Scientific Committee) and regional fishery managers and stakeholders will need to consider during this SC meeting and in the near future.

Issues will require consideration from both a management perspective and scientific perspective. We identify some of these issues in Sections 3 and 4, respectively. From the scientific perspective, in addition to the specific issues that will be discussed during SC14 under individual working papers, Section 4 highlights some of the key decisions that SC will need to consider in coming meetings.

Communication within WCPFC between managers and scientists is currently through iterative reporting between SC and WCPFC-Commission meetings. A dedicated 'management-science dialogue' meeting will enhance the decision making process for these cross-cutting issues and draft Terms of Reference for such a meeting will be presented to SC14 for technical consideration (MI-WP-06).

Throughout this document we note that Scientific Committee and other subsidiary bodies make recommendations to the Commission and that the WCPFC Annual Session is the body through which formal decisions on all matters are taken.

The areas presented below represent as comprehensive a list as can be developed at the current time. However, further considerations and decision areas are likely to be encountered as the WCPO harvest strategy process develops. To aid the reader, the Annex to this paper contains a short glossary of key terms.

3. FISHERY MANAGER/STAKEHOLDER CONSIDERATIONS

As drivers of the harvest strategy process, fishery managers and the wider stakeholder group will need to define key aspects of the process. Key areas and activities for decision making will include:

- **An agreed procedure for selection of the 'best performing' management procedure (MP)**. Performance indicators are used to highlight how well a candidate MP achieves management objectives. A process for using those performance indicators to identify the "best" MP must be agreed upon (Scott et al., 2018b). This will involve:
  - ***Refinement of management objectives and their relative importance***. The development of harvest strategies is an iterative process. Managers will have the opportunity, throughout the process, to refine and prioritise management objectives for the fishery, and identify possible trade-offs between them.
  - ***Review, refinement and prioritisation of corresponding performance indicators***. Where management objectives are refined, their corresponding performance indicators must be reviewed and, where necessary, modified to ensure they continue to provide appropriate information.

  These discussions will require input from both managers and scientists.
- **Approach for implementing the agreed procedure**. Once a management procedure is agreed, the approach for its implementation, from development of CMMs to changes in how Commission business is undertaken, will need to be defined. Individual CCMs will need to have clear pathways for implementation of the agreed management procedure.
- **Adopting Target Reference Points (TRPs) that define desirable states of a stock and fishery.** TRPs can indicate stock levels that achieve several prioritised objectives (e.g. minimal risk, profitability, suitable catch) and hence can condense multiple objectives

into a single performance indicator. Managers will need to adopt TRPs within the harvest strategy framework, as done for skipjack tuna.

- **Definition of fisheries and fishery controls within the harvest strategy**. A fundamental decision is how fisheries should be managed, e.g. through either catch or effort. The overall mechanism to control harvest rates within the fishery of interest should be defined by managers during the early stages of harvest strategy development. In turn, the fisheries to which those harvest controls will apply (all fisheries catching a stock; specific gear type combinations; gear types in a specific location) should also be detailed.
- **Input into candidate harvest control rules (HCRs)**. Managers and stakeholders should provide input to key areas of candidate harvest control rules. This can include:
    - Constraints, where necessary, on maximum catch or effort within the system.
    - Minimum effort levels at low stock size (e.g. exclusion of archipelagic waters from management systems, as in Scott et al., 2016).
    - Constraints on change between management periods (e.g. maximum allowable change in the effort or catch).

  Definition of the fishery and fishery controls (see above) will also help define HCRs by influencing, for example, the minimum levels of fishing at low stock sizes. These discussions will require input from both managers and scientists.
- **Feedback on presentational approaches to enhance decision making**. Developing a robust harvest strategy requires understanding and analysing a large amount of data (for example, exploring the relative performances of numerous candidate MPs using a suite of performance indicators). To enhance decision making it will be necessary to develop methods for the presentation and analysis of these data. The preferred strategy is to develop iteratively a range of presentation methods through the harvest strategy process, relying on the feedback of managers to highlight issues and inform on preferred presentation options.
- **Development of the monitoring strategy.** The actual performance of the implemented harvest strategy must be monitored to determine whether outcomes achieved are consistent with the performance expected from the modelling work. Managers may need to prioritise and refine areas of data collection from the fishery to ensure that objectives can be monitored.
- **Definition of exceptional circumstances**. Exceptional circumstances include any event that falls outside the range of assumptions over which the management procedure has been tested. For example if biomass falls below the limit reference point, or catches continually exceed some upper threshold. The events considered to be exceptional circumstances, as well as the actions to be taken if they occur, will need to be agreed. These discussions will require input from both managers and scientists (see also Section 4).

4. SCIENTIFIC COMMITTEE

Key decisions for SC14 have been detailed within the individual working papers on operating models (Scott et al., 2018a), performance indicators (Scott et al., 2018b) and development of harvest strategy elements for south Pacific albacore (Pilling et al., 2018). Here we detail further harvest strategy areas that the Scientific Committee will need to consider at future meetings:

- **Operating model (OM) refinement and development**. For skipjack, following adoption of the candidate initial suite of OMs, there will be a need to consider the expansion or refinement of that suite in subsequent meetings. In turn, the frequency at which the OM suite needs to be reconditioned, for example based upon updated stock assessments (e.g. in 2019 for skipjack), will need to be defined. For the other stocks/fisheries, the candidate suites of OMs will need to be defined in order to allow MSE analyses to progress.

- **Define candidate estimation methods (EMs)**. Alternative candidate model-based and/or empirical-based EMs will need to be defined for evaluation within the harvest strategy framework for each stock/fishery, and SC will have a role in reviewing the models and inputs to them prior to evaluation.
- **Refine and evaluate performance indicators**. Through the iterative MSE process, existing performance indicators will be refined and reviewed by SC, and new performance indicators developed where managers identify new fishery objectives. This will include review of the approaches used to display the information to improve clarity for management decision making (see Section 3).
- **Provide advice on scientific aspects of candidate HCRs**. Through the MSE evaluation of candidate HCRs, SC will provide scientific advice to managers on their suitability based upon the performance indicators.
- **Support TRP definition**. Scientific analyses will be required to support the identification of candidate TRPs that appropriately trade off manager's objectives. Examples are the analyses performed for skipjack and south Pacific albacore in this area.
- **Review approaches to support the monitoring strategy**. SC will need to review the data requirements underpinning the monitoring strategy for the stocks/fisheries, to ensure that data collection for those requirements are in place prior to harvest strategy implementation, and provide relevant bodies with advice in this regard.
- **Evaluate economic indicators**. Related to both performance indicators and the monitoring strategy, SC will need to evaluate relevant economic indicators and provide advice on the data requirements to support particular harvest strategies in this regard.
- **Evaluate exceptional circumstances**. As part of the monitoring strategy, SC will also need to check for the occurrence of 'exceptional circumstances', for example where the estimated stock trajectory under a harvest strategy falls outside the range expected from the results of simulation testing. SC will need to identify the conditions considered to be exceptional circumstances and, if they occur, highlight this eventuality to managers, who must then consider what action should be taken (see Section 3).
- **Develop multi-species approaches**. Many of the fisheries under consideration affect more than one key tuna stock. This is an important consideration for e.g. the tropical longline fishery (yellowfin and bigeye) and in the longer term for the southern longline fishery (where yellowfin and bigeye are important contributors to revenue). SC will need to provide input into the development of the multispecies MSE framework.

5. REFERENCES

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ANNEX

A selected glossary of key terms used in this paper:

Estimation Method

The estimation method is used within the management procedure to provide an indicator of stock status, for example through a model-based stock assessment (e.g. MULTIFAN-CL) or through an empirical method such as CPUE analysis.

Harvest Control Rule (HCR)
An HCR is an agreed rule, or algorithm, that describes how fishing opportunities are intended to be controlled by management in relation to the state of some indicator of stock status. It is a component of the management procedure.

Management Procedure (MP)

The MP represents the management system of the fishery and can be described as the formally specified combination of monitoring data, analysis method (e.g., the estimation of stock status through an estimation method) and management actions (through a HCR). The MP may be based on current or alternative assessment methods and management approaches. MPs are tested by simulation and chosen for their performance in meeting specified management objectives and their robustness to uncertainty.

Operating Model (OM)

The OM is a mathematical representation of the biological components of the resource as well as the fishery that operates on the modelled population. It also includes models for the generation of data and the procedures for implementation of management regulations. It simulates the real world by attempting to capture all existing knowledge and data processes for the exploited populations and associated fisheries. Where knowledge is incomplete the OM should allow for the evaluation of the consequences of contrasting hypotheses about the dynamics of those populations and fisheries. In this respect a suite of different OMs may be identified, each one representing an alternative hypothesis. Very often the OMs will include a greater level of complexity than that used for the stock assessment so that all sources of uncertainty about future stock status might be appropriately included in the evaluation process.