SCIENCE-MANAGEMENT DIALOGUE
FIRST SESSION
Online
19, 22 August 2022

Progress in developing harvest strategies for WCPFC stocks and fisheries

WCPFC-SMD01-2022/BP-02

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Introduction

WCPFC agreed to develop and implement the harvest strategy approach through CMM 2014-06. That CMM notes the different desirable elements of a harvest strategy, focussed upon the four 'key' tuna stocks: WCPO skipjack, bigeye and yellowfin and South Pacific albacore, and the fisheries that catch them.

In this background paper we will summarise the progress in developing the following elements:

- Defined operational management objectives for the fishery or stock,
- Management procedures, including decision rules that aim to achieve the target reference point and aim to avoid the limit reference point,
- An evaluation of the performance of proposed management procedures against management objectives ('management strategy evaluation'), using performance indicators.
- Incorporating mixed fishery considerations, and
- Development of a monitoring strategy using best available information to assess management procedure performance.

Current progress against these elements is summarised in Table 1. The WCPFC's Harvest Strategy Workplan (here), which highlights the key decision points required by WCPFC and its subsidiary bodies to progress the work, is regularly updated to reflect the Commission's progress.

Table 1. Summary of progress towards implementing the harvest strategy elements for key WCPFC stocks and fisheries.

Stock:	**SKJ**	**SP-ALB**	**BET**	**YFT**
Key gear:	**Tropical purse seine**	**Southern longline**	**Tropical longline**	
Management objectives	Noted	Noted	Noted	Noted
Management procedure	Candidate MPs	Initial MPs		
Performance indicators	Identified	Identified	Identified	Identified
Mixed fishery	Developing			
Monitoring strategy	Developing	Developing		

We also point readers to https://www.wcpfc.int/harvest-strategy; and SC18-MI-IP-03.

Management objectives

Management objectives guide the harvest strategy work and underpin selection of the 'best performing' management procedure. WCPFC13 and WCPFC14 noted management objectives (for the tropical purse seine fishery, see WCPFC13 Summary Report Attachment M; for the tropical and Southern longline fisheries, see WCPFC14 Summary Report Attachment K), which originated from Management Objectives Workshops (MOW) outcomes. These provide high level indications of the key objectives for the fisheries in the WCPO for the purpose of evaluating harvest strategies.

Given the diversity of management objectives and the different priorities individual WCPFC members will have, it is unlikely that a single set of objectives will be agreed. In turn, managers may refine and re-prioritise management objectives for the fishery throughout the process. Ultimately, selection of a management procedure will implicitly identify the overall trade-off between objectives that achieves an acceptable outcome.

Following adoption of a management procedure, managers should continue to evaluate the wider performance of the fishery relative to events affecting it that are outside the control of an adopted management procedure. This may include changes in the global or regional situation that affect members' priorities and that lead to revised objectives, and may require a review of whether an adopted management procedure remains the 'best' one to achieve those revised objectives.

Not all management objectives can be achieved directly through the harvest strategy process, but that process should set the overall conditions through which other instruments – be it national decisions or separate fishery management interventions – can achieve them.

Management procedure

There are three components of a management procedure: the data collection process, an estimation method that uses that data to estimate stock status, and the harvest control rule (HCR) that uses that estimate to set future fishing levels. The three components are agreed together as a fixed package within the harvest strategy, as a) an estimation method needs to have a specific and consistent set of data to run; b) changes to the way those data are developed can affect resulting estimates of stock status and hence this must be fixed; c) the estimation method and its settings also needs to be fixed to ensure consistent (and testable) performance; and d) the decisions on future fishing levels defined by the HCR must also be pre-agreed.

The HCR takes the indication of stock status provided by the estimation method to set future fishing levels. Its design can vary, but an example is shown in Figure 1. The rule (red line in Figure 1) defines the future level of fishing for a given estimate of stock status.

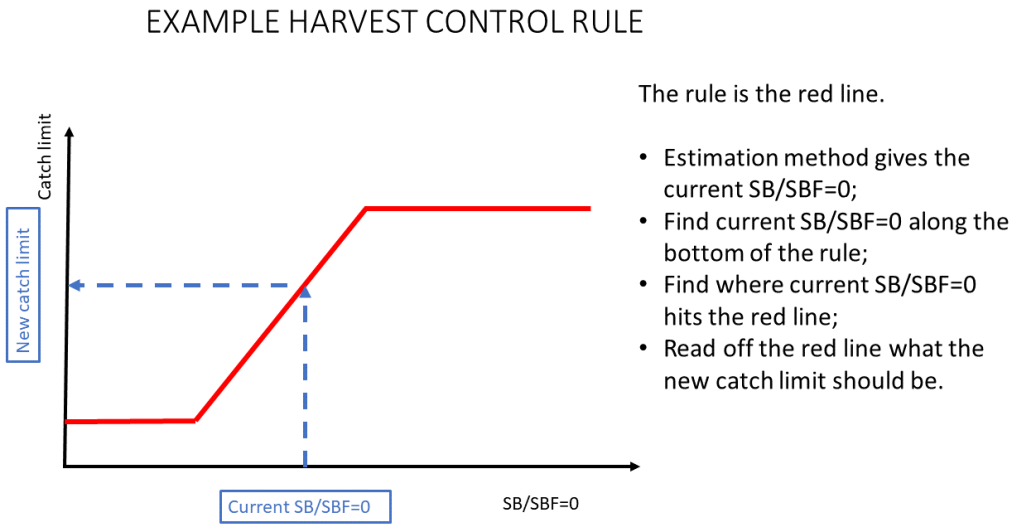

Figure 1. Design of a harvest control rule.

Before adopting a management procedure, many different candidates are tested using Management Strategy Evaluation (MSE) computer simulation. The preferred management procedure is the one most likely to achieve desired management objectives, as judged based upon the calculated performance indicators.

The MSE framework is well developed for skipjack, and candidate management procedures have been evaluated based upon a 'cut down' MULTIFAN-CL stock assessment as the estimation method, and a

range of alternative HCRs that define the resulting change in subsequent fishing levels. Results are available in the interactive web-based tool PIMPLE (https://ofp-sam.shinyapps.io/pimple2022/) to aid interrogation and selection of preferred options. It is noted that decisions that have been made to progress the modelling work will need to be confirmed by managers (see also SMD background paper 3).

For South Pacific albacore, work has focussed on longline CPUE as an indicator of stock status, consistent with the management discussions focussed upon economic management objectives and profitability. However, modelling challenges have resulted in refocussing efforts toward model-based management procedures that use CPUE data within simple assessments (biomass dynamics models) and which incorporate further information to provide a more robust indication of stock status. While this work shows promise, the development work has taken longer than anticipated (see also SMD background paper 4).

Performance indicators

Performance indicators are calculated during the MSE process. They measure the expected performance of each management procedure in relation to defined management objectives. They allow managers to consider agreeable trade-offs.

Initial performance indicators corresponding to the different candidate management objectives for tropical purse seine fisheries were accepted by WCPFC13, while WCPFC14 noted those for the southern longline fishery and tropical longline fishery (see WCPFC13 Summary Report Attachment M; WCPFC14 Summary Report Attachment K). Work has subsequently identified where those PIs can be modelled within the current harvest strategy framework.

The wide range of objectives and corresponding performance indicators mean that not all can be effectively examined within the modelling framework, for example because they refer to specific fisheries that are not present within the framework (e.g. nearshore fisheries), or because outcomes depend on national and regional decision making and external factors that cannot be modelled (e.g. future economic performance, technical management interventions to reduce bycatch). In those cases, it has been recommended that they are a focus of the monitoring strategy so that the actual performance of an adopted management procedure against those objectives can be tracked.

Mixed fishery

The approach of the harvest strategy workplan has been to concentrate initially upon the two stocks which are the subject of primarily ‘stand-alone’ fisheries, being skipjack (purse seine/pole and line) and South Pacific albacore (southern longline/troll). This provided a technically tractable approach to the development of corresponding management procedures.

However, the activities of most fishing gears have impacts on other tuna stocks. It is therefore important to consider mixed fishery interactions when developing harvest strategies. SC15 agreed to consider the technical multi-species modelling framework for initial development of mixed fishery harvest strategies. Under this framework, fisheries are managed through single stock management procedures for skipjack, bigeye and South Pacific albacore. This approach should be regarded as an initial attempt at considering multispecies and mixed fisheries. If this approach is found to be unsuccessful in terms of achieving objectives for all four stocks, alternative approaches will need to be developed.

Mixed fishery performance indicators, which indicate the potential impact of management procedures for one stock on those others that are affected by that gear, are now being developed that will allow managers to consider those interactions.

Monitoring strategy

After adoption of a management procedure, the monitoring strategy continually evaluates its actual performance and determines whether outcomes achieved are consistent with the performance expected through the modelling work. This applies both for performance indicators evaluated within the evaluation framework, and – as noted above - for information on management objectives that could not be evaluated by that framework (e.g., economics, small scale fishery outcomes, livelihoods). This may require the collection of new information to track performance in areas for which data are not routinely gathered or considered.

An element of the monitoring strategy is the consideration of the potential occurrence of 'exceptional circumstances', events that fall outside the range of assumptions over which the management procedure has been tested, or non-availability of important input data. For example, if biomass declines toward the limit reference point, or catches continually exceed some upper threshold. Resulting discussions between scientists and managers should identify the process to be taken in response. For example, it may be necessary to re-evaluate the management procedure or, in severe cases where there is a risk to the stock, take remedial action.

The monitoring strategy for skipjack and South Pacific albacore has been the subject of initial discussions and will be a focus of upcoming work.