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

Overview of the harvest strategy development for skipjack tuna

WCPFC-SMD01-2022/BP-03
05 August 2022

OFP, SPC
Pacific Community (SPC), Noumea, New Caledonia

Introduction

Under the harvest strategy approach the management of stocks and fisheries will be determined by a management procedure (MP). These comprise pre-agreed rules that set future fishing opportunities depending on the status of the stock to try to achieve defined management objectives. Before adopting and implementing an MP it should be tested to see if it is likely to achieve the desired objectives.

Our knowledge of the dynamics of stocks and fisheries is incomplete, and many aspects are subject to uncertainty. MPs should be tested against a range of conditions that represent plausible alternative scenarios for both the current and future dynamics of the stock and the fishery. To ensure that the MP is adequately tested, the range of alternative scenarios, termed operating models (OMs), should adequately reflect our knowledge of, and uncertainty in, the status of the stock and the dynamics of the fishery.

The results of evaluations to test the expected performance are used in the first instance to identify the best performing MP (relative to the others) but will also be used subsequently as part of a monitoring strategy to compare the expected performance of an MP with its actual performance.

A variety of candidate MPs for WCPO skipjack have been proposed and tested against the current OM grid. Under the updated workplan for the development of harvest strategies for WCPO stocks and fisheries (WCPFC17, attachment H), SC18 is scheduled to agree the OM grid for WCPO skipjack, and WCPFC19 to review and adopt a skipjack management procedure.

Operating models for WCPO skipjack

It is considered best practice to identify separate sets of OMs corresponding to a reference set and a robustness set. The reference set of OMs (Table 1.) comprises scenarios considered most plausible and is the priority consideration for the initial selection process when identifying a preferred MP.

It should not be necessary to update the OM grid each time a new assessment is conducted. However, the ranges of uncertainty to include in the OM grid may change over time as new information becomes available and as new modelling approaches are developed. The scenarios that comprise the OM grid will be routinely reviewed under the monitoring strategy to ensure that they remain appropriate. Through this process any necessary changes to the OM grid can be made. Where changes are made to the OM grid, MPs should be re-evaluated against the new set of scenarios to ensure that the selected MP continues to represent the best performing option.

The OM grid in relation to the TRP

The scenarios represented in the OM grid will most likely differ from those represented in the most recent stock assessment and it will be unlikely that both sets of models provide the same median estimate of stock status (i.e. the basis of the TRP). Using an historical baseline as the basis of the TRP is therefore a useful approach, similar to the current considerations for setting a skipjack TRP to achieve similar conditions in the future to those experienced in 2012.

Under this approach, when testing and selecting MPs, the performance of each candidate MP will be evaluated relative to the historical baseline conditions as estimated from the models of the OM grid. When using the stock assessment to monitor the performance of an adopted MP the relative performance against the same historical baseline will be used, only this time using the estimate from

the stock assessment. In this way the stock assessment can be used to monitor the performance of the MP even though the absolute estimates of stock status may differ from those of the OM grid.

Management procedures for WCPO skipjack

The modelling framework for WCPO skipjack has been in place for a number of years and has recently received only minor updates. The results of evaluations of candidate MPs are presented in an updated interactive web-based tool (https://ofp-sam.shinyapps.io/pimple2022/, note the change in address) to aid interrogation of the results and the selection of preferred options. The range of MPs for which results are presented has been modified from previous years and the numbering of the harvest control rules (HCRs) has changed. Note also the very recent addition of an extra MP (HCR9) based on a hybrid form of HCRs 2 and 6.

An MP comprises a data collection programme, an estimation method and an HCR. For the MPs considered here for skipjack, the data collection and estimation model do not change. It is assumed that future catch and effort reporting; biological sampling; tag release and the reporting of recaptured tags continue at their current levels. As such, the alternative MPs evaluated here differ only in the HCR.

The relative success of each MP in achieving defined objectives is measured using performance indicators (PIs). Currently six performance indicators (Table 2) are calculated for the skipjack evaluations. A further four indicators, requested by members, remain under consideration pending further discussion on how they might best be calculated.

The dynamics of the fishery under the MP are likely to be more variable than the average values that are often presented when all of the runs are plotted together. Whilst the median estimate of, for example, depletion might be very close to a target value throughout the simulations, the trajectory of depletion for individual runs will vary around this value. Performance Indicators 6 and 7 measure the extent of inter-annual variation in catch and effort.

Features of the management procedures

The design of the skipjack MPs and the structure of the evaluation framework comprise a number of features:

- A 3 year management period is assumed (based upon the output of the management procedure the level of fishing is set for a 3 year period, before the MP is again run to define the level of fishing for the next 3 year period);
- All fisheries, except longline and archipelagic fisheries, are subject to control by the MP;
- Purse seine fisheries are managed through effort controls and all other fisheries are managed through catch controls;
- The reference year for catch and effort scaling 2012;
- For some HCRs, constraints apply that limit the change in catch or effort between management periods.

Key areas for SMD consideration

Under the harvest strategy workplan (WCPFC17, Attachment H), the WCPFC is scheduled to agree on a management procedure for the WCPO skipjack / tropical purse seine fishery in 2022. To support this

process SMD01 is tasked with initiating discussion on prioritising/identifying (a subset of) preferred management procedures for WCPO skipjack, for consideration by WCPFC19.

We seek feedback from the SMD01 in the following areas:

- advice on a preferred set of management procedures for WCPO skipjack;
- recommendations for the procedures for selecting the 'best performing' MP;
- feedback on the information available and presentation approaches to support decision making.
- Where no preferred options can be identified, we seek input into:
    - the design of alternative management procedures for testing and,
    - advice on the desired PI performance that should be achieved under the management procedure.

Table 1. Skipjack OM uncertainty grid (reference set, 96 scenarios).

Axis	Levels	Options		
		0	1	2
Process Uncertainty				
Recruitment variability	2	1982-2018	2005-2018	
Observation Uncertainty				
Catch and effort	1	20%		
Size composition	1	Estimated		
Tag recaptures	1	Status-quo		
Model Uncertainty				
Steepness of the SRR	3	0.65	0.8	0.95
Tag mixing period (qtrs.)	2	1	2	
Growth	2		low	High
Movement	1	Estimated		
Hyperstability in CPUE (k)	2	0	-0.5	
Implementation Uncertainty				
Effort creep	2	0%	2%	

Table 2. Performance indicators used to measure the expected success of candidate management procedures for WCPO skipjack at achieving defined objectives.

Indicator 1	Maintain SKJ, YFT, BET biomass at or above levels that provide fishery sustainability throughout their range.
Indicator 3	Maximise economic yield from the fishery (average expected catch).
Indicator 4	Maintain acceptable CPUE.
Indicator 6	Catch stability (catch variation relative to a reference period)
Indicator 7	Effort stability (effort variation relative to a reference period)
Indicator 8	Proximity of $SB_{latest}/SB_{F=0}$ to average $SB_{latest}/SB_{F=0}$ in 2012.

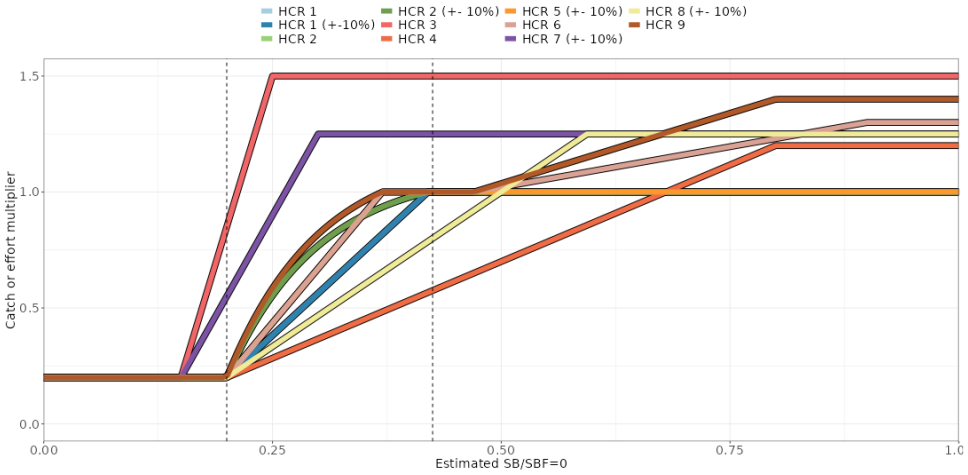

Figure 1. Harvest control rules for WCPO skipjack that have been evaluated to date under the skipjack MSE framework and available for viewing in https://ofp-sam.shinyapps.io/pimple2022/ (note the recent addition of HCR9).

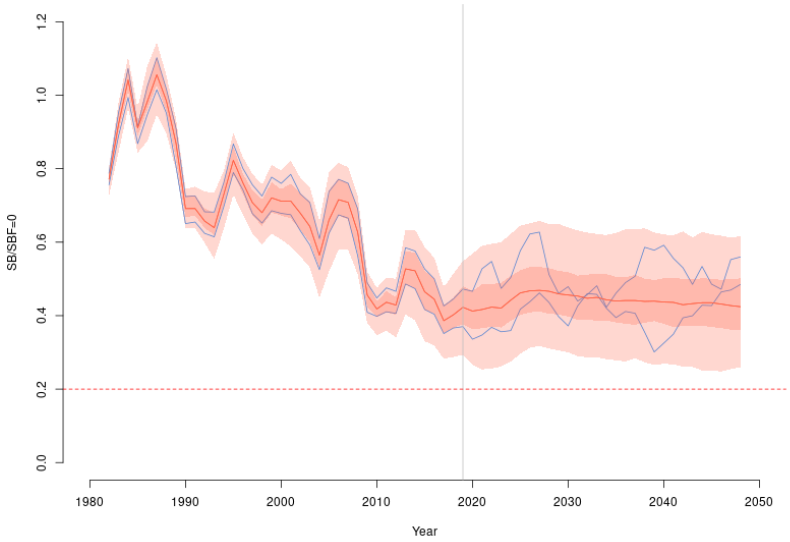

Figure 2. Estimated stock status ($SB_{latest}/SB_{F=0}$) resulting from the evaluation of a candidate MP. Red ribbons show the 50th and 95th percentiles and median values. Blue squiggly lines show two individual trajectories of stock status randomly selected from the full set of 960 runs. Vertical grey line denotes the start of the evaluation period.