SCIENTIFIC COMMITTEE
NINETEENTH REGULAR SESSION
Koror, Palau
16–24 August 2023

Monitoring the WCPO skipjack management procedure

WCPFC-SC19-2023/MI-WP-02

July 25, 2023

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Executive Summary

The monitoring strategy routinely evaluates the performance of the MP to check that it is working as expected. The monitoring strategy should consider all aspects of the harvest strategy including procedures for evaluating and testing the MPs; identify any scenarios that should be added to the OM grid; the preparation and application of the EM and the performance of the management procedure as a whole. In addition, it may identify changes in the dynamics of the fishery resulting from environmental, economic or social factors that may require a reconsideration of the management objectives and the testing of alternative MPs.

In this report we outline some of the key considerations of the monitoring strategy and make recommendations on the time frames over which they might be considered. We identify the key sources of information that can be used to monitor the performance of the MP and where data gaps may occur. We propose a process by which the various elements of a monitoring report might be progressively collated through existing bodies of the WCPFC.

We invite SC19 to:

- consider the proposed approach for the progressive collation of information to review the performance of the WCPO skipjack MP and advise of any additional considerations that should be taken into account;
- provide advice on the structure and contents of the summary monitoring report document;
- provide advice on any changes that may be necessary to the agendas of existing Commission bodies to accomodate the monitoring strategy;
- advise on any additonal information that should be taken into account regarding the monitoring of the WCPO skipjack MP;
- consider the proposed drafting of an MP summary report by SC and TCC for the consideration of the Commisssion and advise accordingly.

1 Introduction

Once a management procedure (MP) has been adopted and put in place, it should be routinely monitored to ensure that it is performing as expected. To this end a formal monitoring strategy can be developed to check:

- the performance of the MP, including that outcomes are consistent with those predicted by the simulation testing procedure (MSE, management strategy evaluation) and the necessary data are both available and of sufficient quality to run the estimation method;
- the overall management objectives of the adopted MP remain valid;
- the underlying technical MSE framework remains appropriate and captures the appropriate range of uncertainties;
- that exceptional circumstances are not occurring.

Aspects of the monitoring strategy for the WCPO skipjack MP are outlined in CMM2022-01 in terms of the data requirements for running the MP and monitoring its performance (Annex III, table 1) and the elements of the MP that might be considered under the monitoring strategy (Annex III, table 2, also shown in table 1 of this report). In addition, the CMM specifies the schedule for monitoring performance of the MP (CMM2022-01, para 8).

In this paper we outline a proposed monitoring strategy report for the WCPO skipjack MP that can be used to update the WCPFC Commission on the performance of the MP. Since this is the first year for which this MP will be run there is, clearly, limited ability to monitor its performance at this point in time. Instead, we outline some of the key considerations of the monitoring strategy and make recommendations on the time frames over which they might be considered, we identify key sources of information that can be used to monitor the performance of the MP and instances where data gaps may occur, and we consider the process by which the various elements of a monitoring report might be collated through SC and TCC.

The full list of items to consider under the monitoring strategy can be extensive. We propose an approach for the progressive collation of information, using existing work streams, so as to minimise the work involved in monitoring the performance of the MP.

2 Review performance of the MP

Perhaps the most pertinent aspect of the monitoring strategy is to review the performance of the MP and to determine if outcomes are consistent with those predicted by the MSE. In the first instance the performance indicators for nominal data generated from the evaluation framework, such as catch and effort levels and variability in catch and effort, can be used to compare observed and expected outcomes. However, comparisons for performance indicators based on model estimates (e.g. stock status) will require updated information determined from a stock assessment.

Table 1: Elements of the management procedure that may be considered for inclusion in the monitoring strategy and the Commission body at which those considerations can be made.

MP Element	Commission Body	Monitoring Considerations
Review performance of the MP		
Comparison of predicted MP performance against latest assessment outcomes	SC	Check that the MP is performing as expected
Data availability to run the MP	SC/TCC	Check availability, quantity and quality of data necessary to run the MP (e.g. the estimation method)
Other sources of data to monitor performance	SC/TCC	Identify other data as available, that may not be included in the MSE framework, to inform calculation of performance indicators (economic, social, ecosystem, etc.)
Performance of the estimation method	SC	Confirm the EM is performing well and not subject to estimation failure.
Review of the MP		
Management objectives	Commission	Check that overall objectives of the MP remain appropriate
Scope of the management procedure	SC/TCC/Comm.	Confirm the fisheries controlled by the MP, and the method of control, remains appropriate.
Exceptional circumstances	SC/TCC/Comm.	Drawing on all of the above, have events (unexpected, extra-ordinary) occurred such that remedial action is required to either review modify or replace the MP
Review the underlying MSE Framework		
Operating model grid	SC	Ensure that the most important sources of uncertainty are included in the OM grid
Calculation of performance indicators	SC	Check for appropriate representation of objectives by performance indicators
Modelling assumptions	SC	Consider the technical details of the simulation and testing framework
Data availability to support the MSE framework	SC/TCC	Improvements to data collection to either enhance the OM framework or to reduce uncertainty included in the OM grid

The frequency and extent of the monitoring process will depend on the availability of data and will vary between elements. Information on stock status, for example, is available from routine stock assessments that are typically conducted on a 3-year rolling schedule. Others, such as catch and effort levels, employment and revenue, may be available at finer timescales. In addition, the temporal variability in performance indicators should also be considered when determining

timescales for monitoring. Indicators with very high short-term variability (e.g. CPUE) can provide misleading information when considered over very short time periods.

2.1 Comparison of MP performance against latest assessment outcomes

One of the primary indicators to consider as part of the monitoring strategy is current stock status in relation to the TRP and LRP. This will require updated information on stock status from a stock assessment which, as noted above, are typically conducted on a 3-year rolling schedule.

The results of the stock assessment should be used to check that stock status remains within acceptable bounds (well away from the LRP), is not deviating from the levels anticipated from the MSE testing process and hence is within the expected range around the TRP. The latter might be considered one of the key considerations of the monitoring strategy, as the chosen TRP represents a trade-off of several different management objectives (e.g. minimising the risk of falling below the LRP, achieving acceptable catch and CPUE, etc.). By maintaining stock status close to the TRP it might be expected that other management objectives are also achieved, at least to acceptable levels. Proximity to the TRP is therefore likely to be a good indicator of the overall performance of the MP. It is, however, desirable to monitor performance against other management objectives where possible.

2.2 Data availability to run the MP

The monitoring strategy should identify whether the data required to run the adopted MP are both available and of sufficient quality. Availability can be affected by factors such as delays in data provision or gaps in a key data input (e.g. gaps in or cessation of a tagging programme, closure of or change in a fishery that provides an index of abundance). Data gaps can be considered on an annual basis and brought to the attention of SC where problems are identified. The quality of data available should be confirmed each time the MP is run and any instances of significant data deterioration highlighted.

2.3 Other sources of data to monitor performance

The full set of management objectives for the tropical purse seine fishery includes economic, social and ecosystem considerations, many of which cannot be fully represented in the MSE modelling framework. Consideration of performance in relation to these wider objectives therefore requires additional analyses using 'real world' data that may not have been included in the MP testing process, including economic information, data from national social surveys, etc.

Very often these additional sources of data may not be available for all fisheries or countries that fall under the MP. Information on, for example, employment levels, economic viability of fisheries and impacts on small scale fishers may only be available at the national level and only for some countries. Even where these data are available, they may not be updated on a regular basis.

Inclusion of these data in a formal monitoring strategy is therefore challenging. It may not be possible to produce quantitative metrics to measure performance for these objectives and instead a more qualitative analysis may be required.

Under the monitoring strategy therefore, provision should be made for individual CCMs, or CCM groups, to submit reports on an ad-hoc basis on the performance of the MP in relation to the wider management objectives. Where deficiencies or poor performance are identified, the report should demonstrate that this is the result of the MP and not a consequence of factors that fall outside the control of the MP, which may include wider national decision making. This information could be submitted to SC and TCC, included in the monitoring strategy through the progressive collation of information, and considered in the context of the general review of the MP outlined in Section 3.

In recent years, information has been submitted to the SC presenting a range of climate change indicators (OFP, 2022), which were adopted as a standing agenda item of SC. While drawing direct links between changes or trends in these oceanographic and ecosystem indicators and impacts on tuna and their ecosystem, they highlight changes that require further investigation by SC and act as an 'early warning' of potential impacts that need to be considered further, particularly in the context of climate change scenarios for the OM grid.

2.4 Performance of the estimation method

The estimation method is based on a fixed implementation of MULTIFAN-CL. The model settings for the estimation method do not change and it is effectively run as a fixed algorithm that has been simulation tested in the MSE analyses to demonstrate that it is able to determine a reliable and relatively unbiased estimate of stock status. Consequently, detailed interrogation of the estimation method diagnostics, as is typically carried out for a stock assessment, is not necessary. However, it is prudent to examine a number of key model outputs and diagnostics to ensure that the estimation method is performing well and is not subject to estimation failure. In this respect goodness of fit diagnostics such as the catch estimate deviates and effort deviates provide an overall indication of the performance and reliability of the estimation method. Similarly model estimates of fishery specific selectivity at age and time series of recruitment deviates can provide an indication of whether or not the model is performing to expectation (Merino et al., 2022).

Reports submitted to SC detailing the running of the MP (see for example Scott et al. (2023)) should include specific considerations for the monitoring strategy. This should include the availability and quality of data necessary to run the MP and the necessary checks to ensure that the MP has run adequately.

3 Review of the MP

In addition to reviewing the performance of the MP and the status of the MSE framework (as detailed in Sections 4 and 2), the monitoring strategy also presents an opportunity to take a broader look at the MP and review the criteria under which it was developed. These might include the underlying management objectives, the scope of the MP (perhaps in terms of the fisheries to which it applies) and to consider the over-arching issue of whether exceptional circumstances are occurring. This review process can occur across the subsidiary bodies of the WCPFC, and ultimately by the Commission itself.

3.1 Management objectives

Management objectives for specific fishery sectors were discussed extensively during the initial phases of developing the harvest strategy approach. They were expressed in relatively broad terms repesenting high-level management goals, often without specific target values or points of reference. More operational management objectives have been agreed in terms of the risk of falling below the LRP and the target level of spawning biomass depletion ratio at which the stock should be maintained on average (TRP).

The monitoring strategy provides an opportunity to review and where necessary update the management objectives to ensure the overall harvest strategy remains appropriate as the nature of the fishery evolves over time. For example, external factors such as the recent COVID pandemic or changes in the price of materials or available markets may lead to new objectives, or a different prioritisation of existing objectives. There will then need to be an evaluation of whether these changes lead to 'exceptional circumstances' (see below).

3.2 Scope of the management procedure

The adopted MP is specific in the fisheries that are subject to control, the method of control (e.g. effort, catch), and the baseline levels defined. Ensuring that this scope remains relevant to achieving the management objectives, noting that specific fisheries may change over time and new ones may evolve, is a relevant role of the monitoring strategy.

3.3 Exceptional circumstances

The monitoring strategy will highlight conditions that may represent 'exceptional circumstances', representing the occurrence of events that are outside the range of scenarios considered when testing an adopted MP. A full definition of exceptional circumstances, the procedures to determine if they exist and the process to follow in the event that they do exist is detailed in Annex IV of CMM2022-01.

The implications of identified exceptional circumstances will need to be evaluated. They may ultimately have little consequence to the design and selection of the MP, and may result in no

change to the existing MP. Changes to other circumstances may require a re-evaluation of candidate MPs to ensure the adopted MP remains the best to achieve the objectives specified.

In specific circumstances, a decision must be made whether changes in the state of the fishery represent moderate impacts that can be resolved by the re-evaluation and potential replacement of an adopted MP with a preferred alternative if that alternative performed better under the new conditions, perhaps over a period of one to two years. Alternatively they may represent exceptional circumstances requiring that the existing MP be abandoned and the immediate implementation of remedial measures.

4 Review the MSE framework

In addition to the performance of the adopted MP and an overarching review of fishery conditions and objectives, the monitoring strategy should consider the technical status of the modelling framework that was used to test and evaluate the candidate MPs and to determine their expected performance. The underlying assumptions and technical details of the modelling framework should be routinely checked to ensure that, to the best of our ability, appropriate estimates of future performance are being obtained. As a technical review, this falls primarily to the SC, although TCC is suggested to have a role through the review of provided data.

4.1 Operating model grid

A key component of the evaluation framework is the grid of operating models (OMs) that describes the biological features of the fish stock and the technical features of the fisheries that exploit it. The range of OMs should account for the major sources of uncertainty associated with these biological and technical aspects.

Ongoing research into the dynamics of fish stocks and fishing fleets in the WCPO can provide information on key sources of uncertainty that should be accounted for. In addition the full stock assessment (see Section 2.1) may also identify gaps in the range of scenarios present in the OM grid. The monitoring strategy should consider any new information and, where necessary, make recommendations for modifying the OM grid to incorporate them.

The OM grid is separated into the reference set, representing model assumptions and fishery scenarios that are considered most plausible, and a robustness set, comprising scenarios that, though still considered plausible, represent more extreme situations. While the latter are of less relevance to the monitoring process, additional areas of uncertainty can be assigned to either of these sets, as appropriate. The monitoring strategy should also consider if the allocation of OMs to either the reference or robustness set remains appropriate.

4.2 Calculation of performance indicators

The performance indicators considered under this section relate specifically to those generated by the MSE framework that are used to measure the expected performance of candidate MPs (the results of which can be compared to real-world outcomes during the monitoring of the performance of an adopted MP, see Section 2). Currently seven performance indicators are calculated from the MSE framework and used to evaluate the expected performance of the adopted skipjack MP (Scott et al., 2022). These performance indicators have been designed and calculated to provide the best possible representation of the expected performance of the MP in relation to the management objectives.

The monitoring strategy should consider whether the modelled performance indicators continue to provide the best estimates of predicted MP performance. It can also make recommendations where modifications to the existing set of performance indicators are necessary, or where additional performance indicators can be developed to capture the wider list of documented management objectives, taking into consideration developments in the MSE framework and the availability of appropriate data. These additional performance indicators may arise with the addition of previously unavailable data or the development of new modelling approaches.

4.3 Modelling assumptions

A further consideration for the OM grid concerns the generation of simulated data. To evaluate the skipjack MP, OMs need to simulate fishery specific catch, effort and length frequency data as well as tag release and recapture data (i.e. the inputs to the estimation method). The statistical procedures under which these data are simulated should be periodically reviewed under the monitoring strategy, for example to confirm that data being generated are comparable to that seen in the real world, and recommendations for the modification of the OMs made where improved methods become available or differences are identified. This might be achieved either through the considerations of the SC or through periodic external review, and is considered further in Section 6 of this report.

4.4 Data availability to support the MSE framework

Where updates or modifications to the evaluation framework are recommended, and in particular with regard to the OM grid, the quantity and quality of data available to develop those models should be considered. The monitoring strategy should not only monitor the continuing availability and quality of existing data (see Section 2.2), but should also check for the availability of any new data that might become available. Examples of such new data might be a new tagging program; the results of new genetic analyses to investigate stock structure, or the increasing quantity of electronic monitoring data.

5 Outline SKJ MP monitoring report

To try to simplify and streamline the monitoring process as much as possible, a summary monitoring report can be compiled consisting of just a summary table that identifies the elements of the monitoring programme that may require additional work or through which major problems have been identified, along with a few short paragraphs to provide further details of the work required to address those issues. The priority of any issues identified can be determined based on the considered severity of the issue and the amount of work required to address it.

This short report is intended to provide an overview of the status of the MP and to allow for information to be collated progressively as elements of the MP are considered by different groups and Commission bodies. An example is shown below.

Summary Table

Table 2 provides a summary of the main issues identified for the WCPO skipjack MP arising from the analyses conducted this year to run the MP.

Table 2: Monitoring report summary for the WCPO SKJ management procedure.

item	MP Element	Status & Comments	Priority
1	**Review MP performance**		
1.1	Comparison with stock assessment	Good - terminal estimates within prediction bounds - historical uncertainty	low
1.2	Data availability & quality	Pole and line CPUE in tropical regions	high
1.3	Other sources of data	No new information	
1.4	EM performance	Acceptable performance - longer term concerns	
2	**Review of the MP**		
2.1	Management objectives	No new information	
2.2	Scope of the MP	No new information	
2.2	Exceptional circumstances	None identified	
3	**Review MSE Framework**		
3.1	Operating model grid	Climate change scenarios	medium
3.2	Calculation of PIs	No new information	
3.3	Modelling assumptions	Pole and line CPUE for tropical regions	high
3.4	Data availability & quality	Generally good	

Further Details

1. Review MP performance

    1.1 Comparison against stock assessment outcomes: A comparison of the MSE predicted outcomes of the adopted MP and the 2022 stock assessment shows good correspondence for the most recent years but shows some departure for the historical period. This is not

considered a major problem affecting the MP but some further investigation of the OM grid may be required. This issue is considered to be a low priority.

1.2 Data availability and quality: Sufficient data were available to run the MP. However, it was noted that pole and line fishing effort in tropical regions continues to decline and this presents a potential problem for the future running of the MP. A re-evaluation of the estimation method is recommended prior to the next implementation of the MP. This issue is considered to be a high priority.

1.3 Other sources of data: No other sources of data have been identified.

1.4 EM performance: Overall the estimation method performed well and provided estimates of stock status within the prediction range of the MSE.

2. Review MP

2.1 Management objectives: No change

2.2 Scope of the MP: No change

2.3 Exceptional circumstances: None identified.

3. Review MSE framework

3.1 Operating Model Grid: OM grid to be extended to include climate change scenarios. In particular the effects of warm pool expansion in WCPO. These analyses require further analysis of the SEAPODYM outputs and may occur over an extended timeframe. This issue is considered to be of medium priority. See also 1.1.

3.2 Calculation of performance indicators: No change

3.3 Modelling assumptions: no issues identified, however, re-evaluaion of the skipjack EM (identified above) may require a re-evaluation of the modelling framework (for example the calculation of simulated data used to test the MP). This issue is considered to be of high priority.

3.4 Data availability and quality: Generally good - some changes may be required depending on the approach adopted to address the decline in pole and line fishing in tropical regions.

6 Operationalising the monitoring strategy

A comprehensive review of all elements of the MP would be a substantial undertaking. In addition, the information necessary to conduct a full review may not be available in each year. The results of a full stock assessment will likely be available every 3 years (Section 2.1). Therefore, to minimise the implications for CCMs we propose a process to progressively gather the relevant information to monitor the performance of the MP through existing work programmes.

Information relating to the summary monitoring report (as outlined in Section 5) can be progressively collated through SC, TCC and any other relevant working groups. The summary report can then be reviewed and updated as necessary at the WCPFC annual meeting.

To implement this procedure some modifications to existing work programmes may be required to ensure that all elements of the monitoring strategy are considered at the appropriate juncture. For example standing agenda items may need to be added to the MI theme of SC and to the relevant stock specific sections of the Commission agenda to consider the availability of new information and to update the monitoring strategy report as necessary. It is likely that data provision aspects of the monitoring strategy can be sufficiently addressed at SC, and therefore no input from TCC would be required in this respect. However, there may still be a role for TCC to report on any compliance issues associated with the MP.

It is anticipated that much of the information feeding into the ongoing monitoring of the MP might be conducted by the WCPFC scientific services provider (SSP) and submitted to SC, TCC or inter-sessional working groups as appropriate. Additional voluntary information may be provided by CCMs, on an ad-hoc basis, that could be collated through the subsidiary bodies of the Commission, allowing information from economic analyses, household surveys, and any other analyses that might inform on the performance of the MP, either at the regional or sub-regional level, to be captured.

A further source of information might be from external peer reviews of work conducted by the SSP. To date a number of such reviews have been conducted and the reports submitted to SC, indcluding:

- external review of the skipjack MSE modelling framework (Scott et al., 2019)
- external review of the south Pacific albacore MSE modelling framework (Mosqueira, 2020)
- mid-term review of the NZ funded MSE project (Chapman, 2021)
- external review of the yellowfin tuna stock assessment (Punt et al., 2023)

The outline skipjack MP monitoring report (Section 5) is also provided in an annex to the SKJ MP report (Scott et al., 2023). We propose that this document may be updated by TCC to include any additional information as necessary, and be forwarded as a stand alone document to the Commission for its consideration of the status of the skipjack MP and any issues that may have been identified.

7 Conclusions

In this report we have outlined some of the key considerations of the monitoring strategy and made recommendations on the time frames over which they might be considered. We have identified key sources of information that can be used to monitor the performance of the MP and identify where data gaps may occur. We propose a process by which the various elements of a summary monitoring report might be progressively collated through existing bodies of the WCPFC.

We invite SC19 to:

- consider the proposed approach for the progressive collation of information to review the performance of the WCPO skipjack MP and advise of any additional considerations that should be taken into account;
- provide advice on the structure and contents of the summary monitoring report document.
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- advise on any additonal information that should be taken into account regarding the monitoring of the WCPO skipjack MP;
- consider the proposed drafting of an MP summary report by SC and TCC for the consideration of the Commisssion and advise accordingly.

Acknowledgments

We gratefully acknowledge funding for this work from the New Zealand Ministry of Foreign Affairs and Trade (MFAT) funded project "Pacific Tuna Management Strategy Evaluation".

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