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Performance indicators and monitoring strategies for south Pacific albacore compatible with candidate management objectives for the Southern Longline Fishery

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Abstract

In accordance with the timetable for the development of a harvest strategy approach for WCPFC stocks and fisheries, SC12 provided advice to the Commission in 2016 on candidate performance indicators and monitoring strategies for the tropical purse seine fishery and the southern longline fishery. During the Commission meeting the proposals for the tropical purse seine fishery were further considered by an informal WCPFC13 small working group to produce a refined list of prioritised indicators for the various biological, economic, social and ecosystem objectives for that fishery. The small working group suggested that the WCPFC Science Services Provider undertake a similar process for the southern longline fishery, for consideration by SC13.

In this document we therefore present a similar prioritisation of the list of management objectives and associated performance indicators for the southern longline fishery. This list has been constructed so as to be as close as possible to that produced for the tropical purse seine fishery. In many cases the management objectives and associated performance indicators and monitoring strategies for the southern longline fishery are the same (or very similar) to those for the tropical purse seine fishery, enabling a very similar approach to be adopted for the two sets of fishery objectives. However a small number of economic and social objectives are unique to the southern longline fishery. We present these cases separately.

We note that some of the prioritised objectives for the tropical purse seine fishery may not be entirely appropriate for the southern longline fishery with specific regard to albacore, and that the conversation on objectives for the fishery has matured subsequent to the Management Objectives Workshop process that developed these original candidate management objectives (WCPFC10-2013-15b). The need for further feedback from managers over time to refine those objectives, and hence the performance indicators, is noted.

No target reference point has yet been agreed for stocks of relevance to the southern longline fishery, in particular south Pacific albacore. The adoption of an interim target reference point for the fishery that helps quantify managers' objectives may balance and trade off many of the different performance indicators shown herein. Challenges in developing performance indicators for specific social and economic objectives for the fishery as outputs of the simulation framework are highlighted. We invite WCPFC-SC13 to:

- Consider the updated list of performance indicators and monitoring strategy for the southern longline fishery consistent with that for the tropical purse seine fishery;
- Provide feedback in particular on the 'additional' objectives listed in Table 2, including relevant proxies for use as performance indicators, as this will influence the modelling framework to be developed;
- Provide advice to WCPFC14 on this range of performance indicators to evaluate the performance of harvest control rules.

Introduction

In accordance with the timetable for the development of a harvest strategy approach for WCPFC stocks and fisheries (WCPFC-13 Summary Report Attachment N), SC12 provided advice to the Commission in 2016 on candidate performance indicators and monitoring strategies for the tropical purse seine fishery and the southern longline fishery (WCPFC-SC12-MI-WP-04; WCPFC13-2016-14). During the WCPFC13 meeting the proposals for the tropical purse seine fishery specifically were further considered by an informal Small Working Group on Management Objectives. This group produced a refined list of prioritised indicators for the various biological, economic, social and ecosystem objectives (WCPFC-13 Summary Report Attachment M, also included as Annex A of this document). This list was accepted as an initial list of performance indicators for tropical purse seine fisheries for the purpose of the evaluation of harvest control rules (WCPFC13 summary report, para 286).

The WCPFC13 small working group suggested that the WCPFC Science Services Provider undertake a similar process for the southern longline fishery, for consideration by SC13. In this document we therefore take the candidate list of management objectives developed by the WCPFC Management Objectives Workshop for the southern longline fishery (WCPFC10-2013-15b) and undertake a similar prioritisation to that produced for the tropical purse seine fishery. We note that the ultimate choice of performance statistics and monitoring strategies will be dependent on the decisions of managers on their objectives for the fishery.

Management Objectives and Performance Indicators

Throughout the discussions held within WCPFC on the development of a harvest strategy approach, management objectives have typically been framed at the fishery level (i.e. tropical purse seine and southern longline fisheries). Performance indicators are the corresponding metrics used to evaluate the performance of a harvest control rule in achieving those management objectives.

Performance indicators for fishery-level objectives (e.g. economic performance) should incorporate not only aspects of the 'key' stock of interest, but also important bycatch species. However, the simulation frameworks currently used to evaluate candidate harvest control rules are typically built around species-specific assessment models and this often restricts the development of performance indicators at a multi-species, or fishery level. Whilst multi-species evaluation frameworks have been developed for testing harvest control rules, they are not yet considered to be sufficiently developed for application in tuna fisheries. At present, therefore, some performance indicators and monitoring strategies have here been translated to the 'key' stock level (i.e. WCPO skipjack and South Pacific albacore). Fishery-level benefits can, however, be captured by relating the level of key stock catches to those of other species (e.g. Pilling et al., 2016).

Revised list of management objectives, performance indicators and monitoring strategies for the Southern Long-line Fishery and South Pacific Albacore

We present here a revised list of potential performance indicators and monitoring strategies for the southern longline fishery (Table 1). The revised list is based upon the prioritisation conducted for the tropical purse seine fishery. The original list is provided in Annex A, with those objectives excluded

from Table 1 'marked as deleted'. This allows the reader to identify those performance indicators that have been excluded.

In many cases the management objectives and associated performance indicators and monitoring strategies for the southern longline fishery are the same (or very similar) to those for the tropical purse seine fishery, enabling a very similar approach to be adopted for the two sets of objectives. However a small number of economic and social objectives have been identified for the southern longline fishery that were not identified for the tropical purse seine fishery (Table 2).

Discussion

We present a prioritised list of objectives, performance indicators and monitoring strategies for the southern longline fishery based on the considerations of the WCPFC13 small working group for the tropical purse-seine fishery. We note, however, that some of the prioritised objectives for the tropical purse seine fishery may not be entirely appropriate for the southern longline fishery with specific regard to albacore (e.g. the economic objective to maximise catch), and that the conversation on objectives for the fishery has matured following the Management Objectives Workshop (MOW) process that led to the 'strawman' document (WCPFC10-2013-15b). An MSY-based target for albacore has been shown to be incompatible both with the biological objective to maintain the stock at levels that have a low probability of falling below the agreed LRP (WCPFC-SC11-2015/ MI-WP-04) and also to be incompatible with economic objectives that are based on catch rates rather than catch volume (WCPFC-SC11-2015/ MI-WP-04, WCPFC-SC12-2016/ MI-WP-01). In turn, achieving MEY for the southern longline fishery would require a significant reduction in effort.

We note that no target reference point has yet been agreed for stocks of relevance to the southern longline fishery, in particular south Pacific albacore. The calculation of performance indicators for stock status relative to the TRP will clearly not be possible until stock specific TRPs have been agreed. We highlight that the adoption of an interim target reference point for the fishery that helps quantify the objectives of managers would balance and trade off many of the different performance indicators shown in Tables 1 and 2.

The social objective to "avoid adverse impacts on subsistence and small scale fishers" was selected by the small working group for inclusion in the refined list for the tropical purse seine fishery along with suggested sources of information for a performance indicator, since no performance indicator had previously been identified for this objective (see Annex A). Performance indicators will typically be generated from the outputs of the simulation framework. In order to produce a performance indicator for the status of small scale fishers it will be necessary either to explicitly incorporate small scale fisheries into the simulation framework or more feasibly to derive an alternative metric to use as a proxy. In the same way, the necessary information to calculate performance indicators for the social objective to "maintain food security in developing states" may not be readily available as outputs from the MSE. In the simplest case, therefore, management can only aim to maintain the stock at levels that can provide for small-scale fisheries.

We note similar challenges for objectives identified in Table 2. For example, while capacity can be measured at an appropriate scale in the simulation framework, to develop an indicator for the economic objective to 'maximise capacity' requires a definition on what managers consider "optimum" capacity to be. Moreover, in the light of more recent discussions, this might no longer be

considered an appropriate objective for albacore. With regards to the performance indicators for the social objectives identified in Table 2, the calculation of domestic catch would require a greater level of detail in the operating model than is currently envisaged. We consider that, in the first instance, a decision is required on whether the objectives identified in Table 2 should be included in the prioritised list. Subsequently, further thought may be required on how appropriate performance indicators for those objectives might be constructed from the information available.

Recommendations

We invite WCPFC-SC13 to:

- Consider the updated list of performance indicators and monitoring strategy for the southern longline fishery consistent with that for the tropical purse seine fishery;
- Provide feedback in particular on the 'additional' objectives listed in Table 2, including relevant proxies for use as performance indicators, as this will influence the modelling framework to be developed;
- Provide advice to WCPFC14 on this range of performance indicators to evaluate the performance of harvest control rules.

Table 1. Revised candidate management objectives for the southern longline fishery and proposed performance indicators and monitoring strategies.

Objective Type	**Objective Description**	**Performance Indicators**	**Monitoring Strategy**
Biological	Maintain albacore (and SWO, YFT & BET) biomass at or above levels that provide stock sustainability throughout their range.	Probability of $SB/SB_{F=0} > 0.2$ as determined from MSE	Probability of $SB/SB_{F=0} > 0.2$ in the long-term as determined from the reference set of operating models (updated and reconditioned periodically, as appropriate).
Economic	Maximise economic yield from the fishery.	Predicted effort relative to E_{MEY} (to take account of multi-species considerations, BET and other spp; may be calculated at the individual fishery level). B_{MEY} and F_{MEY} may also be considered at a single species level.	Observed effort in the fishery relative to E_{MEY}.
	Maximise catch	Average expected catch. (may also be calculated at the assessment region level)	Observed catch information
	Maintain acceptable CPUE.	Average deviation of predicted CPUE from reference period levels.	Observed CPUE data from the longline fishery
	Maximise SIDS revenues from resource rents.	Average value of SIDS/non-SIDS catch	Observed proportion of SIDS-effort/catch to total effort/catch in SIDS waters from log-sheet or VMS data.
	Catch stability.	Average annual variation in catch.	Observed variation in catch as estimated from logsheet and other data
	Effort predictability	Effort variation relative to reference period level (may also be calculated at the assessment region level).	Observed effort levels from log-sheet or VMS data
	Maintain ALB, BET, YFT, SWO stock sizes around the TRP (where adopted)	Probability of and deviation from $SB/SB_{F=0} > X$ in the short-medium- long-term as determined from MSE (may also be calculated at the assessment region level).	Current median adult biomass, as determined from the reference set of operating models.
Social	Food security in developing states (import replacement)	As a proxy: Average proportion of CCMs-catch to total catch for fisheries operating in specific regions.	Ratio of locally marketed fish to imported fish products.
	Avoid adverse impacts on small scale fishers.		Monitoring of fisheries in CCMs
Ecosystem	Minimise catch of non-target species.	Expected catch of other species - as possible.	Ratio of target species catch to catch of non-target species from observer program

Table 2. Candidate management objectives and proposed performance indicators and monitoring strategies that are specific to the southern longline fishery and have not been previously considered during the tropical purse seine discussions.

Objective Type	Objective Description	Performance Indicators	Monitoring Strategy
Biological			
Economic	Optimise capacity		Vessel numbers targeting SPA
Social	Maintain/develop domestic fishery	Ratio of domestic catch to total catch	Monitoring of fisheries in CCMs
	Human resource development	Ratio of domestic catch to total catch	Monitoring of fisheries in CCMs. Employment in the fishing sector. Training of nationals
Ecosystem			

References

Australia (2016) Proposal for adopting interim acceptable levels of risk for breaching limit reference points of four key tuna species in the WCPO WCPFC-SC12-2016/ MI-WP-03

Cartwright, I., Allen, R. and Ianelli, J. (2013) Report of the expert working group: Management objectives, performance indicators and reference points. WCPFC10-2013-15b

Pilling, G.M., Skirtun, M., Reid, C., and Hampton, J. (2016) Biological and economic consequences of alternative trajectories to achieve a candidate south Pacific albacore target reference point. WCPFC-SC12-2016/ MI-WP-01

Pilling, G.M., Reid, C., Harley, S. and Hampton, J. (2015) Compatibility and consequences of alternative potential Target Reference Points for the south Pacific Albacore stock. WCPFC-SC11-2015/ MI-WP-04

Scott, R., Pilling, G.M. and Hampton, J. (2016) Performance statistics and monitoring strategies for skipjack and South Pacific albacore commensurate with: candidate management objectives for the Tropical Purse Seine and Southern Longline Fisheries SC12-2016/ MI-WP-04

Scott, R., Pilling, G.M. and Hampton, J. (2016a) Performance statistics and monitoring strategies for skipjack and South Pacific albacore commensurate with: candidate management objectives for the Tropical Purse Seine and Southern Longline Fisheries WCPFC13-2016-14

Annex A

Results of SWG on Management Objectives

Suggested **initial list** of performance indicators (shaded) for Tropical Purse Seine Fisheries **for the purpose of the evaluation of HCRs only**. SPC is requested to continue the work on HCRs based on the suggested indicators here as much as possible. Short-, medium-, and long-term calculation results would be provided, if possible. **The list is interim and should be reviewed and may be revised when further information is available.**

Objectives included here do not consist a consensus view of the SWG. The SWG developed a list of useful indicators, simply using the MOW/US suggestions as a guide without agreeing/disagreeing them. Each indicator is considered to have different importance to different CCMs, thus should not be considered to have equal weights.

Objective Type	MOW4 Strawman	US proposal (DP22)	SWG suggestion of objective	Performance Indicator (WP14)	Monitoring Strategy (WP14)	SWG Suggestion to include as an indicator
Biological	Maintain SKJ (and YFT & BET) biomass at or above levels that provide fishery sustainability throughout their range.	Maintain SKJ, YFT, BET stock sizes above LRPs.		Probability of $SB/SB_{F=0} > 0.2$ in as determined from MSE.	Probability of $SB/SB_{F=0} > 0.2$ in the long-term as determined from the reference set of operating models	**Yes**
Economic	Maximise economic yield from the fishery			Predicted effort relative to E_{MEY} (to take account of multi-species considerations, SKJ, BET and YFT; may be calculated at the individual fishery level). B_{MEY} and F_{MEY} may also be considered at a single species level.	Observed rent from the fishery relative to MEY. Observed effort in the fishery relative to E_{MEY}.	**Yes**
			Maximize catch	Average expected catch. (may also be calculated at the assessment region level)	Observed catch information	**Yes**
	Increase fisheries-based development			As a proxy: Average proportion of SIDS-catch to total catch for fisheries	Percentage contribution of fisheries to GDP.	

	within developing states (SIDS) economies, especially on-shore processing capacity.			operating in specific regions.	Proportion of total catch processed by SIDS Value of product exported from SIDS.	
	Maintain acceptable CPUE.			Average deviation of predicted SKJ CPUE from reference period levels.	Observed CPUE maintained at or greater than specified levels.	**Yes**
	Optimise fishing effort			E_{MEY} (as for Maximise economic yield). Effort consistent with specified level	Annual monitoring through logbook/VMS	
	Maximise SIDS revenues from resource rents	Take into account the special requirements of developing states and territories		Proxy: average value of SIDSs/non-SIDDs catch ~~Average proportion of SIDS-effort or catch to total effort or catch for fisheries operating in specific regions~~	Observed proportion of SIDS-effort/catch to total effort/catch from SIDS waters from logsheet or VMS data	**Yes**
	Catch stability			Average annual variation in catch ~~in the short-, medium- and long- term~~.	Observed variation in catch from logsheet data	**Yes**
	Stability and continuity of market supply			Average annual variation in catch effort in the short-, medium- and long-term	Observed variation in catch From logsheet data Observed variation in market prices Market throughput of tuna products	
			Effort predictability	Effort variation relative to reference period level (may also be calculated at the assessment region level).		**Yes**
		Maintain SKJ, YFT, BET stock sizes around TRPs (where adopted).		Probability of and deviation from $SB/SB_{F=0} > 0.5$ (SKJ) in the short-medium- long-term as determined from MSE (may also be	Current median adult biomass, as determined from the reference set of Operating Models.	**Yes**

				calculated at the assessment region level).		
Social	Affordable protein for coastal communities			As a proxy: Average proportion of CCMs-catch to total catch for fisheries operating in specific regions.	Average fish consumption per year per person relative to some target.	
	Food security in developing states (import replacement)			As a proxy: Average proportion of CCMs-catch to total catch for fisheries operating in specific regions.	Ratio of locally marketed fish to imported fish products.	**Yes**
	Avoid adverse impacts on small scale fishers	Minimize adverse impacts on other fisheries, including: ○ Downstream fisheries like longline fisheries; ○ Competing fisheries like troll, pole-and-line, and non-tropical purse seine fisheries;		○ MSY of SKJ, BET, YFT ○ Possible information on other competing fisheries targeting SKJ. (may also be calculated at the assessment region level) ○ Any additional information on other fisheries/species as possible.	Monitoring of fisheries in CCMs	**Yes**
	Employment opportunities			As a proxy: Average proportion of CCMs-catch to total catch for fisheries operating in specific regions as determined from stochastic projections.	Monitoring of fishing and processing sector in CCMs	
Ecosystem	Minimise bycatch	Minimize adverse impacts on NADSs		Number of FADs sets Expected catch of other species as possible	Ratio of target species catch to catch of non-target species from observer program	**Yes**
	Minimise ecosystem impact			Size or age structure of population Total bycatch amount	From observer based size sampling and stock assessment outputs	
Other		Adhere to the other				

		principles and provisions of the Convention				