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**Operationalising the monitoring strategies for tropical purse seine and southern longline fisheries:  
Information requirements and data availability**

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**WCPFC-SC13-2017/MI-IP-01**

Robert Scott<sup>1</sup>, Graham Pilling<sup>1</sup>, Chris Reid<sup>2</sup>, Peter Williams<sup>1</sup> and Neville Smith<sup>1</sup>

<sup>1</sup> Oceanic Fisheries Programme, The Pacific Community (SPC)

<sup>2</sup> Forum Fisheries Agency (FFA)

## Abstract

Annex 1 of Conservation and Management Measure 2014-06 outlines the elements of a harvest strategy. These elements include a monitoring strategy, for each fishery or stock. The purpose of the monitoring strategy is to enable, for example, the Scientific Committee and other relevant regional bodies to track the performance of the selected harvest strategy (or management procedure), once it has been implemented, to see if it is performing as expected and that the actual outcomes are within the range of values predicted by the MSE (management strategy evaluation) and are consistent with achieving agreed management objectives.

Although management objectives have not been finalised for WCPFC fisheries, there is merit in considering whether current data collection processes are sufficient to support a harvest strategy approach. If gaps are identified, one can evaluate how those gaps may be filled, and the costs of doing so. In this paper, therefore, we perform a high level evaluation of current WCPO data collection processes to assess the availability of data to support the monitoring strategy against each of the candidate management objectives for the tropical purse seine fishery and the southern longline fishery, and their corresponding performance indicators.

No major data deficiencies are identified for monitoring strategies associated with biological objectives. With regards to the economic objectives, several monitoring strategies can be summarised as 'data partially available', depending on the method and the scale at which they are to be calculated. Key potential gaps include the availability of relevant fishing cost information, which is generally commercially sensitive. For many of the social and ecosystem objectives, however, we identify more serious data deficiencies that will require either the collection of additional data in the future or reformulation of the monitoring strategy.

Processes are in place to manage WCPO fishery information, and to a lesser extent ecosystem information. However, within the WCPO there is no clearly defined system for regularly gathering and managing the information for economic and social management objectives. The mechanisms for collecting and curating these data in a confidential manner will need to be considered where relevant management objectives are considered important.

We consider the availability and the quality of data for implementing the monitoring strategy to be an important consideration in the development and implementation of harvest strategies. However, at this stage, we suggest that detailed consideration of these issues be delayed until management objectives are more concretely defined. From this initial investigation, however, it is clear that the monitoring strategies for several social and ecosystem objectives will require further consideration.

We invite WCPFC-SC13 to:

- Consider what additional metrics might be calculated from existing data holdings to support monitoring strategies.
- Consider what additional data might be collected, from which meaningful statistics can be calculated, to implement monitoring strategies in particular for social, economic and ecosystem objectives.
- Consider what measures and procedures will need to be put in place to ensure that data are collected and curated in accordance with acceptable data quality standards and that confidentiality, where relevant, is maintained.

## Introduction

Annex 1 of Conservation and Management Measure 2014-06 outlines the elements of a harvest strategy. These elements include a monitoring strategy, for each fishery or stock. The purpose of the monitoring strategy is to enable, for example, the Scientific Committee and other relevant regional bodies to track the performance of the selected harvest strategy (or management procedure) once it has been implemented, to see if it is performing as expected and that the actual outcomes are within the range of values predicted by the MSE (management strategy evaluation) and are consistent with achieving agreed management objectives.

Performance indicators and monitoring strategies for both single- and multi-species MSEs have typically focussed on three dimensions of performance: i) catches; ii) biomass of the target species and iii) catch variability (Punt, 2017), although fishing effort and revenue might also be included in this list. These indicators of performance are principally concerned with biological and economic objectives for the fishery. In the case of WCPFC fisheries, however, additional candidate management objectives have been identified (Cartwright et al., 2013) that will require additional metrics to be developed to monitor, in particular, social and ecosystem aspects of the fishery.

Although management objectives have not been finalised for WCPFC fisheries, there is merit in considering whether current data collection processes are sufficient to support a harvest strategy approach. If gaps are identified, one can evaluate how those gaps may be filled, and the costs of doing so. In this paper, therefore, we perform a high level evaluation of current WCPO data collection processes to assess the availability of data to support the monitoring strategy against each of the candidate management objectives for the tropical purse seine fishery and the southern longline fishery, and their corresponding performance indicators.

## Gap Analysis

Potential monitoring strategies consistent with the revised candidate management objectives for the southern longline fishery and tropical purse seine fishery are shown in Table 1 (see also WCPFC-SC13-2017/MI-WP-02 and 03 for more information). There is considerable overlap between the management objectives between these two fisheries, and while not yet formally considered by the Commission, performance indicators and hence monitoring strategies for the southern longline fishery have been developed consistent with the approach used by the WCPFC13 SWG on management objectives for the tropical purse seine fishery (see WCPFC-SC13-2017/MI-WP-02). As a result, we have combined the objectives and performance indicators where possible, to simplify the process here. We also consider a small number of monitoring strategies for management objectives that are currently unique to the southern longline fishery (Table 2).

We consider each management objective and its corresponding monitoring strategy to try to determine whether existing data sources are likely to be sufficient to calculate the necessary statistics and identify where gaps in current regional and sub-regional data collection programmes exist that might prevent implementation of particular elements of the monitoring strategy.

### *Biological and economic management objectives – stock reference points*

Calculation of monitoring strategy metrics associated with objectives to maintain biomass at or above levels that provide stock sustainability (i.e. above the limit reference point) or at levels around the target reference point will require estimates of stock status to be determined from the reference set

of operating models (e.g. stock status estimates from the relevant range of MULTIFAN-CL assessment models). This process is therefore similar to the current practice for conducting stock assessments across the uncertainty grid of alternative assessment assumptions. Whilst current data holdings are not considered to be perfect and areas for improvements in data quality and coverage can be identified, no major data deficiencies have been identified for these monitoring strategies. It is, however, unlikely that assessments will be performed on an annual basis; as currently, these metrics may therefore be calculated once every two or three years.

### *Other economic management objectives*

Many of the metrics identified for economic objectives are based on catch, effort or catch per unit effort (CPUE) either in terms of their absolute levels or their variation over time. At the regional scale, metrics can be calculated at the individual fleet level or for specific assessment regions and may be derived from either logsheet records or VMS data. We consider catch and effort to be comprehensively recorded in the majority of cases. However, at the national level some issues with catch estimation remain, although we note the efforts of, for example, WCPFC-administered WPEA (Western Pacific East Asia) projects to improve data provision. In turn, when considering metrics for objectives related to fishing capacity and CPUE for which standardised estimates may be desired, data should also allow the identification and evaluation of targeting activities (e.g. for south Pacific albacore), the options for which may be limited in aggregate data. We note, however, the increased provision of operational data in recent years should reduce this issue for the future.

Other metrics are based on maximum economic yield (MEY), or as identified during the development of the harvest strategy approach, desirable but less optimal fleet profitability levels. The economics of a fishery can be calculated in a number of different ways. Perhaps the simplest approach for converting catch to monetary value is to multiply the overall catches by the average market price for each of the target species caught in the fishery, but other more sophisticated approaches can be employed where data are available, for example information on the size and grade of the fish caught and their respective prices. Whilst total catch and catch rate of the target species are a major influence on economic conditions, other factors can play a significant role. For example Pilling et al. (2016) calculated MEY for the southern longline fishery based on calculations which included estimates of the cost of fishing, long-term fish prices and assumptions of the catch rates for other species that contribute to vessel revenue.

An alternative approach was taken by Reid and Raubani (2015) who developed an index of economic conditions for the southern longline fishery based on indices of prices, catch rates and fishing costs. Their index was independent of the abundance of the target stock and was calculated so as to provide a relative index that could identify temporal trends in economic conditions rather than an absolute measure.

On this basis, a time series of price information is generally readily available from key markets. This may be suitable for evaluations at the regional level, but at a finer scale where the market used by a particular fleet may vary it may be more challenging to evaluate, given that information on the price actually received by the operator may be required. In addition, market data are often highly aggregated and for some analyses data reflecting price differences associated with product certification or handling may be required, for example, prices for MSC certified/uncertified catch.

Cost information at the level of the fleet, and in particular a time series of costs, is also difficult to obtain. Cost information may be available for specific fleets, but the commercial sensitivities in these data make them hard to collect and they are generally provided on a confidential basis. Costs may be assumed based on key cost factors such as the global or local price of fuel, as in Reid and Raubani (2015) but at the finer scale, the price actually incurred by a fleet may vary significantly from a generic baseline.

An approach may be to identify an 'indicator fishery' or fisheries for which data collection can be regularly undertaken, that can be used to provide a benchmark for that economic objective. This indicator could be either an 'average' fishery, or a 'marginal' fishery, dependent upon the objective in question; for example, this might be relevant if the objective of maximising profitability is adjusted in the future to reflect maintaining some minimum level of fishery-wide profitability. It is also important to note that currently there is no Commission process for the collection of economic data and that data collection to date has been done by individual CCMs or regional organisations. It is also worth noting that SC13 has been tasked with considering guidelines for the voluntary submission of economic data to the Commission by CCMs (WCPFC-2017-SC13/ST-WP-09, SC12 report, recommendation 22c).

The calculation of MEY and profitability options can therefore be summarised as 'data partially available', depending on the method and the scale at which they are to be calculated.

### *Social objectives*

Two social objectives are common to the purse seine and southern longline fisheries: avoiding adverse impacts on small scale fishers and supporting food security in developing states (import replacement).

Identifying small-scale fishers within countries, and monitoring the impacts of industrial fisheries upon them is potentially complicated. In the first instance, the development of a clear working definition for small scale fishers will be required. For example, this could be defined by vessel type or size, or vessels that leave and return to port on the same day. Small-scale fishers may sell their catch to local markets and perhaps even export markets (e.g. small-scale handline fishers in Indonesia and Philippines selling yellowfin), while subsistence fishers may keep the majority of the catch for their family consumption. These categories are not presently separated in the primary WCPO data collection and the lack of separation will complicate the calculation of an informative set of statistics.

Alternative data sources may be required to monitor these social objectives. These include artisanal fisheries monitoring, market surveys, creel surveys, household surveys, national censuses, national trade balances and employment statistics. A number of proxy indicators that could provide useful information have been used in the new coastal fisheries report card (SPC, 2016). Regional studies, such as the 'Benefish' study (Gillett, 2017) can also provide statistics on social objectives across a range of PICT countries. It is noted that the Benefish study provided specific definitions of fisher-types that could be used to help define the relevant monitoring strategy. However, like national censuses, these regional studies are frequently either one-off or dependent on funding, and hence are unlikely to provide year-on-year monitoring of particular objectives. In this respect, an advantage of the artisanal fisheries monitoring programme is that it is ongoing and readily scalable to most of the PICTs in the region. In turn, the finer scale data collection implied by, for example, calculation of the ratio of locally marketed fish to imported fish products to monitor food security may be challenging.

Similar to the suggestions made in the economics section, the identification of an individual or set of indicator countries or case studies that could be used to reasonably monitor the objective in question could be considered. If considered valuable, funding will need to be made available to collect the necessary data and to assess the appropriateness of cheaper proxy data collection.

Finally, we note that a consistent definition of an 'adverse impact' on small scale fishers, that incorporates the ability to identify the cause and effect of any changes, will need to be developed. Although there has been some research in this area (e.g. Leroy et al., 2016), it will be increasingly important to understand the nature and scale of changes in this area if social objectives are to be monitored effectively.

For social objectives, options can therefore be summarised as 'data partially available' or 'data absent', depending on the method and the scale at which they are to be calculated. These social objectives appear to be a key potential gap within the monitoring strategy that will need to be considered in more detail.

### *Ecosystem objectives*

The candidate ecosystem objectives focus on minimising the catch of non-target species, and for skipjack specifically they also refer to minimising the adverse impacts of FADs.

Recording of the catch of key non-target species occurs through logsheet submissions and data collection through the relevant WCPO observer programmes. Observer coverage can vary substantially between fisheries in the WCPO. While information for the tropical purse seine fishery may be good, data for specific high seas fleets in the southern longline fishery are more limited, and the limitations in observer coverage within the longline fishery in general may limit the precision of the available information.

We note that recent developments in e-monitoring and e-reporting may lead to substantial improvements in both the quantity and quality of data collected for key non-target species. We further note that efforts in other fisheries fora to develop ecosystem indicators have investigated the use of metrics such as average fish size (across all species) in the catch (Jennings and Dulvy, 2005), and the identification of either individual species or so-called sentinel fisheries that can be used to provide an indication of overall ecosystem status.

For ecosystem objectives, options can therefore be summarised as 'data partially available' or 'data absent', depending on the method and the scale at which they are to be calculated.

### **Discussion**

In this information paper, we have undertaken a high-level evaluation of data sources available relative to the existing management objectives, their performance indicators and corresponding monitoring strategies for the tropical purse seine fishery and the southern longline fishery. We have repeatedly noted that there are issues of scale to be considered. While, for example, estimates of catch at the regional scale may be considered reasonably robust and sufficient to support a given monitoring strategy, at the level of country, fleet, fleet component, or fisher type (e.g. artisanal vs industrial), there would be a need to examine the ability of the data sources to achieve this level of granularity. In turn, the use of indicator fisheries or countries may be considered so that cost effective data collection can be undertaken to inform the monitoring strategy.

Processes are in place to manage WCPO fishery information, and to a lesser extent some ecosystem and social information, through SPC as the data services provider to the WCPFC and supporter of SPC members in this area. However, there is no clearly defined system for regularly gathering and managing the information for economic and social management objectives. FFA will hold some information on economic issues (e.g. the price of species in key markets, some overall fuel costs, etc.) and individual industry members will hold their own detailed economic figures, but no central data repository exists and no universal set of data standards is in place. When using these data, the mechanisms for collecting and curating them in a confidential manner as necessary will need to be considered where relevant management objectives remain important.

We consider the availability and the quality of data for implementing the monitoring strategy to be an important consideration in the development and implementation of harvest strategies. However, at this stage, we suggest that detailed consideration of these issues be delayed until management objectives are more concretely defined. From this initial investigation, however, it is clear that the monitoring strategies for several economic, social and ecosystem objectives will require further consideration.

## Recommendations

We invite WCPFC-SC13 to:

- Consider what additional metrics might be calculated from existing data holdings to support monitoring strategies.
- Consider what additional data might be collected, from which meaningful statistics can be calculated, to implement monitoring strategies in particular for social, economic and ecosystem objectives.
- Consider what measures and procedures will need to be put in place to ensure that data are collected and curated in accordance with acceptable data quality standards and that confidentiality, where relevant, is maintained.

Table 1. Summary of available data sources to support monitoring strategies for the combined candidate tropical purse seine and southern longline fishery management objectives and proposed performance indicators. (Where data are identified as ‘available’ we note that this is dependent on the method and the scale at which the various metrics are to be calculated).

Objective Type	Objective Description	Performance Indicators	Monitoring Strategy	Potential data sources	Summary
Biological	Maintain skipjack/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.	MULTIFAN-CL stock assessments, supported by regional data collection programmes. Note assessments for a stock are not performed annually.	Data available, but with key deficiencies where greater granularity required.
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 $E_{MEY}$ .	Price information from major markets, and time series available. Generic cost information available, and some more detailed information available for specific fleets. However, time series of cost information not available and data often confidential.	Data partially available.
	Maximise catch.	Average expected catch. (may also be calculated at the assessment region level).	Observed catch information.	Available through regional data collection programmes (logsheets, observers, etc) and WCPFC processes.	Data available.
	Maintain acceptable CPUE.	Average deviation of predicted CPUE from reference period levels.	Observed CPUE maintained at or greater than specified levels.	Available from regional data collection programmes (logsheets, observers, etc) and WCPFC processes. Targeting issues within aggregate data provided limits ability to standardise CPUE series if required.	Data available.



	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.	Available through regional data collection programmes (logsheets, observers, etc.) and WCPFC processes. National and sub-regional information sources, but some information may be confidential. Some issues for objective 'maximise economic yield from the fishery' also apply here.	Data partially available.
	Catch stability.	Average annual variation in catch.	Observed variation in catch from logsheet data.	Available from regional data collection programmes (logsheets, observers, etc).	Data available.
	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	Available from regional data collection programmes and VMS. Note that targeted effort of the longline fishery may be more challenging.	Data partially available.
	Maintain SKJ, 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.	MULTIFAN-CL stock assessments, supported by regional data collection programmes. Note assessments for a stock are not performed annually.	Data available, but with key deficiencies where greater granularity required.
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.	National data collection, government figures and censuses, as well as irregular regional studies. No current system to collate this information across the region.	Data partially available/data absent.
	Avoid adverse impacts on small scale fishers.		Monitoring of fisheries in CCMs.	National data collection and censuses, as well as irregular studies. No current system to collate this information across the region.	Data partially available/data absent.

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.	Key bycatch noted in logsheets, wider information available through observers. Coverage limited on the longline fleet.	Data partially available.
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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	Potential data sources	Summary
Biological	-	-	-		
Economic	Optimise capacity.		Vessel numbers targeting SPA.	Aggregate data provided for the southern longline fishery on the high seas does not allow targeting to be defined. CCM-defined vessel numbers actively fishing for south Pacific albacore were developed under CMM 2015-02. We note that the increased provision of operational data by fleets to the WCPFC may allow targeting to be evaluated in future years.	Data partially available.
Social	Maintain/develop domestic fishery.	Ratio of domestic catch to total catch.	Monitoring of fisheries in CCMs.	Available from regional data collection programmes (logsheets, observers, etc.)	Data available.
	Human resource development.	Ratio of domestic catch to total catch.	Monitoring of fisheries in CCMs.	Available from regional data collection programmes (logsheets, observers, etc.)	Data available.
Ecosystem	-	-	-		

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