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**Review of Project 60 outputs and work plan**

**WCPFC-SC12-2016/ST WP-02**

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**1. INTRODUCTION**

*Project 60: Collection and evaluation of purse seine species composition data: paired sampling and unloading data comparisons*

**1.1 Project Objective**

The objective of the project is to improve the collection and representative nature of species composition data for tuna (skipjack, yellowfin and bigeye) caught by purse-seine fisheries in the WCPO in order to improve the stock assessments of these key target species in the WCPO.

**1.2 Project History**

Project 60 and work on the collection and evaluation of purse seine species composition data through paired sampling and unloading data comparisons began in April 2009. The initial duration of the project was from April 2009 to the end of January 2010. The project was extended in April 2010 through January 2011, and then from February 2011 to 31 January 2012.

Following discussion of the “Plan for the improvement of the availability and use of purse-seine composition data” (SPC-OFP 2012), the Scientific Committee made the following recommendation (Anon., 2012a) at para

89, section d: *Project 60 be continued through 2013. The study has a target of 50 trips to be sampled, of which*

*35 trips will be completed by the end of 2012.* The Commission (Anon., 2012b) supported the SC8 recommendation and approved the project with funding to cover the cost of the remaining 15 trips for further analysis. In 2014 further research for project 60 was supported under the SC9 unobligated budget, with additional funding from PNG.

SC11 noted that future work should include finalisation of analyses of existing data, the collection of further paired sampling data where these results can be compared to accurate estimates of landed weights by species and simulation modelling to assess alternative sampling protocols (Anon., 2015a). The Scientific Committee made the following recommendation (Anon., 2015a) at para 107:

*a. The WCPFC science/data service provider produce an update to Table 1 in ST-WP-02 annually (until an agreement on methodology can be reached) as it provides a very useful summary of the purse-seine catch estimates derived using the four different methods to ascertain catch composition.*

*b. In regards to the implementation of observer spill sampling in the tropical purse seine fishery,*

*i. The WCPFC Secretariat and the WCPFC scientific services provider investigate operational aspects including alternatives for spill sampling on purse seine vessels where the current spill sampling protocol is difficult to implement and report back to SC12.*

*ii. The WCPFC scientific services provider will undertake additional data collection and analyses to evaluate the benefits of spill sampling compared to corrected grab-sampling.*

To implement the 2015 Scientific Committee recommendations, and after approval from the Commission (Anon., 2015b), the WCPFC Secretariat has contracted the Scientific Services Provider to continue project 60 as described in section 1.3.

**1.3 Project 60 Scope in 2016-17**

The scope of work over 01 July through 31 December 2017 will include, but not be limited to, the following:

a. Continue to identify key sources of sampling bias in the manner in which species composition data are currently collected from WCPO purse seine fisheries and investigate how such biases can be reduced;

b. Review a broad range of sampling schemes at sea as well as onshore; develop appropriate sampling designs to obtain unbiased species composition data by evaluating the selected sampling procedures; extend sampling to include fleets, areas and set types where no representative sampling has taken place; verify, where possible, the results of the paired sampling against cannery, unloading and port sampling data;

c. Review current stock assessment input data in relation to purse-seine species composition and investigate any other areas to be improved in species composition data, including the improvements of the accuracy of collected data;

d. Update standard spill sampling methodology if required; and

e. Analyse additional data collected to evaluate the benefits of spill sampling compared to corrected grab-sampling.

Within this scope, the work plan below identifies the tasks to be completed in 2016-17 to further project 60.

**1.4 Addressing SC11 recommendations**

The SC recommendations from 2015 are identified in section 1.2 above. This paper sets out the approach to addressing recommendation b. over the period July 2016-December 2017. Recommendation a. has been addressed for 2016 in Hampton and Williams (2016) which provides annual estimates of purse seine catches by species based on alternative data sources using the same four methods used by Hampton and Williams (2015) last year (1 - Uncorrected logsheets, 2 - Yellowfin and bigeye tuna adjusted, 3 - Full species adjustment using observer sampling data corrected for grab selection bias, and 4 - Full species adjustment using uncorrected observer data). It is intended that this update will occur annually in this manner until an agreement on a revised methodology can be reached.

**2. PREVIOUS OUTPUTS AND FUTURE WORK PLAN**

This work is focused on improving the representative nature of species composition data for tuna (skipjack, yellowfin and bigeye) caught by purse-seine fisheries in the WCPO. It also has the secondary benefits of providing accurate data to support in the identification of strategies to reduce the bycatch of bigeye and/or yellowfin in purse seine fisheries if desired, and, improving utilization of the fisheries observer resource in the region. The work plan in Table 1 is intended for the period 01 July 2016 through 31 December 2017. The work is divided into three components, all intended to collectively deliver on the scope of the project. Note that SPC will provide a report of progress to SC13 in July 2017 and a final report to WCPFC in December 2017.

**2.1 Investigating key sources of sampling bias**

Historically, observer data-derived purse seine species catch compositions (hereafter, catch compositions) were estimated using grab sampling, a sampling protocol where 5 fish are selected at random by observers from each brail and sampled. In more recent years, where possible catch compositions have been estimated using the spill sampling protocol, where bins are filled with fish from a selected brail and observers sample all fish contained in the bin (Lawson, 2008; Anon 2015a). Sampling bias in catch composition estimates have previously been estimated using paired grab sampling and spill sampling experiments, where catch compositions of a given fishing vessel trip are calculated using both grab and spill sampling and compared (e.g. Lawson, 2014, and references therein). Previous analyses indicated that grab sampling under-estimated skipjack and overestimated yellowfin catch proportions, due to length-dependent selectivity bias (Lawson,

2012). Port sampling can be used as an additional basis of comparison with paired grab sampling and spill sampling, which removes the need to assume that spill sampling-derived catch composition estimates have zero error. It is important to note that simulations suggest that correction of grab sample-derived catch compositions for selection bias can result in (corrected grab-sample) catch composition estimates with relatively low bias (Lawson , 2013).

This project will utilize a similar overall approach to that used in previous analyses (e.g. Lawson, 2014; Lawson 2012), where: bias in grab sample and corrected grab sample-derived catch compositions are estimated by comparison with spill sample-derived catch compositions; and where possible, bias in grab sample, corrected grab sample and spill sample derived catch compositions are estimated by comparison with landings samples at port or canneries. It should be noted that these analyses will include data from paired grab/spill sampling experiments and port sampling in PNG from 2014 that have not been analysed to date due to delays in data availability. Furthermore, additional paired grab/spill sampling experiments will be undertaken through the project to extend sampling to include fleets, areas and set types where no representative sampling has taken place to date so as to expand the dataset available for investigation of sampling biases in catch compositions. Simulation modelling can then be used to compare precision and bias in catch compositions based on grab sampling, grab sampling corrected for selection bias and spill sampling. Two questions that this work should address are whether spill sampling is the method of choice for observer-based catch sampling, and whether corrected grab samples are a reasonable proxy for spill samples. The new at-sea work under this project will also collect information on the extent to which pre-sorting of catch prior to sampling may potentially bias observer sampling (e.g. removal of large individual yellowfin for separate processing).

An additional data source to be explored as part of this work will be detailed unloading data available in some ports from some CMMs. This investigation will also utilize data and findings from the recent cannery study (Lewis and Williams 2016), and any new data collection arising from that work, to the extent relevant.

**2.2 Exploring other sampling approaches**

Ongoing paired sampling is unlikely to be cost-effective. Further, in some fisheries spill sampling is not practical for a range of reasons including vessel size (Anon., 2015a). Other approaches are required to improve purse seine catch composition data in the medium-term. In particular, methods which can improve the proportion of the catch sampled at-sea, currently ~0.04% (Hampton and Williams, 2015). The project will review a broad range of sampling schemes at-sea as well as onshore (in-port, and at the cannery) to determine which approaches are feasible and how they might be implemented in the WCPO. As part of this work electronic monitoring (EM) technology will be considered. If possible this will include preliminary at sea trials of EM technology for this purpose on a purse seine vessel in the WCPO. If practical this will be one of the vessels and trips sampled with paired observers and monitored in-port unloading.

**2.3 Developing a medium term approach to monitoring catch composition**

Based off the investigation of key sources of sampling bias and exploration of other sampling approaches, a medium-term approach to practical sampling for least biased species composition data will be identified. This will include providing an updated standard sampling methodology for observers, and identification of data collection from key sources (at-sea and onshore) over the next five years. For example, catch compositions could be based on corrected grab samples, with periodic paired grab/spill sample experiments to track any changes in bias in uncorrected grab samples.

**3. COMMENTS**

This work plan is indicative and subject to change as practical issues are addressed. One of the key constraints is the volume of data able to be collected within the project budget (noting especially that the second observer placed on a purse seine vessel is paid for from the project budget).

One of the challenges with the proposed methods is that there is no absolute against which to compare sample data, especially on a set basis (precise unloadings data should allow a comparison at the trip level). To achieve an absolute there is the potential methodology of keeping the catch resulting from different sets separate from catch event to the factory, with complete catch analysis in the factory as tested in the EPO (Restrepo, ISSF, pers. Comm.). There are additional costs associated with this method, but with additional funding partners and industry co-operation it would be feasible (noting that we understand that this has already been implemented in some fisheries). If this approach were pursued, it would be necessary to conduct the work on vessels on which spill/grab sampling trials are also conducted.

**Table 1: Work plan for project 60 for the period July 2016 to December 2017.**

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| **Component** | **2016-17 Tasks** | **Timing** | **Notes** |
| **1. Investigating purse seine tuna catch composition and biases resulting from raising data from observer sampling information Review of available information** | Review information available from previous paired spill/grab sampling experiments and port sampling and cannery data | Aug 2016- Sep 2016 | Identify datasets available for the project, including spatial and temporal extent, and the analyses that can be undertaken. Note this will include the 2014 data collected in Papua New Guinea. |
| Undertake additional observerspill/grab sampling paired sampling | Aug 2016-June 2017 | To test for temporal and spatial variation in estimates of catch by species for the same trips. Requires additional at-seasampling where dual observers are present on a trip. These trips will also obtain pictures, video and specific details to inform components 2 and 3. |
| Undertake additional unloadingsamples paired with observer trips | Aug 2016-June 2017 | Extend the comparisons of grab- and spill-sampling-based species composition with accurate unloadings and/or cannerydata to explore absolute bias in catch compositions, as well as relative bias, derived from grab samples, corrected grabsamples and spill samples. |
| Investigative data analysis of historic and new data | Mar 2017- Dec 2017 | To identify key sources of sampling bias in the manner in which species composition data are currently collected from WCPO purse seine fisheries and investigate how such biases can be reduced. Undertake additional simulation modelling to estimate precision and bias of using corrected grab sampling data as the basis for estimating purse seine species composition at various levels of resolution. |
| **2. Exploring****other sampling approaches for obtaining least biased purse seine tuna catch composition data** | Review available sources of unloadingsdata | Aug 2016-Mar 2017 | Work with CMMs who collect detailed unloading data to compile additional datasets (Japan, USA)Investigate options for incorporating such sampling into the medium term monitoring programme |
| Review available electronic monitoringapproaches for determining catchcomposition in purse seine fisheries | Aug 2016-Nov 2016 | Electronic monitoring can potential provide a range of data to inform catch composition, potentially including: individualbraille weights, individual fish counts, fish counts by species, length frequency data, and distribution of fish to wells. Thetechnology is best suited to vessels with on deck conveyor belts. It also has potential for in-port unloadings. |
| Test EM for catch composition in theWCPO | Aug 2016-Nov 2017 | Note that this work is likely to be small scale and pilot given the scale of this project. Work is already underway in theIndian Ocean and this work will learn from that to the greatest extent possible. |
| **3. Developing****a medium****term approach to monitoring purse seine tuna catch composition** | Provide recommendations on amethodology to ascertain catchcomposition | Jun 2017-Nov 2017 | Once available, to be proposed to SC to replace the current approach reported in Hampton and Williams (2016). |
| Standard observer sampling protocols, EM data standards | Apr 2017- Nov 2017 | To improve the quality of observer training in purse seine fishery scientific sampling. |
| Ongoing at-sea , in-port and cannerysampling programme | Apr 2017-Nov 2017 | Irrespective of the outcomes of this project, it will be necessary to continue to refine estimates of selectivity bias and tosupport additional simulation modelling in future. This will require ongoing data collection. This work will develop a futuresampling plan to ensure relevant data are available for that work. If accurate data can be obtained from canneries, it would be an invaluable additional source of information for the estimation of species composition of the purse seine catch (Lewis and Williams, 2016). |
| Developing systems to support ongoingmonitoring | Apr 2017-Nov 2017 | Over the coming year, SPC plans to re-write the software for purse seine species composition estimation, to make it moreefficient and consistent with new database structures now in use within the SPC-OFP. This will also include flexibility toadopt the new/revised methods outlined by this project. |

**4. ACKNOWLEDGEMENTS**

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