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**Report for the WCPFC Consultancy on the Collection and Evaluation of Purse-Seine
Species Composition Data, August 2013 - January 2014**

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Timothy Lawson¹

¹ Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia

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Oceanic Fisheries Programme
Secretariat of the Pacific Community
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Introduction

A consultancy agreement was established between the Western and Central Pacific Fisheries Commission and the Secretariat of the Pacific Community in April 2009 for a project on the collection and evaluation of purse-seine species composition data. The objective of the project is to improve the collection and representative nature of species composition data caught by purse-seine fisheries in the WCPO in order to improve the stock assessments of key target species in the WCPO. The initial duration of the project was from 1 April 2009 to 31 January 2010. The project was extended to the period from 1 April 2010 to 31 January 2011, then to the period from 1 February 2011 to 31 January 2012, then to the period from 1 February 2012 to 31 January 2013, and finally to the period from 1 February 2013 to 31 January 2014. This report is intended to satisfy the requirement under the Terms of Reference that a final report for the current period shall be submitted to the Commission by 31 January 2014.

Scope

The scope of work under the project includes 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;
- e. In preparing project report, be cognisant of the SC8 Summary Report discussion sections (Paras 79-88), and the Recommendations (Para 89):
 - a compromise between the size of the spill sample and the necessary volume of data be determined;
 - the practicality of an observer taking spill samples from every tenth brail as well as all other observer duties be considered;

- the level of improvement in the accuracy of logsheet reporting of purse-seine species composition by fleet be indicated in future papers relating to the availability of purse-seine catch composition data.

The following activities have been undertaken:

Scope (a)

- During the April 2009 – January 2010 period, a study entitled “[Selectivity bias in grab samples and other factors affecting the analysis of species composition data collected by observers on purse seiners in the Western and Central Pacific Ocean](#)” was completed. Size selectivity bias in grab samples taken by observers was estimated using data collected from paired grab and spill samples during four trips on purse seiners fishing anchored FADs in Papua New Guinea during 2008.

During the April 2010 – January 2011 period, the study was extended with data from a total of 17 purse-seine trips during which paired grab and spill sampling took place. The study was presented at the Sixth Regular Session of the WCPFC Scientific Committee, 10–19 August 2010, Nuku’alofa, Tonga, in a working paper entitled “[Update on the estimation of selectivity bias based on paired spill and grab samples collected by observers on purse seiners in the Western and Central Pacific Ocean.](#)”

During the February 2011 – January 2012 period, historical grab samples corrected for selectivity bias were used to generate purse-seine length frequencies. The study was presented at the Seventh Regular Session of the WCPFC Scientific Committee, 9–17 August 2011, Pohnpei, Federated States of Micronesia, in an information paper entitled “[Purse-Seine Length Frequencies Corrected for Selectivity Bias in Grab Samples Collected by Observers.](#)”

During the February 2012 – January 2013 period, additional analyses on sampling bias were undertaken, including (i) the effect of layering by size during brailing on the selectivity bias; (ii) development of a high-resolution model of geographic area to estimate the species composition of purse-seine catches from grab samples corrected for selectivity bias and spill samples; and (iii) use of the catches determined from the model-based estimates of the species composition to scale purse-seine length frequencies. The results of these analyses were presented at the Eighth Regular Session of the WCPFC Scientific Committee, 7–15 August 2012, Busan, Korea, in a working paper entitled “[Estimation of the species composition of the catch by purse seiners in the Western and Central Pacific Ocean using grab samples and spill samples collected by observers.](#)”

During the February 2013 – January 2014 period, further analyses on sampling bias were undertaken:

- (i) the estimation of selectivity bias using splines was developed and applied to paired grab and spill sampling data covering 41 trips;
- (ii) the proportion of skipjack reported on logsheets was incorporated into the high-resolution model to estimate the species composition of purse-seine catches from grab samples corrected for selectivity bias, and was found to improve the estimates, particularly in years for which observer data are unavailable (1967–1992) and years for which coverage is very low (1993–2001);
- (iii) historical grab samples were corrected with new estimates of the selectivity bias;

- (iv) a simulation model of the brailing and sampling processes was developed to compare methods of estimating the selectivity bias from the paired samples, with the method of *availability* being shown to be the most accurate of those examined; and
- (v) the pooling of observer data to estimate the species composition was examined and found to be a reasonable alternative to the model-based estimates for strata of year-quarter, 5° longitude by 5° latitude and school association, for which observer coverage is at least 20%.

The results of these analyses were presented at the Ninth Regular Session of the WCPFC Scientific Committee, 6–14 August 2013, Pohnpei, Federated States of Micronesia, in Working Paper SC9–ST–WP–03, entitled “[Update on the estimation of the species composition of the catch by purse seiners in the Western and Central Pacific Ocean, with responses to recent independent reviews](#)”.

Scope (b)

- Table 1 shows the target number of paired sampling trips determined at the Fifth Regular Session of the WCPFC Scientific Committee for each flag state or group of states, and the numbers of successful and unsuccessful trips completed as of January 2014. In Table 1, ‘Unsuccessful’ trips include those during which the spill sampling protocol was not followed correctly, nor those for which the data are permanently unavailable, while ‘Ongoing’ trips are those for which the data processing had not yet been completed.

The Data Collection Officer (DCO) was recruited by the OFP, with funding from New Zealand, in July 2011, and has been particularly effective in implementing the paired sampling trips. His contract was extended from 30 June 2013 and terminated on 31 August 2013.

The DCO also implemented a project in the Solomon Islands, in conjunction with National Fisheries Development Ltd, to compare species compositions determined from (i) logsheets, (ii) grab samples, (iii) spill samples, (iv) cannery receipts and (v) port samples of species and size categories landed at the cannery in Noro, Solomon Islands. Data processing for nine trips has been completed; however, port sampling was not conducted for three of the trips and the cannery receipts are not available for another two trips, leaving only four trips for which all sources of data are available. Three additional trips have been undertaken and the data will be processed and analysed in due course.

- In May 2012, the DCO also participated in a trip on a purse seiner chartered by the International Seafood Sustainability Foundation (ISSF), the *Cape Finisterre*, during which he collected further spill sampling data and evaluated video monitoring of the catch.

Scope (c)

- In July 2013, estimation of purse-seine catches by species and size composition were adjusted with observer grab samples, 1993–2012, corrected for size selectivity bias estimated using splines (Figure 2 and 3). Three model-based approaches to estimating the species composition were applied (see Working Paper SC9–ST–WP–03). Length-frequency data were also adjusted and scaled by the catch. These estimates are the input data for the stock assessments conducted by the OFP and will be further updated on a regular basis.

Scope (d)

- During the current reporting period, a smaller spill sampling bin was tested successfully. Samples were taken more often than every tenth brail, with the number of brails between sampling depending on the size of the fish in the sample; it takes more time to measure a bin full of small fish than a bin full of large fish. The recommended dimensions for a spill sampling bin and the sampling protocol are given in the Appendix.

Scope (e)

- As noted under Scope (d), a smaller spill sampling bin was tested successfully, with samples taken more often than every tenth brail.
- Commencing in September 2012, the DCO directed all observers collecting spill samples to also collect all of the other data regularly collected by observers; prior to then, the spill sample observers collected only the spill sample data, while the grab sample observers collected the other information. Since then, the spill sample observers have regularly submitted their data, including the spill samples and the other information.
- Logsheet reporting of purse-seine species composition by fleet has been included in Working Paper [SC9-ST-WP-01](#).

Conclusion and Future Work

Regarding scope (a), improvements have been made to the models used to estimate the species composition from the observer data; a simulation model of the brailing and sampling processes has been developed; and an analysis of pooling of the observer data was conducted. Future work, beyond Project 60, will extend the use of the simulation model and further examine pooling and post-stratification.

Regarding scope (b), the field work of Project 60 has been completed and the contract of the Data Collection Officer terminated on August 31, 2013. The target of 50 paired sampling trips was exceeded, with 54 successful trips, although not all fleets in Table 1 were represented. Spill sampling has been shown, on both a theoretical and empirical basis, to be a more accurate and reliable protocol for the collection of species and size composition data than grab sampling; the recommended spill sampling protocol is given in the Appendix. Analysis of the Noro data was delayed due to data processing and will be conducted under Scope #1 of *Project Theme Three: Collection and Evaluation of Purse-Seine Species Composition Data*, which was recommended at SC9 and for which a consultancy was awarded to SPC in December 2013; the analysis of the Noro data under the new project is at no additional cost.

Regarding scope (c), both the catch data and length frequencies used in the tuna stock assessments are now adjusted regularly on the basis of the analyses discussed under scope (a). The collection and analysis of the paired spill and grab samples has resulted in procedures for correcting over 20 years of historical grab sample data, which would otherwise have only limited utility. The models developed to estimate the species composition from the corrected grab samples have resulted in improved estimates of the historical catches of skipjack, yellowfin and bigeye by purse seiners.

Regarding scope (d), the spill sampling methodology has been updated in the Appendix. Regarding scope (e), see the notes above.

Table 1. Target number of paired sampling trips determined at the Fifth Regular Session of the WCPFC Scientific Committee and the numbers of successful and unsuccessful trips completed as of January 2014

Vessel Nationality / Arrangement	Target Number of Trips	Trips as of January 2014		
		Successful	Unsuccessful	Ongoing
FSM Arrangement	8			
Federated States of Micronesia		3		
Marshal Islands			1	
Papua New Guinea		15		
China	2			
Japan	6	5		1
Korea	8	7	4	1
New Zealand	2		4	
Philippines	2			
Solomon Islands	2	10		4
Chinese Taipei	8	5	4	
United States of America	8	7	3	1
Vanuatu	2	2		1
EU and EPO-based fleets	2			1
TOTAL	50	54	16	9

Figure 1. Location of sets from which paired spill and grab samples were collected, 2008–2013

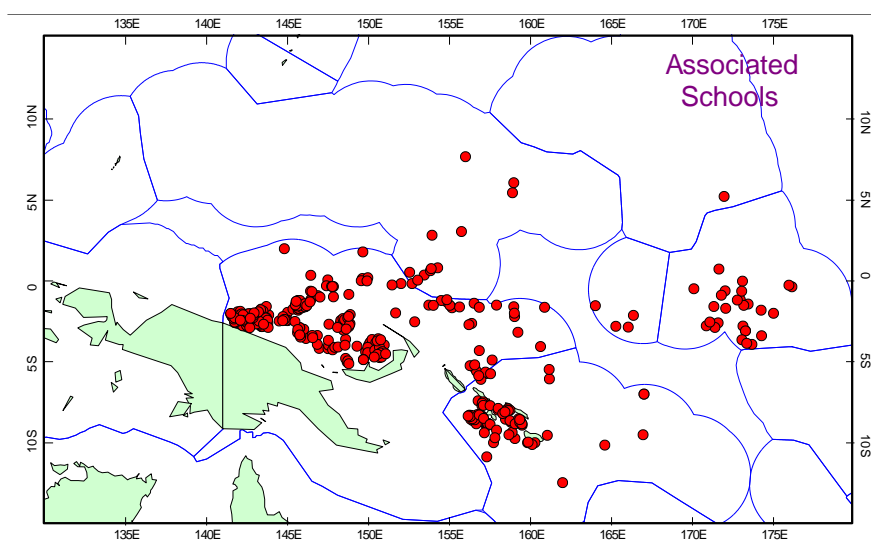


Figure 1 (continued)

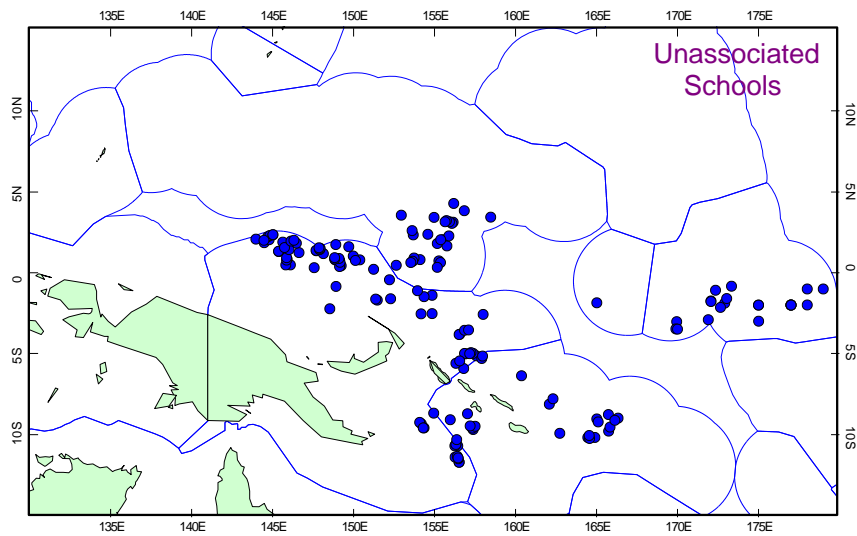


Figure 2. Relationship between *availability* and length estimated from paired sampling data using a cubic spline. The horizontal line represents the average *availability*.

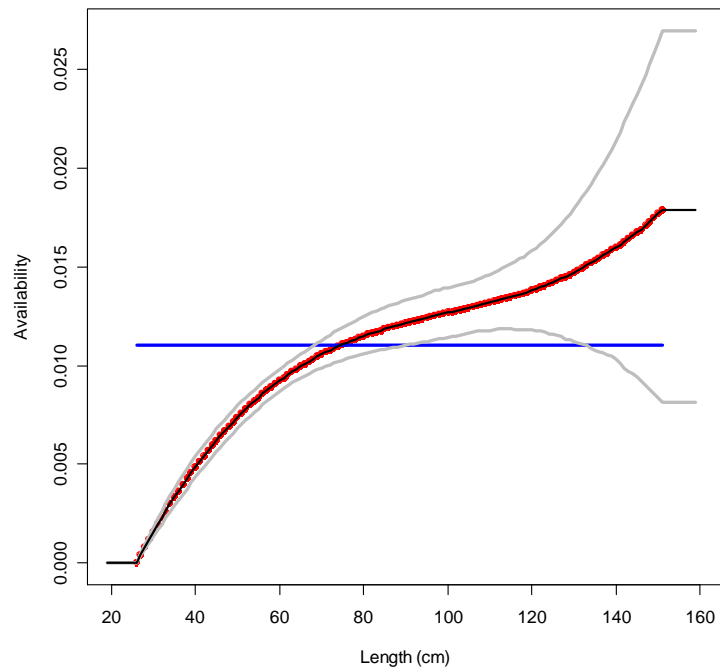
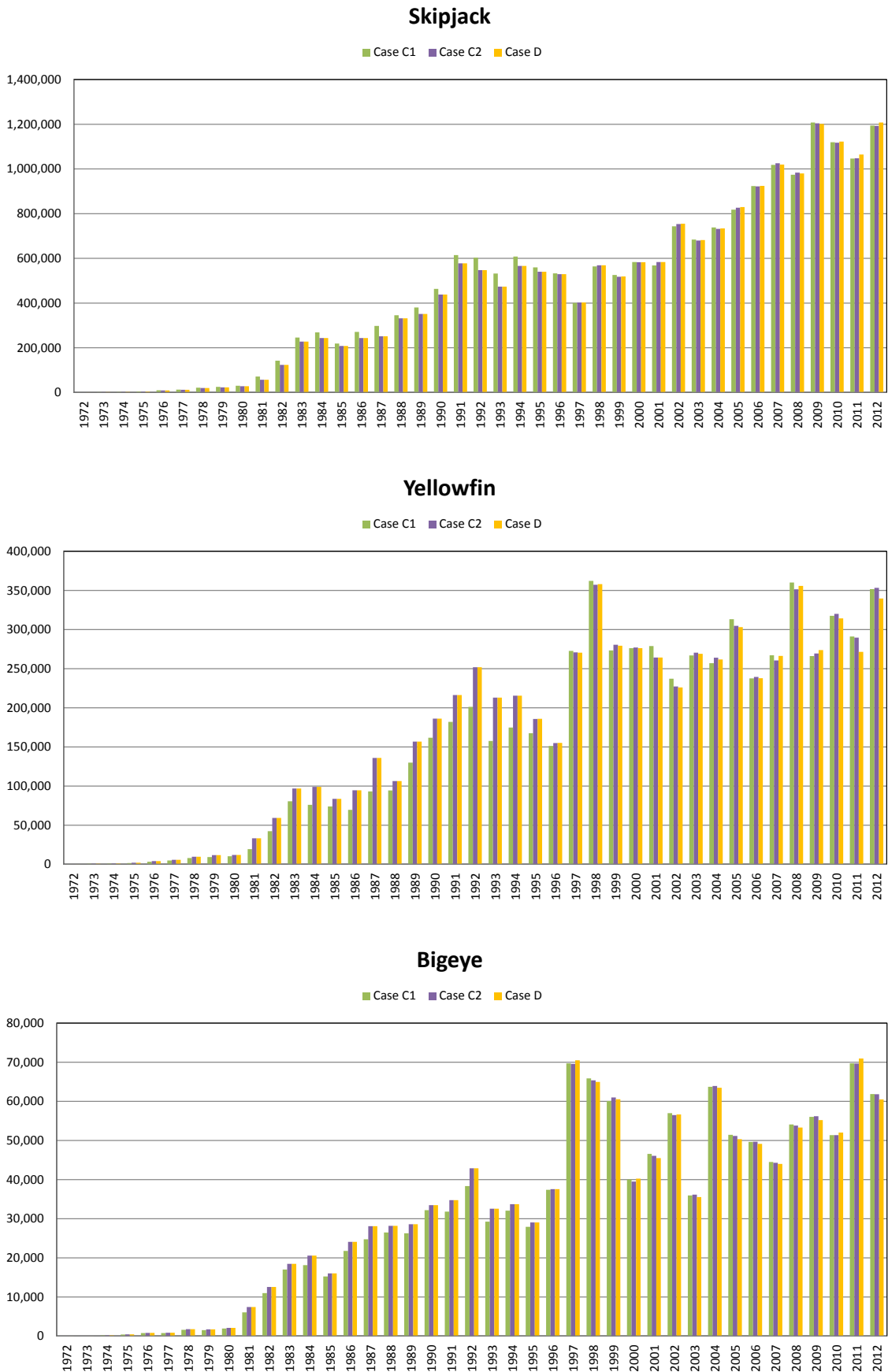


Figure 3. Annual purse-seine catches in MFCL Skipjack Areas 2 and 3
(see Working Paper SC9–ST–WP–03)



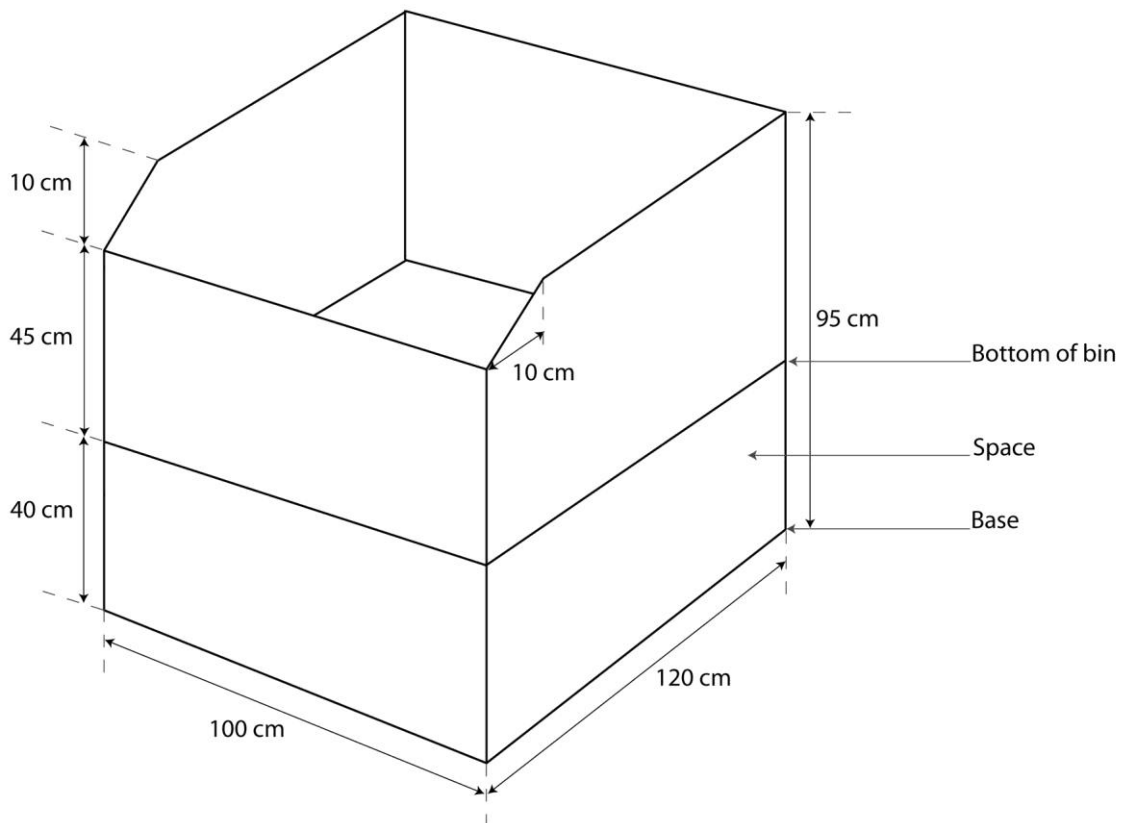
Appendix. Spill Sampling Protocol

Objective of Spill Sampling

- To collect samples that can be used to estimate the species composition and the length frequency, either of the catch per trip or the catch in strata of time period and geographic area, such as strata of $1^\circ \times 1^\circ$ grid and month or strata of MFCL Area and quarter.

Equipment Used

- The recommended dimensions of the spill sampling bin are illustrated below. The bottom of the bin is raised by 40 cm from the base, while the height of the bin above the bottom is 55 cm, so that the total height is 95 cm; the bottom and top of the bin correspond, more or less, to just below knee level to waist level. The width at the front and back of the bin is 100 cm and the length of the sides is 120 cm. The sides of the bin have a slope towards the front extending 10 cm in height and depth, to allow the excess fish to fall out of the front. The observer stands next to one of the sides of the bin when measuring fish.



The bin size may need to be modified to suit the deck layout and the mode of operation of brailing of certain vessels.

- Measuring board, calipers and data collection forms.
- Voice recorder, earphones and (aquapac) waterproof housing.

Sampling Protocol

1. The number of the initial brail to be sampled is changed with each set to avoid the effects of potential layering by species or size. For sets of 20 tonnes or more, the initial brail to be sampled should be one of the first six brails. For sets of less than 20 tonnes, the initial brail to be sampled should one of the first three brails.
2. Advise the brail winch operator of the brail to be sampled just as the brail is being transferred from the net to the vessel. The brail winch operator must not be warned any further in advance of the brail to be sampled, otherwise he may be tempted to modify his brailing behaviour, which may introduce unwanted bias.
3. Open the selected brail to discharge a portion of the content to fill the sampling bin (Figure 4). It is important that the bin always be filled to the brim, regardless of the size of the fish. The sample size of a spill sample is determined by the volume of the bin; thus, there will more fish in the sample when the fish are small than when they are large.
4. Check that the voice recorder is turned on.
5. Verbally identify the species of each fish in the bin, including non-target species, and measure the fork length by placing the fish on a flat surface, such as a measuring board, and using the measuring board (or calipers for larger fish) to measure the length from the tip of the snout to the fork of the tail.
6. After all fish in the bin have been measured, repeat steps #2 to #5 for one of the next few brails to come onboard, until brailing is complete.

Figure 4. Discharging fish from the brail to the bin



Figure 5. Measuring fish from the spill sampling bin

