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Potential use of cannery receipt data for the scientific work of the WCPFC

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ABSTRACT

This paper describes the potential use of cannery receipt data for the work of the Western and Central Pacific Fisheries Commission (WCPFC), and in particular, providing a means of validating the estimates of the purse seine catch by species using logsheet-reported catches adjusted with observer data estimates of species and size composition.

The findings in this paper are based on a study funded by the International Seafood Sustainability Foundation (ISSF) which included a review of cannery receipt data provided by ISSF-participating processing companies to the WCPFC over the past 4 years. The WCPFC is currently conducting an extension to this study, targeting processors not covered in the ISSF study.

Summarised data (tables and figures) are provided to show comparisons of the purse seine catch by species and size categories from observer and cannery data for years that complete data are available (2013 and 2014).

The main findings of this paper were that there is clearly potential for using cannery receipts data to validate/compare species and size composition breakdowns by fleet determined from observer-derived estimates, provided the following applies:

- The consolidated total trip catch according to cannery data is consistent with the total trip catch from logsheets and observer data (that is, the data from canneries covering the entire trip are collected, compiled and available), and
- The cannery is recording species composition for all relevant size categories.

SC12 is invited to consider and respond to the following questions:

1. Given the findings of this initial study, **does SC12 agree that cannery receipt data are potentially useful for validating the estimated WCPFC purse seine species catch and size composition?**
2. The cannery receipt data currently provided to the WCPFC do not cover all WCPO catch that is canned (i.e. are not complete) and there is some inconsistency in the species/size categories being used. The cannery receipt data would only be useful to the WCPFC for validating purse seine catch, if there was complete submission of cannery data (from WCPFC purse seine catch) with an agreed standard for size/species categories and some refinement to the current protocol for enumeration. **Would the WCPFC be prepared to work towards developing an appropriate Conservation and Management Measure (CMM) or another mechanism for obtaining complete cannery receipt data for validating the purse seine catch?**

BACKGROUND

The issues with the logsheet-reported tuna species catch in the Western and Central Pacific Fisheries Commission (WCPFC) purse seine fishery have been well documented and so the WCPFC has, for a number of years, adopted an estimation method that uses observer samples (Lawson, 2007; Lawson, 2013, Lawson, 2014; Hampton and Williams, 2016). The accepted methodology essentially adjusts the tuna species composition in aggregated purse-seine catch logsheet data using observer sampling data corrected for grab sample selection bias (more detail is provided in the references above).

Some concerns have been raised in regards to the current observer sampling method (for example, the grab sample biases selection related to size and species, the sample size is too small to obtain reliable estimates of catch by species at the trip level, and perhaps broader issues), but discussions to date have made it clear that any enhancements to the current sampling protocols are likely to negatively impact the loading of fish into the wells during the fishing operation. The advent of E-Monitoring has been touted as the logical solution to resolve these issues (since it would provide a larger sample size for example), although there would still be a requirement to validate the species catch estimates generated through an E-Monitoring system.

Companies processing the purse seine catch (e.g. for canning, pre-cooked loins, pouch) document the receipts of purse seine catch by vessel trip and specific species/size categories (see [Table 1](#))³ for processing efficiency and market requirements; this process is acknowledged to require full or near-full enumeration of the catch by species and by broad size categories. The ideal situation where cannery receipt data are comprehensively collected covering the full-trip catch sorted into each species/size category (i.e. full or near-full enumeration) should therefore potentially provide a very good source of ground-truth for evaluating estimates of purse seine species and size composition obtained from the logsheet data, adjusted with observer sampling data.

The establishment of Catch Documentation Schemes (CDS) will mean that data collection from on-board and onwards through the process chain will become more stringent, but it is not yet certain what adjustments to the existing species/size category breakdowns will be required for CDS. However it is likely that any adjustments required for CDS are likely to be positive in regards to the usefulness of cannery receipt data to validate against the estimates of purse seine species catch (obtained through the current methodology).

Comprehensive cannery receipts data from more than twenty processors [receiving WCPFC purse seine catch] have been provided to the WCPFC over the past four years as part of an initiative of the International Seafood Sustainability Foundation (ISSF) and their participating companies. This paper is a summary of a study funded by ISSF looking specifically at the usefulness of 2013 and 2014 cannery receipt data (the most complete years of the submissions to date) in validating the estimates of the purse seine catch by species and size, and so potentially addressing a key uncertainty in fishery monitoring and ultimately, in stock assessment and management. WCPFC is currently funding an extension of this study, targeting processors not covered in the ISSF study and is work in progress only briefly reported here (as Annex 1). It should be understood that this paper only covers the processed industrial purse seine catch, even though the ISSF participating companies are also provided data for other fishing gears (e.g. pole-and-line and longline). However, unlike the purse seine fishery there are limited observer data available for comparison or cross-referencing for these fisheries.

³ Size and species separation prior to processing is normally a two stage process - an initial partial sort, typically 10-20% of the shipment, for the Bill of Lading which triggers payment of 90% plus of the final payment to the vessel owner or carrier/trader, and a second comprehensive sort prior to processing which allows the Quality and Quantity reconciliation to be done and the balance of payment owing to be calculated.

CANNERY DATA AS A VALIDATION TOOL

The following explanation outlines how cannery data could potentially be used by the WCPFC to verify the estimates of tuna catch by species and commercial size categories at the trip level.

The current protocol used by observers to sample the catch is mainly the 'grab' sample method, whereby five tuna are randomly selected from each brail brought on-board. The biases in fish selection have already been documented (Lawson, 2010), as have the procedures used to correct these biases using data collected from the 'spill' sampling method (the other protocol used by observers to sample the tuna catch from purse seine vessels). One issue identified with the current sampling protocols is that the low proportion of the catch sampled (around 0.2-0.5% of the total tuna catch only, see [Figure 1](#)) means that determining accurate tuna species composition at the set and trip level has a high level of uncertainty. The level of certainty however increases with increasing levels of aggregation of the data, e.g. data at the fleet level (higher aggregation) is considered more certain than data at the trip and set level.

Cannery data have the potential to provide a very accurate breakdown of the tuna species catch at the trip level since, in theory, it represents close to full enumeration, i.e. species and size sorting is usually undertaken for nearly all of the catch and these categories are then weighed. The smallest size category only – <3lbs (<1.4kgs) – may often not be sorted by species, because of the difficulty of separation and also the time taken to do so accurately. This smallest size category (< 3lbs) appears to represent a minor proportion of the total catch (**8% on average**, according to observer estimates) and could still be estimated from sub-sampling.

Complete trip-level cannery data could therefore potentially be used to compare and adjust the tuna species catch estimated from observer data at the trip level, and to verify size composition aggregated to the commercial categories.

[Figures 2 and 3](#) show an example of what might be expected from a comparison of the species composition for a purse-seine vessel trip based on cannery receipt data and observer estimates, respectively. This comparison could be used to:

- i. ascertain whether or not the observer estimates are consistent with the cannery receipt data (considered as the control or base data), and
- ii. adjust the observer estimates based on the cannery data, if this is deemed possible/necessary, or identify which observer estimates to exclude from the overall purse seine tuna catch estimation process.

[How this might be undertaken requires some consideration/investigation, for example, a 'tolerance' level would need to be identified in the comparison between cannery and observer data].

[Figures 4 and 5](#) provide a further example of what might be expected from a comparison of the bigeye tuna catch by size category from a purse-seine vessel trip based on cannery receipt data and observer estimates, respectively.

Using the data submitted by ISSF participating companies, a dataset was produced that linked cannery receipts data at the trip level to respective logsheet and observer trip data; [Table 2](#) shows the extent of matches at the trip level amongst these data types.

In regards to the **total trip catch** reported by observers against that recorded on logsheets, the frequency of the percentage difference in the total catch reported from the two sources is compared in **Figure 6**. This is generally quite consistent, with little difference between the two.

When logsheet data are compared with cannery receipts (**Figure 7**), the frequency of the percentage difference is strongly skewed towards logsheet estimates of trip catch being consistently higher, indicating that not all the catch from a trip is unloaded to canneries from which data were available to this study, and must regularly go elsewhere i.e. to canneries where data have not been made available. The two largest categories of difference are however 0 and -10%, also suggesting that trip total catch is well covered by the cannery data in many instances, and it is these trips that should be selected for further comparisons amongst observer, cannery and logsheet data.

In regards to species composition, **Figure 8** compares observer-estimated species composition and cannery species composition for those trips where the difference between total trip catch according to observer and cannery is $\geq -5\%$ and $\leq +5\%$. The species composition is close, although even with total trip catches being reasonably close, there may have been some small percentage of larger yellowfin included in the observer's estimate of the catch which may have gone to another cannery from which data were not available to this study and therefore not included in the cannery species composition estimate here. The practice of onboard sorting/high grading is widespread, but varies amongst fleets, and with larger fish often destined for different markets or processors.

Figure 9 demonstrates, with actual data, a potential use of cannery data to validate/compare species and size composition breakdowns by FLEET determined from observer-derived estimates. Based on these initial findings for the dataset highlighted in **Figure 9**, there may be some potential use of cannery data, provided the following applies:

- The consolidated total trip catch according to cannery data (i.e. the trip catch unloaded to the cannery) is consistent with the total trip catch from logsheets and observer data;
- The cannery is recording species composition for all relevant size categories.

Unfortunately, at this stage, very few data are available to undertake comparisons of catch by species and size comparisons at the trip level, but there may be comparisons at the broader level that are useful. In **Figure 9**, for example, the proportion of bigeye tuna catch in the combined YFT+BET catch of size category 4–7.5 lbs fish for Fleet #16 according to the cannery data is higher than that estimated from observer data which might warrant further investigation.

The data available for the study (see **Table 2**) indicates that only 5% of the available cannery data satisfies the following criteria which would be necessary to validate observer data:

- (i) Matching of trips for observer and cannery data, and
- (ii) Species composition was undertaken by the processing company for all size categories, and
- (iii) The difference between estimated catch from observer and cannery data is $< 5\%$

This severely limits the direct application of the data at the present time, and for cannery data to be useful as a validation tool for WCPFC purse seine species catch estimates, most if not all processing plants receiving WCPFC purse seine catch would need to provide data.

More detailed comparisons of the catch by species and size categories between observer data and available cannery data are available in **Figures 10 and 11**, which provide some indication of both the potential and the shortcomings (e.g. lack of coverage) with the available cannery data.

DISCUSSION AND CONCLUSIONS

The current study provided the opportunity to evaluate the usefulness of the cannery receipts data being voluntarily provided by ISSF participating companies to the WCPFC since late 2012. The complete data from the years 2013 and 2014 were analysed here⁴. The rationale was that these data could potentially provide an important independent estimate of the purse seine fishery catch collected on logbooks, both in terms of volume and particularly in the breakdown of catch by species/ size and related to this work, provide a means of validating observer species composition estimates.

The proportion of the catch with corresponding observer and logsheet coverage proved to be high, providing a good potential basis for evaluating the usefulness of the data for WCPFC work. A series of comparisons amongst the data sets revealed issues with the cannery data supplied, as follows:

- Total catch per trip is difficult to estimate, because of partial trip unloadings to especially smaller canneries and also the lack of data on receipts by canneries that were not part of this study and which receive the balance of the fish⁵.
- species breakdown by size classes, especially for fish < 4lbs is incomplete for many canneries
- small fish < 4lbs may be under-represented in receipts of some canneries

There is clearly potential for using cannery receipts data to validate/compare species and size composition breakdowns by fleet determined from observer-derived estimates, provided the following applies:

- **The consolidated total trip catch according to cannery data is consistent with the total trip catch from logsheets and observer data.**
- **The cannery is recording species composition for all relevant size categories.**

Unfortunately **only 5% of the available cannery data** at this stage meet these requirements and therefore severely limits the application of the data to the work of WCPFC at the present time. This situation would be remedied with full reporting by all canneries that process WCPO tuna so that full trips would be accounted for.

The larger canneries, with larger cold storage facilities and which maintain larger inventories, are presumably more likely to receive the entire catch from a trip. These canneries make up all known cases where the above requirements are met. However, based on the transshipment data, the volume averaged over 600t per transshipment, suggesting that partial transshipment occurs in many cases, including unloading less than the full quantity onboard and/or unloading to multiple buyers or processors

The only solution for that requirement to apply is to receive cannery receipts data from the other canneries not currently providing data (i.e. nearly 50% of the processing volume for WCPO tuna); this provision of data would ensure more complete coverage of unloadings. For this reason, the WCPFC has received funding to pursue the voluntary provision of cannery receipts data by processors currently outside the present ISSF data provision arrangement. This study was launched

⁴ additional coverage is available for 2015 (these data are probably of better quality) but these data have not been included or analysed here

⁵ it is roughly estimated that data supplied for the present study comprises around 50% of the volume of WCPO purse seine fish processed in the WCPO and beyond

in February 2016 and aims to encourage other processors to voluntarily provide data in an agreed format to WCPFC for its work. The response to date has been positive and the Annex to this paper summarizes the approaches so far to encourage processors to provide the required data on a voluntary basis.

The species / size composition issue seems to arise because many canneries are supplying data based on Outturn Receipts/Bill of Lading data, where species may not be separated for certain size classes, most notably 4–7.5 lbs, where there is no price differential by species. In most of these cases however, size and species separation is done to a satisfactory extent because of processing requirements i.e. sizing is used to guide thawing and cooking times: species separation, especially for bigeye, is increasingly undertaken to meet marketing requirements. These more detailed data have not always been supplied perhaps because of a lack of clarity in the original data submission requirements (and highlighting the need for refining the current protocol). There may also be extra work involved and delays in compiling the data if complete sorting only occurs just prior to processing, which may involve some time lag.

The study provided a series of recommendations to address the current short-comings in the cannery receipts data to enable their potential to enhance the work of the WCPFC to be more fully realized. Additional analyses of the 2015 data, possibly with greater coverage and of enhanced quality will assist, as will the data received from processors currently outside the ISSF arrangement, which hopefully will be compiled to commence from the first quarter of 2016 onwards.

WHERE TO FROM HERE?

SC12 is invited to consider and respond to the following questions:

1. Given the findings of this initial study, does SC12 agree that cannery receipt data are potentially useful for validating the estimated WCFPC purse seine species catch and size composition?
2. The cannery receipt data currently provided to the WCPFC do not cover all WCPO catch that is canned (i.e. are not complete) and there is some inconsistency in the species/size categories being used. The cannery receipt data would only be useful to the WCPFC for validating purse seine catch, if there was complete submission of cannery data (from WCFPC purse seine catch) with an agreed standard for size/species categories and some refinement to the current protocol for enumeration. Would the WCPFC be prepared to work towards developing an appropriate Conservation and Management Measure (CMM) or another mechanism for obtaining complete cannery receipt data for validating the purse seine catch?

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<http://www.wcpfc.int/system/files/SC10-ST-WP-2%20PS%20spp%20catch%20comp.pdf>

TABLES

Table 1. Typical Cannery Data Size Categories

< 3lbs	(< 1.4 kgs)
3.0 - 4.0 lbs	(1.4- 1.8 kgs)
4.0 -7.5 lbs	(1.8 – 3.4 kgs)
7.5 - 20 lbs	(3.4 – 9.1 kgs)
20 lbs up	(9 or 10 kgs up)

Table 2. Breakdown of data used in the study

Category of data	Description	# Trips	% of all cannery data
1	# of matched trips Logsheet and Cannery data	1,756	
2	# of matched trips for Logsheet, Observer and Cannery data	1,034	59%
3	# of matched trips Observer and Cannery data	1,034	59%
4	# of matched trips Logsheet, Observer and Cannery data with difference between Cannery submission and logsheet total catch is < 20%	185	11%
5	# of matched trips Logsheet, Observer and Cannery data with difference between cannery submission and logsheet catch of SMALL TUNA ONLY is < 20%	328	19%
6	# of matched trips for Observer and Cannery data with difference between Observer catch and cannery submission of SMALL TUNA ONLY is < 20%	277	16%
7	# of matched trips for Observer and Cannery data where species composition is available for all size categories, and the difference between Observer catch and Cannery submission of < 5%	82	5%

FIGURES

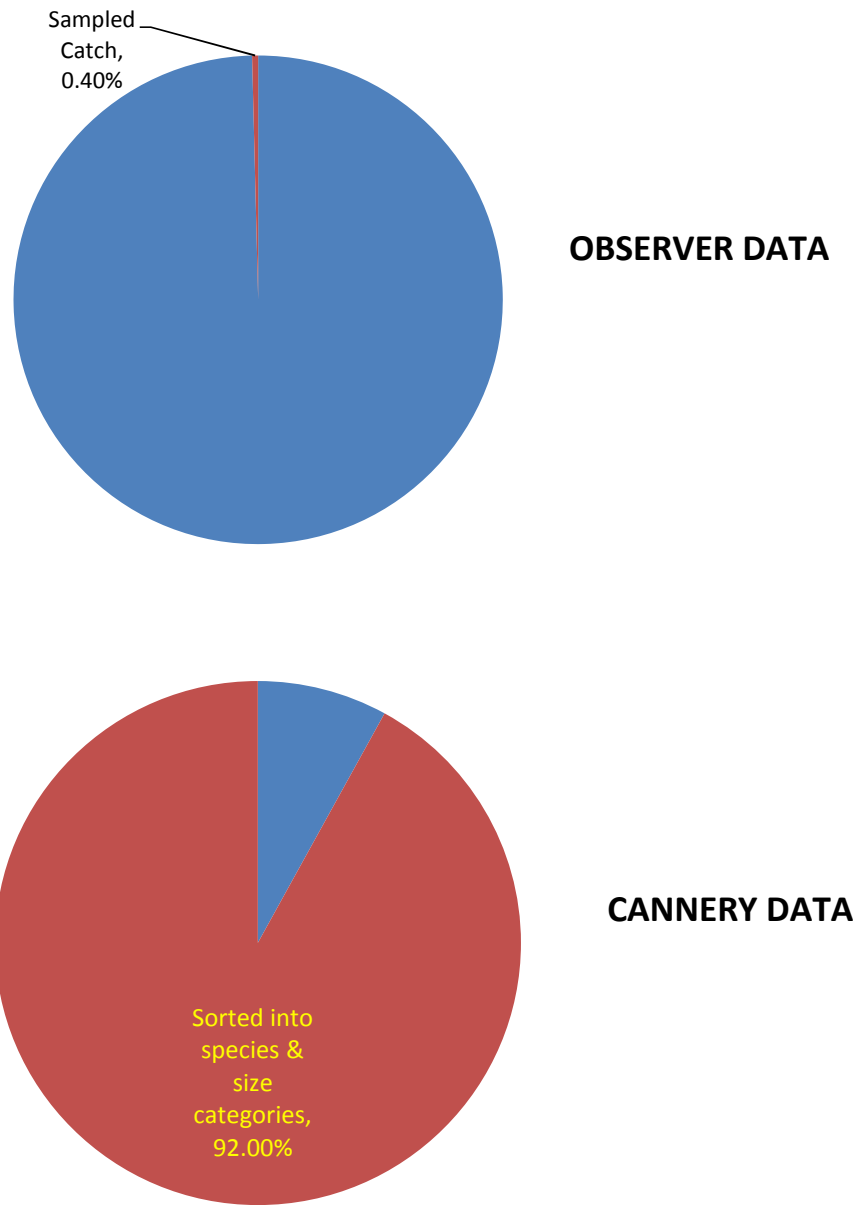


Figure 1. Comparison of the proportion of the purse-seine catch sampled by observers in 2014 (top) to catch enumerated in cannery receipt data, where the smallest size class is not separated by species (bottom).

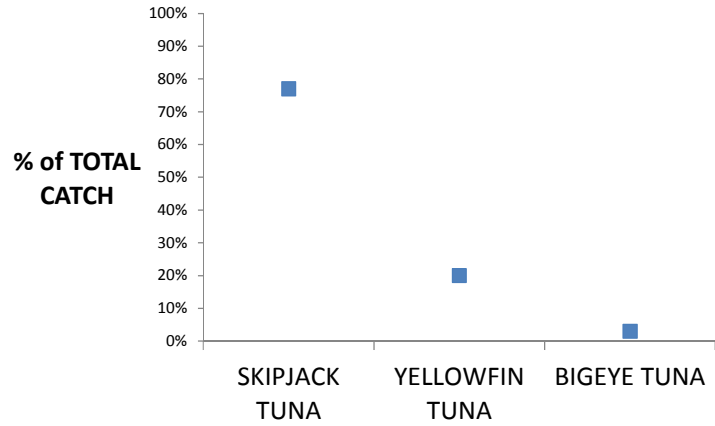


Figure 2. Tuna species composition – Trip #1
(based on Cannery data)

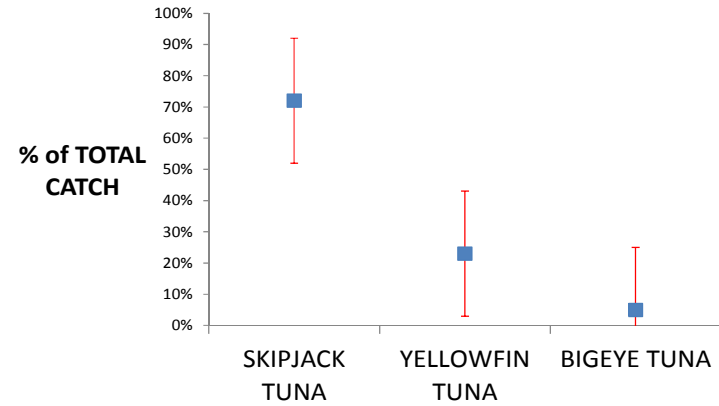


Figure 3. Tuna species composition – Trip #1
(based on Observer estimates)

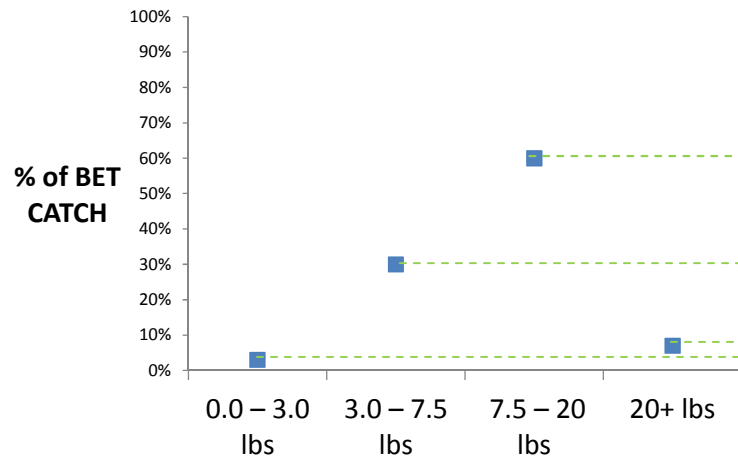


Figure 4. Bigeye tuna catch by size category – Trip #1
(based on Cannery data)

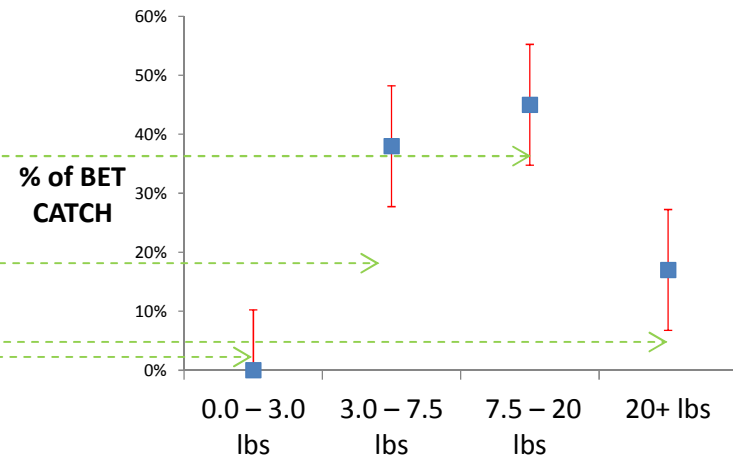


Figure 5. Bigeye tuna catch by size category – Trip #1
(based on Observer estimates)

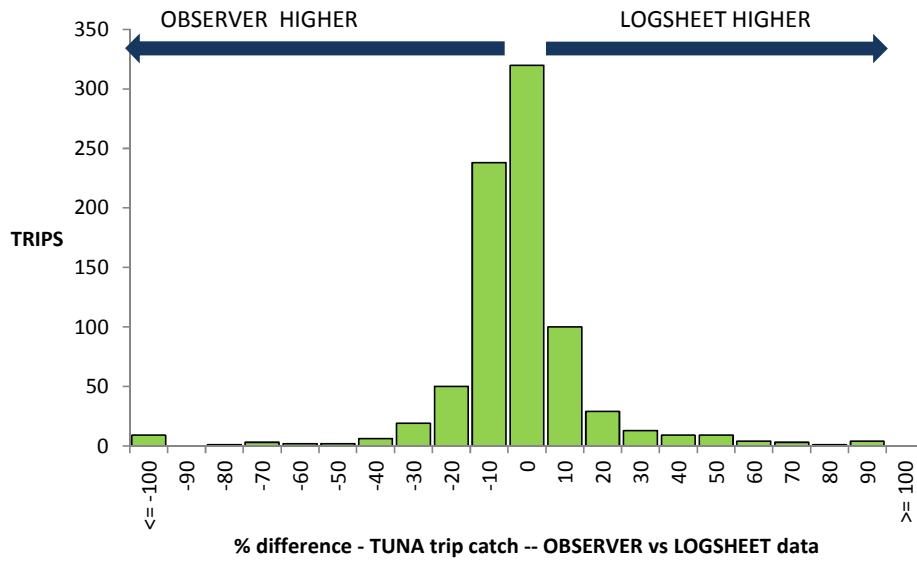


Figure 6. Frequency of the % difference in total TRIP tuna catch reported by OBSERVERS versus LOGSHEETS

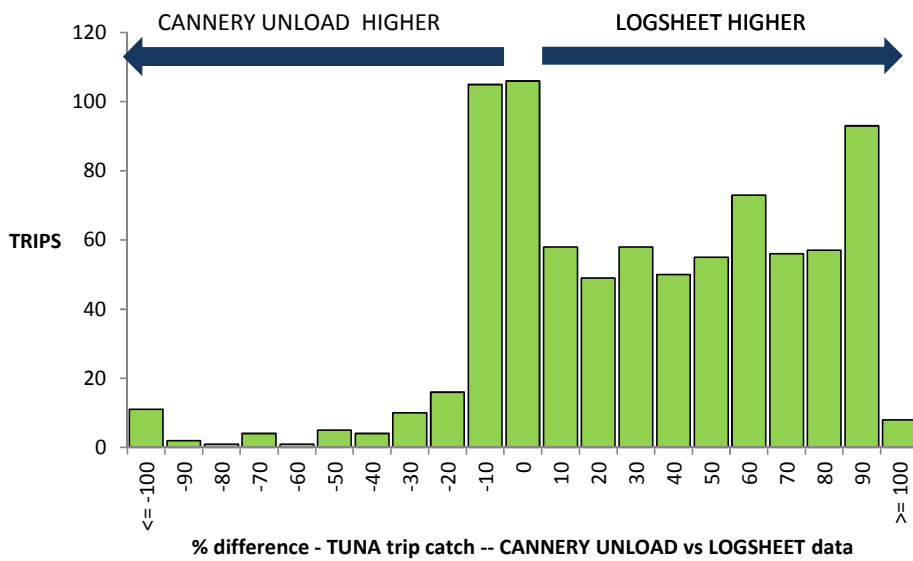


Figure 7. Frequency of the % difference in total TRIP tuna catch reported from consolidated CANNERY RECEIPTS versus LOGSHEETS

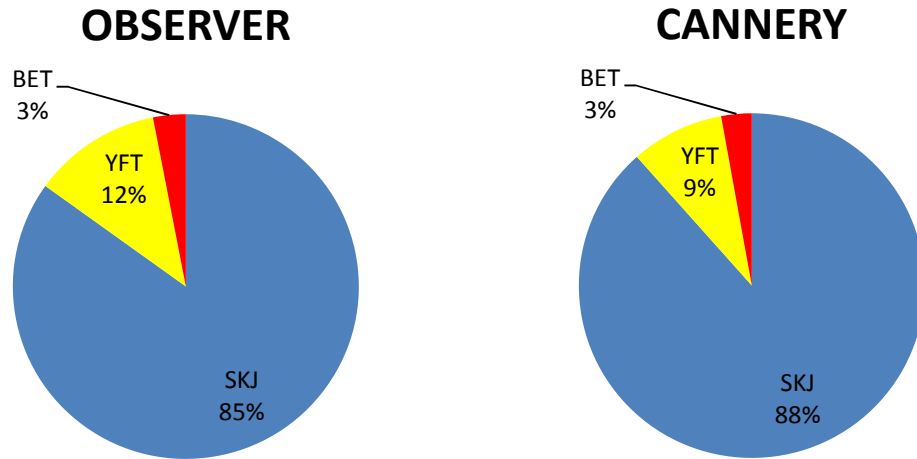


Figure 8. Species composition comparison of matched Observer and Cannery receipt data trips.

For trips where % difference in total tuna catch is $\geq -5\%$ and $\leq 5\%$. Cannery #18 and #19 only since species breakdown is provided in these canneries. N = 48 trips

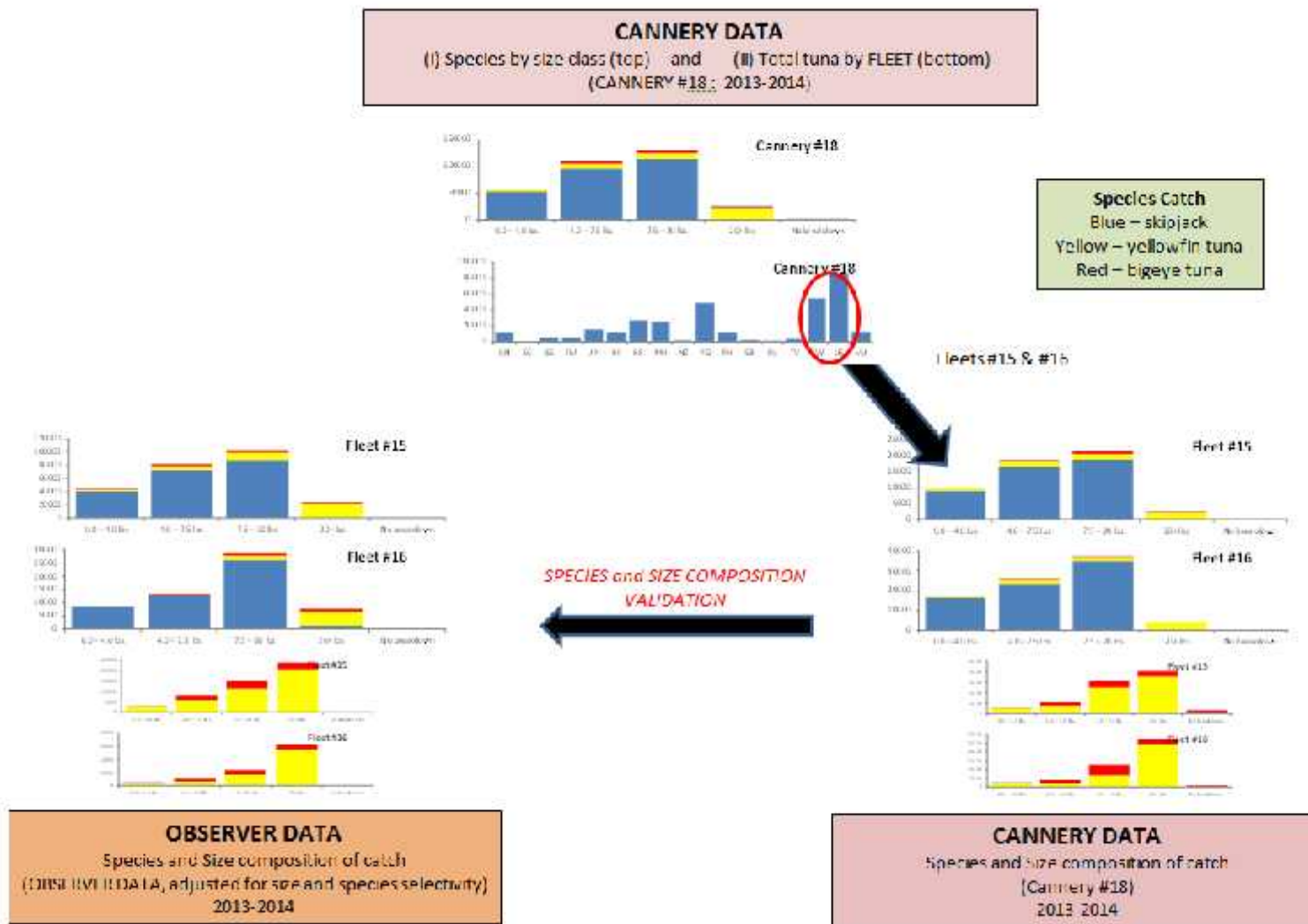


Figure 9. Potential use of Cannery data to validate species and size composition data estimated from observer data.

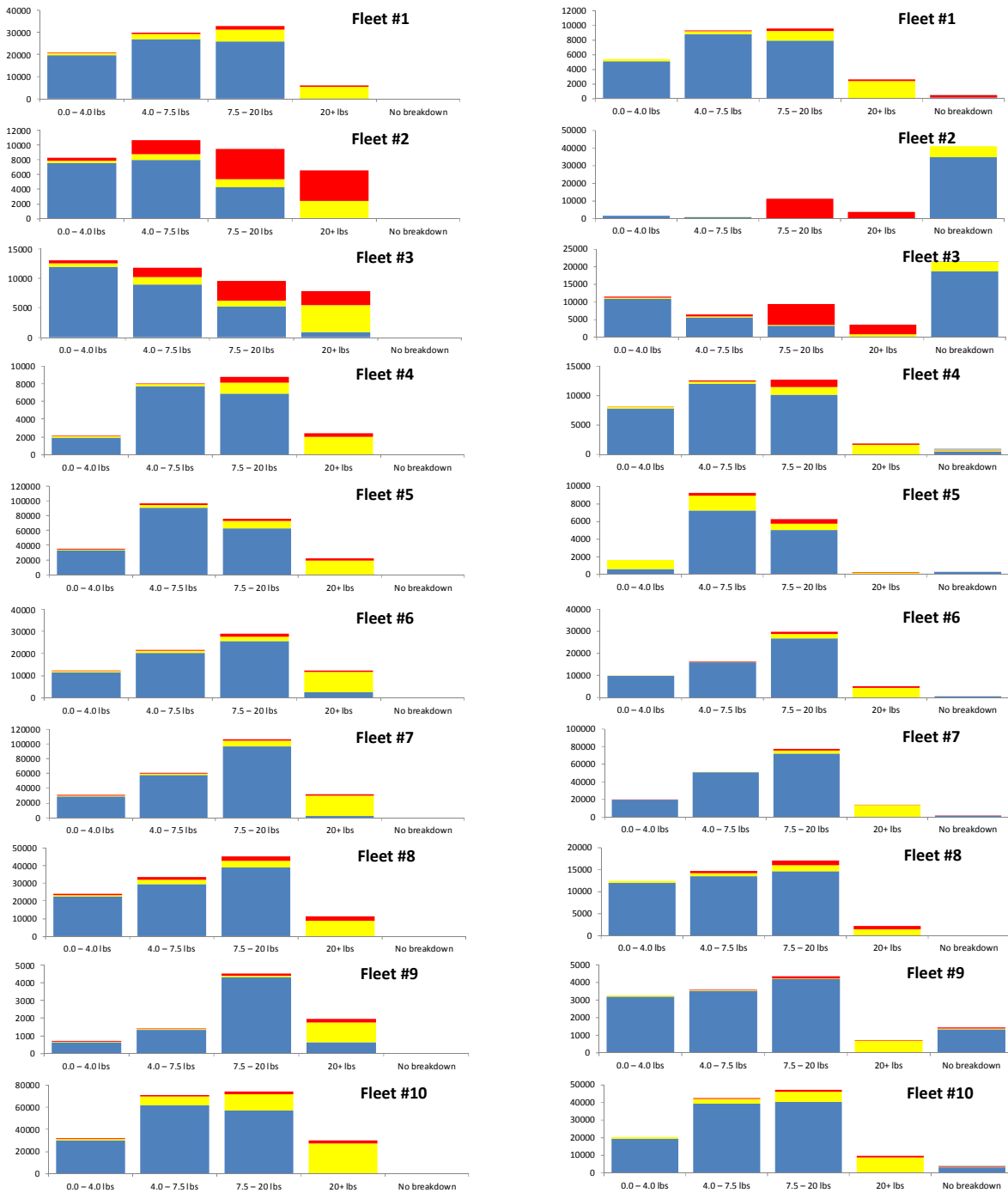


Figure 10. Comparison of WCPO purse seine catch by fleet in 2013-2014 – species and size categories according to observer data adjusted for species and size selectivity bias (left) and available cannery data (right).

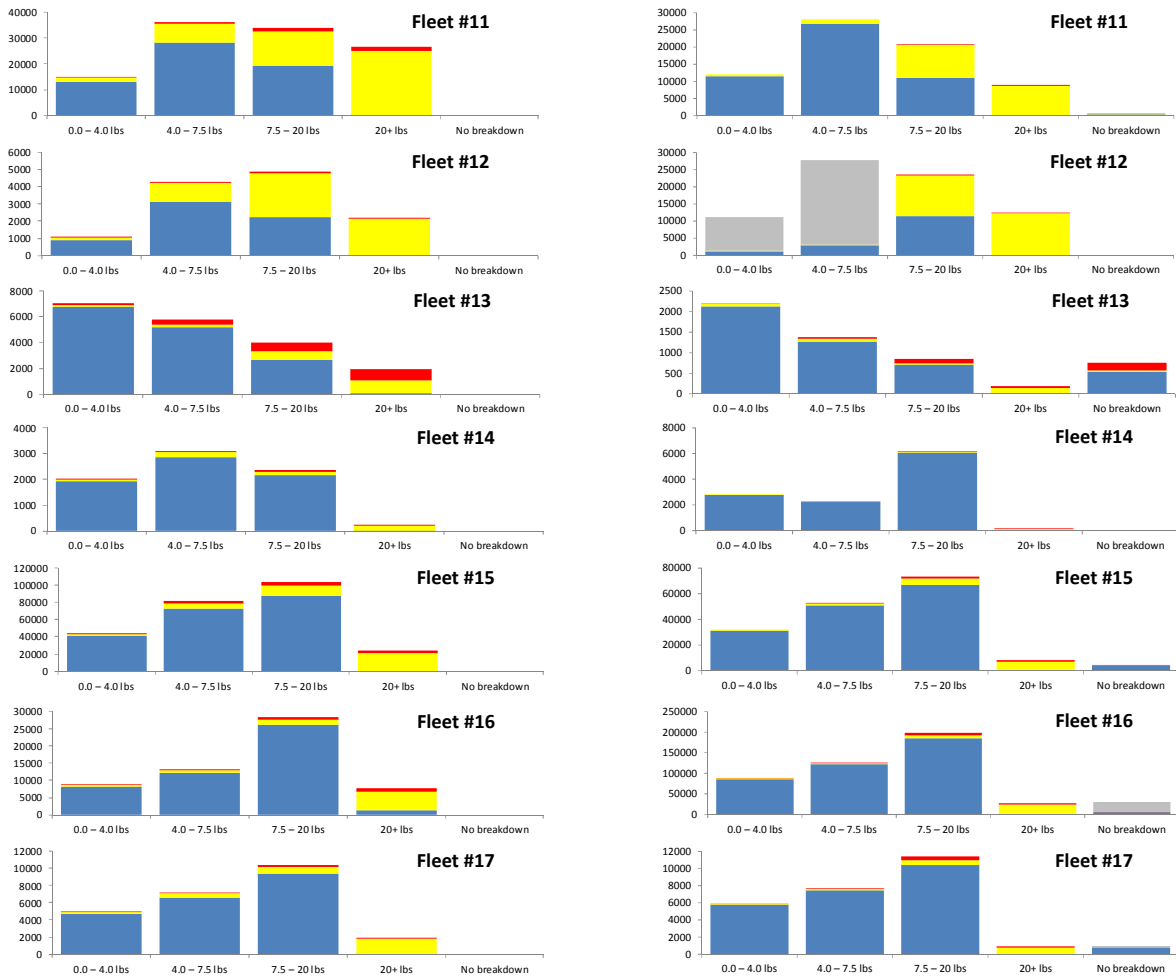


Figure 10. Comparison of WCPO purse seine catch by fleet in 2013-2014 – species and size categories according to observer data adjusted for species and size selectivity bias (left) and available cannery data (right)

(continued)

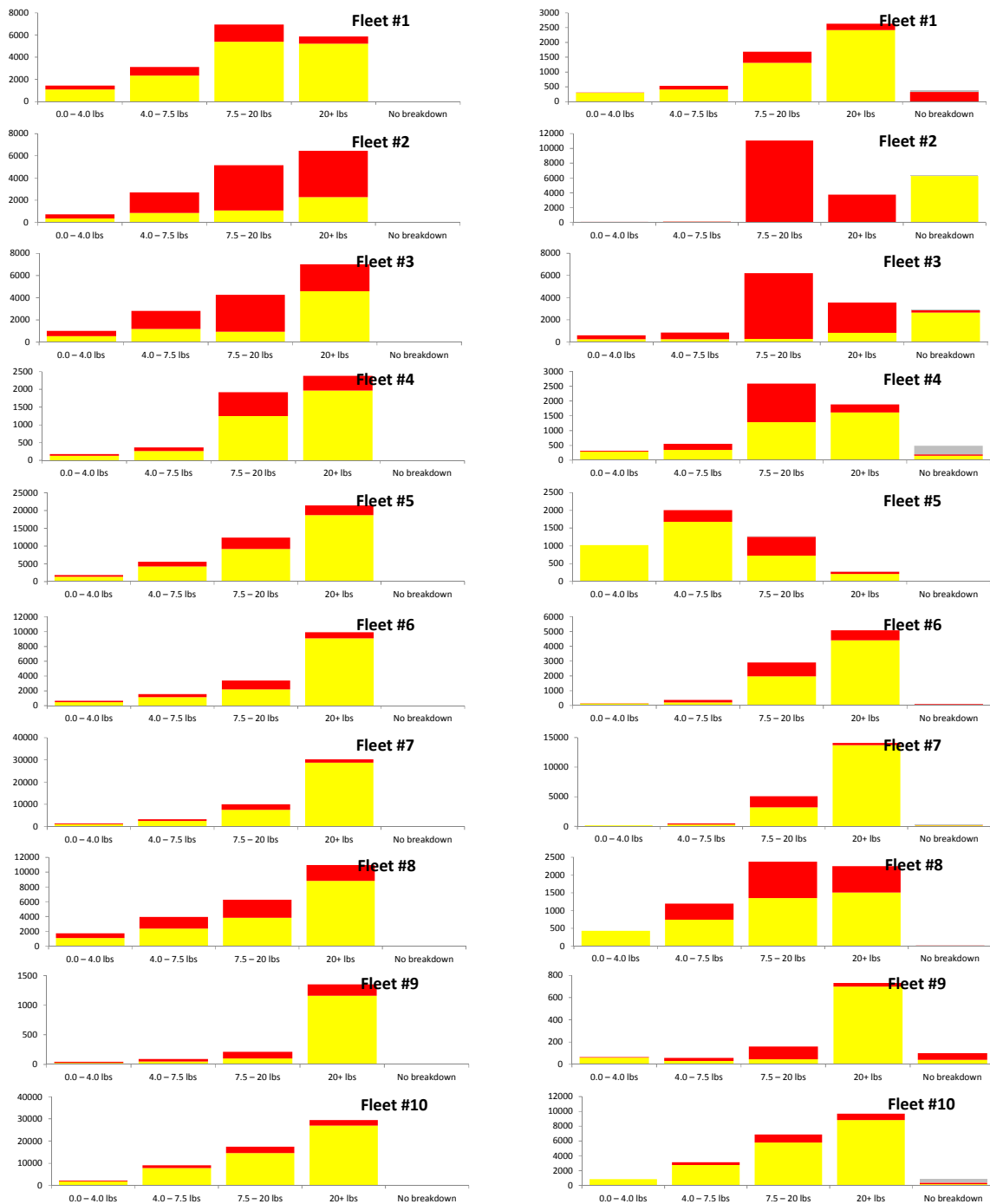


Figure 11. Comparison of WCPO purse seine catch by fleet in 2013-2014 – species (YFT and BET only) and size categories according to observer data adjusted for species and size selectivity bias (left) and available cannery data (right).

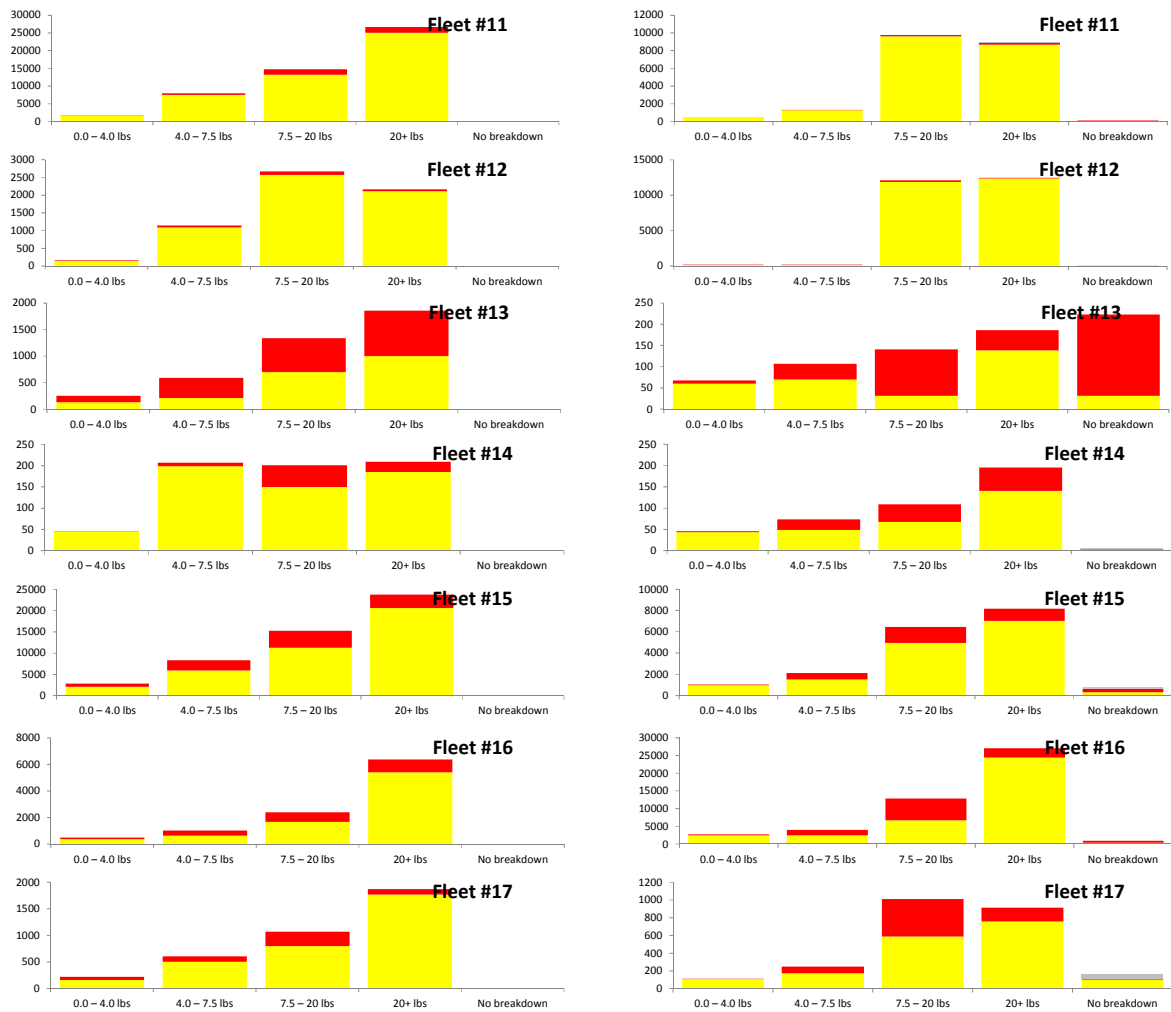


Figure 11. Comparison of WCPO purse seine catch by fleet in 2013-2014 – species (YFT and BET only) and size categories according to observer data adjusted for species and size selectivity bias (left) and available cannery data (right)

(continued)

Annex 1 Details of approaches undertaken so far during the WCPFC cannery study

Country	Dates	Canneries visited
Vietnam	March	Two of the four major tuna canneries visited, and amenable to providing data. MoU for data provision to WCPFC to be developed. One unlikely to cooperate voluntarily; the final company will cooperate but processes mostly longline fish Much local fish not covered by logsheets and observers.
Philippines (General Santos)	April	Four canneries of the six canneries willing to supply required data, and two already supplying under existing arrangements - MoU being developed with BFAR as facilitator.
PNG	April - May	Five processors - two canners visited and cooperative, another not yet in operation, one presently unwilling whilst another a long term supplier of data MoU possibly to be developed through potential involvement of NFA
Thailand	May	Four large canneries other than ISSF participating companies visited, with good prospects of support; other small canneries in Rayong and Phuket not yet visited and probably Indian Ocean fish. Most large Thai canners already providing data under existing arrangements. Good cooperation from this dominant processing country
China	July	Selected canneries in Ningbo and Zhousan visited and very amenable in general
Indonesia	July	Selected canneries only, as much catch processed is not covered by logsheet or observers at present. Several new ISSF members covered under existing arrangement
Future work/visits to be undertaken		
Korea		All canneries to be visited
Japan		Considerable existing data to be scoped, but minor proportion of landings canned/loined
China		Additional canneries and locations to possibly be visited after initial scoping visit in July
Latin America		Additional processors of WCPO purse/seine fish to be scoped and visited
PNG		Revisits and a visit to new cannery when opened
Thailand		Revisit to increase coverage but distinguish IO vs WCPO fish
General watching brief as new loining plants and canneries utilizing WCPO purse seine (and pole-and-line fish) develop		