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An update on cannery data with potential use to the WCPFC

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Peter Williams[1]

[1] Oceanic Fisheries Programme (OFP), Pacific Community (SPC)

INTRODUCTION

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 for purse seine catch composition that uses observer samples (Lawson, 2007; Lawson, 2013, Lawson, 2014; Hampton and Williams, 2017). 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).

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 processing companies. Lewis and Williams (2016) reviewed 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 main findings of Lewis and Williams (2016)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 the 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.

Unfortunately, Lewis and Williams (2016) found 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 data availability/data quality situation severely limits the direct application of cannery data to be useful as a validation tool for WCPFC purse seine species catch estimates, and Lewis and Williams (2016) concluded that most if not all processing plants receiving WCPFC purse seine catch would need to provide data.

With the benefit of further consideration, this paper proposes a methodology for increasing the coverage of available cannery data to validate/compare species and size composition breakdowns by fleet determined from observer-derived estimates.

METHODOLOGY

As for Lewis and Williams (2016), an updated data set was prepared to get the best possible match of available logsheet, observer and cannery data at the trip level, now including 2016 data. Table 1 shows the standard cannery size classes, with large yellowfin and bigeye tuna captured in the category >20 lbs (9-10 kgs); logsheets used by purse seine vessels only require small and large categories to be recorded (right-hand column in Table 1). Lewis and Williams (2016) found that the trip tuna catches from the matching of logsheet and observer data was generally within the range of ±10% (Figure 1), whereas a comparison between the logsheet and cannery data for vessel trips was skewed towards gaps in the cannery data (Figure 2). Table 2 shows the coverage of matched logsheet, observer and cannery trips by comparing the total logsheet tuna catch of the matched trips with the estimate of total catch in the WCPFC tropical purse seine fishery

(excluding Indonesia, Philippines and Vietnam domestic fisheries). The relatively low coverage for 2016 matched data is mostly due to low 2016 observer trip data coverage at this stage (see Williams et al. 2017).

The purse seine transshipment sometimes involves the separation of large yellowfin and bigeye tuna (> ~20lbs/9kgs), which are then transshipped onto a different carrier and destination than the smaller fish, which are not separated by species (and size class) until they are offloaded into a processing plant. It is therefore understandable that some of the cannery data made available to the WCPFC through submissions by ISSF-affiliated processing companies could lack, *inter alia*, the component of the trip catch constituting these large YFT/BET. There is evidence of this lack of large YFT/BET in the available cannery data as 37% of the matched trip data have a higher proportion of large YFT in the total logsheet-reported catch than the cannery data (12% of these trips with zero large YFT in the cannery data). Further, there were 62% of trips with a higher proportion of large YFT in the total catch reported by the observer than in the cannery data. This essentially means that there are a certain number of trips where the cannery data are not properly accounting for the large YFT/BET component of the trip catch as reported by observers.

An attempt was therefore made to produce an adjusted version of the cannery data to account for the missing large YFT/BET (when compared to the logsheet) which would provide a more appropriate data set with better coverage to compare with the estimates of purse seine species composition based on observer data (grab samples adjusted for selectivity bias). Logsheets used in the tropical WCPFC purse seine fishery have a specific column for reporting the catch of large yellowfin tuna at the set level. We would therefore expect that reporting of large yellowfin on the logsheet normally has some level of reliability and that the logsheet-based estimate should produce the minimum range estimate of the total catch of large yellowfin tuna (given some levels of non-reporting by vessels). The methodology therefore entails substituting the logsheet-reported trip catch of large yellowfin tuna where it is lacking in the cannery data.

The following data preparation was undertaken:

a) Where the logsheet trip catch of large yellowfin tuna was greater than zero and the cannery receipt data for that trip existed, but (i) did not have any large yellowfin catch, or (ii) the proportion of large YFT was smaller in the cannery data, then the logsheet trip catch of large yellowfin was used as the substitute for the cannery record of large yellowfin tuna. [The same logic was undertaken for data preparation for large bigeye tuna]. When this process was complete, it was necessary to adjust the cannery values for the small fish categories (SKJ, YFT and BET) upwards to align with the total small tuna catch according to the logsheet. In other words, the total small-fish tuna catch reported on the logsheet was apportioned into species/size catch according to the cannery data breakdown and these values were used as the adjusted cannery data values in conjunction with the adjusted large tuna values.
b) In cases where large YFT were reported in the cannery data with a similar proportion to the logsheet, and total cannery catch represented at least 50% of the logsheet-reported trip catch, then all cannery species and size categories where raised according to the total catch from the logsheet.
c) If cases (a) and (b) above were not applicable, then the original cannery data remained unadjusted for that trip.

Figure 3 shows the comparison of matched trip catch between the logsheet and the adjusted cannery data. Figures 4 and 5 show the comparison of species composition of the purse seine catch from different sources, essentially showing the difference in using the raw cannery data without accounting for gaps (Figure 4), with adjusted cannery data (Figure 5), which attempts to account for the gaps as described above.

DISCUSSION AND OBSERVATIONS

The following are observations on information presented herein:

1. Part of the adjustment of the cannery data (e.g. essentially a two-stage raising of cannery trip data to total logsheet tuna catch) was designed to improve the match between cannery and logsheet data and this is evident in comparing Figures 2 and 3. However, there remain some cannery data where it was not possible to raise to the total logsheet tuna catch, as the cannery data represented catch that was too low compared to the total logsheet catch (this is evident in the columns to the right in Figure 3). Further work is required in understanding whether these incomplete cannery receipts can be adequately raised to equate to the total trip catch.
2. In both Figures 4 and 5, the species composition of the WCPFC estimates and the observer data are relatively close, but differ. The difference is due to (i) the observer data are only from those trips that match the cannery data, so a subset of all available observer trips (see Table 2), and (ii) The WCPFC estimates are based on all available observer, but through a model which also takes into account size and species selection bias in the observer data (see Lawson 2010).
3. Figure 4 shows that the original cannery data have species composition for skipjack and yellowfin tuna similar to the logsheet-reported species composition, although the bigeye tuna species composition is closer to the observer and WCPFC estimates. The assumption on the similarity for skipjack and yellowfin tuna in the cannery and logsheet data is (i) the lack of large tuna covered in the available cannery data and (ii) the lack of an adequate breakdown of small yellowfin tuna in the logsheet data. The reason as to why the species composition of the bigeye tuna from cannery data is better aligned to the WCPFC estimates and observer data is not evident at this stage. These findings need further investigation.
4. Figure 5 shows that the adjusted cannery data has a better alignment of species composition for all tuna species with the WCPFC estimates and observer data, particularly in more recent years 2015 and 2016, which could be explained as a result of ISSF conducting audits and advocating the standard species and size categories in company data submissions.
5. The major difference between the cannery and adjusted cannery data (i.e. between Figures 4 and 5) is the change in the species composition of skipjack tuna (downwards) and yellowfin tuna (upwards). The increase in the species composition for yellowfin tuna in the adjusted cannery data is due to the method applied whereby the cannery data were augmented by 'missing' large yellowfin tuna catch (and to a lesser extent large bigeye tuna catch) through the comparison of logsheet and cannery unloadings at the trip level. This increase in the proportion of large yellowfin (and bigeye) tuna in the adjusted cannery data means a compensation occurs in the other species/size classes, and this change has the most effect with the skipjack tuna species composition.
6. In contrast to skipjack and yellowfin tuna, the bigeye tuna species composition for the cannery data (i.e. original cannery data versus adjusted cannery data) did not change significantly between Figures 4 and 5. This could be due to the lack of large bigeye tuna that is not covered in the available cannery data, which has been included in the adjusted cannery data version through logsheet-reported large bigeye tuna catch. This assumption will need to be investigated.

FUTURE WORK

This paper attempts to show how cannery data can be used in the process of validating estimates of the species composition of the purse seine catch. Only 20-25% of the available cannery data account for full trip catch in the matched data, so the work is to identify the cannery data that are considered a representative sample of the trip catch (e.g. accounting for any bias in missing large yellowfin). This work will be ongoing and a better understanding of the representativeness of the cannery data will only improve these insights to the point where, for example, the trends in cannery data species composition can be included in the information presented in Hampton and Williams (2016), for example. The ongoing work with cannery data

would also fit very well under Project 60, with a goal to investigate better methods for comparing cannery and observer data (see Peatman et al., 2017).

The previous section presents some assumptions and proposes further specific investigation (to be undertaken over the coming year), acknowledging that improved coverage of cannery data (i.e. submissions from all processor plants) will obviously improve the usefulness of these data.

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TABLES

Table 1. Typical Cannery Data Size Categories

< 3lbs	(< 1.4 kgs)	SMALL < 20 lbs (~9 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)	LARGE > 20 lbs (~9 kgs)

Table 2. Coverage of matched logsheet/observer/cannery trip data for the WCPFC tropical purse seine fishery (excludes Indonesia, Philippines and Vietnam domestic fisheries).

YEAR	TOTAL TUNA CATCH		
	WCPFC Estimates	Matched Log / Obs / Cannery	%
2013	1,559,892	488,565	31.3%
2014	1,744,898	470,015	26.9%
2015	1,552,804	395,965	25.5%
2016	1,571,947	273,005	17.4%

FIGURES

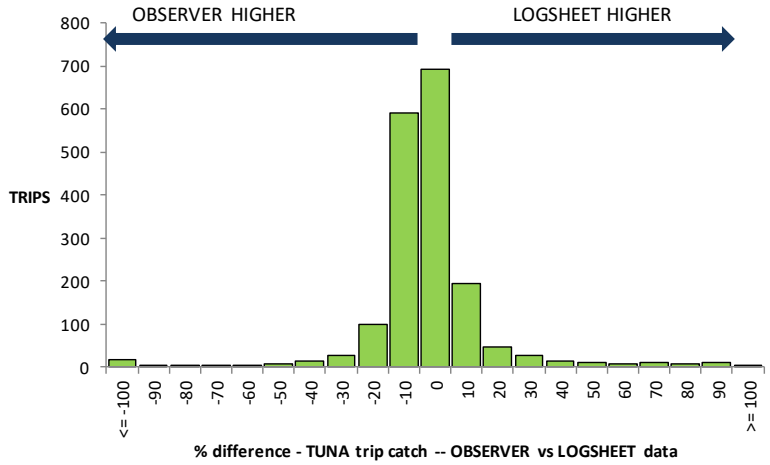

Figure 1. Frequency of the % difference in total TRIP tuna catch reported by OBSERVERS versus LOGSHEETS

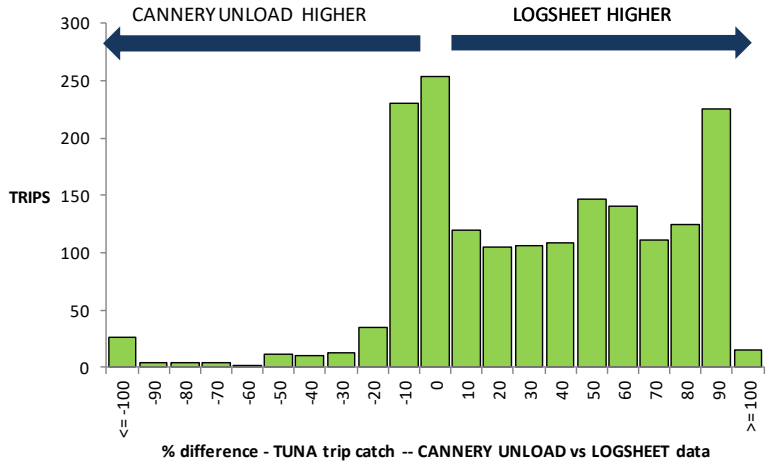

Figure 2. Frequency of the % difference in total TRIP tuna catch reported from consolidated CANNERY RECEIPTS versus LOGSHEETS

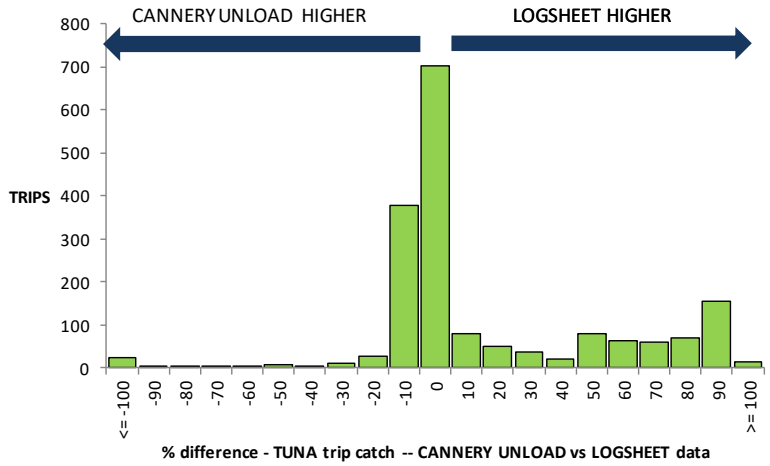

Figure 3. Frequency of the % difference in total TRIP tuna catch reported from adjusted CANNERY RECEIPTS versus LOGSHEETS

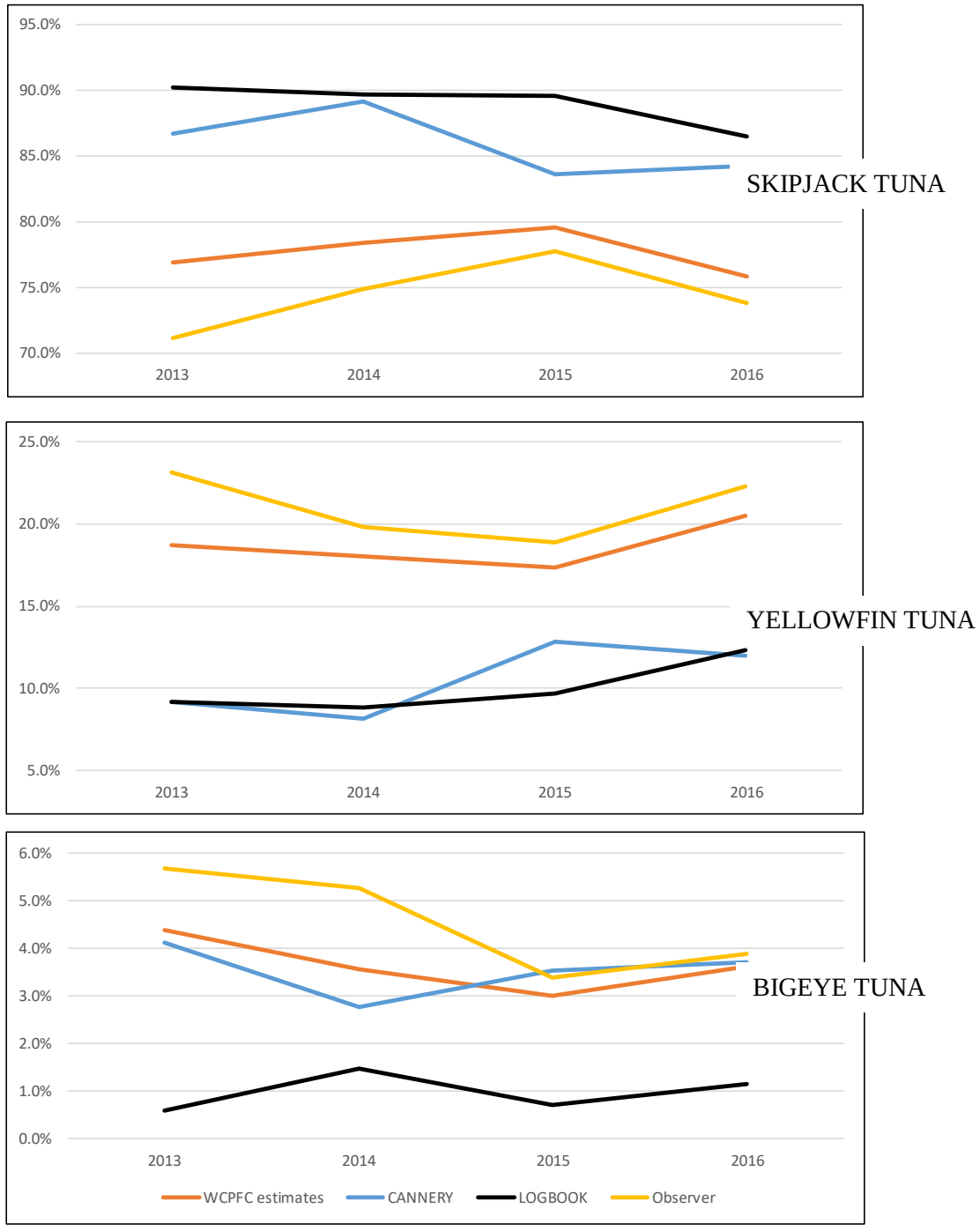

Figure 4. Purse seine tuna species composition by source of data, including unadjusted cannery data.

WCPFC Estimates: Estimates of WCPFC tropical purse seine fishery catch, excluding Indonesia, Philippines and Vietnam domestic fisheries. Catch is estimated according to Lawson 2007, Lawson 2010, Lawson 2013.
Logbook: Unadjusted logbook data for the WCPFC tropical purse seine fishery. Trips matched to observer and cannery data only.
Observer: Observer sample estimates, not adjusted for size and species selectivity. Trips matched to logsheet and cannery data only.
Cannery: Cannery data. Trips matched to logsheet and observer data only.

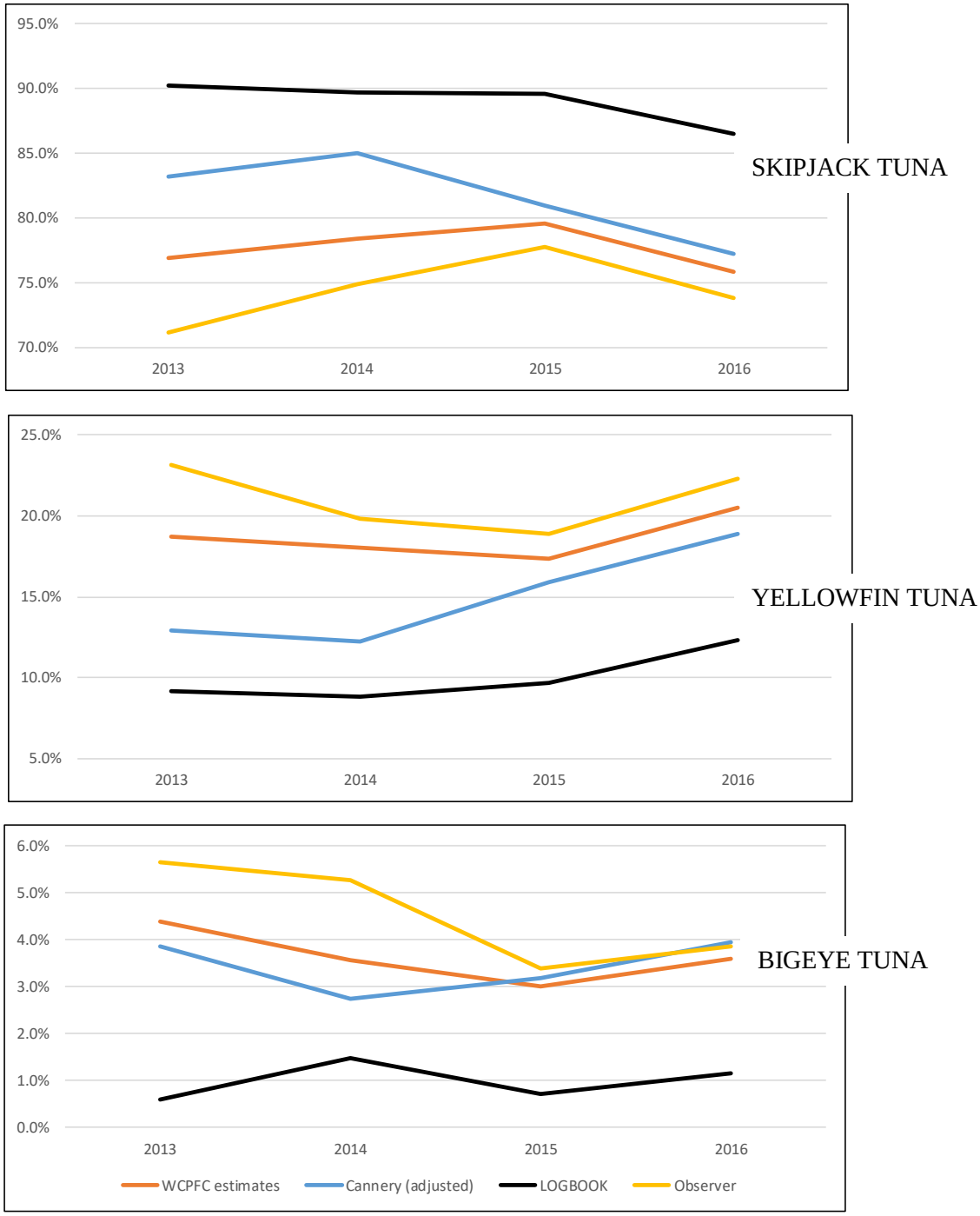

Figure 5. Purse seine tuna species composition by source of data, including <u>adjusted</u> cannery data.

WCPFC Estimates: Estimates of WCPFC tropical purse seine fishery catch, excluding Indonesia, Philippines and Vietnam domestic fisheries. Catch is estimated according to Lawson 2007, Lawson 2010, Lawson 2013.
Logbook: Unadjusted logbook data for the WCPFC tropical purse seine fishery. Trips matched to observer and cannery data only.
Observer: Observer sample estimates, not adjusted for size and species selectivity. Trips matched to logsheet and cannery data only.
Cannery (adjusted): Adjusted cannery data (see section METHODOLOGY above). Trips matched to logsheet and observer data only.