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Species composition in the USA purse seine fishery as estimated by logsheets and cannery receipts¹

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Abstract

This paper provides a preliminary analysis on the potential use of cannery receipt data for estimating species composition in the USA western Pacific purse seine fishery. Total tuna catches recorded on logsheets by year were very close (0.5% more in 2014 and 2.8% more in 2015) to those shown by cannery receipts indicating that vessel operators accurately record total catches on daily logsheets. Species composition differed with cannery receipts having a lower percentage of skipjack and higher percentages of both yellowfin and bigeye tuna than reported on logsheets. Cannery data provide catch by species and size categories, and annual trends are illustrated for 2014 and 2015 for size categories of <3 lbs (<1.4 kgs), 3.0-7.5 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), and 20 lbs and up (9 or 10 kgs and up). Cannery catches for the USA western Pacific purse seine fleet were compared to SPC-OFP (2016) catch estimates which are conducted with a full species adjustment using observer sampling data corrected for grab sample selection. The SPC-OFP (2016) estimates are lower for skipjack and higher for yellowfin and bigeye tuna. Recommendations are provided to continue analyses with logsheet, observer, cannery, and port sampling data to provide robust estimates of purse catches of key tuna species in the western Pacific.

Background

Several significant issues have been previously identified with determining robust estimates of tuna species composition in the purse seine fishery in Western and Central Pacific Fisheries Commission (WCPFC) Convention Areas. Current regionally accepted estimation methods rely on the use of observer samples (Lawson 2007, 2013, and 2014, Hampton and Williams 2017). The Secretary of the Pacific Community Oceanic Fisheries Program (SPC-OFP) estimates purse seine composition for skipjack, yellowfin, and bigeye tuna according to four methodologies (Hampton and Williams 2017):

Method 1: Unadjusted logsheet data: Total catches are disaggregated by species according to the species catch proportions in logsheet data.

Method 2: YFT-BET adjusted: Total catches are disaggregated into skipjack and yellowfin+bigeye according to the unadjusted logsheet data. The yellowfin+bigeye component is then split into separate yellowfin and bigeye tuna components using uncorrected observer grab sampling data in an analysis of variance (ANOVA) or General Additive Model (GAM) procedure (Lawson 2007).

Method 3: Full species adjustment using observer sampling data corrected for grab sample selection bias and total catches are disaggregated into skipjack, yellowfin, and bigeye using the method described as “Case D” in Lawson (2013).

Method 4: Full species adjustment using uncorrected observer data: This method is identical to method 3, except that observer grab sampling data have not been corrected for grab sample selection bias.

Hampton and Williams (2017) indicate that Method 3 continues to be the current SPC-OFP method of choice for purse seine catch estimation for stock assessment and catch reporting.

Lewis and Williams (2016) described the potential use of cannery-generated data for validating the estimates of the purse seine catch by species. They summarized cannery receipt data from processing companies that participate in the International Seafood Sustainability Foundation (ISSF). Complete data were available for 2013 and 2014 calendar years (inclusive) and summarized to show comparisons of the purse seine catch by species and size categories from observer and cannery-generated data. The main conclusions of the Lewis and Williams (2016) study were:

- 1) 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
- 2) The cannery is recording species composition for all relevant size categories.

In 2014, the National Marine Fisheries Service, Pacific Islands Fisheries Science Center assumed data management for the USA purse seine fishery in the Pacific Ocean from the Southwest Fisheries Science Center. Under domestic regulations, data collected by the USA purse seine operators from the purse fishery include:

- 1) Regional Purse Seine Logsheets (RPLs) which are completed each day within a purse seine trip,

- 2) Unloading logsheet (ULs) which reflect the unloadings when the vessel offloads or transships in port and,
- 3) Cannery receipts or Final Out-turns (FOT) which are provided by the processor(s), via the vessel operator for each purse seine trip.

Logsheets and ULs are typically submitted by vessels operators in a timely manner soon after the vessel lands in port., These are consolidated by NMFS personnel and provided by law to the Forum Fisheries Agency (FFA). Cannery receipts may take up to six months to obtain as the catch for each trip may be transshipped and distributed to multiple canneries. Vessel operators provide the cannery information to NMFS which is then forwarded to FFA. In these transmittals NMFS personnel may provide a copy to SPC-OFI if data are provided electronically (all data are submitted in hard copy under the current regulations).

The purpose of this study was to compare tuna catch estimates from daily catch and effort logsheets and cannery receipts for the USA WCPO purse seine fishery. Lewis and Williams (2016) compared species composition and catch estimates based on observer and cannery data; however, we did not conduct a comparison with observer data in this study.

Logsheets and Cannery receipts

Cannery receipts were assigned as year 2014 or 2015 based on the year that the trip departed. Aggregate logsheet catches were merged with cannery landings reports for each trip. Using the criterion to assign year of fishing, the US purse seine fleet conducted 325 and 274 trips in 2014 and 2015, respectively (Table 1). Data were summarized for logsheets and cannery receipts in Tables 2 and 3. Data were summarized for skipjack, yellowfin, and bigeye tuna from logsheets. From cannery receipts, data were summarized for skipjack, yellowfin and bigeye tuna, and a species category of both skipjack and yellowfin tuna. There was also a “mixed” category that was used if a receipt had fish described with some variation of the following: broken, damaged, others, (raw) rejects, smashed, or scrap. Total tuna catches reported on logsheets were very close (0.5% more in 2014 and 2.8% more in 2015) to cannery receipts indicating that vessel operators accurately record total catches on logsheets.

However, the species composition differed when cannery receipts had a lower percentage of skipjack (cannery – 83.6% in 2014 and 83.5% in 2015, logsheets – 90.2% in 2014 and 91.2% in 2015) and higher percentages of yellowfin (cannery – 10.0% in 2014 and 8.8% in 2015, logsheets – 8.9% in 2014 and 7.8% in 2015) and bigeye (cannery – 1.3% in 2014 and 1.5% in 2015, logsheets – 0.9% in 2014 and 1.0% in 2015) tuna (Tables 2 & 3). The mean difference between trips with total tuna catch on logsheets and cannery receipts was low (0.21% in 2014 and 0.25% in 2015). There were 10 trips in 2014 (Figure 1) and 13 trips in 2015 (Figure 2) in which the difference was greater than 20% between logsheets and cannery receipts data. Inspection of these 23 trips indicated that differences occurred due to having fish onboard after partial unloading and trips that contained partial cannery receipts. Data were then filtered to remove any trips that had catch differences >20%, and the resulting species compositions were similar to using all trips (Tables 3 & 4).

Cannery data provide catch by species and size categories, such as <3 lbs (<1.4 kgs), 3.0-7.5 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), and 20 lbs and up (9 or 10 kgs and up). Tables 4 to 7 indicate species catches and percentages by the five size categories for 2014 and 2015. The 7.5-20 lbs size category dominates the cannery landings for skipjack and bigeye tuna (Tables 4-7, Figures 3 & 4). The 20 lbs and up size category dominates the cannery landings for yellowfin tuna (Tables 4-7, Figures 3 & 4).

Cannery receipts have species categories not assigned to skipjack, yellowfin, or bigeye tuna, such as skipjack/yellowfin and mixed (no breakdown). Cannery receipts for unassigned species were 5.1% in 2014 and 0.5% in 2015. Raised catches were estimated by applying the cannery receipt percentages by skipjack, yellowfin, and bigeye tuna to the two unknown species categories. The total raised catches by skipjack, yellowfin, and bigeye tuna are provided in Table 8.

To compare with the cannery catches for the USA fleet, the SPC-OFP (2016) catch estimates for the fleet are illustrated in Table 9. These catch estimates are based on Method 3 which results in a full species adjustment using observer sampling data corrected for grab sample selection.

A few differences are apparent between the SPC-OFP (2016) estimates and this study. The total catches are higher in the SPC-OFP (2016) estimates which may result from the definition of year, whereby cannery receipts were assigned to a specific year based on trip departure. SPC-OFP (2016) estimates are lower for skipjack (83.9% in 2014, 87.4% in 2015) than in this study (88.3% in 2014, 89.3% in 2015). SPC-OFP (2016) estimates are higher for yellowfin (12.8% in 2014, 10.3% in 2015) and bigeye tuna (3.2% in 2014, 2.3% in 2015) than in this study (yellowfin - 10.3% in 2014, 9.2% in 2015, bigeye – 1.4% in 2014 and 1.6% in 2015).

Discussion and Conclusions

This study documents that cannery receipts for the USA western Pacific purse seine fleet are largely in congruence with total catches for each trip as compared to that reported on daily logsheets. A next step would be analyzing observer data for each trip and provide a possible explanation for species composition differences between cannery receipts and SPC-OFP methodologies. Lewis and Williams (2016) matched 11% of trips that had logsheets, observer, and cannery data when the difference between cannery submission and logsheet total catch was <20%. We found much lower numbers of trips greater than the 20% level when comparing logsheets and cannery reports. If observer data are incorporated, we would expect a higher percentage of matching trips for the USA fleet as: 1) observer coverage is ~100%, 2) cannery receipts represent both participating and non-participating ISSF canneries, and 3) this study showed 95-97% of trips that had logsheets and cannery data where the differences in total catch according to logsheets and cannery data are <20%.

Species composition differences between this study and the SPC-OFP methodologies may result from under-reporting of species among certain size categories in cannery receipts. This study had lower yellowfin and bigeye percentages in 2014 and 2015 than SPC-OFP (2016). These lower percentages may occur if some canneries do not provide reliable estimates for certain size categories, especially in the 0-7.5 lbs range. Thus, if this is not accounted for by other canneries, the cannery (FOT) data will be under-

reported. The individual cannery analysis could be supplemented with knowledge from the world-wide ISSF cannery study (Lewis and Williams 2016) which documented size categories which may be accurately weighed at individual canneries and which size categories may be biased for species composition. Understanding the size categories which accurately reflect species composition at individual canneries, the WCPFC Scientific Committee could consider endorsement of an alternative methodology to estimate species composition in the purse seine fishery by using the percentage breakdown of the canneries known to accurately estimate catch to species and size categories.

An additional step is to analyze observer data with alternate species composition information. There is a long history of port sampling of the USA fleet at Pago Pago, American Samoa. The protocol is to sample individual wells that contain catch from a known set type – that being unassociated or associated. These port sampling estimates of species composition could be linked to observer sets to further understand potential biases resulting from estimates of species composition.

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Table 1. Comparison between matched purse seine Regional Purse Seine Logsheets (RPLs) and Final Out-turns (FOTs, Cannery receipts) for the USA purse seine fleet in the WCPFC Convention Area for 2014 and 2015 calendar years.

Description	# Trips	% of all cannery data	Reason difference between matched logsheet and Cannery data is >20%
Year 2014 - # of matched trips Logsheet and Cannery data	325		
Year 2014 - # of matched trips Logsheet and Cannery data with difference between Cannery submission and logsheet total catch is < 20%	315	97%	7 trips had fish onboard after partial unloading. 3 trips have partial FOTs
Year 2015 - # of matched trips Logsheet and Cannery data	274		
Year 2015 - # of matched trips Logsheet and Cannery data with difference between Cannery submission and logsheet total catch is < 20%	261	95%	1 trip had fish onboard after partial unloading. 12 trips have partial FOTs. 1 trip had a very low catch and the difference was >20%.

Table 2. Year 2014 fish catch comparison between purse seine Regional Purse Seine Logsheets (RPLs) and Final Out-turns (FOTs, Cannery receipts) for the USA purse seine fleet in the WCPFC Convention Area.

Description	Metric tons	% of total retained tuna
Logsheets total retained	299,151.6	
Logsheets total retained SKJ, YFT and BET	299,130.9	
Logsheets total retained SKJ	269,845.5	90.21
Logsheets total retained YFT	26,663.4	8.91
Logsheets total retained BET	2,621.9	0.88
Cannery total processed	297,536.4	
Cannery total processed SKJ, YFT, BET, MIXX and SKJ/YFT	297,524.9	
Cannery total processed SKJ	248,930.8	83.66
Cannery total processed YFT	29,780.5	10.01

Cannery total processed BET	3,752.0	1.26
Cannery total processed MIXX	1,180.1	0.39
Cannery total processed SKJ/YFT	13,881.4	4.66
Catches for when the difference between Cannery submission and logsheet total catch is < 20%		
Logsheet total retained	290,192.0	
Logsheet total retained SKJ, YFT and BET	290,172.0	
Logsheet total retained SKJ	262,869.0	90.59
Logsheet total retained YFT	24,737.0	8.52
Logsheet total retained BET	2,565.9	0.88
Cannery total processed	291,137.6	
Cannery total processed SKJ, YFT BET, MIXX and SKJ/YFT	291,126.1	
Cannery total processed SKJ	243,927.5	83.78
Cannery total processed YFT	28,485.64	9.78
Cannery total processed BET	3,712.02	1.27
Cannery total processed MIXX	13,881.41	4.76
Cannery total processed SKJ/YFT	1,119.45	0.38

Table 3. Year 2015 fish catch comparison between purse seine Regional Purse Seine Logsheets (RPLs) and Final Out-turns (FOTs, Cannery receipts) for the USA purse seine fleet in the WCPFC Convention Area.

Description	Metric tons	% of total retained tuna
Logsheet total retained	238,101.0	
Logsheet total retained SKJ, YFT and BET	238,068.9	
Logsheet total retained SKJ	217,132.0	91.20
Logsheet total retained YFT	18,484.9	7.76
Logsheet total retained BET	2,451.9	1.02
Cannery total processed	231,674.3	
Cannery total processed SKJ, YFT BET, MIXX and SKJ/YFT	231,672.1	
Cannery total processed SKJ	193,413.8	83.48
Cannery total processed YFT	20,326.1	8.77
Cannery total processed BET	34,18.4	1.47
Cannery total processed MIXX] 796.3	0.34

Cannery total processed SKJ/YFT	13,717.4	5.92
Catches for when the difference between Cannery submission and logsheet total catch is < 20%		
Logsheet total retained	223,555.2	
Logsheet total retained SKJ, YFT and BET	223,523.4	
Logsheet total retained SKJ	204,122.2	91.32
Logsheet total retained YFT	17,117.1	7.65
Logsheet total retained BET	2,284.1	1.02
Cannery total processed	224,582.3	
Cannery total processed SKJ, YFT BET, MIXX and SKJ/YFT	224,580.2	
Cannery total processed SKJ	187,831.4	83.63
Cannery total processed YFT	19,302.0	8.59
Cannery total processed BET	3,279.7	1.46
Cannery total processed MIXX	762.2	0.33
Cannery total processed SKJ/YFT	13,404.8	5.96

Table 4. Weight (mt) by size category and species from 2014 by cannery receipts (Final Out-turns, FOTs) for the USA purse seine fleet in the WCPFC Convention Area.

Species	Cannery data size categories						No breakdown	Total cannery landings
	<3 lbs	3.0-4.0 lbs	4.0-7.5 lbs	7.5-20 lbs	20 lbs and up	Total with size categories		
SKJ	25,501.9	21,047.0	65,505.7	118,101.9	1,394.8	231,551.4	12,376.0	243,927.5
YFT	270.9	435.2	1,156.4	7,708.8	17,430.2	27,001.7	1,483.8	28,485.6
BET	25.2	88.7	716.6	1,768.2	1,060.4	3659.2	52.7	3,712.0
SKJ/YFT	2,024.9	2,538.2	9,318.2			13,881.3	0.03	13,881.4
MIXX							1,119.4	1,119.4
Total	27,823.1	24,109.1	76,697.0	127,578.9	19,885.5	276,093.9	15,037.1	291,126.1

Table 5. Percentage (%) by size category and species from 2014 by cannery receipts (Final Out-turns, FOTs) for the USA purse seine fleet in the WCPFC Convention Area.

Species	Cannery data size categories						No breakdown	Total cannery landings
	<3 lbs	3.0 -4.0 lbs	4.0-7.5 lbs	7.5-20 lbs	20 lbs and up	Total with size categories		
SKJ	8.760%	7.230%	22.501%	40.567%	0.479%	79.536%	4.251%	83.788%
YFT	0.093%	0.149%	0.397%	2.648%	5.987%	9.275%	0.510%	9.785%
BET	0.009%	0.030%	0.246%	0.607%	0.364%	1.257%	0.018%	1.275%
SKJ/YFT	0.696%	0.872%	3.201%			4.768%		4.768%
MIXX							0.385%	0.385%
Total	10.1%	8.7%	27.8%	46.2%	7.2%	94.8%	5.1%	100%

Table 6. Weight (mt) by size category and species from 2015 by cannery receipts (Final Out-turns, FOTs) for the USA purse seine fleet in the WCPFC Convention Area.

Species	Cannery data size categories						No breakdown	Total cannery landings
	<3 lbs	3.0 -4.0 lbs	4.0-7.5 lbs	7.5-20 lbs	20 lbs and up	Total with size categories		
SKJ	11,064.5	16,581.7	51,761.7	107,884.3	96.4	187,388.7	442.7	187,831.4
YFT	129.7	219.4	1,000.1	4,143.6	13,807.0	19,299.8	2.2	19,302.0
BET	16.9	52.2	787.2	1,400.1	1,019.7	3,276.0	3.7	3,279.7
SKJ/YFT	1,206.2	2,389.9	9,801.7			13,397.7	7.2	13,404.9
MIXX							762.2	762.2
Total	12,417.2	19,243.3	63,350.6	113,428.0	14,923.1	223,362.3	1,217.9	224,580.2

Table 7. Percentage (%) by size category and species from 2015 by cannery receipts (Final Out-turns, FOTs) for the USA purse seine fleet in the WCPFC Convention Area.

Species	Cannery data size categories						No breakdown	Total cannery landings
	<3 lbs	3.0 -4.0 lbs	4.0-7.5 lbs	7.5-20 lbs	20 lbs and up	Total with size categories		
SKJ	4.927%	7.383%	23.048%	48.038%	0.043%	83.440%	0.197%	83.637%
YFT	0.058%	0.098%	0.445%	1.845%	6.148%	8.594%	0.001%	8.595%
BET	0.008%	0.023%	0.351%	0.623%	0.454%	1.459%	0.002%	1.460%
SKJ/YFT	0.537%	1.064%	4.364%	0.000%	0.000%	5.966%	0.003%	5.969%
MIXX							0.339%	0.339%
Total	5.5%	8.6%	28.2%	50.5%	6.6%	99.5%	0.5%	100%

Table 8. Raised estimates by species and year for the USA purse seine fleet in the WCPFC Convention Area.

Year	Species	Mt in size categories	Mt with no breakdown	Total with applied percentages of SKJ:YFT:BET	Annual percentages of SKJ:YFT:BET
2014	SKJ	231,551.4	12,376.0	257,084.1	88.307%
2014	YFT	27,001.7	1,483.8	29,979.1	10.298%
2014	BET	3659.2	52.7	4,062.7	1.396%
2014	SKJ/YFT	13,881.3	0.03		
2014	MIXX		1,119.4		
2014	Total			291,126.1	
2015	SKJ	187,388.7	442.7	200,432.8	89.248%
2015	YFT	19,299.8	2.2	20,643.3	9.192%
2015	BET	3,276.0	3.7	3,504.1	1.560%
2015	SKJ/YFT	13,397.7	7.2		
2015	MIXX		762.2		
2015	Total			224,580.2	

Table 9. Tuna species catch for the U.S.A fleet in 2014 and 2015 for the USA purse seine fleet in the WCPFC Convention Area as reproduced from SPC-OFP WCPFC13-2016-IP04 CMM Tropical Tunas data summary.

Fleet	Year	SKJ mt	SKJ %	YFT mt	YFT %	BET mt	BET %	Total mt
USA	2014	250,516	83.9%	38,317	12.8%	9,678	3.2%	298,511
USA	2015	218,970	87.4%	25,858	10.3%	5,674	2.3%	250,502

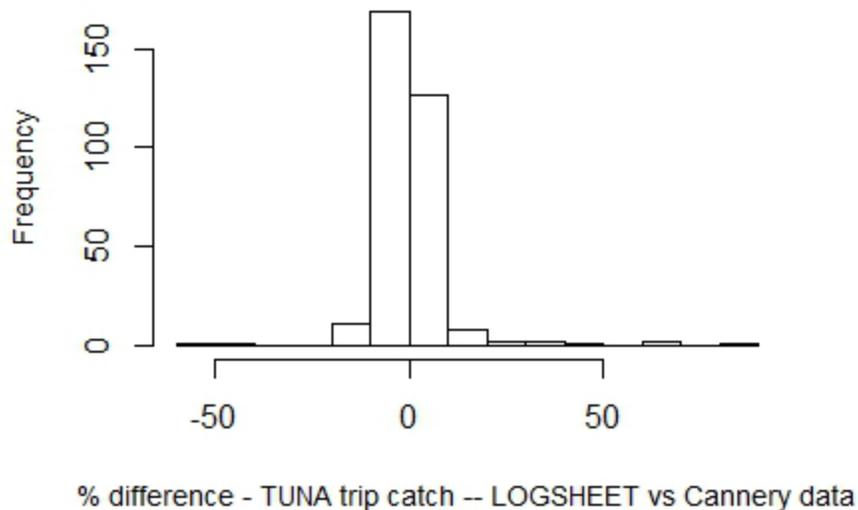


Figure 1. Frequency of the percentage difference in total trip tuna catch for 2014 as reported by Regional Purse Seine Logsheets (RPLs) and Final Out-turns (FOTs, Cannery receipts). Negative values indicate higher catches on RPLs, positive values indicate higher catches on FOTs.

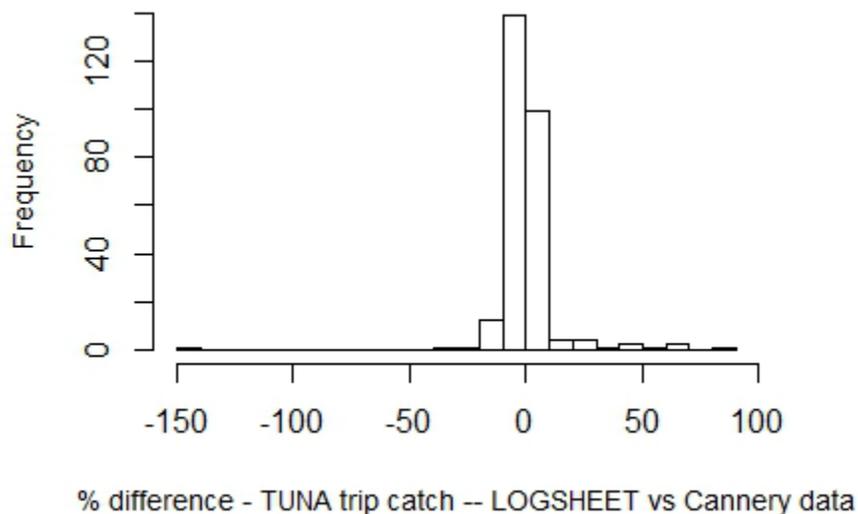


Figure 2. Frequency of the percentage difference in total trip tuna catch for 2015 as reported by Regional Purse Seine Logsheets (RPLs) and Final Out-turns (FOTs, Cannery receipts). Negative values indicate higher catches on RPLs, positive values indicate higher catches on FOTs.

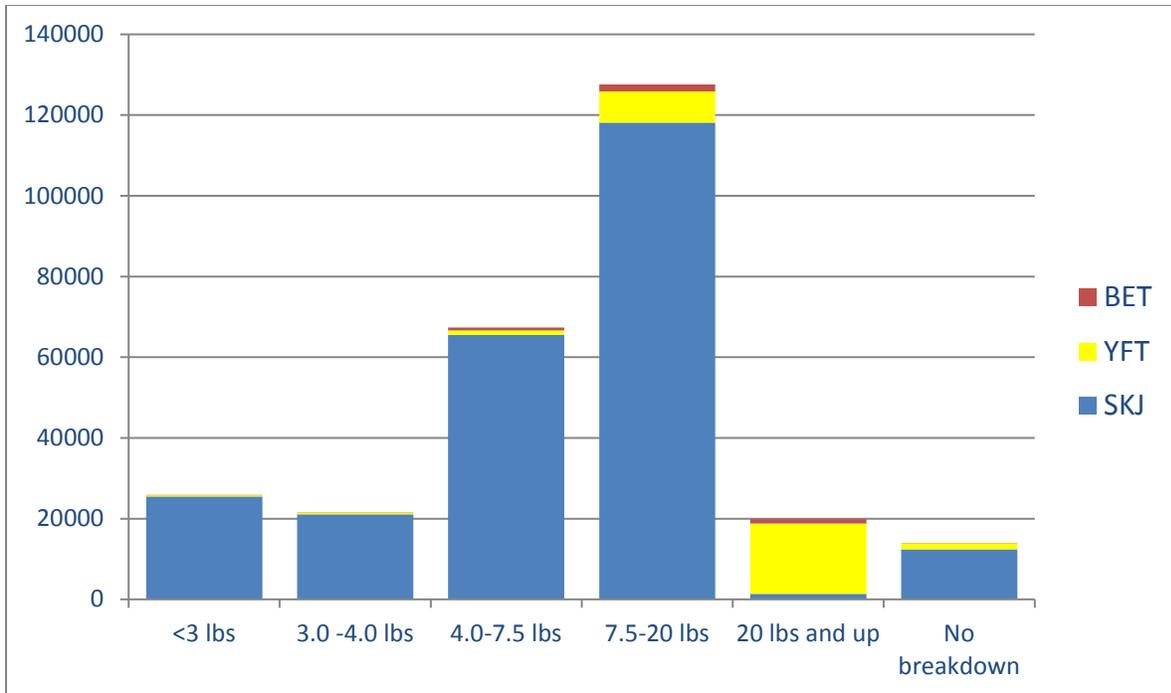


Figure 3. Composition of USA purse seine catch in 2014 by skipjack, yellowfin, and bigeye tuna and size composition according to available cannery data.

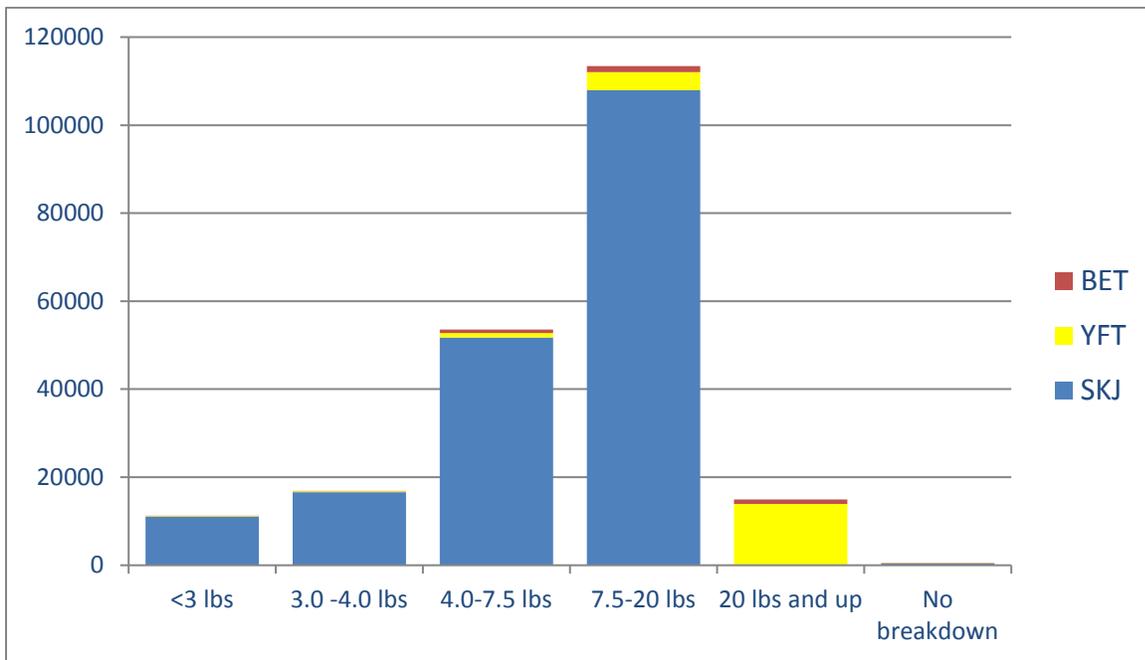


Figure 4. Composition of USA purse seine catch in 2015 by skipjack, yellowfin, and bigeye tuna and size composition according to available cannery data.

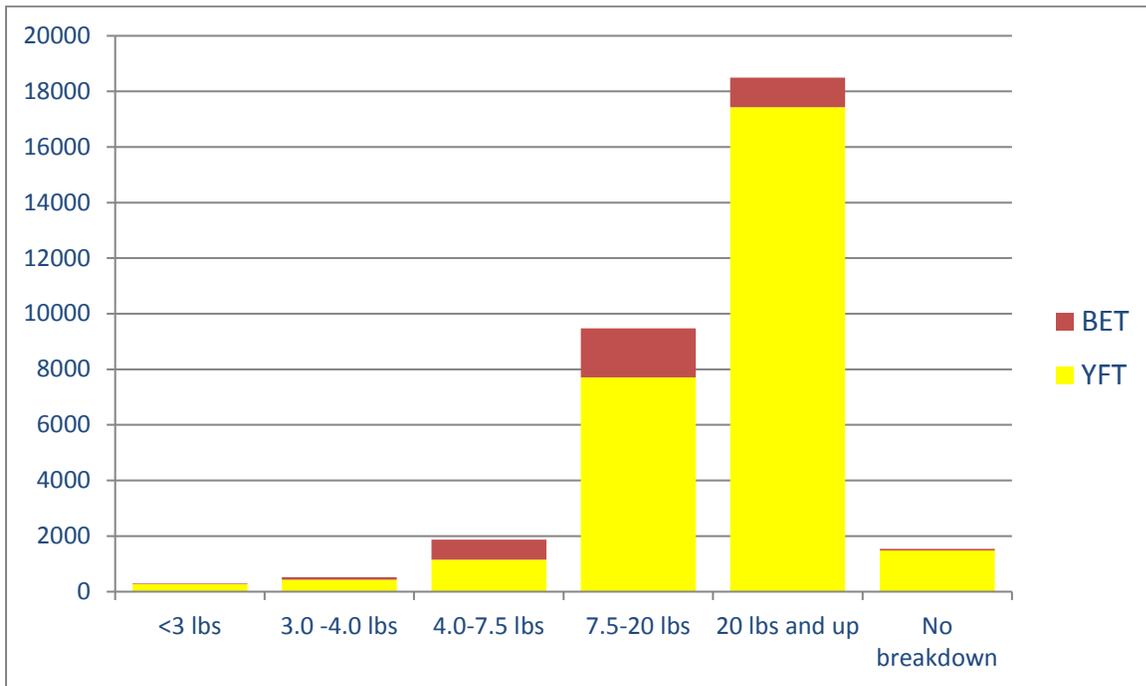


Figure 5. Composition of USA purse seine catch in 2014 by yellowfin and bigeye tuna and size composition according to available cannery data.

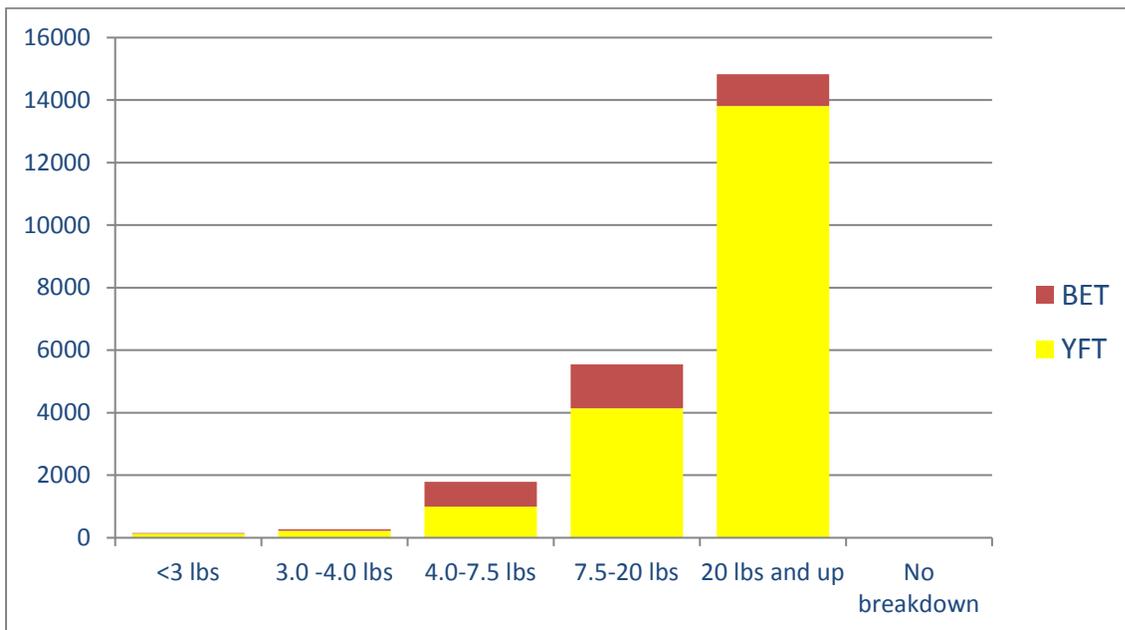


Figure 6. Composition of USA purse seine catch in 2015 by yellowfin and bigeye tuna and size composition according to available cannery data.