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National Report on Canadian Tuna and Tuna-like Fisheries in the North Pacific Ocean in 2017

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SUMMARY

Canada has one fishery for highly migratory species in the Pacific Ocean, a troll fishery targeting juvenile north Pacific Albacore Tuna (*Thunnus alalunga*). Category I, II, and III data from the 2017 fishing season are summarized in this report. The Canadian fleet consisted of 121 vessels and fishery continued to be largely coastal in its operations in 2017. However, fishing effort is more widely distributed in 2017 than in the past few years. Five Canadian vessels entered the north Pacific WCPFC convention area, and two vessels entered the waters off the Southern California coast and adjacent high seas to fish albacore in 2017. Provisional 2017 estimates of catch and effort are 1,831 metric tonnes (t) and 4,978 vessel-days, respectively, which represent a 36% decrease in catch and 7.1% decrease in effort relative to 2016. Both catch and catch rate are close to the lowest levels since 1995. About 93% of the catch occurred in a sea surface temperature band of 15-18 °C. Forty-two (42) vessels measured 10,517 fork lengths on 72 trips in 2017 for a sampling rate of 3.6% of the reported catch. Fork lengths (FL) ranged from 50 to 96 cm and were dominated by a single mode single mode at 66-68 cm FL.

1.0 INTRODUCTION

The Canadian fishery for highly migratory species uses troll gear with jigs to target juvenile north Pacific Albacore (*Thunnus alalunga*) in the surface waters of the Pacific Ocean. The majority of catch and effort by the Canadian fleet occurs within the exclusive economic zones (EEZ) of Canada and the United States. Access to the United States EEZ is permitted through a bilateral Treaty, which provides for access by Canadian-flagged and licensed vessels to fish for Albacore and to land Albacore at designated ports. Some of the larger Canadian vessels follow Albacore into offshore waters and occasionally fish in the central and western Pacific Ocean. The most recent management regulations for Canadian vessels fishing Albacore Tuna cover a 3 year period from 01 April 2017 to 31 March 2019 are documented in the Albacore Tuna Integrated Fisheries Management Plan (IFMP) http://waves-vagues.dfo-mpo.gc.ca/Library/40597386.pdf. Historically, the most effort and catch for north Pacific Albacore has occurred from early July to the end of October**.**

This report summarizes Category I (annual catch and effort), Category II (monthly 1° x 1° catch and effort), and Category III (bycatch, catch size composition) data for vessels active in the Canadian north Pacific Albacore Tuna troll fishery in 2017.

2.0 DATA SOURCES

Data on Albacore Tuna catch and effort from 1995 through to the present are compiled from hail records, logbooks, and sales slips and stored in the Canadian Albacore Tuna Catch and Effort Relational Database (Stocker et al. 2007). This database contains the best available estimates of annual catch and effort by geographic zone (Canadian, US, and high seas waters) for the Canadian fishery. All Canadian fishing vessels are required to hail (call) a third party service provider when they intend to start fishing and stop fishing, and when they change fishing zones. Canadian vessels must also carry logbooks in which daily position, catch and effort (latitude, longitude, number of fish, estimated weight) are recorded for Albacore Tuna and non-target species. These data have the highest temporal and spatial resolution and are obtained when logbooks are returned in November after the fishing season is completed. The third data source, sales slips, record the weight of Albacore Tuna landed and bought by domestic buyers and provide the most accurate estimates of Albacore Tuna catch in weight since these data are the basis for payment to harvesters (Stocker et al. 2007). Logbooks and sales slips from domestic buyers (plus trans-shipment slips if applicable) are forwarded for entry into the Albacore Tuna catch database (Stocker et al. 2007).

Fork length data are collected through an on-board sampling program initiated in 2009, with a sampling goal of 1% of the reported catch. Harvesters record the lengths of the first 10 Albacore landed daily to randomize measurements. Size composition data were collected by port samplers from a portion of the Canadian catch landed in United States ports between 1981 and 2008. Size data reported by Canada since 2009 are from the domestic on-board sampling program only.

The fishery data provided in this report were taken from Canadian tuna database version 18.03.21. Figures up to and including 2016 are considered definitive and are derived from a reconciliation of logbook data (best estimates of effort, catch in pieces, and geographic location) and sales slip (best estimate of catch weight) data (Stocker et al. 2007). The 2017 data are preliminary at this time.

3.0 AGGREGATED CATCH AND EFFORT DATA

3.1 Catch

The preliminary estimate of the Canadian Albacore Tuna catch in 2017 is 1,831 metric tons (t), which is a 36% decrease relative to catch in 2016 (Table 1) and is approximately as low as the lowest annual catch in 1995-2016 (Figure 1). The total catch by the Canadian troll fishery has ranged from 1,761 t in 1995 to 7,857 t in 2004 and averaged 5,061 ± 1,647 t (± sd) since 2003, the period when logbook coverage has exceeded 90% of all vessels participating in this fishery. The 2017 catch was primarily distributed among United States coastal waters (75.0%), Canadian coastal waters (11.2%), and adjacent high seas waters (10.8%). The remaining 3.0% of the catch was from the north Pacific WCPFC convention area. Forty-five (45) Canadian vessels entered the US EEZ and fished in 2017, as permitted according to the bilateral Treaty.

The number of Albacore released in 2017 was 545 fish, almost the same as in 2016 (Table 2). However, the mean weight of released albacore was 3.05 kg in 2017, lower than the mean weight of 3.80 kg in 2016. Albacore are released because they are below a threshold size of about 3.18 kg (7 lbs), which is considered the minimum marketable size. The weight of released fish is not included in Table 1, which records retained catch only.

3.2 Effort

The Canadian Albacore Tuna troll fleet consisted of 121 unique vessels in 2017, representing a 20.4% decrease in participation relative to 2016 and well below the average participation rate of 172 vessels since 2003 (Table 1). The 2017 estimate of fishing effort is 4,978 v-d and is a 7.1% decrease in effort relative to 2016 (Table 1; Figure 1). Fishing effort in 2017 was split between Canadian coastal waters (27.0%), United States coastal waters (57.6%), adjacent high seas waters (13.4%), and WCPFC convention area (2.0%). Annual fishing effort has ranged between 4,320 v-d in 1997 and 10,021 v-d in 2001, averaging 6,734 ± 1,539 v-d since 2003.

3.2 Catch Rate

Catch rate is expressed as catch per unit effort (CPUE). Catch rate in 2017 is lower than in 2016, and catch rate in 2016 is lower than in 2015. Catch rate in 2017 is only slightly higher than the lowest one observed in 1995 (Figure 1).

4.0 SPATIAL DISTRIBUTION OF CATCH AND EFFORT DATA

The Canadian troll fleet operated primarily in the Canadian and US EEZs, where about 85% of the 2017 fishing effort and catch occurred. This coastal distribution is consistent with the pattern of operation observed in the last decade. However, the proportion of effort and catch occurring within United States EEZ waters is higher in 2017 (58% and 75%, respectively) than in 2016 (35% and 44%, respectively). The Canadian troll fleet operation is also more widely distributed in 2017 than in 2016. Two Canadian vessels fished in the coastal waters off California and adjacent high seas waters, and five Canadian vessels fished in the WCPFC convention area. No Canadian vessels fished in these waters in 2016.

Monthly effort and catch concentrated in the waters of the US EEZ in June and July, and started to shift towards the Canadian EEZ in August (Figures 2 and 3). Some effort and catch were distributed in the high seas and the WCPFC convention area in August, September and October.

Albacore were caught in waters with sea surface temperatures ranging from 12 to 22 °C in 2017, but 93% of the fish were harvested in waters within the15-18 °C temperature band (Figure 4).

Catch rates have two peaks in 2017 (Figure 5). The first peak occurred in the period of last 10 days of June, and the second peak appeared in mid-August. Catch rates in June were about the same as the historical average. Catch rates from the beginning of July to mid-October were below the lower bound of the 95% confidence interval for the historical average CPUE. Catch rate appeared to be about the same as the historical average just before the termination of the 2017 fishery. This rate was, however, calculated based only on catch data from one vessel fishing for just four days at the ending period. Low catch rates contribute to the very low catches of albacore by the Canadian fishery in 2017.

5.0 BIOLOGICAL DATA

5.1 By-Catch

Reported by-catch was 19 fish and five species in 2017 (Table 3), of which 47% were retained. Yellowtail (*Seriola lalandi*) was the most commonly retained species. One shortfin Mako Shark (*Isurus oxyrinchus*) and one Pacific Bluefin (*Thunnus orientalis*) were also retained. Blue Shark (*Prionace glauca*) and Yellowfin (*Thunnus albacares*) were released in 2017. Total weight of all retained by-catch is estimated to be approximately 56 kg and total estimated weight of released by-catch is 43 kg.

5.2 Biological

Forty-two (42) vessels measured 10,517 fork lengths on 72 trips in 2017 (Figure 6), resulting in measurements from 3.6% of the reported catch. The majority of measurements are of fish caught in the United States EEZ (56.8%), followed by the Canadian EEZ waters (22.2%) and the high seas (21.0%).

Albacore in the Canadian catch ranged from 50 to 96 cm fork length (FL) in size (Figure 6) and are dominated by a single mode at 66-68 cm FL. Albacore caught in the Canadian EEZ has the highest mean fork length (71.6 cm), and fish captured in the United States EEZ has a higher mean fork length (68.4 cm) than in the high seas and the WCPFC convention area (67.3 cm). Albacore harvested in June has a smaller mean fork length than those caught in July or August, which were smaller, on average, than fish captured in September or October (Figure 7).

6.0 RESEARCH

A study was conducted to examine correlations between albacore catch rates from the Canadian fishery and two climatic indices, the North Pacific Gyre Oscillation (NPGO) and the Pacific Decadal Oscillation (PDO) (Zhang 2018). The NPGO and the PDO appear to combine to control low-frequency upwelling and alongshore transport dynamics in the North Pacific sector (Di Lorenzo et al. 2013). The NPGO also closely reflected inter-annual variations in ocean nutrient (Di Lorenzo et al., 2008). As a result, the NPGO may have a positive influence on the survival of small albacore. A positive and significant correlation was found between the catch rates and the

NPGO indices with 4 or 5 years in a time lag. However, the NPGO only explains about 35% variations in the catch rates. Correlations between catch rates and the PDO indices appeared to be negative but not statistically significant.

7.0 DISCUSSION

There are two distinctive features in the 2017 Canadian troll fishery. Both catch and catch rate in 2017 are very low, similar to the lowest levels since 1995. Annual means of the NPGO indices have been decreasing since 2013. This may have a negative impact on abundance of albacore harvested by the Canadian fishery. However, the NPGO may only explain about 35% of the variation in catch rates. The factor(s) regulating the abundance of these albacore are unknown.

Canadian harvesters' fishing effort was more widely distributed in 2017 relative to the past few years. Some Canadian vessels reached the waters off the Southern California coast and waters within the WCPFC convention area. This extensive fishing pattern is possibly due to low catch and catch rate in the coastal waters off British Columbia, Washington and Oregon states. Albacore were harder to find in coastal areas in 2016 than in 2015. Albacore were even more harder to find in 2017.

8.0 LITERATURE CITED

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Di Lorenzo, E., Schneider, N., Cobb, K.M., Franks, P.J.S., Chhak, K., Miller, A.J., McWilliams, J.C., Bograd, S.J., Arango, H., Curchitser, E., Powell, T.M., and Rivière, P. 2008. North Pacific Gyre Oscillation links ocean climate and ecosystem change. Geophys. Res. Lett., 35, L08607, doi:10.1029/2007GL032838.

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Table 1. Fishery statistics from the Canadian troll fishery for north Pacific Albacore Tuna, 1995-2017. Catch and effort data are expanded or raised to account for vessels that do not report logbook data. The level of expansion can be determined by the logbook coverage figures.

Year	Total Catch (t)	Effort (vessel-days)	Total Vessels	Logbook Coverage[2] (%)
1995	1,761	5,923	287	18%
1996	3,321	8,164	295	24%
1997	2,166	4,320	200	30%
1998	4,177	6,018	214	50%
1999	2,734	6,970	238	71%
2000	4,531	8,769	243	68%
2001	5,249	10,021	248	81%
2002	5,379	8,323	232	74%
2003	6,847	8,428	193	96%
2004	7,857	9,942	221	92%
2005	4,829	8,564	213	94%
2006	5,833	6,243	174	95%
2007	6,040	6,902	207	92%
2008	5,464	5,774	137	93%
2009	5,693	6,540	138	97%
2010	6,527	7,294	161	96%
2011	5,385	8,556	176	99%
2012	2,484	5,974	174	100%
2013	5,088	6,465	183	99%
2014	4,780	4,745	160	100%
2015	4,391	5,244	164	99%
2016	2,842	5,359	152	100%
2017[1]	1,831	4,978	121	100%

1. 2017 data are preliminary based on Ver.18.03.21 of the *Canadian Albacore Tuna Catch and Effort Relational Database*. See Stocker et al. (2007) for a description of the database.
2. Logbook coverage = Number of vessels reporting logbooks/Total number of vessels fishing based on all data sources (sales slips, logbooks, hail records) in database Ver. 15.02.17 for 1995-2014.

Table 2. Releases of Albacore below marketable size (3.18 kg) reported by the Canadian Albacore fishery.

Year	Number of Fish	Total Weight (kg)
2013	289	918
2014	2,214	7,153
2015	42,283	14,550
2016	562	2,134
2017	545	1,660

Table 3. Reported catch of non-target species (by-catch) by the Canadian Albacore Tuna troll fishery in 2017.

			Catch (Number of fish)	
Month	Common name	Scientific Name	Retained	Released
July	Blue Shark	*Prionace glauca*		1
	Pacific Bluefin	*Thunnus orientalis*	1	
August	Shortfin Mako Shark	*Isurus oxyrinchus*	1	
	Yellowfin	*Thunnus albacares*		7
	Yellowtail	*Seriola lalandi*	3	1
September	Yellowtail	*Seriola lalandi*	5	
		TOTALS	10	9

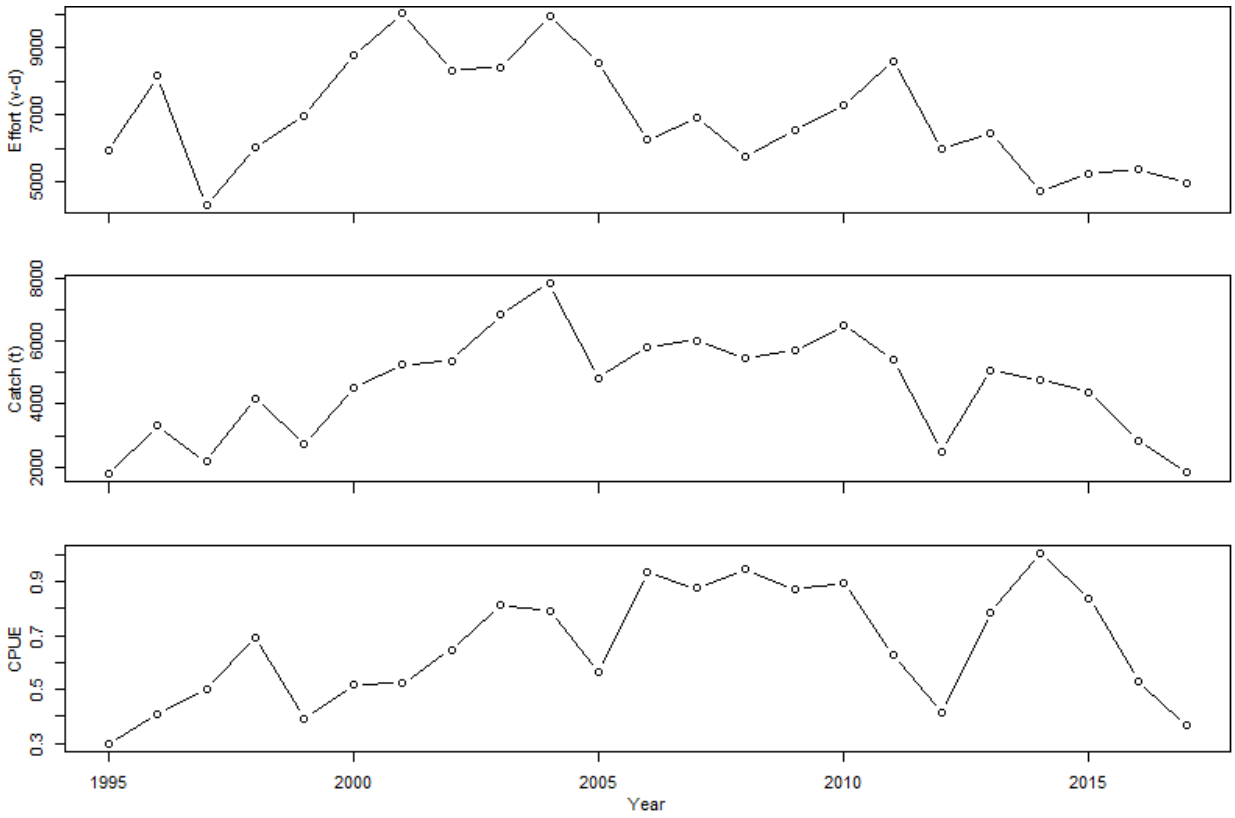

Figure 1. Historical trends in expanded catch (metric ton), effort (vessel-days) and catch per unit effort (CPUE) in the Canadian troll fishery for north Pacific Albacore Tuna from 1995 to 2017.

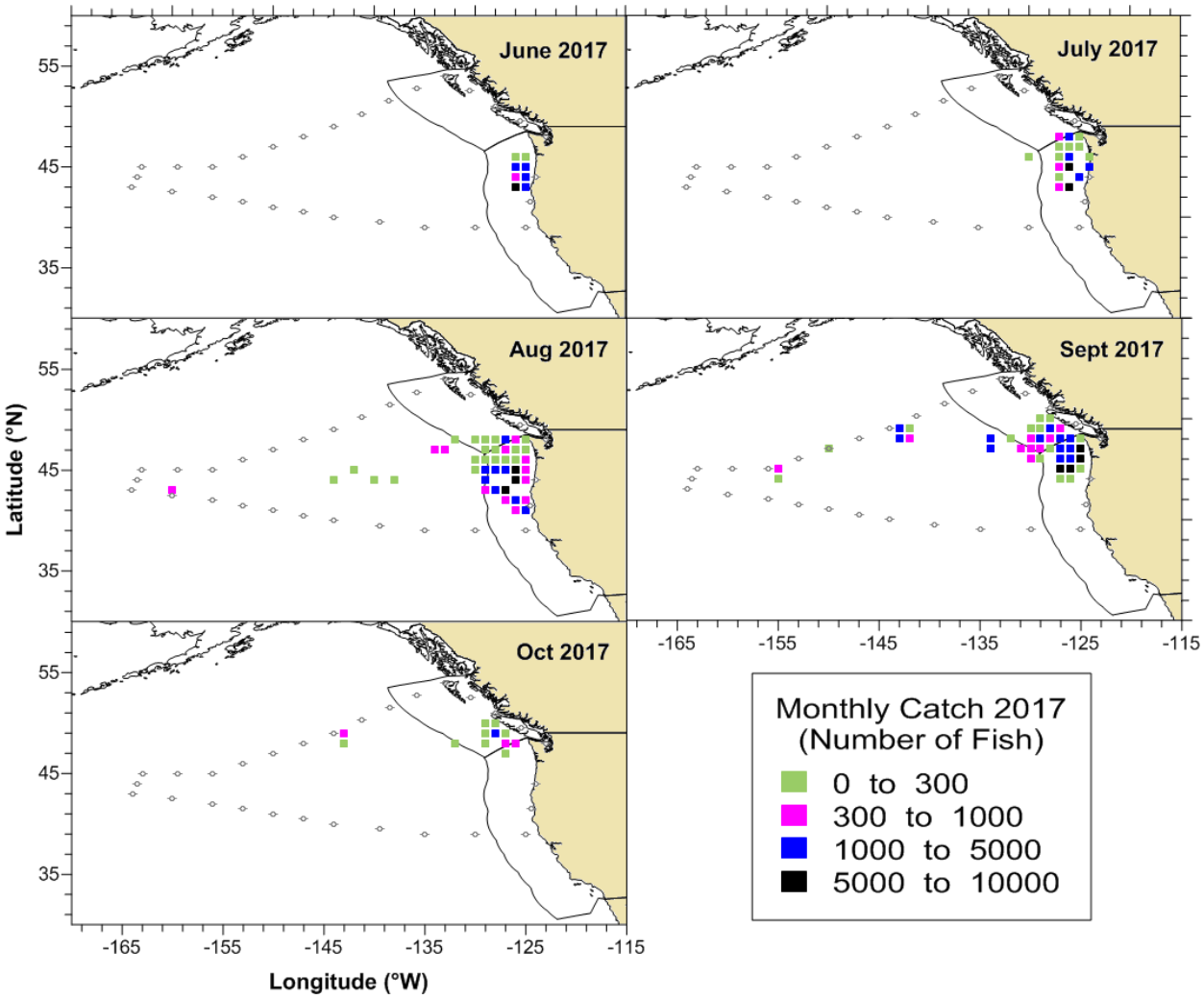

Figure 2. Monthly spatial distribution of reported catch in Canadian Albacore Tuna troll fishery in 2017. Data are plotted on a 1° x 1° strata with symbols located on the bottom-right corner. Strata in which fewer than three vessels reported are not shown. Empty dots approximate the border line of the operational area of the Canadian fishery in 2017.

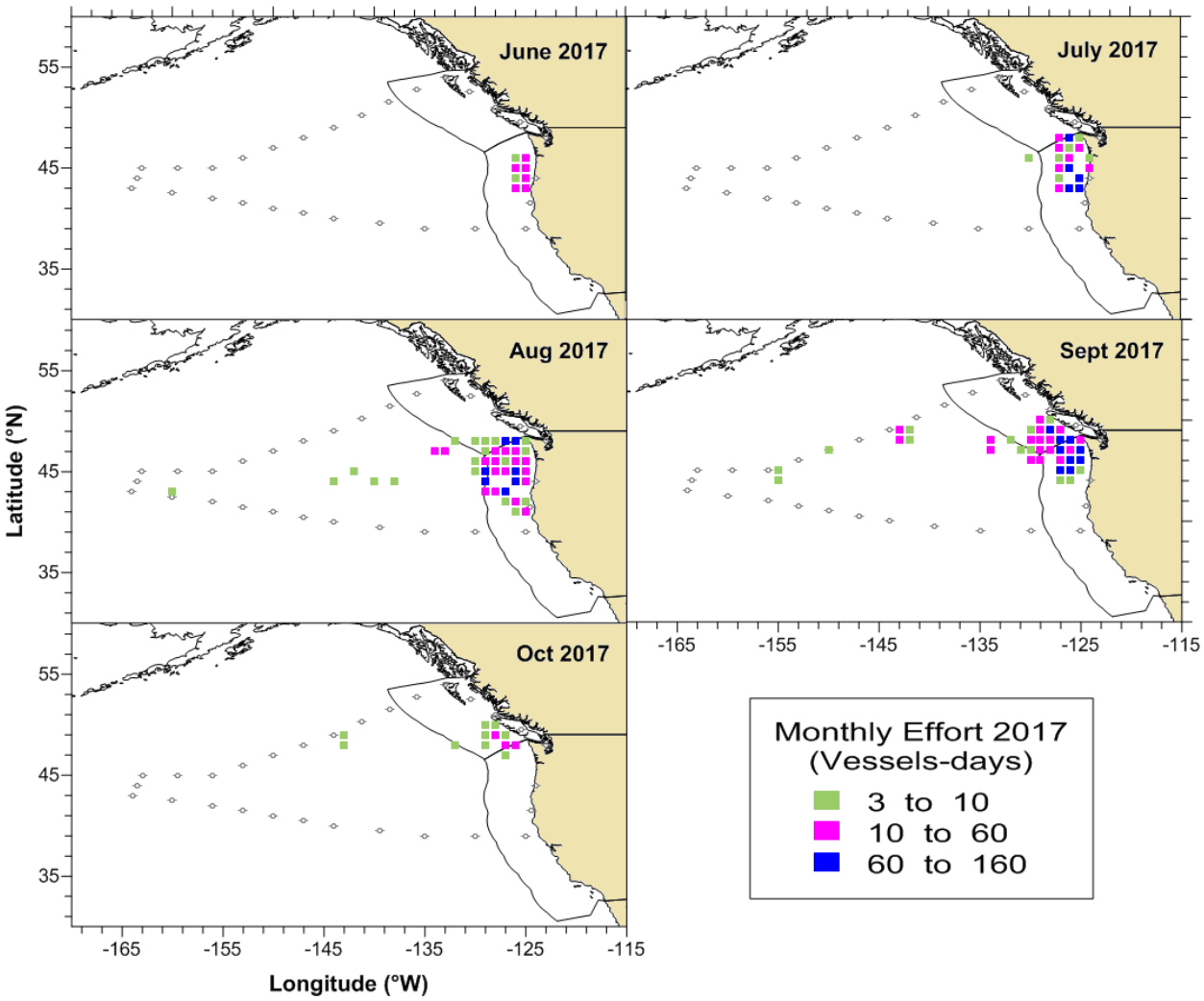

Figure 3. Monthly spatial distribution of effort by the Canadian Albacore Tuna troll fishery in 2016. Data are plotted on 1° x 1° strata with symbols located on the bottom-right corner. Empty dots approximate the border line of the operational area of the Canadian fishery in 2017.

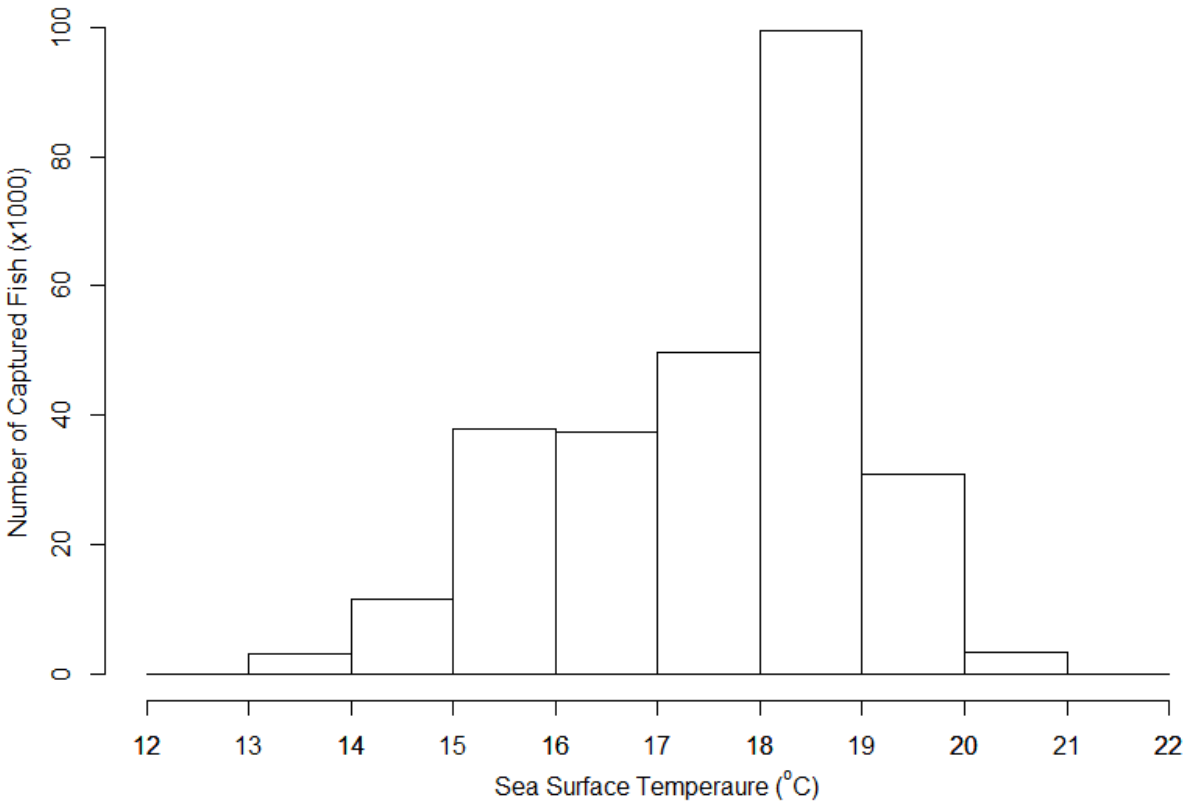

Figure 4. Sea surface temperatures at which Albacore Tuna were caught by the Canadian troll fishery in 2017.

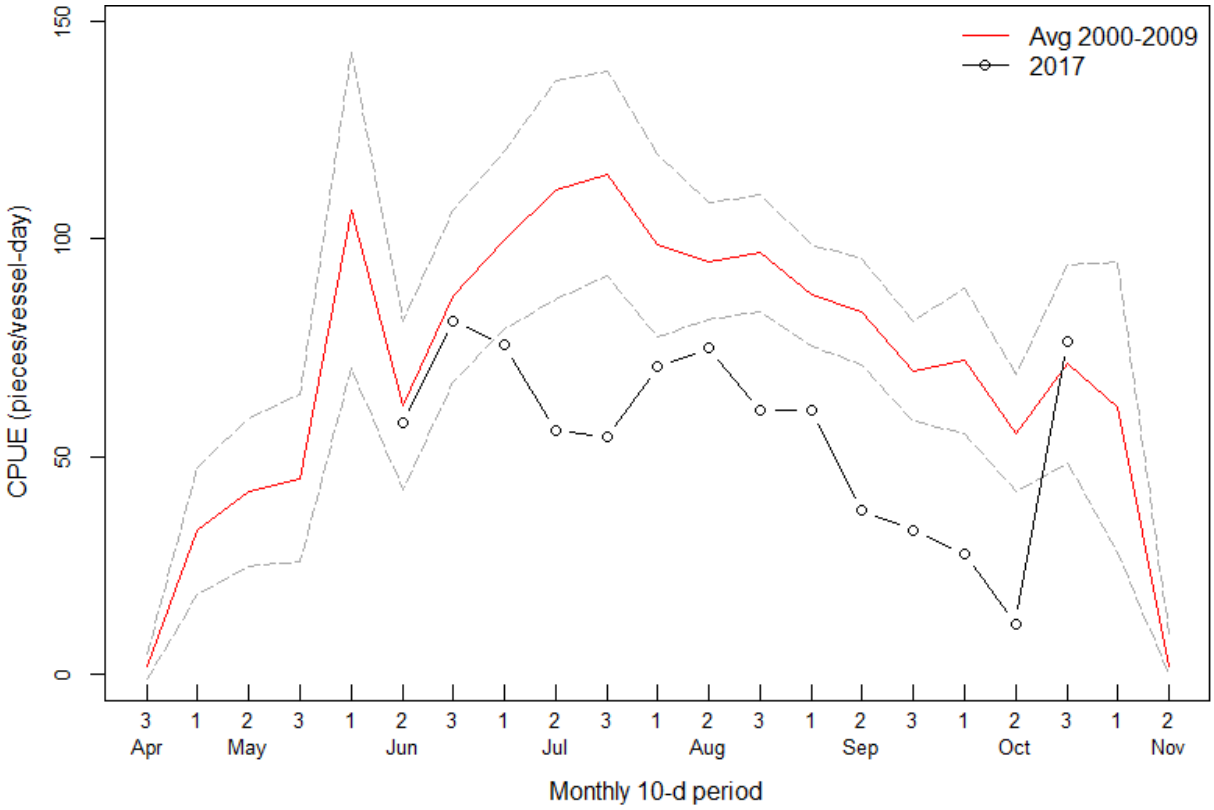

Figure 5. Nominal catch per unit effort (CPUE) for 10-day periods of the Canadian fleet averaged for 2000-2009 compared to the 2017 fishing season. Each data point is the average of all 1°x1° spatial strata in which effort occurred during one of three 10-day periods in a month. The grey dashed lines are the lower and upper 95% confidence interval around the average CPUE "climatology". See Kleiber and Perrin (1991) for CPUE calculation details**Figure 4**. Sea surface temperatures at which Albacore Tuna were caught by the Canadian troll fishery in 2017.

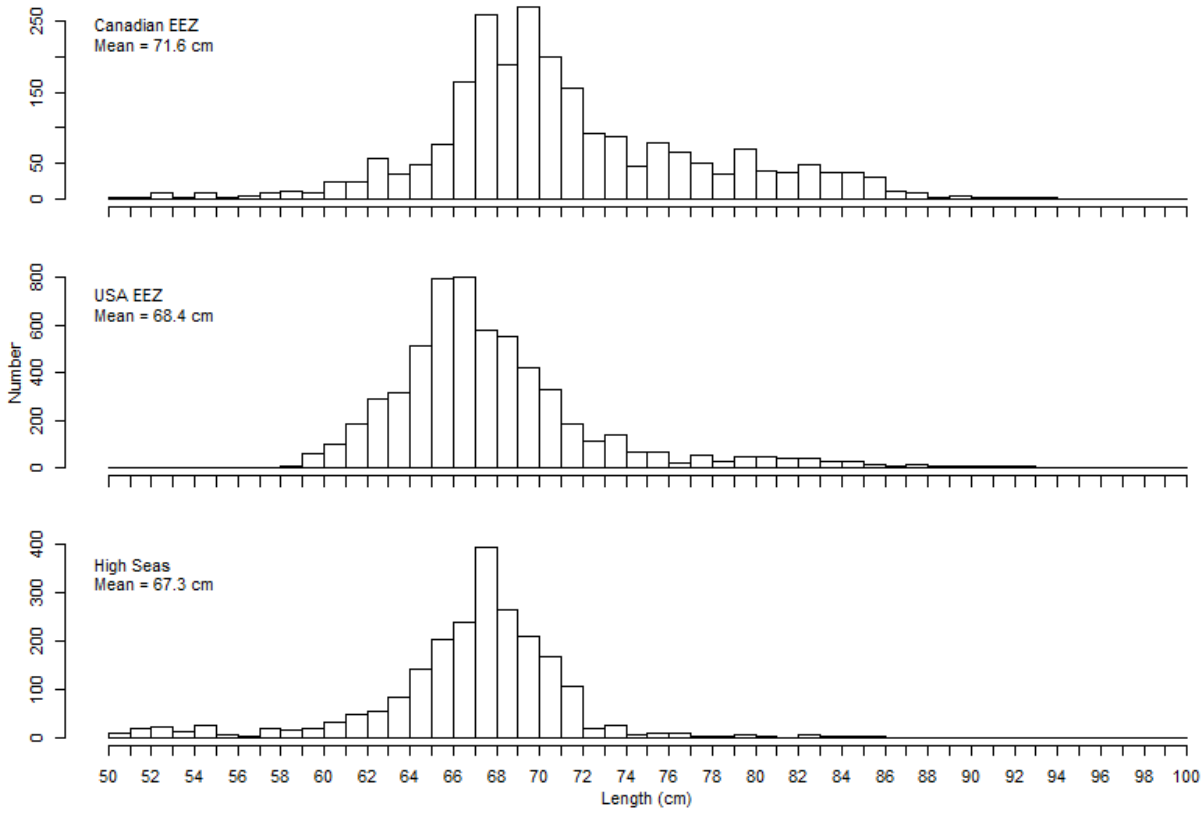

Figure 6. Length distributions of North Pacific Albacore Tuna harvested by the Canadian troll fishery in 2017 in Canadian EEZ, USA EEZ and High Seas (including the WCPFC conventional area).

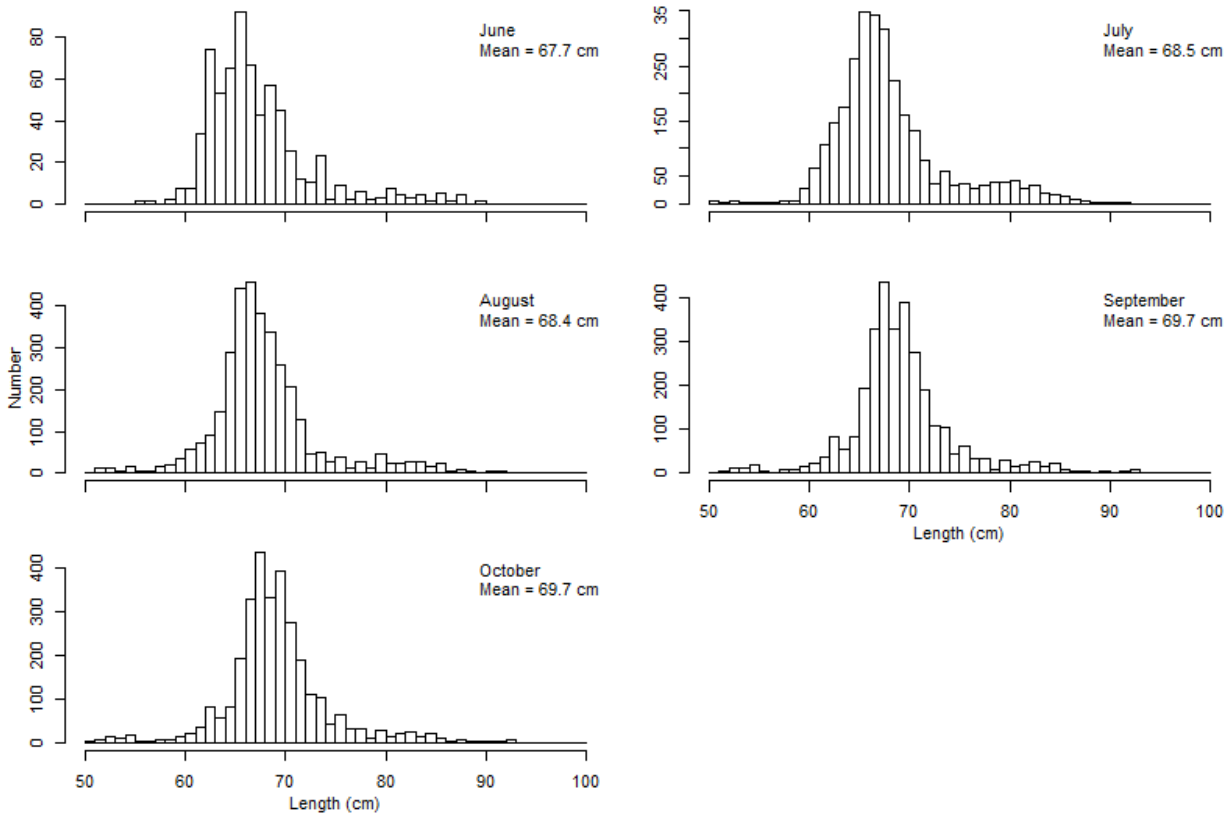

Figure 7. Length distributions of North Pacific Albacore Tuna harvested by the Canadian troll fishery in 2017 in different months.