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**NATIONAL REPORT OF CANADA
(Canadian Tuna and Tuna-like Fisheries in the
North Pacific Ocean in 2016¹)**

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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 2016 fishing season are summarized in this report. The Canadian fleet consisted of 152 vessels and operated exclusively within the eastern Pacific Ocean. Provisional 2016 estimates of catch and effort are 2,842 metric tonnes (t) and 5,359 vessel-days, respectively, which represent a 35% decrease in catch and 2.2% increase in effort relative to 2015. Catch and effort were split primarily between Canadian waters (55% of the catch and 64% of the effort) and US waters (44% of the catch and 35% of the effort) while the remaining catch and effort occurred in adjacent high seas waters. About 96% of the catch occurred in a sea surface temperature band of 15-18 °C. Forty-eight (48) vessels measured 14,189 fork lengths on 115 trips in 2016 for a sampling rate of 3.2% of the reported catch. Fork lengths (FL) ranged from 47 to 94 cm and were dominated by a single mode at 68-71 cm FL corresponding to 2-year old fish. The Canadian troll fishery continues to be largely coastal in its operations, occurring almost exclusively within the exclusive economic zones of Canada and United States in 2016.

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 2015 to 31 March 2017 are documented in the Albacore Tuna Integrated Fisheries Management Plan (IFMP) <http://www.pac.dfo-mpo.gc.ca/fm-gp/mplans/2015/tuna-thon-sm-2015-eng.pdf>. A revised plan for 2017 to 2020 is not publically available yet. 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 2016.

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 17.01.31. Figures up to and including 2015 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 2016 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 2016 is 2,842 metric tons (t) and is a 35% decrease relative to catch in 2015 (Table 1; 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 $5,286 \pm 1,439$ t (\pm sd) since 2003, the period when logbook coverage has exceeded 90% of all vessels participating in this fishery. The 2016 catch was distributed among Canadian coastal waters (66.6%) and United States coastal waters (33.3%), while catch in adjacent high seas waters was minimal (0.1%). Forty-five (45) Canadian vessels were permitted to fish in the coastal waters of the United States in 2015, but only 43 vessels entered the US EEZ and fished.

The number of Albacore released in 2016 decreased to 562 fish, a 98% decrease relative to 2015 (Table 2). The weight of released fish is not included in Table 1, which records retained catch only. Albacore are released because they are below a threshold size of about 3.18 kg (7 lbs), which is considered the minimum marketable size.

3.2 Effort

The Canadian Albacore Tuna troll fleet consisted of 152 unique vessels in 2016, representing a 7.3% decrease in participation relative to 2015 and below the average participation rate of 177 vessels since 2003 (Table 1). The 2016 estimate of fishing effort is 5,359 v-d and is a 2.2% increase in effort relative to 2015 (Table 1; Figure 1). Fishing effort in 2016 was split between Canadian coastal waters (64%), United States coastal waters (35%), and adjacent high seas waters (<1%). Annual fishing effort has ranged between 4,320 v-d in 1997 and 10,021 v-d in 2001, averaging $6,856 \pm 1,520$ v-d since 2003.

4.0 SPATIAL DISTRIBUTION OF CATCH AND EFFORT DATA

The Canadian troll fleet operated within a 12° latitudinal band between 42 and 54°N within the EEZs of Canada and the United States in 2016 (Figures 2 and 3), where more than 99% of the 2015 fishing effort and catch occurred. This coastal distribution is consistent with the pattern of operation observed in the last decade, although the proportion of effort and catch occurring within United States EEZ waters is lower (35% and 44%, respectively) than average (66% of effort and catch) for the 1995 to 2011 period. This reduction in fishing and catch relative to historical levels is the result of the fishing regime in the bilateral Albacore Tuna treaty negotiated for 2013 and adopted for a three-year period beginning in 2014 and renewed for the 2017-2020 period.

The Canadian fishery operated exclusively within the Inter-American Tropical Tuna Commission (IATTC) convention area east of 150°W and north of the equator. No effort or catch were made in the Western and Central Pacific Fisheries Commission (WCPFC) convention area west of 150°W in 2016, continuing a trend that began in 2005 of concentrating effort and catch in the eastern Pacific Ocean (EPO).

Monthly effort and catch shifted from waters in the US EEZ south of 47°N in June to north of 48°N in the Canadian EEZ and remained distributed throughout the Canadian and United States EEZs until the 2016 fishery terminated in October (Figures 2 and 3).

Albacore were caught in waters with sea surface temperatures ranging from 10 to 22 °C in 2016, but 96% of the fish were harvested in waters within the 15-18 °C temperature band (Figure 4).

Nominal catch rates peaked well above average in June and then exhibited a consistent decline to termination of the fishery in October (Figure 5). Below average catch rates were observed from early July through August and September and October (Figure 5). The 2016 CPUE pattern is unusual in that peak catch rates occurred much earlier than normal (July-Aug) and catch rates were below average for most of the fishing season. This pattern may explain the reduction in catch since highest catch rates occurred in June with participation in the fishery is typically low (31 vessels or 20% of the fleet in 2016) and expended 4% of the total effort. Later in the season when more vessels are participating in the fishery, albacore were apparently harder to find since effort was high but catches were low (Figure 5).

5.0 BIOLOGICAL DATA

5.1 By-Catch

Reported by-catch was 10 fish and three species in 2016 (Table 3), of which 60% were retained. Yellowtail (*Seriola lalandi*) was the most commonly retained species. Shortfin Mako Shark (*Isurus oxyrinchus*) and Blue Shark (*Prionace glauca*) were the other species recorded and were the most commonly released species. Total weight of all retained by-catch is estimated to be approximately 50 kg and total estimated weight of released by-catch is 75 kg.

5.2 Biological

Forty-eight (48) vessels measured 14,189 fork lengths on 115 trips in 2016 (Figure 6), resulting in measurements from 3.2% of the reported catch. The majority of measurements are of fish caught in the Canadian EEZ (80%), followed by the United States EEZ waters (9.5%) and the high seas (0.5%). Although

Albacore in the Canadian catch ranged from 47 cm to 94 cm fork length (FL) in size (Figure 6) and are dominated by a single mode at 68-71 cm FL in all three fishing zones. A smaller secondary mode between 79 and 83 cm FL is visible in the size composition data from the Canadian and US EEZs. The primary mode corresponds to 2-year old fish while the secondary mode may be 3-year old fish.

6.0 DISCUSSION

The 2016 Canadian troll fishery occurred almost exclusively within the Canadian and United States EEZs. Catch rates were high early in the fishing season and then declined to below average for much of the fishing season (Figure 5). Although effort increased relative to 2015, catch declined substantially; albacore were harder to find in coastal areas in 2016.

The fishing regime in the Canada-United States bilateral Pacific Albacore Tuna Treaty continues to influence the Canadian fishery by limiting the number of Canadian vessels in US waters to 45 from June 15 to September 15 annually. As a result, fishing operations have shifted, with

increasing proportion of effort and catch in Canadian waters relative to the period prior to 2012. This fishing regime was renewed in 2017 for another three years.

A recreational fishery for Albacore Tuna is developing off the west coast of Vancouver Island. This fishery consists of both charter-boat and private boat components. Two methods have been used in attempts to collect information on recreational catch and effort: (1) a logbook program for the major charter-boat operators and fishing lodges along the west coast of Vancouver Island, and (2) a web-based survey of recreational anglers that purchased a licence to fish in tidal waters (e.g., see DFO 2015). The estimated catches and effort for 2013 to 2015 are under investigation to resolve differences between methods. The majority of fishing effort and catch appear to occur in the June to September period (consistent with the commercial fishery) and most of the effort occurs on the seaward side of the continental slope off the southwest coast of Vancouver Island. The recreational catch and effort data are not included in the tables and figures in this report because they are highly uncertain.

7.0 LITERATURE CITED

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Table 1. Fishery statistics from the Canadian troll fishery for north Pacific Albacore Tuna, 1995-2016. 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 Coverage² (%)
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 ¹	2,842	5,359	152	100%

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Year	Total Catch (t)	Effort (vessel-days)	Total Vessels	Logbook Coverage² (%)
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1. 2016 data are preliminary based on Ver.17.01.31 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

Table 3. Reported catch of non-target species (by-catch) by the Canadian Albacore Tuna troll fishery in 2016.

Month	Common name	Scientific Name	Catch (Number of fish)	
			Retained	Released
June	Shortfin Mako Shark	<i>Isurus oxyrinchus</i>		1
	Blue Shark	<i>Prionace glauca</i>		1
July	Blue Shark	<i>Prionace glauca</i>		1
	Yellowtail	<i>Seriola lalandi</i>	1	
August	Shark		1	1
	Yellowtail	<i>Seriola lalandi</i>	3	
October	Yellowtail	<i>Seriola lalandi</i>	1	
TOTALS			6	4

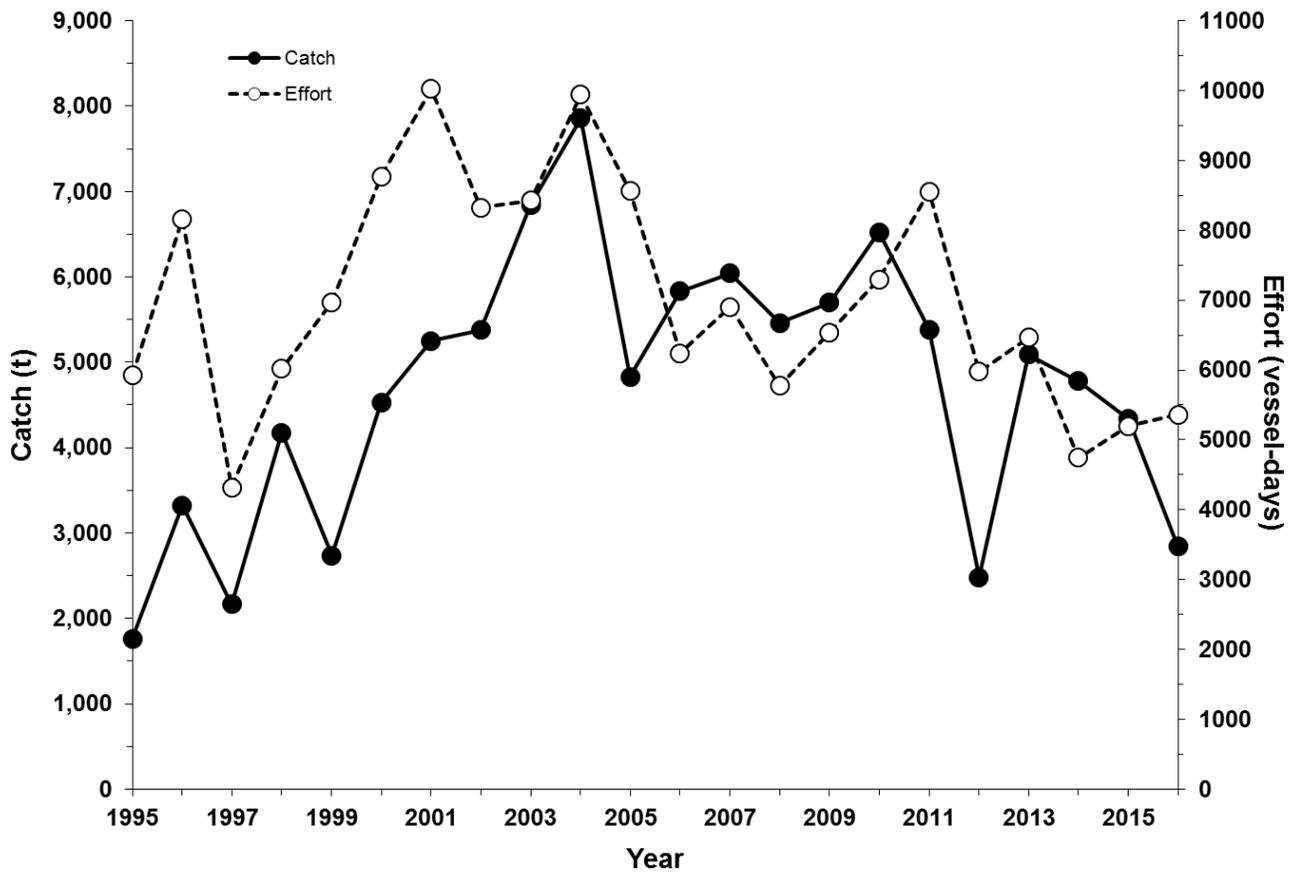


Figure 1. Historical trends in expanded catch and effort in the Canadian troll fishery for north Pacific Albacore Tuna from 1995 to 2016.

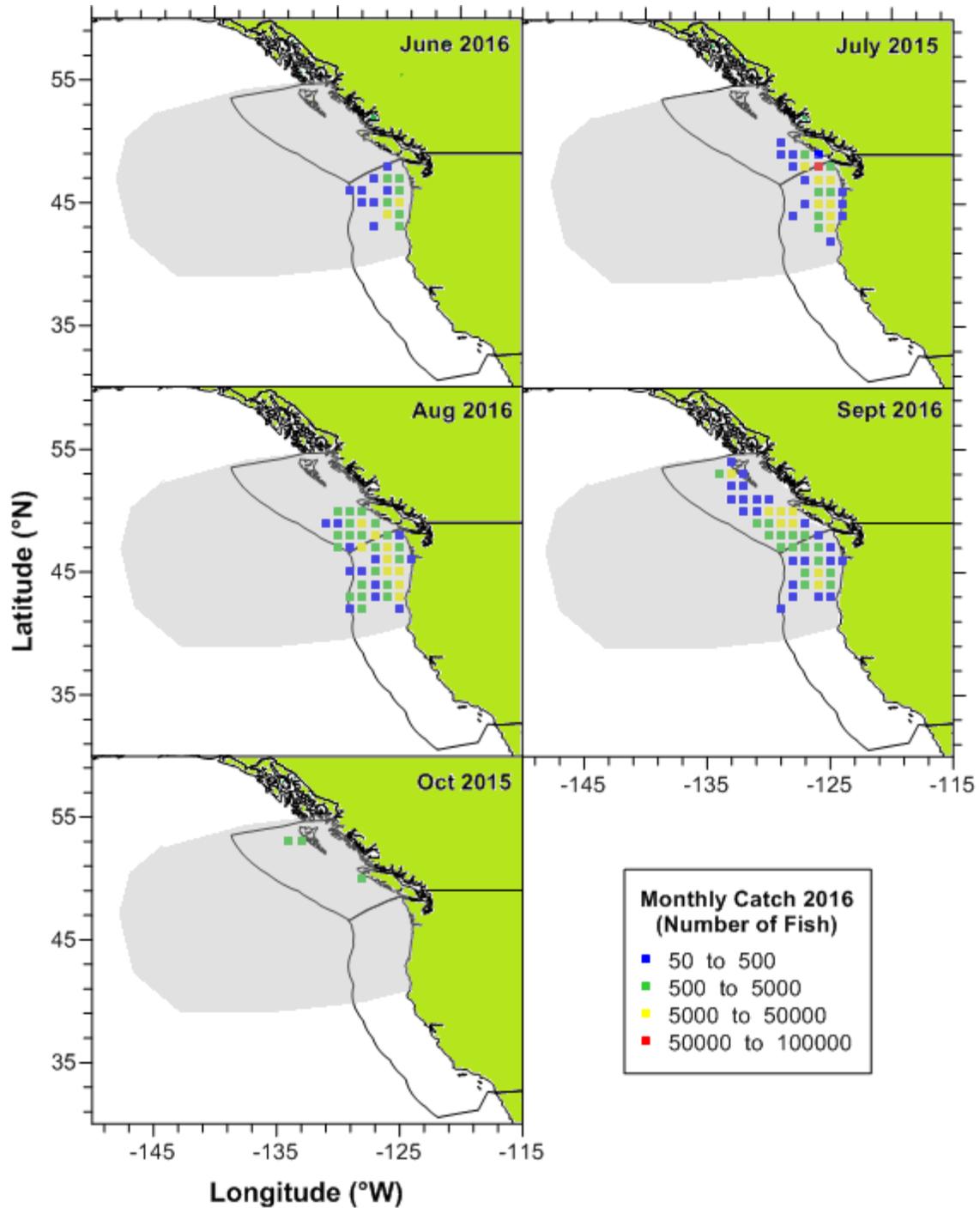


Figure 2. Monthly spatial distribution of reported catch in Canadian Albacore Tuna troll fishery in 2016. Data are plotted on a 1° x 1° strata with symbols located on the bottom-right corner of each stratum. Strata in which fewer than three vessels reported are not shown. Grey

area is the approximate operational area of the Canadian fishery in 2016.

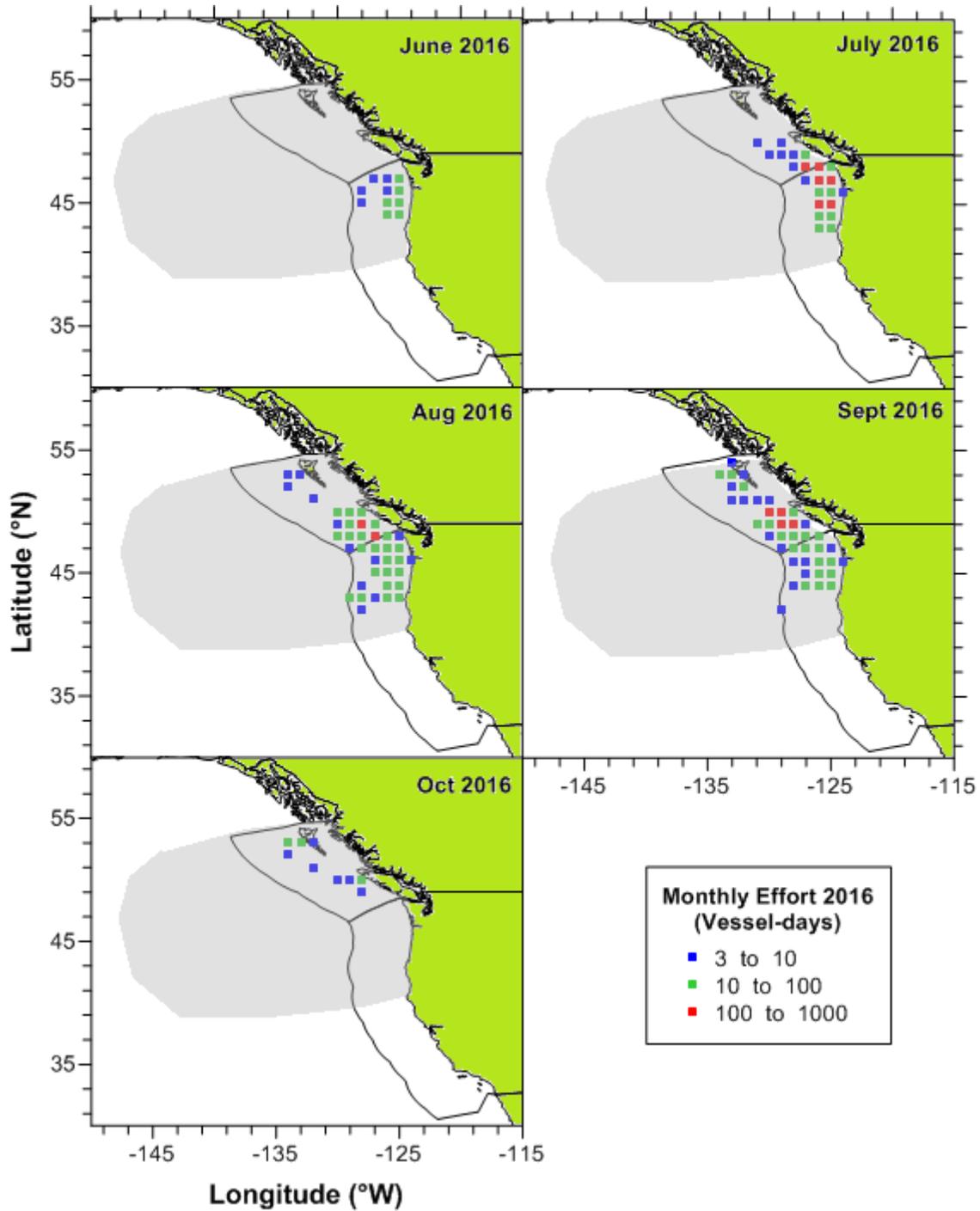


Figure 3. Monthly spatial distribution of effort by the Canadian Albacore Tuna troll fishery in 2016. Data are plotted on $1^{\circ} \times 1^{\circ}$ strata with symbols located on the bottom-right corner of

each stratum. Strata in which fewer than three vessels reported are not shown. Grey area is the approximate operational area of the Canadian fishery in 2016.

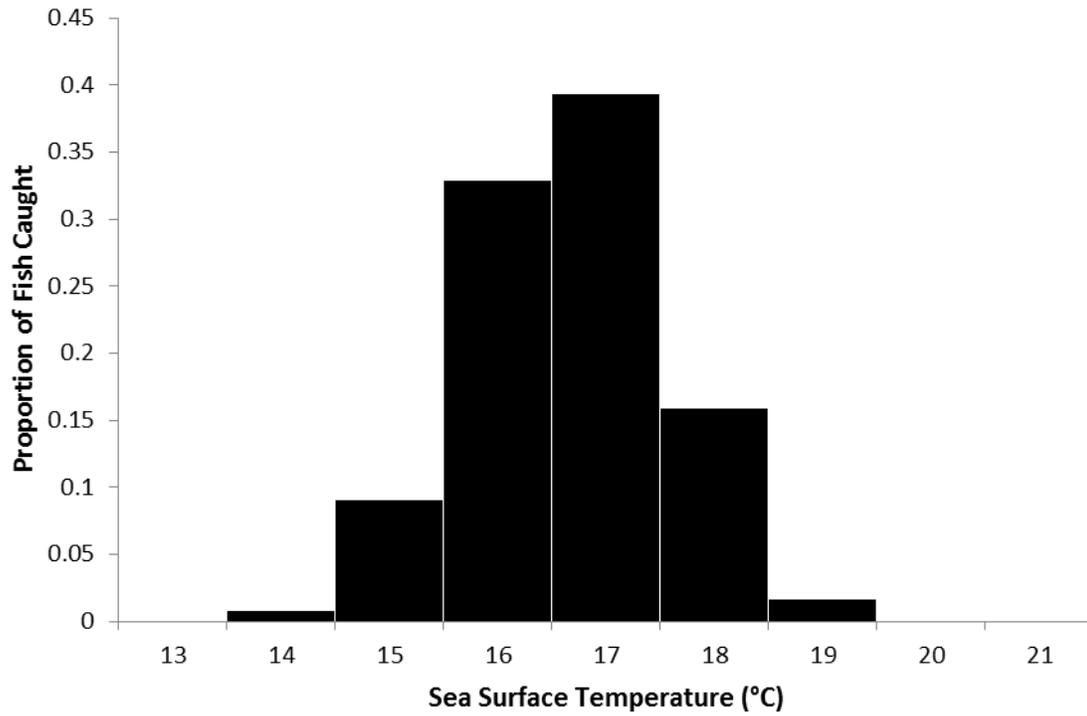


Figure 4. Sea surface temperatures at which Albacore Tuna were caught by the Canadian troll fishery in 2016. Plot is based on N = 394,843 fish with associated water temperature data reported in logbooks.

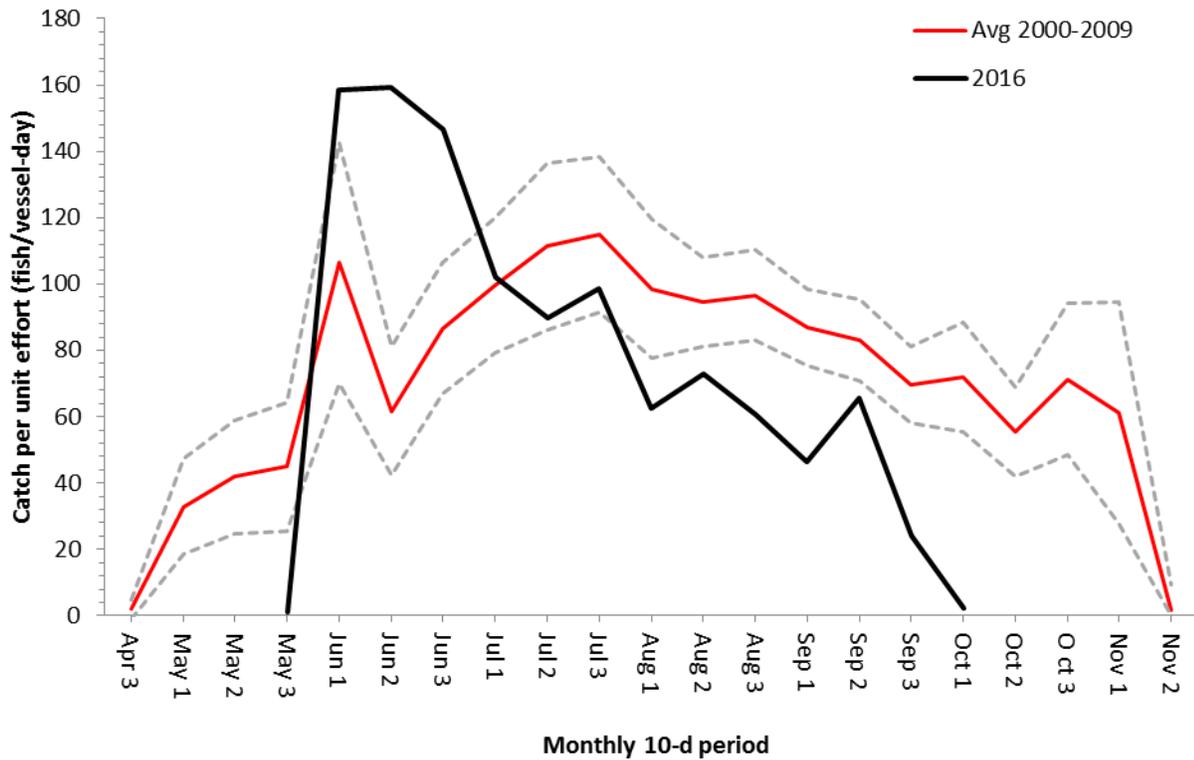


Figure 5. Nominal catch per unit effort for 10-day periods of the Canadian fleet averaged for 2000-2009 compared to the 2016 fishing season. Each data point is the average of all $1^\circ \times 1^\circ$ spatial strata in which effort occurred during one of three 10-day periods in a month. The grey dashed lines are the lower and upper 95% confidence interval around the average CPUE "climatology". See Kleiber and Perrin (1991) for CPUE calculation details.

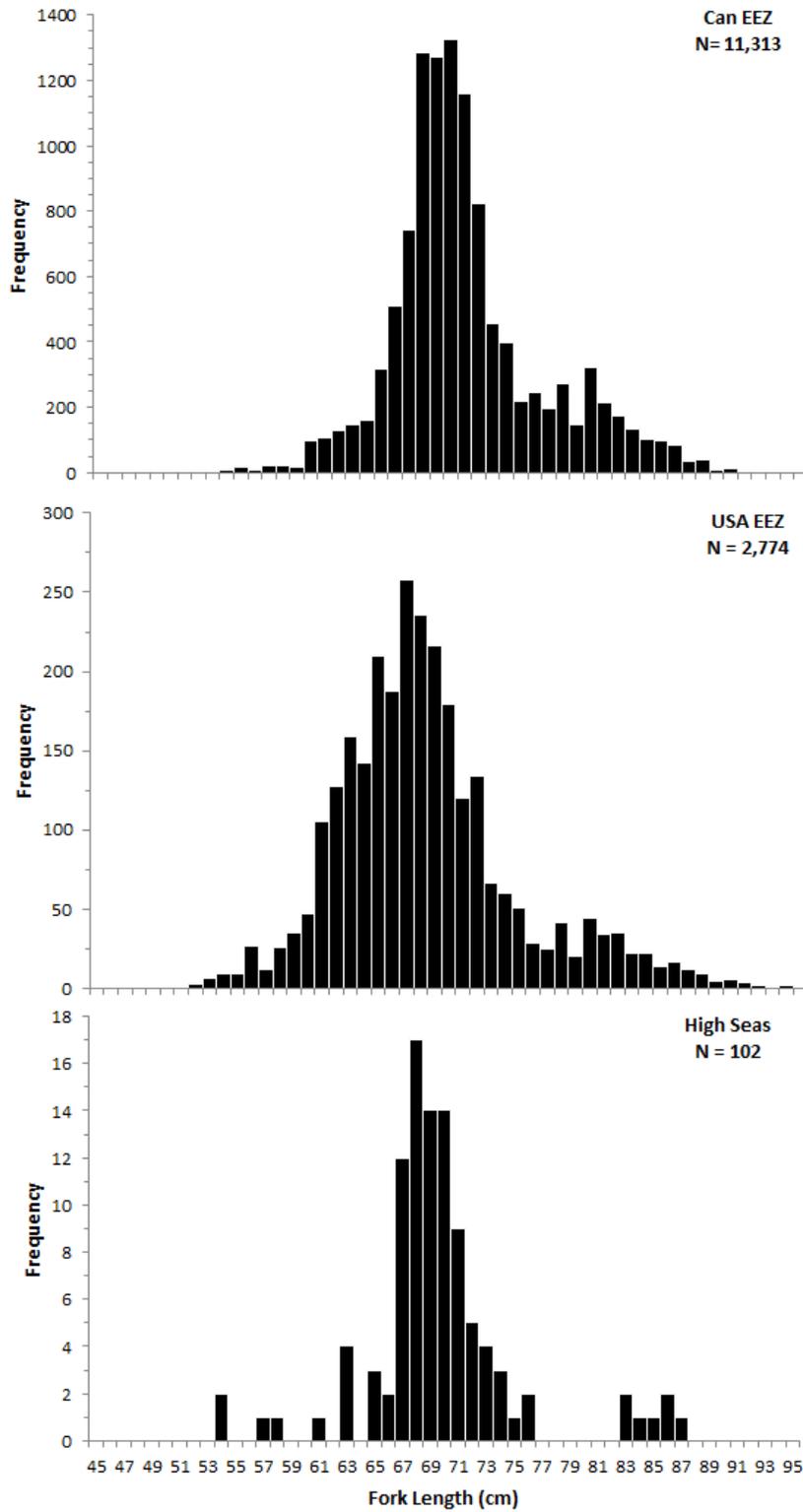


Figure 6. Measured fork lengths of North Pacific Albacore Tuna harvested by the Canadian troll fishery in 2016. Total sample is 14,189 fish.