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National Report of Canada (Canadian Tuna and Tuna-like Fisheries in the North Pacific Ocean in 2013)[1]

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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 2013 fishing season are summarized in this report. The Canadian fleet consisted of 183 vessels and operated almost exclusively within the eastern Pacific Ocean. Provisional 2013 estimates of catch and effort are 5,090 metric tonnes (t) and 6,469 vessel-days, respectively, which represent a 104% increase in catch and 7.6% increase in effort relative to 2012. Catch and effort were split primarily between Canadian waters (59% of the catch and 66% of the effort) and US waters (31% of the catch and 24% of the effort) while the remaining catch and effort occurred in adjacent high seas waters. Roughly 80% of the catch was made in sea surface temperature band of 16-18 °C. Seventy-five (75) vessels participated in the on-board size sampling program and measured 17,150 fish on 175 trips for a sampling rate of 2.24% of the reported catch. These measurements were dominated by fish between 65-71 cm fork length (FL) corresponding to 2-year old fish, and a significant number of fish between 75-78 cm FL, which are 3-years old. The major change affecting the operation of this fishery between 2012 and 2013 was the implementation of a new fishing regime under the terms of the a bilateral treaty between Canada and the United States. There was no access by either country for fishing in the waters of the other country in 2012 whereas in 2013 a reduced number of Canadian vessels relative to recent historical levels were permitted fish in US waters for three months, which is a shorter season than previously fished.

1.0 INTRODUCTION

The Canadian fishery for highly migratory species uses troll gear with jigs to target juvenile north Pacific albacore tuna (*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 US-flagged vessels licensed to fish for albacore and for the landing of albacore catches at designated ports within each country. Some of the larger Canadian vessels follow albacore tuna concentrations into offshore waters and into the central and western Pacific Ocean. Management regulations for Canadian vessels fishing albacore tuna from 01 April 2013 to 31 March 2014 are documented in the Albacore Tuna Integrated Fisheries Management Plan (IFMP) http://www.dfo-mpo.gc.ca/Library/348174.pdf. Historically the majority of catch and effort for north Pacific albacore has occurred in a four month period from early July to the end of October**.**

This report summarizes Category I (annual catch and effort), Category II (annual 1° x 1° catch and effort data), and Category III (bycatch, catch size composition) data for vessels active in the Canadian north Pacific albacore troll fishery in 2013. This report also provides information on scientific research conducted by Fisheries and Oceans Canada (DFO) in support of resource conservation and management both domestically and internationally, including stock assessment, biological and oceanographic studies.

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 generates the best available estimates of total 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 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 landed and bought by domestic buyers and provide the most accurate estimates of albacore 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 catch database (Stocker et al. 2007).

Fork length data are collected by fishermen through an on-board sampling program initiated in 2009. Participation in this program is voluntary and harvesters are asked to record the lengths of the first 10 albacore landed on a daily basis in their logbooks. Size composition data were collected by US port samplers from a portion of the Canadian catch landed in United States ports specified by the bilateral Canada-United States Albacore Tuna Treaty between 1981 and 2008. Fork length data reported by Canada since 2009 to the present are from the domestic on-board sampling program only.

The fishery data provided in this report were taken from Canadian tuna database version 14.04.01. Figures up to and including 2012 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 2013 catch and effort data are preliminary at this time.

3.1 AGGREGATED CATCH AND EFFORT DATA

3.2 Catch

The preliminary estimate of the Canadian albacore catch in 2013 is 5,090 metric tons (t) and is a 104% increase relative to 2012, but a 6% decrease relative to catch in 2011 (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 5,645 ± 1,709 (± sd) t since 2003, the period when logbook coverage has exceeded 90% of all vessels participating in this fishery. The 2013 catch was distributed among Canadian coastal waters (59%), United States coastal waters (31%) and adjacent high seas waters (10%). Unlike 2012, some Canadian vessels were permitted to fish in the coastal waters of the United States in 2013(45 were permitted to fish, but only 43 vessels entered the US EEZ and fished).

3.3 Effort

The Canadian albacore troll fleet consisted of 183 unique vessels in 2013, an increase of about 5% in participation relative to 2012 and above the average participation rate of 180 vessels since 2003 (Table 1). The 2013 estimate of fishing effort is 6,469 v-d and is an 8% increase in

effort relative to 2012 (Table 1; Figure 1). Fishing effort in 2013 was split between Canadian

coastal waters (66%), United States coastal waters (24%), and adjacent high seas waters (10%). Annual fishing effort has ranged between 4,320 v-d in 1997 and 10,021 v-d in 2001, averaging 7,342 ± 1,345 v-d since 2003.

4.0 SPATIAL DISTRIBUTION OF CATCH AND EFFORT DATA

The Canadian troll fleet operated in a latitudinal band between 40 and 54°N and from the west coast of North America to 155° W in 2013 (Figure 2a,b). This spatial distribution is more compressed latitudinally than in 2012 and is consistent with the average operational area of the fishery in the eastern Pacific Ocean since the 2006 fishing season. The Canadian fishery operated north of the equator primarily within the Inter-American Tropical Tuna Commission (IATTC) convention area east of 150°W, but a minor amount of catch (<1 t) was made in the Western and Central Pacific Fisheries Commission (WCPFC) convention area west of 150°W, continuing a trend of concentrating effort and catch by this fishery in the eastern Pacific Ocean (EPO) that began in 2005. Approximately 90% of the fishing effort and catch occurred within the coastal waters of Canada and the United States in 2013, although the proportion of effort and catch occurring within United States waters is much lower (24% and 31%, respectively) than average (78% of effort and 79% of catch) over the 1995 to 2011 period. This reversal of the fishing pattern in 2013 relative to the period prior to 2012 is the result of a new fishing regime in the bilateral albacore tuna treaty negotiated for 2013.

Albacore were caught in waters with sea surface temperatures ranging between 12 and 24 °C in 2013, but 94% of the fish were harvested in waters within a narrow temperature band of 15-19 °C (Figure 3).

Nominal catch rates peaked in mid-July and then exhibited gradual decline through October (Figure 4). The initial peak in early June is likely an artifact of the data since only a few vessels were fishing at that time and presumably they found a school of fish. The overall pattern of catch rates is consistent with the average pattern in this fishery and within the 95% confidence interval (Figure 4).

5.1 BIOLOGICAL DATA

5.2 By-Catch

Reported by-catch was 55 fish and nine species in 2013 (Table 2), of which 84% were retained. Yellowtail (*Seriola lalandi)* was the most commonly reported by-catch species with 30 individuals followed by skipjack tuna (*Katsuwonus pelamis*) and Pacific bluefin tuna (*T. orientalis*). Total weight of all by-catch is estimated to be approximately 512 kg, of which yellowtail accounted for more than 50%.

5.3 Biological

Seventy-five (75) vessels measured 17,150 fork lengths on 175 trips in 2013 (Figure 5), representing a sample rate of 2.24% of the reported catch. This sampling rate is well above the target of 1.0% of the reported catch. The amount of sampling in the three fishing zones (Canada - 76%; United States waters - 17%; high seas - 7%) was not proportional to the effort in each zone.

Albacore in the Canadian catch ranged from 48 cm to 105 cm fork length (FL) in size (Figure 5), which is slightly larger than the size range reported in previous years (see Holmes 2011, 2012, 2013). The dominant mode in these data corresponds to 2-year old fish at 64-69 cm FL. A significant number of fish formed a less prominent second mode between 74-78 cm FL, corresponding to 3-year old fish (Figure 5). Although the size range reported is somewhat larger than in previous years, the pattern of two modes corresponding to 2- and 3-yr old fish is consistent with previously reported size composition data for this fleet.

6.0 DISCUSSION

The main factor affecting the Canadian fishery in 2013 was an agreement between Canada and the United States on a new one year fishing regime within the bilateral Canada-United States Albacore Tuna Treaty. There was no fishing regime in place for the 2012 fishing season, which resulted in a 54% reduction in catch and 30% reduction in effort relative to 2011 because Canadian vessels were not able to access albacore in US waters. The 2013 fishing regime specified that up to 45 Canadian vessels could fish in US waters between June 15 and September 15. Both the number of vessels and length of the fishing period are reductions relative to previously negotiated fishing regimes, and these reductions are reflected in the effort (24%) and catch (31%) in US waters relative to long-term averages (79% effort and 78% of catch). The terms of the 2013 fishing regime were adopted by both countries for a new three year regime in April 2014 and will take effect with the 2014 fishing season.

There is anecdotal evidence of a growing recreational fishery for albacore tuna off the west coast of Vancouver Island as offshore technology (boats, engines, navigation gear) improves and as migratory conditions bring the fish within Canadian waters and relatively close to shore for a substantial period of time. At present, this sport fishery consists of both charter-boat and private boat components, but little else is known concerning the level of effort and catch within this fishery. Attempts to collect information on catch, effort and size of catch in 2013 with a logbook program were largely unsuccessful. The program has been revised for 2014 with the help of some of the charter-boat operators and marinas as a scoping program designed to assess when and where catches occur and how many fish are retained. Based on this information, a catch monitoring program will be developed.

7.0 RESEARCH

Canadian highly migratory species research in the Pacific Ocean has focused on improving understanding of the biology and ecology of north Pacific albacore tuna to enhance assessments of the effects of fishing and the environment on stock dynamics and status. The studies highlighted below have recently been completed or are ongoing and are conducted largely in cooperation with stakeholders and in collaboration with both Canadian and international colleagues. Three manuscripts are at various stages in the publication process.

A tagging program using pop-up satellite archival tags (PSATs) was designed for implementation in 2013. The goal of this program is to investigate daily and seasonal movement patterns of juvenile albacore in the eastern Pacific Ocean. Protocols for handling and tagging fish and minimizing premature tag release have been developed and PSATs and tagging gear purchased. PSATs produced by Desert Star Systems and Wildlife Computers will be compared for performance and tags will be deployed in 2014.

Five vessels were equipped with scales (spring-loaded Pesola scales) in 2012 and 2013 to record individual lengths and weights of the first 10 fish landed on a daily basis or as often as possible. The goal of this program is to update length-weight relationships for juvenile albacore used by vessel captains to estimate weights in their logbooks. Approximately 3,000 data pairs were reported in 2012 and another 3,000 in 2013 by crews from two vessels. Analysis of these data is underway to assess growth differences between areas and years.

Canada has continued with modeling research evaluating the impacts of biological and oceanographic variables on the population dynamics of albacore tuna using a logistic surplus production model. The effects of oceanographic indices such as the Pacific Decadal Oscillation (PDO), North Pacific Oscillation Index (NOI), Multivariate ENSO Index (MEI), and the North Pacific Gyre Oscillation (NPGO) on K and r were modeled. The model fits primarily to abundance index derived from the Japanese longline fleet, but did not fit the other abundance indices as well. Preliminary results were reviewed at the March 2013 workshop of the ALBWG and show that the NPGO has a significant positive effect on stock productivity and the MEI has a significant negative impact on productivity at a time lag of 4 years. The other indices had no detectable effects on productivity. The mechanism by which these indices appear to affect albacore productivity is through recruitment. A manuscript describing the model and results has been accepted for publication.

Canada is collaborating with US colleagues (Y. Xu and S. Teo) on research investigating environmental influences on albacore distribution in the coastal and open ocean waters of the eastern Pacific Ocean. The project uses logbook data from the US and Canadian troll and pole-and-line fisheries to develop a predictive model of albacore distribution and abundance based on remotely sensed satellite data predictors including sea surface temperature, sea surface height (SSH) anomaly, meridional and zonal geostrophic currents and chlorophyll-a (chl-a) concentration. Preliminary results were reviewed at the March 2013 workshop of the ALBWG and showed that albacore dynamics in open ocean and coastal waters respond to different sets of environmental covariates. Two manuscripts based on project results were submitted for publication.

Research Manuscripts

Zhang, Z., Holmes, J., and Teo, S.L.H. A study on relationships between large-scale climate indices and estimates of North Pacific albacore tuna productivity. Fish. Oceanogr. (accepted for publication 09 May 2014)

Nieto, K., Xu, Y., Teo, S.L.H., McClatchie, S., and Holmes, J. Coastal upwelling fronts: a key habitat for albacore tuna (Thunnus alalunga) in the Northeast Pacific Ocean. Prog. Oceanogr. (In review).

Xu, Y., Nieto, K., Teo, S.L.H., McClatchie, S., and Holmes, J. Influence of Subtropical Fronts on the Spatial Distribution of Albacore Tuna (Thunnus alalunga) in the Northeast Pacific over the past 30 years (1982-2011). Prog. Oceanogr. (In review).

8.0 LITERATURE CITED

Holmes, J.A. 2013 MS. Canadian Tuna and Tuna-like Fisheries in the North Pacific Ocean. Document prepared for the Thirteenth Meeting of the International Scientific Committee on Tuna and Tuna-like Species in the North Pacific Ocean (ISC), 17-22 July 2013, Busan, Republic of Korea. ISC/13/PLENARY/05: 14 p.

Holmes, J.A. 2012 MS. The 2011 Canadian North Pacific albacore troll fishery. Document prepared for the Twelfth Meeting of the International Scientific Committee on Tuna and Tuna-like Species in the North Pacific Ocean (ISC), 18-23 July 2012, Sapporo, Hokkaido, Japan. ISC/12/Plenary/06: 16 p.

Holmes, J.A. 2011 MS. The 2010 Canadian North Pacific albacore troll fishery. Document prepared for the Eleventh Meeting of the International Scientific Committee on Tuna and Tuna-like Species in the North Pacific Ocean (ISC), 20-25 July 2011, San Francisco, USA. ISC/11/Plenary/08: 18 p.

Kleiber, P., and Perrin, C. 1991. Catch-per-effort and stock status in the U.S. north Pacific albacore fishery: reappraisal of both. Fish. Bull., US. 89: 379-386.

Stocker, M., H. Stiff, W. Shaw, and A.W. Argue. 2007. The Canadian albacore tuna catch and effort relational database. Canadian Technical Report of Fisheries and Aquatic Sciences 2701: vi+76 p.

Table 1. Fishery statistics from the Canadian troll fishery for north Pacific albacore tuna, 1995-2013. 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	5,415	8,605	177	98%
2012	2,498	6,005	175	99%
2013[1]	5,090	6,469	183	99%

1. 2013 data are preliminary based on Ver.14.04.01 of the *Canadian Albacore Tuna Catch and Effort Relational 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. 14.04.01 for all years.

Table 2. Reported catch of non-target species (by-catch) by the Canadian albacore troll fishery in 2013.

			Catch (Number of fish)	
Month	Common name	Scientific Name	Retained	Released
July	Bigeye tuna	*Thunnus obesus*	1	
	Pacific bluefin tuna	*Thunnus orientalis*	3	2
	Shark			1
	Steelhead	*Oncorynchus mykiss*	1	
	Yellowtail	*Seriola lalandi*	16	
August	Bonito	*Sarda chiliensis*	1	1
	Blue shark	*Prionace glauca*		1
	Dolphinfish	*Coryphaena hippurus*	1	
	Pacific bluefin tuna	*Thunnus orientalis*		1
	Yellowtail	*Seriola lalandi*		1
September	Blue shark	*Prionace glauca*		2
	Yellowtail	*Seriola lalandi*		1
October	Skipjack tuna	*Katsuwonis pelamis*	9	2
	Yellowtail	*Seriola lalandi*	14	
		TOTALS	46	9

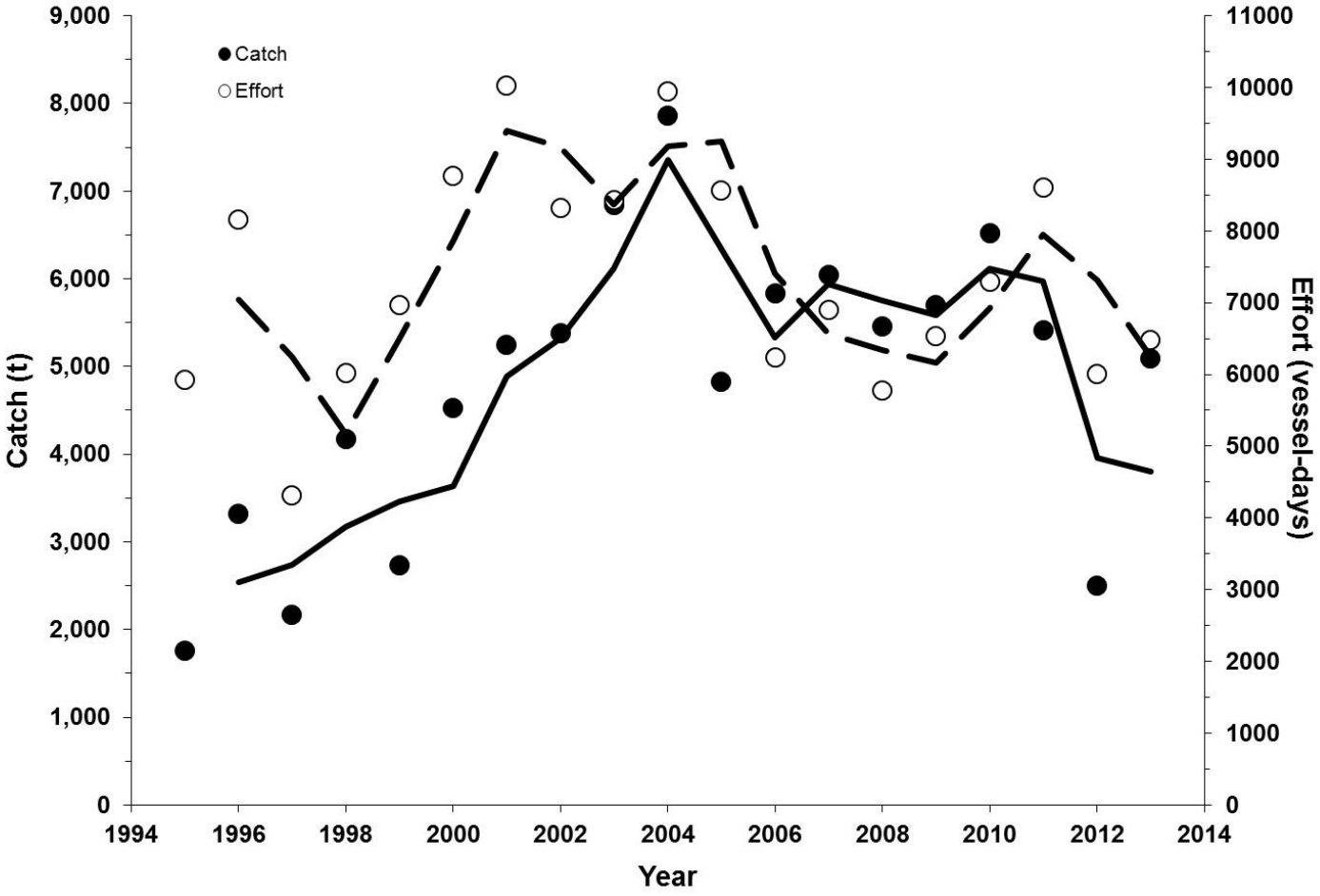

Figure 1. Historical trends in expanded catch and effort in the Canadian troll fishery for north Pacific albacore tuna from 1995 to 2013. Lines are 2-yr moving averages of catch in t (**—**) and effort in vessel-days (– –).

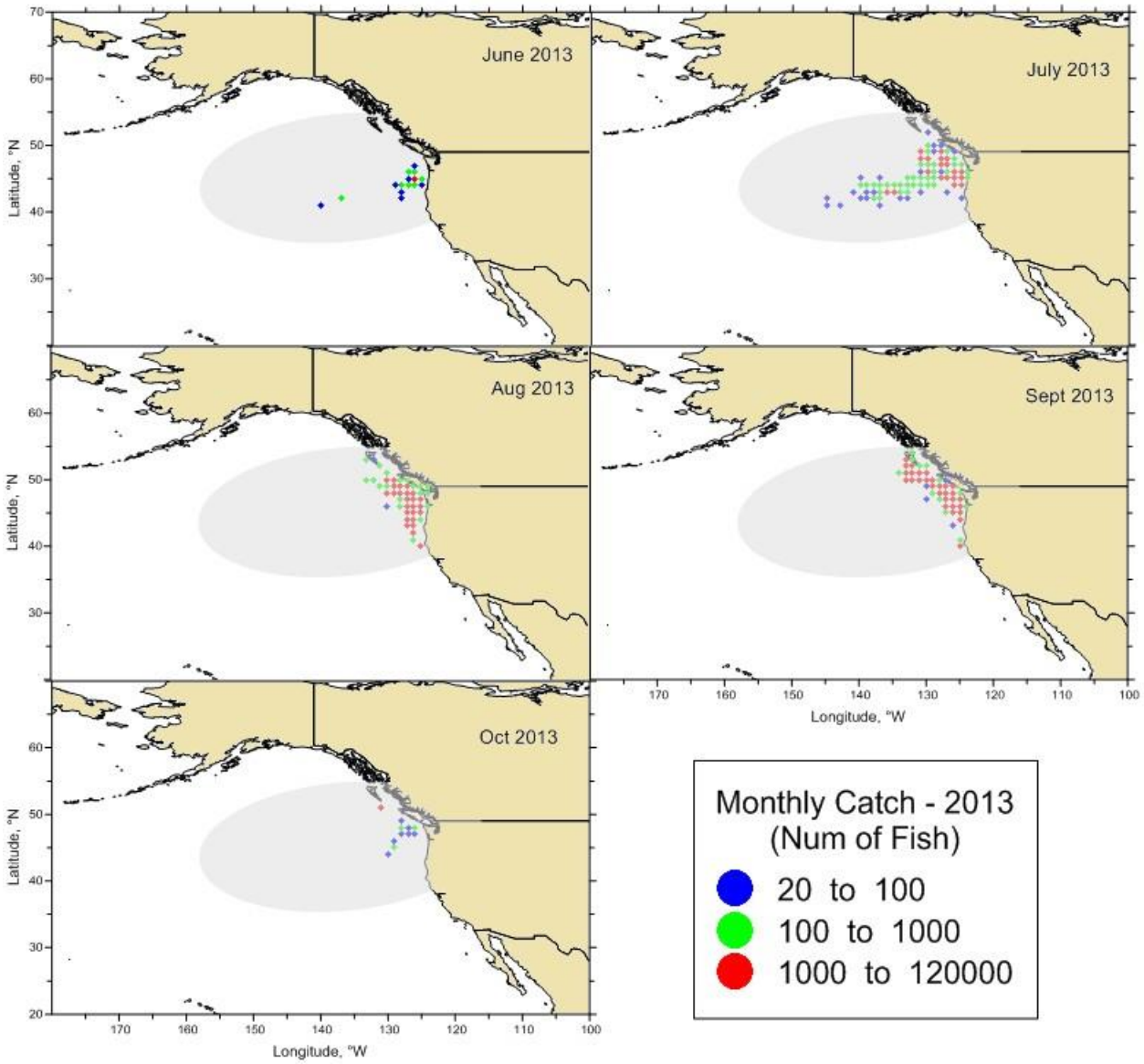

Figure 2a. Monthly spatial distribution of reported catch in Canadian albacore troll fishery in 2013. Data are plotted on a 1° x 1° grid with symbols located on the bottom-right corner of each cell. Cells in which fewer than three vessels reported are not shown. Grey area is the approximate operational area of the Canadian fishery in 2013.

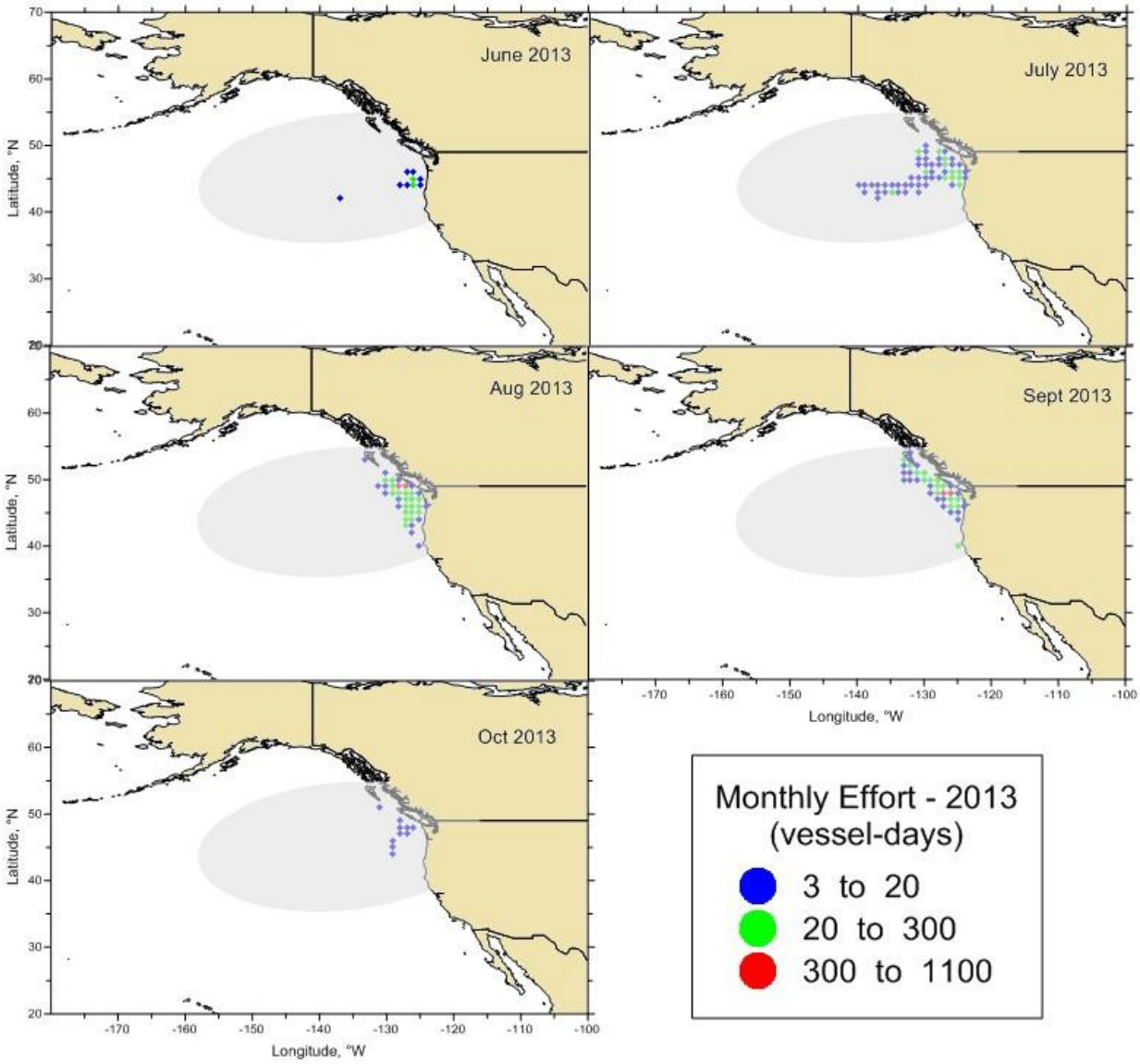

Figure 2b. Monthly spatial distribution of effort by the Canadian albacore troll fishery in 2013. Data are plotted on a 1° x 1° grid with symbols located on the bottom-right corner of each cell. Cells in which fewer than three vessels reported are not shown. Grey area is the approximate operational area of the Canadian fishery in 2013.

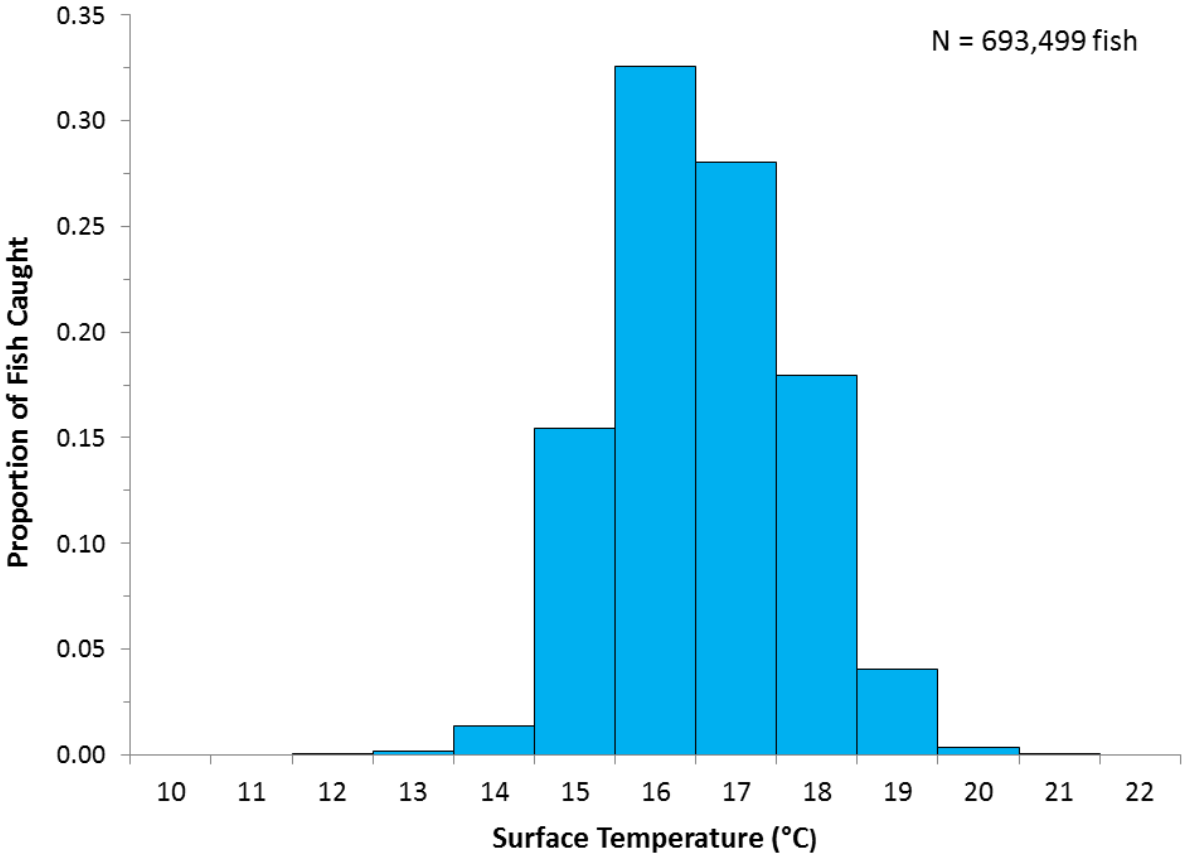

Figure 3. Sea surface temperatures at which albacore tuna were caught by the Canadian troll fishery in 2013. N = fish with associated water temperature data reported in logbooks.

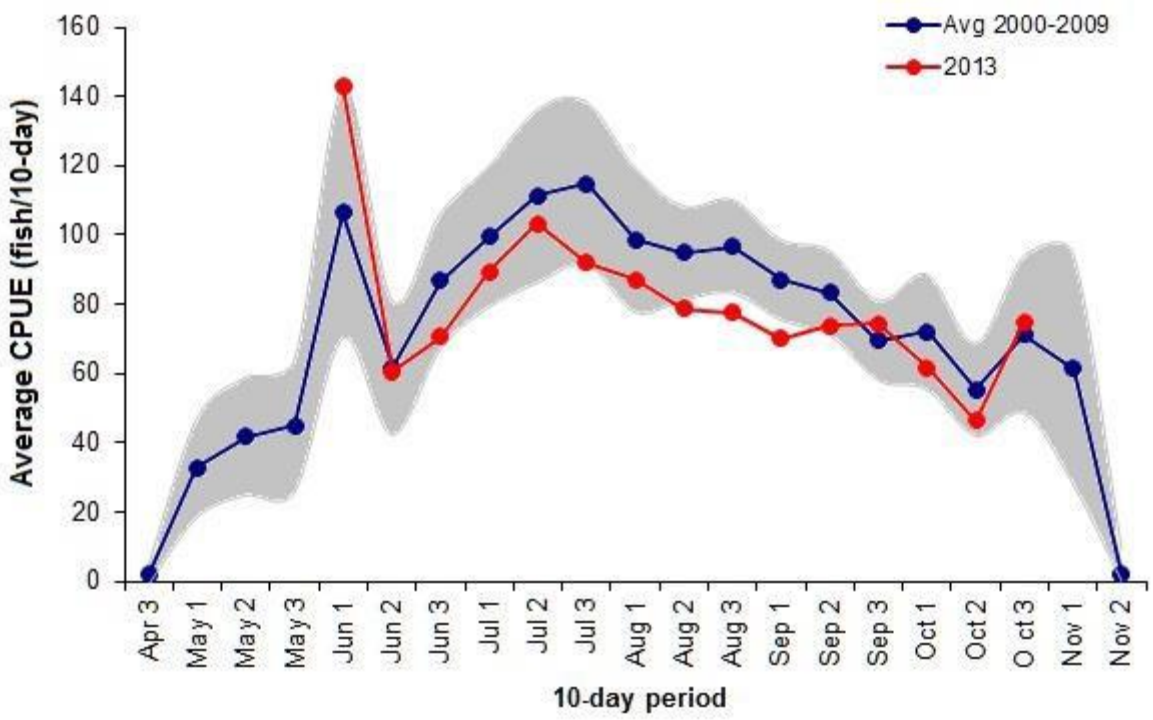

Figure 4. Nominal catch per unit effort for 10-day periods of the Canadian fleet averaged for 2000-2009 compared to the 2013 fishing season. Each data point is the average of all 1°x1° spatial strata in which effort occurred during one of three 10-day periods in a month. The grey area is the 95% confidence interval around the CPUE "climatology". See Kleiber and Perrin (1991) for CPUE calculation details.

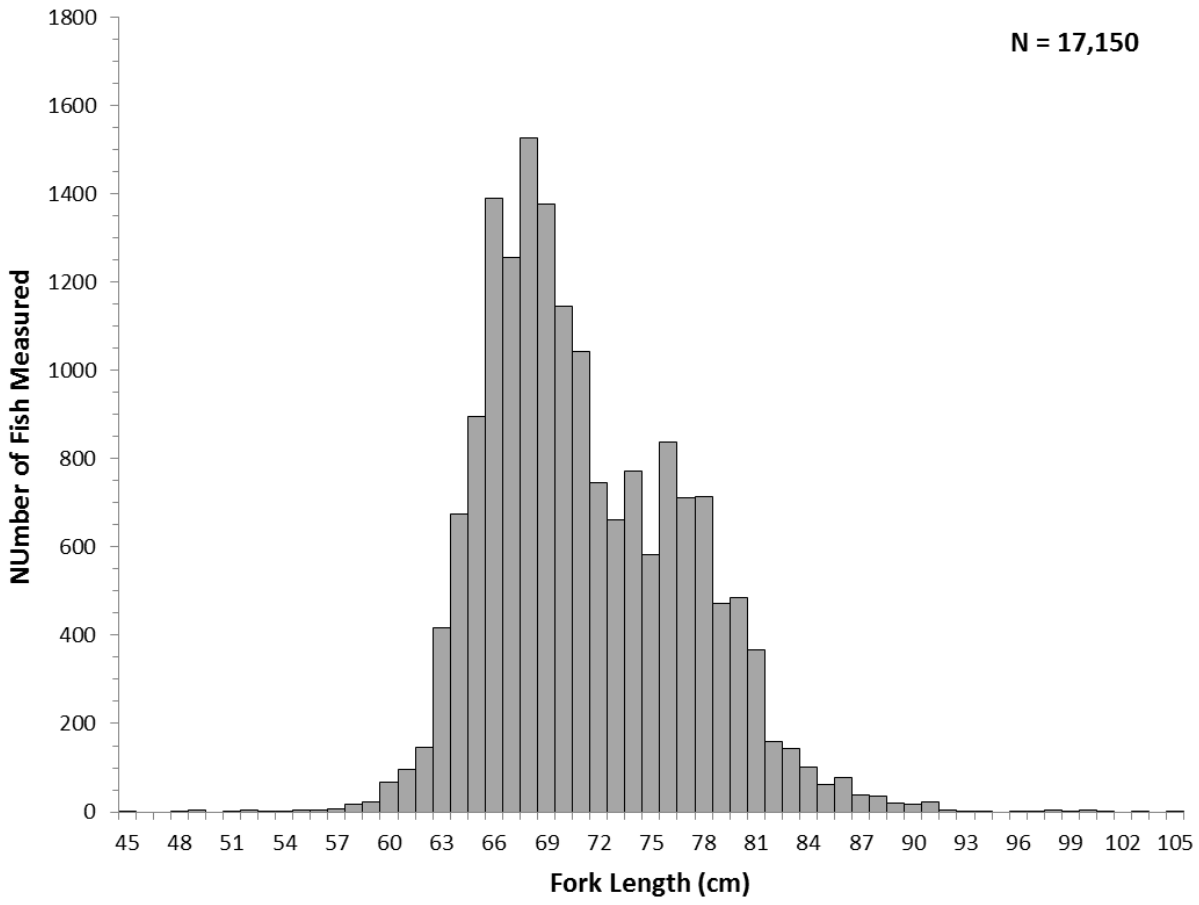

Figure 5. Fork lengths of North Pacific albacore harvested by the Canadian troll fishery in 2013. The 17,150 measurements represent a sampling rate of 2.24% of the reported 2013 catch.