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NATIONAL REPORT OF CANADA: CANADIAN TUNA AND TUNA-LIKE FISHERIES IN THE NORTH PACIFIC OCEAN IN 2023

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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 submitted to the ISC from the 2023 fishing season are summarized in this report. The Canadian fleet consisted of 79 vessels and operated only within the eastern Pacific Ocean, in 2023. No vessels from the Canadian fleet operated in the Central and western Pacific Ocean in 2023. The Canadian troll fishery operates in coastal waters, predominantly within the Canadian and United States exclusive economic zones (EEZ). In 2023, however, the Canadian fleet did not have access to fishing in the United States EEZ due to the absence of a fishing regime for 2023 under the bilateral tuna treaty between the countries. A small proportion of the catch and effort did occur outside the Canadian EEZ, in high seas waters. The provisional 2023 estimates of total catch and effort in the eastern Pacific Ocean are 1,143 metric tonnes (t) and 2,100 vessel-days, respectively. This represents the lowest catch and effort in the timeseries, which begins in 1995. This low catch and effort is partially due to no fishing in the United States EEZ however, the catch and effort in the Canadian EEZ also decreased by 59.4% and 35%, respectively, relative to 2022. The remaining catch and effort occurred in adjacent high seas waters, which increased only slightly relative to 2022. Catch rate (CPUE) decreased from 0.89 in 2022 to 0.54 in 2023, the lowest since 2018. Approximately 86% of the Albacore catch occurred in the favorable water temperature band of 16-19 °C in 2023. Thirty-one (31) vessels measured 7,179 fork lengths in 2023 for a sampling rate of 4.3% of the reported catch. Fork lengths ranged from 47 to 92 cm, having a mode at 68 cm corresponding to 2-year old fish and a smaller mode around 80cm corresponding to 3-year old fish. Mean length was 69.9 cm, which is similar to previous years.

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. In 2023, however, the Canadian fleet did not have access to fishing in the United States EEZ due to the absence of agreement on a fishing regime under the bilateral tuna treaty between the countries. Some of the larger Canadian vessels may follow albacore into offshore waters and occasionally fish in the high seas of the central and western Pacific Ocean. The most recent management regulations for Canadian vessels fishing albacore tuna, covering one year period from 01 April 2023 to 31 March 2024, are documented in the Albacore Tuna Integrated Fisheries Management Plan (IFMP; Pacific region tuna IFMP (publications.gc.ca)). Historically, most of the Canadian effort and catch for north Pacific albacore has occurred between early July and 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 2023.

1. 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. 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 annually (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 24.01.24. Figures up to and including 2022 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 2023 data are preliminary at this time.

2. AGGREGATED CATCH AND EFFORT DATA

2.1. Catch

The preliminary estimate of the Canadian albacore tuna catch in the eastern Pacific Ocean, in 2023 was 1,143 metric tons (t), which represents a 68.6% decrease relative to 2022 and the lowest catch in the timeseries (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 4,315 ± 1,877 t (± sd) since 2003, the period when the annual logbook coverage consistently exceeded 90% of all vessels participating in this fishery. In 2023, the Canadian catch primarily occurred in Canadian coastal waters (87.6%) and the total catch in the Canadian EEZ decreased by 59.4%, relative to 2022. The remaining small proportion (12.4%) of the eastern Pacific Ocean Canadian catch occurred in adjacent high seas waters. No fishing occurred by the Canadian fleet in the United States EEZ, in 2023, due to on-going treaty renegotiations between Canada and the United States. No vessels from the Canadian albacore troll fleet were active in the south Pacific Ocean in 2023.

The Canadian fleet caught 2,560 albacore that were below marketable size (3.18 kg) in 2023 (Table 2). The estimated mean weight of released albacore was 3.35 kg in 2023, similar to the mean weight of 3.23 kg in 2022. The weight of released fish is not accounted for in Table 1, which records retained catch only.

2.2. Effort

In 2023, the Canadian albacore tuna troll fleet consisted of 79 unique vessels, well below the average participation of 136 vessels over the last decade (Table 1). This low participation was in part due to no Canadian vessels fishing in the United States EEZ during the ongoing treaty renegotiations. The 2023 estimate of total fishing effort for the Canadian fleet is 2,100 vessel-days (v-d) and is a 48.4% decrease relative to the fishing effort in 2022 (Table 1; Figure 1). Fishing effort in 2023 occurred largely in Canadian coastal waters (88.1%) and the effort in the Canadian EEZ decreased by 35%, relative to 2022. A small proportion (12%) of the Canadian fleet effort was reported in adjacent high seas waters in 2023. No Canadian vessels from the albacore tuna fleet operated in the south Pacific in 2023.

2.3. Catch Rate

Catch rate or catch per unit effort (CPUE) is calculated by dividing the catch in metric tons by the number of vessel days. Total CPUE for the Canadian fleet was relatively stable from 2018 to 2021, around 0.66 t/v-d on average. In 2022, the CPUE increased substantially to 0.89 t/v-d but in then decreased 2023 to 0.54 t/v-d (Figure 1). The CPUE in the Canadian EEZ also decreased in 2023 relative to 2022. The catch rates in the high seas increased only slightly compared to 2022, similar to rates seen in 2021. The peak of the catch rates varied by area in 2023 (Figure 2). The peak catch rate in the Canadian EEZ occurred in August 2023, at 0.6 t/v-d, and in the high seas the peak was observed in June.

3. SPATIAL DISTRIBUTION OF CATCH AND EFFORT DATA

In 2023, the Canadian troll fleet primarily operated within the Inter-American Tropical Tuna Commission (IATTC) convention area east of 150°W and north of the equator, with approximately 88% of the fishing effort and catch occurring within the Canadian EEZ. The catch and effort in the adjacent North Pacific high seas appeared to be more widely distributed in 2023 then in previous years, likely due to the fleet not being able to operate in the United States waters.

A small amount of catch and effort occurred in June 2023 in the North Pacific in Canadian waters and the bordering high seas. The catch and effort in July and August were distributed in the Canadian and the high seas with the majority occurring in Canadian waters. As in previous years, in September the effort and catch were predominantly concentrated in the Canadian EEZ and fishing only occurred in the Canadian EEZ in October. (Figures 3 and 4).

Albacore were caught in waters with sea surface temperatures ranging from 10 to 19 °C in 2023 (Figure 5). The proportion of fish caught in waters within the favourable 16-19 °C temperature band was 86% in 2023, similar to 89% observed in 2022.

4. BIOLOGICAL DATA

4.1. By-Catch

In 2023, the reported by-catch consisted of 21 fish and four sea birds of unidentified species (Table 3). All sea birds were released and 14 by-catch fish were retained, including 10 Yellowtail Amberjacks (*Seriola lalandi*), and four Pacific Bluefin Tuna (*Thunnus orientalis*). Other by-catch species that were released included Coho Salmon (*Oncorhynchus kisutch*), Blue Shark (*Prionace glauca*) and Salmon Shark (*Lamna ditropis*).

4.2. Biological Sampling

Thirty-one (31) Canadian troll vessels measured 7,179 fork lengths in 2023 for a sampling rate of 4.3% of the reported catch. However, given the low catches in 2023 there was only around half the amount of length data typically collected from the Canadian fleet. Fork lengths ranged from 47 to 92 cm, similar to what has been seen in previous years. The dominant mode in these data corresponds to 2-year-old fish at 67-72 cm and a significant number of fish formed a less prominent second mode around 80 cm, corresponding to 3-year-old fish. The overall mean length of albacore caught in 2023 was 69.9 cm, which is similar to previous years.

Similar to previous years, the monthly mean length of fish in 2023 increased from June (67.6 cm) to September (68.6 cm) and decreased in October (68.4 cm; Figure 7). Albacore caught from the Canadian EEZ had a mean length of 70.9 cm and, as in previous years, the albacore caught in the high seas were slightly smaller, with a mean length 66.5 cm (Figure 8).

5. CLIMATE CHANGE CONSIDERATIONS

Climate change is having a significant impact on Canadian fish stocks and fisheries in the Pacific Ocean and it is becoming more evident over time (DFO 2013; Hunter and Wade 2015). Climate change is expected to result in physical changes such as increasing sea surface temperature, marine heat waves, rising sea level, salinity changes, ocean acidification, and deoxygenation, all of which affect Canadian fisheries. Canada is taking action to build resilience to the impacts of climate change through several initiatives linked by key goals to take action on climate change and its impacts and to conserve and protect the oceans (DFO 2023). In 2011, the Canadian government initiated the Aquatic Climate Change and Adaptation Services Program (ACCASP) to improve understanding of climate change and prepare for climate-related changes. A key activity under the ACCASP was to advance understanding of the vulnerability of commercial species to the impacts of climate change and to develop a strategy to incorporate this knowledge into fisheries stock assessments. In the Pacific Ocean, potentially major impacts of climate change have already been noted in Canadian waters, including changes in species distributions (e.g. increased bycatch in recent years of tropical tuna species and Pacific bluefin tuna in Canadian waters), changes in recruitment and abundance (e.g. effects of recent marine heat wave (2014-2016) in Canadian waters (Free et. al., 2023)), changes in community compositions (e.g. shifts in zooplankton diversity to include more southern species), and changes in fish growth (e.g. smaller sizes at age observed in a number of species).

In 2018, a national review process was used to develop a framework for incorporating climate change considerations into fisheries stock assessments (Pepin et. al., 2020). The results of this review launched Canada's commitment to an Ecosystem Approach to Fisheries Management (EAFM) initiative in 2019. This initiative is aimed at developing a national framework to operationalize incorporating ecosystem variables (including climate, oceanographic and ecological factors) in order to enable climate-ready decision-making and better inform stock and individual fishery-focused management decisions. Canadian scientists have started to initiate several monitoring and research activities to document and further understand how changes in population dynamics and species distributions are linked to changing ocean conditions (e.g., State of the Pacific Ocean Reports and Ocean Networks Canada). Additionally, Canadian scientists have started to refine modelling initiatives that incorporate potential long term climate scenarios to improve forecasting and assess risk in decision making (e.g. Pacific Herring EAFM case study (Pepin et. al., 2023)).

North pacific albacore tuna are a highly migratory species and are only present seasonally in Canadian waters. The distribution of this species is highly influenced by oceanic conditions, including temperature and ocean productivity fronts. It is therefore highly likely that climate change will influence the timing and spatial distribution of the feeding migrations of albacore that enter into Canadian waters. Spawning and rearing of albacore may be expected to occur further north in Canadian waters as a response to water temperature increases. However, there is currently no clear definitive evidence of a direct impact of climate change on albacore in Canadian waters. The complexity in interpreting the trend of albacore in Canadian waters is in part due to the use of fishery dependent data to examine these relationships. Throughout the time series of catch and effort there have been spatial changes in the operation of the fishery, as well as, economic drivers of effort. Additionally, there is currently no in-season monitoring and initial estimates of catch or effort are not available until a few months after the fishery ends. The Canadian government is working toward implementing a fleet-wide vessel monitoring system (VMS) in order to effectively monitor, control and enforce safe, responsible and sustainable practices in real time. Data pertaining to catch locations are currently only provided in the logbooks without independent verification or sufficient detail to support localized spatial analysis of stock and fishing dynamics. VMS data will also be critical in supporting the analytical work done by the ISC to advance the assessment and incorporate climate-driven changes in fishing activity.

6. DISCUSSION

In 2023, the Canadian albacore fishery recorded a 68.6% decrease in total catch and 48.4% decrease in effort, relative to 2022. This reduction resulted in the lowest catch and effort observed in the timeseries. The fishery also had a significant reduction in the fleet size in 2023 with only 79 unique vessels participating, well below the 117 vessels that participated in 2022 and the average 136 vessels over the last decade. The decline in this fishery appears is partially due to no fishing in the United States in the absence of agreement on a fishing regime in 2023 under the bilateral Canada-United States Albacore Tuna Treaty. The fleet did also see a reduction in catch rates in Canadian waters in 2023, compared to the large increase that was observed in 2022, however was not the lowest seen in the last decade. The Canadian albacore catches 2014-2023 appear to be largely composed of Age 2 fish compared to the earlier years of 2009-2013, during which catches were mainly composed of Age 3-4 Albacore.

A recreational fishery for albacore is continuing to develop in Canadian waters. This fishery consists of both charter-boats and private boats. This recreational fishing is seasonal, between June and September, similar to the commercial fishery. Over the last few years methods have been developed to collect catch and effort data for the fishery through a regional recreational catch reporting survey and methods have been developed to expand these estimates. These preliminary data do not appear to be significant and have not been included in the tables and figures in this report because they are still considered to be highly uncertain.

7. LITERATURE CITED

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TABLES

Table 1. Fishery statistics from the Canadian troll fishery for north Pacific Albacore Tuna, 1995-2023. 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 (%)
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	1,830	4,978	121	100%
2018	2,717	4,196	121	100%
2019	2,402	3,882	122	100%
2020	2,376	3,302	104	100%
2021	2,419	3,687	113	100%
2022	3,639	4,073	118	100%
2023[1]	1,143	2,100	79	100%

[1] 2023 data are preliminary based on Ver. 24.01.24 of the *Canadian Albacore Tuna Catch and Effort Relational Database*. See Stocker et al. (2007) for a description of the database.

Table 2. Releases of Albacore below marketable size (3.18 kg) reported by the Canadian Albacore fishery in 2013-2023.

Year	Number of Fish	Total Weight (kg)
2013	289	918
2014	2,214	7,153
2015	4,295	14,271
2016	562	2,134
2017	545	1,660
2018	5,508	18,291
2019	4,093	12,929
2020	668	2,082
2021	6,624	21,709
2022	159	514
2023	2,560	9,085

Table 3. Reported catch of non-target species (by-catch) by the Canadian Albacore Tuna troll fishery in 2023.

			Catch (in Numbers)	
Month	**Common name**	**Scientific Name**	**Retained**	**Released**
July	Yellowtail Amberjack	*Seriola lalandi*	6	
	Pacific Bluefin Tuna	*Thunnus thynnus*	1	
	Blue Shark	*Prionace glauca*		1
	Salmon Shark	*Lamna ditropis*		1
August	Sea Bird	*N/A*		1
	Salmon Shark	*Lamna ditropis*		1
	Yellowtail Amberjack	*Seriola lalandi*	4	
	Pacific Bluefin Tuna	*Thunnus thynnus*	3	
September	Sea Bird	*N/A*		3
	Coho Salmon	*Oncorhynchus kisutch*		4
		TOTALS	14	11

FIGURES

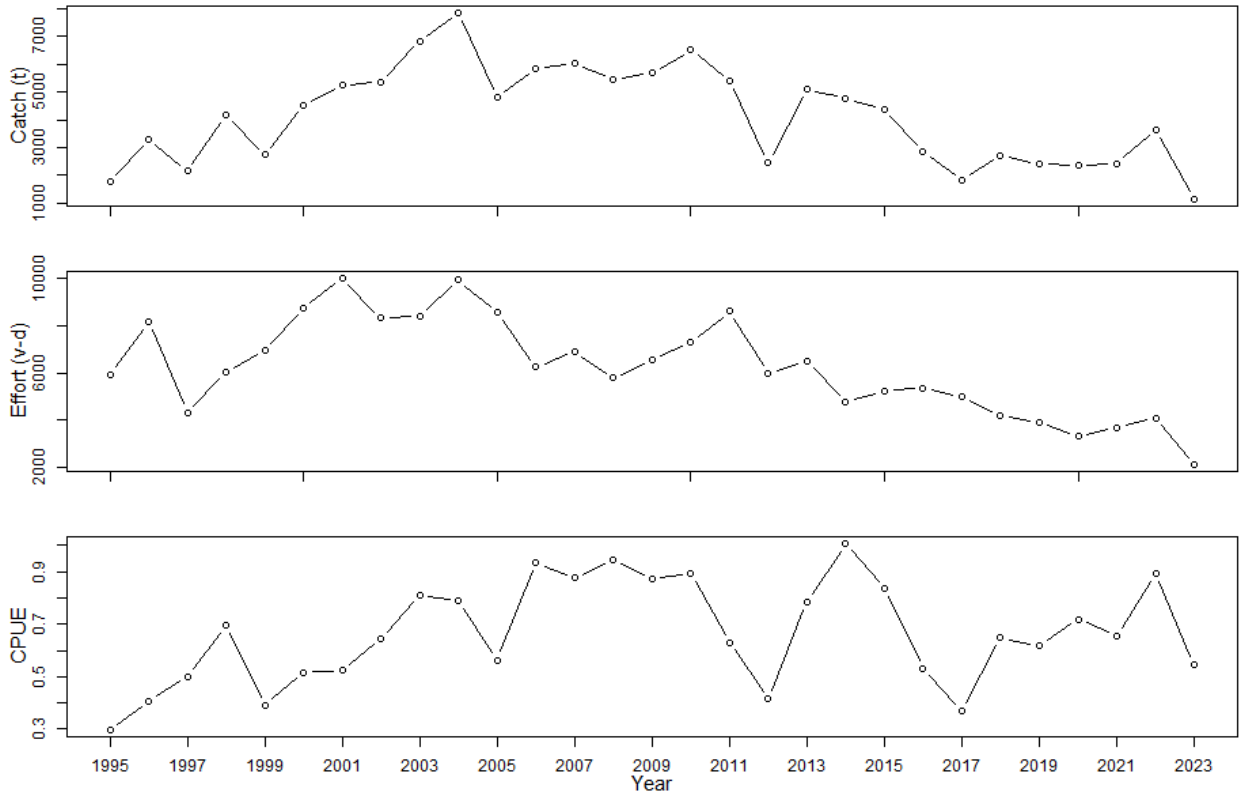

Figure 1. Historical trends in expanded catch (metric tonnes, t), effort (vessel-days, v-d) and catch per unit effort (CPUE, t/vessel-day) in the Canadian troll fishery for north Pacific Albacore Tuna from 1995 to 2023.

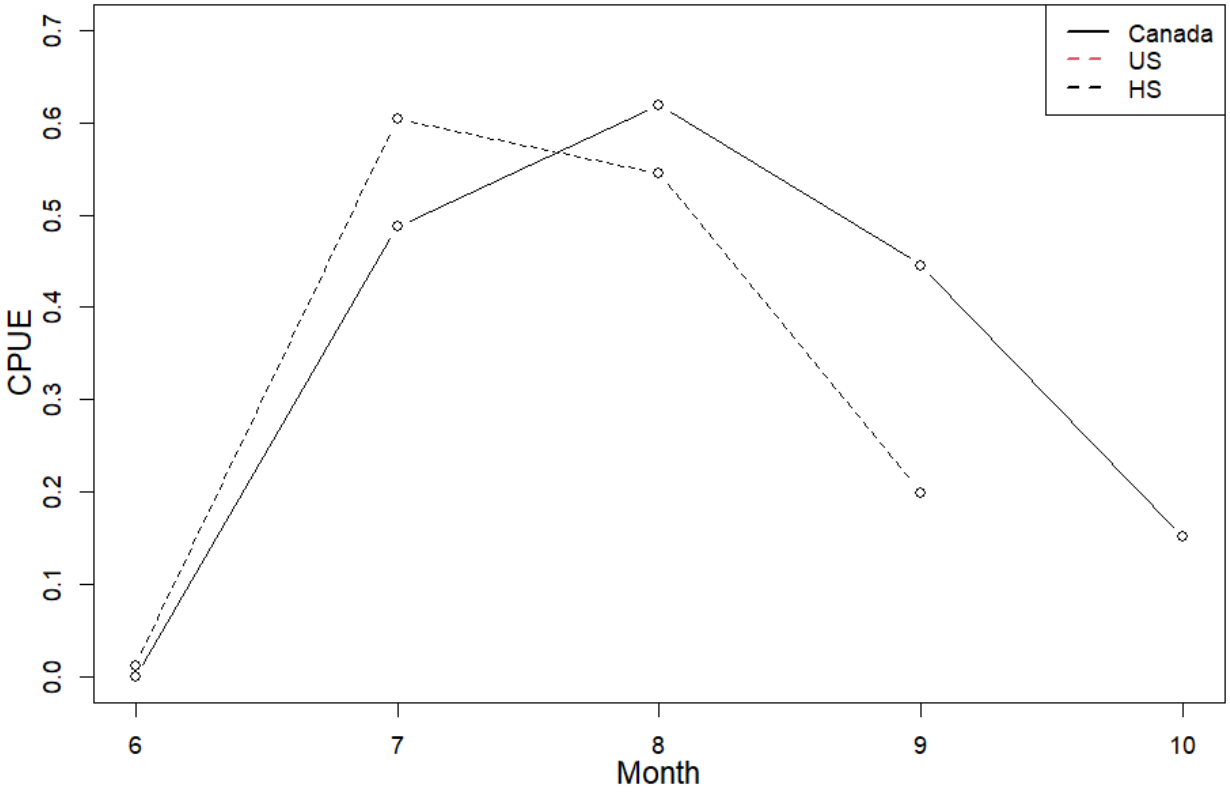

Figure 2. Monthly catch per unit effort (CPUE, t/vessel-day) in the Canadian and U.S. EEZs for Canadian Albacore Tuna troll fishery in 2023.

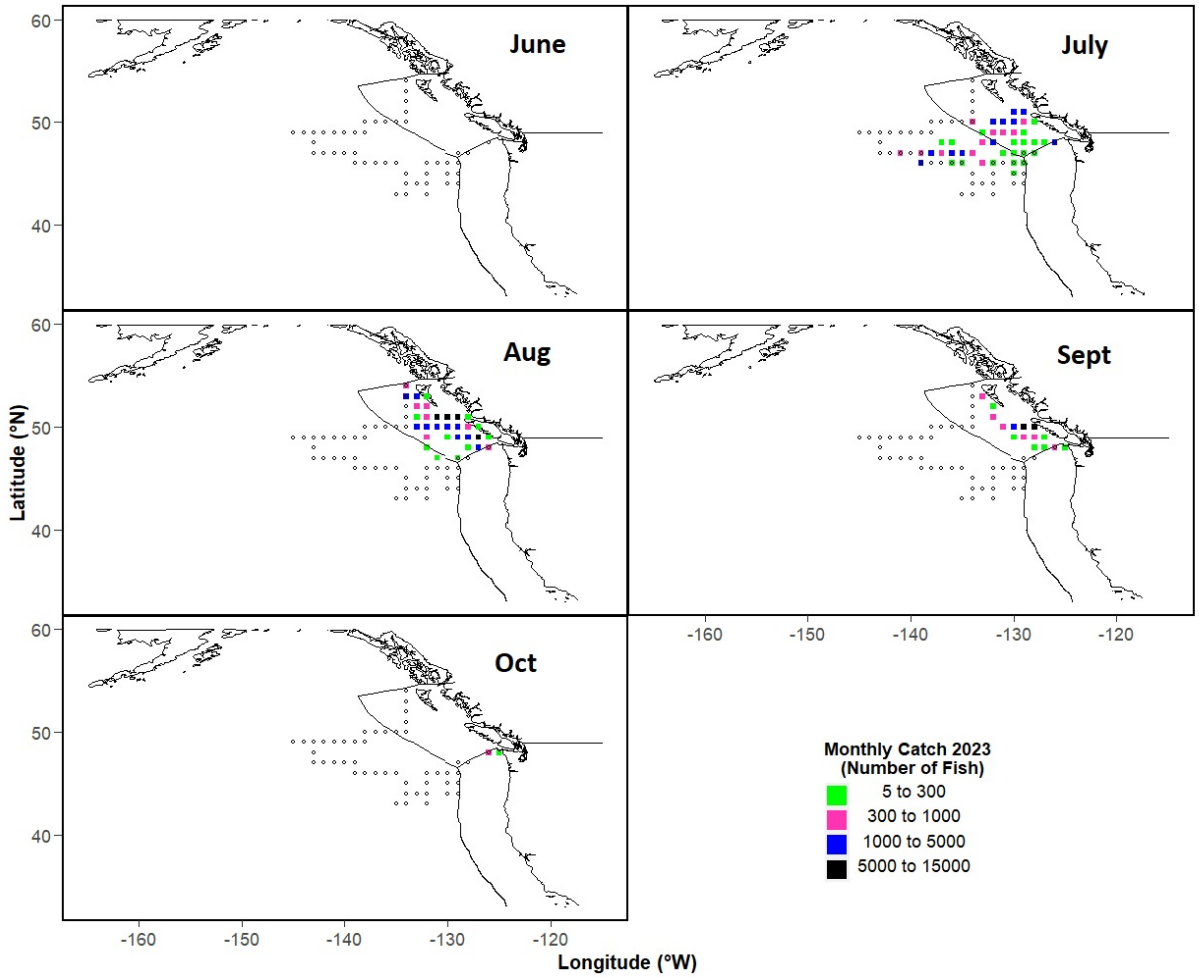

Figure 3. Monthly spatial distribution of reported catch in Canadian Albacore Tuna troll fishery in 2023. Data are plotted on a 1° x 1° strata with symbols located on the bottom-right corner. Data in locations with less than 3 unique vessels operating are excluded due to domestic privacy rules. Strata 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 2023.

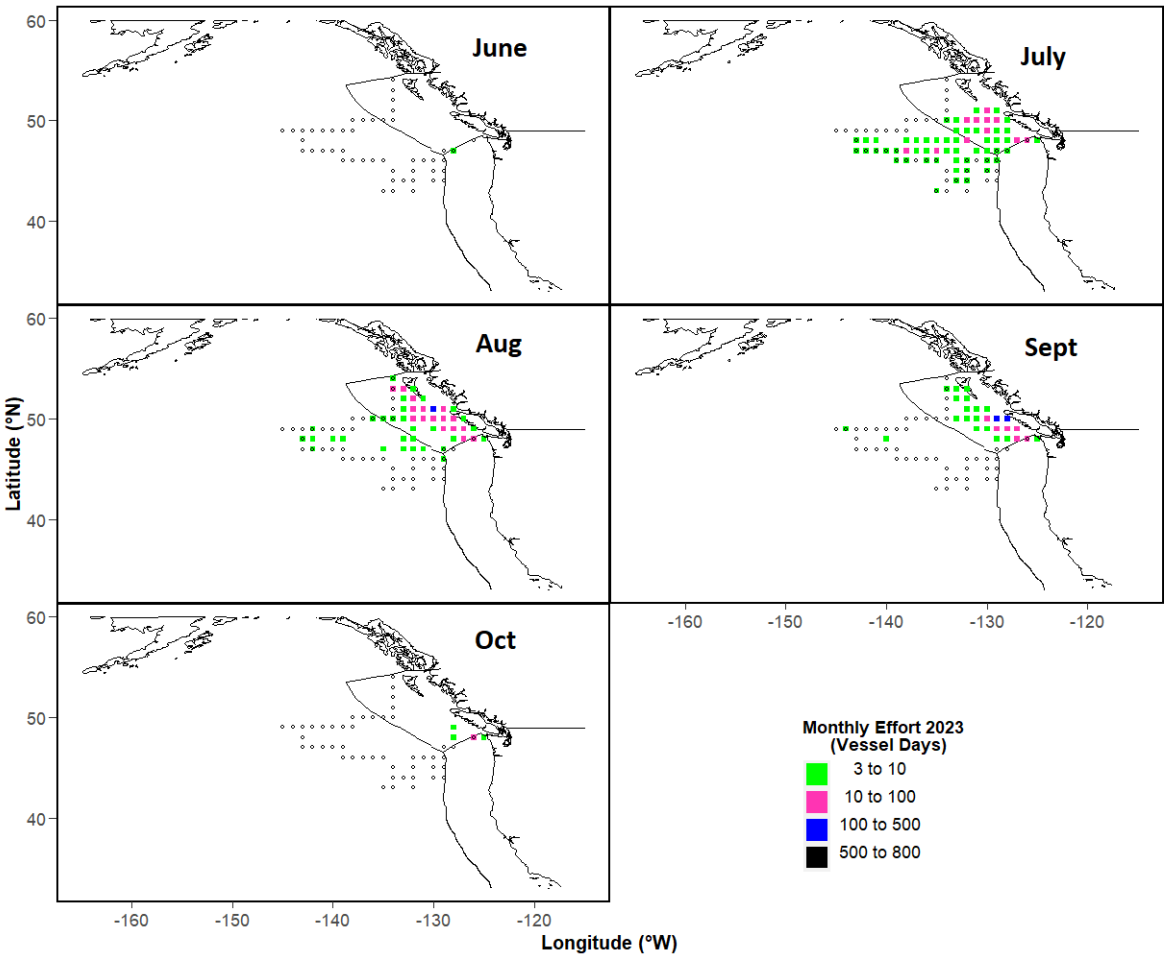

Figure 4. Monthly spatial distribution of effort by the Canadian Albacore Tuna troll fishery in 2023. Data in locations with less than 3 unique vessels operating are excluded due to domestic privacy rules. Data are plotted on 1° x 1° strata with symbols located on the bottom-right corner. Empty dots approximate the border line of the operational area of the Canadian fishery in 2023.

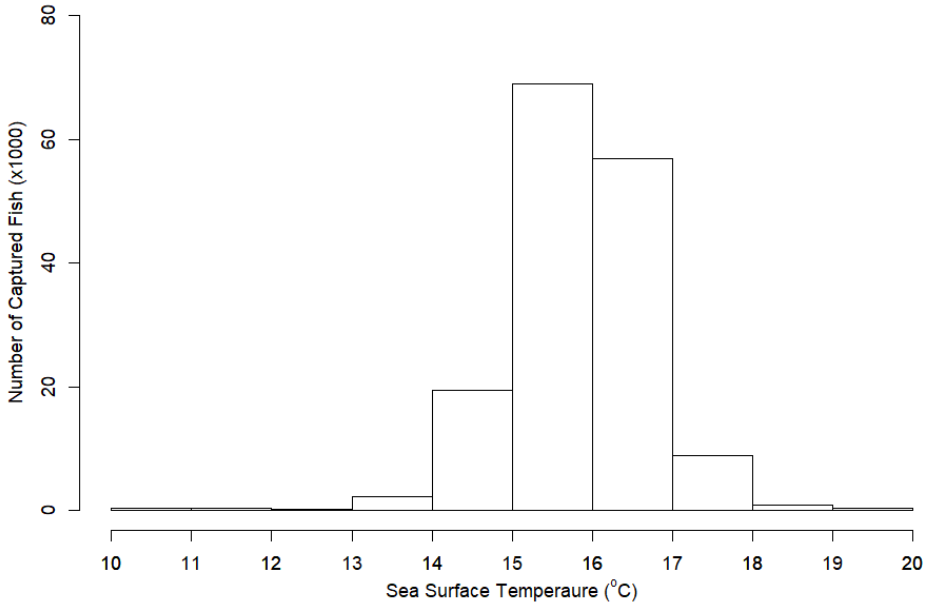

Figure 5. Number of north Pacific Albacore Tuna caught by the Canadian troll fishery in 2023 at various sea surface temperatures.

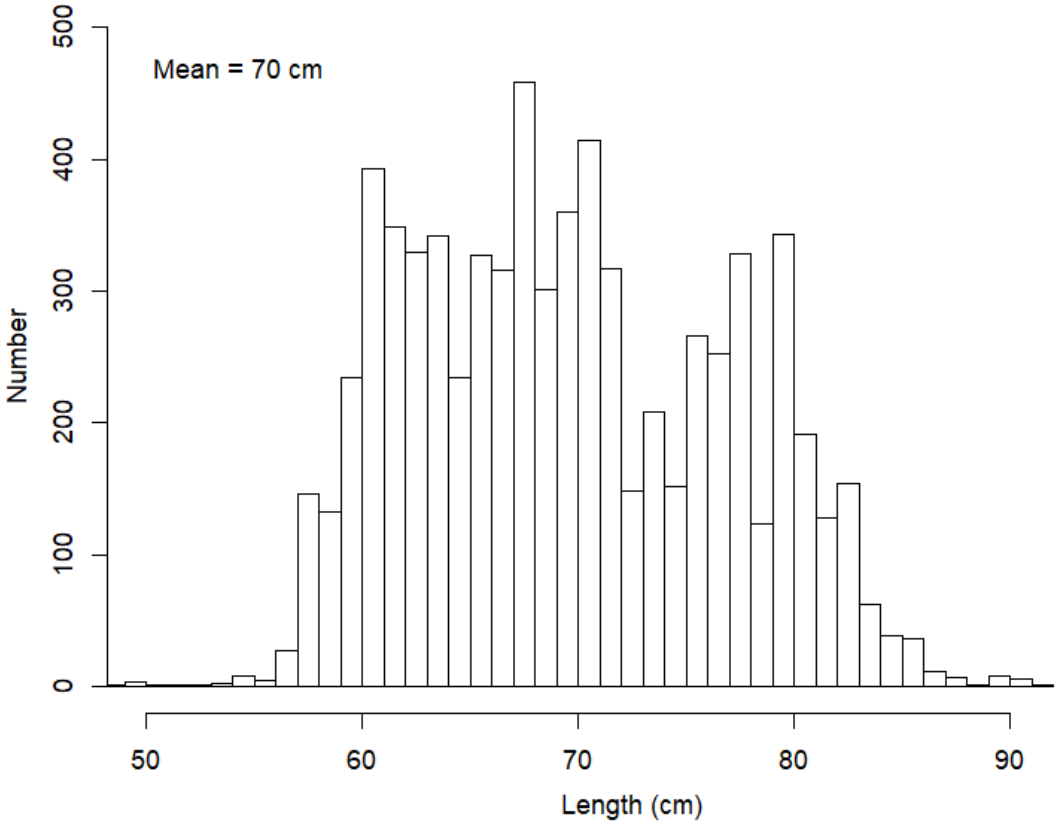

Figure 6. Distributions of fork lengths (cm) of north Pacific Albacore Tuna harvested by the Canadian troll fishery in 2023.

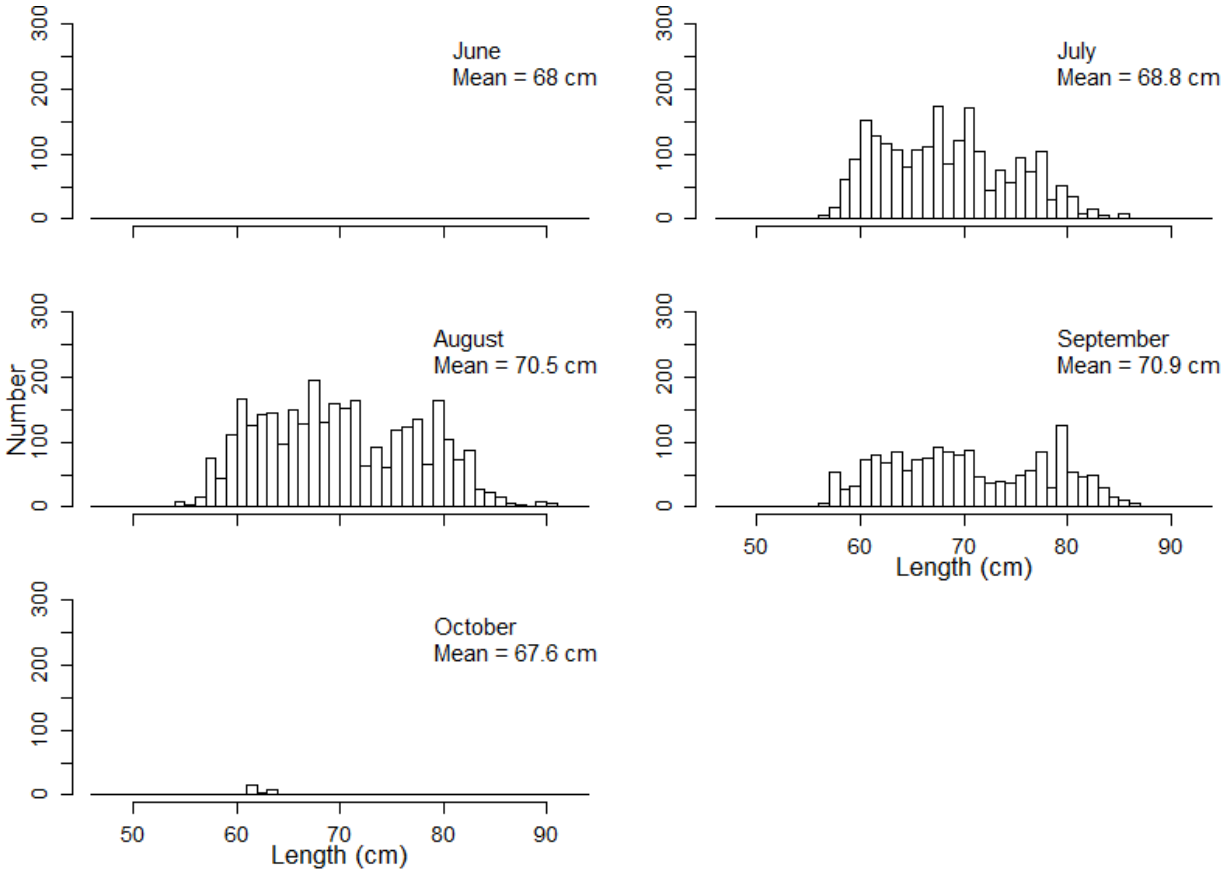

Figure 7. Monthly fork length (cm) distributions of north Pacific Albacore Tuna harvested by the Canadian troll fishery in 2023.

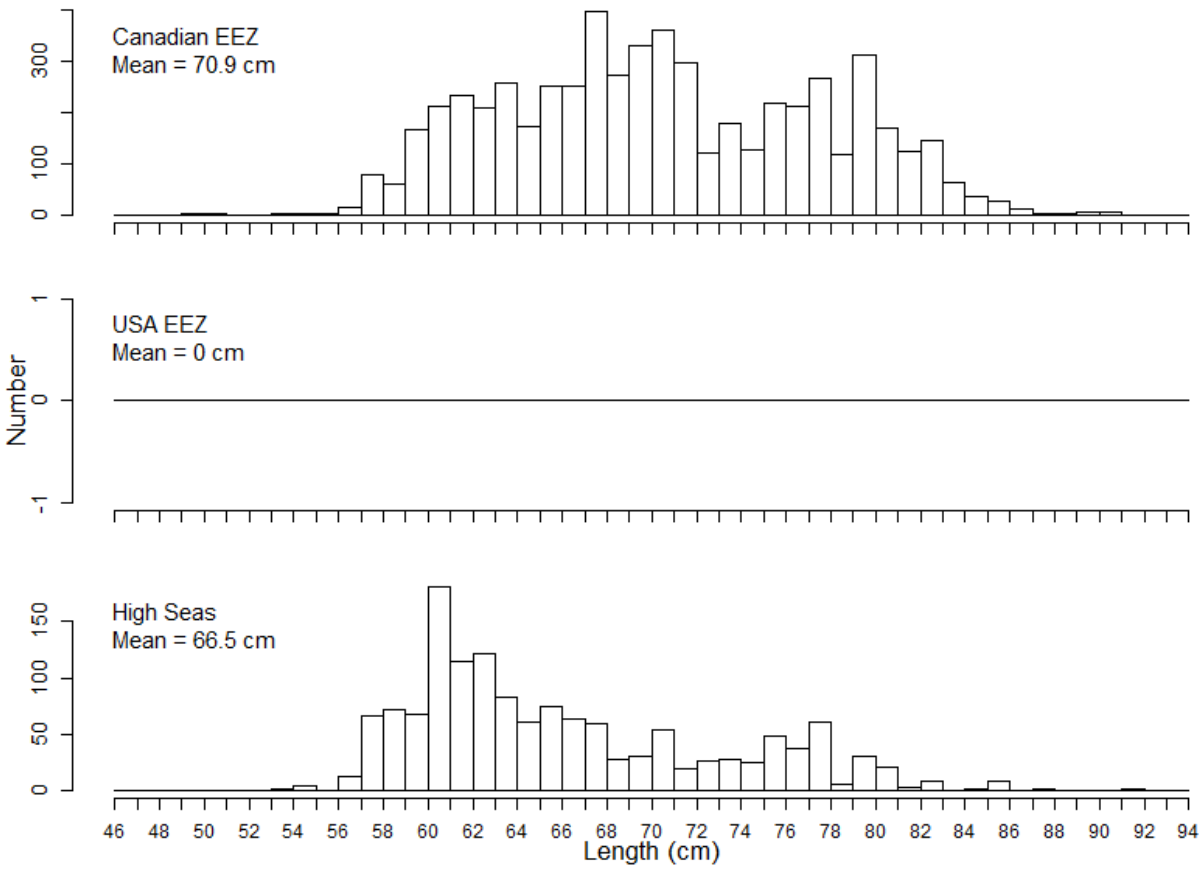

Figure 8. Distributions of fork lengths (cm) of north Pacific Albacore Tuna harvested by the Canadian troll fishery in 2023 in Canadian EEZ, USA EEZ and High Seas. Note: No fishing occurred by the Canadian fleet in the USA EEZ in 2023.