

A Summary of the Recreational Shark Fishing Tournament Landings Data and Canadian Dart Tag Database from Maritimes Region

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ABSTRACT

Bowlby, H., Joyce, W., Coates, P., and MacDonald, C. 2023. A summary of the recreational shark fishing tournament landings data and Canadian dart tag database from Maritimes Region. Can. Tech. Rep. Fish. Aquat. Sci. 3516: iv + 26 p.

This report describes: (1) the history and data collected from annual recreational shark fishing tournaments in the Maritimes Region, Nova Scotia. These have been ongoing since 1993; and (2) data contained within the Canadian Dart Tag Database, which was initiated in 2006 in conjunction with the recreational shark fishing tournaments. All morphological sampling information from landings as well as the tag and recapture information have been archived on the Government of Canada Open Data Portal (<https://open.canada.ca/data/en/dataset//c4c5c7f1-bfa6-4ff6-b4a0-c164cb2060f7>). This document is intended to facilitate interpretation of these data, focusing on Blue Shark (*Prionace glauca*) as the primary species captured at the tournaments.

RÉSUMÉ

Bowlby, H., Joyce, W., Coates, P., and MacDonald, C. 2023. A summary of the recreational shark fishing tournament landings data and Canadian dart tag database from Maritimes Region. Can. Tech. Rep. Fish. Aquat. Sci. 3516: iv + 26 p.

Ce rapport décrit : (1) l'histoire et les données recueillies lors des tournois annuels de pêche récréative au requins dans la région des Maritimes, en Nouvelle-Écosse. Celles-ci sont en cours depuis 1993 ; Et (2) les données contenues dans la base de données canadiennes sur le marquage des fléchettes, qui a été lancée en 2006 en conjonction avec les tournois de pêche récréative aux requins. Toutes les informations d'échantillonnage morphologique des débarquements ainsi que les informations d'étiquetage et de recapture ont été archivées sur le portail de données ouvertes du gouvernement du Canada (<https://open.canada.ca/data/fr/dataset//c4c5c7f1-bfa6-4ff6-b4a0-c164cb2060f7>). Ce document vise à faciliter l'interprétation de ces données, en se concentrant sur le requin bleu (*Prionace glauca*) en tant que principale espèce capturée lors des tournois.

INTRODUCTION

The Canadian Atlantic Shark Research Laboratory of Fisheries and Oceans Canada (DFO) is part of the Science Branch, Maritimes Region, and is tasked with research to support fisheries assessment and species-at-risk processes for pelagic shark species in Atlantic Canada. The three main species considered are Blue Shark (*Prionace glauca*), Porbeagle Shark (*Lamna nasus*), and Shortfin Mako Shark (*Isurus oxyrinchus*).

This report describes: (1) the history of sampling and kinds of data collected from the recreational shark fishing tournaments in the Maritimes region, which have been ongoing since 1993 and (2) data contained within the Canadian dart tag tagging database, which was initiated in 2006 in conjunction with the recreational shark fishing tournaments. The report focuses on Blue Sharks the primary species captured at the tournaments.

RECREATIONAL TOURNAMENT HISTORY

The recreational shark fishery in Atlantic Canada (includes DFO Maritimes, Gulf, Quebec and Newfoundland and Labrador Regions) is catch and release only. The exceptions are private-sector or community-sponsored recreational shark fishing tournaments, held annually in Nova Scotia (Maritimes Region). In these tournaments, sharks are permitted to be landed and morphological data are collected from the carcasses for scientific study. Tournament organizers obtain a licence from DFO to conduct a tournament. Tournaments are restricted to rod and reel gear only and all landed sharks must be sampled onshore (dockside monitoring), which has been done annually by Science staff and/or third-party dockside monitors. Tournaments are not sponsored or run by DFO or the Canadian Atlantic Shark Research Laboratory.

The first recreational shark fishing tournament in Nova Scotia was held in 1993 in Halifax as a kick-off to the annual tuna fishing tournament. In subsequent years, additional tournaments were held as community events geared towards attracting tourism. The number of tournaments held each year has varied from one (1993) to a maximum of seven (2012) (Table 1). All tournaments in 2020 were cancelled due to Nova Scotia Public Health guidelines that restricted gatherings during the COVID-19 pandemic (<https://novascotia.ca/coronavirus/>).

Tournaments are typically held over a weekend (1-2 days) during late July to early September. All tournaments are subject to requirements set out by licence conditions from DFO Fisheries Management. In addition to these, organizers set out specific rules at each event (e.g., tournament judging criteria) which means that each tournament has a slightly different format, depending on the organizing committee. For example, the largest shark landed could be judged based on round (whole shark landed) or dressed (guts removed) weight. Tournaments begin with a captain's meeting the day before to discuss rules and safety, and end at pre-determined times.

In the past 28 years, tournaments have been carried out somewhat regularly in Nova Scotia each year in 8 fishing ports by 11 different organizations: Halifax/Dartmouth (including Eastern Passage), Lockeport, Yarmouth, Brooklyn, Riverport, Petit de Grat, Jeddore, and Louisbourg. Participant numbers ranged among tournaments from a low of 11 (Jeddore, 2010) to a high of 349 (Yarmouth, 2001) with an average of 119 (Table 1). The number of boats participating ranged from 4 (Jeddore, 2010) to 83 (Brooklyn, 2003) with an average of 23 boats per tournament. Vessels typically travel 15 to 20 nautical miles (NM) offshore while fishing, yet some have gone as far as 40-60 NM.

REGULATORY CHANGES

The majority of regulatory changes were implemented to improve scientific data collection and/or promote conservation objectives. Typically, changes occurred following new information or scientific assessments on population status (e.g. Campana et al. 2004, COSEWIC 2004). To facilitate ongoing management, a Recreational Shark Derby Management Plan was developed in 2002, in consultation with DFO Science and tournament representatives (DFO 2007).

When the tournaments started in 1993, four species of shark could be landed: Shortfin Mako (*Isurus oxyrinchus*), Porbeagle (*Lamna nasus*), Blue Shark (*Prionace glauca*), and Common Thresher (*Alopias vulpinus*). Any of these species had to be a minimum total length of 180 cm (6 ft.). Each participant required a recreational shark fishing licence from DFO, was permitted to land 1 shark per day of the tournament, and was required to submit a monitoring log (Appendix 1) to record their fishing activities (whether a shark was landed or released), though this wasn't strictly enforced until 2013. As long as DFO Science teams were present, dedicated dockside samplers were not required. After 2013, dockside samplers were required.

Originally, sharks were landed dressed (guts removed) as in commercial fisheries. In 2000, DFO Science requested that sharks be landed round (guts intact) or that guts be bagged and brought back to the wharf for examination. This was primarily to provide stomach samples for diet analysis and reproductive tracts for information on maturity status. Unfortunately, landing sharks round spoils the meat, which eliminated the possibility for human consumption of the catches. Hence, 'gut bagging' was implemented on a trial basis and some tournaments (e.g. Lockeport) chose to bag the guts for numerous years. The morphological samples from bagged guts tended not to be of sufficient quality for research, so licence conditions were changed in 2001 to require some tournaments to land their fish round on a rotating basis by year. Since 2009, all sharks landed at recreational tournaments have been landed round.

In 2013, tournament organizers were made responsible for returning the monitoring documents from all participating captains to ensure consistent reporting. From 2014 onwards, each shark tournament was authorized under a Section 52 Scientific Licence covering all vessels and participants to further simplify reporting. This meant that individual tournaments operated under a single licence, and that all catches at a tournament were associated with the same licence. Committee organizers were then responsible to collect all logbooks and submit them to a Dockside Monitoring Program. After 2022, DFO Science will no longer be requesting sampling under a Section 52 licence, which will mean that a different method of permitting will be required to allow landings at the tournaments from 2023 onwards.

In 2004, the first fisheries assessment of blue shark was completed. It found that blue shark landings at tournaments accounted for 3% of blue sharks killed annually in Canada, having a negligible effect on the overall population (Campana et al. 2004). Blue shark were again re-assessed in 2016 and found to be "not at risk" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). To keep mortality from the recreational tournaments low, total combined weight, for all species, from all tournament landings was capped in 2011 at 20 metric tonnes (mt). To date, this limit has never been reached. It is taken into account whenever DFO receives a request for an additional tournament.

In 2004, Porbeagle Shark were assessed as "endangered" by COSEWIC (COSEWIC 2004) and in 2014 this status was confirmed. After 2006, tournament organizing committees voluntarily excluded porbeagle from consideration when landings were judged to promote conservation. This effectively meant that porbeagle shark were prohibited from being landed, because participants could not win by landing a porbeagle. This tournament rule was formally added to licence conditions in 2017. Similar conservation concerns for Shortfin Mako (discussed at the International Commission for the Conservation of Atlantic Tunas (ICCAT) (ICCAT 2017) and

being assessed as “endangered” by COSEWIC in 2019) as well as concerns for Common Thresher (Rigby *et al.* 2019) led to licence conditions being changed in 2018 to permit Blue Shark landings only. All other shark species were prohibited.

In 2006, the minimum size of landed sharks was increased from 6 ft to 8 ft total length to better protect juvenile animals from mortality for tournaments in mainland Nova Scotia (Eastern Passage, Riverport, Lockeport, Yarmouth, and Brooklyn). Recognizing the need for biological data as well as the relative scarcity of large sharks in the waters off Cape Breton, tournaments initiated in Petit de Grat (2011) and Louisburg (2012) were allowed to keep the 6 ft minimum fish length. Also starting in 2006, many tournament organizers imposed additional restrictions to promote conservation. These included: (1) increasing the minimum size of shark landed to 9 ft. total length, (2) allowing only 1 shark to be landed per participant and/or landing only 3 sharks total per boat, and (3) in the case of 2-day tournaments, not allowing any landings on day 2 that were smaller than the largest shark caught on day 1.

All of the above management and regulatory changes have been organized into a timeline, given in Appendix 2.

DATABASE SUMMARY

SHARK TOURNAMENT DATA

Data collected from landed sharks have varied year to year and between tournaments, primarily due to research questions of interest and tournament judging criteria. Less biological data were collected during the early years of the tournaments because sharks were landed dressed.

All morphometric measurements collected by DFO Science (staff and volunteers) were stored in Microsoft Excel worksheets and have since been posted on the Government of Canada Open Data Portal (<https://open.canada.ca/data/en/dataset/c4c5c7f1-bfa6-4ff6-b4a0-c164cb2060f7>). Recorded variables included information such as length (cm), weight (kg), sex, stomach contents, stomach volume, and reproductive stage. If organs, tissue or vertebrae were collected, these samples were flagged in the spreadsheets. If a specific type of information was not collected for a particular individual, these cells were left blank. Other observational information (such as bite marks on females or presence of parasites) was periodically recorded but should not be considered quantitative.

CANADIAN DART TAG DATABASE

Beginning in 2006, DFO Science implemented a voluntary tagging project with the recreational shark tournaments and encouraged participants to tag any sharks less than 240 cm (8 ft) before they released them. Tagging kits and instructions on how to tag were distributed to captains before the start of each tournament. Individuals participating in the tagging program would voluntarily collect information on location, weight, length, sex, water temperature, condition and species from any tagged shark they released. These tagging forms were returned to DFO biologists at the end of the tournaments. Note that all recorded weights and the majority of lengths were estimated since none of the participating vessels had scales to measure weight and few took the time to use a measuring tape to get a precise length for each captured shark.

Due to their ease of application and low cost, dart tags have also been deployed through a variety of research projects, citizen science programs, recreational fisheries, commercial fisheries, and recreational shark fishing charters. Either FloyTag or Hallprint dart tags were used, which are uniquely identifiable by an alphanumeric code. All information is stored in Microsoft Excel spreadsheets that are updated annually by the shark unit.

When a tagged shark was recaptured, the dart tag contained a mailing address so that information about the recapture could be returned to DFO. The majority of recaptures (63%) were from Spanish and Japanese vessels fishing in the mid-North Atlantic. Typically, the size, sex, and location of the recapture was sent back. Comparing the size at release with the size at recapture gives information on growth. Similarly, comparing the location of release with the location of recapture gives information on the minimum distance travelled by the tagged shark.

PREVIOUS USES

Within DFO, these data have been used to produce advice for the Canadian Science Advisory Secretariat on blue shark abundance, status and threats (Campana et al. 2003; 2004; 2015), and have contributed to two primary publications on aging and diet (MacNeil and Campana 2002, McCord and Campana 2003).

Outside of DFO, data and samples have been used to support teaching and research at several institutions, including: Dalhousie University (faculties of agriculture and biology), and the Oceanographic Environmental Research Society

SUMMARY STATISTICS

LANDINGS

Since 1993, a total of 4,266 sharks have been landed at various tournaments around Nova Scotia, including 4,193 Blue Sharks (98%), 52 Shortfin Mako (1.2%), 15 Porbeagle (0.4%) and 6 Common Thresher (0.1%) (Table 2). Catches of Blue Sharks as well as fishing effort have generally declined since 2002-2003 (Figure 1).

Total landed weight (all species) increased from around 4 mt in 1993 to just over 19 mt in 2002. Since the increase in minimum size implemented in 2006, annual landed weight has been around 8 mt (Figure 1). The decrease in landed weight in 2015-16 was due to the cancellation of the Yarmouth tournament, which tends to have the highest landed weights of all the tournaments. Landed animals ranged in length from 76.5 cm to 345 cm fork length. Undersized sharks were occasionally landed at the tournaments and though disqualified, they were still examined by DFO Science.

The length distribution of sharks landed during tournaments is not representative of the Blue Shark population in the North Atlantic. From 1993-2005, the landings were comprised of immature males and females, as well as mature males (Figure 2A, 2C). Mature females have never been present in tournament catches due to their absence from Canadian waters (Campana et al. 2002). After 2006, the majority of the landings were mature males (Figure 2B, 2D). A few immature females were still landed at tournaments held in Cape Breton where the 183 cm (6 ft) total minimum length was still allowed. It is important to remember that small sharks are poorly represented and large males are over-represented in the tournament catches, particularly after 2006 (Campana et al. 2015). Minimum size restrictions had a similar impact on the sex composition of the landings. From 1993-2005, the sex ratio was 48:52, males to females. After 2006, 82% of sharks landed were males. There were also regional differences in the sex composition; tournaments held in mainland NS landed 63% males, while 97% of landings in Cape Breton were females. Segregation by sex is a fairly well-documented feature of shark populations, especially in Blue Sharks.

TAGGING

Several species have been tagged as part of the tagging program: Blue Shark (N = 3,746), Porbeagle (N = 322), Shortfin Mako (N = 51), Spiny Dogfish (*Squalus acanthias*; N = 2) and Tiger Sharks (*Galeocerdo cuvier*; N = 3) (Figure 3). Tagging locations were distributed throughout the Canadian Exclusive Economic Zone (EEZ) in the western North Atlantic with the greatest concentrations along the coast of Nova Scotia, Gulf of Maine/ Bay of Fundy, and along the edge of the continental shelf. Very few tags were deployed outside the EEZ in international waters on commercial trips. The vast majority of dart tagging was done by the participants in the recreational shark tournaments (Figure 4).

A total of 2,748 Blue Sharks have been tagged and released in recreational shark fishing tournaments in Nova Scotia. Mean fork length ranged from 133 cm to 185 cm and mean weight ranged from 19 kg to 47 kg (Table 3). Combining all sources (tournaments, DFO staff, commercial fishermen), a total of 3,314 Blue Sharks were tagged off the coast of Nova Scotia since 2006 (Table 4).

Roughly 2% (Figure 3) of tagged individuals have been recaptured to date (84 recaptures out of 3,695 tagging events), with 79 being Blue Sharks (94%), 3 Porbeagle (4%) and 2 Shortfin Mako (2%). Most of the recaptures were from international fleets in the central Atlantic. Days at liberty for recaptured individuals ranged from 0 to 3,552 days or 0 to 9.7 years (Figure 6). Comparing the recapture and release locations demonstrates that Blue Sharks distribute widely in the Atlantic (Figure 5).

CAVEATS TO INTERPRETATION

It is important to recognize that the length and weight data for the majority of tagged sharks are only approximate. This is why growth estimates from Figure 6 can be negative. Measurements from landed sharks were accurate because they were conducted by DFO Science and/or dockside monitors using appropriate equipment (scales, measuring tape).

There is the potential for species mis-identification of Shortfin Mako and Porbeagle sharks in the tagging program, due to their outwardly similar morphology. Species ID materials were distributed to recreational captains to help guard against this issue, which affects an unknown number of tagging records. There were also instances where the tagged species was unknown (12 of 3617 tagging events; 8.63%) or the location of the tagging event wasn't recorded (218 tagging events) and these records were removed from the dataset.

All stomach contents measurements are only approximate, representing a volumetric estimate of amount, and visual identification of prey species from otoliths or partially-digested matter done in the field. Controlled laboratory measurements were not done. Also, many of the sharks arriving at the dock had empty or inverted stomachs after being hoisted by their tails off the vessels.

An increasing focus on conservation substantially affected the number and size distribution of Blue Sharks landed at the tournaments. The morphological data collected dockside represents an extremely low number of samples which are not representative of the larger population (Campana et al. 2015). This limits the scope of scientific research questions that can be meaningfully evaluated from these data.

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TABLES

Table 1. Numbers of blue sharks landed, weight landed, numbers of boats, numbers of participants and days of tournament, by tournament (1993 to 2022).

Year	Tournament	Number sharks landed	Weight landed (kg)	No. boats	No. participants	Days of Tournament
1993	Total	93	3636		94*	
	Halifax	93	3636		94*	1
1994	Total	117	5048		117*	
	Halifax	65	2133		65*	1
	Lockeport	15	565		15*	2
	Split Crow	37	2350		37*	1
1995	Total	122	6464		112*	
	Dartmouth	32	1010		32*	1
	Halifax	80	4659		62*	1
	Split Crow	10	795		18*	1
1996	Total	114	4967	32	138*	
	Eastern Passage	52	1886	17	26*	1
	Dartmouth	29	1093	15	34*	1
	Lockeport	16	669		61*	2
	Split Crow	17	1318		17*	1
1997	Total	273	10315	78	316*	
	Eastern Passage	112	4353	32	134*	1
	Lockeport	15	541		14*	2
	Halifax	95	3158	25	91*	1
	Split Crow	51	2263	21	77*	1
1998	Total	269	10406	91	733	
	Eastern Passage	123	4280	35	210	1
	Dartmouth	68	3183	28	181	1
	Lockeport	53	2114	12	160	2
	Yarmouth	16	499	16	74	2
	Split Crow	9	330		108	1
1999	Total	300	14598	100	577	
	Dartmouth	89	3209	34	180	1
	Lockeport	74	2939	11	100	2
	Yarmouth	106	6356	30	180	2
	Split Crow	31	2094	25	117	1
2000	Total	235	15488	107	656*	
	Dartmouth	32	1886	21	140	1
	Lockeport	100	5627	13	84*	2

Year	Tournament	Number sharks landed	Weight landed (kg)	No. boats	No. participants	Days of Tournament
	Yarmouth	76	5745	49	312	2
	Split Crow	27	2230	24	120	1
2001	Total	162	7594	167	921	
	Eastern					
	Passage	25	1186	31	176	1
	Lockeport	13	575	35	140	2
	Yarmouth	74	3596	60	349	2
	Brooklyn	37	1404	26	185	2
	Halifax	13	834	15	71	1
2002	Total	327	19324	133	1070*	
	Eastern					
	Passage	37	1470	35	188	1
	Riverport	17	594	5	35	2
	Lockeport	122	6754	20	108*	2
	Yarmouth	100	6427	51	318	2
	Brooklyn	42	3330		330	2
	Halifax	9	750	22	91	1
2003	Total	342	12016	232	1203	
	Eastern					
	Passage	53	1787	37	199	1
	Riverport	32	1303	20	76	2
	Lockeport	64	2113	30	223	2
	Yarmouth	81	3203	50	348	2
	Brooklyn	111	3581	83	307	2
	Halifax	1	29	12	50	1
2004	Total	257	10282	150	869	
	Eastern					
	Passage	49	1536	26	143	1
	Riverport	14	542	18	49	2
	Lockeport	55	2022	26	119	2
	Yarmouth	71	2519	40	260	2
	Brooklyn	68	3664	40	298	2
2005	Total	129	6275	131	624	
	Riverport	13	768	13	37	2
	Lockeport	31	1201	27	127	2
	Yarmouth	12	421	38	225	2
	Brooklyn	73	3886	53	235	2
2006	Total	98	10018	147	682	
	Eastern					
	Passage	5	195	32	158	1
	Riverport	4	363	14	33	2

Year	Tournament	Number sharks landed	Weight landed (kg)	No. boats	No. participants	Days of Tournament
	Lockeport	5	526	22	102	2
	Yarmouth	50	5124	27	188	2
	Brooklyn	34	3811	52	201	2
2007	Total	89	8358	71	456	
	Riverport	1	86	10	40	2
	Lockeport	9	934		98	2
	Yarmouth	69	6197	21	156	2
	Brooklyn	10	1141	40	162	2
2008	Total	144	13172	80	395	
	Riverport	4	456	10	33	2
	Lockeport	14	1319	16	86	2
	Yarmouth	117	10674	18	147	2
	Brooklyn	9	724	36	129	2
2009	Total	103	10457	64	362	
	Riverport	5	381	10	28	2
	Lockeport	35	3371	19	91	2
	Yarmouth	48	4973	19	167	2
	Brooklyn	15	1732	16	76	2
2010	Total	121	12418	49	227	
	Riverport	4	483	9	34	2
	Lockeport	47	4264	21	72	2
	Yarmouth	44	5138	15	110	2
	Brooklyn	26	2532			2
	Jeddore	0	0	4	11	1
2011	Total	97	9107	110	519	
	Riverport	1	99	11	38	2
	Lockeport	36	3384	29	50	2
	Yarmouth	39	4454	14	122	2
	Brooklyn	7	802	32	205	2
	Jeddore	1	32	8	28	1
	Petit de Grat	13	337	16	76	1
2012	Total	162	12994	115	543	
	Riverport	10	1035	11	46	2
	Lockeport	44	3914	25	114	2
	Yarmouth	45	4941	17	137	2
	Brooklyn	13	1223	19	85	2
	Jeddore	26	999	12	49	1
	Petit de Grat	20	588	24	112	1
	Louisbourg	4	295	7		1
2013	Total	114	9752	78	241	

Year	Tournament	Number sharks landed	Weight landed (kg)	No. boats	No. participants	Days of Tournament
	Riverport	4	331	16	42	2
	Lockeport	21	2082			2
	Yarmouth	54	5934			2
	Brooklyn	4	336	22	123	2
	Petit de Grat	30	1029	20	76	1
	Louisbourg	1	40	20		1
2014	Total	106	7855	89	511	
	Riverport	12	885	16	78	2
	Lockeport	22	2146	16	77	2
	Yarmouth	29	3460	14	111	2
	Petit de Grat	34	1109	23	113	1
	Louisbourg	9	256	20	132	1
2015	Total	47	2900	87	460	
	Riverport	7	716	21	80	2
	Lockeport	13	1274	12	65	2
	Petit de Grat	14	524	31	173	1
	Louisbourg	13	386	23	142	1
2016	Total	47	2607	81	438	
	Riverport	7	648	14	63	2
	Lockeport	10	948	17	87	2
	Petit de Grat	9	409	28	135	1
	Louisbourg	21	602	22	153	1
2017	Total	63	5190	44	313	
	Lockeport	9	860			2
	Yarmouth	39	3756	19	147	2
	Petit de Grat	8	323			1
	Louisbourg	7	251	25	166	1
2018	Total	70	6612	76	480	
	Lockeport	16	1658	17	102	2
	Yarmouth	45	4664	16	114	2
	Petit de Grat	4	114	26	120	1
	Louisbourg	5	176	17	144	1
2019	Total	77	6834	45	145	
	Lockeport	10	1078	13		2
	Yarmouth	45	4961	15		2
	Petit de Grat	13	489			1
	Louisbourg	9	307	17	145	1
2020	Total	Cancelled due to Covid Pandemic				

Year	Tournament	Number sharks landed	Weight landed (kg)	No. boats	No. participants	Days of Tournament
2021	Total	55	6046	33	234	
	Lockeport	14	1343	19	115	2
	Yarmouth	41	4702	14	119	2
2022	Total	60	5869	58	335	
	Petit de Grat	11	438	25	106	1
	Lockeport	14	1504	21	127	2
	Yarmouth	35	3928	12	102	2
*minimum number of participants, based on logs submitted						

Table 2. Total numbers of each species of shark landed by year in recreational shark tournaments from 1993 to 2022.

Year	Blue	Mako	Porbeagle	Thresher	Total by Year
1993	93	0	1	0	94
1994	117	0	0	0	117
1995	122	0	0	0	122
1996	114	1	0	0	115
1997	273	0	0	0	273
1998	269	0	0	0	269
1999	300	0	0	0	300
2000	235	3	0	0	238
2001	162	0	1	1	164
2002	327	4	1	0	332
2003	342	3	1	0	346
2004	257	6	0	0	263
2005	129	2	3	1	135
2006	98	5	7	1	111
2007	89	3	0	0	92
2008	144	0	0	2	146
2009	103	3	0	0	106
2010	121	3	0	0	124
2011	97	2	1	0	100
2012	162	5	0	0	167
2013	114	2	0	0	116
2014	106	3	0	0	109
2015	47	2	0	0	49
2016	47	3	0	0	50
2017	63	2	0	1	66
2018	70	0	0	0	70
2019	77	0	0	0	77
2020	0	0	0	0	0
2021	55	0	0	0	55
2022	60	0	0	0	60
Total by Species	4193	52	15	6	4266

Table 3. Summary of the number (N) and size of Blue sharks (*Prionace glauca*) tagged in the various recreational shark fishing tournaments in Nova Scotia, Canada between 2006 and 2022.

Derby	N	Mean Total Length (cm)	Mean Fork Length (cm)	Mean Weight (kg)
Brooklyn	146	169.7632	143.1073	26.41116
Eastern Passage	1	220.7414	185.42	39.80556
Jeddore	72	157.7673	132.8831	18.8798
Lockeport	530	169.8436	142.7183	24.25184
Louisbourg	21	173.5479	146.2102	44.54759
Petit de Grat	385	169.1437	147.378	25.86302
Riverport	556	170.9128	143.0494	25.42594
Yarmouth	1037	208.6285	188.5142	58.46932

Table 4. Summary of the number and size of tagged blue sharks (*Prionace glauca*) from all sources caught off the coast of Nova Scotia, Canada. Length and weight data are based on information submitted by the vessel on the size of each tagged shark.

Year	Sex	N	Mean Total Length (cm)	Mean Fork Length (cm)	Mean Weight (kg)
2006	Male	31	191.9	160.8	29.5
2006	Female	101	195.8	164.1	33.2
2006	Unknown	38	206.0	172.8	43.0
2007	Male	60	195.5	163.8	33.8
2007	Female	80	181.3	151.7	24.2
2007	Unknown	26	209.1	175.4	40.3
2008	Male	44	177.8	148.5	25.2
2008	Female	70	174.8	146.9	23.5
2008	Unknown	26	181.6	151.8	23.7
2009	Male	48	198.5	164.1	31.6
2009	Female	40	196.9	165.5	29.4
2009	Unknown	42	216.1	183.4	46.2
2010	Male	103	194.4	165.1	36.7
2010	Female	168	187.7	157.7	28.0
2010	Unknown	35	178.9	155.1	29.9
2011	Male	114	170.5	143.0	25.1
2011	Female	159	164.2	137.0	21.9
2011	Unknown	39	156.4	135.1	24.4
2012	Male	154	177.0	146.0	28.4
2012	Female	127	163.6	137.7	20.4
2012	Unknown	64	178.1	149.6	28.8
2013	Male	100	205.0	172.1	45.1
2013	Female	296	175.3	147.0	22.3
2013	Unknown	62	187.8	155.3	30.5
2014	Male	80	184.8	155.2	35.1
2014	Female	112	169.3	141.2	22.7
2014	Unknown	55	172.6	146.1	22.1
2015	Male	74	171.1	142.8	24.3
2015	Female	151	171.7	143.5	22.1
2015	Unknown	28	155.9	130.5	34.7
2016	Male	35	179.6	153.8	35.2
2016	Female	29	181.0	151.3	29.3
2016	Unknown	7	187.8	159.8	25.5
2017	Male	64	201.6	169.8	39.9
2017	Female	73	174.1	146.7	22.8
2017	Unknown	43	203.1	170.2	41.7
2018	Male	2	223.5	187.0	41.3

Year	Sex	N	Mean Total Length (cm)	Mean Fork Length (cm)	Mean Weight (kg)
2018	Female	8	165.7	144.4	20.6
2018	Unknown	15	173.6	144.9	19.5
2019	Male	96	205.2	172.5	43.0
2019	Female	170	172.7	144.8	21.8
2019	Unknown	42	198.4	167.2	42.9
2021	Male	57	251.2	211.5	77.0
2021	Female	52	191.8	160.6	35.2
2021	Unknown	31	202.7	170.8	57.8
2022	Male	28	205.7	00	56.7
2022	Female	10	171.2	00	21.8
2022	Unknown	25	230.4	00	45.4

FIGURES



Figure 1. Total landed weight (kg) by year of all sharks (blue line) and Number of participants (red line), all tournaments combined. Vertical lines indicate the year minimum size increased to 8 ft (2006) and the year tournaments were restricted to blue shark only (2018).

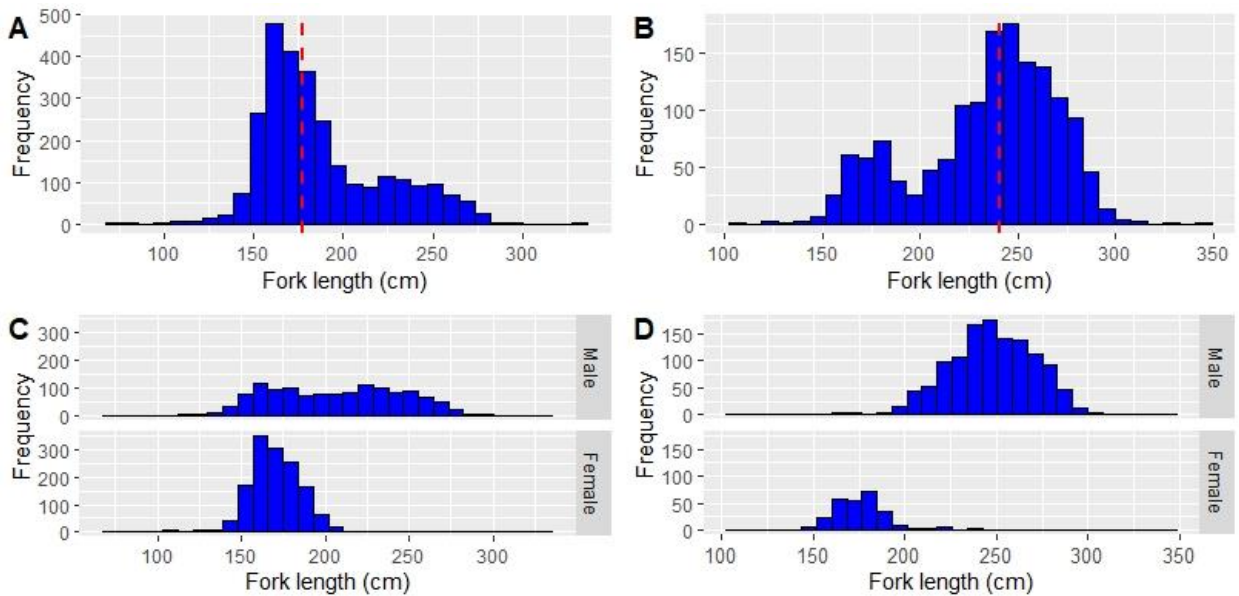


Figure 2. Length distribution (cm) of Blue Shark landed at shark tournaments. Panel A: before 2006, sexes combined, panel B: after 2006, sexes combined, Panel C: male and female distribution before 2006, Panel D: male and female distribution after 2006. Dashed lines in Panels A & B represent median length.

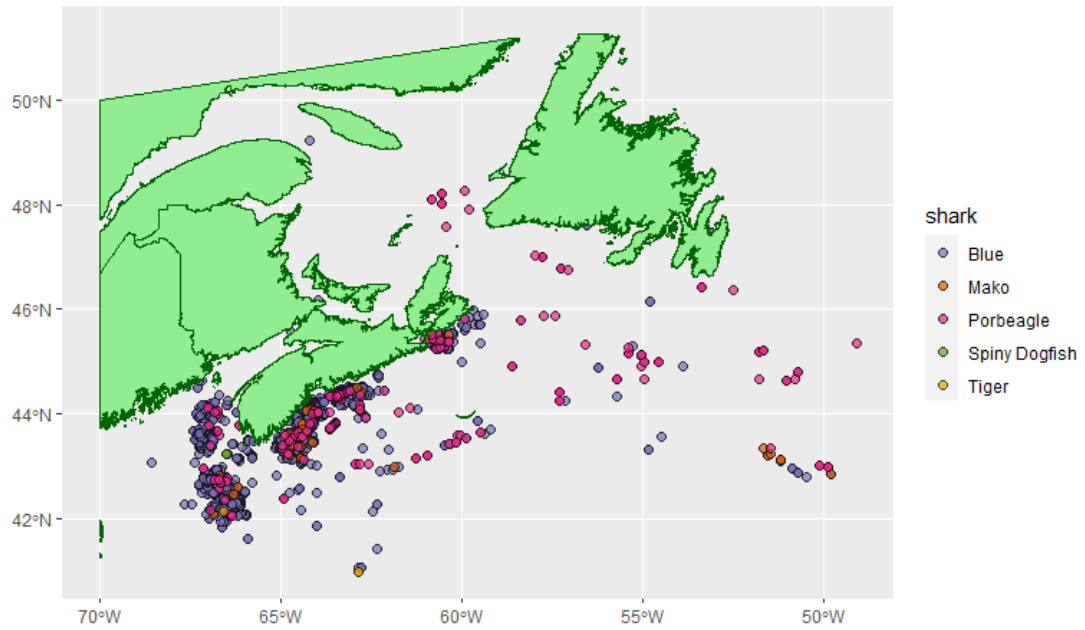


Figure 3: Release locations of all tagged sharks by species, off the coast of Nova Scotia, Canada from all tagging programs in the Canadian dart tag database.

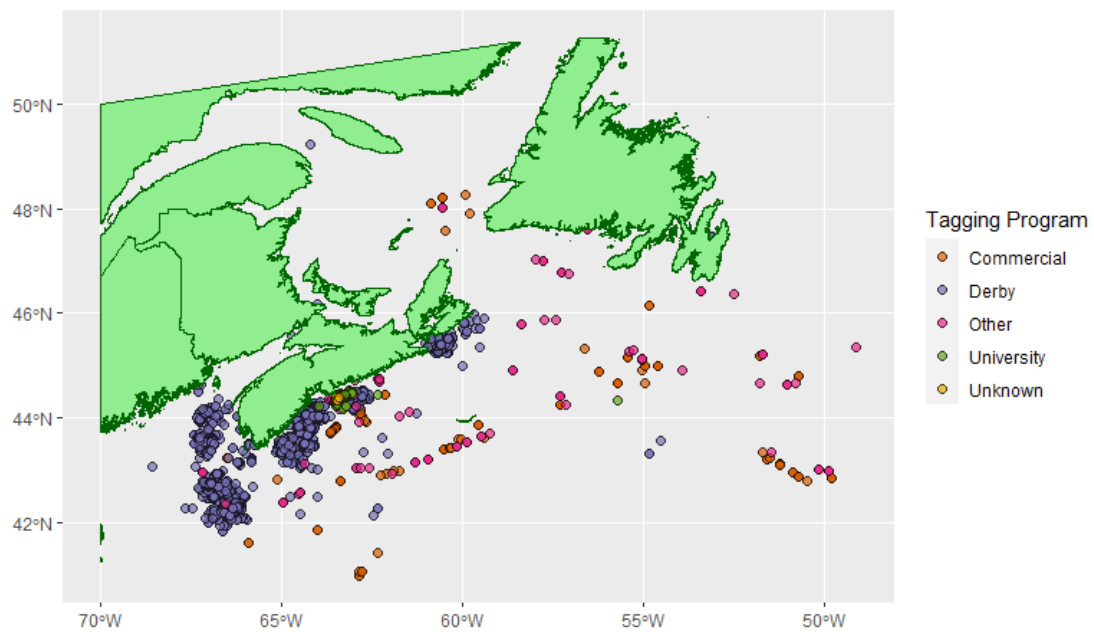
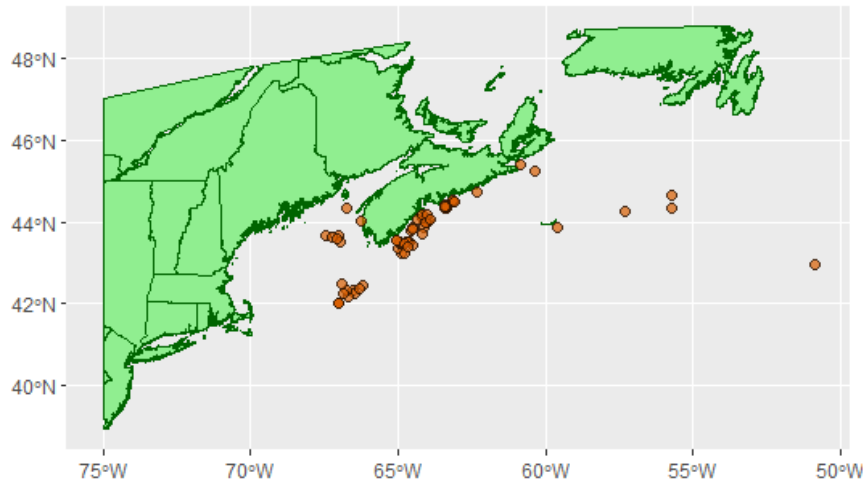


Figure 4: Release locations of all tagged sharks by tagging program, off the coast of Nova Scotia, Canada in the Canadian dart tag database.

Initial Capture



Recapture

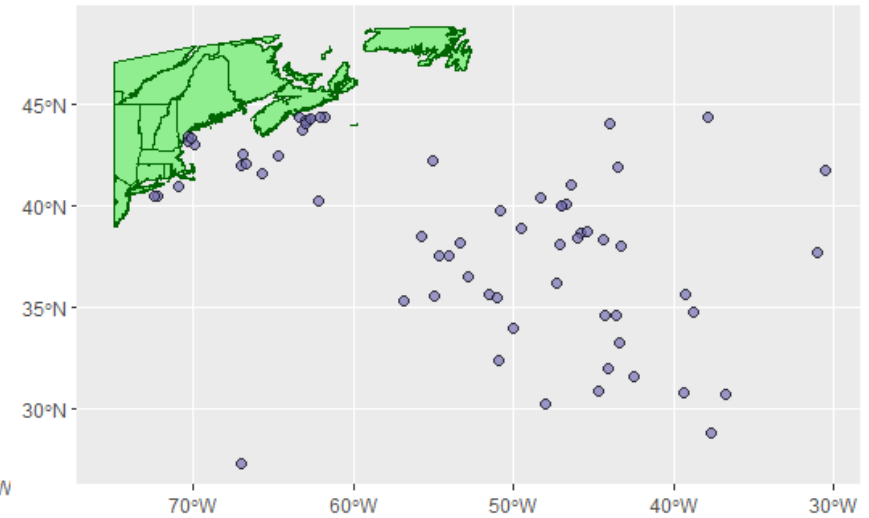


Figure 5: Tagging locations/Initial capture (left panel) and recapture locations (right panel) of Blue Shark (*Prionace glauca*) off the coast of Nova Scotia, Canada. Note that there appear to be so few tagging points ($n=3251$) because the geographical locations are very close together in comparison with the recapture locations ($n=79$).

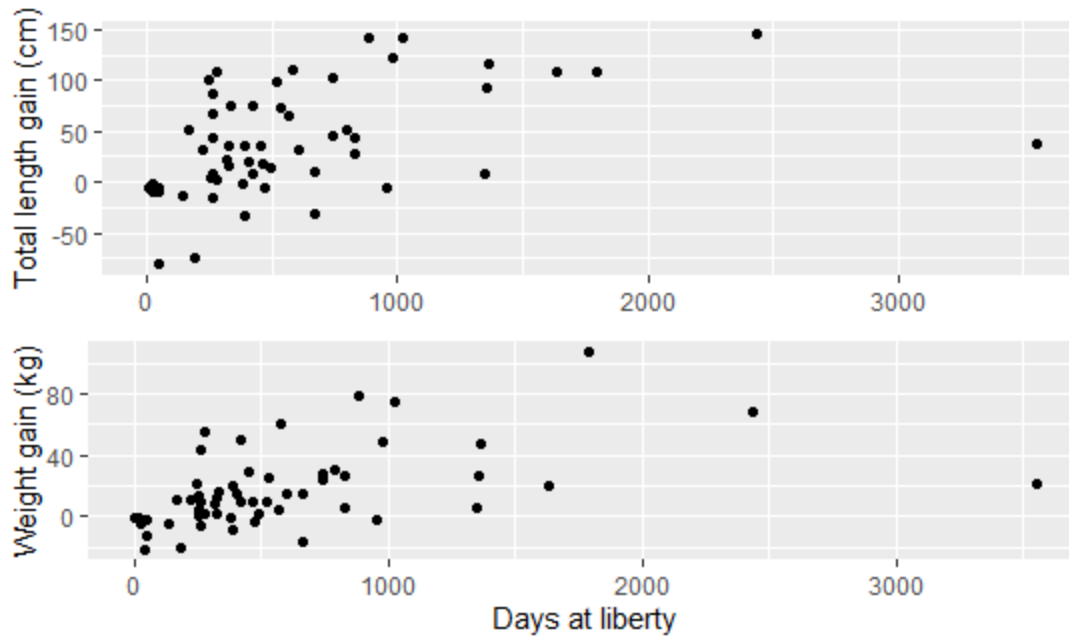


Figure 6: Increases in total length (cm) and weight (kg) of Blue Shark (*Prionace glauca*) in the time between tagging and recapture. Note that values < 0 represent errors in which the estimated length/weight at tagging was larger than the reported length/weight at recapture.

Appendix 2. Timeline of regulatory changes for shark fishing tournaments held in Nova Scotia (Maritimes Region).

Year	Number of Tournaments	Location / Name of Tournament	Tournament Regulations	Science Requests	Management Requirements
1993	1	Halifax			All shark landed to be min. 180 cm (6 ft) total length. Permitted species: Blue Shark (<i>Prionace glauca</i>), Shortfin Mako (<i>Isurus oxyrinchus</i>), Porbeagle (<i>Lamna nasus</i>), Common Thresher (<i>Alopias vulpinas</i>)
1994	3	Halifax, Lockeport, Split Crow			
1995	3	Dartmouth, Halifax, Split Crow			
1996	4	Eastern Passage, Dartmouth, Lockeport, Split Crow			
1997	4	Eastern Passage, Halifax, Lockeport, Split Crow			
1998	5	Eastern Passage, Dartmouth, Lockeport,			

Year	Number of Tournaments	Location / Name of Tournament	Tournament Regulations	Science Requests	Management Requirements
		Yarmouth, Split Crow			
1999	4	Dartmouth, Split Crow, Lockeport, Yarmouth			
2000	4	Dartmouth, Split Crow, Lockeport, Yarmouth		DFO Science asks organizers to land sharks round or to "bag" guts	
2001	5	Eastern Passage, Lockeport, Yarmouth, Brooklyn, Halifax			Tournaments asked to land sharks round on a rotational yearly plan.
2002	6	Eastern Passage, Riverport, Lockeport, Yarmouth, Brooklyn, Halifax			
2003	6	Eastern Passage, Riverport, Lockeport,			

Year	Number of Tournaments	Location / Name of Tournament	Tournament Regulations	Science Requests	Management Requirements
		Yarmouth, Brooklyn, Halifax			
2004	5	Eastern Passage, Riverport, Lockeport, Yarmouth, Brooklyn			
2005	4	Riverport, Lockeport, Yarmouth, Brooklyn			
2006	5	Eastern Passage, Riverport, Lockeport, Yarmouth, Brooklyn	<p>Tournaments voluntarily exclude Porbeagle Shark from landings.</p> <p>Lockeport/Yarmouth allowed shark boats to stay out overnight.</p> <p>Riverport decides not to land shark on second day smaller than largest shark caught on Day 1</p>	Volunteer tagging program began	Minimum size increases from 180 cm (6 ft) to 240 cm (8 ft) total length.

Year	Number of Tournaments	Location / Name of Tournament	Tournament Regulations	Science Requests	Management Requirements
2007	4	Riverport, Lockeport, Yarmouth, Brooklyn	Riverport moves to 9 ft total length minimum		
2008	4	Riverport, Lockeport, Yarmouth, Brooklyn			
2009	4	Riverport, Lockeport, Yarmouth, Brooklyn	Yarmouth decides to only land 3 shark per vessel		All tournaments required to land sharks round
2010	5	Riverport, Lockeport, Yarmouth, Brooklyn, Jeddore			
2011	6	Riverport, Lockeport, Yarmouth, Brooklyn, Jeddore, Petit de Grat			Tournaments held in Cape Breton did not have to abide by the 8' minimum size restriction to allow DFO Science to collect data on sharks landed from that region.
2012	7	Riverport, Lockeport, Yarmouth, Brooklyn, Jeddore, Petit			A revised recreational shark log that included a section for derbies to use was introduced in 2012. Prior to 2012 there was a slightly different log.

Year	Number of Tournaments	Location / Name of Tournament	Tournament Regulations	Science Requests	Management Requirements
		de Grat, Louisbourg			
2013	6	Riverport, Lockeport, Yarmouth, Brooklyn, Petit de Grat, Louisbourg	Lockeport decides to only land 2 shark per vessel. Petit de Grat sets min. size limit to 6'9"		Switch from individual recreational licences to section 52 licences, Dockside monitors required at each tournament.
2014	5	Riverport, Lockeport, Yarmouth, Petit de Grat, Louisbourg			
2015	4	Riverport, Lockeport, Petit de Grat, Louisbourg			
2016	4	Riverport, Lockeport, Petit de Grat, Louisbourg	Riverport only allows participants to land blue shark		
2017	4	Lockeport, Yarmouth, Petit de Grat, Louisbourg			Exclusion of Porbeagle formally added to licence conditions
2018	4	Lockeport, Yarmouth,			Only Blue Shark landings permitted (all other sharks prohibited)

Year	Number of Tournaments	Location / Name of Tournament	Tournament Regulations	Science Requests	Management Requirements
		Petit de Grat, Louisbourg			
2019	4	Lockeport, Yarmouth, Petit de Grat, Louisbourg			corrodible circle hooks (max size 16/0) or corrodible barbless J hooks (max size 12/0) and max line strength not greater than 200 lb
2020					ALL TOURNAMENTS CANCELLED DUE TO COVID-19 PANDEMIC
2021	2	Lockeport, Yarmouth			
2022	3	Petit de Grat Lockeport, Yarmouth		Landings no longer requested under Section 52 license	