Lake Ontario Fish Communities and Fisheries:

2020 Annual Report of the Lake Ontario Management Unit

Ontario

Cover Photos:

(Top Left) Walleye harvested during the Bay of Quinte winter fishery. For more information on the recreational fisheries in Lake Ontario and the Bay of Quinte, see Section 2.

(Bottom Left) American Eel from Lake Ontario at the Glenora Fisheries Station. For more information on species restoration in Lake Ontario, see Section 6.

(Right) MNRF staff participating in Chinook egg collection in a Lake Ontario tributary. For more information on the stocking program in Lake Ontario, see Section 5.

LAKE ONTARIO FISH COMMUNITIES AND FISHERIES:

2020 ANNUAL REPORT OF THE LAKE ONTARIO MANAGEMENT UNIT

Prepared for the
Lake Ontario Committee
Great Lakes Fishery Commission

Printed in Picton, Ontario, Canada

November 2021

Report ISSN 1201-8449

Please cite this report as follows:
Ontario Ministry of Natural Resources and Forestry. 2021. Lake Ontario Fish Communities and Fisheries: 2020 Annual Report of the Lake Ontario Management Unit. Ontario Ministry of Natural Resources and Forestry, Picton, Ontario, Canada.

This report is available online at:
http://www.glfc.org/lakecom/loc/mgmt_unit/index.html

TABLE OF CONTENTS

Lake Ontario Fish Communities and Fisheries: 2020 Annual Report of the Lake Ontario Management Unit

Foreword

The Lake Ontario Management Unit (LOMU) and the Lake Ontario research staff from the Applied Research and Monitoring Section (ARMS) operating at the Glenora Fisheries Station, are pleased to provide the 2020 Annual Report of monitoring, assessment, research and management activities.

Lake Ontario fisheries are managed by the Lake Ontario Committee, consisting of the Ontario Ministry of Natural Resources and Forestry (MNRF) in partnership with New York State, under the auspices of the Great Lakes Fishery Commission. The Lake Ontario Fish Community Objectives (2013) provide bi-national fisheries management direction to protect and restore native species and to maintain sustainable fisheries. Our partners include New York State Department of Environmental Conservation (NYSDEC), Fisheries and Oceans Canada (DFO), U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS) and many other Ontario provincial ministries, conservation authorities, U.S. state and federal agencies, universities and non-government partners.

Glenora Fisheries Station dedicated staff safely delivered 23 field and laboratory projects in 2020 under strict COVID-19 safety procedures, restrictions, and staffing capacity constraints. This included the comprehensive long-term base monitoring program that spans over five decades. In 2020, assessment of the Canadian waters from the Niagara River to Cornwall including 104 gill net sets in over 95 sites, and 83 trawls. Across all programs, 78716 fish were captured (comprising more than 40 species) and 1893 calcified structures were processed for age and growth assessment. LOMU staff interviewed 719 anglers during a new winter, ice fishing access point angler survey on the Bay of Quinte. Over 14,250 fish were counted migrating upstream in the Ganaraska River and 4684 fish were counted migrating upstream in the Credit River on the MNRF video fish counter system. MNRF Fish Culture Section and partners stocked over 1.7 million fish into the Canadian waters of Lake Ontario to support species restoration and a world-class recreational trout and salmon fishery. MNRF, DFO, NYSDEC, USFWS, University of Windsor and Queen’s University researchers continue to use acoustic telemetry to understand the spatial ecology of many Lake Ontario species.

We would like to express our sincere appreciation to the many partners and volunteers who contributed to the successful delivery of LOMU initiatives. Special thanks to the Ontario Federation of Anglers and Hunters and the many other partners committed to the Lake Ontario Atlantic Salmon restoration program. LOMU gratefully acknowledges the important contribution of the Lake Ontario Commercial Fishery Liaison Committee, the Fisheries Management Zone 20 Council (FMZ20) members, the Ringwood Hatchery partnership with the Metro East Anglers, Chinook Net Pen Committee, Muskies Canada, the Ganaraska River Fishway volunteers, Napanee and District Rod & Gun Club, Queen’s University and the University of Windsor and the participants in the angler diary and assessment programs.

Our team of skilled and dedicated staff and partners delivered an exemplary program in the face of a worldwide pandemic in 2020. Information obtained through this comprehensive fisheries assessment and management program provides long-term benefits to the citizens of Ontario. We are pleased to share the important information about these activities and findings of the Lake Ontario Management Unit from 2020.

Steve McNevin
A/Lake Ontario Manager
613-813-4762
FAX: (613) 476-7131

This Annual Report is available online at: http://www.glfc.org/lakecom/loc/mgmt_unit/index.html

1. Index Fishing Projects

1.1 Lake Ontario and Bay of Quinte Fish Community Index Gill Netting

E. Brown, Lake Ontario Management Unit

The Lake Ontario and Bay of Quinte annual fish community index gill netting program is used to monitor the abundance and biological characteristics of a diversity of warm, cool and cold-water fish species. Data from the program are used to help manage local commercial and recreational fisheries as well as for tracking long-term changes in the aquatic ecosystem.

Gill net sampling areas are shown in Fig. 1.1.1 and the basic sampling design is summarized in Table 1.1.1. Included in the design are fixed single-depth sites, depth-stratified sampling areas, and depth stratified random sites. In 2020, not all sites listed in Table 1.1.1 were visited.

The annual index gill netting field work occurs during the summer months. Summer was chosen based on an understanding of water temperature stability, fish movement/migration patterns, fish growth patterns, and logistical considerations. The time-frames for completion of field work varies among sampling sites/areas (Table 1.1.1). This increases the probability of encountering a wide-range of water temperatures across the depth ranges sampled, both seasonally and by geographic area. In 2020, seasonal sampling was not completed.

Monofilament gill nets with standardized specifications are used (monofilament mesh replaced multifilament in 1992; only catches from 1992-present are tabulated here). Each gill net gang consists of a graded-series of ten monofilament gill net panels of mesh sizes from 38 mm (1½ in) to 152 mm (6 in) stretched mesh at 13 mm (½ in) intervals, arranged in sequence. However, a standard gill net gang may consist of one of two possible configurations. Either, all ten mesh sizes (panels) are 15.2 m (50 ft) in length (total gang length is 152.4 m (500 ft)), or, the 38

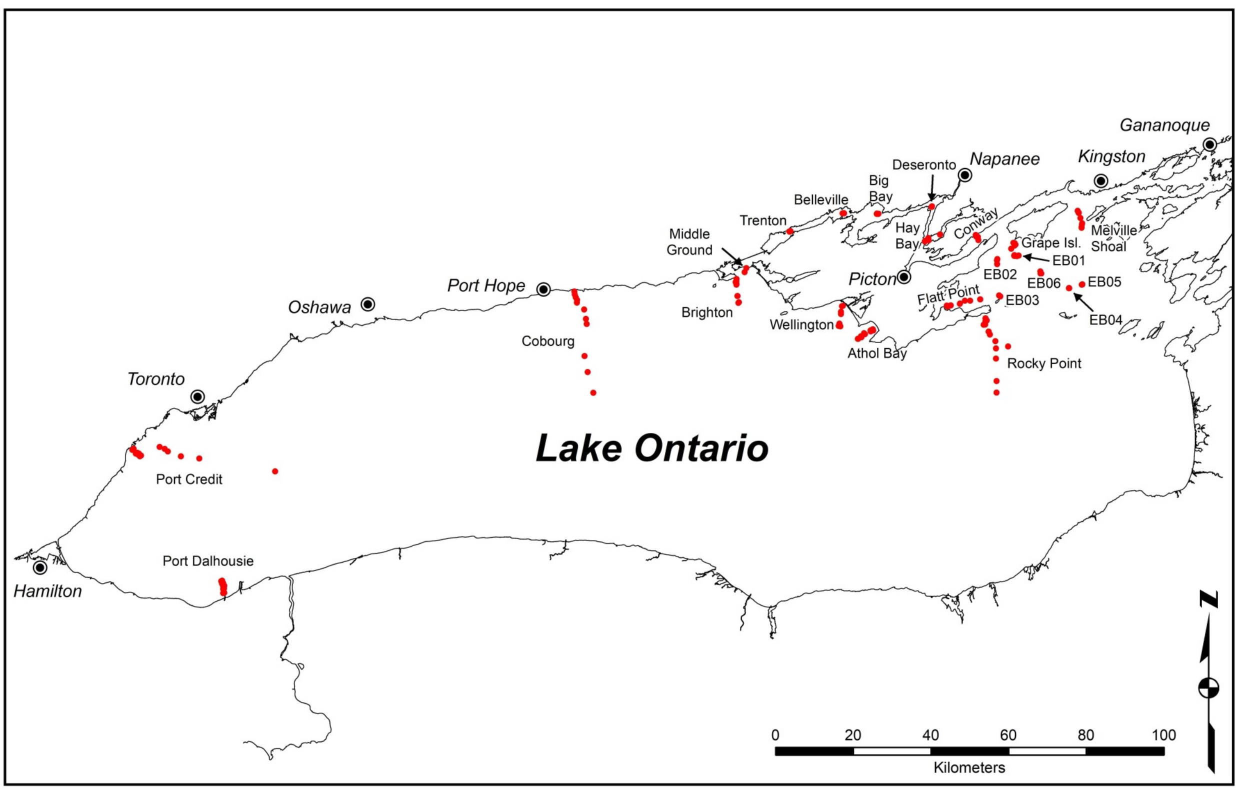

FIG. 1.1.1. Map of Lake Ontario showing fish community index gill netting sites (2020 Bay of Quinte depth stratified random sites excluded).

mm (1½ in) mesh size (panel) is 4.6 m (15 ft) in length and the remaining mesh sizes are 15.2 m (50 ft) each in length (total gang length is 141.7 m (465 ft)) (see Table 1.1.1). Note that use of the shorter 38 mm gill net panel is related to the processing time required to deal with large numbers of small fish (e.g., Alewife and Yellow Perch) caught in this small mesh size. Gill net gangs are connected in series (i.e., cork lines and lead lines attached), but are separated by a 15.2 m (50 ft) spacer to minimize "leading" of fish. The 152 mm (6 in) end of one gang is connected to the 38 mm (1 ½ in) gang of the adjoining gang. The entire gill net strap (all joined gangs) is set within 2.5 m of the site depth listed in Table 1.1.1. Since 2019, only one gang was used at each site in the Bay of Quinte. The gill net set duration target ranges from 18-24 hours. Gill net catches were summed across the ten mesh sizes from 1½-6 inch. In the case where the 38 mm mesh size used was 4.6 m in length, the catch in this mesh was adjusted (i.e., multiplied by 15.2/4.6) prior to summing the ten mesh sizes. Therefore, all reported catches represent the total catch in a 152.4 m (500 ft) gang of gill net.

In 2020, 64 gill net samples occurred from Jun 30 to Sep 1. Thirty different species and 8,780 individual fish were caught. Sixty-nine percent of the observed catch was Alewife, followed by White Perch (11%). Yellow Perch (8%), Walleye (4%). Species-specific gill net catch summaries are shown by geographic area/site in Tables 1.1.3-1.1.11. Abundance trends for the most common species caught in Kingston Basin and the Bay of Quinte (Fig. 1.1.2-1.1.3). Selected biological information is also presented for Walleye (Table 1.1.12).

Kingston Basin, Lake Ontario

Kingston Basin (Melville Shoal, Grape Island and Flatt Point) Nearshore Areas (Tables 1.1.3-1.1.6)

Three depth-stratified sampling areas (Melville Shoal, Grape Island, Flat Point) that employ a common and balanced sampling design were used here to provide a broad picture of the warm, cool and cold-water fish community inhabiting the open-coastal waters out to about 30 m water depth in the eastern half of Lake Ontario. Results were summarized and presented graphically (Fig. 1.1.2) to illustrate abundance trends of the most abundant fish species.

Bay of Quinte, Lake Ontario

Bay of Quinte, Depth Stratified Random(Upper, Middle and Lower Bay of Quinte; Tables 1.1.7-1.1.8)

Since 2019, effort was made to expend the depth and area sampled in the upper, middle and lower Bay of Quinte. To accomplish this, the Lake Ontario and Bay of Qunite Fish Community Index Gill Netting program was redesigned to reallocate a portion of Bay of Quinte fixed site sampling effort to randomly select sites within six depth strata based on their proportional representation in Bay of Quinte. Species specific catch per gill net set by depth strata and area are show in Table 1.1.7 and Table 1.1.8, respectively.

Bay of Quinte, Fixed Sites (Conway, Hay Bay and Big Bay; Tables 1.1.9-1.1.11)

Three sites are used to monitor long-term trends in the Bay of Quinte fish community. Big Bay is a single-depth site; Hay Bay has two depths and Conway five depths. Average summer catch for the three sites are summarized graphically in Fig. 1.1.3 to illustrate abundance trends of the most abundant species from 1992-2020.

Species Highlights

Walleye

Three hundred and four Walleye were caught and interpreted for age in the 2020 summer index gill nets (Table 1.1.12). Eighty five Walleye (27%) were age-2 (2018 year-class). In the Kingston Basin nearshore gill nets, 86% of Walleye were age-6 or greater, and in the Bay of Quinte gill nets, 82% were age-5 or less.

TABLE. 1.1.1. Sampling design of the Lake Ontario fish community index gill netting program (Lake Ontario) including geographic and depth stratification, number of visits, number of replicate gill net gangs set during each visit (by gill net length), and the time-frame for completion of visits. Also shown is the year in which gill netting at a particular area/site was initiated, the number of prior years netting has occurred, and if netting occurred in 2020.

Region name	Area Name (Area code)	Design	Site name	Depth (m)	Visits	Replicates by net size[3] 465 feet	500 feet	Site location (approx) Latitude (dec min)	Longitude (dec min)	No.SAM (Visits x Replicates)	Time-frame	Start-up year	Number years[4]	2020 Visit
Southwestern Lake Ontario	Port Dalhousie (PD)	Depth stratified area	PD08	7.5	2	2		431294	791615	4	Jul 21 - Sep 15	2018	2	no
Southwestern Lake Ontario	Port Dalhousie	Depth stratified area	PD13	12.5	2	2		431352	791622	4	Jul 21 - Sep 15	2018	2	no
Southwestern Lake Ontario	Port Dalhousie	Depth stratified area	PD18	17.5	2	2		431387	791622	4	Jul 21 - Sep 15	2018	2	no
Southwestern Lake Ontario	Port Dalhousie	Depth stratified area	PD23	22.5	2	2		431426	791647	4	Jul 21 - Sep 15	2018	2	no
Southwestern Lake Ontario	Port Dalhousie	Depth stratified area	PD28	27.5	2	2		431458	791667	4	Jul 21 - Sep 15	2018	2	no
Northwestern Lake Ontario	Port Credit (PC)	Depth stratified area	PC08	7.5	2	2		433230	793476	4	Jul 21 - Sep 15	2014	6	no
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC13	12.5	2	2		433182	793403	4	Jul 21 - Sep 15	2014	6	no
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC18	17.5	2	2		433164	793355	4	Jul 21 - Sep 15	2014	6	no
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC23	22.5	2	2		433156	793335	4	Jul 21 - Sep 15	2014	6	no
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC28	27.5	2	2		433143	793308	4	Jul 21 - Sep 15	2014	6	no
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC40	40	1		3	433269	792976	3	Jul 21 - Sep 15	2016	4	no
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC50	50	1		3	433249	792874	3	Jul 21 - Sep 15	2016	4	no
Northwestern Lake Ontario	Port Credit	Depth stratified area	0060	60	1		3	433213	792808	3	Jul 21 - Sep 15	2014	6	no
Northwestern Lake Ontario	Port Credit	Depth stratified area	0080	80	1		3	433190	792515	3	Jul 21 - Sep 15	2014	6	no
Northwestern Lake Ontario	Port Credit	Depth stratified area	0100	100	1		3	433162	792161	3	Jul 21 - Sep 15	2014	6	no
Northwestern Lake Ontario	Port Credit	Depth stratified area	0140	140	1		3	433065	790735	3	Jul 21 - Sep 15	2014	6	no
Northcentral Lake Ontario	Cobourg (CB)	Depth stratified area	CB08	7.5	2	2		435701	781167	4	Jul 21 - Sep 15	2010	10	no
Northcentral Lake Ontario	Cobourg	Depth stratified area	CB13	12.5	2	2		435661	781157	4	Jul 21 - Sep 15	2010	10	no
Northcentral Lake Ontario	Cobourg	Depth stratified area	CB18	17.5	2	2		435622	781136	4	Jul 21 - Sep 15	2010	10	no
Northcentral Lake Ontario	Cobourg	Depth stratified area	CB23	22.5	2	2		435584	781109	4	Jul 21 - Sep 15	2010	10	no
Northcentral Lake Ontario	Cobourg	Depth stratified area	CB28	27.5	2	2		435549	781110	4	Jul 21 - Sep 15	2010	10	no
Northcentral Lake Ontario	Cobourg	Depth stratified area	CB40	40	1		3	435454	780943	3	Jul 21 - Sep 15	2016	4	no
Northcentral Lake Ontario	Cobourg	Depth stratified area	CB50	50	1		3	435299	780924	3	Jul 21 - Sep 15	2016	4	no
Northcentral Lake Ontario	Cobourg	Depth stratified area	0060	60	1		3	435257	780916	3	Jul 21 - Sep 15	2014	6	no
Northcentral Lake Ontario	Cobourg	Depth stratified area	0080	80	1		3	434813	780919	3	Jul 21 - Sep 15	2014	6	no
Northcentral Lake Ontario	Cobourg	Depth stratified area	0100	100	1		3	434589	780857	3	Jul 21 - Sep 15	2014	6	no
Northcentral Lake Ontario	Cobourg	Depth stratified area	0140	140	1		3	434310	780728	3	Jul 21 - Sep 15	2014	6	no
Northcentral Lake Ontario	Whitby (WH)	Depth stratified area	WH08	7.5	2	2		435038	785204	4	Aug 1-Sep 15	2019	1	no
Northcentral Lake Ontario	Whitby	Depth stratified area	WH13	12.5	2	2		435026	785158	4	Aug 1-Sep 15	2019	1	no
Northcentral Lake Ontario	Whitby	Depth stratified area	WH18	17.5	2	2		435010	785151	4	Aug 1-Sep 15	2019	1	no
Northcentral Lake Ontario	Whitby	Depth stratified area	WH23	22.5	2	2		434956	785146	4	Aug 1-Sep 15	2019	1	no
Northcentral Lake Ontario	Whitby	Depth stratified area	WH28	27.5	2	2		434926	785134	4	Aug 1-Sep 15	2019	1	no
Northeastern Lake Ontario	Brighton (BR)	Depth stratified area	BR08	7.5	2	2		435955	774058	4	Jul 21 - Sep 15	1988	32	no
Northeastern Lake Ontario	Brighton	Depth stratified area	BR13	12.5	2	2		435911	774071	4	Jul 21 - Sep 15	1988	32	no
Northeastern Lake Ontario	Brighton	Depth stratified area	BR18	17.5	2	2		435878	774053	4	Jul 21 - Sep 15	1988	32	no
Northeastern Lake Ontario	Brighton	Depth stratified area	BR23	22.5	2	2		435777	774034	4	Jul 21 - Sep 15	1988	32	no
Northeastern Lake Ontario	Brighton	Depth stratified area	BR28	27.5	2	2		435624	774004	4	Jul 21 - Sep 15	1988	32	no
Northeastern Lake Ontario	Middle Ground (MG)	Fixed site	MG05	5	2	2		440054	773906	4	Jul 21 - Sep 15	1979	41	no
Northeastern Lake Ontario	Wellington (WE)	Depth stratified area	WE08	7.5	2	2		435622	772011	4	Jul 21 - Sep 15	1988	32	no
Northeastern Lake Ontario	Wellington	Depth stratified area	WE13	12.5	2	2		435544	772027	4	Jul 21 - Sep 15	1988	32	no
Northeastern Lake Ontario	Wellington	Depth stratified area	WE18	17.5	2	2		435515	772025	4	Jul 21 - Sep 15	1988	32	no
Northeastern Lake Ontario	Wellington	Depth stratified area	WE23	22.5	2	2		435378	772050	4	Jul 21 - Sep 15	1988	32	no
Northeastern Lake Ontario	Wellington	Depth stratified area	WE28	27.5	2	2		435348	772066	4	Jul 21 - Sep 15	1988	32	no
Northeastern Lake Ontario	Rocky Point (RP)	Depth stratified area	RP08	7.5	2	2		435510	765220	4	Jul 21-Sep 15	1988	32	no
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP13	12.5	2	2		435460	765230	4	Jul 21-Sep 15	1988	32	no
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP18	17.5	2	2		435415	765222	4	Jul 21-Sep 15	1988	32	no
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP23	22.5	2	2		435328	765150	4	Jul 21-Sep 15	1988	32	no
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP28	27.5	2	2		435285	765135	4	Jul 21-Sep 15	1988	32	no
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0040	40	1		3	435190	765040	3	Jul 1-Jul 31	2016	4	no
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0050	50	1		3	435090	765030	3	Jul 1-Jul 31	2016	4	no
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0060	60	1		3	434950	765029	3	Jul 1-Jul 31	1997	23	no
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0080	80	1		3	434633	765006	3	Jul 1-Jul 31	1997	23	no
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0100	100	1		3	434477	764998	3	Jul 1-Jul 31	1997	23	no
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0140	140	1		3	434122	764808	3	Jul 1-Jul 31	1997	23	no
Kingston Basin (nearshore)	Flatt Point (FP)	Depth stratified area	FP08	7.5	2	2		435665	765993	4	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP13	12.5	2	2		435659	765927	4	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP18	17.5	2	2		435688	765751	4	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP23	22.5	2	2		435726	765541	4	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP28	27.5	2	2		435754	765314	4	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Grape Island (GI)	Depth stratified area	GI08	7.5	2	2		440537	764712	4	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI13	12.5	2	2		440523	764747	4	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI18	17.5	2	2		440476	764710	4	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI23	22.5	2	2		440405	764718	4	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI28	27.5	2	2		440470	764796	4	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Melville Shoal (MS)	Depth stratified area	MS08	7.5	2	1		441030	763500	2	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS13	12.5	2	1		441004	763470	2	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS18	17.5	2	1		440940	763460	2	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS23	22.5	2	1		440835	763424	2	Jul 1-Jul 31	1986	35	yes
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS28	27.5	2	1		440792	763424	2	Jul 1-Jul 31	1986	35	yes
Kinston Basin (offshore)	Eastern Basin (EB)	Fixed site	EB01	31	3	3		440400	764650	9	Jun 20-Jul 17; Jul 18-Aug 14; Aug 15-Sep 9	2016	4	no
Kinston Basin (offshore)	Eastern Basin (EB)	Fixed site	EB02	30	3	3		440330	765050	9	Jun 20-Jul 17; Jul 18-Aug 14; Aug 15-Sep 9	1968	53	no
Kinston Basin (offshore)	Eastern Basin (EB)	Fixed site	EB03	25	3	3		435820	764950	9	Jun 20-Jul 17; Jul 18-Aug 14; Aug 15-Sep 9	2016	5	no
Kinston Basin (offshore)	Eastern Basin (EB)	Fixed site	EB04	27	3	3		435940	763610	9	Jun 20-Jul 17; Jul 18-Aug 14; Aug 15-Sep 9	2016	5	no
Kinston Basin (offshore)	Eastern Basin (EB)	Fixed site	EB05	29	3	3		440000	763400	9	Jun 20-Jul 17; Jul 18-Aug 14; Aug 15-Sep 9	2016	5	no
Kinston Basin (offshore)	Eastern Basin (EB)	Fixed site	EB06	30	3	3		440220	764210	9	Jun 20-Jul 17; Jul 18-Aug 14; Aug 15-Sep 9	1968	53	no

TABLE 1.1.1. (continued). Sampling design of the Lake Ontario fish community index gill netting program (Lake Ontario) including geographic and depth stratification, number of visits, number of replicate gill net gangs set during each visit (by gill net length), and the time-frame for completion of visits. Also shown is the year in which gill netting at a particular area/site was initiated, the number of prior years netting has occurred, and if netting occurred in 2020.

						Replicates by net size[3]		Site location (approx)						
Region name	Area Name (Area code)	Design	Site name	Depth (m)	Visits	465 feet	500 feet	Latitude (dec min)	Longitude (dec min)	No.SAM (Visits x Replicates)	Time-frame	Start-up year	Number years[4]	2020 Visit
Bay of Quinte	Conway	Depth stratified area	CO08	7.5	1	1		440664	765463	1	Jul 21-Aug 21	1972	49	yes
Bay of Quinte	Conway	Depth stratified area	CO13	12.5	1	1		440649	765452	1	Jul 21-Aug 21	1972	49	yes
Bay of Quinte	Conway	Depth stratified area	CO20	20	1	1		440643	765453	1	Jul 21-Aug 21	1972	49	yes
Bay of Quinte	Conway	Depth stratified area	CO30	30	1	1		440620	765440	1	Jul 21-Aug 21	1972	49	yes
Bay of Quinte	Conway	Depth stratified area	CO45	45	1	1		440601	765402	1	Jul 21-Aug 21	1972	49	yes
Bay of Quinte	Hay Bay (HB)[2]	Depth stratified area	HB08	7.5	1	1		440656	770156	1	Jul 21-Aug 21	1959	62	yes
Bay of Quinte	Hay Bay	Depth stratified area	HB13	12.5	1	1		440575	770400	1	Jul 21-Aug 21	1959	62	yes
Bay of Quinte	Deseronto (DE)	Fixed site	DE05	5	1	1		441035	770339	1	Jul 21-Aug 21	2016	5	yes
Bay of Quinte	Big Bay (BB)	Fixed site	BB05	5	1	1		440920	771360	1	Jul 21-Aug 21	1972	49	yes
Bay of Quinte	Belleville (BE)	Fixed site	BE05	5	1	1		440914	772048	1	Jul 21-Aug 21	2016	5	yes
Bay of Quinte	Trenton (TR)	Fixed site	TR05	5	1	1		440636	773063	1	Jul 21-Aug 21	2016	5	yes
Bay of Quinte	Upper Bay of Quinte (UB)	Depth stratified random site		1-3	2	1				2	Jul 21-Aug 21	2019	2	yes
Bay of Quinte	Upper Bay of Quinte (UB)	Depth stratified random site		3-6	1	1				1	Jul 21-Aug 21	2019	2	yes
Bay of Quinte	Upper Bay of Quinte (UB)	Depth stratified random site		6-12	2	1				2	Jul 21-Aug 21	2019	2	yes
Bay of Quinte	Middle Bay of Quinte (MB)	Depth stratified random site		1-3	2	1				2	Jul 21-Aug 21	2019	2	yes
Bay of Quinte	Middle Bay of Quinte (MB)	Depth stratified random site		3-6	2	1				2	Jul 21-Aug 21	2019	2	yes
Bay of Quinte	Middle Bay of Quinte (MB)	Depth stratified random site		6-12	2	1				2	Jul 21-Aug 21	2019	2	yes
Bay of Quinte	Middle Bay of Quinte (MB)	Depth stratified random site		12-20	2	1				2	Jul 21-Aug 21	2019	2	yes
Bay of Quinte	Lower Bay of Quinte (LB)	Depth stratified random site		1-3	1	1				1	Jul 21-Aug 21	2019	2	yes
Bay of Quinte	Lower Bay of Quinte (LB)	Depth stratified random site		3-6	2	1				2	Jul 21-Aug 21	2019	2	yes
Bay of Quinte	Lower Bay of Quinte (LB)	Depth stratified random site		6-12	2	1				2	Jul 21-Aug 21	2019	2	yes
Bay of Quinte	Lower Bay of Quinte (LB)	Depth stratified random site		12-20	2	1				2	Jul 21-Aug 21	2019	2	yes
Bay of Quinte	Lower Bay of Quinte (LB)	Depth stratified random site		20-35	4	1				4	Jul 21-Aug 21	2019	2	yes
Bay of Quinte	Lower Bay of Quinte (LB)	Depth stratified random site		>35	4	1				4	Jul 21-Aug 21	2019	2	yes

[1] changed from a fixed site where the gillnet was set perpendicular to shore across contours to a depth stratified site with five depths in 1992

[2] changed from a fixed site where the gillnet was set parallel and close to shore to a depth stratified area with two depths (sites) in 1992

[3] two types of gillnet effort are used; both types consist of a graded series of mesh sizes attached in order by size from 38-153 mm at 13 mm intervals; one type has 15 ft of 38 mm mesh and 50 ft of all nine other mesh sizes the second type has 50 ft of all mesh sizes

[4] the basic sampling design of the program has been largely consistent since 1992; for years prior to 1992 consult field protocols and FISHNET project definitions for changes in sampling design.

TABLE 1.1.2. Species-specific catch in 2020 gill net sets from June 30 to September 1. "Standard catch" is the observed catch expanded to represent the catch in a 50 ft panel length of 1 1/2 inch mesh size in cases where only 15 ft was used. A total of 64 gill nets were set and 30 species comprising 8,780 fish were caught.

Species	Observed Catch	Standard Catch	Mean Weight (g)
Alewife	6028	19793	3
Bluegill	32	53	5
Bowfin	3	3	348
Brown Bullhead	7	9	34
Brown Trout	5	5	352
Channel Catfish	2	2	98
Chinook Salmon	3	3	184
Cisco	7	7	44
Common Carp	2	2	102
Freshwater Drum	158	160	56
Gizzard Shad	198	555	10
Golden Shiner	1	3	4
Lake Trout	38	38	245
Lake Whitefish	15	15	126
Largemouth Bass	10	15	53
Longnose Gar	58	74	185
Morone sp.	1	1	77
Northern Pike	9	9	203
Pumpkinseed	49	67	5
Rainbow Smelt	1	3	2
Rock Bass	18	27	10
Round Goby	9	30	4
Shorthead Redhorse	9	9	110
Silver Redhorse	1	1	129
Smallmouth Bass	14	19	119
Walleye	323	332	161
White Bass	19	24	38
White Perch	986	1203	12
White Sucker	93	93	66
Yellow Perch	681	1769	7

TABLE 1.1.3. Species-specific catch per depth strata a depth-stratified areas in Lake Ontario **Kingston Basin Nearshore** Areas (Melville Shoal, Grape Island and Flatt Point), 2020. The total number of species caught and number of gill nets set are indicated.

	Site depth (m)				
Species	7.5	12.5	17.5	22.5	27.5
Alewife	562.04	737.72	1,150.75	784.29	301.70
Brown Trout	0.17	0.17	0.17	-	-
Chinook Salmon	-	-	-	0.50	-
Cisco	-	-	-	0.50	0.17
Lake Trout	-	-	-	1.00	1.50
Lake Whitefish	-	-	-	0.67	0.50
Rainbow Smelt	-	-	-	-	0.55
Rock Bass	-	0.33	-	-	-
Round Goby	-	-	2.75	1.65	-
Smallmouth Bass	2.00	1.00	-	-	-
Walleye	19.50	5.17	-	-	-
White Sucker	0.33	-	0.17	-	-
Yellow Perch	-	1.10	2.87	-	-
Total catch	584	745	1157	789	304
Number of species	5	6	5	6	5
Number of sets	15	15	15	15	15

TABLE 1.1.4. Species-specific catch per gillnet set at **Flatt Point in the Kingston Basin of Lake Ontario**, 1992-2020. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 1-3 visits during summer. Mean catches for 1992-2000, 2001-2010, and 2011-2020 time-periods are shown in **bold.** The total number of species caught and gillnets set each year are indicated.

	1992-2000											**2001-2010**											**2011-2020**
	mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	**mean**
Sea Lamprey	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	0.05	-	-	**0.01**
Lake Sturgeon	**0.01**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Alewife	**78.18**	45.97	5.17	6.87	101.38	141.78	203.18	140.02	297.45	305.56	620.72	**186.81**	908.17	818.60	337.43	11.57	293.48	487.80	885.96	133.43	98.19	796.65	**477.13**
Gizzard Shad	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	0.15	-	-	**0.02**
Chinook Salmon	**0.16**	-	-	-	0.35	0.05	-	0.10	-	-	0.05	**0.06**	0.05	0.15	-	-	-	-	-	0.05	0.10	0.10	**0.05**
Rainbow trout	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.15									**0.02**
Brown Trout	**0.02**	0.10	-	-	-	-	0.10	-	0.10	0.05	0.10	**0.05**	0.55	0.55	0.20	0.05	-	-	0.05	0.10	0.15	-	**0.17**
Lake Trout	**10.72**	2.47	0.75	1.25	0.98	0.88	0.30	1.22	0.92	2.07	1.00	**1.18**	1.95	0.60	2.20	2.45	0.70	0.72	0.25	0.50	1.10	0.10	**1.06**
Lake Whitefish	**4.17**	4.60	2.72	0.85	2.80	0.55	0.20	1.30	0.75	0.15	0.25	**1.42**	0.25	0.95	0.20	0.05	0.42	0.35	0.05	0.05	0.27	0.10	**0.27**
Cisco	**0.83**	-	-	0.10	-	0.05	-	-	-	-	-	**0.02**	-	0.05	0.05	-	-	0.15	0.05	0.05	0.15	0.10	**0.06**
Coregonus sp.	**0.00**	0.05	-	-	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Rainbow Smelt	**0.22**	-	-	-	-	-	0.05	-	0.05	-	0.10	**0.02**	-	-	-	-	-	-	-	-	-	0.33	**0.03**
Northern Pike	**0.08**	0.10	-	-	0.05	0.15	0.05	0.05	0.25	0.15	0.10	**0.09**	0.10	0.10	-	0.05	0.65	0.15	0.15	0.05	0.10	-	**0.14**
White Sucker	**0.98**	0.45	0.45	0.70	1.00	0.60	0.35	0.20	0.50	0.05	0.20	**0.45**	0.30	0.25	-	-	0.05	-	-	-	-	0.10	**0.07**
Brown Bullhead	**0.05**	-	0.05	0.05	0.05	0.05	-	0.05	-	-	-	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**
Stonecat	**-**	0.05	0.05	-	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Burbot	**0.02**	0.10	-	-	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
White Perch	**0.02**	-	-	0.10	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Rock Bass	**0.87**	0.53	0.05	0.05	0.22	-	0.70	0.25	0.27	0.05	-	**0.21**	0.73	0.52	0.17	-	0.17	-	0.73	0.88	1.41	0.20	**0.48**
Smallmouth Bass	**0.06**	-	0.10	0.05	-	-	-	-	-	-	-	**0.02**	-	0.05	-	-	-	0.05	-	0.05	0.10	-	**0.03**
Yellow Perch	**22.70**	5.24	5.02	8.62	41.35	29.83	51.51	20.53	5.77	5.06	12.17	**18.51**	9.58	2.32	0.22	1.16	1.75	2.97	1.47	-	0.17	-	**1.96**
Walleye	**0.10**	-	-	-	-	0.05	0.05	0.05	0.10	0.15	0.25	**0.07**	0.10	0.10	-	-	0.15	0.10	-	0.05	0.25	-	**0.08**
Round Goby	**-**	-	-	-	0.99	4.96	12.26	8.18	1.70	0.50	2.81	**3.14**	1.49	3.97	0.17	-	0.50	0.99	2.31	1.49	0.50	1.65	**1.31**
Freshwater Drum	**0.08**	-	-	-	-	-	-	-	-	-	-	**-**	0.05	-	-	-	-	0.05	-	0.05	0.05	-	**0.02**
Total catch	**119**	60	14	19	149	179	269	172	308	314	638	**212**	923	828	341	15	298	493	891	137	103	799	**483**
Number of species	**10**	11	9	11	10	11	11	11	11	10	11	**11**	12	14	8	6	9	10	9	14	13	9	**10**
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20	20	20	20	20	10	

TABLE 1.1.5. Species-specific catch per gillnet set at **Grape Island in the Kingston Basin of Lake Ontario**, 1992-2020. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 1-3 visits during summer. Mean catches for 1992-2000, 2001-2010, and 2011-2020 time-periods are shown in **bold.** The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2001-2010 mean	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2011-2020 mean
Lake Sturgeon	**0.01**	0.05	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Alewife	**116.14**	155.14	15.03	47.83	42.83	225.83	376.62	153.49	358.67	244.82	719.98	**234.02**	1,244.67	675.03	463.46	43.11	225.54	1,135.89	930.37	677.92	164.60	970.25	**653.08**
Chinook Salmon	**0.02**	-	-	-	-	0.15	-	0.10	-	-	-	**0.03**	-	-	-	-	-	-	-	0.10	-	-	**0.01**
Brown Trout	**0.02**	-	-	-	0.05	0.05	0.10	-	-	-	0.05	**0.03**	0.25	0.10	0.10	0.10	-	-	-	0.15	0.05	0.30	**0.11**
Lake Trout	**6.56**	0.30	0.57	0.45	0.10	0.15	0.15	0.57	0.05	0.40	0.20	**0.29**	0.20	0.20	1.78	2.27	1.70	0.25	0.35	0.72	1.35	0.80	**0.96**
Lake Whitefish	**2.86**	0.20	0.20	0.15	-	0.10	0.10	0.20	0.10	0.10	0.10	**0.13**	0.10	0.10	0.15	-	-	0.20	0.40	0.05	0.35	0.60	**0.20**
Cisco	**0.08**	-	-	-	-	-	-	-	-	-	0.15	**0.02**	0.05	-	0.10	0.05	-	0.40	0.25	0.32	0.25	0.30	**0.17**
Rainbow Smelt	**0.03**	-	-	-	-	-	-	-	-	0.05	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Northern Pike	**-**	-	-	-	-	-	-	0.05	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
White Sucker	**0.04**	-	-	0.05	-	-	-	0.05	0.05	-	-	**0.02**	0.10	0.05	-	0.05	0.05	0.10	0.30	0.30	0.05	0.20	**0.12**
Silver Redhorse	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
Brown Bullhead	**-**	-	-	0.15	0.17	-	0.05	-	-	-	-	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**
Channel Catfish	**0.02**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Stonecat	**0.04**	-	0.17	0.43	0.33	-	-	-	-	-	-	**0.09**	-	-	-	-	-	-	-	-	-	-	**-**
Burbot	**0.17**	-	0.10	0.05	-	-	-	-	-	-	-	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**
Threespine Stickleback	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
White perch	**0.07**	-	-	0.10	0.10	0.05	-	-	-	-	-	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**
Rock Bass	**1.43**	1.01	0.05	0.72	0.33	0.17	0.37	0.93	1.01	0.43	0.35	**0.54**	0.05	0.80	0.20	0.05	0.17	0.22	0.05	0.38	0.05	-	**0.20**
Smallmouth Bass	**0.68**	0.15	0.48	0.47	0.48	0.05	0.52	0.15	0.35	0.32	0.25	**0.32**	0.50	0.85	0.50	0.27	0.45	0.60	0.70	2.02	0.30	0.20	**0.64**
Yellow Perch	**14.36**	3.54	19.72	18.54	45.07	12.18	18.13	15.82	7.44	6.98	6.91	**15.43**	4.61	0.98	2.63	1.37	2.25	1.70	2.88	2.29	0.98	-	**1.97**
Walleye	**2.90**	0.50	0.10	0.80	0.37	0.20	2.55	0.50	0.95	0.15	1.05	**0.72**	0.70	1.30	0.40	0.35	1.40	0.90	1.30	1.25	-	1.80	**0.94**
Round Goby	**-**	-	-	1.32	49.22	4.51	8.35	7.97	1.09	-	1.65	**7.41**	1.16	1.42	1.98	-	0.22	0.50	0.88	2.15	0.50	0.99	**0.98**
Freshwater Drum	**0.28**	0.05	-	0.20	-	-	0.05	-	0.05	-	0.05	**0.04**	-	-	-	-	-	-	-	0.10	-	-	-
Total catch	**146**	161	36	71	139	243	407	180	370	253	731	**259**	1,252	681	471	48	232	1,141	937	688	168	975	659
Number of species	**11**	9	9	16	11	11	11	11	10	8	11	**11**	11	10	10	9	8	10	10	13	10	9	10
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20	20	20	20	20	10	10

TABLE 1.1.6. Species-specific catch per gillnet set at **Melville Shoal in the Kingston Basin of Lake Ontario**, 1992-2020. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 1-3 visits during summer. Mean catches for 1992-2000, 2001-2010, and 2011-2020 time-periods are shown in **bold.** The total number of species caught and gillnets set each year are indicated.

	1992-2000											**2001-2010**											**2011-2020**
	mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	**mean**
Lake Sturgeon	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	0.05	-	-	-	-	**0.01**
Alewife	**71.63**	40.83	39.19	14.14	82.41	177.38	195.64	83.04	134.66	496.46	620.85	**188.46**	666.70	223.18	553.63	93.28	170.89	805.59	710.49	490.25	294.79	355.00	**436.38**
Gizzard Shad	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
Chinook Salmon	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	0.05	-	0.05	-	0.20	**0.03**
Rainbow Trout	**-**	-	-	-	-	-	-	0.05	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Brown Trout	**-**	-	-	-	-	-	0.05	-	0.10	-	0.15	**0.03**	0.05	0.05	-	0.05	-	-	-	-	0.10	-	**0.03**
Lake Trout	**3.54**	0.10	0.05	0.05	0.05	-	0.05	0.05	0.10	0.40	0.15	**0.10**	1.02	0.10	0.35	1.00	0.55	0.20	0.25	0.25	0.20	0.60	**0.45**
Lake Whitefish	**1.59**	0.10	0.20	0.30	-	-	-	0.05	-	-	-	**0.07**	-	-	-	-	-	-	-	-	-	-	**-**
Cisco	**0.04**	-	-	-	-	-	-	-	-	-	0.20	**0.02**	0.05	0.05	-	0.05	0.27	0.38	0.90	0.20	-	-	**0.19**
Coregonus sp.	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
Rainbow Smelt	**0.08**	-	-	-	-	-	-	-	0.17	-	0.05	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**
Northern Pike	**0.07**	0.10	0.10	0.05	-	-	-	-	-	0.10	0.10	**0.05**	-	-	-	-	0.05	0.05	-	-	-	-	**0.01**
White Sucker	**0.03**	0.05	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	0.05	-	-	-	**0.01**
Greater Redhorse	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
Moxostoma sp.	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
Common Carp	**0.02**	-	-	0.05	0.10	-	-	-	0.05	-	-	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**
Channel Catfish	**0.15**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Stonecat	**0.03**	0.33	0.43	-	-	0.50	-	-	-	-	-	**0.13**	-	-	-	-	-	-	-	-	-	-	**-**
Burbot	**0.10**	-	-	-	0.05	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
White Perch	**0.20**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
Rock Bass	**1.88**	1.99	0.98	1.33	2.25	1.84	1.82	1.72	3.16	0.80	1.28	**1.72**	1.20	1.89	0.42	1.99	1.51	1.02	1.33	0.58	0.40	-	**1.03**
Pumpkinseed	**-**	0.17	-	-	-	-	-	-	-	-	-	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**
Smallmouth Bass	**0.53**	0.42	0.25	0.40	0.27	0.15	0.20	0.57	0.70	0.25	0.60	**0.38**	0.40	1.00	-	0.87	0.10	0.20	0.70	0.37	0.70	1.60	**0.59**
Yellow Perch	**28.76**	12.57	26.57	20.20	49.72	16.14	44.66	38.74	18.75	9.75	25.97	**26.31**	10.38	8.82	3.92	12.58	6.03	6.11	13.68	7.33	4.50	2.38	**7.57**
Walleye	**8.73**	4.63	3.90	3.50	5.08	4.45	5.25	7.30	4.55	7.50	12.45	**5.86**	10.10	7.05	0.55	11.70	7.00	6.95	12.55	9.35	9.10	13.00	**8.74**
Round Goby	**-**	-	-	-	9.02	9.80	5.34	4.84	2.18	1.16	0.50	**3.28**	0.71	1.16	1.16	-	0.50	-	0.83	1.21	-	-	**0.56**
Freshwater Drum	**0.09**	0.05	-	0.05	-	-	-	0.22	-	-	0.10	**0.04**	0.05	-	-	-	0.05	-	-	-	-	-	**0.01**
Total catch	**118**	61	72	40	149	210	253	137	164	516	662	**227**	691	243	560	122	187	821	741	510	310	373	**456**
Number of species	**12**	12	9	12	9	7	8	10	10	8	12	**10**	10	9	6	8	10	10	9	9	7	6	**8**
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20	20	20	20	10	5	

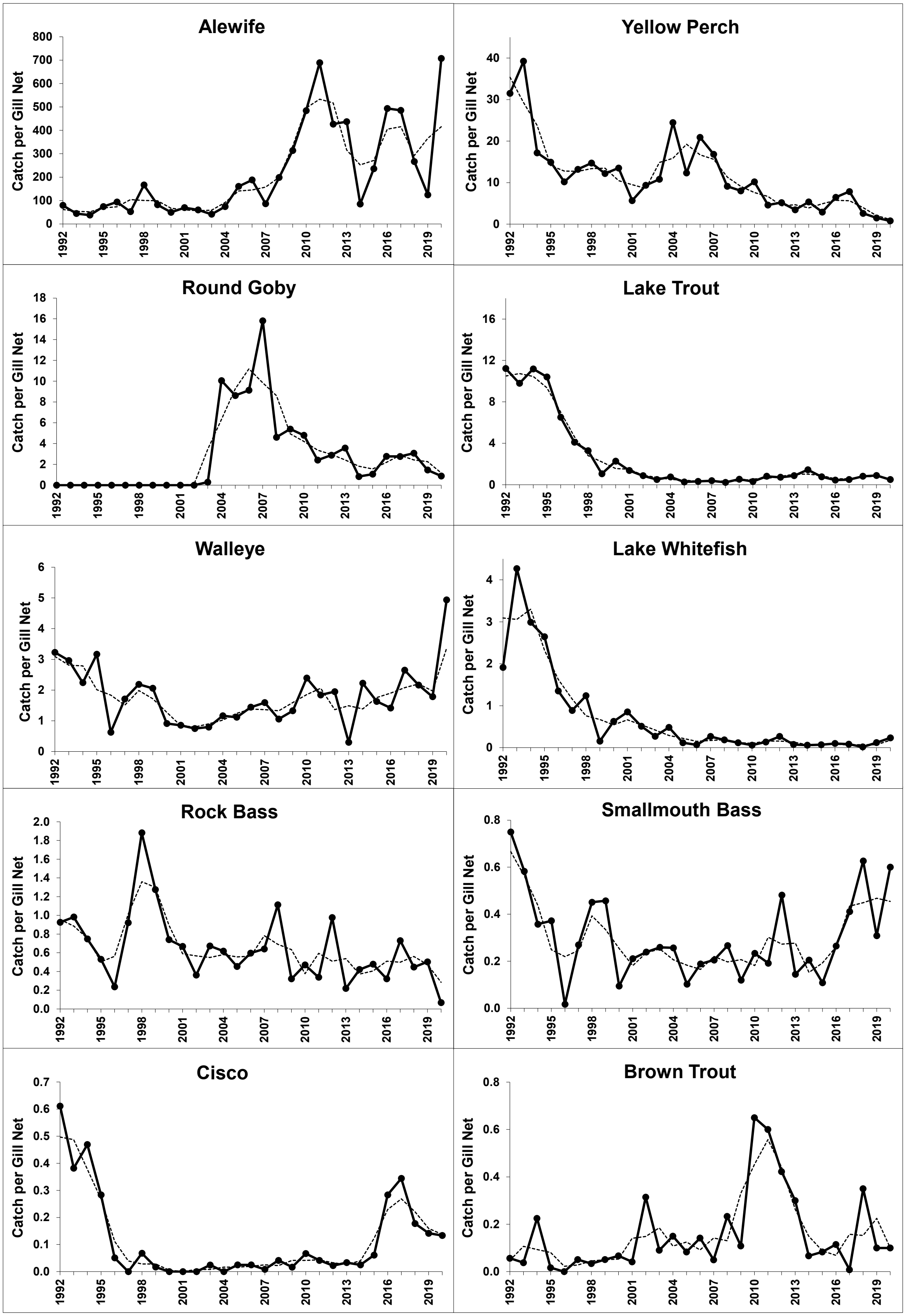

FIG. 1.1.2. Abundance trends for the most common species caught in gill nets at six depth-stratified transects (nearshore out to 30 m) in Northeastern and Kingston Basin Lake Ontario Nearshore (Melville Shoal, Grape Island, Flatt Point, Rocky Point, Wellington and Brighton; see Fig. 1.1.1). In 2020, only Kingston Basin Lake Ontario Nearshore were visited (Melville Shoal, Grape Island, Flatt Point) Annual catch per gill net values are unweighted means. Dotted lines show 3-yr running averages (two years for first and last years graphed).

TABLE 1.1.7. Species-specific catch per gill net set by depth at all **Bay of Quinte** gill net site locations (fixed and depth-stratified random sites combined), summer 2020. The total catch and the number of species caught and gill nets set are indicated.

	Depth Strata (m)					
Species	1-3	3-6	6-12	12-20	20-35	>35
Longnose Gar	1.00	5.56	0.38	-	-	-
Bowfin	0.40	0.11	-	-	-	-
Alewife	4.20	0.22	7.38	1.86	0.80	1.60
Gizzard Shad	5.00	15.22	4.50	-	-	-
Brown Trout	-	-	-	-	0.40	-
Lake Trout	-	-	-	-	2.00	3.20
Lake Whitefish	-	-	-	-	1.40	0.20
Cisco	-	-	0.13	-	0.20	0.20
Northern Pike	0.40	0.33	-	0.57	-	-
White Sucker	0.60	3.44	2.50	3.00	2.80	0.20
Silver Redhorse	0.20	-	-	-	-	-
Shorthead Redhorse	1.80	-	-	-	-	-
Common Carp	0.20	-	0.13	-	-	-
Brown Bullhead	0.40	0.44	0.13	-	-	-
White Perch	32.80	45.11	37.38	16.71	-	-
White Bass	1.60	0.67	0.13	0.57	-	-
Morone sp.	0.20	-	-	-	-	-
Rock Bass	2.40	0.22	-	0.29	-	-
Pumpkinseed	2.80	2.22	1.88	-	-	-
Bluegill	3.20	1.11	0.75	-	-	-
Smallmouth Bass	0.40	-	-	0.29	-	-
Largemouth Bass	1.60	0.22	-	-	-	-
Yellow Perch	21.60	18.89	25.50	24.71	0.80	3.40
Walleye	10.80	15.78	4.13	1.57	-	-
Round Goby	-	-	-	0.14	-	-
Freshwater Drum	2.60	11.11	3.63	2.29	-	-
Total catch	94	121	89	52	8	9
Number of species	21	16	14	11	7	6
Number of net sets	5	9	8	7	5	5

TABLE 1.1.8. Seasonal species-specific catch per gill net set at **upper, middle and lower Bay of Quinte** gill net site locations (fixed and depth-stratified random sites combined), 2020. The total catch and the number of species caught and gill nets set are indicated.

Species	Upper	Middle	Lower
Longnose Gar	8.24	-	-
Bowfin	-	0.20	0.05
Alewife	-	0.66	17.12
Gizzard Shad	36.90	22.30	-
Chinook Salmon	-	-	0.05
Brown Trout	-	-	0.10
Lake Trout	-	-	1.30
Lake Whitefish	-	-	0.40
Cisco	-	0.10	0.10
Northern Pike	0.22	0.50	0.10
White Sucker	3.00	3.60	1.35
Silver Redhorse	0.11	-	-
Shorthead Redhorse	1.00	-	-
Common Carp	-	0.10	0.05
Golden Shiner	-	0.33	-
Brown Bullhead	0.59	0.20	0.10
Channel Catfish	-	0.20	-
White Perch	77.07	32.94	8.98
White Bass	0.92	1.03	0.25
Morone sp.	-	0.10	-
Rock Bass	0.48	0.30	0.90
Pumpkinseed	5.28	1.33	0.33
Bluegill	5.38	0.43	-
Smallmouth Bass	-	0.10	0.38
Largemouth Bass	0.78	0.76	-
Yellow Perch	33.92	62.23	41.46
Walleye	7.29	7.06	5.65
Round Goby	-	-	0.17
Freshwater Drum	10	3	2
Total catch	183	137	81
Number of species	16	21	19
Number of net sets	9	10	20

TABLE 1.1.9. Species-specific catch per gillnet set at **Conway in the Bay of Quinte**, 1993-2020. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 20, 30 and 45 m) during each of 1-3 visits during summer. Mean catches for 1992-2000, 2001-2010, and 2011-2020 time-periods are shown in **bold.** The total number of species caught and gillnets set each year are indicated.

Species	**1993-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	**2011-2021 mean**
Sea Lamprey	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	0.05	-	-	-	-	-	-	**0.01**
Lake Sturgeon	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	0.05	-	-	-	-	**0.01**
Longnose Gar	**0.00**	0.05	-	-	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Alewife	**46.74**	8.25	2.90	6.00	16.20	69.45	11.55	19.35	71.00	74.95	175.35	**45.50**	176.44	112.70	86.30	54.60	137.08	468.20	37.10	4.12	9.25	45.14	**113.09**
Gizzard Shad	**0.01**	-	-	-	0.05	-	-	0.20	0.10	-	-	**0.04**	0.10	-	-	-	-	-	0.05	-	-	-	**0.02**
Chinook Salmon	**0.03**	0.05	-	0.05	0.10	-	-	0.10	0.10	0.10	0.05	**0.06**	0.15	-	-	0.10	0.10	-	0.17	0.17	0.66	-	**0.13**
Rainbow Trout	**-**	-	-	-	-	0.05	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Atlantic Salmon	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
Brown Trout	**0.29**	0.10	0.05	0.35	0.10	0.25	0.25	0.15	0.45	0.15	0.05	**0.19**	0.40	-	0.05	-	-	-	-	0.05	-	-	**0.05**
Lake Trout	**2.02**	0.75	2.30	1.75	2.05	2.75	1.15	1.35	0.95	0.10	0.15	**1.33**	0.95	1.80	2.25	2.80	1.65	3.15	1.78	2.12	0.80	1.20	**1.85**
Lake Whitefish	**0.96**	0.45	0.25	0.75	0.10	0.60	0.30	0.25	0.20	0.05	0.20	**0.32**	0.30	0.20	0.40	0.05	0.15	0.55	0.15	0.15	0.66	0.20	**0.28**
Cisco	**0.19**	0.20	-	-	-	-	0.05	-	0.10	0.05	0.15	**0.06**	-	0.15	-	-	0.45	0.75	0.58	-	-	-	**0.19**
Coregonus sp.	**0.00**	-	-	-	0.05	-	-	-	-	-	-	**0.01**	-	-	-	0.05	-	-	-	-	-	-	**0.01**
Rainbow Smelt	**0.08**	0.20	-	-	0.05	0.20	0.05	-	0.35	0.10	0.15	**0.11**	0.10	-	0.10	-	0.25	0.10	0.43	0.05	-	-	**0.10**
Northern Pike	**0.04**	0.05	-	0.05	-	-	-	0.05	0.05	-	0.05	**0.03**	-	-	-	0.10	-	-	-	-	0.20	-	**0.03**
White Sucker	**2.36**	3.30	2.60	2.15	1.05	0.60	0.45	1.45	0.55	0.30	0.20	**1.27**	0.05	0.05	0.10	0.10	0.05	0.55	0.50	0.45	0.20	-	**0.21**
Silver Redhorse	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
Moxostoma sp.	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
Common Carp	**0.04**	-	-	-	-	-	-	0.05	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Brown Bullhead	**0.05**	0.05	-	0.10	0.20	0.15	0.90	0.35	-	-	-	**0.18**	0.05	-	-	-	-	-	-	-	-	-	**0.01**
Channel Catfish	**0.02**	0.05	0.05	-	-	0.05	-	-	-	-	-	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**
Stonecat	**-**	0.05	0.05	-	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Burbot	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
Trout-perch	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
White Perch	**1.95**	-	0.05	0.85	2.65	-	0.85	1.25	1.15	0.15	0.05	**0.70**	0.50	0.30	2.30	-	0.05	0.05	0.82	4.44	3.00	3.78	**1.52**
White Bass	**-**	-	-	-	-	-	-	-	-	-	-	**-**	0.05	-	-	-	-	-	-	0.15	-	-	**0.02**
Morone sp.	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	0.05	-	-	-	**0.01**
Rock Bass	**2.19**	0.45	0.90	0.15	0.15	0.50	0.95	3.85	2.05	0.20	0.95	**1.02**	0.95	0.05	0.40	0.40	0.30	1.00	0.10	0.60	0.86	0.20	**0.49**
Pumpkinseed	**0.03**	0.05	0.05	0.05	-	-	-	0.05	-	-	-	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**
Smallmouth Bass	**0.31**	0.05	-	-	-	0.05	0.15	0.15	0.05	-	0.15	**0.06**	0.10	0.10	0.05	-	-	-	0.10	0.05	-	-	**0.04**
Yellow Perch	**84.25**	65.50	77.50	48.65	33.15	28.00	57.25	18.20	26.10	11.60	16.25	**38.22**	25.75	11.40	25.60	7.10	3.00	12.65	95.87	29.94	23.73	18.12	**25.32**
Walleye	**8.23**	1.00	1.45	2.70	1.05	1.25	1.90	2.50	1.60	1.40	1.25	**1.61**	2.10	0.60	1.00	0.35	0.80	0.65	6.90	4.30	2.20	2.60	**2.15**
Round Goby	**-**	-	1.00	11.00	31.05	0.80	0.15	0.10	0.25	-	0.05	**4.44**	-	0.05	-	-	-	-	-	-	-	-	**0.01**
Freshwater Drum	**0.54**	0.05	0.10	0.15	0.65	0.50	1.20	1.35	0.75	0.40	0.75	**0.59**	3.25	0.10	0.40	0.05	-	0.05	1.40	1.70	1.20	0.40	**0.86**
Total catch	**150**	81	89	75	89	105	77	51	106	90	196	**96**	211	128	119	66	144	488	146	48	43	72	**146**
Number of species	**13**	19	14	15	15	15	15	18	17	13	16	**16**	16	12	12	11	11	12	14	14	11	8	**12**
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20	20	20	20	5	5	

TABLE 1.1.10. Species-specific catch per gillnet set at **Hay Bay in the Bay of Quinte**, 1992-2020. Annual catches are averages for 1-3 gillnet gangs set at each of 2 depths (7.5 and 12.5 m) during each of 1-3 visits during summer. Mean catches for 1992-2000, 2001-2010, and 2011-2020 time-periods are shown in **bold.** The total number of species caught and gillnets set each year are indicated.

Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	**2011-2020 mean**
Sea Lamprey	**-**	-	-	-	-	-	-	-	0.13	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Lake Sturgeon	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
Longnose Gar	**-**	-	-	-	-	-	-	0.13	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Alewife	**8.33**	19.25	8.13	-	1.25	0.25	7.50	3.75	0.13	9.75	28.75	**7.88**	12.00	5.38	3.75	4.88	13.13	57.25	4.27	46.63	8.76	-	**15.60**
Gizzard Shad	**0.71**	-	0.25	-	-	-	0.50	0.13	0.13	-	-	**0.10**	-	0.38	5.38	-	1.25	-	-	0.17	-	1.00	**0.82**
Chinook Salmon	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.13	-	-	0.13	-	-	-	-	-	**0.03**
Rainbow Trout	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	0.08	-	-	-	-	**0.01**
Brown Trout	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
Lake Trout	**0.12**	-	-	0.25	-	-	-	-	-	-	-	**0.03**	-	-	-	-	-	0.33	0.08	-	-	-	**0.04**
Lake Whitefish	**0.06**	0.13	-	-	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	0.08	-	0.08	-	-	**0.02**
Cisco	**3.79**	1.00	0.13	-	0.13	-	-	0.13	-	0.13	10.25	**1.18**	0.38	0.25	-	-	-	0.42	0.67	0.58	1.50	-	**0.38**
Coregonus sp.	**0.04**	-	-	-	-	-	-	-	0.13	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Rainbow Smelt	**0.19**	-	0.25	-	-	-	0.13	-	-	0.38	-	**0.08**	-	-	-	-	0.13	-	-	-	0.50	-	**0.06**
Northern Pike	**1.00**	0.88	0.13	0.38	-	0.50	0.38	1.13	1.00	0.50	3.00	**0.79**	0.38	0.13	-	0.25	0.13	0.67	0.50	1.19	-	1.50	**0.47**
White Sucker	**6.12**	5.63	2.88	2.25	6.13	1.50	1.75	1.38	2.50	4.25	8.75	**3.70**	2.25	2.75	0.88	5.38	3.38	3.92	8.75	6.25	4.50	4.50	**4.25**
River Redhorse	**-**	-	-	-	-	-	-	0.13	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Common Carp	**0.23**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	0.13	-	-	-	-	-	-	-	**0.01**
Golden Shiner	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.25	0.13	-	0.50	1.33	-	0.08	-	-	**0.23**
Spottail Shiner	**0.01**	-	-	-	-	-	-	0.13	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Brown Bullhead	**0.94**	0.88	0.13	0.25	0.25	0.38	0.88	0.38	0.50	-	-	**0.36**	-	-	-	0.25	0.13	-	-	-	-	-	**0.04**
Channel Catfish	**0.01**	-	-	0.13	0.13	-	-	-	-	-	-	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**
Burbot	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
White Perch	**11.00**	0.50	5.38	8.38	14.50	0.13	30.13	16.25	20.75	9.38	1.75	**10.71**	4.00	7.88	55.63	1.00	0.63	2.92	3.16	28.57	7.00	35.41	**14.62**
White bass	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.13	-	-	-	0.25	0.25	0.33	1.00	-	**0.20**
Rock Bass	**0.03**	-	-	-	-	-	-	-	0.13	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**
Pumpkinseed	**0.86**	1.13	1.00	0.63	2.13	0.38	0.63	0.75	0.75	0.75	0.75	**0.89**	0.75	-	-	0.50	-	0.08	0.33	2.08	-	2.50	**0.62**
Bluegill	**-**	-	-	-	-	-	-	-	-	-	-	**-**	0.13	-	-	-	-	-	-	-	-	-	**0.01**
Smallmouth Bass	**0.10**	0.13	0.13	-	-	-	-	-	-	-	-	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**
Black Crappie	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	0.13	-	-	0.08	-	-	-	-	**0.02**
Yellow Perch	**154.09**	144.13	112.13	110.50	86.00	142.75	64.00	102.00	98.88	81.63	210.00	**115.20**	94.63	35.75	6.13	53.50	37.25	113.58	99.64	91.02	90.50	58.87	**68.09**
Walleye	**4.39**	2.50	3.75	2.75	2.13	0.88	1.75	2.50	1.13	2.75	2.00	**2.21**	1.50	1.25	2.88	2.13	0.75	2.00	3.08	2.88	3.50	3.50	**2.35**
Round Goby	**-**	-	0.25	0.25	0.25	0.13	-	-	-	-	-	**0.09**	-	-	-	-	-	-	-	-	-	-	**-**
Freshwater Drum	**1.08**	0.25	3.13	1.25	6.63	2.50	8.25	1.00	0.88	1.00	0.75	**2.56**	0.25	0.63	3.88	2.75	0.13	0.42	2.94	1.92	-	4.50	**1.74**
Total catch	**193**	176	138	127	120	149	116	130	127	111	266	**146**	116	55	79	71	58	183	124	182	117	112	**110**
Number of species	**14**	12	14	11	11	10	11	14	13	10	9	**12**	10	12	10	9	12	15	11	13	8	8	**11**
Number of sets		8	8	8	8	8	8	8	8	8	4		8	8	8	8	8	12	12	12	2	2	

TABLE 1.1.11. Species-specific catch per gillnet set at **Big Bay in the Bay of Quinte**, 1992-2020. Annual catches are averages for 1-2 gillnet gangs set during each of 1-4 visits during summer. Mean catches for 1992-2000, 2001-2010, and 2011-2020 time-periods are shown in **bold.** The total number of species caught and gillnets set each year are indicated.

Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	**2011-2020 mean**
Lake Sturgeon	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	0.17	-	-	**0.02**
Longnose Gar	**1.39**	1.00	1.00	0.17	1.00	1.50	3.00	0.33	2.50	3.77	6.50	**2.08**	2.33	3.83	12.83	0.17	1.67	3.63	3.75	2.49	4.00	12.30	**4.70**
Alewife	**0.70**	-	0.88	1.67	3.17	-	0.75	-	1.00	2.67	1.00	**1.11**	0.50	0.50	0.17	2.17	2.17	2.38	3.47	1.27	-	-	**1.26**
Gizzard Shad	**7.23**	2.13	6.63	2.00	0.17	42.17	0.25	1.00	3.67	-	3.33	**6.13**	88.50	10.83	-	-	1.50	3.75	2.17	0.17	-	16.52	**12.34**
Lake Whitefish	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.17	-	-	-	-	-	-	-	-	**0.02**
Cisco	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
Northern Pike	**0.68**	0.13	0.13	-	0.17	0.17	0.50	0.17	-	-	-	**0.13**	-	-	-	-	-	0.25	0.17	0.17	-	-	**0.06**
Mooneye	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
White Sucker	**7.30**	3.50	9.25	2.33	5.33	2.50	5.00	2.50	4.33	3.33	3.67	**4.18**	4.00	7.00	5.50	3.50	7.00	4.13	8.50	9.67	9.00	15.00	**7.33**
Silver Redhorse	**-**	-	-	-	-	-	-	-	-	-	0.17	**0.02**	-	-	-	-	-	-	-	0.17	-	-	**0.02**
Shorthead Redhorse	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	0.13	-	-	-	-	**0.01**
Moxostoma sp.	**0.04**	0.13	-	0.17	-	-	-	-	-	-	-	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**
Common Carp	**0.30**	-	-	0.17	0.17	-	-	-	-	-	-	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**
Brown Bullhead	**6.72**	6.75	5.50	1.83	2.33	0.83	2.00	0.83	0.67	0.67	-	**2.14**	0.17	0.50	1.17	0.33	0.67	0.50	1.72	1.67	2.00	-	**0.97**
Channel Catfish	**0.37**	-	0.13	-	0.17	-	0.25	-	-	0.17	-	**0.07**	-	-	0.17	0.17	-	0.50	0.67	0.17	-	-	**0.19**
Burbot	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**
White Perch	**90.12**	22.00	36.38	59.83	130.50	79.50	196.75	119.00	127.50	123.17	92.00	**98.66**	91.83	138.00	144.17	17.17	35.67	76.75	141.44	73.64	196.22	121.52	**103.64**
White Bass	**0.08**	-	0.13	-	-	-	-	0.17	0.17	-	-	**0.05**	-	0.17	-	0.33	0.50	1.38	0.17	1.00	5.00	1.00	**0.95**
Rock Bass	**0.26**	-	-	-	-	0.17	-	-	-	-	-	**0.02**	-	-	0.17	-	0.83	-	0.17	-	-	-	**0.12**
Pumpkinseed	**3.97**	17.00	8.25	0.83	4.33	0.33	3.25	0.50	1.00	0.67	0.17	**3.63**	0.83	1.00	2.50	0.67	0.50	1.63	0.67	0.83	-	1.00	**0.96**
Bluegill	**0.57**	7.13	3.75	0.50	0.33	2.50	6.50	5.33	3.17	5.55	6.67	**4.14**	6.83	1.17	11.33	4.33	11.83	0.63	0.33	0.67	25.61	7.00	**6.97**
Smallmouth Bass	**1.11**	0.50	-	-	-	-	0.50	-	-	0.17	-	**0.12**	-	-	-	-	-	-	-	-	-	-	**-**
Largemouth Bass	**0.02**	-	-	-	-	-	0.25	-	-	-	0.17	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**
Black Crappie	**0.11**	0.25	0.38	0.33	0.17	0.17	2.25	1.00	0.33	-	-	**0.49**	-	-	-	-	-	-	-	-	-	-	**-**
Yellow Perch	**138.65**	190.63	182.88	115.33	109.67	103.00	119.00	16.50	63.00	129.54	43.17	**107.27**	47.17	17.67	26.67	71.67	59.00	39.63	36.52	67.30	55.35	82.00	**50.30**
Walleye	**16.88**	4.50	7.63	6.50	8.00	5.83	10.75	5.33	9.17	8.00	10.83	**7.65**	6.33	5.17	17.17	6.33	5.33	7.25	9.27	6.17	6.00	7.00	**7.60**
Round Goby	**-**	-	-	0.33	0.33	0.50	-	-	-	-	-	**0.12**	-	-	-	-	-	-	-	-	-	-	**-**
Freshwater Drum	**15.50**	21.25	7.38	7.33	7.33	9.50	19.75	11.33	6.50	8.67	4.83	**10.39**	5.50	3.33	5.33	4.83	10.33	28.38	11.50	7.00	10.00	18.00	**10.42**
Total catch	**292**	277	270	199	273	249	371	164	223	286	173	**248**	254	189	227	112	137	171	221	173	313	281	**208**
Number of species	**14**	14	15	15	16	14	16	13	13	12	12	**14**	11	12	12	12	13	14	15	16	9	10	**12**
Number of sets		8	8	6	6	6	4	6	6	6	6		6	6	6	6	6	8	6	6	1	1	

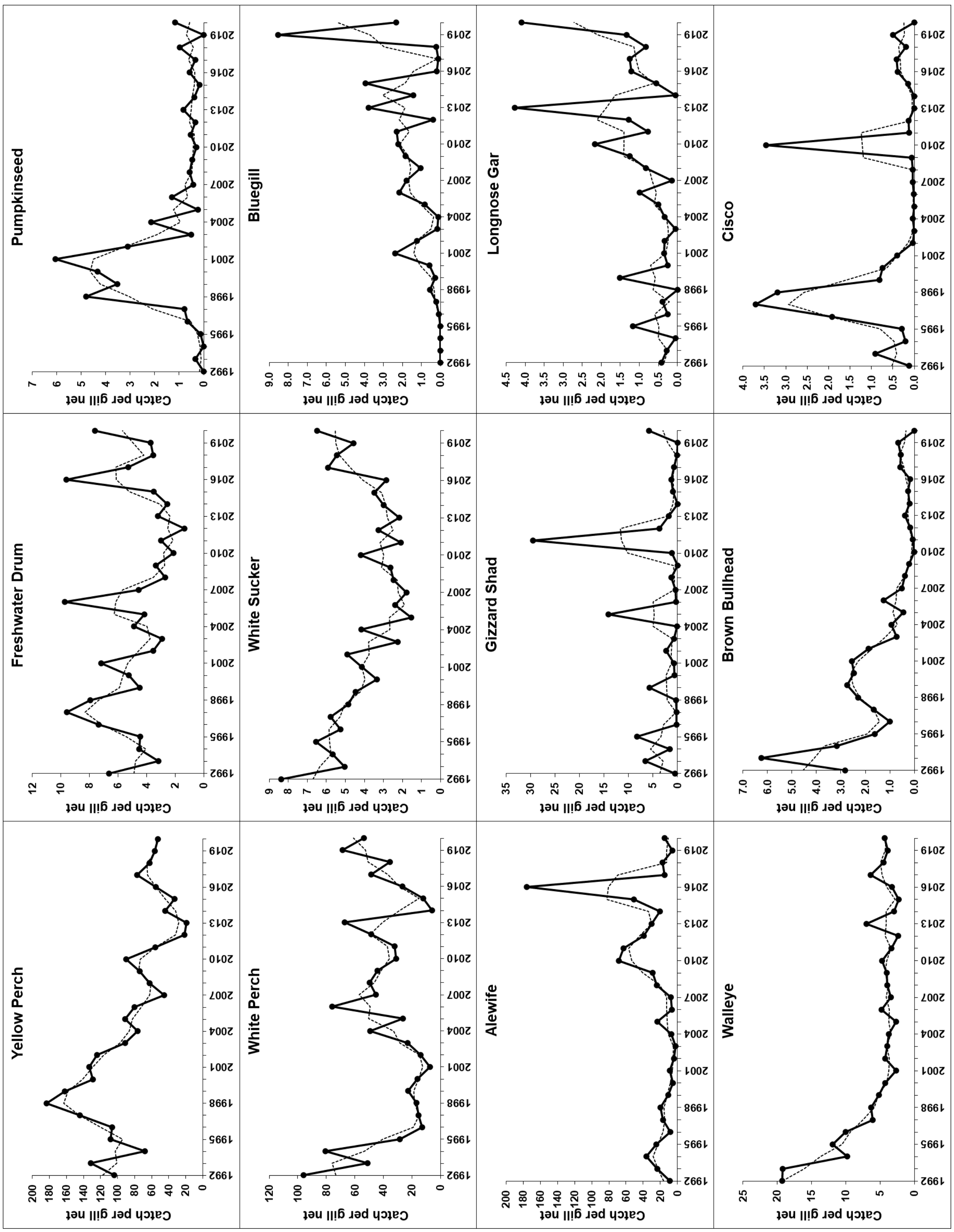

FIG. 1.1.3. Abundance trends (annual means) for the most common species caught in gill nets at three areas in the Bay of Quinte (Conway, Hay Bay and Big Bay; see Fig. 1.1.1). Dotted lines show 3-yr running averages (two years for first and last years graphed).

TABLE 1.1.12. Age distribution of **304 Walleye** sampled from **summer** index gill nets, by region, 2020. Also shown are mean fork length, mean weight, mean GSI (females), and percent mature (females). GSI = gonadal somatic index calculated for females only as log10 (gonad

	Age (years) / year-class																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	22	
Region	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	1998	Total
Bay of Quinte	10	85	40	36	24	21	1	2	15	-	1	2	1	1	-	-	-	-	239
Kingston Basin (nearshore)	-	-	2	3	4	7	1	5	8	4	4	7	6	3	5	3	2	1	65
Total aged	10	85	42	39	28	28	2	7	23	4	5	9	7	4	5	3	2	1	304
Mean fork length (mm)	240	344	427	475	499	545	536	583	605	612	657	620	643	605	668	664	646	699	
Mean weight (g)	139	455	936	1,311	1,606	2,045	2,085	2,509	2,882	3,039	3,722	3,235	3,624	3,138	4,103	4,286	3,431	3,965	
Mean GSI femals	0.05	0.14	0.22	0.28	0.32	0.33	-	-	0.40	0.41	0.42	0.47	0.42	0.23	0.42	0.49	0.46	0.46	
Proportion mature	0.00	0.02	0.22	0.79	0.75	0.70	-	-	0.90	1.00	1.00	1.00	0.75	0.50	1.00	1.00	1.00	1.00	

1.2 Lake Ontario and Bay of Quinte Fish Community Index Trawling

E. Brown, Lake Ontario Management Unit

Bottom trawling has been used to monitor the relative abundance of small fish species and the young of large-bodied species in the fish community since the 1960s. After some initial experimentation with different trawl specifications, two trawl configurations (one for the Bay of Quinte and one for Lake Ontario) were routinely employed (see trawl specifications Table 1.2.1).

In the Kingston Basin of eastern Lake Ontario, six sites, ranging in depth from about 20 to 35 m, were visited about four times annually up until 1992 when three sites were dropped. From 1992 to 2015, three visits were made to each of three sites annually, and four replicate ½ mile trawls are made during each visit. After 1995, a deep water site was added outside the Kingston Basin, south of Rocky Point (visited twice annually with a trawling distance of 1 mile; about 100 m water depth), to give a total of four Lake sites (Fig. 1.2.1). In 2014, a second trawl site/ depth was added at Rocky Point (60 m) and two trawl sites at each of Cobourg and Port Credit (60 and 100 m depths at both locations). In 2015, the Lake Ontario trawling was expanded significantly to include several more sampling depths at each of Rocky Point, Cobourg, and Port Credit. In 2016, 2017 and 2018, the three Kingston Basin sites that were dropped in 1992, were added back in to the sampling design, and trawling was not done at Cobourg and Port Credit (note that these sites were sampled in spring and fall prey fish assessments). In 2019, trawling was not done at Cobourg, Port Credit and Rocky Point, further, the seasonal component was dropped (note that these sites were sampled in spring and fall prey fish assessments). In 2020, trawling only occurred in the Bay of Quinte.

In the Bay of Quinte, six fixed-sites, ranging in depth from about 4 to 21 m, are visited annually on two or three occasions during mid to late-summer. Four replicate ¼ mile trawls are made during each visit to each site. The 2020 bottom trawl sampling design is shown in Table 1.2.2.

Twenty-nine species and nearly 34,000 fish were caught in 48 bottom trawls in 2020 (August, Table 1.2.3). Gizzard shad (24%), Alewife (24%), Yellow Perch (20%), and White Perch

TABLE 1.2.1. Bottom trawl specifications used in Eastern Lake Ontario and Bay of Quinte Fish Community sampling.

	3/4 Western (Poly) (Bay Trawl)	3/4 Yankee Standard No. 35 (Lake Trawl)
Head Rope Length (m)	14.24	12
Foot Rope Length (m)	19	17.5
Side Brail Height (m)	2	1.9
Mesh Size (front)	4" knotted black poly	3.5" knotted green nylon
Twine Type (middle)	3" knotted black poly	2.5" knotted nylon
Before Codend	2" knotted black poly	2" knotted nylon
	1.5" knotted black nylon	(chafing gear)
	1" knotted black nylon	
Codend Mesh Size	0.5" knotted white nylon	0.5" knotless white nylon
Remarks:	Fishing height 2.0 m	Fishing height 1.9 m
	FISHNET gear dimensions	FISHNET gear dimensions
	as per Casselman 92/06/08	as per Casselman 92/06/08
GRLEN:length of net	N/A	N/A
GRHT:funnel opening height	2.25 m	2.3 m
GRWID:intake width	6.8 m	9.9 m
GRCOL:1 wt,2 bl,3 gn	2	7 (discoloured)
GRMAT:1 nylon,2 ploypr.	2	1
GRYARN:1 mono,2 multi	2	2
GRKNOT:1 knotless,2 knots	2	2

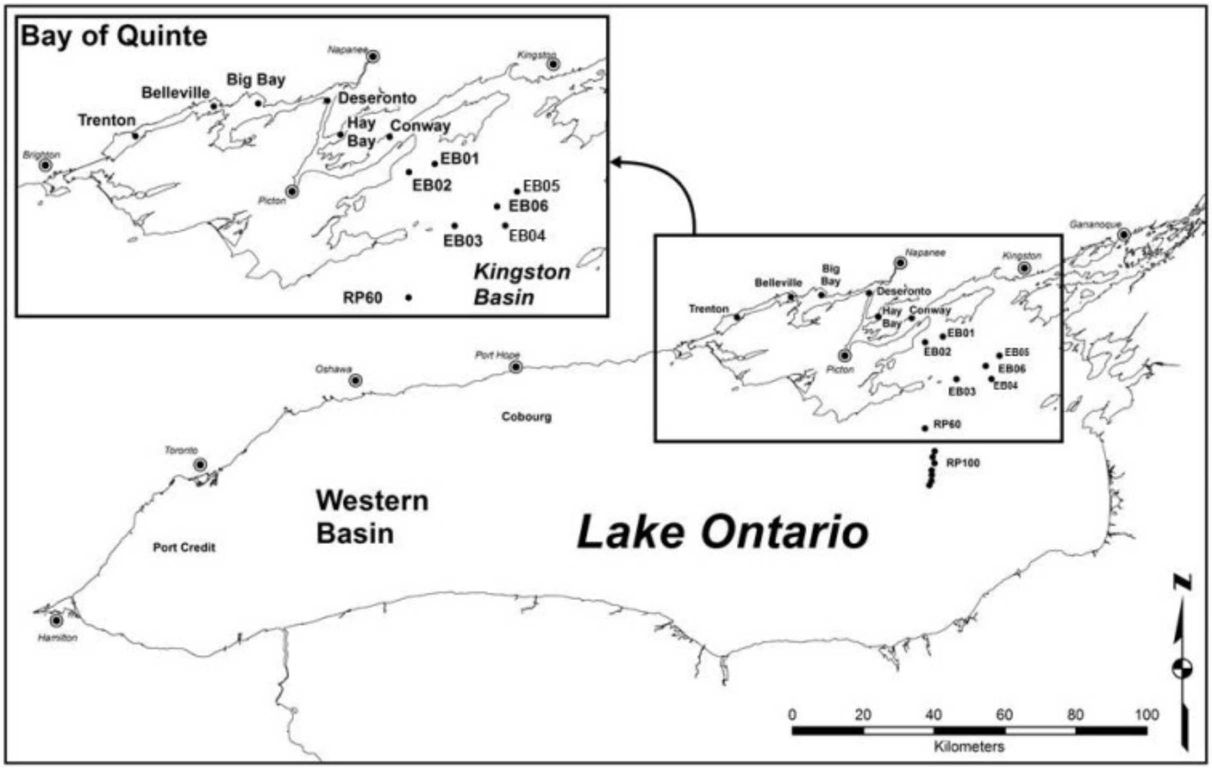

FIG. 1.2.1. Map of north eastern Lake Ontario. Shown are eastern Lake Ontario and Bay of Quinte fish community index bottom trawling site locations.

TABLE 1.2.2. Sampling design of the Lake Ontario fish community index bottom trawling program including geographic stratification, number of visits, number of replicate trawls made during each visit, and the time-frame for completion of visits. Also shown is the year in which bottom trawling at a particular area was initiated and the number of years that trawling has occurred. Note that in 2020 trawls were only conducted in the Bay of Quinte

Region name	Area Name (Area code)	Site name	Depth (m)	Visits*	Replicates x duration	Site location: Latitude	Site location: Longitude	Visits x reps	Time-frame	Start year	Number years	2020 Visit
Kingston Basin	Eastern Basin (EB)	EB01	30	1	1 x 5 minute	440400	764720	1	Aug 1-Sep 9	2016	4	no
Kingston Basin	Eastern Basin (EB)	EB02	30	1	1 x 5 minute	440280	765120	1	Aug 1-Sep 9	1972	48	no
Kingston Basin	Eastern Basin (EB)	EB03**	21	1	4 x 5 minute**	435780	764810	4	Aug 1-Sep 9	1972	48	no
Kingston Basin	Eastern Basin (EB)	EB04	35	1	1 x 5 minute	435680	763700	1	Aug 1-Sep 9	2016	4	no
Kingston Basin	Eastern Basin (EB)	EB05	33	1	1 x 5 minute	440110	763540	1	Aug 1-Sep 9	2016	4	no
Kingston Basin	Eastern Basin (EB)	EB06	35	1	1 x 5 minute	435940	763910	1	Aug 1-Sep 9	1972	48	no
Bay of Quinte	Conway (LB)	BQ17	21	2	4 x 6 minutes	440650	765420	8	Aug 1-Sep 15	1972	49	yes
Bay of Quinte	Hay Bay (MB)	BQ15	5	2	4 x 6 minutes	440650	770175	8	Aug 1-Sep 15	1972	49	yes
Bay of Quinte	Deseronto (UB)	BQ14	5	2	4 x 6 minutes	441000	770360	8	Aug 1-Sep 15	1972	49	yes
Bay of Quinte	Big Bay (UB)	BQ13	5	2	4 x 6 minutes	440975	771360	8	Aug 1-Sep 15	1972	49	yes
Bay of Quinte	Belleville (UB)	BQ12	5	2	4 x 6 minutes	440920	772010	8	Aug 1-Sep 15	1972	49	yes
Bay of Quinte	Trenton (UB)	BQ11	4	2	4 x 6 minutes	440600	773120	8	Aug 1-Sep 15	1972	49	yes

TABLE 1.2.3. Species-specific total bottom trawl catch in August 2020. Frequency of occurrence (FO) is the number of trawls, out of a possible 48, in which each species (29 species and 33,872 individual fish) was caught.

Species	FO	Catch	Biomass (kg)	Mean weight (g)
Alewife	40	8,181	23.220	2.8
Black crappie	8	15	0.988	65.9
Bluegill	26	462	11.909	25.8
Brook silverside	4	17	0.012	0.7
Brown bullhead	34	166	46.598	280.7
Channel catfish	2	2	1.539	769.5
Cisco	4	28	0.243	8.7
Common carp	6	6	33.576	5596.1
Emerald shiner	3	57	0.412	7.2
Freshwater drum	40	425	127.946	301.0
Gizzard shad	38	8,200	73.138	8.9
Johnny darter	6	8	0.007	0.9
Largemouth bass	33	314	1.774	5.6
Lepomis sp.	35	1,324	0.530	0.4
Logperch	10	45	0.098	2.2
Morone sp.	3	45	0.020	0.4
Pumpkinseed	37	1,252	39.076	31.2
Pumpkinseed x Bluegill	2	10	0.205	20.5
Rainbow smelt	5	480	3.184	6.6
Rock bass	8	13	0.073	5.6
Round goby	41	1,210	5.077	4.2
Spottail shiner	39	1,028	3.783	3.7
Trout-perch	29	229	0.443	1.9
Walleye	40	267	12.946	48.5
White bass	22	43	0.473	11.0
White perch	42	3,065	44.276	14.4
White sucker	10	29	16.058	553.7
Yellow perch	48	6,927	49.028	7.1
Unknown	3	22	0.382	17.4
Totals		33,872	497.02	

(9%) collectively made up 78% of the catch by number. Species-specific catches in the 2020 trawling program are shown in Tables 1.2.4-1.2.9.

Bay of Quinte

Conway, Hay Bay, Deseronto, Big Bay, Belleville, and Trenton (Tables 1.2.8-1.2.13)

Bottom trawls were conducted six sites in the Bay of Quinte in August 2020. Species-specific catch per trawl at each site shown in Tables 1.2.8-1.2.13. Bottom trawl results were summarized across the six Bay of Quinte sites and presented graphically to illustrate abundance trends for major species in Fig. 1.2.3. All species show significant abundance changes over the long-term.

Species Highlights

Catches of age-0 fish in 2020 for selected species and locations are shown in Table 1.2.14-1.2.18.

TABLE 1.2.8. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Conway** (24 m depth), Bay of Quinte. Catches are the mean number of fish observed at each site for the number of trawls indicated. Total catch and number of species caught are indicated.

	Year																						
	1992-2000											**2001-2010**											**2011-2020**
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	**mean**
Silver Lamprey	**0.000**	0.000	0.000	0.000	0.083	0.000	0.000	0.000	0.000	0.000	0.000	**0.008**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Alewife	**121.972**	0.000	0.000	2.250	1.917	0.417	9.667	0.083	214.622	1.583	0.333	**23.087**	375.352	0.125	14.875	97.809	11.750	85.332	4.625	4.875	0.250	1.250	**59.624**
Gizzard Shad	**0.000**	0.000	0.000	0.000	0.000	0.000	1.167	0.000	0.000	0.000	0.000	**0.117**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Chinook Salmon	**0.028**	0.000	0.000	0.000	0.000	0.167	0.083	0.000	0.000	0.000	0.000	**0.025**	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**
Brown Trout	**0.000**	0.000	0.125	0.167	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.029**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Lake Trout	**0.014**	0.000	0.250	0.000	0.417	0.000	0.000	0.000	0.000	0.000	0.000	**0.067**	0.000	0.125	0.375	0.000	0.250	0.000	0.000	1.625	1.375	0.000	**0.375**
Lake Whitefish	**13.208**	1.000	1.000	8.083	0.750	3.083	3.833	4.750	0.250	0.333	0.333	**2.342**	0.625	0.000	7.000	2.250	0.125	0.000	2.375	2.000	0.125	0.000	**1.450**
Cisco	**2.301**	0.000	0.250	3.000	0.083	7.667	4.500	2.000	0.167	0.000	6.333	**2.400**	8.250	23.500	1.625	11.750	1.750	3.375	1.250	2.750	0.000	3.500	**5.775**
Coregonus sp.	**0.000**	0.000	0.000	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.008**	0.000	0.000	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	**0.013**
Rainbow Smelt	**112.713**	0.000	39.625	10.167	3.583	6.750	0.083	25.167	1.083	0.083	0.000	**8.654**	0.625	0.500	8.750	29.875	7.000	0.500	12.000	46.750	0.500	59.981	**16.648**
White Sucker	**4.412**	134.836	28.750	6.667	7.417	4.750	3.167	11.250	0.500	0.000	0.167	**19.750**	0.500	1.375	1.375	0.000	0.875	1.250	1.250	0.000	0.750	2.000	**0.938**
Moxostoma sp.	**0.000**	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Emerald Shiner	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7.125	
Spottail Shiner	**0.000**	0.625	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.063**	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	**0.013**
American Eel	**0.056**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	**0.013**
Burbot	**0.000**	0.000	0.000	0.000	0.083	0.000	0.000	0.000	0.000	0.000	0.000	**0.008**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Threespine Stickleback	**0.019**	0.000	0.000	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.008**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Trout-perch	**132.813**	139.443	58.234	53.667	43.333	12.250	0.500	1.000	13.000	0.083	0.000	**32.151**	0.500	0.000	1.125	38.875	2.750	0.500	10.125	0.375	0.000	0.875	**5.513**
White Perch	**0.116**	0.000	0.000	0.000	0.000	0.000	3.000	0.000	0.000	0.250	0.167	**0.342**	5.500	0.250	0.375	0.000	0.000	0.125	0.125	0.000	0.125	2.125	**0.863**
White Bass	**0.000**	0.000	0.000	0.000	0.000	0.000	0.833	0.000	0.000	0.000	0.000	**0.083**	1.125	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	**0.125**
Rock Bass	**0.028**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Bluegill	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**
Yellow Perch	**12.597**	134.715	181.251	178.153	58.667	53.750	146.584	20.000	108.980	8.250	56.956	**94.731**	125.915	70.580	59.875	47.000	22.375	34.000	15.000	4.625	43.375	40.484	**46.323**
Walleye	**2.764**	1.250	0.000	0.250	1.000	0.083	0.417	0.417	0.083	0.000	0.333	**0.383**	0.375	0.000	0.000	0.125	0.125	0.375	0.250	0.625	0.000	0.125	**0.200**
Johnny Darter	**0.306**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Round Goby	**0.000**	0.000	0.500	282.241	79.167	127.225	40.833	173.211	89.723	80.768	146.979	**102.065**	261.710	203.978	103.471	81.375	175.493	247.749	149.175	176.274	223.736	106.000	**172.896**
Freshwater Drum	**0.000**	0.125	0.000	0.250	0.000	0.083	0.500	0.000	0.083	0.000	0.000	**0.104**	0.000	0.000	0.000	0.000	0.000	0.000	0.375	0.000	0.250	0.125	**0.075**
Sculpin sp.	**0.009**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Mottled Sculpin	**0.009**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Slimy Sculpin	**0.079**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Total catch	**403**	412	310	545	197	216	215	238	428	91	212	**286**	780	301	199	309	223	373	197	240	270	224	**311**
Number of species	**9**	8	9	13	12	11	14	9	10	7	8	**10**	11	9	10	9	11	10	13	9	9	11	**10**
Number of trawls		8	8	12	12	12	12	12	12	12	12		8	8	8	8	8	8	8	8	8	8	

TABLE 1.2.9. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Hay Bay** (7 m depth), Bay of Quinte. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated.

	Year																						
Species	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2001-2010 mean	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2011-2020 mean
Alewife	**204.149**	566.143	21.125	1.750	67.067	72.097	394.507	695.331	631.710	713.136	967.999	**413.086**	561.676	530.946	360.990	498.796	411.086	1364.539	321.008	1325.918	17.500	238.823	**563.128**
Gizzard Shad	**10.153**	2.625	0.125	0.000	0.125	0.000	0.375	0.125	7.000	0.750	4.000	**1.513**	1.375	100.159	3.250	0.000	24.875	117.900	3.125	5.000	0.375	9.375	**26.543**
Lake Whitefish	**0.019**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Cisco	**0.056**	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.100**	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**
Rainbow Smelt	**3.958**	0.000	0.000	0.000	0.000	0.000	0.125	0.000	0.375	0.000	0.000	**0.050**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Northern Pike	**0.069**	0.000	0.000	0.125	0.000	0.000	0.000	0.125	0.000	0.125	0.000	**0.038**	0.000	0.000	0.000	0.250	0.000	0.000	0.000	0.000	0.000	0.000	**0.025**
White Sucker	**3.579**	3.500	0.125	5.875	8.250	0.000	0.625	4.875	3.000	0.000	3.625	**2.988**	4.375	2.125	3.625	3.250	2.125	0.000	1.875	0.625	0.750	0.250	**1.900**
Common Carp	**0.343**	0.250	0.000	0.000	0.000	0.875	0.000	0.000	0.750	0.125	0.000	**0.200**	0.000	0.125	0.000	0.000	0.000	0.000	0.125	0.000	0.250	0.000	**0.050**
Golden Shiner	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.125	0.000	**0.013**	0.000	0.375	0.125	0.000	0.125	6.000	0.000	0.000	0.000	0.000	**0.663**
Common Shiner	**0.000**	0.000	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Spottail Shiner	**32.120**	63.513	54.000	53.250	64.375	79.119	133.960	188.595	47.750	46.500	53.375	**78.444**										70.337	
Fathead Minnow	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**
Brown Bullhead	**15.046**	32.750	15.750	8.000	10.375	10.500	15.000	8.875	0.750	3.500	2.500	**10.800**	0.250	1.750	5.375	2.125	1.500	0.750	2.625	0.125	0.375	1.250	**1.613**
Channel Catfish	**0.028**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.125	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.025**
American Eel	**1.579**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Burbot	**0.023**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Trout-perch	**65.125**	5.750	2.750	3.750	77.500	1.750	3.000	59.500	6.625	3.750	4.375	**16.875**	22.875	1.125	6.250	4.625	25.375	0.250	1.250	3.375	23.625	0.875	**8.963**
White Perch	**94.666**	9.250	132.573	14.750	495.340	24.625	504.187	27.500	163.757	167.704	54.875	**159.456**	73.281	57.750	271.752	0.875	7.250	27.500	215.836	117.847	47.750	60.750	**88.059**
White Bass	**0.185**	0.000	0.000	1.750	0.125	0.125	1.375	1.375	0.875	0.500	2.000	**0.813**	9.500	0.250	0.000	0.125	1.625	9.750	0.125	2.750	2.000	2.250	**2.838**
Sunfish	**0.056**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Rock Bass	**0.028**	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.125	**0.025**	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.750	**0.088**
Pumpkinseed	**10.231**	19.625	11.875	0.750	4.625	1.125	44.500	11.375	8.625	0.250	13.250	**11.600**	0.875	2.500	4.000	2.750	0.875	4.625	10.500	0.250	29.750	3.625	**5.975**
Bluegill	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.125	3.625	0.125	0.250	**0.413**	0.125	0.375	0.125	0.000	0.000	0.000	0.375	0.125	0.500	0.500	**0.213**
Smallmouth Bass	**0.000**	0.000	1.250	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.125**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Largemouth Bass	**0.000**	0.250	1.750	0.000	0.000	0.000	0.000	0.000	0.375	1.375	2.125	**0.588**	1.000	1.250	0.125	0.000	0.000	0.000	0.000	0.375	0.000	2.750	**0.550**
Black Crappie	**0.000**	0.000	0.000	0.000	0.000	1.375	0.875	0.000	0.000	0.000	0.000	**0.225**	0.500	0.000	0.125	0.000	12.625	2.000	0.125	0.000	0.000	0.750	**1.613**
Lepomis sp.	**0.000**	0.000	0.000	0.000	0.000	13.375	0.000	0.000	0.000	0.000	0.000	**1.338**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.500	0.000	2.250	**0.275**
Yellow Perch	**372.617**	726.620	856.879	119.203	551.884	278.670	580.861	906.704	138.067	146.065	206.695	**451.165**	14.125	61.500	96.130	274.987	212.839	117.355	63.244	71.625	146.819	97.901	**115.653**
Walleye	**7.333**	7.125	3.250	1.750	3.125	4.125	7.125	8.500	13.375	5.000	8.500	**6.188**	7.750	3.375	3.250	7.000	10.500	2.500	8.625	3.125	2.125	3.500	**5.175**
Johnny Darter	**0.079**	0.000	1.750	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	**0.188**	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.125	**0.025**
Logperch	**0.046**	0.250	0.000	0.000	0.125	0.375	0.250	1.250	0.250	0.250	0.125	**0.288**	0.000	0.000	0.000	0.000	0.250	0.000	0.000	0.250	0.000	0.000	**0.050**
Brook Silverside	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.875	**0.088**	0.000	0.375	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.050**
Round Goby	**0.000**	0.125	1.250	14.250	3.500	40.125	6.000	17.125	11.375	1.625	2.375	**9.775**	0.125	3.500	0.875	2.125	7.375	0.000	0.250	0.250	0.125	1.500	**1.613**
Freshwater Drum	**2.773**	4.375	4.875	6.875	10.500	16.375	39.125	6.000	5.000	5.125	11.125	**10.938**	8.250	6.250	11.875	2.375	3.250	5.375	30.125	5.125	12.250	11.000	**9.588**
Slimy Sculpin	**0.009**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Total catch	**824**	1443	1109	232	1297	545	1732	1938	1043	1096	1338	**1177**	706	774	768	800	722	1659	659	1537	284	509	**835**
Number of species	**15**	16	15	13	15	15	17	17	18	18	18	**16**	17	19	19	15	16	13	16	17	15	19	**17**
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	8	8	8	8	8	

TABLE 1.2.10. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Deseronto** (5 m depth), Bay of Quinte. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated.

	Year																						
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	**2011-2020 mean**
Longnose Gar	**0.014**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Alewife	**120.590**	180.074	47.625	277.403	55.380	54.219	106.270	1037.631	217.123	16.250	447.062	**243.903**	1017.115	332.364	1099.888	511.081	141.988	701.081	805.217	149.680	43.750	499.170	**530.133**
Gizzard Shad	**54.324**	32.000	20.875	11.875	1.375	22.000	62.100	29.250	109.387	47.539	20.500	**35.690**	53.000	453.242	67.765	0.125	73.125	304.873	6.000	29.375	0.250	110.142	**109.790**
Rainbow Smelt	**0.028**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Northern Pike	**0.028**	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	**0.013**
White Sucker	**1.028**	0.625	0.375	1.250	1.250	0.125	0.375	0.375	0.625	2.625	0.125	**0.775**	1.375	0.375	4.875	4.000	1.750	0.375	4.375	0.500	2.875	0.875	**2.138**
Lake Chub	**0.000**	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Common Carp	**0.278**	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.125	**0.025**	0.375	0.000	0.000	0.000	0.000	0.000	0.000	0.250	0.250	0.125	**0.100**
Emerald Shiner	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	1.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.113**
Spottail Shiner	**29.194**	25.250	25.000	35.625	1.500	18.875	54.750	28.750	104.125	38.625	18.000	**35.050**	40.250	25.625	29.250	126.375	69.500	124.064	47.750	21.125	22.625	35.625	**54.219**
Brown Bullhead	**24.250**	69.250	10.625	21.500	37.000	12.500	11.625	18.125	2.500	4.000	1.000	**18.813**	1.250	5.625	27.580	13.250	2.875	4.625	12.000	4.625	18.500	4.875	**9.521**
Channel Catfish	**0.083**	0.000	0.000	0.000	0.125	0.250	0.125	0.000	0.000	0.000	0.000	**0.050**	0.000	0.000	0.125	0.125	0.000	0.000	0.125	0.125	0.000	0.000	**0.050**
Ictalurus sp.	**0.000**	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
American Eel	**0.861**	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.250	0.125	0.000	0.000	0.000	0.250	1.000	0.625	0.000	**0.225**
Trout-perch	**35.125**	4.750	7.500	0.125	4.500	6.000	12.375	18.375	550.279	226.843	1.750	**83.250**	58.875	4.250	122.986	6.000	165.895	16.000	73.875	18.375	92.751	2.625	**56.163**
White Perch	**273.179**	10.250	194.882	306.265	3076.179	237.616	794.071	226.216	298.129	811.713	25.250	**598.057**	658.175	276.439	341.366	27.250	24.625	204.583	1118.446	319.683	106.280	168.312	**324.516**
White Bass	**0.403**	0.000	0.000	0.500	1.625	1.250	4.250	0.375	0.000	1.250	0.250	**0.950**	4.500	0.750	0.000	0.125	4.000	16.500	2.625	0.500	6.125	0.375	**3.550**
Sunfish	**0.125**	0.375	0.000	0.000	0.000	0.000	1.375	0.000	0.125	0.000	0.000	**0.188**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Rock Bass	**0.014**	0.125	1.750	0.250	0.000	0.000	0.000	0.000	0.000	0.500	0.250	**0.288**	0.000	0.125	0.250	0.000	0.125	0.000	0.250	0.000	0.375	0.375	**0.150**
Pumpkinseed	**15.042**	118.095	17.500	67.500	19.500	14.750	15.500	19.125	11.500	30.500	11.000	**32.497**	26.000	3.750	9.375	36.500	28.000	63.250	39.375	3.000	93.625	105.676	**40.855**
Bluegill	**0.014**	0.500	0.125	4.500	0.000	0.125	0.875	0.375	0.000	0.250	1.250	**0.800**	2.750	3.875	1.750	0.125	0.250	0.375	0.625	0.000	9.625	0.375	**1.975**
Smallmouth Bass	**0.500**	0.500	0.125	1.000	1.250	0.625	0.250	0.000	0.000	0.250	0.000	**0.400**	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**
Largemouth Bass	**0.083**	0.000	1.125	0.000	0.250	1.125	2.125	0.000	0.125	0.375	2.750	**0.788**	2.375	1.750	5.500	0.000	0.125	7.000	0.375	0.625	0.375	8.125	**2.625**
Black Crappie	**0.028**	0.125	0.625	0.125	0.000	1.750	1.375	4.875	0.000	3.375	0.125	**1.238**	0.125	0.625	2.875	0.250	6.250	0.125	0.250	0.000	0.375	1.125	**1.200**
Lepomis sp.	**0.000**	0.000	0.000	0.000	0.000	483.734	0.000	1.000	0.250	0.000	1.875	**48.686**	0.000	0.000	3.250	0.250	0.250	8.000	0.000	0.125	0.875	2.375	**1.513**
Yellow Perch	**320.934**	412.720	555.437	683.480	152.149	1031.209	638.509	1087.358	531.795	219.331	66.231	**537.822**	1466.894	126.916	247.843	425.715	967.424	656.154	332.890	421.890	351.550	334.042	**533.132**
Walleye	**17.486**	12.500	2.875	7.500	15.125	5.000	5.250	9.875	19.875	15.875	1.875	**9.575**	11.875	4.875	3.500	22.375	18.875	14.750	10.375	14.750	4.500	5.750	**11.163**
Johnny Darter	**0.403**	0.625	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.063**	0.000	0.000	0.000	0.250	0.625	0.000	0.125	0.125	0.875	0.125	**0.213**
Logperch	**0.278**	1.000	0.125	0.375	0.000	3.625	0.125	0.750	2.875	23.625	0.250	**3.275**	2.875	0.000	0.125	1.500	2.000	0.125	0.375	0.125	2.125	0.375	**0.963**
Brook Silverside	**0.306**	0.000	0.000	0.000	0.000	0.750	0.000	0.000	0.000	0.000	3.000	**0.375**	0.125	2.750	0.125	0.000	0.000	0.625	0.000	0.000	0.000	1.000	**0.463**
Round Goby	**0.000**	1.250	11.500	16.125	20.625	117.305	4.625	4.250	4.500	2.750	1.625	**18.456**	1.625	13.875	2.000	0.375	10.750	6.875	1.125	4.375	0.500	8.000	**4.950**
Freshwater Drum	**9.111**	16.500	1.875	15.375	15.625	8.250	22.000	24.000	10.125	11.500	0.875	**12.613**	7.375	7.125	10.375	2.625	2.250	10.250	16.625	46.750	13.875	11.375	**12.863**
Total catch	**904**	887	900	1451	3403	2021	1738	2511	1863	1457	605	**1684**	3357	1266	1981	1178	1521	2140	2473	1037	773	1301	**1703**
Number of species	**16**	21	19	19	16	22	20	17	16	19	21	**19**	20	20	21	19	21	19	22	20	22	22	**21**
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	8	8	8	8	8	

TABLE 1.2.11. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Big Bay** (5 m depth), Bay of Quinte. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated.

	Year																						
	1992-2000											**2001-2010**											**2011-2020**
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	**mean**
Longnose Gar	**0.111**	0.000	0.000	0.000	0.000	0.000	0.000	0.250	0.000	0.000	0.000	**0.025**	0.000	0.000	0.000	0.000	0.000	0.250	0.000	0.000	0.000	0.000	**0.025**
Alewife	**33.495**	0.000	224.952	0.000	407.516	35.750	13.000	0.375	190.282	37.875	332.829	**124.258**	52.055	122.472	313.093	100.931	36.500	120.414	0.500	60.343	52.000	46.108	**90.442**
Gizzard Shad	**228.179**	0.000	52.250	23.250	58.375	25.875	2.250	2.250	68.745	0.000	66.222	**29.922**	52.250	82.732	3.375	0.125	99.696	1112.491	3.375	1.875	2.375	33.342	**139.164**
Rainbow Smelt	**0.039**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.125	0.125	0.000	0.000	**0.025**
Northern Pike	**0.056**	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
White Sucker	**4.031**	0.750	2.875	1.125	1.375	0.875	0.125	0.375	0.375	0.625	3.750	**1.225**	2.500	2.000	1.250	2.875	0.500	1.625	1.125	0.875	0.250	0.125	**1.313**
Moxostoma sp.	**0.007**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Common Carp	**0.545**	0.250	0.000	0.500	0.375	0.250	0.875	0.125	0.375	0.000	1.000	**0.375**	1.375	0.375	0.125	0.000	0.000	0.500	0.375	0.125	0.000	0.375	**0.325**
Emerald Shiner	**0.042**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Spottail Shiner	**16.069**	12.125	63.625	8.875	20.250	56.250	18.625	15.375	10.625	19.500	37.625	**26.288**	53.750	92.750	11.000	82.728	43.750	52.625	26.250	11.375	9.250	7.000	**39.048**
Brown Bullhead	**29.570**	16.375	32.625	38.000	23.750	12.125	54.625	9.750	8.750	3.000	4.750	**20.375**	4.250	1.875	6.375	7.875	1.375	2.625	4.375	3.000	1.375	1.875	**3.500**
Channel Catfish	**0.151**	0.000	0.125	0.000	0.000	0.125	0.375	0.000	0.000	0.000	0.000	**0.063**	0.000	0.000	0.125	0.500	0.125	0.250	0.125	0.125	0.125	0.250	**0.163**
Ictalurus sp.	**0.000**	0.375	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.038**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
American Eel	**0.337**	0.125	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.025**	0.000	0.000	0.000	0.000	0.000	0.375	0.000	0.000	0.125	0.000	**0.050**
Trout-perch	**23.320**	1.375	9.125	5.000	3.125	21.625	21.000	14.000	65.875	67.750	45.625	**25.450**	86.750	40.875	64.250	643.990	71.875	46.000	48.000	50.750	60.024	6.250	**111.876**
White Perch	**446.656**	18.250	793.237	145.125	1499.098	554.616	1252.318	363.567	456.729	1117.116	190.786	**639.084**	1552.354	240.164	540.939	34.250	52.250	211.330	817.221	138.319	397.124	71.375	**405.533**
White Bass	**1.221**	0.000	2.125	0.000	0.250	2.625	3.875	0.250	0.750	8.250	0.375	**1.850**	2.375	0.375	0.750	0.625	1.750	1.250	1.875	2.250	0.875	0.875	**1.300**
Morone sp.	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	17.250	0.000	0.250	**1.750**
Sunfish	**1.708**	50.000	0.000	0.000	0.000	0.000	25.250	0.000	9.750	0.000	0.000	**8.500**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Rock Bass	**0.000**	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Pumpkinseed	**18.612**	83.875	64.125	67.625	36.625	3.750	6.875	1.875	5.750	12.125	5.875	**28.850**	10.250	4.500	16.250	2.125	5.875	23.125	11.125	0.250	6.500	12.000	**9.200**
Bluegill	**1.930**	124.875	13.625	14.625	0.750	9.625	6.750	16.000	3.875	10.375	4.250	**20.475**	13.000	3.250	2.125	2.250	13.625	10.375	12.875	1.375	8.250	48.625	**11.575**
Smallmouth Bass	**0.032**	0.125	0.250	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.038**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Largemouth Bass	**0.000**	0.000	0.250	0.000	0.250	0.000	0.000	0.000	0.125	1.500	1.625	**0.375**	0.125	9.500	1.000	0.000	0.000	0.000	0.000	0.000	0.000	3.875	**1.450**
Black Crappie	**0.356**	0.625	0.500	0.375	0.375	1.000	2.625	0.250	0.125	0.250	0.000	**0.613**	0.000	0.000	0.000	0.000	0.625	0.125	0.000	0.000	0.000	0.000	**0.075**
Lepomis sp.	**0.000**	0.000	66.625	0.000	0.000	1060.443	0.000	4.125	56.481	41.500	170.465	**139.964**	0.500	59.625	5.250	10.750	49.250	18.250	1.000	70.625	18.250	92.679	**32.618**
Yellow Perch	**62.998**	381.125	153.463	107.650	200.266	90.623	99.395	33.750	660.643	197.790	184.258	**210.896**	435.501	121.071	82.625	577.728	164.461	321.134	26.000	50.375	13.375	57.875	**185.015**
Walleye	**10.485**	7.500	6.125	19.250	16.875	6.500	8.125	8.750	28.125	10.750	7.250	**11.925**	26.750	11.000	4.125	23.375	18.250	10.000	2.875	6.875	3.875	6.750	**11.388**
Johnny Darter	**0.037**	1.250	0.250	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.150**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Logperch	**0.053**	0.125	0.000	0.250	0.000	0.000	0.125	0.250	3.250	2.250	0.000	**0.625**	0.125	0.000	0.125	3.125	0.000	0.000	0.000	0.125	0.000	0.000	**0.350**
Brook Silverside	**0.069**	0.000	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.375	**0.050**	0.000	1.125	0.625	0.000	0.250	1.500	0.125	0.000	0.000	0.000	**0.363**
Round Goby	**0.000**	0.000	0.125	1.375	15.750	9.500	4.750	50.423	1.125	0.625	0.375	**8.405**	0.750	1.625	0.625	0.375	1.250	0.000	0.625	1.125	0.250	1.000	**0.763**
Freshwater Drum	**10.894**	21.750	24.375	9.000	15.625	125.520	178.465	139.361	14.625	11.625	51.500	**59.185**	15.750	31.500	22.750	4.125	6.375	90.201	20.250	42.000	34.750	9.875	**27.758**
Total catch	**891**	721	1511	442	2301	2017	1700	661	1586	1543	1109	**1359**	2310	827	1077	1498	568	2024	978	459	609	401	**1075**
Number of species	**18**	18	23	15	17	18	20	19	20	17	18	**19**	18	18	20	17	18	20	19	21	17	20	**19**
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	8	8	8	8	8	

TABLE 1.2.12. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Belleville** (5 m depth), Bay of Quinte. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated.

Species	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2001-2010 mean	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2011-2020 mean
Sea Lamprey	**0.014**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Longnose Gar	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.000	**0.600**	0.000	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	**0.013**
Alewife	**92.034**	0.250	82.375	0.125	11.500	13.875	9.750	0.125	34.875	78.782	59.821	**29.148**	128.250	24.750	272.438	0.000	65.026	27.000	0.375	33.625	89.753	14.750	**65.597**
Gizzard Shad	**266.440**	99.204	234.375	46.029	581.893	50.571	88.327	73.318	326.992	321.441	500.849	**232.300**	920.843	708.151	1011.184	0.000	204.767	72.884	9.000	910.080	49.779	476.011	**436.270**
Rainbow Smelt	**0.111**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.125	0.000	**0.013**
Northern Pike	**0.111**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Mooneye	**0.014**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
White Sucker	**2.648**	0.375	0.375	0.500	0.125	0.000	0.750	0.250	0.250	0.125	0.625	**0.338**	0.125	0.000	0.375	0.250	0.000	0.250	0.125	0.125	0.250	0.250	**0.175**
Common Carp	**0.319**	0.125	0.125	0.625	0.000	0.500	0.625	0.250	0.125	1.000	1.500	**0.488**	0.000	0.375	0.125	0.125	0.000	0.875	0.500	0.250	0.000	0.250	**0.250**
Spottail Shiner	**71.584**	10.625	21.500	4.750	3.875	13.250	23.875	3.750	17.375	33.375	8.125	**14.050**	26.750	2.750	13.500	9.250	6.125	76.557	11.625	29.875	6.750	11.375	**19.456**
Brown Bullhead	**17.824**	32.000	10.875	5.375	17.875	15.000	14.875	9.375	6.000	2.750	6.250	**12.038**	1.250	1.125	1.250	2.375	4.000	3.125	3.625	0.625	7.750	7.875	**3.300**
Channel Catfish	**0.069**	0.000	0.125	0.125	0.000	0.375	0.000	0.000	0.000	0.000	0.000	**0.063**	0.000	0.250	0.000	0.000	0.000	0.000	0.000	0.375	0.250	0.000	**0.088**
American Eel	**0.194**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	**0.013**
Burbot	**0.014**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Trout-perch	**78.532**	13.000	5.500	12.750	14.375	9.750	4.000	14.250	19.000	32.125	18.625	**14.338**	32.000	22.250	39.125	38.875	21.625	18.000	75.375	46.250	159.685	16.375	**46.956**
White Perch	**306.900**	6.625	154.625	165.015	1930.129	476.087	880.660	338.969	845.077	1601.655	104.285	**650.313**	394.588	50.125	2494.625	24.375	45.250	175.135	363.391	129.725	421.900	57.500	**415.661**
White Bass	**1.509**	0.125	3.000	1.625	3.625	2.000	6.000	0.250	1.000	13.375	3.875	**3.488**	13.750	0.750	2.000	1.875	29.750	9.125	0.500	2.375	2.250	1.000	**6.338**
Morone sp.	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.625	0.000	43.750	5.250	**4.963**
Sunfish	**4.472**	48.125	0.000	14.625	0.000	0.000	14.500	0.000	42.125	0.000	0.000	**11.938**	0.000	0.000	0.000	0.000	0.000	0.000	1.125	0.000	0.000	0.000	**0.113**
Rock Bass	**0.236**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.125	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	**0.025**
Pumpkinseed	**26.422**	21.750	5.125	1.875	4.125	1.750	1.125	0.875	0.500	0.250	0.375	**3.775**	0.500	0.125	0.375	0.125	0.500	0.500	30.250	2.000	26.750	18.125	**7.925**
Bluegill	**13.431**	0.250	0.500	0.125	0.000	0.375	1.250	1.875	0.000	0.000	0.625	**0.500**	0.375	0.000	0.125	3.625	0.000	0.375	16.500	0.875	49.375	1.875	**7.313**
Smallmouth Bass	**0.296**	0.125	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.025**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Largemouth Bass	**0.157**	0.125	0.375	0.250	0.625	0.375	0.000	0.125	0.625	0.000	1.500	**0.400**	0.375	0.375	3.875	0.000	0.000	0.875	0.250	0.375	0.000	8.125	**1.425**
Black Crappie	**3.389**	0.375	0.000	0.000	0.250	0.125	2.000	0.375	0.250	0.125	0.000	**0.350**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Lepomis sp.	**0.014**	0.000	88.375	0.000	2.375	409.720	0.250	5.125	9.000	17.875	293.990	**82.671**	13.375	30.625	5.625	31.250	20.500	28.625	1.375	18.500	30.125	32.125	**21.213**
Yellow Perch	**116.494**	37.875	53.250	14.250	66.250	47.375	14.625	78.750	214.729	44.375	300.513	**87.199**	637.039	21.750	40.750	681.156	168.711	95.847	51.000	193.821	36.625	47.750	**197.445**
Walleye	**13.352**	5.375	0.750	8.500	2.625	2.000	2.750	8.625	18.125	3.500	10.375	**6.263**	8.750	3.500	0.750	18.625	6.375	7.875	2.000	7.875	3.375	8.625	**6.775**
Johnny Darter	**1.481**	12.500	2.125	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**1.475**	0.000	0.000	0.000	0.125	0.250	0.000	0.000	0.000	0.000	0.375	**0.075**
Logperch	**0.347**	0.250	0.500	0.125	0.125	0.125	0.000	0.750	1.000	1.000	0.250	**0.413**	0.125	0.000	0.000	1.500	0.625	0.250	0.500	0.000	0.125	0.000	**0.313**
Brook Silverside	**0.139**	0.000	0.500	0.000	0.000	0.000	1.250	0.000	0.000	0.000	8.500	**1.025**	0.125	2.000	0.000	0.000	0.000	4.125	0.000	0.000	0.000	1.125	**0.738**
Round Goby	**0.000**	0.000	1.625	67.000	47.250	60.250	7.125	53.875	8.625	30.500	5.875	**28.213**	1.250	6.500	1.250	7.000	39.375	7.000	1.500	2.125	3.750	21.875	**9.163**
Freshwater Drum	**23.412**	163.750	58.250	20.875	4.375	214.777	87.000	830.175	25.000	31.000	53.375	**148.858**	13.875	17.625	9.250	11.250	27.750	151.597	19.250	30.250	32.250	16.250	**32.935**
Sculpin sp.	**0.019**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Total catch	**1042**	453	724	365	2691	1318	1161	1421	1571	2213	1385	**1330**	2193	893	3897	832	641	680	589	1409	965	747	**1285**
Number of species	**19**	20	22	20	17	19	19	19	19	17	20	**19**	19	17	17	16	17	20	20	18	19	20	**18**
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	8	8	8	8	8	

TABLE 1.2.13. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Trenton** (4 m depth), Bay of Quinte. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated.

	Year																						
	1992-2000											**2001-2010**											**2011-2020**
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	**mean**
Alewife	**66.911**	149.297	98.611	174.137	8.625	508.870	126.639	24.500	8.750	112.375	26.875	**123.868**	49.500	86.639	354.152	56.754	44.250	96.852	36.000	197.128	86.677	222.519	**123.047**
Gizzard Shad	**165.299**	4.125	6.375	22.250	0.000	30.375	23.375	1.375	38.500	5.750	84.234	**21.636**	25.625	70.000	4.125	0.000	55.366	8.625	0.125	192.386	15.250	396.185	**76.769**
Rainbow Smelt	**0.056**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Northern Pike	**0.069**	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Mooneye	**0.056**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
White Sucker	**3.000**	0.500	1.625	0.625	1.125	1.875	2.125	2.125	0.375	0.500	0.750	**1.163**	0.625	1.625	0.000	0.125	8.875	0.250	0.250	0.375	0.125	0.125	**1.238**
Silver Redhorse	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	**0.013**
Shorthead Redhorse	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	**0.013**
Minnow	**0.014**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Common Carp	**0.278**	0.000	0.250	0.000	0.000	0.000	0.250	0.000	0.000	0.000	0.125	**0.063**	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**
Spottail Shiner	**88.467**	217.425	60.875	60.875	1.250	24.500	41.750	0.000	76.000	148.410	120.061	**75.115**	158.481	189.616	5.875	1.000	86.873	3.625	23.500	97.125	2.250	4.125	**57.247**
Brown Bullhead	**26.431**	10.625	3.500	4.250	1.125	8.750	3.750	4.500	1.375	0.875	1.500	**4.025**	2.375	3.875	0.125	1.125	3.500	1.375	0.250	6.500	1.250	4.875	**2.525**
Channel Catfish	**0.236**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.125	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	**0.025**
American Eel	**0.250**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Banded Killifish	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.125	**0.013**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Burbot	**0.000**	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Trout-perch	**27.139**	0.500	0.500	0.000	0.000	0.125	0.125	0.000	0.250	1.625	1.500	**0.463**	3.250	1.750	0.000	2.750	1.250	0.500	1.875	20.375	12.000	1.625	**4.538**
White Perch	**321.116**	54.250	19.875	240.032	80.777	279.018	388.312	29.875	33.750	669.313	16.250	**181.145**	261.900	361.891	27.125	0.250	11.125	72.244	62.875	385.768	144.820	23.125	**135.112**
White Bass	**0.403**	0.000	0.125	0.000	0.000	0.000	1.250	0.125	0.000	0.875	0.125	**0.250**	1.625	0.250	0.000	0.000	5.125	0.375	0.000	1.625	1.750	0.875	**1.163**
Sunfish	**13.764**	33.250	0.000	22.375	0.000	0.000	11.500	0.000	0.875	0.000	0.000	**6.800**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.125	**0.013**
Rock Bass	**0.889**	0.625	0.625	0.125	0.000	0.500	2.250	0.000	1.250	2.875	2.250	**1.050**	4.000	0.375	0.500	1.750	1.875	0.000	0.875	3.500	1.375	0.500	**1.475**
Pumpkinseed	**86.353**	84.750	32.250	88.887	56.794	46.750	20.000	77.522	143.790	66.250	62.250	**67.924**	67.062	40.125	118.617	20.000	63.875	2.625	91.750	22.375	19.500	17.125	**46.305**
Bluegill	**0.750**	1.125	0.500	1.500	0.875	0.375	3.875	5.250	2.625	0.625	5.125	**2.188**	11.875	1.000	3.875	2.500	1.625	0.000	29.625	21.125	22.500	6.375	**10.050**
Smallmouth Bass	**0.556**	0.375	0.250	0.500	0.500	0.125	0.000	0.000	0.125	0.250	0.000	**0.213**	0.125	0.000	0.250	0.000	0.000	0.000	0.125	0.000	0.250	0.000	**0.075**
Largemouth Bass	**2.236**	2.375	2.875	4.625	0.125	6.625	4.250	0.125	6.375	2.750	6.875	**3.700**	14.125	11.250	5.500	0.125	5.500	10.750	0.250	12.250	7.000	16.375	**8.313**
Black Crappie	**1.681**	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Lepomis sp.	**0.764**	0.000	64.796	0.000	0.000	59.750	10.250	0.000	17.000	0.625	7.125	**15.955**	24.875	6.500	3.125	5.000	10.250	15.625	0.000	10.375	13.250	36.125	**12.513**
Yellow Perch	**317.772**	200.638	239.014	544.694	186.465	340.868	130.139	584.825	769.635	1095.367	335.295	**442.694**	1169.504	278.565	892.895	525.098	1009.464	140.827	194.013	653.821	185.591	287.880	**533.766**
Walleye	**9.764**	9.625	3.625	10.500	1.500	1.875	0.750	4.750	7.375	6.125	2.125	**4.825**	8.000	9.000	0.000	16.000	24.750	2.250	2.000	9.125	2.000	8.625	**8.175**
Johnny Darter	**5.458**	2.500	7.250	7.625	0.375	0.000	0.000	0.000	0.000	0.000	0.000	**1.775**	0.250	0.250	0.000	0.125	0.000	0.125	0.000	0.875	0.000	0.375	**0.200**
Logperch	**3.097**	2.000	0.000	15.250	4.250	52.750	0.625	5.625	23.375	32.375	6.875	**14.313**	24.375	4.750	2.625	48.750	12.250	1.000	0.750	15.500	3.500	5.250	**11.875**
Tessellated Darter	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.250	0.000	0.000	**0.025**
Brook Silverside	**0.000**	0.000	0.000	0.250	0.000	0.000	0.000	0.125	0.000	0.000	0.125	**0.050**	0.125	0.000	0.000	0.000	0.000	0.500	0.000	0.000	0.000	0.000	**0.063**
Round Goby	**0.000**	0.000	0.000	2.875	8.500	13.125	5.250	0.750	12.375	34.125	7.375	**8.438**	18.750	12.125	1.875	19.750	32.625	7.000	1.250	14.875	6.125	12.875	**12.725**
Freshwater Drum	**11.931**	6.750	3.625	2.000	0.375	4.125	4.875	9.500	1.500	4.875	1.375	**3.900**	2.125	1.125	0.000	1.500	3.000	1.250	8.750	7.625	6.625	4.500	**3.650**
Total catch	**1155**	781	547	1203	353	1381	781	751	1145	2186	688	**982**	1849	1081	1421	703	1382	366	454	1673	532	1050	**1051**
Number of species	**20**	20	19	19	15	19	20	15	19	19	21	**19**	22	20	14	18	19	18	18	21	19	21	**19**
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	8	8	8	8	8	

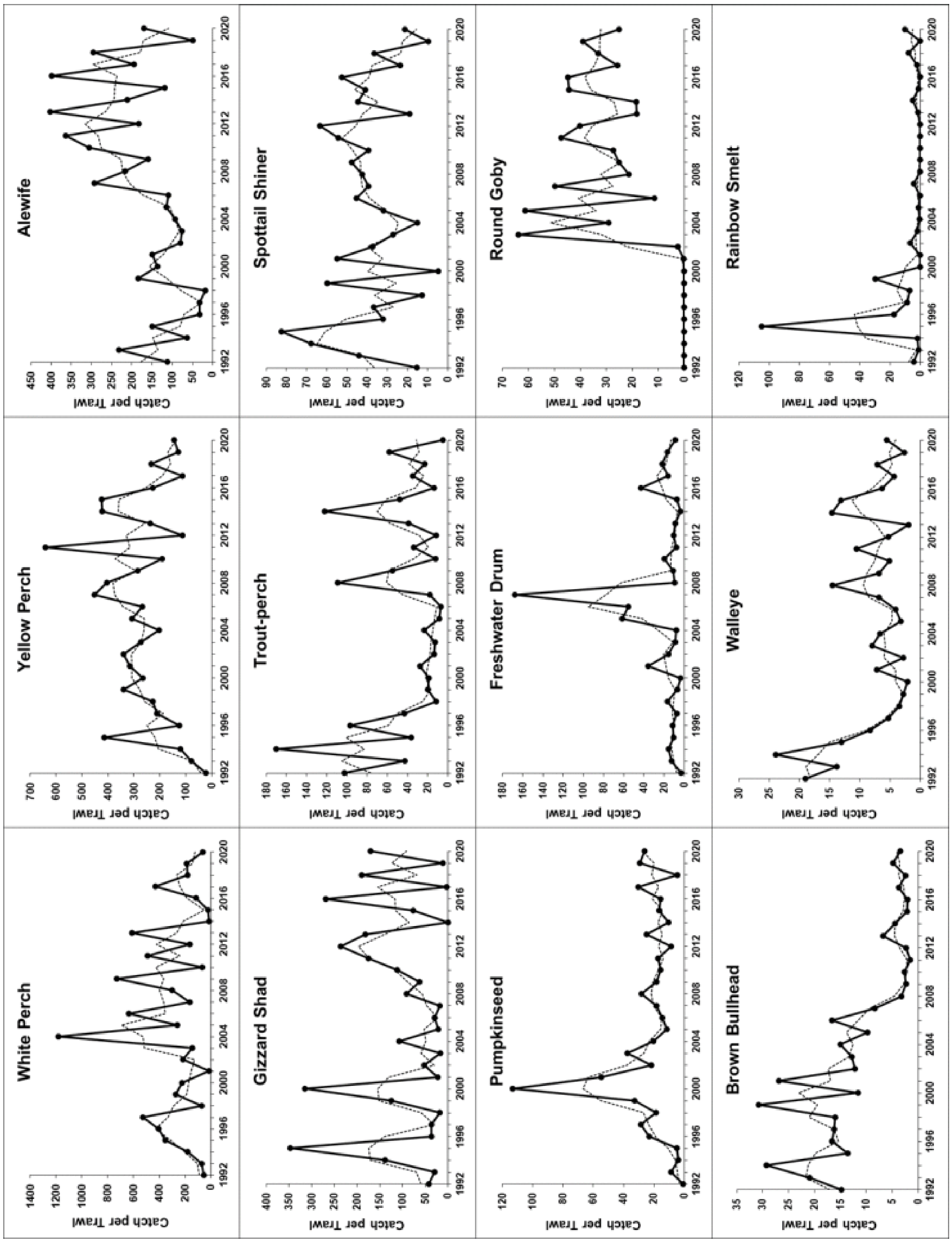

FIG. 1.2.3. Abundance trends (annual means) for the most common species caught in bottom trawls at six sites in the Bay of Quinte (Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton; see Fig. 1.2.1). Values shown here are 3-yr running averages (two years for first and last years graphed).

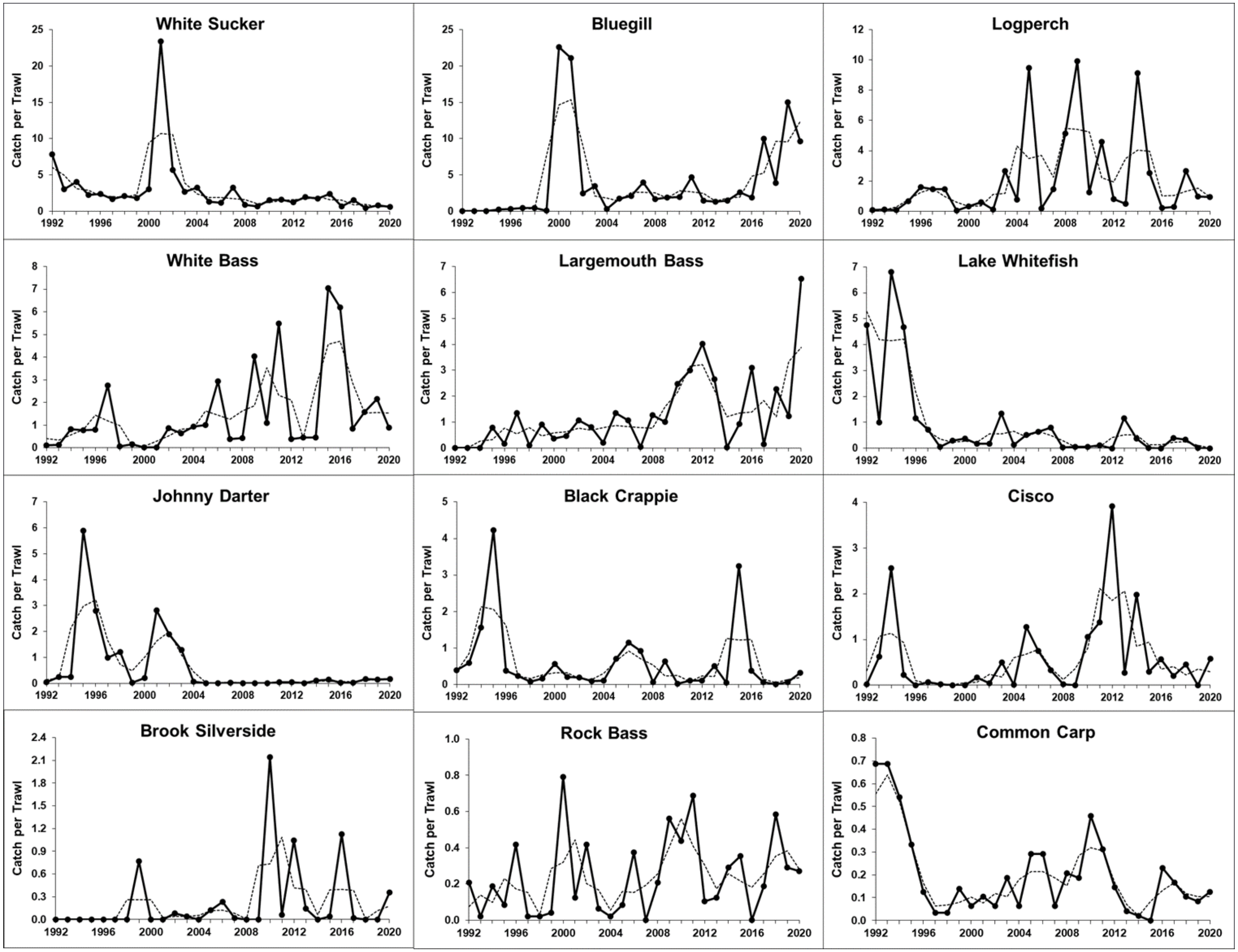

FIG. 1.2.3 (continued). Abundance trends for the most common species caught in bottom trawls at six sites in the Bay of Quinte (Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton; see Fig. 1.2.1). Values shown here are 3-yr running averages (two years for first and last years graphed).

TABLE 1.2.14. Mean catch-per-trawl of **age-0 Lake Whitefish** at two sites, Conway in the lower Bay of Quinte and EB03 near Timber Island in eastern Lake Ontario, 1992-2020. Four replicate trawls on each of two to four visits during August and early September were made at each site. Distances of each trawl drag were 1/4 mile for Conway and 1/2 mile for EB03.

Year	Conway	N	EB03	N
1992	23.4	8	0.9	12
1993	3.1	8	4.7	12
1994	40.5	8	79.7	8
1995	27.1	8	17.1	8
1996	2.6	8	0.8	8
1997	5.1	8	6.0	8
1998	0.4	8	0.0	8
1999	0.0	8	0.0	8
2000	0.4	8	0.0	8
2001	0.1	8	0.0	8
2002	0.1	8	0.0	8
2003	8.1	12	44.9	16
2004	0.0	12	2.1	12
2005	2.8	12	49.8	12
2006	2.4	12	3.6	8
2007	0.8	12	0.3	12
2008	0.1	12	0.0	8
2009	0.3	12	0.1	12
2010	0.3	12	4.7	12
2011	0.1	8	0.0	8
2012	0.0	8	0.0	8
2013	7.0	8	0.0	8
2014	2.3	8	0.0	8
2015	0.1	8	0.4	8
2016	0.0	8	0.0	6
2017	2.4	8	0.0	5
2018	1.5	8	0.0	5
2019	0.0	8	0.3	4
2020	0.0	8	-	0

TABLE 1.2.15. Mean catch-per-trawl of **age-0 Cisco** at Conway in the lower Bay of Quinte, 1992-2020. Four replicate trawls on each of two to four visits during August and early September were made at the Conway site. Distances of each trawl drag was 1/4 mile.

Year	Conway	N
1992	0.00	8
1993	1.50	8
1994	7.69	8
1995	1.25	8
1996	0.00	8
1997	0.00	8
1998	0.14	8
1999	0.00	8
2000	0.00	8
2001	0.00	8
2002	0.13	8
2003	2.83	12
2004	0.08	12
2005	7.17	12
2006	4.50	12
2007	2.00	12
2008	0.17	12
2009	0.00	12
2010	6.33	12
2011	8.25	8
2012	23.25	8
2013	1.50	8
2014	11.63	8
2015	1.75	8
2016	3.00	8
2017	1.13	8
2018	2.63	8
2019	0.00	8
2020	3.5	8

TABLE 1.2.16. Mean catch-per-trawl of **age-0 Yellow Perch** at six Bay of Quinte sites, 1992-2020. Four replicate trawls on each of two to three visits during August and early September were made at each site. Distance of each trawl drag was 1/4 mile.

	Trenton	Belleville	Big Bay	Deseronto	Hay Bay	Conway	Mean	Number of trawls
1992	3.1	1.3	0.4	0.1	0.5	0.0	0.9	48
1993	203.7	14.0	0.4	36.3	1.6	0.3	42.7	48
1994	526.6	50.6	10.3	101.5	29.3	6.9	120.8	48
1995	730.4	101.1	9.5	764.5	268.9	0.0	312.4	48
1996	2.6	2.9	4.3	2.5	8.5	0.1	3.5	48
1997	302.0	4.0	36.0	135.0	526.0	0.0	167.2	48
1998	13.1	14.0	11.5	0.1	2.9	0.0	7.0	48
1999	24.5	7.0	4.9	638.7	900.3	0.0	262.6	48
2000	0.0	5.8	5.4	0.8	6.0	0.3	3.0	48
2001	158.0	27.6	16.8	71.8	127.0	0.0	66.9	48
2002	0.0	0.3	9.2	141.8	241.1	0.0	65.4	48
2003	228.5	3.8	0.9	9.2	1.6	0.5	40.8	52
2004	0.0	0.9	4.5	8.4	18.0	0.0	5.3	52
2005	202.8	37.5	24.8	444.7	61.9	0.0	128.6	52
2006	3.8	3.5	51.7	532.8	306.0	0.2	149.7	52
2007	284.3	70.9	29.6	883.5	776.0	0.1	340.7	52
2008	123.8	153.4	114.5	263.6	12.4	0.0	111.3	52
2009	101.3	29.8	130.2	81.1	14.3	0.0	59.4	52
2010	216.8	280.3	167.0	34.6	148.8	0.0	141.2	52
2011	729.7	582.4	382.3	1216.8	4.8	1.7	486.3	53
2012	72.5	16.8	103.6	31.5	38.1	0.1	43.8	48
2013	6.1	8.6	49.5	22.8	9.7	0.0	16.1	48
2014	330.1	223.2	449.3	98.7	48.1	0.0	191.6	48
2015	171.6	83.4	124.3	670.0	224.3	0.0	212.3	48
2016	54.4	92.3	296.4	378.6	36.0	0.0	142.9	48
2017	0.1	5.4	11.3	3.9	3.0	0.0	4.0	48
2018	447.4	189.8	49.1	370.5	47.4	0.1	184.1	48
2019	37.5	10.4	3.6	37.5	4.7	0.1	15.6	48
2020	261.5	40.9	50.4	231.4	55.1	0.7	106.6	48

TABLE 1.2.17 Mean catch-per-trawl of **age-0 Walleye** at six Bay of Quinte sites, 1992-2020. Four replicate trawls on each of two to three visits during August and early September were made at each site. Distance of each trawl drag was 1/4 mile.

Year	Trenton	Belleville	Big Bay	Deseronto	Hay Bay	Conway	Mean	Number of trawls
1992	6.8	12.4	14.0	37.9	6.1	0.8	13.0	48
1993	8.8	16.0	5.0	11.3	1.1	11.9	9.0	48
1994	17.0	21.0	15.0	23.8	11.5	12.5	16.8	48
1995	14.1	8.3	2.6	8.3	5.5	0.9	6.6	48
1996	4.3	7.6	4.9	1.1	0.0	1.1	3.2	48
1997	2.8	7.6	6.1	0.3	0.1	0.0	2.8	48
1998	0.1	0.4	0.6	0.1	0.0	0.0	0.2	48
1999	1.1	0.4	0.4	1.4	9.1	0.1	2.1	48
2000	0.0	3.8	1.0	0.0	0.1	0.0	0.8	48
2001	9.5	4.5	4.8	6.8	3.3	0.1	4.8	48
2002	0.0	0.0	1.1	0.1	0.0	0.0	0.2	48
2003	10.3	8.3	16.8	1.9	0.4	0.0	6.3	52
2004	0.0	0.6	11.4	1.4	0.9	0.0	2.4	52
2005	0.8	1.4	3.8	1.8	1.1	0.0	1.5	52
2006	0.0	1.0	3.0	2.8	5.9	0.3	2.1	52
2007	4.1	6.1	5.4	5.6	5.6	0.2	4.5	52
2008	5.5	17.6	20.5	14.6	12.4	0.0	11.8	52
2009	2.5	2.3	7.6	1.0	2.9	0.0	2.7	52
2010	1.4	4.6	4.5	1.0	3.6	0.0	2.5	52
2011	6.1	8.6	24.5	8.0	4.0	0.1	8.6	52
2012	6.4	2.5	7.1	0.3	0.1	0.0	2.7	48
2013	0.0	0.0	1.0	0.3	0.6	0.0	0.3	48
2014	15.4	18.5	21.0	20.4	6.4	0.0	13.6	44
2015	21.1	5.6	16.6	13.5	7.0	0.0	10.6	48
2016	0.9	5.5	4.9	2.4	0.1	0.0	2.3	48
2017	0.0	0.0	0.3	4.1	5.4	0.0	1.6	48
2018	8.3	7.8	6.1	11.1	2.6	0.0	6.0	48
2019	0.4	1.9	3.4	0.8	0.4	0.0	1.1	48
2020	8.1	8.0	6.4	3.4	1.8	0.0	4.6	48

TABLE 1.2.18. Age distribution of **250 Walleye** sampled from summer bottom trawls, Bay of Quinte, 2020. Also shown are mean fork length and mean weight. Fish of less than 140 mm fork length were assigned an age of 0, those greater than 140 were aged using scales.

Age (years)	0	1	2	3
Year-class	2020	2019	2018	2017
Number of fish	204	27	15	4
Mean fork length (mm)	110	217	308	386
Mean weight (g)	13	105	318	501

1.3 Ganaraska River Fishway Migratory Salmon and Trout Assessment

M.J. Yuille; Assessment Biologist, Lake Ontario Management Unit

Lake Ontario is home to a multi-million-dollar recreational salmon and trout fishery and its tributaries provide spawning habitat to several migratory salmon and trout species, such as, Rainbow Trout, Brown Trout, Chinook Salmon and Coho Salmon. In the spring of 2016, the Lake Ontario Management Unit (LOMU) purchased new in-river fish counting technology to assess salmon and trout activity in the Ganaraska River fishway, Corbett Dam, Ganaraska River, Port Hope. Understanding migration timing and patterns of these species is critical to evaluate the success of restoration efforts and to determine potential overlap between species when using essential spawning and nursery areas. Monitoring and counting these fish during their spawning migration provides LOMU with an index of the species population status in Lake Ontario.

This fish counter technology (known as the Riverwatcher) automatically counts fish as they pass through the counting tunnel and records both a silhouette image and short, high resolution video for each individual fish. This section includes a summary of the Ganaraska River Riverwatcher data (available at: http://www.riverwatcherdaily.is/?I=133) as well as the Ganaraska River Chinook Salmon Spawning Index.

The Riverwatcher was installed in the Ganaraska Fishway on May 12, 2020 and continued to count fish through to November 13, 2020. In this time, 30,292 events were recorded (combined up and down events), with a total of 14,256 upstream counts through the fish counter (Figs. 1.3.1 and 1.3.2). The number of events recorded is a conservative estimate. During periods of heavy rainfall river flows increased, making the water cloudy. As the water became less clear, the light from the infrared counting sensors could not penetrate through the water, thus fish could not be counted. During these periods of high flow and turbid water, we did not have the capacity to count fish as they moved through the fishway. Additionally, there were occasions throughout the monitoring period where the volume of fish moving through the fish counter exceeded the system's ability to count them individually. Calibration of the system using manual hand counts was initiated in 2017 and is ongoing to provide estimates of fish missed during these periods of high turbidity and high fish volume.

September 26th, 2020 marked the most active day during the monitoring period on the fishway with a total of 793 salmon and trout observed migrating upstream through the Riverwatcher (Figs. 1.3.1 and 1.3.2). Throughout the monitoring period, data on Rainbow Trout, Chinook Salmon, Coho Salmon, Brown Trout and Atlantic Salmon were collected. The following paragraphs provide species specific observations.

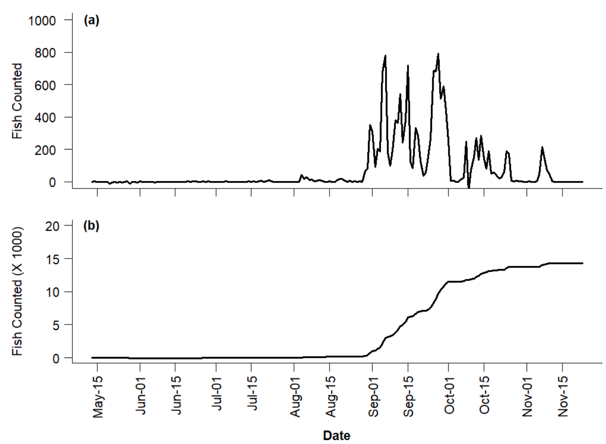

FIG. 1.3.1 (a) Daily and (b) cumulative observed fish counts at the Ganaraska River fishway at Port Hope from May 12, 2020 to November 13, 2020.

Rainbow Trout

The number of Rainbow Trout "running-up" the Ganaraska River during spring to spawn has been estimated at the fishway on Corbett Dam, Port Hope, ON since 1974. Prior to 1987, the Rainbow Trout counts at the fishway were based completely on hand lifts and visual counts. Between 1987 and 2016, fish counts were made with a Pulsar Model 550 electronic fish counter. Based on visual counts the Pulsar counter was about 85.5% efficient, and the complete size of the run was estimated accordingly. In years where

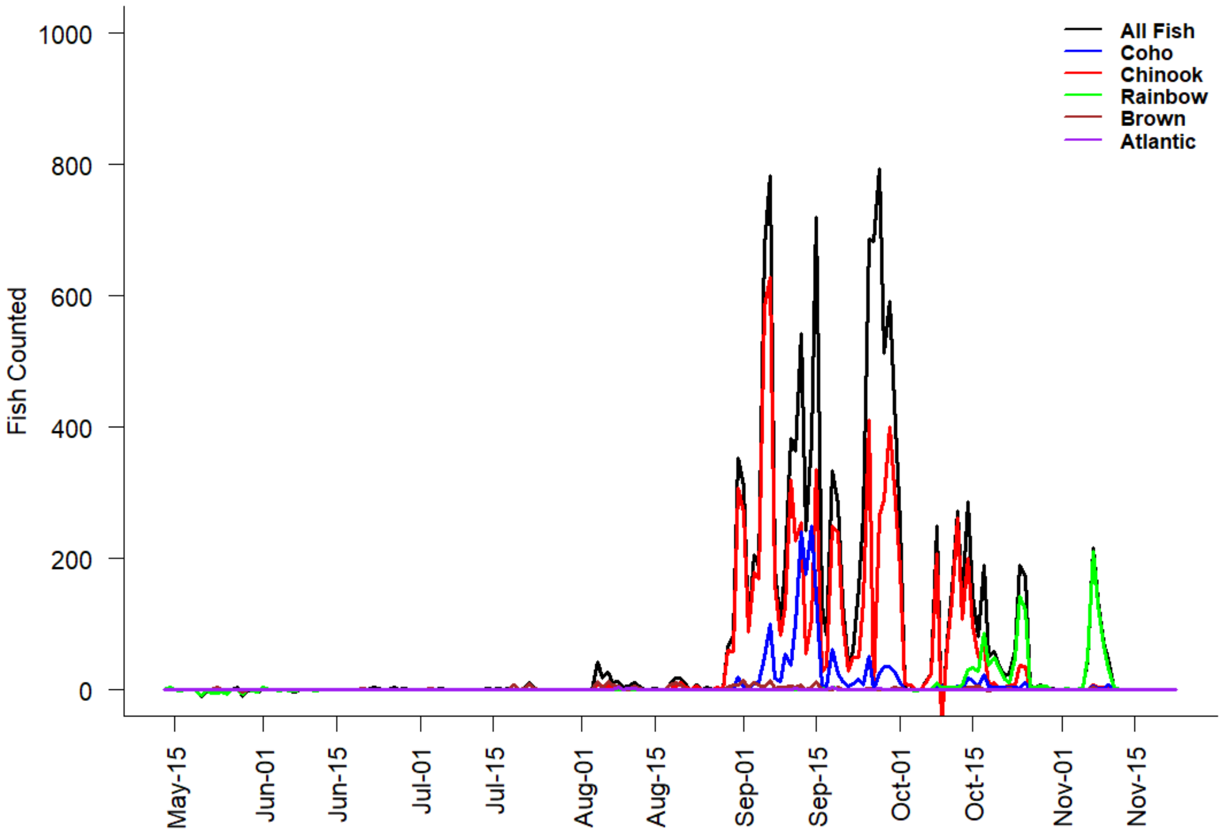

FIG. 1.3.2 Daily counts of each species of salmon and trout observed migrating through the Ganaraska River fishway at Port Hope, Ontario from May 12, 2020 to November 13, 2020.

no observations were made, the run was estimated with virtual population analysis. The counter is usually operated from mid to late March until early May. In 2018, the count of Rainbow Trout migrating upstream through the Corbett Dam was determined using the Riverwatcher fish counting system. The Riverwatcher actively counted and recorded fish from April 2nd to May 18th, 2019 when the Rainbow Trout spawning run ended.

In the spring of 2020, all field operations from the Lake Ontario Management Unit were suspended until proper health and safety guidelines mitigating COVID-19 risks were established.

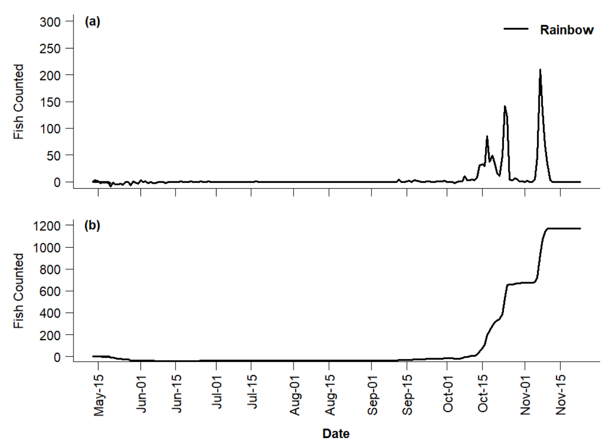

FIG 1.3.3 (a) Daily and (b) cumulative observed counts of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario from May 12 to November 13, 2020.

As a result, the 2020 spring Rainbow Trout run was not monitored. Rainbow Trout were observed utilizing the fishway after the spring monitoring period. During the 2020 monitoring period, a total of 1,172 Rainbow Trout migrated through the Ganarasksa fishway (Fig. 1.3.3).

Chinook Salmon

A total of 8,173 Chinook Salmon were identified migrating upstream through the Riverwatcher in the Ganaraska Fishway during the 2020 monitoring period (Fig. 1.3.4). The first Chinook Salmon was observed August 3, 2020; this is well ahead of the main Chinook Salmon spawning run (Fig. 1.3.4). The last Chinook Salmon migrating upstream through the fishway was observed November 9, 2020. During the monitoring period, 14 Chinook Salmon with adipose clips were observed migrating upstream through the fishway. These fish are a product of stocking efforts in the Credit River and represent mature adults that have strayed to the Ganaraska River to spawning (see Section 1.4 for more information). Detailed sampling of the Ganaraska River Chinook Salmon spawning population did not occur in 2020 as the Chinook Egg Collection program was conducted on the Credit River only (see Section 1.4).

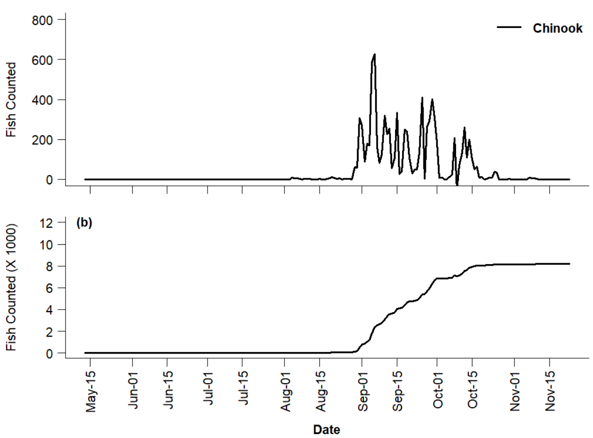

FIG 1.3.4: (a) Daily and (b) cumulative observed counts of Chinook Salmon at the Ganaraska River fishway at Port Hope, Ontario from May 12 to November 13, 2020.

Coho Salmon

The first Coho Salmon observed at the Ganaraska Fishway in 2020 was on August 30. From that time, 1,702 Coho Salmon were identified moving upstream from the Corbett Dam (Fig. 1.3.5). During the monitoring period, seven Coho Salmon with adipose clips were observed migrating upstream through the fishway and represent fish that were stocked in another location in Lake Ontario and strayed to the Ganaraska River to spawn.

Brown Trout

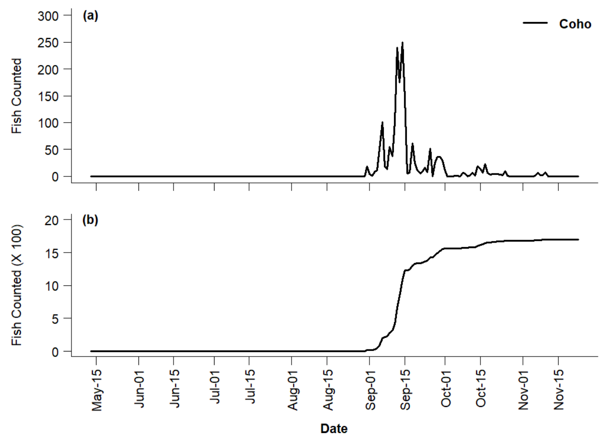

FIG 1.3.5: (a) Daily and (b) cumulative observed counts of Coho Salmon at the Ganaraska River fishway at Port Hope, Ontario from May 12 to November 13, 2020.

The first Brown Trout observed at the Ganaraska Fishway in 2020 was on May 21. From that time, 270 Brown Trout were identified moving upstream from the Corbett Dam (Fig. 1.3.6). Of the Brown Trout identified passing through the fishway, the majority were observed from mid-August to mid-September (Fig. 1.3.6).

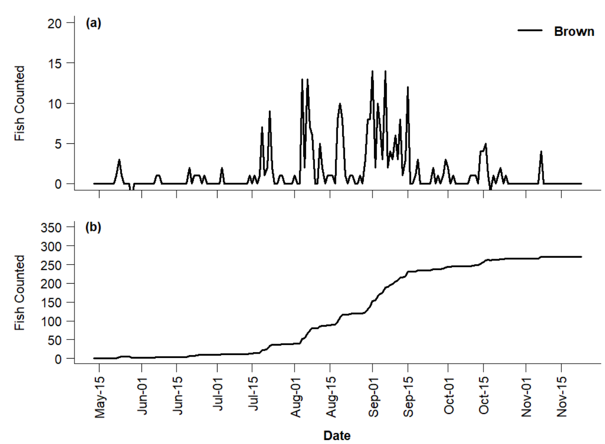

FIG 1.3.6. (a) Daily and (b) cumulative observed counts of Brown Trout at the Ganaraska River fishway at Port Hope, Ontario from May 12 to November 13, 2020.

Atlantic Salmon

The first Atlantic Salmon observed at the Ganaraska Fishway in 2020 was on August 5. A total of 29 Atlantic Salmon successfully navigated upstream from the Corbett Dam (Fig. 1.3.7). Twenty-three of these fish were observed with an adipose clip, representing fish from 2016, 2017 and 2018 stocking events.

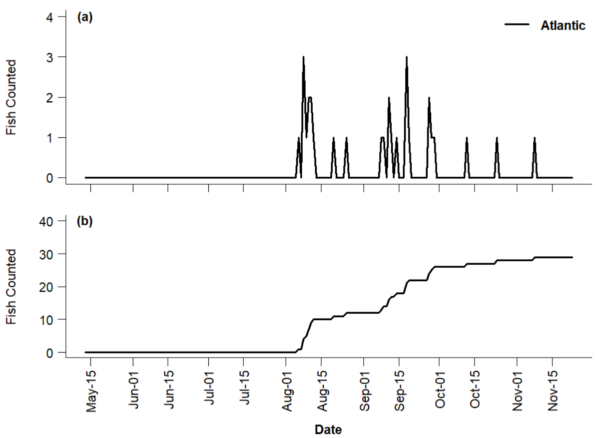

FIG 1.3.7. (a) Daily and (b) cumulative observed counts of Atlantic Salmon at the Ganaraska River fishway at Port Hope, Ontario from May 12 to November 13, 2020.

1.4 Credit River Salmon and Trout Assessment

M.J. Yuille; Assessment Biologist, Lake Ontario Management Unit

The Credit River, below the Kraft Dam in Streetsville, has been the long-term sampling site for Chinook Salmon gamete collection. The Lake Ontario Management Unit completed infrastructure upgrades and construction on the Streetsville Fishway and installed the second Riverwatcher Fish Counting System in August 2018. The Credit River Riverwatcher was operational June 16, 2020 and continued to collect data through to November 13, 2020. This section includes a summary of the Credit River Riverwatcher data (available at: www.riverwatcherdaily.is?I=143) as well as the annual Credit River Chinook Salmon Spawning Index. Traditionally, Aurora District MNRF closes the Streetsville Fishway in the fall, effectively blocking all fish passage from mid-September to the end of Chinook Salmon Egg Collection (see below). For 2018, Aurora District implemented experimental selective passage trials using fishway jump height (LOMU 2018 Annual Report), whereby the fishway was left open, however jump heights were manipulated to facilitate passage of migratory salmonids with superior jumping abilities. In 2019, selective passage using jump height was abandoned and the district did not close the fishway allowing LOMU to monitor and quantify the migratory salmon and trout spawning run for an entire ice-free season. Streetsville fishway was open for free fish passage throughout the ice-free season in 2020. These data establish a baseline for run sizes and timings that will be critical in measuring the effect of management changes to the Credit River migratory fish community.

Credit River Riverwatcher

The Credit River Riverwatcher was installed at the exit of the Streetsville Fishway June 16, 2020. This fish counter technology (known as the Riverwatcher) automatically counts fish as they pass through the counting tunnel and records both a silhouette image and short, high resolution video for each individual fish (see Section 1.3). After installation, data were uploaded to the Riverwatcher Daily website every hour until the system was removed from the river on November 13, 2020. In this time, a total of 4,684 mature salmon and trout were observed moving upstream through the Streetsville Fishway (Fig. 1.4.1). This number is conservative.

During periods of heavy rainfall river flows increased, making the water cloudy. As the water became less clear, the light from the infrared counting sensors could not penetrate through the water, thus fish could not be counted. During these periods of high flow and turbid water, we did not have the capacity to count fish as they moved through the fishway. Additionally, there were occasions throughout the monitoring period

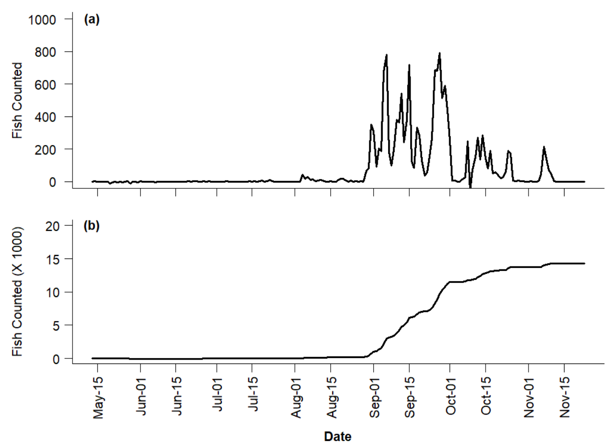

FIG 1.4.1. (a) Daily and (b) cumulative observed fish counts at the Streetsville Fishway, Credit River, Mississauga, Ontario from June 16 to November 13, 2020.

where the volume of fish moving through the fish counter exceeded the system's ability to count them individually. Calibration of each fish counting system is tailored to the specific installation site using manual hand counts. The calibration of both the Credit River and Ganaraska River fish counters is ongoing and will aide in providing estimates of fish missed during periods of high turbidity and high fish volume.

October 1, 2020 marked the most active day on the fishway with a total of 502 salmon and trout observed migrating upstream through the Riverwatcher (Fig. 1.4.2). Throughout the monitoring period, data on Rainbow Trout, Chinook Salmon, Coho Salmon, Brown Trout and Atlantic Salmon were collected. The following paragraphs provide species specific observations.

Rainbow Trout

In 2020, the spring rainbow spawning run was not monitored. A total of 104 Rainbow Trout were identified migrating upstream through the Streetsville Fishway from June 16 to November 13, 2020 (Fig. 1.4.3).

Chinook Salmon

A total of 3,941 Chinook Salmon were identified migrating upstream through the Riverwatcher in 2020. The first Chinook Salmon was observed August 7, 2020 and the last observed on November 12, 2020 (Fig. 1.4.4). Of the Chinook Salmon that passed through the Streetsville Fishway 986 fish were observed with an adipose clip and 1,998 fish were unclipped. Chinook Salmon with the adipose clip represent Ganaraska River egg collections that were subsequently stocked in the Credit River in 2016, 2017, 2018 and 2019. Unclipped Chinook Salmon represent fish stocked in the Credit River that originated from the Credit River egg collections (stocked in 2016, 2017, 2018 and 2019) as well as fish that were naturally produced in the Credit River. Some straying from other river sources occurs, however their contribution to the total spawning population is minimal. For more detailed information on Chinook Salmon, please see Credit River Chinook Salmon Spawning Index (below).

Coho Salmon

The first Coho Salmon observed at the Streetsville Fishway in 2020 was on September 14. A total of 130 Coho Salmon were identified exiting the Streetsville Fishway (Fig. 1.4.5). The last Coho Salmon observed moving through Streetsville Fishway was on November 12, 2020. The majority of Coho Salmon migrating through the fishway were recorded between September 24 and October 15 (Fig. 1.4.5). Of the Coho Salmon that passed through the Streetsville Fishway 106 fish were observed with an adipose clip and eight fish were unclipped. Coho Salmon with the adipose clip represent fish stocked into the Credit River by Metro East Anglers and unclipped Coho Salmon represent fish naturally produced in the Credit River. Some straying from other river sources occurs, however their contribution to the

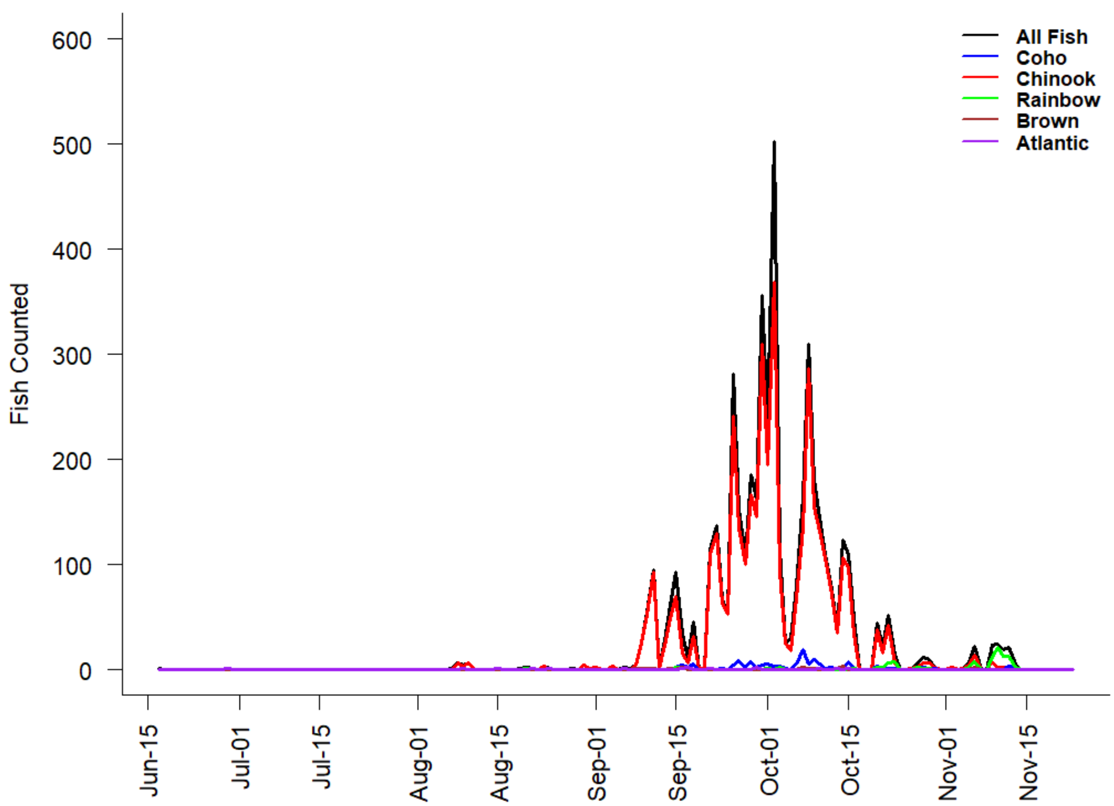

FIG 1.4.2. Daily counts of each species of salmon and trout observed migrating through the Streetsville Fishway, Credit River, Mississauga, Ontario from June 16 to November 13, 2020.

total spawning population is minimal.

Brown Trout

The first Brown Trout observed at the Streetsville Fishway in 2020 was on September 7. A total of 17 Brown Trout were identified exiting upstream the Streetsville Fishway (Fig. 1.4.6). The last Brown Trout observed was on November 5, 2020.

Atlantic Salmon

The first Atlantic Salmon observed at the Streetsville Fishway in 2020 was on June 28. A total of 15 Atlantic Salmon were identified exiting the Streetsville Fishway (Fig. 1.4.7). The last Atlantic Salmon observed on the fish counter was on October 14, 2020.

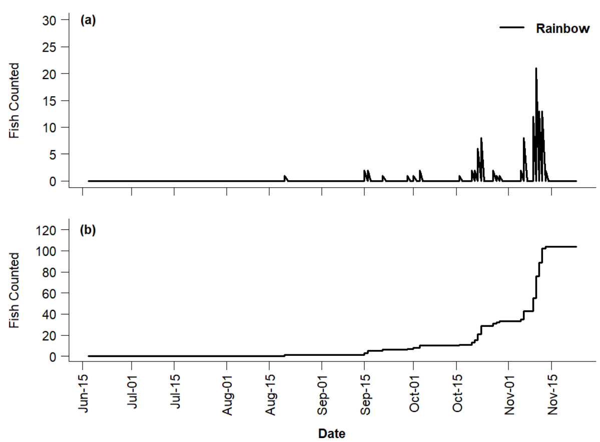

FIG 1.4.3. (a) Daily and (b) cumulative observed counts of Rainbow Trout at the Streetsville Fishway, Credit River, Mississauga, Ontario from June 16 to November 13, 2020.

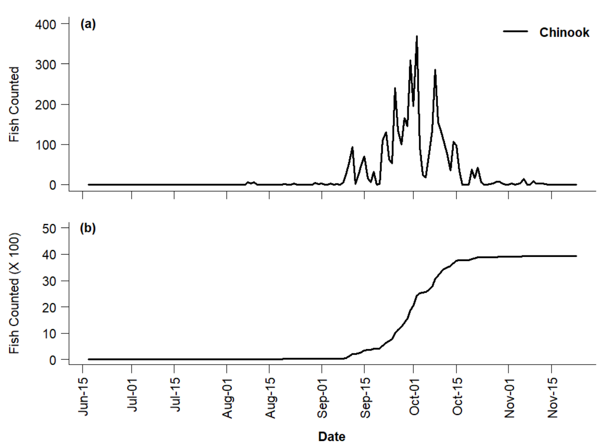

FIG 1.4.4. (a) Daily and (b) cumulative observed counts of Chinook Salmon at the Streetsville Fishway, Credit River, Mississauga, Ontario from June 16 to November 13, 2020.

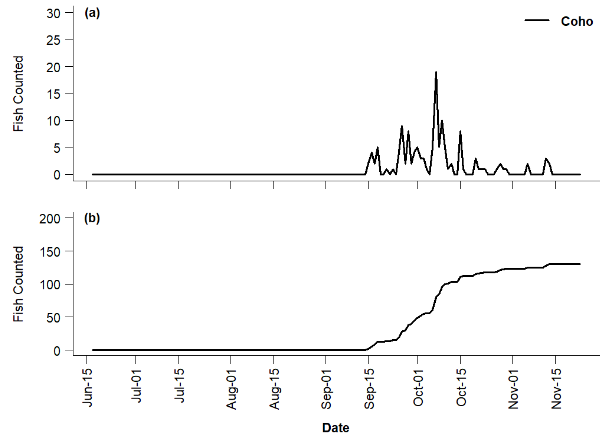

FIG 1.4.5. (a) Daily and (b) cumulative observed counts of Coho Salmon at the Streetsville Fishway, Credit River, Mississauga, Ontario from June 16 to November 13, 2020.

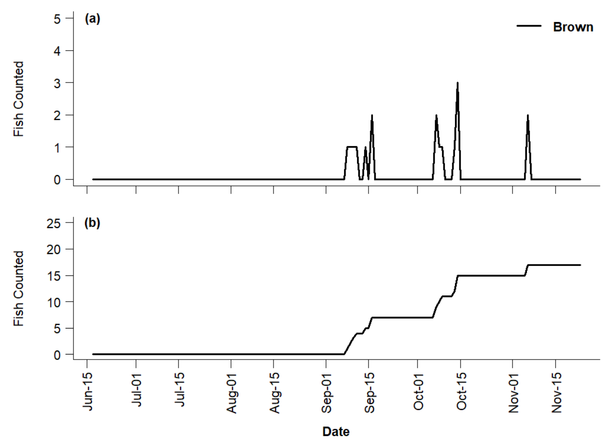

FIG 1.4.6. (a) Daily and (b) cumulative observed counts of Brown Trout at the Streetsville Fishway, Credit River, Mississauga, Ontario from June 16 to November 13, 2020.

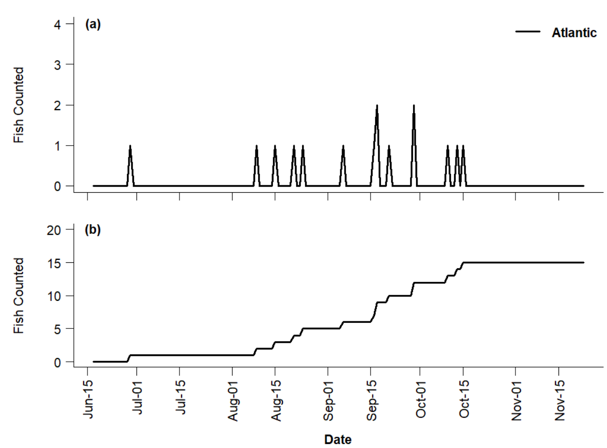

FIG 1.4.7. (a) Daily and (b) cumulative observed counts of Atlantic Salmon at the Streetsville Fishway, Credit River, Mississauga, Ontario from June 16 to November 13, 2020.

Credit River Chinook Salmon Spawning Index

Each year, Chinook Salmon are captured during the fall spawning run on the Credit River, below Streetsville Dam, at the beginning of October using electrofishing gear for gamete collections. LOMU staff have utilized the fish collections to index growth, condition and lamprey marking of Chinook Salmon.

Weight and otoliths are collected from fish used in the spawn collection, which has the potential to be biased toward larger fish. To obtain a representative length sample of the spawning run, 50 fish per day were randomly selected, measured and check for clips prior to fish being sorted for gamete collection and detailed sampling. Detailed sampling included collecting data on length, weight, fin clips, coded-wire tag (CWT), and lamprey marks. A subsample also had otoliths collected for age determination.

Samples for the 2020 Chinook Salmon index were taken between September 30 and October 9. Lengths were taken on a total of 472 Chinook Salmon 300 randomly selected fish (non -detailed sampling) and 172 fish for which detailed sampling occurred. Of the randomly selected fish, 21% were observed with an adipose clip. To increase the diversity of the Chinook Salmon egg collection, LOMU began collecting Chinook Salmon eggs and milt from the Ganaraska River in addition to the Credit River. Fish that were stocked into the Credit River that were collected from the Ganaraska River had their adipose removed prior to stocking. This allows LOMU staff to identify the stock origin (Credit River/Wild = adipose fin intact; Ganaraska = adipose removed/clip) of the mature Chinook Salmon in the Credit River during the spawn/egg collection. Stocking of Ganaraska River Chinook Salmon into the Credit River began in 2016, so fish observed with an adipose clip would be from the 2016, 2017, 2018 and 2019 stocking events (see Section 6.1). Of the 64 fish observed with an adipose clip, 29 were male and 35 were female. In 2020, 61% of the spawning population (clipped and unclipped combined) were three years old, 29% were age 2 (Fig. 1.4.8).

In 2020, average fork length of Chinook Salmon at age-2 and age-3 was comparable to 2019 for both males and females (Fig. 1.4.9). The

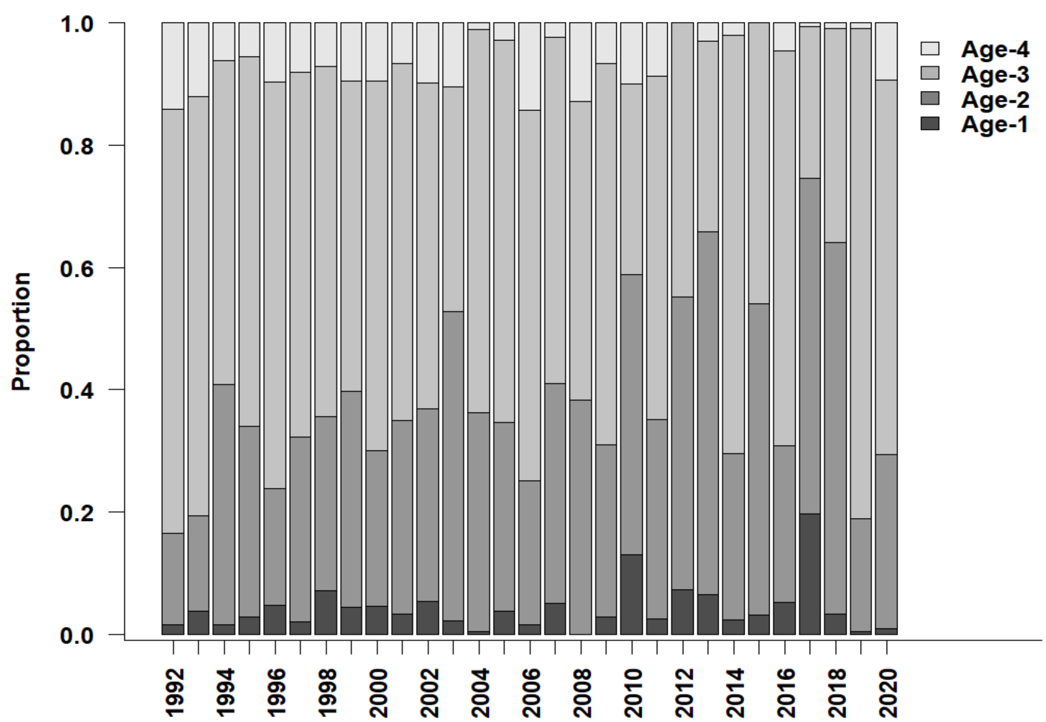

FIG 1.4.8. Age proportions of spawning Chinook Salmon (males and females pooled) sampled during the fall Credit River Chinook Salmon Spawning Index, Credit River, Mississauga, Ontario from 1992 – 2020. The four grey colours correspond to each age where Age 1 is the darkest and Age 4 is the lightest.

average fork length of age-3 males (874 mm) was comparable to 2019 (870 mm) and is 1% below the long-term average of 883 mm. Average length of age-3 females (841 mm) decreased from 2019 (850 mm) and is 3% below the long-term mean (868 mm; Fig. 1.4.9). Length of age-2 females (827 mm) increased, while males (785 mm) has been stable since 2018 and are 3% above and 1% below (respectively) the long-term averages (Fig. 1.4.9).

The estimated weight (based on a log-log regression) of a 914 mm or 36" (total length) Chinook Salmon is used as an index of condition. In 2020, female and male condition measures increased from 2019 (Fig. 1.4.10). Female condition in 2020 (7,487 g) showed a significant increase from 2019 but remains below the previous 10-year average (7,513 g). Male condition in 2020 (7,308 g) is 1% above the average condition over the past 10-years (7,246 g). It should be noted that the absolute difference between maximum and minimum condition for female (1995 and 2019) and male (1995 and 2018) Chinook Salmon in this time series is 1,647 g and 1,156 g (respectively).

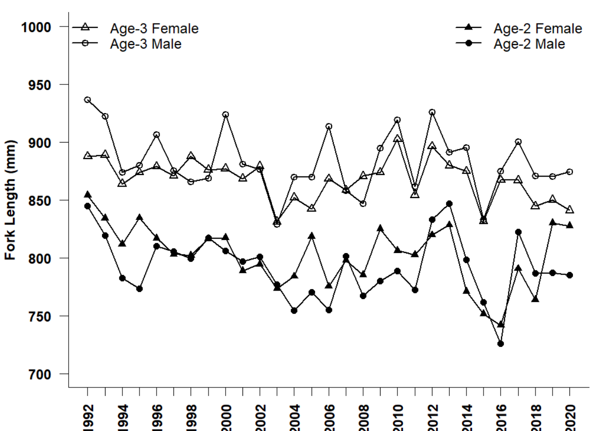

FIG 1.4.9. Mean total length of age-2 and age-3 Chinook Salmon by sex, caught for spawn collection in the Credit River during the fall spawning run (approximately first week of October), 1989-2020.

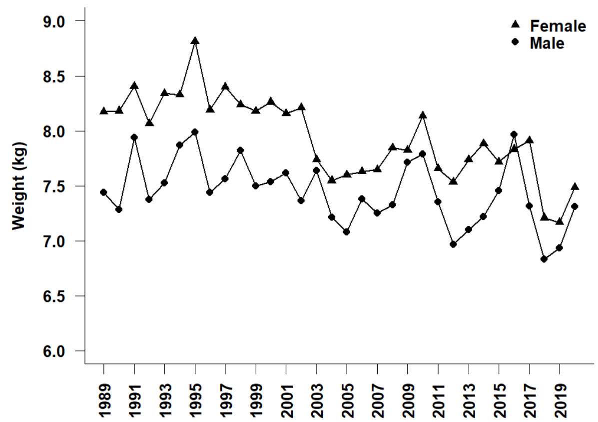

FIG 1.4.10. Condition index as the mean weight of a 914 mm / 36 inch (total length) Chinook Salmon in the Credit River during the spawning run (approximately first week of October), 1989-2020.

1.5 Lake Ontario Fall Benthic Prey Fish Survey

J.P. Holden, Lake Ontario Management Unit

The Lake Ontario offshore prey fish community was once a diverse mix of pelagic and benthic fish but by the 1970s the only native fish species that remained abundant was Slimy Sculpin. Recent invasions of dressenid mussels and Round Goby have further changed the offshore fish community. The Lake Ontario Fall Benthic Prey Fish Survey provides an index of how prey fish abundance, distribution and species composition has adapted through time in response to environmental change and species invasions.

A benthic prey fish assessment in the main basin of Lake Ontario has historically only been conducted by the US Geological Survey (USGS). The survey assessed prey fish along six southern-shore, US transects in depths from 8 - 150m. However, the restricted geographic and depth coverage prevented this survey from adequately informing important benthic prey fish dynamics at a whole-lake scale, including monitoring the reappearance of Deepwater Sculpin. In 2015, this program was expanded to include additional trawl sites conducted by OMNRF and New York Department of Environmental Conservation (NYSDEC) with additional support provided from the US Fish and Wildlife Service (USFWS). The current survey provides abundances indices for Sculpin sp., Round Goby and Bloater with survey techniques comparable to those used in Lake Michigan.

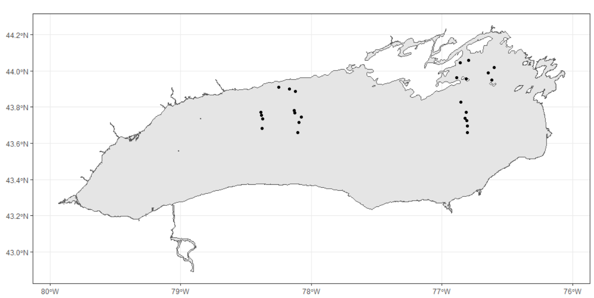

Fig. 1.5.1. Tow sites conducted in the Ontario waters of Lake Ontario during the Fall Benthic Prey Fish Survey.

The Ontario portion of the 2020 survey consisted of 25 trawls conducted from October 8 through October 22 at transects near Port Hope, Rocky Point and in the Kingston Basin (Fig. 1.5.1). Shallow tows (<40m) in Ontario waters are largely confined to the Kingston Basin due to limited suitable sites across the north shore. Past efforts to trawl these areas have resulted in snags and damaged gear due to rocky substrate and large boulders.

The survey is conducted with a 3/4 Yankee Standard using Thyborne metal doors. Depth loggers and wing sensors were used on all trawls to provide estimates of true bottom time and net opening to standardize catches with historical surveys and with US vessels.

Alewife were the most abundant species caught (N = 20569) followed by Deepwater Sculpin (N = 3118) and Round Goby (N = 602). Full catch data presented in Table 1.5.1.

The Lake Ontario Fall Benthic Prey Fish Survey is a subset of a binational prey fish assessment program. The complete data set is available through the Ontario Open Data Catalogue (https://data.ontario.ca/en/dataset/lake-ontario-prey-fish-trawl-data).

Table 1.5.1. Species composition across all trawl sites conducted in Ontario waters of the Fall Benthic Prey Fish Survey.

Species	Total Caught (N)	Total Weight (kg)	Number of Tows Where Caught
Alewife	20569	203.9	23
Deepwater Sculpin	3118	80	14
Round Goby	602	2.4	10
Slimy Sculpin	17	0.3	4
Sea Lamprey	2	0.6	1
Freshwater Drum	1	1.1	1
Yellow Perch	1	0.005	1

1.6 St. Lake St. Francis Community Index Gill Netting

M. Yuille; Lake Ontario Management Unit

Traditionally, the Lake Ontario Management Unit (LOMU) conducts a Fish Community Index Gill Netting Survey in Lake St. Francis every other year in early fall. Since 2019, the St. Lawrence River Fish Community Index Gill Netting Survey (Lake St. Francis and Thousand Islands) was redesigned and has been conducted annually. Netting effort is allocated to randomly selected sites within four depth zones based on their proportional representation in the study area. The catches are used to estimate fish abundance and measure biological attributes. Structures and tissues are collected for age determination, stomach content analyses, contaminant analyses and pathological examinations. The survey is part of a larger collaborative effort between OMNRF and New York State Department of Environmental Conservation (NYSDEC) to monitor changes in the fish communities in four distinct sections of the St. Lawrence River: Thousand Islands, Middle Corridor, Lake St. Lawrence and Lake St. Francis.

In 2020, the survey was conducted during the period of September 21st to 23rd. Fifteen nets were deployed, using standard multi-panel gillnets with monofilament meshes ranging from 1 ½ to 6 inches at half-inch increments. The nets were fished for approximately 24 hours. All catches prior to 2002 were adjusted by a factor of 1.58 to be comparable to the new netting standard used by both OMNRF and NYSDEC that was initiated in 2002. In total, 219 fish were caught, which included 12 different fish species (Table 1.6.1). The average number of fish per net in 2020 (14.6) was comparable to the average catch in 2019. The number of fish per net in 2020 remains below the 1984 – 2019 average for the survey (Fig. 1.6.1). The dominant species in the catch continues to be Yellow Perch (60% of catch, 29% of biomass; Fig. 1.6.2).

Species Highlights

Yellow Perch

Catches of Yellow Perch have declined from peak levels seen previously in 2008 and 2010 (Fig. 1.6.3). 2020 catches of Yellow Perch per net (8.80 fish per net) were lower than the 2019 average catch (11.8 fish per net) and

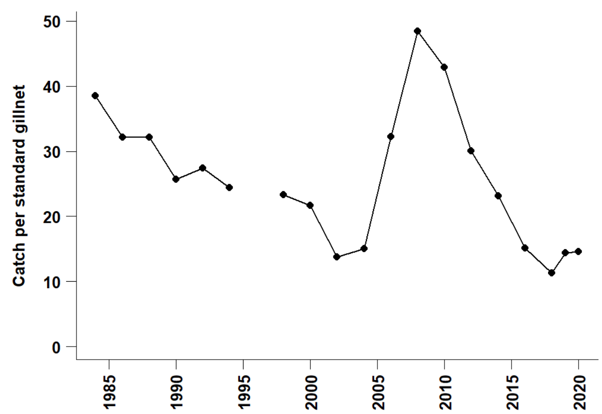

FIG 1.6.1. Average catch per standard gillnet set of all species combined, Lake St. Francis, 1984 – 2020. Survey was not conducted in 1996.

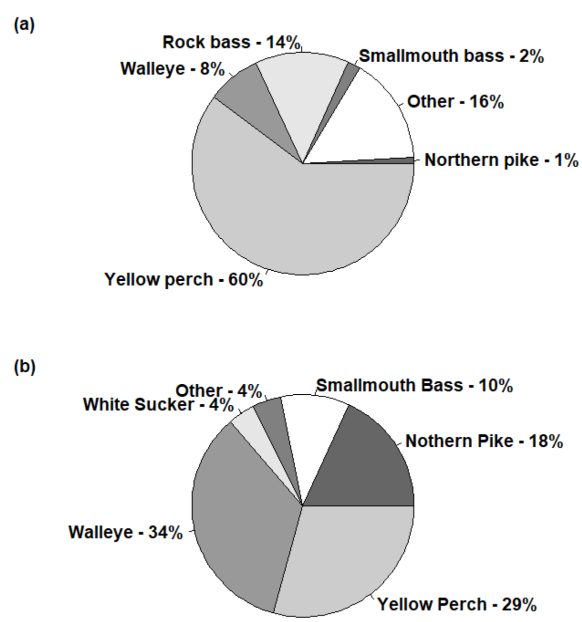

FIG 1.6.2. Species composition by (a) catch and (b) biomass in the 2020 Lake St. Francis community index gill netting program.

remains below the 1984 – 2019 survey average (15.70 fish per net; Table 1.6.1). The increase in 2019 Yellow Perch catches was driven by an increase in the number of small fish (≤ 220 mm) caught (Fig. 1.6.3). The proportion of large fish (> 220 mm) observed in catches (< 10% of catch) remains low (Fig. 1.6.3). Yellow Perch catches in 2020 contained fish from age-2 to age-8 with age-3 fish representing 53% of the total catch (Fig. 1.6.4).

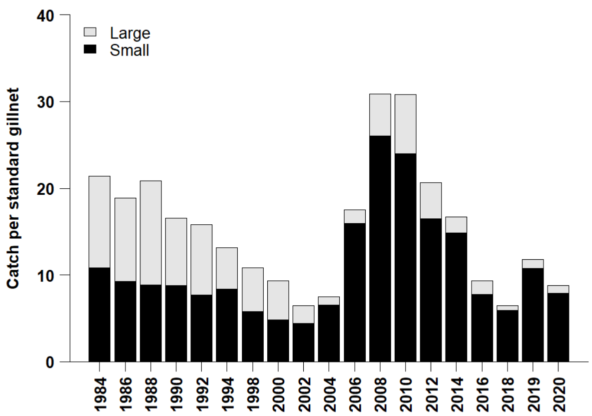

FIG 1.6.3. Catches of small (≤ 220 mm total length) and large (> 220 mm total length) Yellow Perch in the Lake St. Francis community index netting program, 1984 – 2020. Survey was not conducted in 1996.

Centrarchids

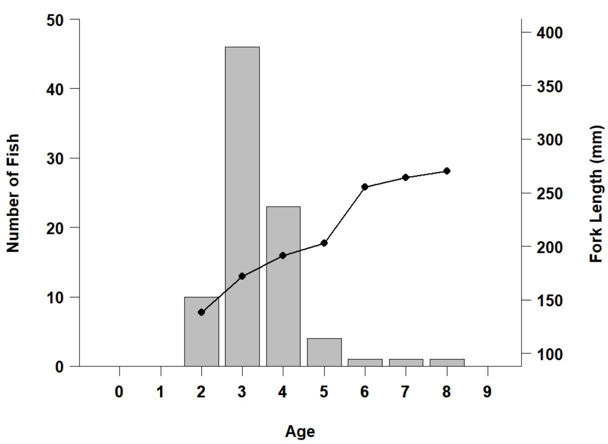

FIG 1.6.4. Age distribution (bars) and mean fork length at age (mm) of Yellow Perch caught in Lake St. Francis, 2020.

The centrarchids are represented by six species in Lake St. Francis: Rock Bass, Pumpkinseed, Bluegill, Smallmouth Bass, Largemouth Bass and Black Crappie (Fig. 1.6.5 and 1.6.6). While Rock Bass remain the most abundant of the centrarchids, catches in 2020 (2.00 fish per net) indicated an increase from the previous survey, but overall they remain below the previous 10-year average (3.16 fish per net). Smallmouth Bass catches in 2020 remained stable since the previous survey in 2019 (0.27 fish per net in both years), however catches remain 63% below the previous 10-year average (0.43 fish per net; Fig. 1.6.5) with three age-1 and one age-9 fish being represented in the catch. In the 2020 survey, two Largemouth Bass and one Bluegill (0.13 and 0.07 fish per net, respectively) were caught. No Pumpkinseed or Black Crappie in the 2020 survey (Figs. 1.6.5 and 1.6.6).

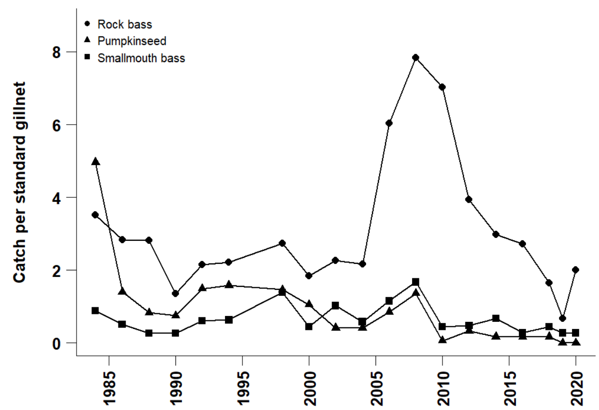

FIG 1.6.5. Rock Bass (circle), Pumpkinseed (triangle) and Smallmouth Bass (square) catches per standard gillnet set in Lake St. Francis, 1984 - 2020.

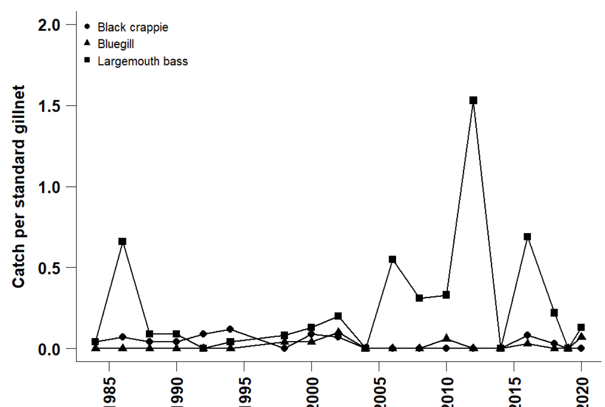

FIG 1.6.6. Black Crappie (circle), Bluegill (triangle) and Largemouth Bass (square) catches per standard gillnet set in Lake St. Francis, 1984 – 2020.

Northern Pike

Northern Pike catches in 2020 remain low (0.13 fish per net; Fig. 1.6.7). Northern Pike abundances have been in decline since the early 1990s and are currently at the lowest levels observed in the 35-year time series (Table 1.6.1). Two Northern Pike were caught in 2020, which were age-5 and age-7. In 2020, there were no small (≤ 500 mm) Northern Pike caught (Fig. 1.6.7). No Muskellunge were caught in 2020.

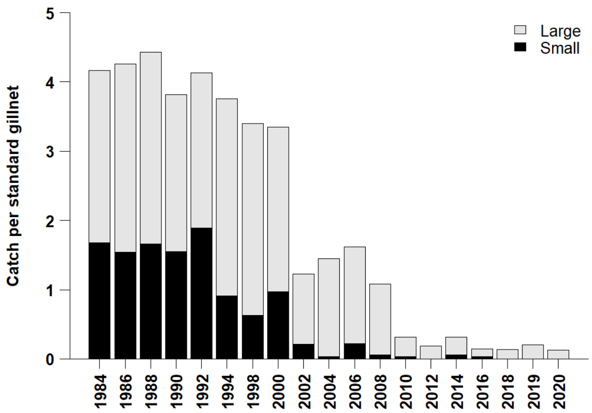

FIG 1.6.7. Catches of small (≤ 500 mm total length) and large (> 500 mm total length) Northern Pike in the Lake St. Francis community index gill netting program, 1984 – 2020. Survey was not conducted in 1996.

Walleye

Walleye represented 8% of the total catch and 34% of total biomass caught in 2020 with 17 individuals caught (Fig. 1.6.2 and Table 1.6.1). The average catch per net was 1.13; an increase from 2019 and roughly 23% above the previous 10-year average (0.92 fish per net). Generally, catches of small fish (≤ 500 mm) and large (>500 mm) Walleye have been equally represented, in 2020, small fish represented 71% of the catch, while large fish represented the remaining 29% (Fig. 1.6.8). Walleye ages ranged from 2 to 11 years of age with the majority being ages 2 and 3 (Fig. 1.6.9).

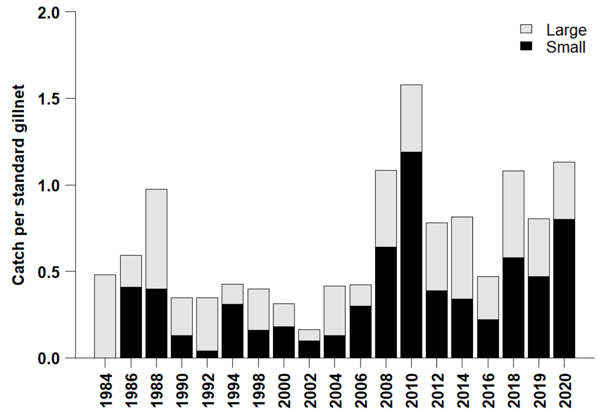

FIG 1.6.8. Catches of small (≤ 500 mm total length) and large (> 500 mm total length) Walleye in the Lake St. Francis community index gill netting program, 1984 – 2020. Survey was not conducted in 1996.

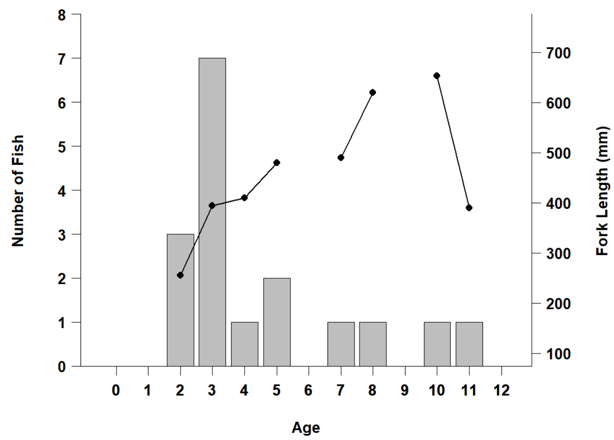

FIG 1.6.9. Age distribution (bars) and mean fork length (circles) at age of Walleye caught in Lake St. Francis, 2020.

TABLE 1.8.1. Summary of catches per gillnet set in the Lake St. Francis Fish Community Index Gillnetting Program, 1984 - 2020. All catches prior to 2002 were adjusted by a factor of 1.58 to be comparable to the new netting standard initiated in 2002.

	1984 - 2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	2019	2020
Lake Sturgeon	0.01	--	0.03	--	0.03	--	0.03	--	0.03	--	--	--
Longnose Gar	0.19	0.4	--	0.06	--	--	0.22	--	0.28	--	0.07	1.13
Bowfin	0.01	--	--	--	--	--	--	--	--	--	--	--
Alewife	0.01	0.03	0.06	0.22	--	--	0.14	0.03	--	--	0.2	--
Gizzard Shad	0.00	--	--	--	--	--	--	--	0.06	--	--	--
Salvelinus sp.	0.01	--	--	--	--	--	--	--	--	--	--	--
Northern Pike	3.92	1.23	1.45	1.67	1.08	0.31	0.19	0.31	0.14	0.14	0.2	0.13
Muskellunge	0.01	--	0.03	--	--	--	--	0.03	--	--	--	--
White Sucker	1.65	0.74	1.06	0.97	1.97	1.56	1.17	1.25	0.56	0.47	0.33	0.67
Silver Redhorse	0.00	--	--	0.11	0.14	0.08	0.06	0.03	0.06	0.11	--	0.07
Shorthead Redhorse	0.00	--	--	--	--	--	0.28	0.06	0.03	0.03	0.07	--
Greater Redhorse	0.01	--	--	--	--	--	--	--	--	--	--	--
River Redhorse	0.02	--	--	--	--	0.06	--	--	--	--	--	--
Moxostoma sp.	0.04	--	--	--	0.06	--	--	--	--	0.11	--	--
Common Carp	0.03	0.09	--	0.25	0.03	--	--	--	--	--	--	--
Golden Shiner	0.01	0.03	--	--	--	--	--	--	0.06	0.22	--	--
Creek Chub	0.01	--	--	--	--	--	--	--	--	--	--	--
Fallfish	0.01	--	--	--	--	--	--	--	0.03	0.14	--	0.13
Brown Bullhead	1.09	0.54	1.38	2.81	1.97	0.56	0.25	0.14	0.03	--	--	--
White Perch	0.00	--	--	--	--	--	--	--	0.03	--	--	0.07
Rock Bass	2.47	2.25	2.17	5.69	7.83	7.03	3.94	2.97	2.72	1.64	0.67	2.00
Pumpkinseed	1.76	0.41	0.41	0.89	1.36	0.06	0.33	0.17	0.17	0.17	--	--
Bluegill	0.01	0.1	--	--	--	0.06	--	--	0.03	--	--	0.07
Smallmouth Bass	0.63	1.02	0.58	1.17	1.67	0.44	0.47	0.67	0.28	0.44	0.27	0.27
Largemouth Bass	0.06	0.2	--	0.61	0.31	0.33	1.53	--	0.69	0.22	--	0.13
Black Crappie	0.07	0.07	--	--	--	--	--	--	0.08	0.03	--	--
Yellow Perch	15.69	6.48	7.49	16.36	30.89	30.83	20.64	16.67	9.36	6.5	11.8	8.80
Walleye	0.44	0.16	0.41	0.39	1.08	1.58	0.78	0.81	0.47	1.08	0.8	1.13
Freshwater Drum	0.00	0.04	--	--	0.03	--	--	--	0.03	--	--	--
All Species	28.14	13.79	15.07	31.2	48.45	42.9	30.03	23.14	15.14	11.3	14.41	14.60
Count of Species	12.63	16	11	13	14	12	14	12	20	14	9	12.00

1.7 St. Lawrence River Fish Community Index Netting – Thousand Islands

M. Yuille; Lake Ontario Management Unit

Traditionally, the Lake Ontario Management Unit (LOMU) conducts a Fish Community Index Gill Netting Survey in the Thousand Islands every other year in early fall. In 2019, the St. Lawrence River Fish Community Index Gill Netting Survey (Thousand Islands and Lake St. Francis) was redesigned and will be conducted annually. Netting effort is allocated to randomly selected sites within four depth zones based on their proportional representation in the study area. The catches are used to estimate abundance, measure biological attributes, and collect materials for age determination, stomach contents and tissues for contaminant analysis and pathological examination. The survey is part of a larger effort to monitor changes in the fish communities in four sections of the St. Lawrence River (Thousand Islands, Middle Corridor, Lake St. Lawrence, and Lake St. Francis), and it is coordinated with the New York State Department of Environmental Conservation (NYSDEC) to provide comprehensive assessment of the river's fisheries resources.

In 2020, the survey was conducted between September 8th and September 16th. Twenty-five nets were deployed, using standard gillnets consisting of 25-foot panels of monofilament meshes ranging from 1.5 to 6 inches in half-inch increments. The nets were fished for approximately 24 hours. The overall catch was 878 fish comprising 19 species (summary in Table 1.7.1). The average number of fish per set was 35.12; comparable to the mean catch over the previous 10 years (34.01 fish per set; Fig. 1.7.1). Yellow Perch remained the dominate species caught in the nets followed by Smallmouth Bass and Rock Bass (Fig. 1.7.2).

Species Highlights

In 2020, Yellow Perch catches increased 16% from 2019 catch estimates to 21.36 fish per net and represented 61% of the total catch by number and 18% by biomass (Table 1.7.1; Fig. 1.7.2 and 1.7.3). Catches of Yellow Perch in the 2020 Thousand Islands survey are comparable the previous 10-year average (average of 22.7 from 2009 to 2019). Age distributions and mean length at age for 2020 catches of Yellow Perch are summarized in Tables 1.7.2 and 1.7.3, respectively.

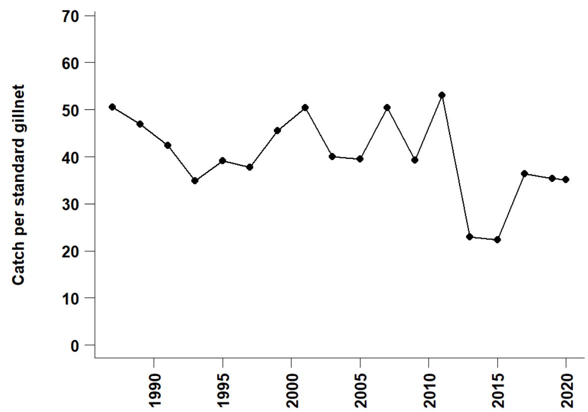

FIG 1.7.1. Total number of fish (all species) per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2020.

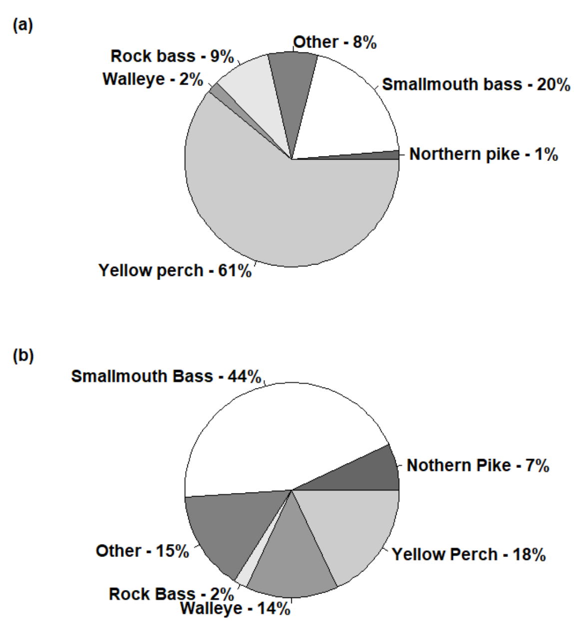

FIG 1.7.2. Species composition by (a) catch and (b) biomass in the 2020 gillnet survey in the Thousand Island area of the St. Lawrence River.

The centrarchids are represented by six species in the upper St. Lawrence: Rock Bass, Pumpkinseed, Bluegill, Smallmouth Bass, Largemouth Bass and Black Crappie (Fig. 1.7.4 and 1.7.5). Smallmouth Bass were the most abundant centrarchid species in the 2020 survey, representing 20% of the total catch by number and 44% by biomass (Figs. 1.7.2 and 1.7.4). Length at age for Smallmouth Bass is comparable to the time series average for age-1 and age-5, while age-3 length at age are above the time series average (Table 1.7.3 and Fig. 1.7.6). Pumpkinseed continue to decline in 2020 and remain at the lowest level observed in this survey (Fig. 1.7.4). Bluegill, Largemouth Bass and Black Crappie were historically at much lower levels than the former three species. Largemouth Bass catches in 2020 declined 36% from the previous survey and are below the previous 10-year average (0.35 fish per net; Fig 1.7.5).

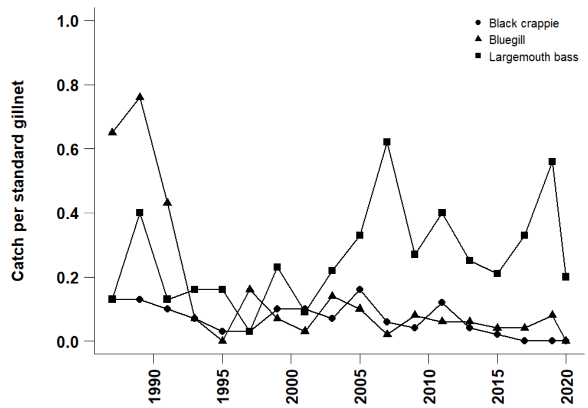

FIG 1.7.5. Black Crappie (circle) Bluegill (triangle) and Largemouth Bass (square) catches per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2020.

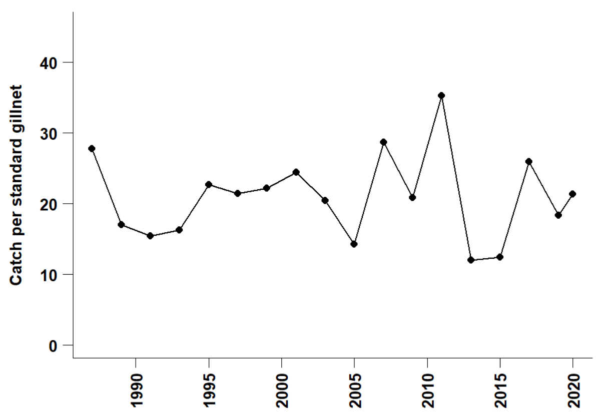

FIG 1.7.3. Yellow Perch catch per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2020.

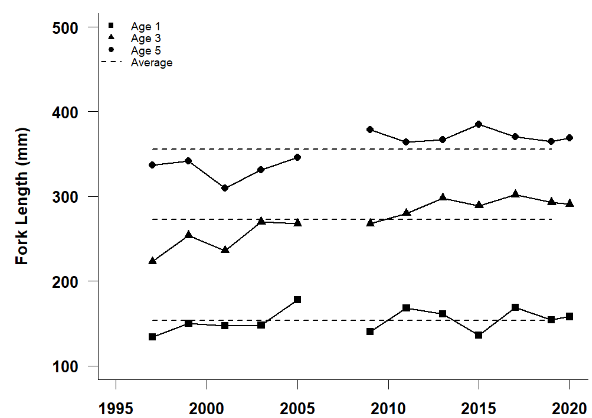

FIG 1.7.6. Mean fork length (mm) of age-1 (square), age-3 (triangle) and age-5 (circle) Smallmouth Bass from 1997 to 2020. Dashed lines represent the average fork length from 1997 to 2020 for the aforementioned ages.

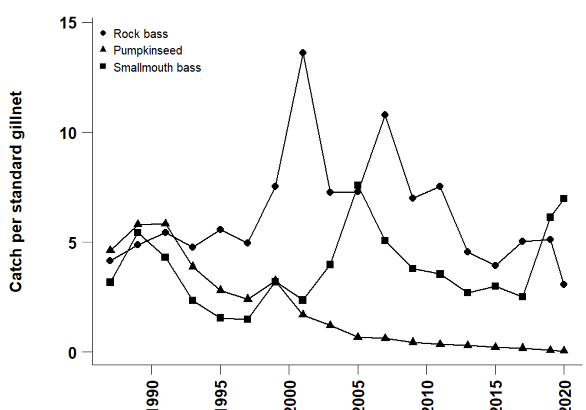

FIG 1.7.4. Rock Bass (circle), Pumpkinseed (triangle) and Smallmouth Bass (square) catches per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2020.

Northern Pike remain at very low levels, reached after a slow steady decline spanning almost the entire history of the Thousand Islands survey (Fig. 1.7.7). Currently, Northern Pike abundance is at a low point in this survey; roughly 6% of its peak observed in 1989. Total catches of Northern Pike in 2020 were comparable to those in 2019, however some small fish (≤ 500 mm) were caught, where none were caught in the previous year (Fig 1.7.7). Although no age-6 fish were caught in 2020, condition as determined by mean lengths of age-4 and age-5 Northern Pike has remained above the time series average since 2017 (Fig. 1.7.8 and Tables 1.7.2 and 1.7.3).

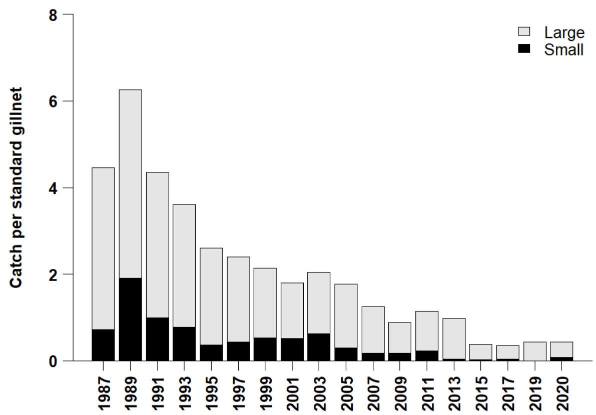

FIG 1.7.7: Catches of small (≤ 500 mm fork length) and large (> 500 mm fork length) of Northern Pike per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2020.

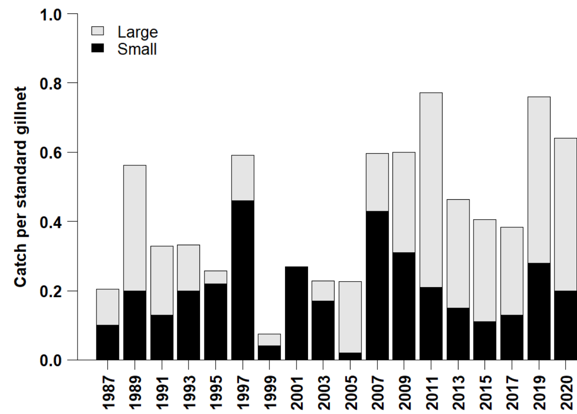

FIG 1.7.9. Catches of small (≤ 500 mm fork length) and large (> 500 mm fork length) of Walleye per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2020.

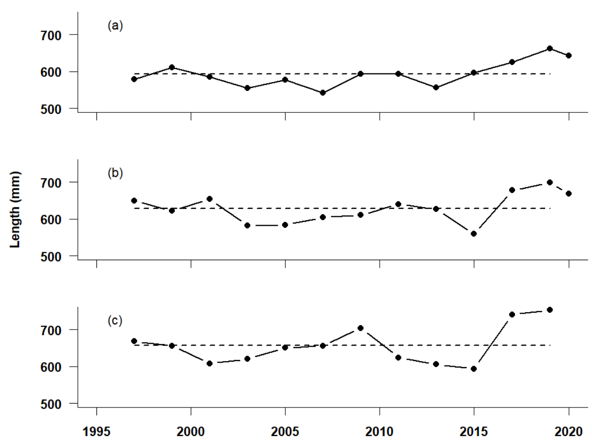

FIG 1.7.8. Mean fork length (mm) of (a) age-4, (b) age-5 and (c) age -6 Northern Pike from 1997 to 2020. Dashed lines represent the average fork length from 1997 to 2020 for the aforementioned ages.

Walleye represented 2% of the total catch and 14% of total biomass caught in 2020 with 16 individuals caught. The average catch per net was 0.64, which is comparable to the previous 10-year average (0.61 Walleye per gill net). Catches of small (≤ 500 mm) and large (>500 mm) fish remain stable with 31% and 69% of the catch representing small and large fish (respectively; Fig. 1.7.9). Walleye ages ranged from 2 to 16 years of age (Table 1.7.2).

TABLE 1.7.2: Age distribution of selected species caught in the 2020 Thousand Islands Community Index Gill Netting program.

	Year-class/Age																
	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004
Species	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Yellow Perch	--	--	35	33	18	12	8	4	1	1	--	--	--	--	--	--	--
Walleye	--	--	4	--	--	2	--	--	3	3	--	--	--	1	--	1	1
Northern Pike	1	--	2	2	3	3	--	--	--	--	--	--	--	--	--	--	--
Smallmouth Bass	--	17	33	5	18	11	9	4	4	1	4	1	--	--	--	--	--

TABLE 1.7.3: Mean fork length (mm) of selected species caught in the 2020 Thousand Islands Community Index Gill Netting program.

	Year-class/Age																
	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004
Species	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Yellow Perch	--	--	146	179	224	249	253	287	285	290	--	--	--	--	--	--	--
Walleye	--	--	372	--	--	443	--	--	594	618	--	--	--	701	--	640	674
Northern Pike	217	--	480	624	642	668	--	--	--	--	--	--	--	--	--	--	--
Smallmouth Bass	--	158	227	291	333	369	397	421	433	465	454	460	--	--	--	--	--

2. Recreational Fishery

2.1 Fisheries Management Zone 20 Council (FMZ 20) / Volunteer Angling Clubs

C. Lake, Lake Ontario Management Unit

Fisheries Management Zone 20 (FMZ20) Council provides advice to the Lake Ontario Management Unit regarding the management of Lake Ontario recreational fisheries. The FMZ20 Council, established in 2008, has been instrumental in shaping the future of the Lake Ontario recreational fishery. Over the past decade, the FMZ20 Council has been involved in renewing the Fish Community Objectives, developing a stocking plan, identifying issues and concerns, and acting as liaison to improve broader pubic awareness about the fishery.

FMZ20 Council members represent a broad spectrum of interests across the zone including: Muskies Canada, competitive bass anglers, Bay of Quinte and Upper St. Lawrence River Guides, Central Lake Ontario Sport Anglers, Metro East Anglers, Port Credit Salmon and Trout Association, Halton Region Salmon and Trout Association, St. Catharines' Game and Fish Association, Ontario Sportfishing Guides Association, Ontario Commercial Fish Association, Ontario Federation of Anglers and Hunters, tributary anglers, academia, environmental interests and several unaffiliated anglers.

Over the past year the FMZ20 Council has been engaged in binational fish stocking decisions, adult Walleye harvest assessment in the Eastern basin of Lake Ontario, and implementation of a new seasons for Largemouth and Smallmouth Bass angling.

Many of our volunteer clubs (council-affiliated and others) also help with the physical delivery of several management programs. Multiple clubs help with planning and implementation of Lake Ontario's net pen rearing initiatives for Chinook Salmon (the program was not run in 2020). Others help with the annual delivery of our stocking program through the operation of community-based hatcheries. The Napanee Rod and Gun Club, Credit River Anglers and Metro East Anglers stock various species including Rainbow Trout, Brown Trout, Atlantic Salmon, and Coho Salmon. Volunteers at the Ganaraska River-Corbett Dam Fishway assist MNRF staff to install, maintain and operate the new fish counter. Numerous anglers and clubs also participate regularly by supplying catch and harvest information in our volunteer angler diary programs.

2.2 Bay of Quinte Access Point Ice Angling Survey

E. Brown, Lake Ontario Management Unit

An access point recreational angling survey was conducted in the winter of 2020 on the Bay of Quinte. The objective of the survey was to estimate angler effort, catch and harvest, and biological attributes of the ice angling harvest. Angler effort was determined using aerial counts of on-ice anglers and ice-huts for the entire Bay of Quinte. Catch and harvest rate information and the biological characteristics of the fish caught was determined by access point angler interviews in most areas of the Bay.

The Bay of Quinte Access Point Ice Angling Survey was conducted from January 1st to March 1st 2020, the last day of the open season for Walleye angling. For analysis purposes, the fishing day was considered to last from 07:00 to 21:00. Sampling was stratified by geographic area (12 areas; Fig. 2.2.1), day-type (weekday and weekend days) and fishing mode (on-ice anglers, portable ice-hut anglers, and permanent ice hut anglers).

Aerial counts were conducted on all areas and were scheduled for two days per week (18 flights total; one weekday and one weekend day). Flights began (approximately) at one of five start times (9:00, 11:00, 13:00, 15:00 or 15:30), selected at random prior to the survey. Separate counts of on-ice anglers, portable ice-huts, and permanent ice-huts were made for each area; persons not fishing (e.g., driving a snow machine) were not included in the counts. Occupancy rate of permanent ice-huts was estimated based on past surveys, and it was assumed that all portable huts were 100% occupied. Aerial activity counts for East Lake, West Lake, Consecon Lake, Weller's Bay, and Presqu'ile Bay were also conducted during the survey. No interview data was collected in these areas and activity estimates are not included in this report.

Some areas with poor ice conditions and/or low angling effort were not surveyed by survey technicians due accessibility. Angling statistics

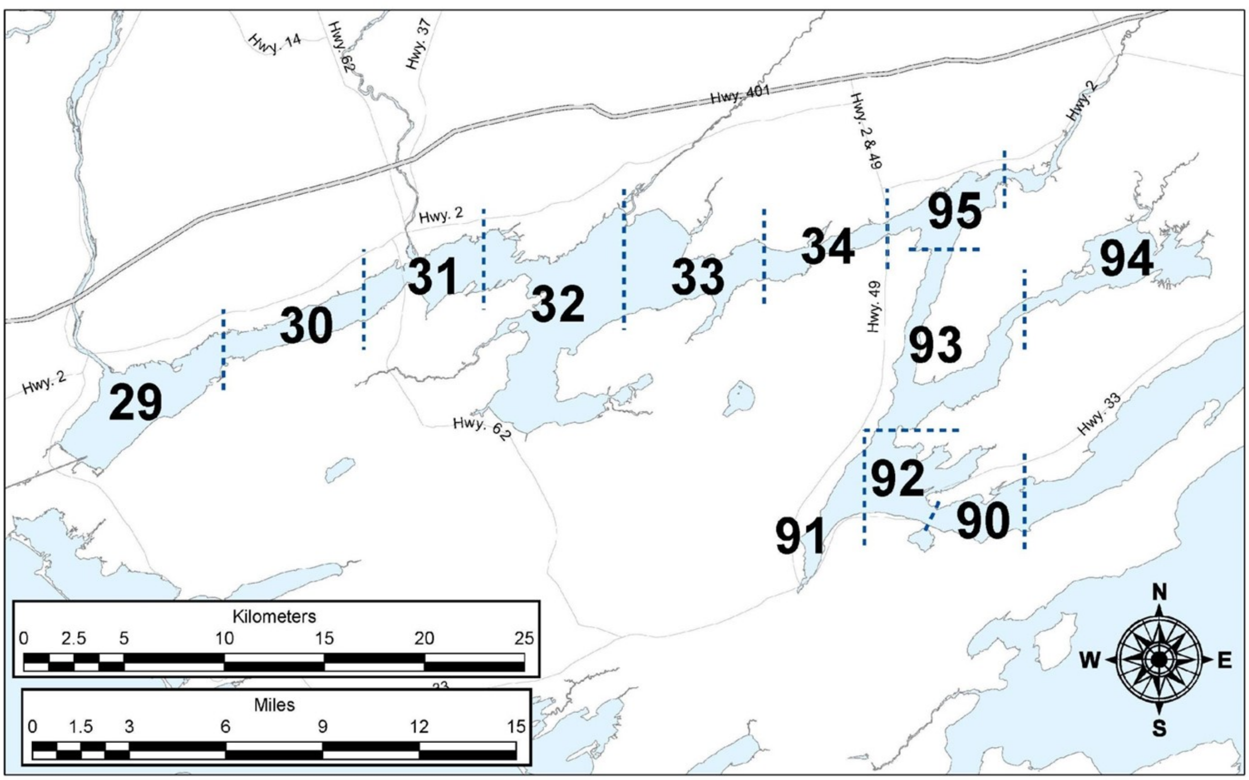

FIG. 2.2.1. Map of the Bay of Quinte showing angling survey areas.

for these areas were calculated based on the aerial counts and using angler interview data from other areas of the bay.

A 1-stage sampling design (statistics calculated for entire sample strata, not by day) was used to analyze the survey data because activity counts and angler interviews are not always conducted on the same day.

Aerial surveys recorded 5,125 activity counts and 457 group interviews were conducted by field crews across 13 public access points (Table 2.2.1). Sixty-one percent of anglers interviewed were local (Brighton to Gananoque, south of HWY 401), 34% were from Ontario (outside the local area), 1% were from elsewhere in Canada, and 4% were from USA.

The 2020 survey estimated a total of 162,287 hours of ice-fishing, slightly higher than the average of the three most recent surveys (137,981). Anglers reported catching 8 different species: Norther Pike, White Perch, Rock Bass, Yellow Perch, Walleye, Longnose Gar, Lake Whitefish and Cisco.

Of the total angling effort, anglers targeting Walleye accounted for 54,246 hours. Anglers caught 5,973 Walleye of which 2,183 were harvested (Fig. 2.2.2.(a)). Walleye fishing success rate (9 hours to catch a Walleye) was slightly above the most recent survey average (Fig. 2.2.2.(b)). The size distribution of Walleye harvest is shown in Fig. 2.2.4. Of the Walleye released, anglers reported 73% were less than 19in, 16% were 19-25in, and 11% were >25in.

Yellow Perch accounted for 51,994 hours of the angler activity. Anglers caught 32,005 Yellow Perch of which 12,779 were harvested. The size distribution of Yellow Perch harvest is shown in Fig. 2.2.4.

TABLE 2.2.1. Angler effort (angler hours), activity counts, angler groups interviewed, anglers per group, and rods per angler for the ice recreational fishery on the Bay of Quinte, 2020.

Total angling effort (hours)	162,287
Number of activity counts	5,125
Number of groups interviewed	457
Average number of anglers per group	1.6
Average number of rods per group	1.8

TABLE 2.2.2. Bay of Quinte ice recreational fishery statistics, 1982 -2020, including walleye angling effort (angler hours), walleye catch and harvest rates (number of fish per hour), and walleye catch and harvest (number of fish).

	Walleye Anglers				
Year	Effort	Catch rate	Harvest rate	Catch	Harvest
1982	80,129		0.103		8,223
1984	108,024		0.091		9,869
1986	143,960		0.165		23,768
1988	163,669		0.045		7,416
1989	175,119	0.145	0.109	25,458	19,147
1990	164,916				
1991	194,088	0.212	0.165	41,204	32,111
1992	327,546	0.172	0.132	56,494	43,343
1993	271,088	0.079	0.055	21,326	14,816
1994	300,049	0.104	0.029	31,060	8,557
1995	215,518	0.134	0.081	28,939	17,445
1996	392,602	0.149	0.053	58,468	20,972
1997	220,263	0.192	0.103	42,315	22,631
1998	117,602	0.095	0.052	11,167	6,089
1999	140,363	0.166	0.109	23,293	15,285
2000	139,047	0.072	0.066	9,949	9,240
2001	77,074	0.013	0.012	982	938
2002	37,129	0.070	0.066	2,601	2,468
2003	16,237	0.020	0.004	321	70
2004	79,767	0.105	0.051	8,413	4,075
2005	58,091	0.059	0.034	3,450	1,947
2007	99,368	0.176	0.114	17,480	11,313
2009	128,415	0.114	0.083	14,666	10,695
2013	141,660	0.084	0.062	11,943	8,716
2014	204,283	0.097	0.069	19,740	14,044
2016	61,333	0.097*	0.069*	5,927	4,216
2020	54,246	0.110	0.040	5,973	2,183

*estimate, no angler interviews in 2016

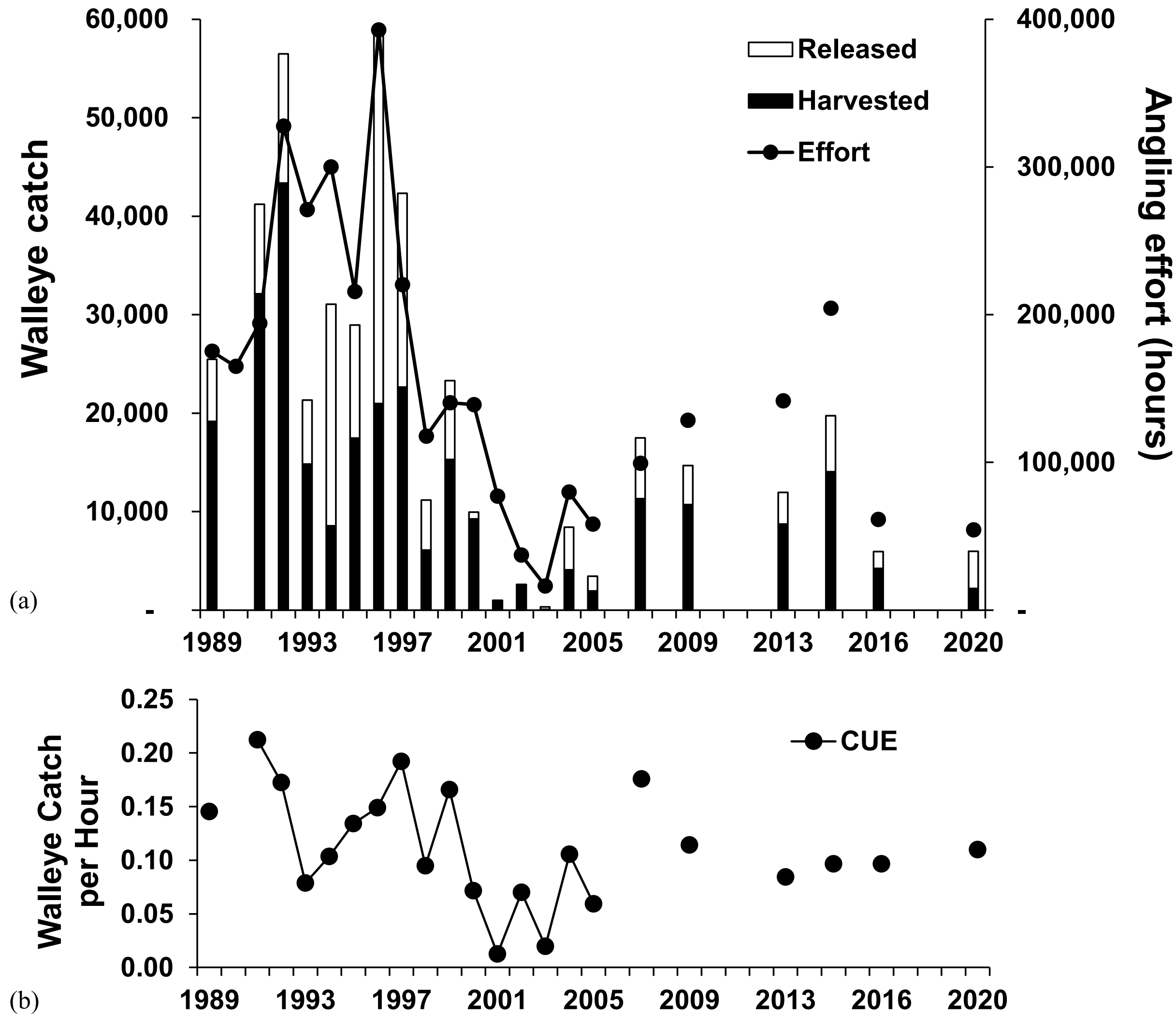

FIG. 2.2.2. (a) Trends in Walleye angling effort and catch (release and harvested) and (b) trends in Walleye CUE (catch per hour), 1988 - 2020 for the ice recreational fishery on the Bay of Quinte. Due to poor ice conditions, only aerial flights were conducted in 2016. 2020 was the first year the interview component of the survey was conducted at access points. No data for 2006, 2008, 2010, 2011, 2012, 2015, 2017, 2018 or 2019.

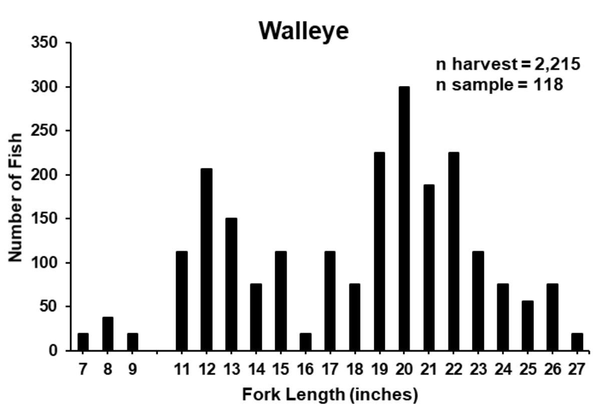

FIG. 2.2.3. Size distribution of Walleye harvested during the 2020 Bay of Quinte ice recreational fishery based on measuring 118 fish.

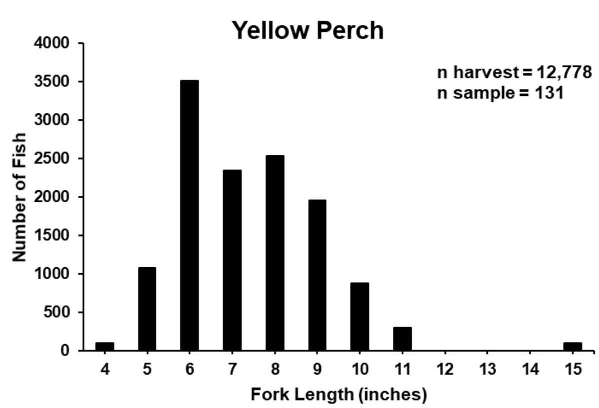

FIG. 2.2.4. Size distribution of Yellow Perch harvested during the 2020 Bay of Quinte ice recreational fishery based on measuring 131 fish.

2.3 Eastern Lake Ontario Volunteer Walleye Angler Diary Program

E. Brown, Lake Ontario Management Unit

A volunteer angler diary program was conducted during late-summer and fall 2020 on the Bay of Quinte and Kingston Basin, eastern Lake Ontario. The diary program focused on the popular late-summer and fall recreational fishery for "trophy" Walleye, primarily on the middle and lower reaches of Bay of Quinte. Increasingly in recent years, a late summer fishery for large migratory Walleye occurs in the Kingston Basin of eastern Lake Ontario; this component of the fishery was also targeted for volunteer anglers. This was the ninth year of the diary program. Anglers that volunteered to participate were given a personal diary and asked to record information about their daily fishing trips and catch (see Fig. 2.3.1). A total of 6 completed diaries were returned as of February 2020. We thank all volunteer anglers for participating in the program.

Objectives of the diary program included:

- engage and encourage angler involvement in monitoring the fishery;
- characterize late summer/fall Walleye angling effort, catch, and harvest (including geographic distribution);
- characterize the size distribution of Walleye caught (kept and released);
- characterize species catch composition.

Only fishing trips targeting walleye were examined. The number of fishing trips reported in each of the 6 diaries ranged from 5 to 31 trips. Fishing trips were reported for 40 out of a possible 126 calendar days from Aug 7 to Dec 11, 2020. There were one to five volunteer angler boats fishing on each of the 40 days, and a total of

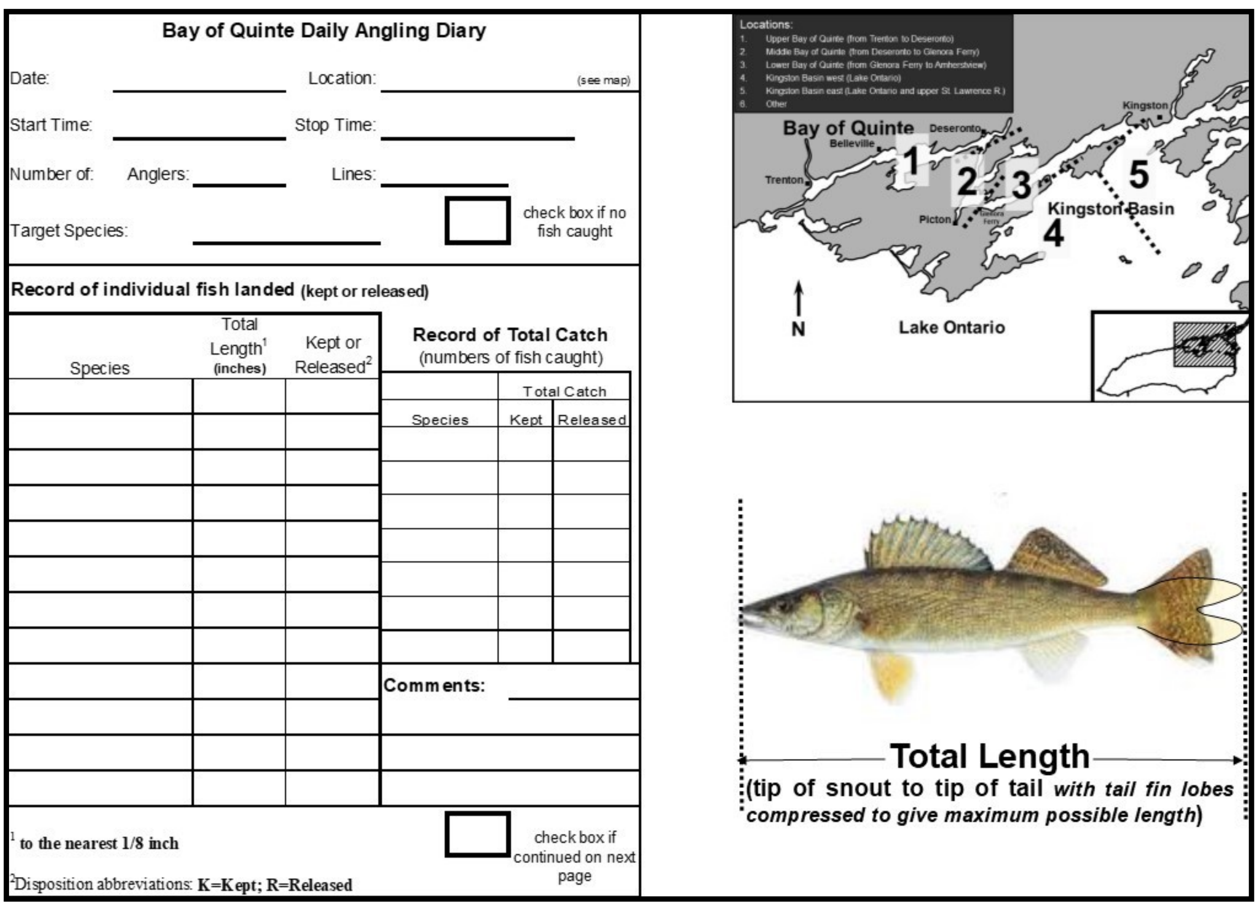

FIG. 2.3.1. Volunteer angler diary used to record information about daily fishing trips and catch.

69 trip reports targeting Walleye; 11 charter boat trips and 58 non-charter boat trips (Table 2.3.1). Of the 69 trips, 55 (80%) were made on Locations 2 and 3 (middle and lower reaches of the Bay of Quinte), and 12 trips (17%) were made in Locations 4 and 5 (Kingston Basin, eastern Lake Ontario; see Fig. 2.3.1). The overall average fishing trip duration was 6.9 hours for charter boats and 3.7 hours for non-charter boats, and the average numbers of anglers per boat trip were 4.8 and 1.6 for charter and non-charter boats, respectively (Table 2.3.1). In Locations 3, 4 and 5, where two lines are permitted, most anglers used two lines.

Fishing Effort and Catch

A total of 769 angler hours of fishing effort was reported by volunteer anglers (Table 2.3.2). Eight species and a total of 186 fish were reported caught by volunteer anglers. The number of Walleye caught was 117; 29 (25%) kept and 88 (75%) released (Table 2.3.3). The next most abundant species caught was Freshwater Drum (52) followed by White Perch (10).

Fishing Success

The overall fishing success for Walleye in fall 2020 was 1.7 Walleye per boat trip or 0.152 fish per angler hour of fishing (Table 2.3.2). Eighty-four percent of all boat trips reported catching at least one Walleye ("skunk rate" 16%).

Length Distribution of Walleye Caught

In 2020, eighty-nine percent of Walleye caught by volunteer anglers were between 11 and 29 inches total length. Over the nine years of the volunteer angler diary program 3,883 Walleye lengths have been reported (Fig. 2.3.2). The proportion of Walleye released was highest for smallest and largest fish and lowest for fish of intermediate size. Only 26% of fish caught that were between 16 and 25 inches were released. In contrast, 66% of fish less than 16 inches and 69% of fish greater than 25 inches were released.

TABLE 2.3.1. Reported total number of boat trips, average trip duration, and average number of anglers per trip for charter and non-charter Walleye fishing trips during late summer and fall 2012-2020 on the Bay of Quinte and the Kingston Basin, eastern Lake Ontario.

Year	Trip type	Total number of boat trips	Average trip duration (hours)	Average number of anglers per trip
2012	Charter	121	7.7	4.4
	Non-charter	137	5.6	2.3
2013	Charter	72	7.4	4.0
	Non-charter	83	4.9	2.1
2014	Charter	123	7.4	4.4
	Non-charter	87	5.3	2.3
2015	Charter	118	7.5	4.3
	Non-charter	115	5.2	1.9
2106	Charter	33	7.2	4.7
	Non-charter	62	4.5	1.8
2017	Charter	77	6.2	4.0
	Non-charter	87	6.0	2.0
2018	Charter	25	7.2	4.8
	Non-charter	101	5.3	2.2
2019	Charter	8	7.1	5.6
	Non-charter	154	5.7	2.3
2020	Charter	11	6.9	4.8
	Non-charter	58	3.7	1.6

TABLE 2.3.2. Reported total number of diaries (with at least one reported fishing trip), boat trips and effort, total angler effort, total number of Walleye caught, harvested, and released, average number of Walleye caught per boat fishing trip, average number of Walleye caught per boat hour, average number of Walleye caught per angler hour, and the "skunk" rate (percentage of trips with no Walleye catch) for Walleye fishing trips during late summer and fall 2012-2020 on the Bay of Quinte and the Kingston Basin, eastern Lake Ontario.

	Year								
Statistic	2012	2013	2014	2015	2016	2017	2018	2019	2020
Number of diaries	22	19	20	22	11	20	16	21	6
Number of boat trips	258	155	210	235	93	164	126	162	69
Boat effort (hours)	1,694	941	1,375	1,506	498	1,001	719	297	292
Angler effort (hours)	5,915	3,093	5,164	5,266	1,602	3,262	2,143	2,383	769
Catch	542	574	682	436	184	604	387	489	117
Harvest	291	307	336	285	112	350	186	199	29
Released	251	267	346	151	72	254	201	290	88
Fish per boat trip	2.1	3.7	3.2	1.9	2.0	3.7	3.1	3.0	1.7
Fish per boat hour	0.305	0.557	0.463	0.307	0.289	0.601	0.615	0.530	0.401
Fish per angler hour	0.102	0.193	0.137	0.138	0.122	0.210	0.279	0.240	0.152
"Skunk rate"	36%	19%	27%	34%	44%	24%	25%	27%	16%

TABLE 2.3.3. Number of fish, by species, reported caught (kept and released) by volunteer anglers during late summer and fall 2012-2020 on the Bay of Quinte - Eastern Lake Ontario.

	2012		2013		2014		2015		2016		2017		2018		2109		2020	
Species	Kept	Released	Kept	Released	Kept	Released	Kept	Released	Kept	Released	Kept	Released	Kept	Released	Kept	Released	Kept	Released
Alewife	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Black crappie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Bowfin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Brown trout	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0
Chinook salmon	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Freshwater drum	1	43	0	25	1	53	8	81	0	38	0	58	0	37	0	74	0	52
Lake trout	0	1	0	0	0	4	3	10	0	1	1	6	0	0	0	2	0	0
Lake whitefish	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Largemouth bass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
Longnose gar	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Morone sp.	1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tiger Muskellunge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Northern pike	1	47	4	20	2	36	2	14	1	18	1	9	0	19	1	11	0	2
Rainbow trout	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Rock bass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Smallmouth bass	0	0	0	3	1	2	0	1	1	1	0	8	0	6	1	10	0	0
Sunfish	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0
Walleye	292	252	307	267	338	350	285	151	112	72	350	254	186	201	199	290	29	88
White bass	0	0	0	3	0	7	9	5	0	5	6	8	5	6	5	44	0	3
White perch	0	0	0	12	0	0	1	0	0	11	0	0	0	2	0	9	0	10
Yellow perch	4	32	2	6	0	0	1	0	0	0	0	0	0	1	8	64	0	0

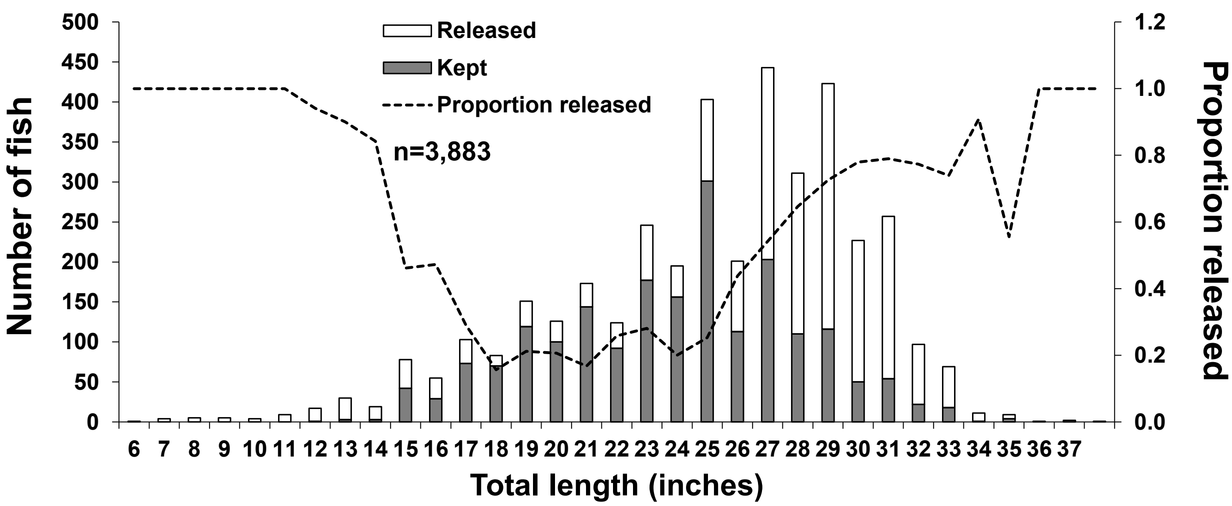

FIG. 2.3.2. Length distribution of 3,883 Walleye caught (kept and released) by volunteer Walleye anglers during late summer and fall 2012-2020on the Bay of Quinte and the Kingston Basin, eastern Lake Ontario. Also shown is the proportion of fish released (dotted line)

3. Commercial Fishery

3.1 Lake Ontario and St. Lawrence River Commercial Fishing Liaison Committee

S. McNevin, Lake Ontario Management Unit

The Lake Ontario and St. Lawrence River Commercial Fishery Liaison Committee (LOLC) consists of Ontario Commercial Fishing License holders that are appointed to represent each of the quota zones, as well as representatives of the Ontario Commercial Fisheries' Association, and MNRF. This committee provides advice to the Lake Ontario Manager on issues related to management of the commercial fishery and provides a forum for dialogue between the MNRF and the commercial industry.

The Lake Ontario Commercial Fishery Annual General Meeting (CFAGM) was cancelled due to COVID-19.

In absence of a CFAGM a news letter was created and distributed in spring 2021. Topics included commercial harvest summaries, an update on the commercial fish net marking initiative to standardize the marking of commercial nets across the province, the implementation of new recreational bass fishing regulations in FMZ 20, a commercial net turtle bycatch update for 2020, overview of the American eel trap and transfer program and the announcement of new MNRF trawling sites in the Bay of Quinte associated with the Bi-National Prey Fish Survey to insure ongoing communications of MNRF netting/trawling activities within commercial fishing areas and seasons.

3.2 Quota and Harvest Summary

E. Brown, Lake Ontario Management Unit

Lake Ontario supports a commercial fish industry; the commercial harvest comes from the Canadian waters of Lake Ontario east of Brighton (including the Bay of Quinte, East and West Lakes) and the St. Lawrence River (Fig. 3.2.1). The waters west of Brighton (quota zone 1-8) currently have no commercial licences. Commercial harvest statistics for 2020 were obtained from the commercial fish harvest information system (CFHIS) which is managed, by MNRF. Commercial quota, harvest and landed value statistics for Lake Ontario, the St. Lawrence River and East and West Lakes, for 2020, are shown in Tables 3.2.1 (base quota), 3.2.2 (issued quota), 3.2.3 (harvest) and 3.2.4 (landed value).

The total harvest (landed value) of all species was 256,893 lb ($410,188) in 2020, down 121,379 lb (32%) from 2019. The harvest (landed value) for Lake Ontario and the St. Lawrence River was 209,374 lb ($330,197) and 47,519 lb ($80,492) (Fig. 3.2.2 and Fig. 3.2.3). There was no harvest in East and West Lake. Lake Whitefish, Yellow Perch, Walleye, Freshwater Drum, and White Perch were the dominant species in the harvest for Lake Ontario. Yellow Perch was dominant in the St. Lawrence River followed by Brown Bullhead.

Major Fishery Trends

Harvest and landed value trends for Lake Ontario (Embayments included) and the St. Lawrence River are shown in Fig. 3.2.4 and Fig. 3.2.5. Having declined in the early 2000s, commercial harvest appeared to have stabilized over the 2003-2013 time-period at about 400,000 lb and 150,000 lb for Lake Ontario (Fig. 3.2.4) and the St. Lawrence River (Fig. 3.2.5) respectively. In 2014, harvest declined again in both major geographic areas. In 2015, harvest

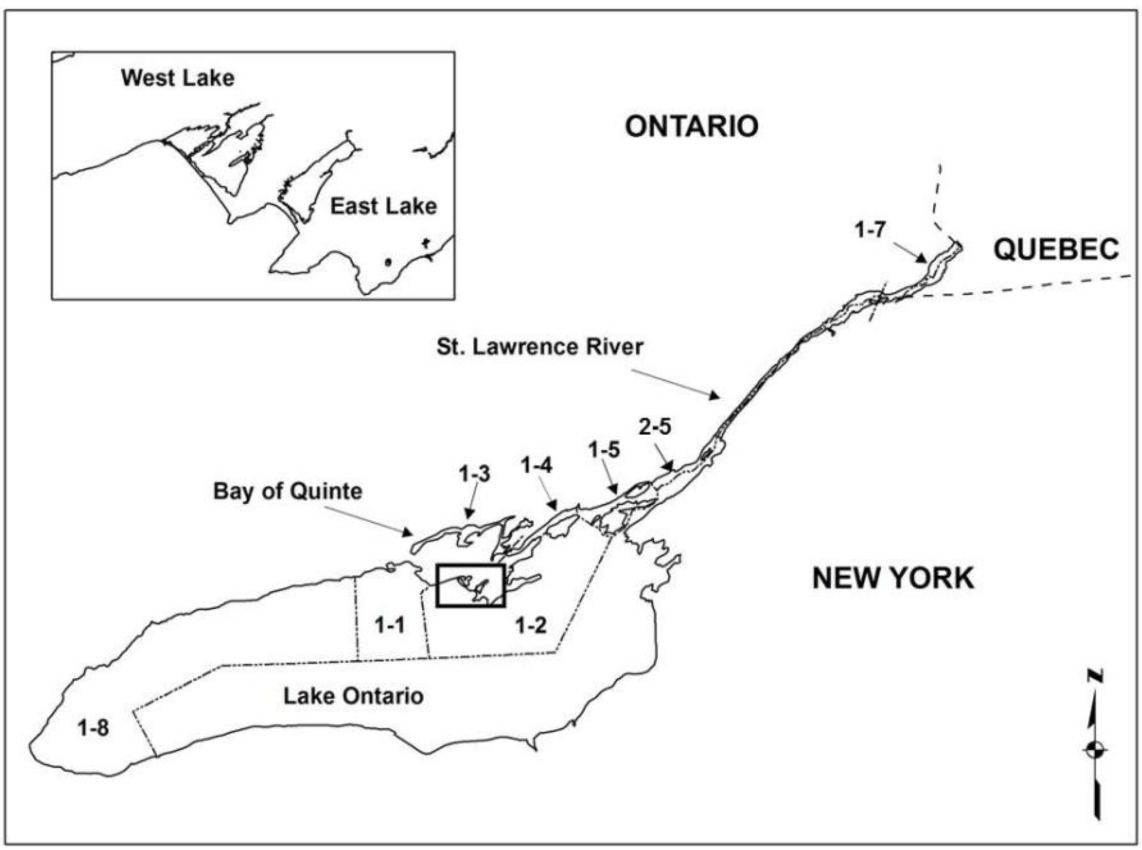

FIG. 3.2.1. Map of Lake Ontario and the St. Lawrence River showing commercial fishing quota zones in Canadian waters.

TABLE 3.2.1. Commercial fish **base quota** (lb), by quota zone, in the Canadian waters of Lake Ontario and the St. Lawrence River, East and West Lakes (two Lake Ontario embayments), 2020.

	Lake Ontario				St. Lawrence River			East Lake	West Lake	Base Quota by Waterbody		
Species	1-1	1-2	1-3	1-4	1-5	2-5	1-7	1	1	Lake Ontario	St. Lawrence River	Total
Black Crappie	4,540	3,000	14,823	1,100	14,170	17,590	4,840	3,100	9,850	23,463	36,600	73,013
Lake Whitefish	6,548	97,743	12,307	18,282	0	0	0	0	0	134,879	0	134,879
Sunfish	28,130	0	0	0	0	0	0	14,600	18,080	28,130	0	60,810
Walleye	4,209	32,930	0	10,953	0	0	0	0	0	48,092	0	48,092
Yellow Perch	18,222	73,458	88,817	88,824	51,789	53,001	14,438	896	2,829	269,320	119,228	392,273
Total	61,649	207,130	115,947	119,158	65,959	70,591	19,278	18,596	30,759	503,884	155,828	709,067

TABLE 3.2.2. Commercial fish **issued quota** (lb), by quota zone, in the Canadian waters of Lake Ontario and the St. Lawrence River, East and West Lakes (two Lake Ontario embayments), 2020.

	Lake Ontario				St. Lawrence River			East Lake	West Lake	Issued Quota by Waterbody		
Species	1-1	1-2	1-3	1-4	1-5	2-5	1-7	1	1	Lake Ontario	St. Lawrence River	Total
Black Crappie	2,270	1,500	9,406	550	7,085	8,795	4,840	3,100	9,850	13,726	20,720	47,396
Lake Whitefish	2,067	150,639	6,302	8,735	0	0	0	0	0	167,744	0	167,744
Sunfish	28,130	0	0	0	0	0	0	14,600	18,080	28,130	0	60,810
Walleye	2,095	14,479	0	32,418	0	0	0	0	0	48,993	0	48,993
Yellow Perch	10,354	38,823	70,280	54,429	33,740	33,655	14,439	896	2,829	173,885	81,834	259,444
Total	44,916	205,442	85,987	96,133	40,825	42,450	19,279	18,596	30,759	432,477	102,554	584,386

TABLE 3.2.3. Commercial **harvest** (lb), by quota zone, for fish species harvested from the Canadian waters of Lake Ontario and the St. Lawrence River, East and West Lakes (two Lake Ontario embayments), 2020.

	Lake Ontario				St. Lawrence River			East Lake	West Lake	Totals		
Species	1-1	1-2	1-3	1-4	1-5	2-5	1-7	1	1	Lake Ontario	St. Lawrence River	All Waterbodies
Black Crappie	14	0	2,888	1	190	167	791	0	0	2,903	1,148	4,051
Bowfin	0	0	520	0	2,201	1,560	147	0	0	520	3,908	4,428
Brown Bullhead	7	8	2,325	26	2,691	983	5,096	0	0	2,366	8,770	11,136
Channel Catfish	0	0	0	0	0	13	0	0	0	0	13	13
Cisco	21	292	63	539	0	0	0	0	0	915	0	915
Common Carp	0	27	629	0	0	0	0	0	0	656	0	656
Freshwater Drum	28	16	6,081	4,981	0	0	0	0	0	11,106	0	11,106
Lake Whitefish	34	100,436	308	677	0	0	0	0	0	101,455	0	101,455
Northern Pike	734	132	4,004	674	0	0	0	0	0	5,544	0	5,544
Rock Bass	708	235	1,520	743	629	685	195	0	0	3,206	1,509	4,715
Sunfish	313	3	7,728	0	154	1,032	504	0	0	8,044	1,690	9,734
Walleye	197	2,385	0	19,731	0	0	0	0	0	22,313	0	22,313
White Bass	0	3	1	1,613	0	0	0	0	0	1,617	0	1,617
White Perch	20	17	4,759	5,435	0	0	0	0	0	10,231	0	10,231
White Sucker	216	0	321	192	0	0	0	0	0	729	0	729
Yellow Perch	785	3,244	13,423	20,317	9,150	10,137	11,194	0	0	37,769	30,481	68,250
Total	3,077	106,798	44,570	54,929	15,015	14,577	17,927	0	0	209,374	47,519	256,893

declined in the St. Lawrence River and increased slightly in Lake Ontario. Harvest increased significantly in both areas in 2016-2017 and declined in 2018 in both geographic areas. In 2019, harvest increased in Lake Ontario and decreased in St. Lawrence River. Harvest increased slightly in 2020 in the St. Lawrence River and declined in Lake Ontario and in the Embayments.

Major Species

For major species, commercial harvest relative to issued and base quota information, including annual trends, is shown in Fig. 3.2.6 to Fig. 3.2.19. Price-per-lb trends are also shown. Species-specific price-per-lb values are means across quota zones within a major waterbody (i.e., Lake Ontario and the St. Lawrence River).

TABLE 3.2.4. Commercial **harvest (lb), price per lb, and landed value** for fish species harvested from the Canadian waters of Lake Ontario and the St. Lawrence River, and the total for all waterbodies including East and West Lakes, 2020.

	Lake Ontario			St. Lawrence River			All Waterbodies		
Species	Harvest	Price per lb	Landed value	Harvest	Price per lb	Landed value	Harvest	Price per lb	Landed value
Black Crappie	2,903	$3.00	$8,696	1,148	$2.85	$3,272	4,051	$2.92	$11,833
Bowfin	520	$0.20	$104	3,908	$0.68	$2,674	4,428	$0.62	$2,755
Brown Bullhead	2,366	$0.23	$546	8,770	$0.46	$4,052	11,136	$0.41	$4,556
Channel Catfish	0			13	$1.00	$13	13	$1.00	$13
Cisco	915	$0.29	$269	0			915	$0.29	$269
Common Carp	656	$0.18	$117	0			656	$0.18	$117
Freshwater Drum	11,106	$0.10	$1,102	0			11,106	$0.10	$1,102
Lake Whitefish	101,455	$1.54	$156,510	0			101,455	$1.54	$156,510
Northern Pike	5,544	$0.23	$1,248	0			5,544	$0.23	$1,248
Rock Bass	3,206	$0.63	$2,023	1,509	$0.70	$1,049	4,715	$0.65	$3,074
Sunfish	8,044	$1.22	$9,781	1,690	$1.17	$1,982	9,734	$1.20	$11,664
Walleye	22,313	$1.83	$40,900	0			22,313	$1.83	$40,900
White Bass	1,617	$0.61	$979	0			1,617	$0.61	$979
White Perch	10,231	$0.43	$4,438	0			10,231	$0.43	$4,438
White Sucker	729	$0.15	$109	0			729	$0.15	$109
Yellow Perch	37,769	$2.74	$103,373	30,481	$2.21	$67,451	68,250	$2.50	$170,621
Total	209,374		$330,197	47,519		$80,492	256,893		$410,188

Yellow Perch

Yellow Perch 2020 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.6. Overall, 17% (68,250 lb) of the Yellow Perch base quota (392,273 lb) was harvested in 2020, down 23% from the previous year. The highest Yellow Perch harvest came from quota zones 1-4. All but one quota zone (1-7) harvested less than 25% of base quota. Trends in Yellow Perch quota (base), harvest and price-per-lb are shown Fig. 3.2.7. In 2019, quota was reduced 20% in quota zone 1-7 and left unchanged in all other quota zones. Harvest decreased in 2020 in all quota zones except 1-2, 1-5, 2-5 and 1-7(Fig. 3.2.7). Yellow Perch price-per-lb has been trending higher for the last number of years.

Lake Whitefish

Lake Whitefish 2020 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.8. Overall, 75% (101,455 lb) of the Lake Whitefish base quota was harvested in 2020. Most of the Lake Whitefish harvest came from quota zone 1-2. Lake Whitefish is managed as one population across quota zones. Therefore, quota can be transferred among quota zones. Issued quota and harvest was higher than base quota in quota zone 1-2 (Fig. 3.2.8). Relatively small proportions of base quota were harvested in quota zones 1-1, 1-3 and 1-4. Trends in Lake Whitefish quota (base), harvest and price-per-lb are shown in Fig. 3.2.9. Base quota remained unchanged in 2020 compared to 2019.

Seasonal whitefish harvest and biological attributes (e.g., size and age structure) information are reported in Section 3.3. Lake Whitefish price-per-lb has been trending up since 2004 with a slight decreasing trend since 2018.

Walleye

Walleye 2020 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.10. Walleye harvest decreased slightly in 2020. Overall, 46% (22,313 lb) of the Walleye base quota (48,092 lb) was harvested. The highest Walleye harvest came from quota zone 1-4. Very small proportions of base quota were harvested in quota zones 1-1 and 1-2. Walleye (like Lake Whitefish) is managed as one fish population across quota zones. Therefore, quota can be

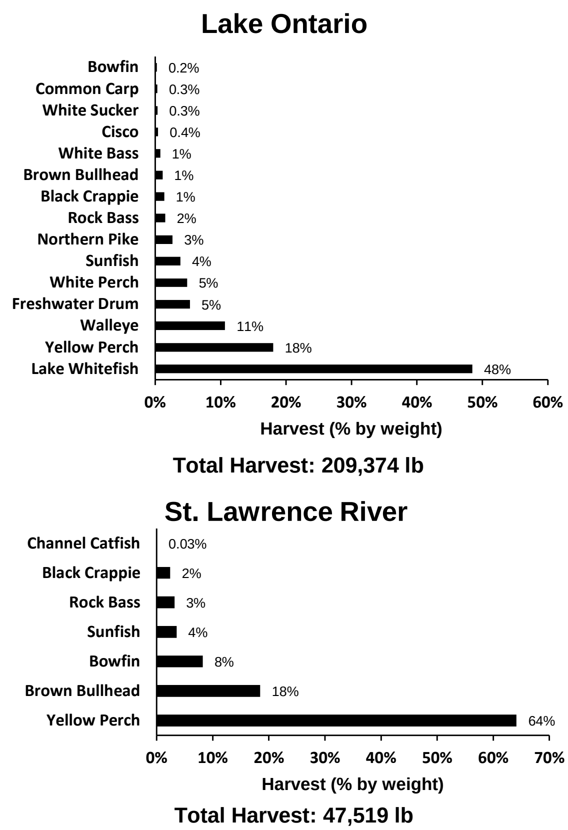

FIG. 3.2.2. Breakdown of 2020 commercial harvest by species **(% by weight)** for Lake Ontario (quota zones 1-1, 1-2, 1-3, 1-4 and 1-8) and the St. Lawrence River (quota zones 1-5, 2-5 and 1-7)

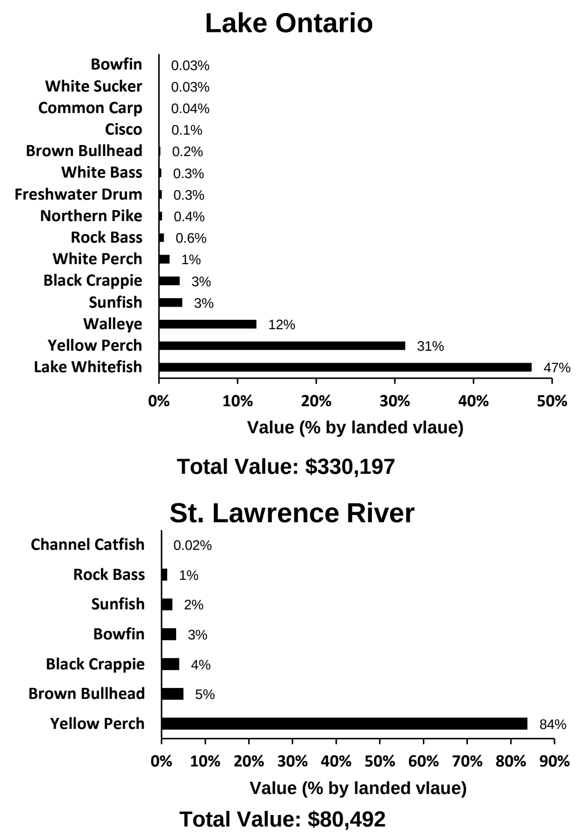

FIG. 3.2.3. Breakdown of 2020 commercial harvest by species **(% by landed value)** for Lake Ontario (quota zones 1-1, 1-2, 1-3, 1-4 and 1-8), the St. Lawrence River (quota zones 1-5, 2-5 and 1-7)

transferred among quota zones 1-1, 1-2 and 1-4. In 2020, this resulted in issued quota and harvest being considerably higher than base quota in quota zone 1-4 (Fig. 3.2.10). Trends in Walleye quota (base), harvest and price-per-lb are shown in Fig. 3.2.11. Quota has remained constant since the early 2000s (just under 50,000 lb for all quota zones combined). Walleye price-per-lb has been trending higher for the last number of years but decreased in 2020.

Black Crappie

Black Crappie 2020 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.12. Overall, only 6% (4,051 lb) of the Black Crappie base quota (73,013) was harvested in 2020. The highest Black Crappie harvest came from quota zone 1-3. Trends in quota (base), harvest and price-per-lb are shown in Fig. 3.2.13. Black Crappie harvest has been trending down in quota zone 1-3 and though price-per-lb remains high, there was a slight decrease in 2020.

Sunfish

Sunfish 2020 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.14. Only quota zones 1-1 (embayment areas only), East Lake and West Lake have quotas for Sunfish; quota is unlimited in the other zones. Most Sunfish harvest was from quota zone 1-3. Trends in Sunfish quota (base), harvest and price-per-lb are shown in Fig. 3.2.15. In 2020, harvest decreased in quota zone 1-3 and price-per-lb is currently high and stable.

Brown Bullhead

Brown Bullhead 2020 commercial harvest by quota zone and total for all quota zones combined is shown in Fig. 3.2.16. Quota was removed in quota zones 1-1, East Lake and West Lake in 2016 and is now unlimited in all zones. In 2020, the highest Brown Bullhead harvest came from quota zone 1-7. Trends in Brown Bullhead quota (base), harvest and price-per-lb

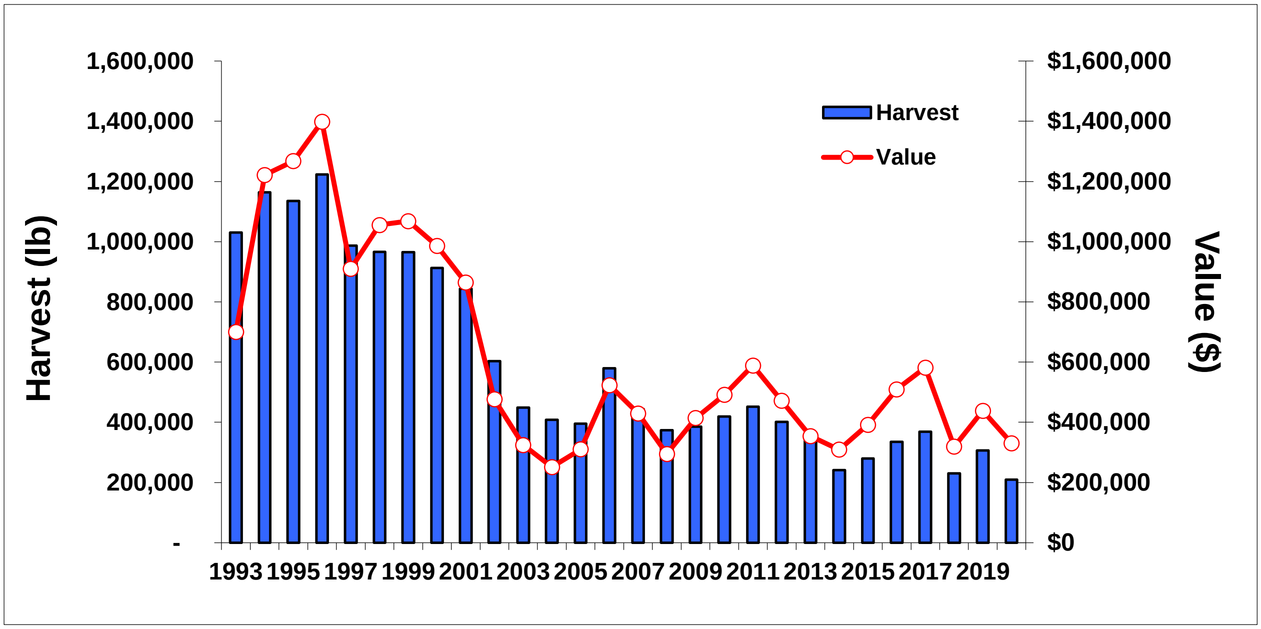

FIG. 3.2.4. Total commercial fishery harvest and value for **Lake Ontario** (Quota Zones 1-1, 1-2, 1-3 ,1-4 and 1-8) and **Embayments** (Quota Zones East Lake and West Lake), 1993-2020.

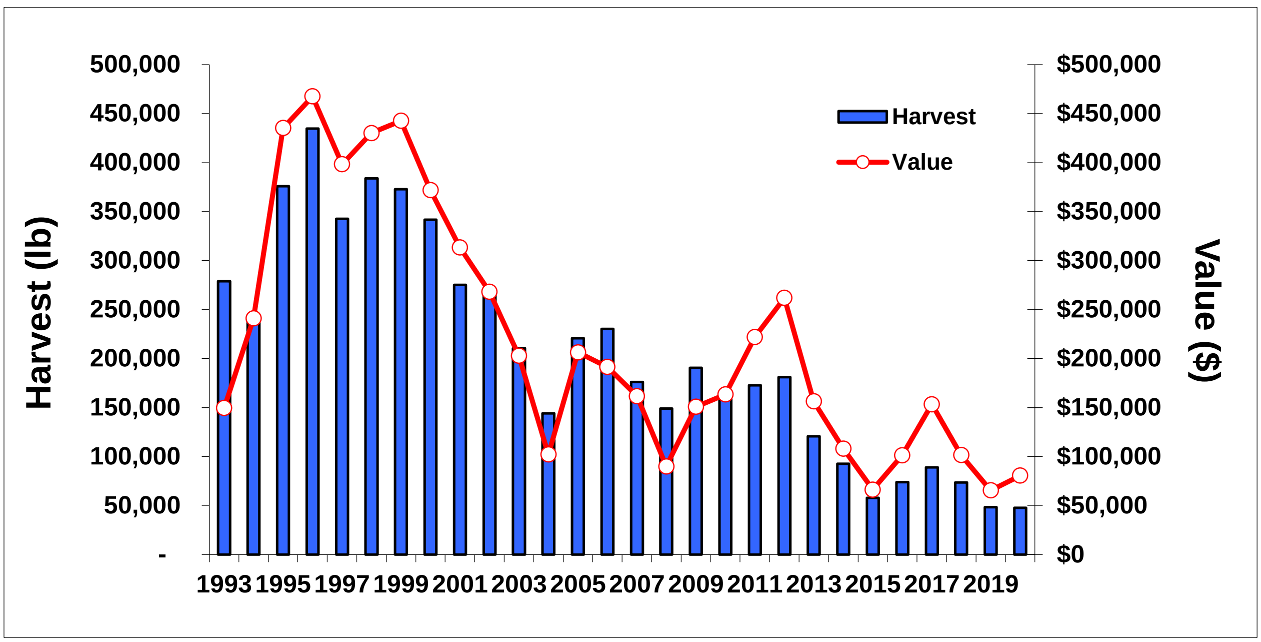

FIG. 3.2.5. Total commercial fishery harvest and value for the **St. Lawrence River** (Quota Zones 1-5, 2-5 and 1-7), 1993-2020.

are shown in Fig. 3.2.17. Current harvest levels are extremely low relative to past levels.

Northern Pike

Northern Pike 2020 commercial harvest by quota zone is shown in Fig. 3.2.18. Highest pike harvest came from quota zone 1-3. Trends in Northern Pike harvest and price-per-lb are shown in Fig. 3.2.19. Harvest remains low as compared to previous years. Norther Pike is managed as an incidental harvest fishery. In 2018-2020, the harvest season was closed from April 1st to the first Saturday in May. Historically, this time period accounted for a significant amount of the annual harvest.

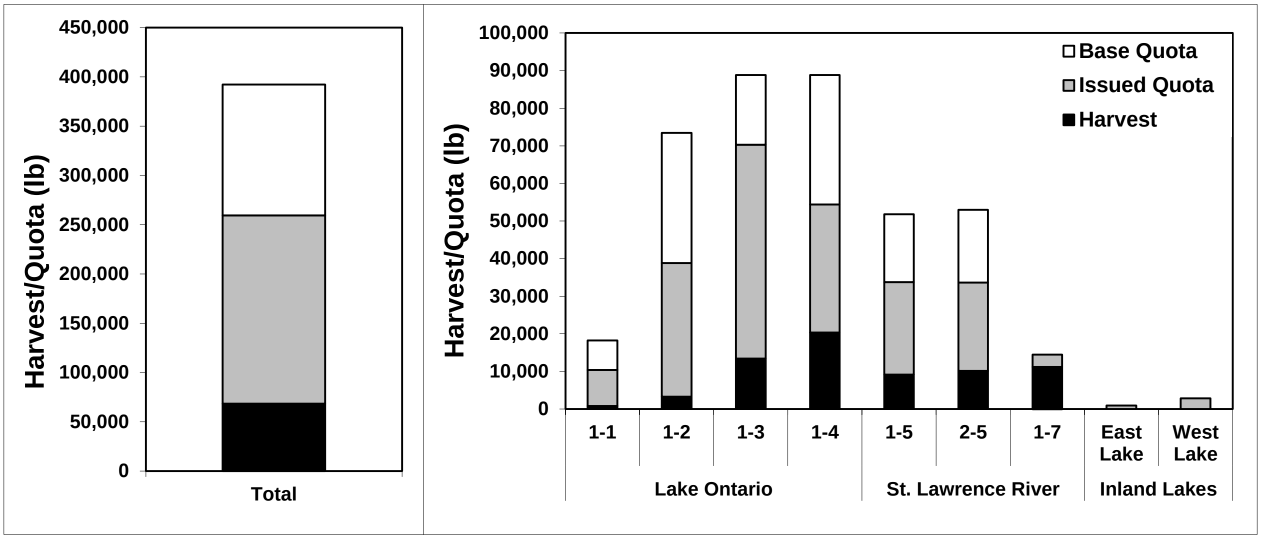

FIG. 3.2.6. **Yellow Perch** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2020.

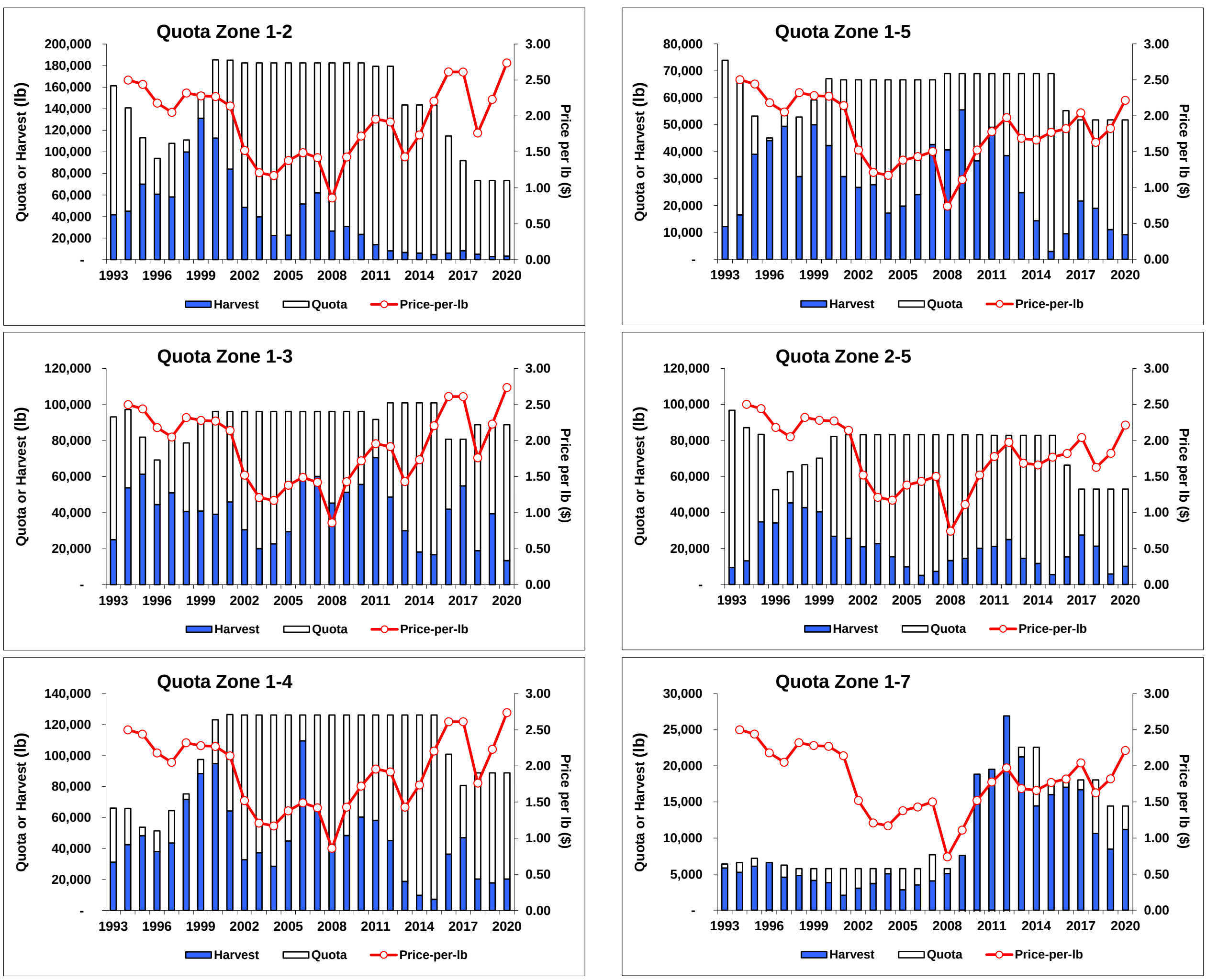

FIG. 3.2.7. Commercial base quota, harvest and price-per-lb for **Yellow Perch** in Quota Zones 1-2, 1-3, 1-4, 1-5, 2-5 and 1-7, 1993-2020.

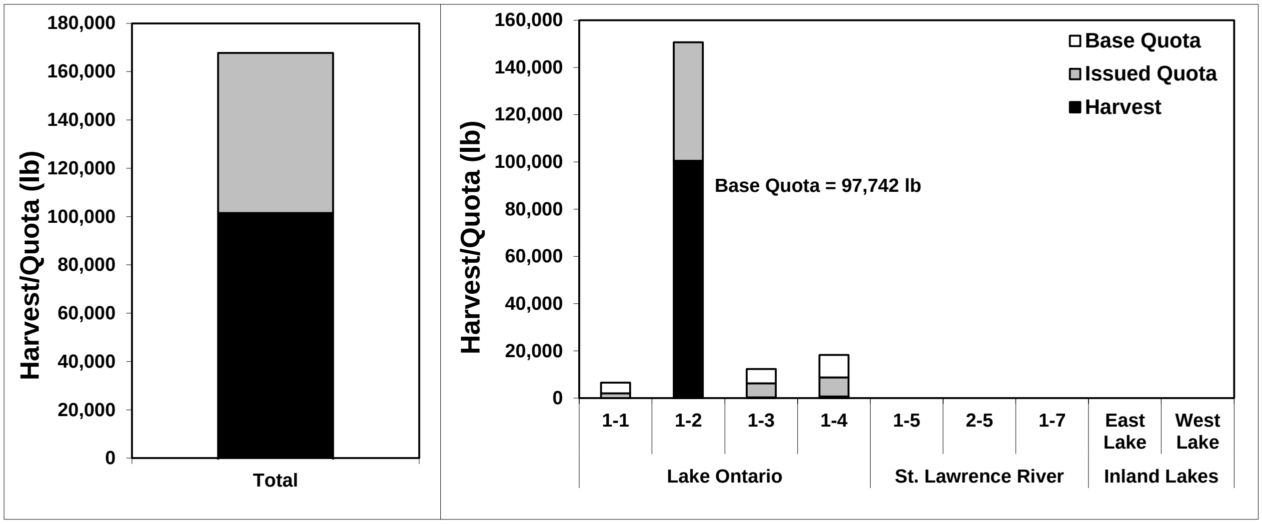

FIG. 3.2.8. **Lake Whitefish** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2020.

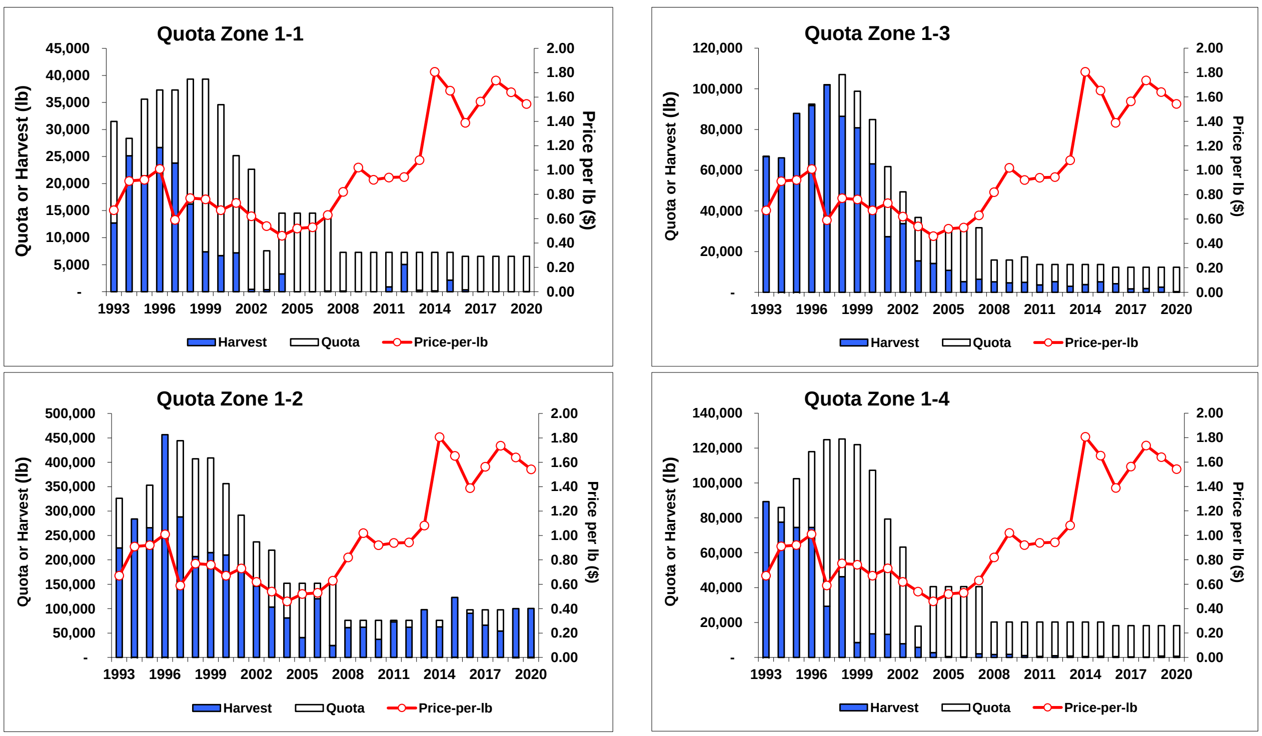

FIG. 3.2.9. Commercial base quota, harvest and price-per-lb for **Lake Whitefish** in Quota Zones 1-1, 1-2, 1-3 and 1-4, 1993-2020.

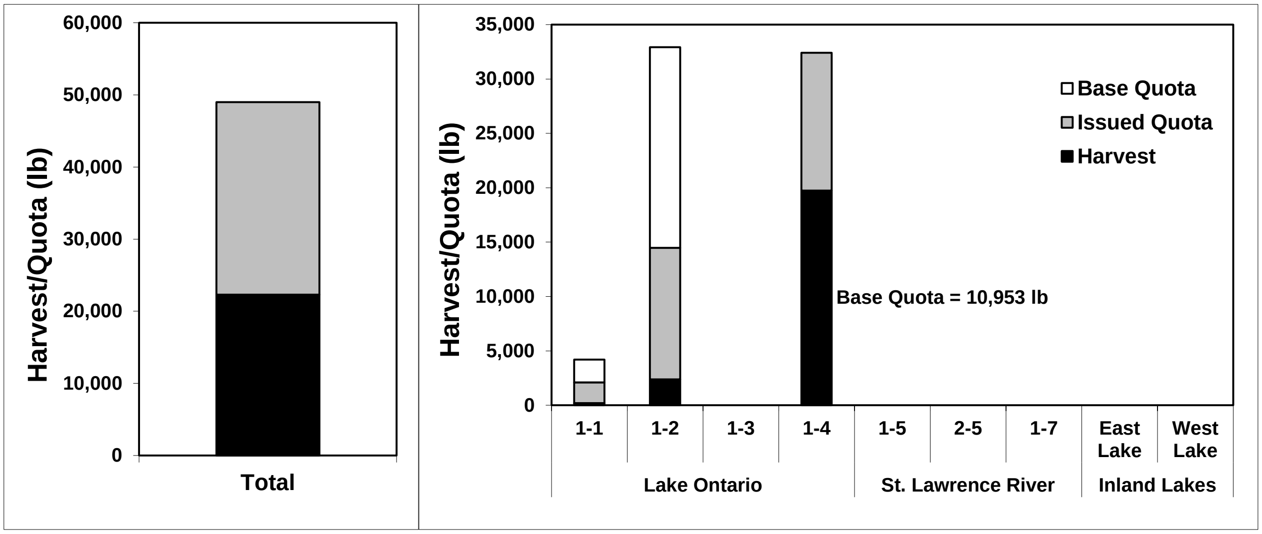

FIG. 3.2.10. **Walleye** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2020.

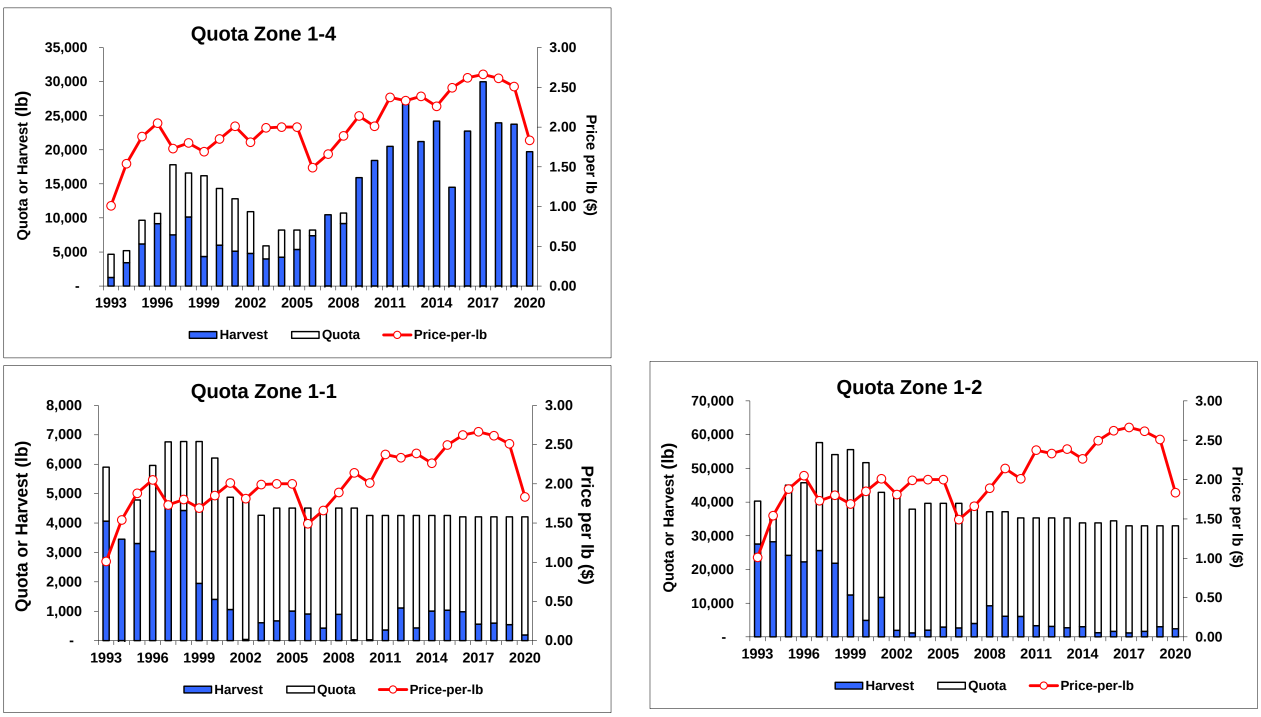

FIG. 3.2.11. Commercial base quota, harvest and price-per-lb for **Walleye** in Quota Zones 1-1, 1-2 and 1-4, 1993-2020.

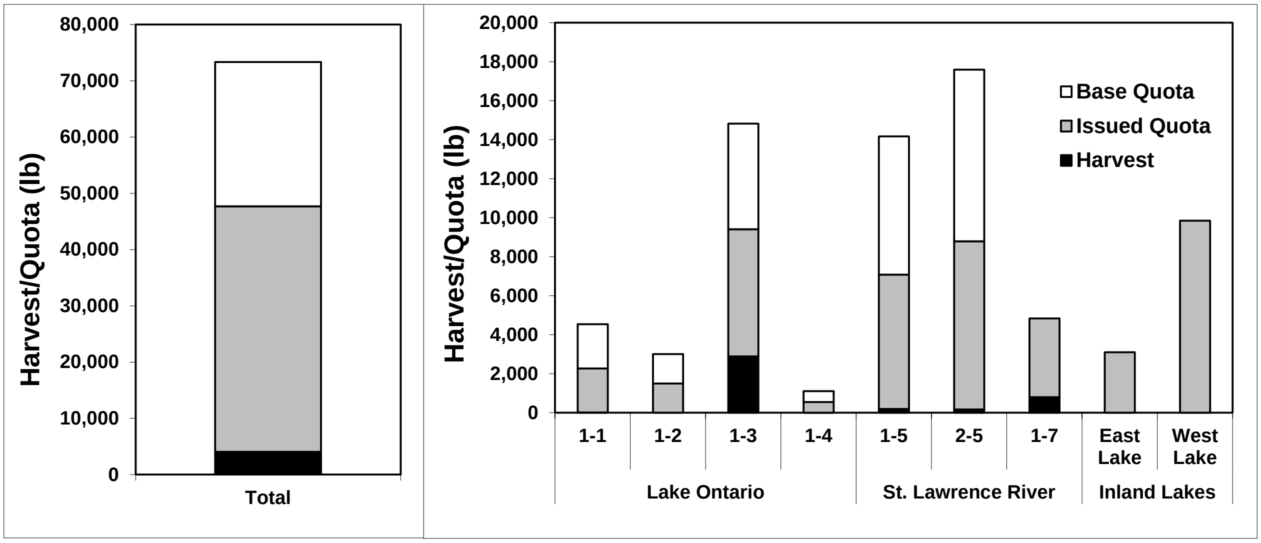

FIG. 3.2.12. **Black Crappie** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2020.

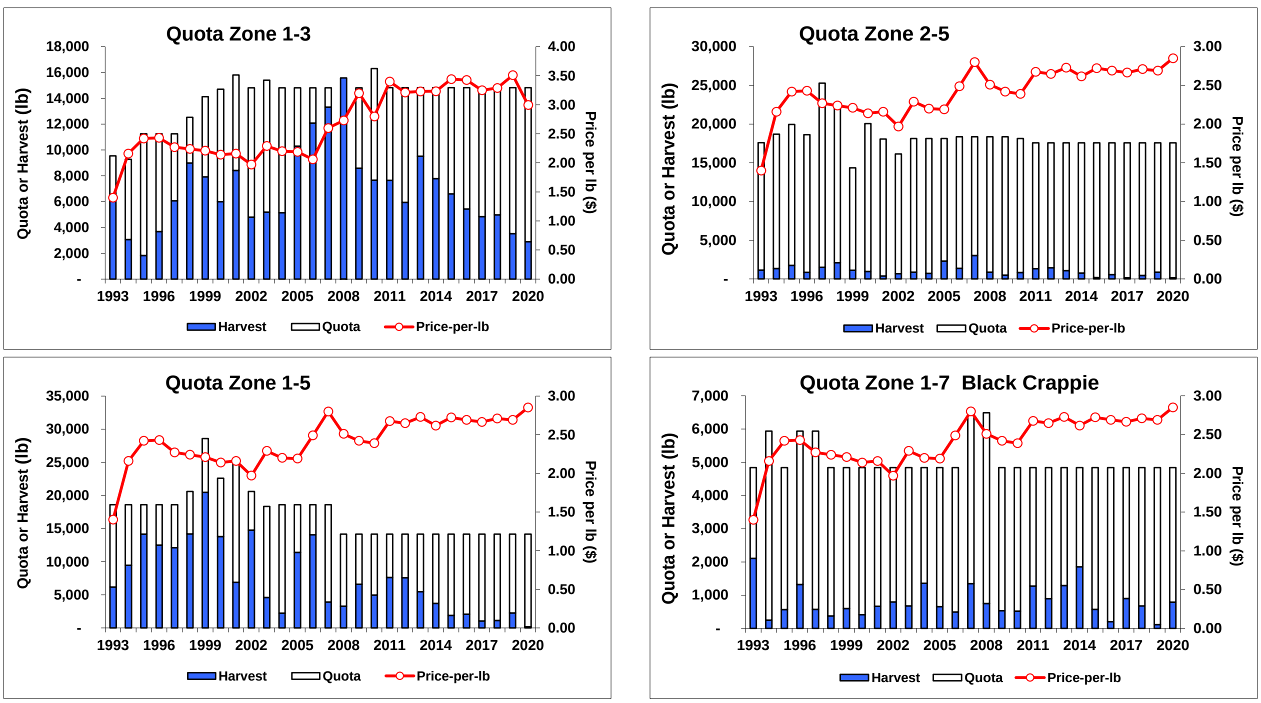

FIG. 3.2.13. Commercial base quota, harvest and price-per-lb for **Black Crappie** in Quota Zones 1-3, 1-5, 2-5 and 1-7, 1993-2020.

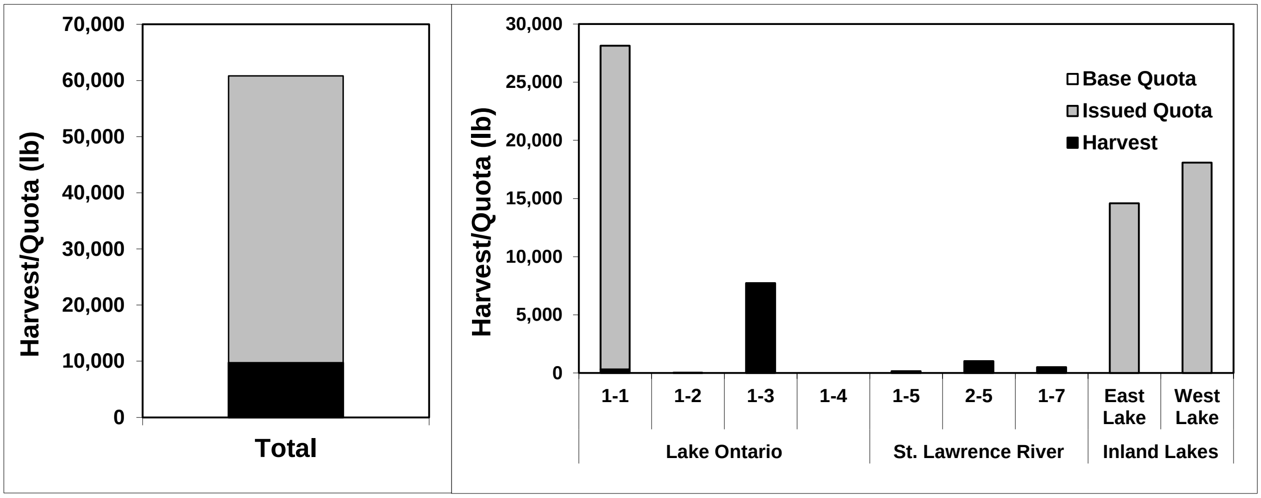

FIG. 3.2.14. **Sunfish** commercial harvest relative to issued and base quota for quota zones 1-1, East Lake and West Lake, 2020. The remaining quota zones have unlimited quota.

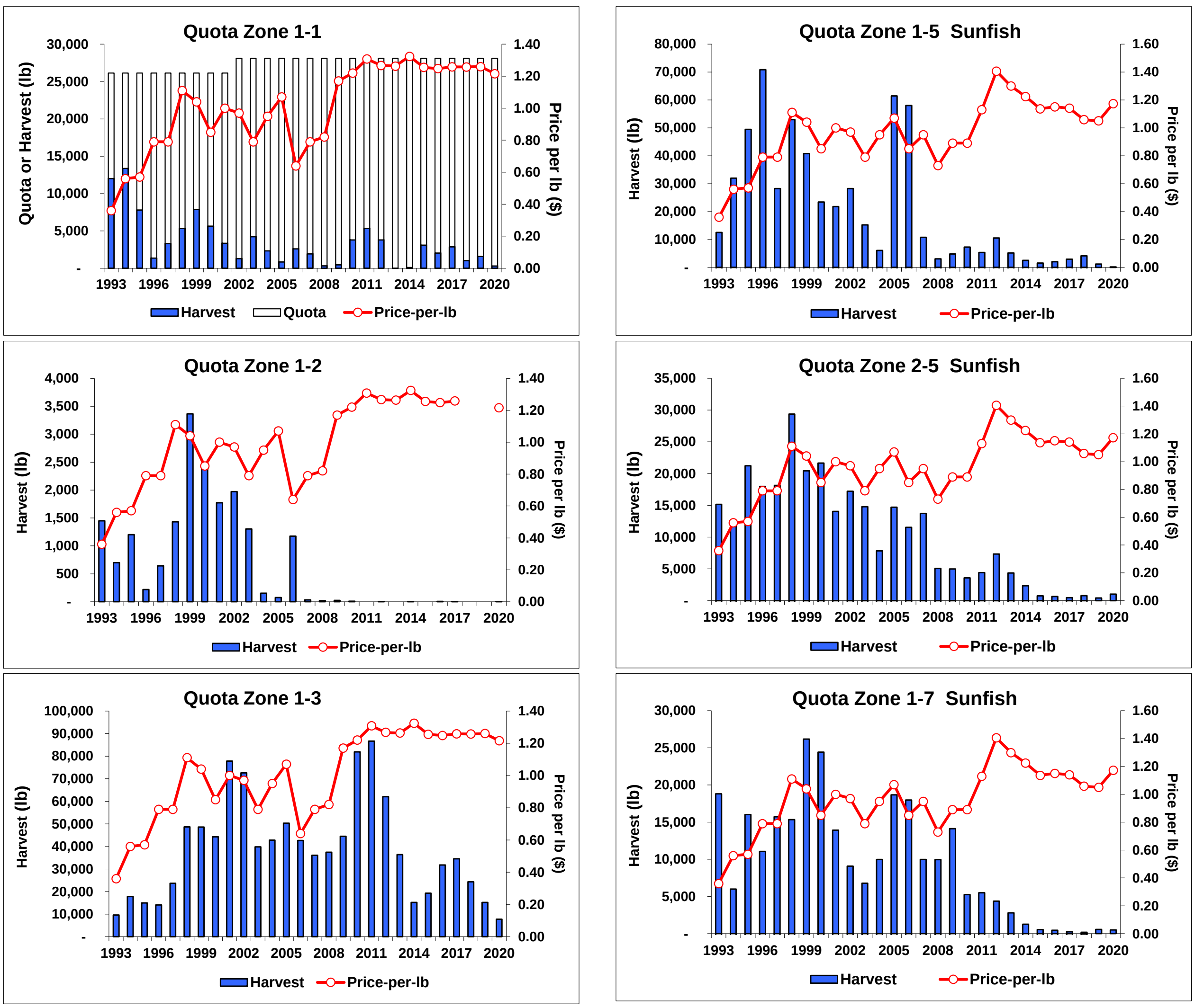

FIG. 3.2.15. Commercial base quota, harvest and price-per-lb for **Sunfish** in Quota Zones 1-1, 1-2, 1-3, 1-5, 2-5 and 1-7, 1993-2020.

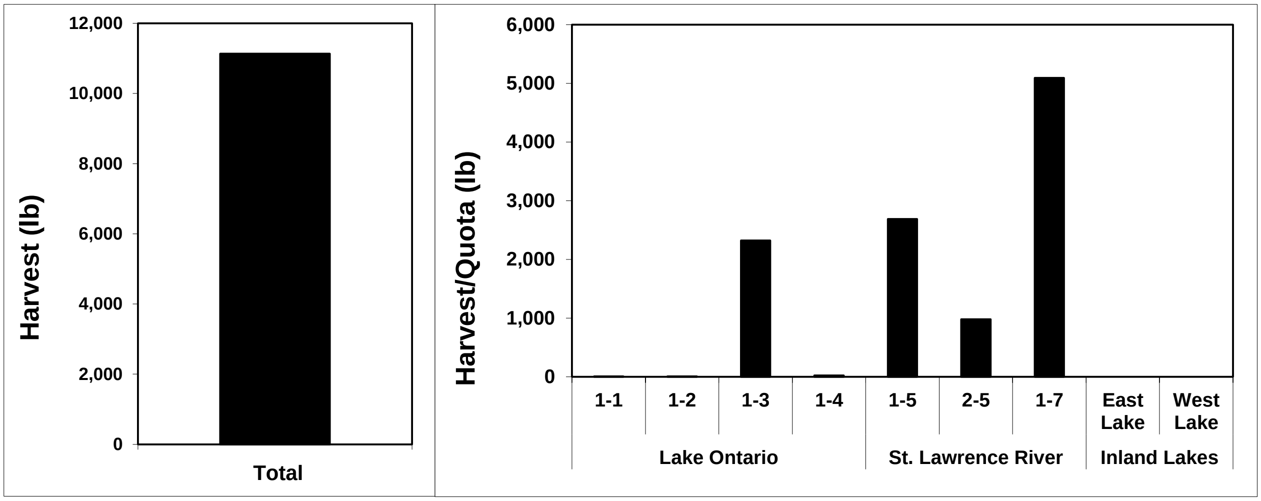

FIG. 3.2.16. **Brown Bullhead** commercial harvest by quota zone, 2020.

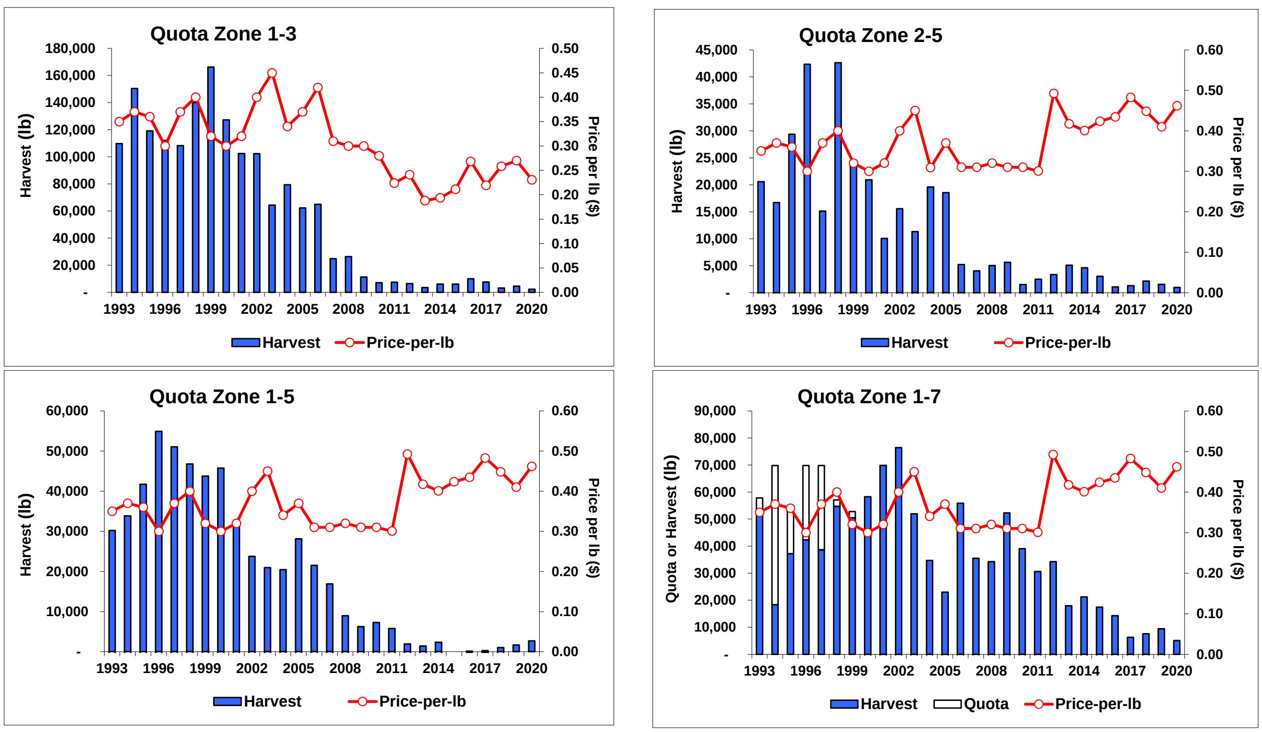

FIG. 3.2.17. Commercial base quota, harvest and price-per-lb for **Brown Bullhead** in Quota Zones 1-3, 1-5, 2-5 and 1-7, 1993-2020.

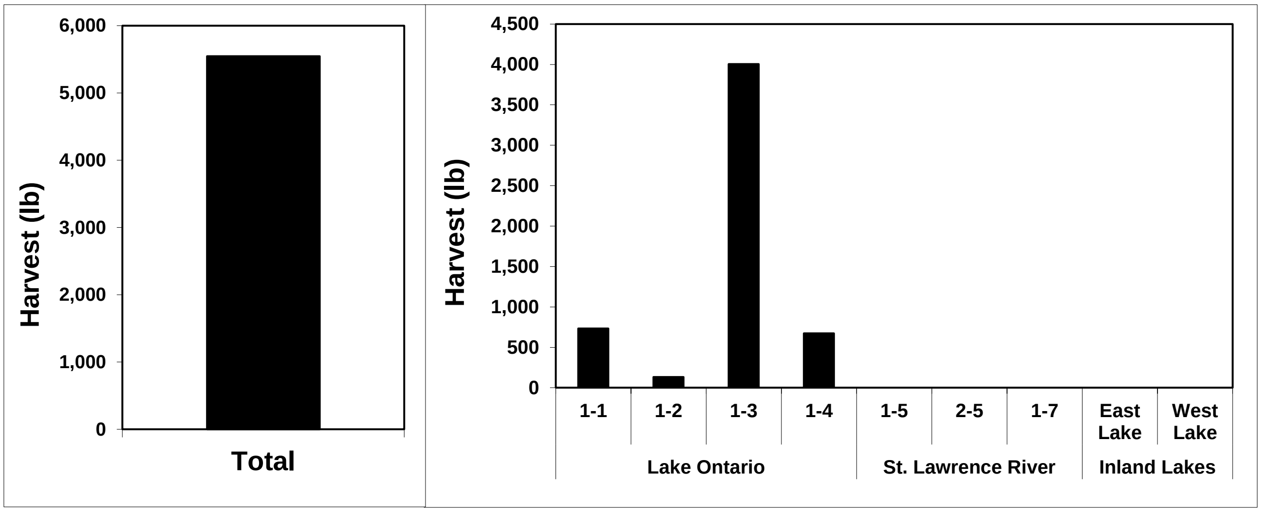

FIG. 3.2.18. **Northern Pike** commercial harvest by quota zone, 2020. In quota zones 2-5 and 1-7 no harvest is permitted; all other zones have unlimited quota.

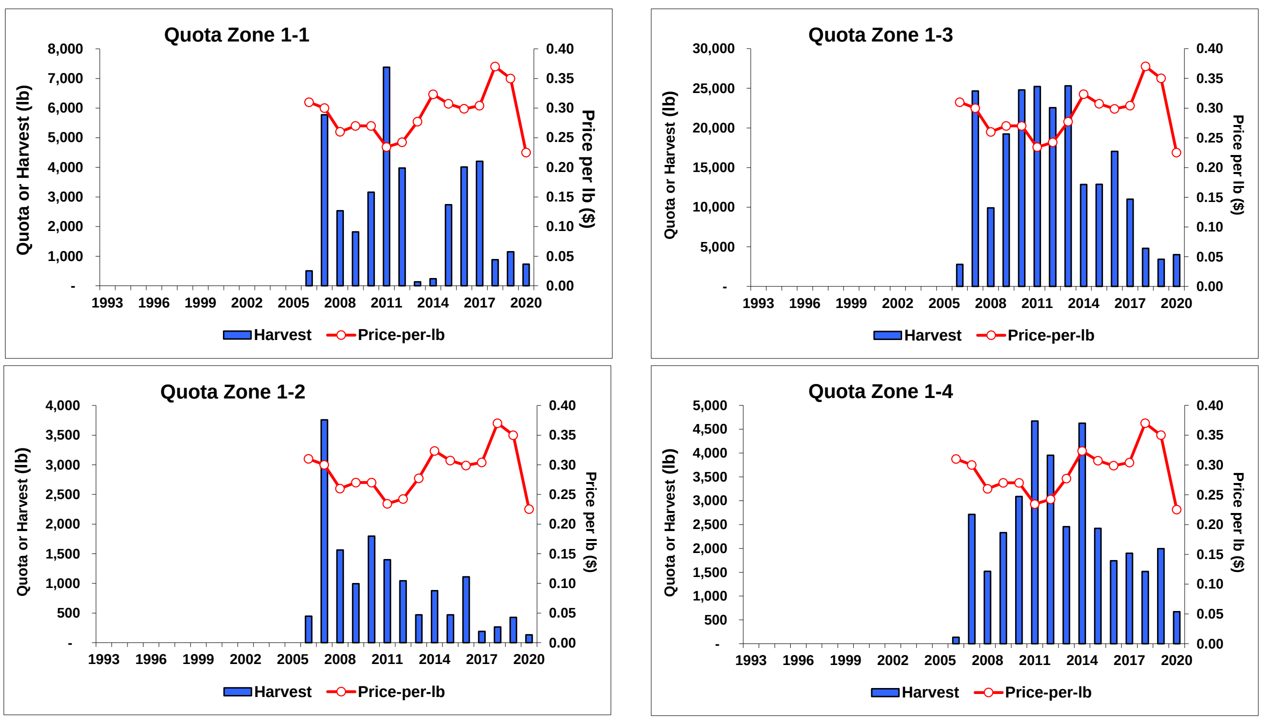

FIG. 3.2.19. Commercial base quota, harvest and price-per-lb for **Northern Pike** in Quota Zones 1-1, 1-2, 1-3, 1-4, 1993-2020.

3.3 Lake Whitefish Commercial Catch Sampling

E. Brown, Lake Ontario Management Unit

Sampling of commercially harvested Lake Whitefish for biological information occurs annually. While total Lake Whitefish harvest can be determined from commercial fish Daily Catch Reports (DCRs; see Section 3.2), biological sampling of the catch is necessary to breakdown total harvest into size and age-specific harvest.

Commercial Lake Whitefish harvest and fishing effort by gear type, month and quota zone for 2020 is reported in Table 3.3.1. Cumulative daily commercial Lake Whitefish harvest relative to quota 'milestones' is shown in Fig. 3.3.1. Total Lake Whitefish harvest for 2020 was 101,455 lbs; 60% of the issued quota.

Most of the harvest was taken in gill nets, 99.6% by weight; 0.4% of the harvest was taken in impoundment gear. Ninety-nine percent of the gill net harvest occurred in quota zone 1-2. Fifty-four percent of the gill net harvest in quota zone 1 -2 was taken in November. In quota zone 1-3 most impoundment gear harvest and effort occurred in November (Table 3.3.1). About 45,000 lbs were harvested before November 1, the date on which an additional 20% of base quota was issued to the "pool" (Fig 3.3.1).

Biological sampling focused on the November spawning-time gill net fishery on the south shore of Prince Edward County (quota zone 1-2), and the October/November spawning-time impoundment gear fishery in the Bay of Quinte (quota zone 1-3). The Lake Whitefish sampling design involves obtaining large numbers of length tally measurements and a smaller length-stratified sub-sample for more detailed biological sampling for the lake (quota zone 1-2) and bay (quota zone 1-3) spawning stocks. Whitefish length and age distribution information is presented in Fig. 3.3.2 and Fig. 3.3.3. In total, fork length was measured for 3,467 fish and age was interpreted using otoliths for 138 fish (Table 3.3.2, Fig. 3.3.2 and 3.3.3).

Lake Ontario Gill Net Fishery (quota zone 1-2)

The mean fork length and age of Lake Whitefish harvested during the gill net fishery in quota zone 1-2 were 476 mm and 10.7 years respectively (Fig. 3.3.2). Fish ranged from ages 4 -27 years. The most abundant age-classes in the fishery were aged 5-18 years which together comprised 93% of the harvest by number (90% by weight).

TABLE 3.3.1. Lake Whitefish harvest (lbs) and fishing effort (yards of gill net or number of impoundment nets) by gear type, month and quota zone. Harvest and effort value in ***bold italic*** represent months and quota zones where whitefish biological samples were collected.

		Harvest (lbs)				Effort (number of yards or nets)			
Gear type	Month	1-1	1-2	1-3	1-4	1-1	1-2	1-3	1-4
Gill net	Mar		140		14		1,280		120
	May		24				160		
	Jun		6,733				34,680		
	Jul		4,616				19,000		
	Aug		17,092				37,200		
	Sep		15,321				23,400		
	Oct		1,203		150		4,000		2,360
	Nov		***54,105***				***44,400***		
	Dec		1,203		458		3,200		1,200
Impoundment	May				29				7
	Jun				26				28
	Sep			22				6	
	Oct			*54*				195	
	Nov	33.8		***232***		2		***190***	

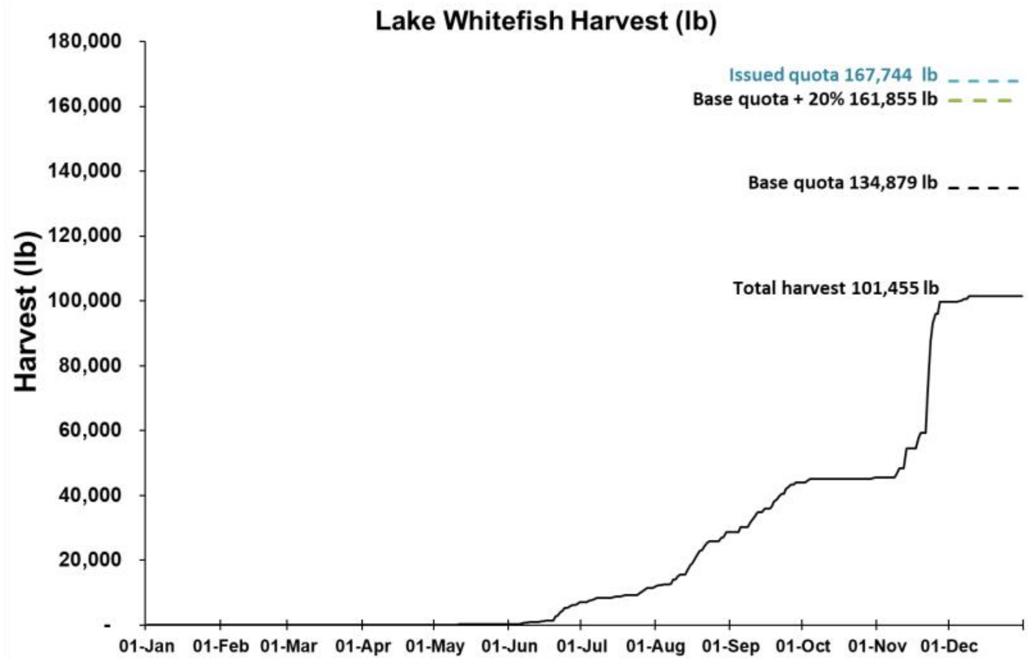

FIG. 3.3.1. Cumulative daily commercial Lake Whitefish harvest (2020) relative to quota 'milestones'.

TABLE 3.3.2. Age-specific vital statistics of Lake Whitefish sampled and harvested including number aged, number measured for length, and proportion by number of fish sampled, harvest by number and weight (kg), and mean weight (kg) and fork length (mm) of the harvest for quota zone 1-2, 2020.

Quota zone 1-2 (Lake stock)							
	Sampled			Harvested			
Age (years)	Number aged	Number lengthed	Proportion	Number	Weight (kg)	Mean weight (kg)	Mean length (mm)
1	-	-	0.000	-	-		
2	-	-	0.000	-	-		
3	-	-	0.000	-	-		
4	3	10	0.003	99	73	0.737	390
5	18	437	0.116	4,200	3,767	0.897	431
6	11	338	0.090	3,249	2,985	0.919	432
7	6	274	0.073	2,629	2,661	1.012	454
8	14	572	0.151	5,491	6,272	1.142	465
9	7	254	0.067	2,441	2,881	1.180	476
10	16	545	0.144	5,236	6,992	1.335	490
11	5	127	0.034	1,221	1,703	1.394	516
12	2	51	0.013	489	720	1.472	516
13	5	125	0.033	1,201	1,921	1.599	518
14	15	427	0.113	4,098	6,000	1.464	509
15	4	115	0.031	1,108	1,856	1.675	530
16	5	104	0.028	1,000	1,715	1.715	537
17	2	84	0.022	804	1,101	1.369	494
18	1	40	0.011	381	522	1.369	495
19	-	16	0.004	154	243	1.579	
20	-	17	0.005	163	244	1.496	
21	-	18	0.005	173	279	1.616	
22	-	19	0.005	183	300	1.642	
23	-	20	0.005	192	326	1.694	
24	-	21	0.006	202	317	1.571	
25	-	22	0.006	211	371	1.754	
26	-	23	0.006	221	370	1.672	
27	3	64	0.017	613	1,185	1.933	554
28	-	25	0.007	240	480	2.000	
29	-	26	0.007	250	500	2.000	
30	-	-	0.000	-	-		
31	-	-	0.000	-	-		
Total	117	3,773	1	36,252	45,558		
Weighted mean						**1.257**	

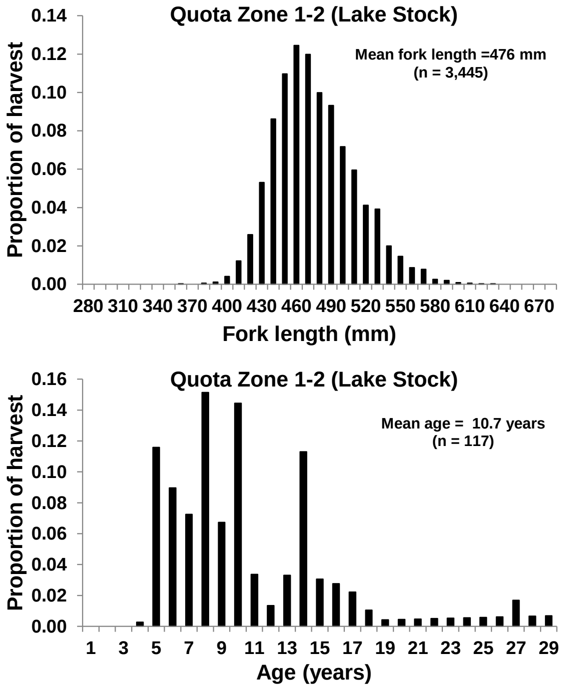

FIG. 3.3.2. Size and age distribution (by number) of Lake Whitefish sampled in quota zone 1-2 during the 2020 commercial catch sampling program.

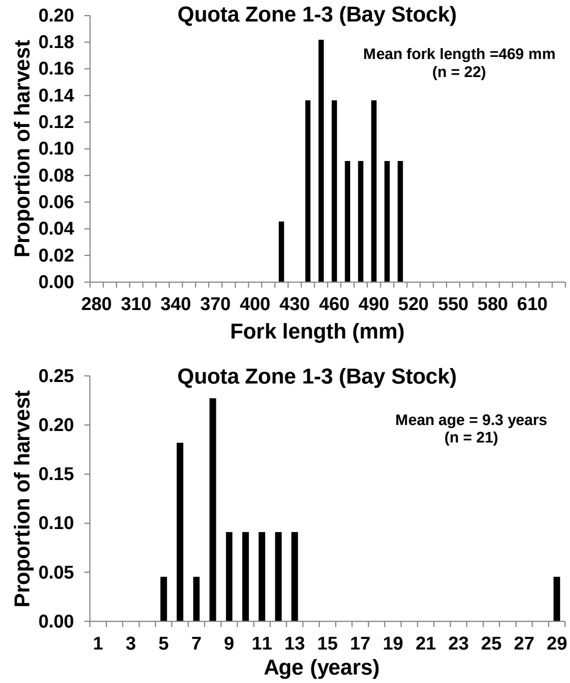

FIG. 3.3.3. Size and age distribution (by number) of Lake Whitefish sampled in quota zone 1-3 during the 2020 commercial catch sampling program.

Bay of Quinte November Impoundment Gear Fishery (quota zone 1-3)

Due to low catch rates in 2020, a very small sample size was obtained and interpreted with caution. Mean fork length and age were 469 mm and 9.3 years, respectively (Fig. 3.3.3). Fish ranged from ages 5-29 years.

Condition

Lake Whitefish (Bay of Quinte and Lake Ontario spawning stocks; sexes combined) relative weight (see Rennie et al. 2008[1]) is shown in Fig. 3.3.4. Condition declined markedly in 1994 and remained low but stable.

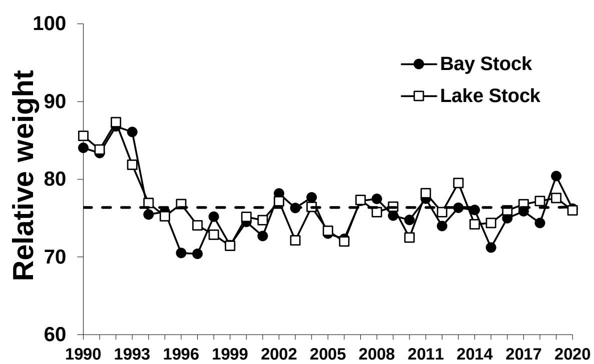

FIG. 3.3.4. Lake Whitefish (Lake Ontario and Bay of Quinte spawning stocks and sexes combined) relative weight (see [1]Rennie et al. 2008), 1990-2020.

[1]*Rennie, M.D. and R. Verdon. 2008. Development and evaluation of condition indices for the Lake Whitefish. N. Amer. J. Fish. Manage. 28:1270-1293.*

4. Age and Growth Summary

S. Kranzl and E. Brown, Lake Ontario Management Unit

Biological sampling of fish from Lake Ontario Management Unit field projects routinely involves collecting and archiving structures used for such purposes as: age interpretation and validation, origin determination (e.g. stocked versus wild), life history characteristics, and other features of fish growth. In 2020, a total of 1296 structures were processed from 6 different field projects (Table 4.1).

TABLE 4.1. Project-specific summary of age and growth structures interpreted for age (n=1296) in support of 6 different Lake Ontario Management Unit field projects, 2020 (CWT, Code Wire Tags).

Project	Species	Structure	n
Lake Ontario and Bay of Quinte Community Index Gillnetting			
	Chinook Salmon	Otoliths	3
	Brown Trout	Otoliths	5
	Lake Trout	Otoliths	38
	Lake Whitefish	Otoliths	15
	Cisco	Otoliths	7
	Northern Pike	Cleithra	9
	White Perch	Scales	165
	Smallmouth Bass	Scales	14
	Largemouth Bass	Scales	10
	Walleye	Otoliths	323
Lake Ontario and Bay of Quinte Community Index Trawling			
	Walleye	Otoliths	1
	Walleye	Scales	83
Lake St. Francis Community Index Netting			
	Northern Pike	Cleithra	2
	Smallmouth Bass	Scales	4
	Largemouth Bass	Scales	2
	Yellow Perch	Scales	86
	Walleye	Otoliths	17
Thousand Island Community Index Netting			
	Northern Pike	Cleithra	11
	Smallmouth Bass	Scales	108
	Largemouth Bass	Scales	5
	Yellow Perch	Scales	103
	Walleye	Scales	16
Credit River Chinook Assessment and Egg Collection			
	Chinook Salmon	Otoliths	128
Commercial Catch Sampling			
	Lake Whitefish	Otoliths	141
Total			1296

5. Stocking Program

5.1 Stocking Summary

C. Lake, Lake Ontario Management Unit

In 2020, OMNRF stocked over 1.77 million fish into Lake Ontario, equaling over 40,600 kilograms of biomass (Fig. 5.1.1; Table 5.1.1). Fish are allocated to one of seven sub-zones (Fig. 5.1.2) based on several factors, including: natural reproduction within the zone, size of local fisheries, and suitable available habitat. More detail on the stocking zones and fish allocation can be found in the Stocking Strategy for the Canadian Waters of Lake Ontario (2015). The St. Lawrence River is not stocked. Table 5.1.2 shows the 2020 stocking levels compared to the targets outlined in the 2015 strategy.

Figure 5.1.3 shows salmon and trout stocking trends in the Ontario waters of Lake Ontario for the most recent five years, broken down by species and stocking zone. Table 5.1.3 provides detailed information on fish stocking by species, location and life stage for 2020.

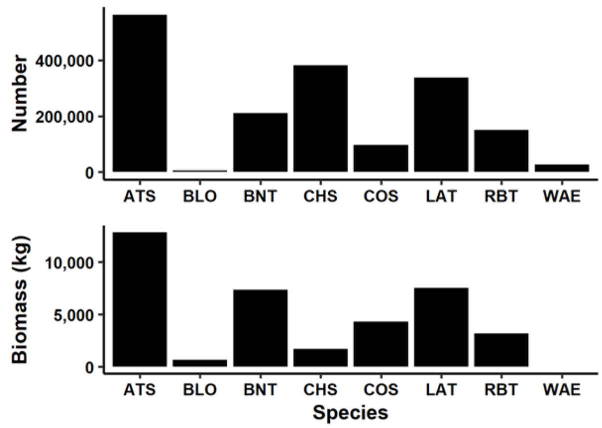

FIG. 5.1.1. TOP: Number of fish stocked into the Ontario waters of Lake Ontario in 2020 (total = 1,771,568). BOTTOM: Biomass of fish stocked into the Ontario waters of Lake Ontario in 2020 (total = 40,636 kg.). Adult, egg and Non-feeding fry life stages not included in totals. ATS = Atlantic Salmon, BLO = Bloater, BNT = Brown Trout, CHS = Chinook Salmon, COS = Coho Salmon, LAT = Lake Trout, RBT = Rainbow Trout, WAE = Walleye.

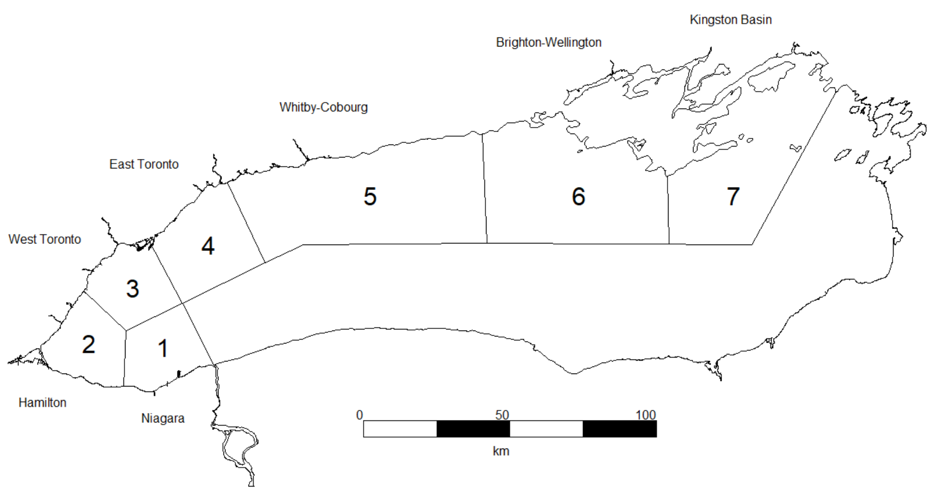

FIG 5.1.2. Stocking zones for the Ontario waters of Lake Ontario.

Chinook Salmon spring fingerlings (382,415; 1,728 kg.) were stocked to provide put-grow-and-take fishing opportunities. This was 111% of the interim target of 344,000. All Chinook Salmon for the Lake Ontario program were produced at Normandale Fish Culture Station. Due to concerns related to COVID-19, the Chinook net pen program was not run in 2020 (see section 5.2).

Atlantic Salmon (563,541; 15,633 kg.) were stocked in support of an ongoing program to restore self-sustaining populations of this native species to Lake Ontario (Section 8.2). Atlantic Salmon are produced at MNRF hatcheries, with some eggs being delivered to academic and community facilities for rearing. All Atlantic Salmon stocking targets were met or exceeded slightly in 2020.

Lake Trout spring yearlings (337,658; 7,519 kg.) were stocked in 2020 as part of an established, long-term rehabilitation program, supporting of the Lake Trout Stocking Plan (Section 8.5). The 2020 target was held at a 20% reduction in response to poor Alewife year classes. Due to COVID-19 related challenges with stocking, 53,170 Lake Trout originally destined for Lake Erie were stocked into Lake Ontario, and the target for 2020 was exceeded as a result.

Bloater (5,171; 652 kg.) were stocked in 2020. This small relative of the Lake Whitefish was an important prey item for Lake Trout until the late 1950's when both species were extirpated. A coordinated program involving staff from the US and Canada resulted in the initial stocking of approximately 15,000 Bloater in 2013. MNRF Fish Culture Section staff continue to work with our partner agencies to advance our understanding of the complicated process of rearing Bloater. See section 6.4 for a detailed description of this restoration effort.

Rainbow Trout (150,069; 3,396 kg.) and Brown Trout (210,320; 7,375 kg.) were stocked at various locations to support shore and boat fisheries. Community hatcheries contribute to the stocking of both species – see Table 5.1.3 for details. Coho Salmon (96,000; 4,320 kg.) were produced by stocking partner Metro East Anglers at the Ringwood Fish Culture Station.

Walleye (26,394; 13 kg.) were stocked in 2020, continuing an effort to re-establish this native, predatory fish to the fish communities of Hamilton Harbour and Toronto Harbour and to promote urban, near-shore angling. Walleye stocking alternates annually between Toronto Harbour and Hamilton Harbour (even years in Hamilton).

TABLE 5.1.1. Fish stocked into the Ontario waters of Lake Ontario in 2020. Numbers reflect both MNRF-produced fish and those raised by community groups. Details can be found in Table 6.1.3.

Species	Lifestage	Number	Biomass (kg)
Atlantic Salmon	Spring Fingerling	355,272	1,156
	Fall Fingerling	78,747	2,465
	Spring Yearling	125,353	8,804
	Sub-adult	3,183	409
	Adult	986	2,799
	Atlantic Salmon Total	**563,541**	**15,633**
Bloater	Sub-adult	**5,171**	**652**
Brown Trout	Spring Fingerling	35,000	70
	Spring Yearling	156,320	6,830
	Fall Yearling	19,000	475
	Brown Trout Total	**210,320**	**7,375**
Chinook Salmon	Spring Fingerling	**382,415**	**1,728**
Coho Salmon	Fall Yearling	**96,000**	**4,320**
Lake Trout	Spring Yearling	**337,658**	**7,519**
Rainbow Trout	Spring Yearling	148,140	3,093
	Sub-adult	1,809	87
	Adult	120	216
	Rainbow Trout Total	**150,069**	**3,396**
Walleye	Summer Fingerling	**26,394**	**13**
Total All Species		**1,771,568**	**40,636**

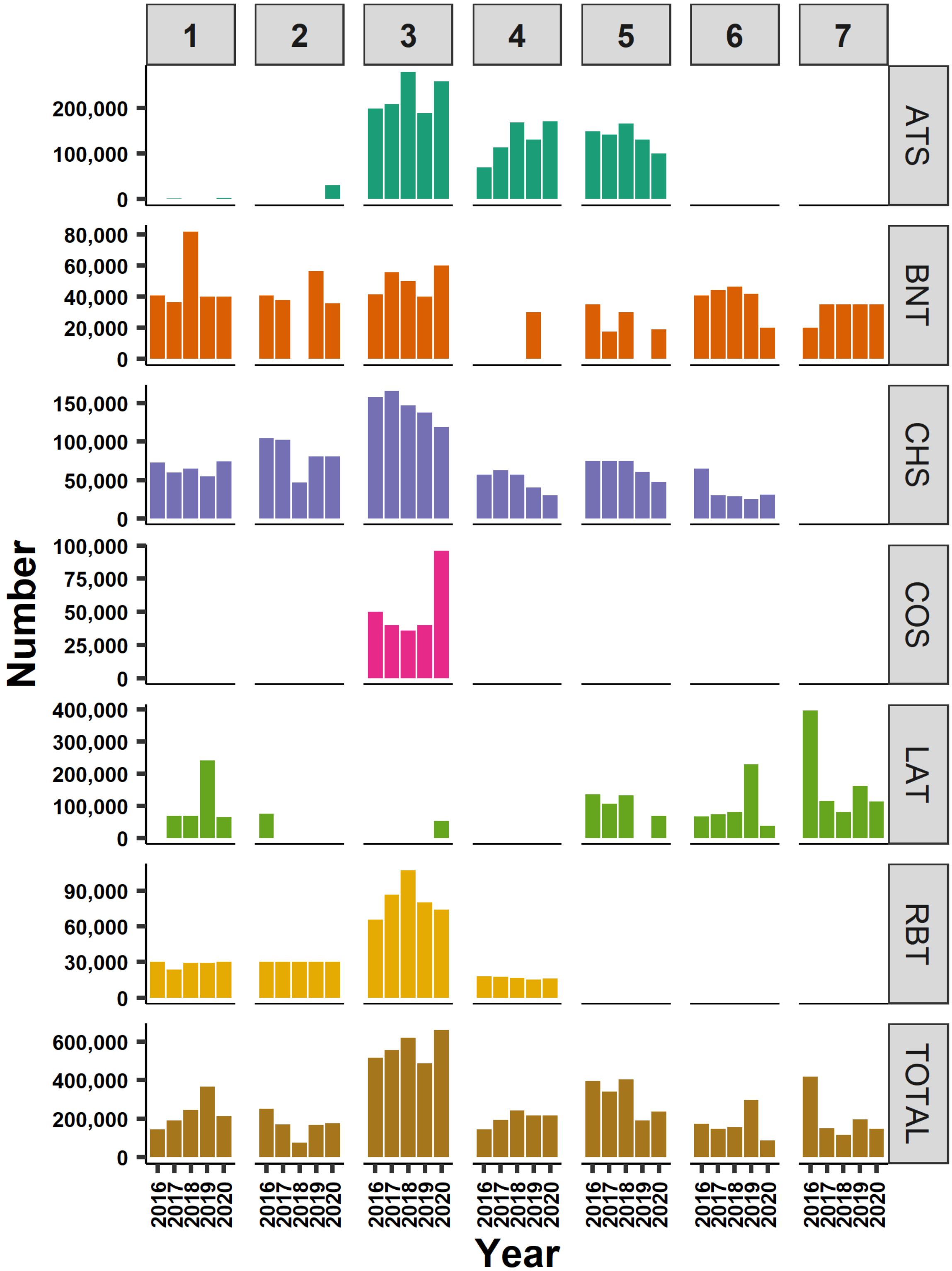

FIG 5.1.3. Numbers of salmon and trout stocked in the Ontario waters of Lake Ontario for the most recent five years (2016-2020). Data are presented by species (rows) and by stocking zone (columns). The bottom panel ("Total") shows the total for all six species for the same time frame. Note that the y-axes are variable. ATS = Atlantic Salmon, BNT = Brown Trout, CHS = Chinook Salmon, COS = Coho Salmon, LAT = Lake Trout, RBT = Rainbow Trout.

TABLE 5.1.2. Fish stocked into the Ontario waters of Lake Ontario in 2020. Numbers reflect both MNRF-produced fish and those raised by community groups. Details can be found in Table 5.1.3.

Species	Lifestage	Number	Target	Difference	Percent
Atlantic Salmon	Spring Fingerling	355,272	300,000	55,272	118%
	Fall Fingerling	78,747	70,000	8,747	112%
	Spring Yearling	125,353	125,000	353	100%
	Sub-adult	3,183			
	Adult	986			
Bloater	Sub-adult	5,171	250,000	-244,829	2%
Brown Trout	Spring Fingerling	35,000			
	Spring Yearling	156,320	165,000	-8,680	95%
	Fall Yearling	19,000			
Chinook Salmon	Spring Fingerling	382,415	344,000	38,415	111%
Coho Salmon	Fall Yearling	96,000	80,000	16,000	120%
Lake Trout	Spring Yearling	337,658	282,000	55,658	120%
Rainbow Trout	Spring Yearling	148,140	140,000	8,140	106%
	Sub-adult	1,809			
	Adult	120			

TABLE 5.1.3. Fish stocked into the Ontario waters of Lake Ontario and its tributaries in 2020. Abbreviations defined at the bottom of the table.

Waterbody	Site	Hatchery	Strain	Marks	Month	Age (months)	Weight (g)	Biomass (kg)	Number
Atlantic Salmon - Egg									
Duffins Cr.	E. Duffins Cr./Uxbridge-Pickering Townline	MNRF-HW	LaHave	-	1	0			25,400
Duffins Cr.	W. Duffins Cr. - 30th Sideline	MNRF-HW	LaHave	-	1	0			26,000
Ganaraska R.	Anderson Rd.	MNRF-HW	LaHave	-	1	0			25,300
Ganaraska R.	Hwy 9	MNRF-HW	LaHave	-	1	0			54,000
Ganaraska R.	Newtonville Rd.	MNRF-HW	LaHave	-	1	0			24,500
Ganaraska R.	Shiloh Rd.	MNRF-HW	LaHave	-	1	0			25,400
Shelter Valley	Doig Property	MNRF-HW	LaHave	-	1	0			25,490
Shelter Valley	Doig Property	MNRF-HW	Sebago	-	1	0			26,220
Shelter Valley	Skyview Rd.	MNRF-HW	LaHave	-	1	0			26,000
Shelter Valley	Skyview Rd.	MNRF-HW	Sebago	-	1	0			27,783
Atlantic Salmon - Spring Fingerling									
Bronte Cr.	Kilbride Cr. - Cedarsprings Rd	MNRF-NM	Sebago	-	5	5	3	46	15,087
Bronte Cr.	Limestone Cr. - Walkers Line	MNRF-NM	Sebago	-	5	5	2.6	40.9	15,717
Credit R.	Black Cr. - 15th Side Rd.	MNRF-NM	Sebago	-	3	5	4.1	60.8	14,950
Credit R.	Black Cr. - 6th Line	MNRF-NM	Sebago	-	3	5	5.2	119.4	22,866
Credit R.	Ellie's Ice Cream Parlour	MNRF-NM	Sebago	-	3	5	3.7	74.6	20,044
Credit R.	Forks	MNRF-NM	Sebago	-	3	5	3.8	58	15,188
Credit R.	McLaughlin Rd. Bridge	MNRF-NM	Sebago	-	3	5	3.8	57.3	15,149
Credit R.	Terra Cotta	MNRF-NM	Sebago	-	3	5	4.2	89.9	21,209
Duffins Cr.	E. Duffins Cr. - Michell Cr., 8th Conc.	MNRF-NM	LaHave	-	5	5	3.1	51.1	16,499
Duffins Cr.	Reesor Cr. - Hwy 7	MNRF-NM	LaHave	-	5	5	3.6	59.1	16,592
Duffins Cr.	Reesor Cr. - Sideline 34	MNRF-NM	LaHave	-	5	5	3.4	57.4	16,882
Duffins Cr.	W. Duffins - Whitevale Bridge	MNRF-NM	Sebago	-	5	5	3.6	56.3	15,470
Duffins Cr.	W. Duffins Cr. - Sideline 28 - Wixon Cr.	MNRF-NM	Sebago	-	5	5	3.5	52.1	14,891
Duffins Cr.	W. Duffins Cr. - Sideline 32	MNRF-NM	Sebago	-	5	5	4	79.6	19,998
Humber R.	Coffey Cr.	Islington	LaHave	-	5	4	0.4	3.4	9,368
Humber R.	Duffy's Lane - Patterson Side Rd.	MNRF-NM	Sebago	-	5	5	2.9	43.5	15,107
Humber R.	Duffy's Lane N. of Castelderg Side Rd.	MNRF-NM	Sebago	-	5	5	3.4	51.4	14,938
Humber R.	Highway 9	Islington	LaHave	-	5	4	0.2	1	4,328
Humber R.	Humber Station Rd.	MNRF-NM	Sebago	-	5	5	2.3	35	15,101
Wilmot Cr.	Wilmot Cr. - 3rd Conc.	MNRF-NM	Sebago	-	5	5	2.3	49.3	21,233
Wilmot Cr.	Wilmot Cr. - 4th Conc.	MNRF-NM	Sebago	-	5	5	2.1	36.3	16,966
Wilmot Cr.	Wilmot Cr. - 5th Conc.	MNRF-NM	Sebago	-	5	5	1.9	33.6	17,689
Atlantic Salmon - Fall Fingerling									
Credit R.	Eldorado Park	MNRF-NM	LaHave	-	10	9	30.4	97	3,189
Credit R.	Eldorado Park	MNRF-NM	Sebago	-	10	10	30.4	281.5	9,255
Credit R.	McLaughlin Rd. Bridge	MNRF-NM	LaHave	-	10	9	28.8	382.9	13,310
Credit R.	Norval	MNRF-NM	LaHave	-	10	9	32.6	307	9,416
Credit R.	Terra Cotta	MNRF-NM	Sebago	-	9	9	31.8	398	12,500
Duffins Cr.	E. Duffins Cr. - 5th Conc.	MNRF-NM	LaHave	-	9	8	29.1	291.5	10,005
Duffins Cr.	E. Duffins Cr. - 5th Conc.	MNRF-NM	Sebago	-	9	9	32.1	321.5	10,012
Duffins Cr.	W. Duffins Cr. - Sideline 28 - Wixon Cr.	MNRF-NM	Sebago	-	10	10	35.8	330.8	9,229
Lk. Ontario	Port Dalhousie East	MNRF-NM	Sebago	AD	11	9	30.1	55.1	1,831

Waterbody	Site	Hatchery	Strain	Marks	Month	Age (months)	Weight (g)	Biomass (kg)	Number
Atlantic Salmon - Spring Yearling									
Credit R.	Credit River Mouth	MNRF-NM	Sebago	-	3	16	71.1	2837.4	39,989
Duffins Cr.	E. Duffins Cr. - 5th Conc.	MNRF-NM	LaHave	AD	4	17	65	30	462
Duffins Cr.	E. Duffins Cr. - 5th Conc.	MNRF-NM	Sebago	-	3	16	71.2	2181.4	31,235
Duffins Cr.	E. Duffins Cr. - 5th Conc.	MNRF-NM	Sebago - wild	-	3	17	83.2	314	3,772
Duffins Cr.	W. Duffins Cr. - North Rd. Con 7	MEA-RW	Sebago	AD	4	16	70	420	6,000
Ganaraska R.	Carscadden Rd.	MNRF-NM	Sebago	AD	4	17	52.9	272.8	5,159
Ganaraska R.	Hwy 9	MNRF-NM	Sebago	AD	4	17	61.1	296.4	4,849
Ganaraska R.	Kendal - MNR Property	MNRF-NM	Sebago	AD	4	17	52.6	196.2	3,733
Ganaraska R.	Newtonville Rd.	MNRF-NM	Sebago	AD	4	17	51.4	260.9	5,071
Ganaraska R.	Port Hope - Mill St. boat ramp	MEA-RW	Sebago	AD	4	15	85	1530	18,000
Ganaraska R.	Shiloh Rd.	MNRF-NM	Sebago	AD	4	17	61.2	208.3	3,402
Ganaraska R.	Soper Rd.	MNRF-NM	Sebago	AD	4	17	71.1	255	3,585
Lk. Ontario	Grimsby - Forty Mile Cr. Park	Western	LaHave	-	5	15	20	1.9	96
Atlantic Salmon - Sub-adult									
Credit R.	Credit River Anglers Assoc.	CRAA	LaHave	-	4	28	45	100.7	2,237
Lk. Ontario	Grimsby - Forty Mile Cr. Park	Western	LaHave	-	5	27	100	3.6	36
Lk. Ontario	Port Dalhousie East	MNRF-NM	Sebago - wild	-	12	23	335	304.9	910
Atlantic Salmon - Adult									
Ganaraska R.	Port Hope - Mill St. boat ramp	MNRF-HW	LaHave	-	1	84	4150	834.1	201
Lk. Ontario	Lakeport	MNRF-HW	LaHave	-	4	52	1990	807.9	406
Lk. Ontario	Newcastle	MNRF-HW	LaHave	-	4	51	1900	391.4	206
Lk. Ontario	Port Dalhousie East	MNRF-NM	Sebago	-	10	48	4427.5	765.5	173
Bloater - Sub-adult									
Lk. Ontario	Cobourg - 100	MNRF-CH	Lk.Mich.	-	11	43	126.1	652	5,171
Brown Trout - Spring Fingerling									
Lk. Ontario	Finkle's Shore Ramp	Springside	Wild	-	4	4	2	70	35,000
Brown Trout - Spring Yearling									
Lk. Ontario	Athol Bay	MNRF-CH	Ganaraska	-	3	15	41.1	830	20,214
Lk. Ontario	Grimsby - Forty Mile Cr. Park	MNRF-CH	Ganaraska	-	3	15	47.7	1715	35,924
Lk. Ontario	Humber Bay Park	MNRF-CH	Ganaraska	-	3	15	42.8	1715	40,080
Lk. Ontario	Lakefront Promenade	MNRF-CH	Ganaraska	-	3	15	41.2	825.2	20,043
Lk. Ontario	Port Dalhousie East	MNRF-CH	Ganaraska	-	3	15	43.6	1744.9	40,059
Brown Trout - Fall Yearling									
Lk. Ontario	Whitby Hrbr.	MEA-RW	Wild	-	11	11	25	475	19,000
Chinook Salmon - Spring Fingerling									
Bronte Cr.	2nd Side Rd. Bridge	MNRF-NM	Credit R.	-	4	6	4.4	183.5	41,325
Bronte Cr.	4th Side Rd. Bridge	MNRF-NM	Credit R.	-	4	6	4.5	175	39,146
Credit R.	Norval	MNRF-NM	Ganaraska	AD	4	6	5	311.3	62,508
Credit R.	Norval	MNRF-NM	Credit R.	-	4	6	4.8	269.5	56,264
Lk. Ontario	Bluffer's Park	MNRF-NM	Credit R.	-	4	6	4.4	131	29,973
Lk. Ontario	Oshawa Hrbr.	MNRF-NM	Credit R.	-	4	6	4.1	197.1	47,964
Lk. Ontario	Port Dalhousie East	MNRF-NM	Credit R.	AD	4	6	4.4	326.8	74,439
Lk. Ontario	Wellington Channel	MNRF-NM	Credit R.	-	4	6	4.3	133.3	30,796

Waterbody	Site	Hatchery	Strain	Marks	Month	Age (months)	Weight (g)	Biomass (kg)	Number
Coho Salmon - Fall Yearling									
Credit R.	Norval	MEA-RW	Wild	-	11	12	45	4320	96,000
Lake Trout - Spring Yearling									
Lk. Ontario	Athol Bay	MNRF-HW	Seneca	LPAD	4	15	31.8	1171.4	36,868
Lk. Ontario	Beacon Inn	MNRF-NB	Seneca	LPAD	4	15	16.2	479.8	29,638
Lk. Ontario	Beacon Inn	MNRF-NB	Slate	LPAD	4	15	13.3	239.5	18,010
Lk. Ontario	Finkle's Shore Ramp	MNRF-WL	Seneca	LPAD	3	13	24.5	549	22,408
Lk. Ontario	Finkle's Shore Ramp	MNRF-WL	Slate	LPAD	3	15	21.6	792.5	36,688
Lk. Ontario	Glenora	MNRF-WL	Seneca	LPAD	3	13	24.5	570	23,267
Lk. Ontario	Glenora	MNRF-WL	Slate	LPAD	3	15	21.6	661	30,600
Lk. Ontario	Jordan Hrbr.	MNRF-NB	Slate	LPAD	4	15	13.4	239.6	17,884
Lk. Ontario	Lakefront Promenade	MNRF-CH	Slate	AD-CWT	3	16	32.7	1736.3	53,170
Lk. Ontario	Lakeport	MNRF-NB	Seneca	LPAD	4	15	16.6	340	20,482
Lk. Ontario	Lakeport	MNRF-NB	Slate	LPAD	4	15	15.1	739.8	48,643
Rainbow Trout - Spring Yearling									
Bronte Cr.	2nd Side Rd. Bridge	MNRF-HW	Ganaraska	-	3	12	20.3	304.4	14,994
Bronte Cr.	4th Side Rd. Bridge	MNRF-HW	Ganaraska	-	3	12	23.8	356.5	14,980
Credit R.	Eldorado Park	MNRF-HW	Ganaraska	-	3	12	20	500.2	25,008
Credit R.	Norval	MNRF-HW	Ganaraska	-	4	12	15.7	330	21,018
Humber R.	E. Branch Islington	MNRF-HW	Ganaraska	-	4	12	21.2	235.8	11,123
Humber R.	King Vaughan Line	MNRF-HW	Ganaraska	-	3	12	23.8	357	15,000
Lk. Ontario	Port Dalhousie East	MNRF-HW	Ganaraska	-	3	12	20.3	609.3	30,017
Rouge R.	Little Rouge R. - Steeles Ave.	MEA-RW	Wild	-	5	12	25	400	16,000
Rainbow Trout - Sub-adult									
Credit R.	Norval	CRAA	Wild	-	5	24	48	86.8	1,809
Rainbow Trout - Adult									
Lk. Ontario	Lakeport	MNRF-HW	Wild	-	4	48	1800	216	120
Walleye - Summer Fingerling									
Hamilton Hrbr.	Hamilton Hrbr.	MNRF-WL	Quinte	-	7	3	0.5	13.2	26,394

MNRF Fish Culture Stations: CH = Chatsworth, HW = Harwood, NM = Normandale, NB = North Bay, WL = White Lake.
Volunteer and other hatcheries: Islington = Islington Sportsman Club, MEA-RW= Metro East Anglers—Ringwood, Springside = Springside Park Hatchery, Western = Western University.

6. Species Rehabilitation

6.1 Introduction

C. Lake, Lake Ontario Management Unit

Lake Ontario has a long history of fish community changes caused by introduced species (intentional and unintentional), overfishing, habitat loss, industrial development and pollution. OMNRF works with many partners - government agencies, non-government organizations and interested individuals at local, provincial and national levels to enhance Lake Ontario fish community fisheries through native species rehabilitation.

Actions to rehabilitate native species include fish stocking, habitat enhancement, fish passage, fish community monitoring and research and management to ensure sustainable harvest. Rehabilitation efforts are occurring across the Lake Ontario basin including the embayments, tributaries and the lower Niagara River and the St. Lawrence River downstream to the Quebec-Ontario boarder.

The sections below describe initiatives to restore Atlantic Salmon, American Eel, Bloater and Lake Trout. Some of these species have been extirpated or greatly reduced in numbers. Successful restoration of these native species will enhance the overall health of the fish community and support fisheries that provide economic and social benefits to Ontario. Native species restoration also contributes to improving Ontario's biodiversity and meeting Ontario's commitments under the GLFC's Fish Community Objectives and commitments identified in the Great Lakes Water Quality Agreement.

6.2 Atlantic Salmon Restoration

M. D. Desjardins, Lake Ontario Management Unit

Atlantic Salmon were extirpated from Lake Ontario by the late 1800s, primarily as a result of spawning and nursery habitat loss in streams. As a top predator, they played a key ecological role in the offshore fish community. They were also a valued food resource for indigenous communities and early Ontario settlers. As such, Atlantic Salmon are recognized as an important part Ontario's natural and cultural heritage.

The Lake Ontario Restoration Program for Atlantic Salmon was initiated in 2006 and has developed into a significant partnership combining the efforts of the Ontario Ministry of Natural Resources and Forestry (OMNRF), the Ontario Federation of Anglers and Hunters (OFAH), and many corporate and community partners. Significant progress has been made through enhancements in fish production, community involvement, research and assessment, and habitat enhancement.

2020 marked the final implementation year of the latest five-year plan (2016-2020), which saw several program adjustments aimed at accelerating restoration with an emphasis on improving adult returns. Changes to hatchery rearing and stocking practices have resulted in larger fish of all life stages being stocked with more emphasis on stocking spring yearling aged Sebago Lake Strain Atlantic Salmon (Section 6.1). Regulation changes in 2016 allowed for catch and release angling of Atlantic Salmon in Lake Ontario tributaries and a significant stocking allocation was directed toward the Ganaraska River to establish a destination fishery.

Progress is being tracked with the help of new fish counter/camera systems (known as the Riverwatcher fish counter) that have been installed in fishways at Corbett's Dam on the Ganaraska River (Section 1.3) and at the Reid Milling Dam (a.k.a. Streetsville Dam) on the Credit River (Section 1.4). This new technology provides better surveillance of the Atlantic Salmon spawning run and provides valuable information on the migratory patterns for other species ascending the Ganaraska and Credit Rivers. Due to the global pandemic, installation of the counters was delayed in 2020. The Ganaraska River fish counter was installed on May 12th and the Credit River counter on June 16th. Both counters were removed from the rivers on Nov 13th. In 2020 adult returns of Atlantic Salmon in these two rivers remains low with 29 Atlantic Salmon recorded moving through the counter on the Ganaraska and 15 on the Credit.

2020 marked a transition year to a new planning phase. Work was initiated toward the development of a new five-year (2021-2025) implementation plan. This new plan will continue to focus effort toward increasing the number of adult Atlantic Salmon returning to Lake Ontario tributaries.

6.3 American Eel Trap and Transport

J. La Rose, Lake Ontario Management Unit

The American Eel (*Anguilla rostrata*) was historically an important predator in the nearshore fish community of Lake Ontario and the upper St. Lawrence River (LO-USLR). They also made up an important component of the LO-SLR commercial fishery during the latter part of the 20th century and are highly valued by indigenous peoples.

American Eel abundance declined in the LO-USLR system as a result of the cumulative effects from a variety of factors. By 2004, American Eel abundance in Ontario had declined to levels that warranted closure of all commercial and recreational fisheries in the province. In 2007, American Eel was identified as Endangered under Ontario's Endangered Species Act (ESA). Safe downstream passage past hydro turbines during the eel's spawning migration is important to restoration of eel and was identified in the Ontario Power Generation Action Plan.

Trap and Transport (T&T) of large yellow eels was initiated in 2008 as a pilot project to evaluate it as a means of mitigating mortality of eels in the turbines at the Saunders Hydroelectric Dam. Through this program, commercial fishers in LO-USLR and Lake St Francis (LSF) are permitted to retain large, healthy eel for transport and release below the furthest downstream dam near Beauharnois, Quebec. From 2008 to 2014, only eels collected during the spring commercial fishery were included in T&T. Since 2014, eels collected during the fall commercial fishery were also included in the T&T project to increase the numbers of eels transported.

Currently, eel T&T forms part of the Eel Implementation Plan developed by Ontario Power Generation (OPG) and the Ontario Ministry of Environment, Conservation and Parks (MECP). The MECP assumed responsibility of the Endangered Species Act and its authorizations in 2019; while the MNRF Lake Ontario Management Unit (LOMU) continues to support T&T operations.

A spring T&T program was not conducted in 2020 as a result of COVID-19 restrictions. T&T operations were adapted to include COVID-19 safety measures and a fall program was carried out from September 8 until October 22 (Figure 6.3.1). Over the 6 weeks of the fall 2020 program, a total 7263 large yellow eel (7093 from LO-USLR and 170 from LSF) were transported and released into Lac St. Louis, downstream of the Beauharnois Hydroelectric Dam (Figure 6.3.2). This represents both the most eel transported in the fall as well as in any year of the T&T program to date. During four of the weeks from mid-September to early October, the program received and transported over one thousand eel per week. This year's successful project was accomplished thanks to the diligent, cooperative efforts of commercial fishers, OPG, their consultants, LOMU technicians and data processing experts.

Lake Ontario Fish Community Objective 1.4 focuses on the restoration of American Eel in Lake Ontario and the St. Lawrence River. Eel trap and transport directly contributes to meeting this objective by reducing the mortality of eel as they migrate downstream towards their spawning grounds.

FIG 6.3.1 Commercial fishers delivering large, American Eel from the Bay of Quinte to the Glenora fisheries station in October 2020, according to new T&T COVID-19 safety protocols.

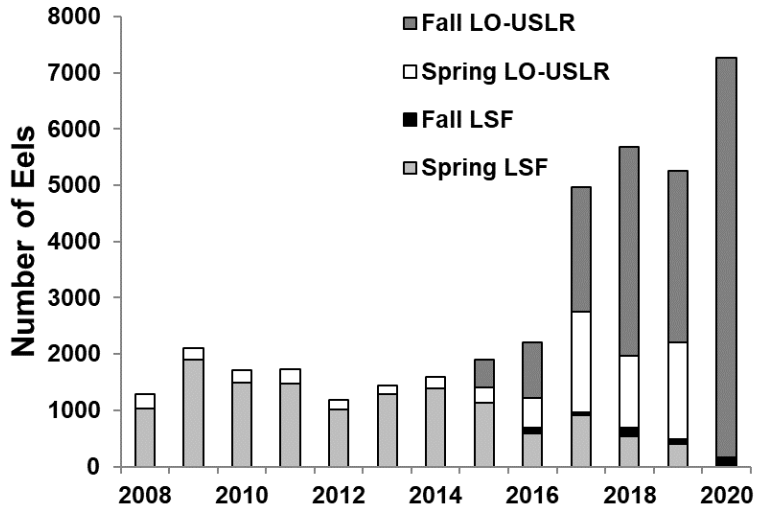

FIG 6.3.2 Total number of eels collected in the Trap and Transport program from 2008-2020. Each total is divided into the locations (Lake St Francis, Lake Ontario-Upper St Lawrence River) at which the eels were captured in commercial fishery nets and the season (Spring and Fall) of collections.

6.4 Bloater Restoration

J.P. Holden, Lake Ontario Management Unit

Prior to the mid-1950s, Lake Ontario was home to a diverse assemblage of deepwater ciscoes including Bloater (*Coregonus hoyi*), Kiyi (*C. kiyi*), and Shortnose Cisco (*C. reighardi*). Currently, only the Cisco (*C. artedi*) remains in Lake Ontario. The Lake Ontario Committee has set a goal to establish a self-sustaining population of Bloater in Lake Ontario requiring a cooperative, international effort between the Ontario Ministry of Natural Resources and Forestry (OMNRF), the New York State Department of Environmental Conservation (NYSDEC), the U.S. Fish and Wildlife Service (USFWS), the U.S. Geological Survey (USGS) and the Great Lakes Fishery Commission (GLFC). The objectives and strategies for the establishment of Bloater are specified in a draft strategic plan. The plan addresses: sources of gametes, culture facilities, culture capacity, stocking, detection of wild fish, increasing our understanding of ecological consequences, research needs, and public education.

Potential long-term benefits of restoring Bloater include: restoring historical food web structures and function in Lake Ontario, increasing the diversity of the prey fish community, increasing resistance of the food web to new species invasions, increasing wild production of salmon and trout by reducing thiaminase impacts of a diet based on Alewife and Rainbow Smelt, and potentially supporting a commercial fishery. Potential risks associated with the reintroduction of Bloater relate to the unpredictability of food web interactions in an evolving Lake Ontario ecosystem. Accepting some risk and uncertainty, doing the necessary science to increase understanding and minimize risk, and adapting management strategies accordingly are prerequisites for successful restoration of Bloater in Lake Ontario.

Bloater stocking continues as a strategy to meet restoration objectives. Detailed stocking records are reported in Section 5. Population assessment surveys were significantly reduced in 2020 with only the Fall Benthic Prey Fish Survey (Section 1.5) targeting depths and habitat that are likely to have encountered Bloater. No Bloater were captured in 2020 during the Fall Benthic Prey Fish Survey.

6.5 Lake Trout Rehabilitation

J. P. Holden, Lake Ontario Management Unit

Once a dominant offshore predator and important commercial fishery, a combination of harvest, habitat destruction and impacts of invasive species resulted in Lake Trout being deemed extirpated in Lake Ontario by the 1950s. Commercial harvest records of Lake Trout began in the 1830s with the peak of the fishery resulting in over a million pounds of landed catch during the 1920s. Early stocking efforts were unsuccessful at sustaining Lake Trout due to high Sea Lamprey predation of adult Lake Trout. The Sea Lamprey control program began on Lake Ontario in the 1970s and offered new optimism for Lake Trout restoration. The first joint Canada/U.S. plan outlining the objectives and strategies for the rehabilitation efforts was formulated in 1983. The two objectives of the recovery strategy are: 1) increase abundance of stocked adult lake trout to a level allowing for significant natural reproduction and 2) improve production of wild offspring and their recruitment to adult stock.

The Canadian waters of Lake Ontario have had gill net assessments since the 1950s. Sites within the Kingston Basin (also referred to as the East Basin - the portion of the lake bounded by Prince Edward Bay, Main Duck Island, Amherst Island and the Canada/US border) provide the most consistent long-term index of Lake Trout monitoring in Ontario waters dating back to 1957. Index gill netting in the main basin of Lake Ontario began in the 1960s but has not been conducted with standard effort and sites throughout the entire period. Stocking throughout the 1980s was successful in restoring Lake Trout biomass throughout Lake Ontario. Ecosystem change, stocking cuts and a period of high Sea Lamprey mortality lead to declines in Lake Trout abundance throughout the 1990s to 2005 (2008 in the main basin). Since 2005 catches in the Ontario waters of the main basin have remained low relative to the peak in the 1990s but exhibit a moderate increasing trend.

Lake Trout target indices are largely derived from Fish Community Index Gill Net (Section 1.1) and Bottom Trawl (Section 1.2). Due to the limited spatial extent of those programs in 2020, Lake Trout assessment trends are not available for this reporting period. A small number of Lake Trout were caught in the nearshore and Lower Bay of Quinte sites and are reported on in Section 1.1. Stocking numbers are reported in Section 5. A summary of progress towards restoration targets up to the 2019 field year is included in Table 6.5.1.

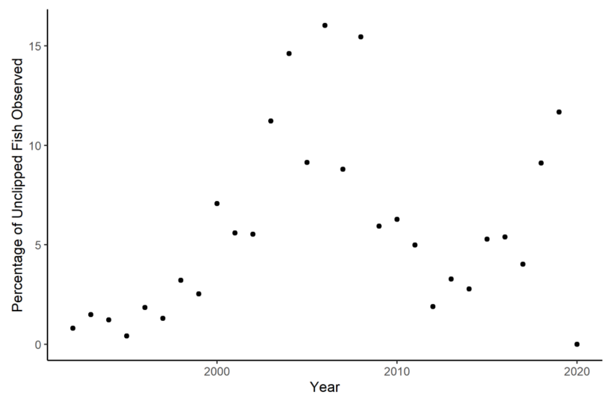

FIG. 6.5.1. Percentage of unclipped Lake Trout observed in Index Gill Netting Surveys in Ontario waters (Section 1.1).

TABLE 6.5.1. Status of Ontario targets identified in the Lake Trout Management Plan.

Management Strategy	Status	Details
Stock 440,000 spring yearlings per year in Canadian waters	Met	Stocking targets were reduced in 2017 due to concerns over available prey. Annual stocking data is presented in Section 5.
Maintain an adjusted catch rate of age-3 fish per standard gill net per 500,000 stocked > 1.5 fish per standard gill net set	Below/Unclear	Historically below target but has shown an increasing trend since 2012 however changes in fish distribution, stocking practices and sampling program confound the interpretation of this index.
A relative abundance greater than a CUE of 1.1 female Lake Trout > 4000g per standardized gill net	Below	Increasing trend but still well below target
Yearly survival of adult fish > 60%	Met	Survival of ages 5 to 15 has averaged 66% since 2016
Maintain the sea lamprey wounding rate in fall gill netting at <2 A1 wounds per 100 lake trout >433mm total length	Met	Target has been consistently met since 1996 although there was a period of high A2 wounding rates between 1995 to 2004.
Maintain annual harvest to <5,000 fish in Canadian waters	Exceeded	Harvest in Lake Ontario Salmon and Trout Angler Survey estimated at 1,349 but does not account for harvest in the Kingston Basin. Kingston Basin has historically been 3.5x higher than reported in Western Lake Ontario suggesting 4703 harvested in the Kingston Basin. Lakewide Ontario harvest is 6055. Harvest estimates do not account for any Lake Trout incidentally killed as commercial by-catch.
Emphasize strains that show the best combination of low post-stocking, juvenile, and adult mortality	Not assessed	In the absence of CWT in stocked lake trout, genetic analysis of all fish would be required in order to determine whether this target is being met. Currently only unclipped fish have tissue collect for genetic analysis.
Emphasize strains that are successfully producing a measurable level of wild recruits	Not reported	DNA samples from unclipped fish are routinely sent for analysis but are not reported here.
Protect naturally produced fish	Unclear	No special measures in place to meet this objective although harvest of all Lake Trout is generally low in Ontario. The percentage of unclipped fish has ranged from 0 to 16% of the observed fish (Fig. 6.5.1).

7. Research Activities

7.1 Station 81: Long-term monitoring at the base of Lake Ontario's food web

Project Leads: Adam Rupnik and Tim Johnson (OMNRF, Aquatic Research and Monitoring Section)
Collaborators: Heather Niblock and Kelly Bowen (Fisheries and Oceans Canada)

Long-term monitoring is important to help understand how changes in the physical and chemical conditions of a lake can affect the food web. Describing a lake's physical limnology (e.g., water temperature, dissolved oxygen, water transparency), nutrient status (e.g., total phosphorus, silica, etc.), primary production (e.g., algal and microbial composition and abundance), and secondary production (e.g., zooplankton and benthic invertebrates) is important to understand aquatic ecosystems and their inhabitants over time.

Long-term water quality data was collected within eastern Lake Ontario at Station 81 from 1981 – 1995 by the Department of Fisheries and Oceans (DFO), and then again from 2007 to present as a partnership with the OMNRF's Aquatic Research and Monitoring Section, the Lake Ontario Management Unit, and DFO. Station 81 is located near the centre of the Kingston basin in eastern Lake Ontario (44° 01.02'N, 76° 40.23'W) in approximately 34 m water depth (Fig. 7.1.1). Two additional sampling locations added in 2017 (T4L, NYSDEC) to better understand spatial differences in lake conditions were not sampled in 2020 due to logistical constraints.

In 2020, samples were collected at Station 81 bi-weekly from August 4th to October 22nd. Typically, sampling would be conducted from April to October; however, collections were limited in 2020 due to the COVID-19 pandemic. Sample collections consisted of water profiles that measured temperature, dissolved oxygen, and chlorophyll-a (an index of the quantity of algae), turbidity, and dissolved organic matter. Secchi depth (water clarity) was estimated, and water was collected for nutrient, phytoplankton, and zooplankton community analyses.

In the late 1970s, binational efforts were initiated to reduce phosphorous loading in the Great Lakes. While the average spring total phosphorous levels declined through the 1980s and early 1990s, average spring total phosphorous levels have been much more variable in the past 13 years (Figure 7.1.2). Total phosphorus measures include dissolved phosphorus as well as phosphorus found in plankton and suspended sediment in the water column. An increase in

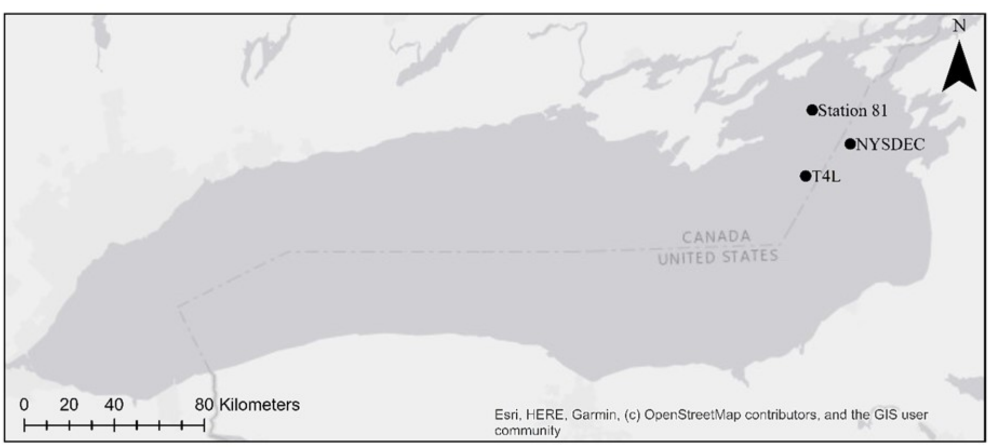

FIG. 7.1.1. Map of Lake Ontario showing the locations of three limnological sampling sites.

wind velocities or storm frequency can contribute to increased suspended sediment and total phosphorus loads.

Average spring Chlorophyll levels are greatly decreased in the recent time period relative to the 1980s and 1990s, but they also exhibit high variability among years (Fig. 7.1.3). Average summer chlorophyll levels are not as reduced as spring when compared to the 1980s and 1990s and are more consistent among years (Fig. 7.1.4). Measures of water transparency (Secchi depth) show increased transparency as well as increased variability among years in the summer (Fig. 7.1.5), further implicating suspended sediments as a more important variable in recent years.

The Station 81 long-term monitoring program provides scientists and lake managers with valuable baseline information on the composition and health of the base of the Lake Ontario food web. This undertaking has helped identify increasing water temperatures (averaging 0.03°C per year, or over 3.0° since sampling began in 1981) and declines in zooplankton densities (as a result of the invasion and subsequent establishment of dreissenid mussels). Continued maintenance and monitoring of these long-term datasets will ensure that resource managers are well equipped to identify and respond to changes that may impact the Lake Ontario ecosystem.

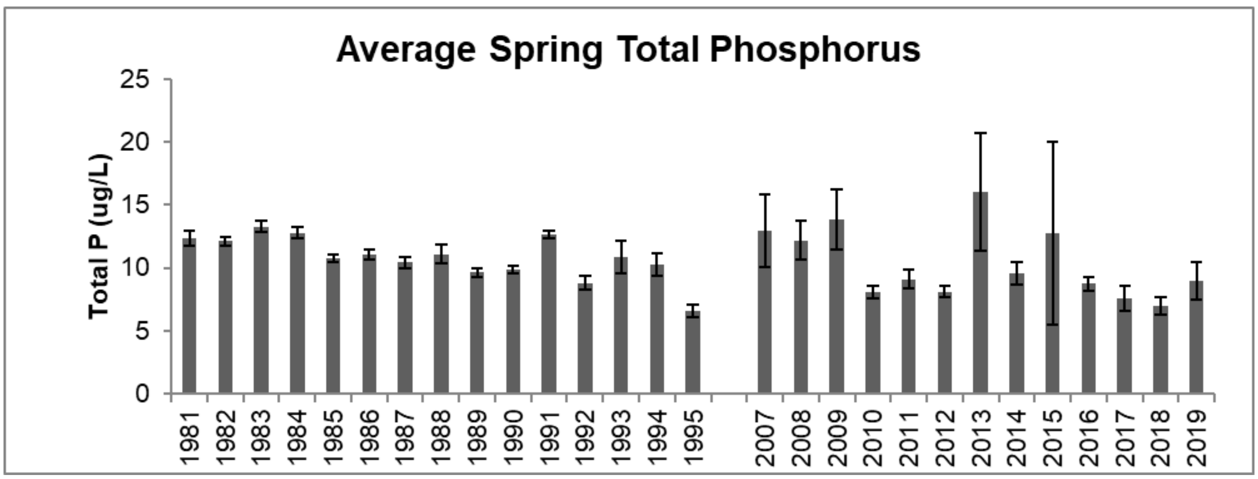

FIG. 7.1.2. May – October average total phosphorus levels (µg/L) (2020 results pending).

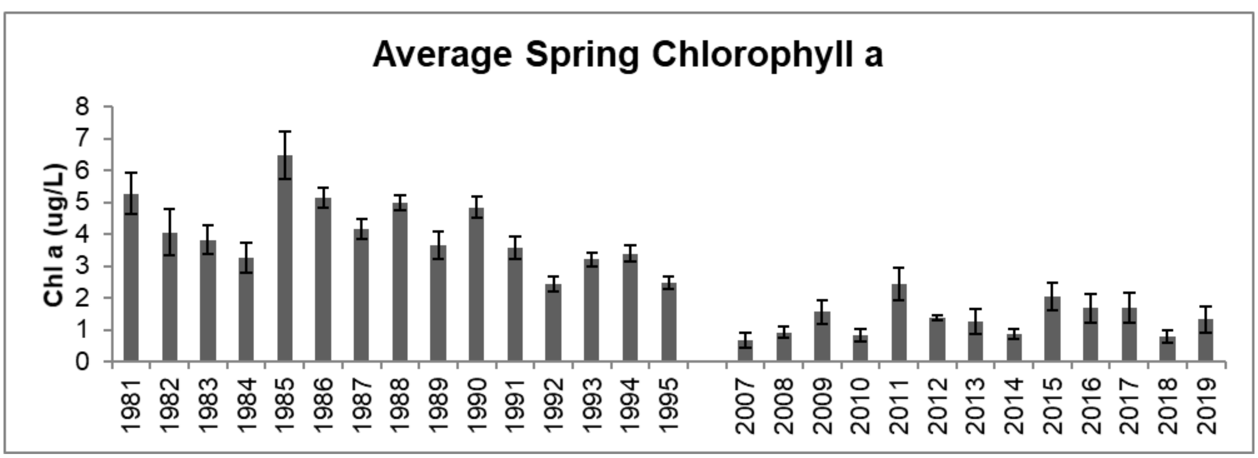

FIG. 7.1.3. May – June average Chlorophyll levels (µg/L) (2020 results pending).

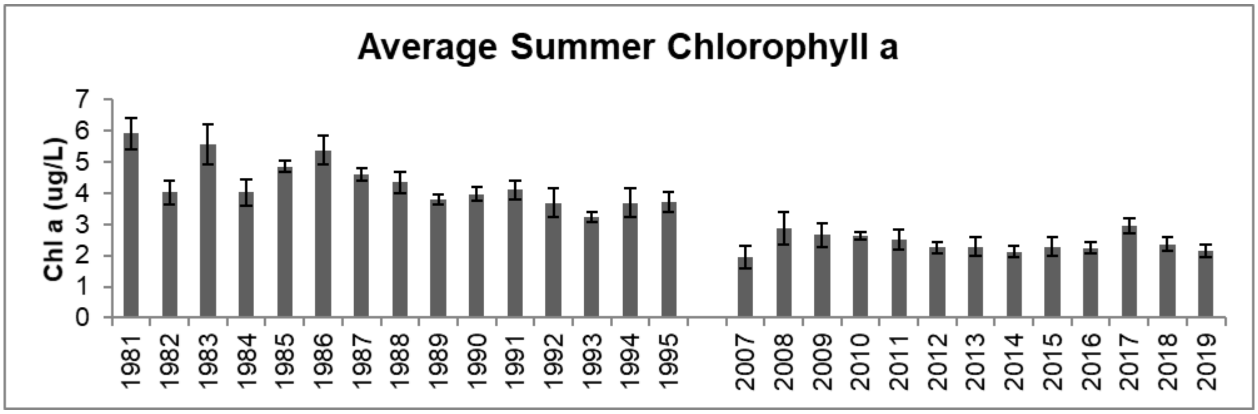

FIG. 7.1.4. July – September average Chlorophyll levels (µg/L) (2020 results pending).

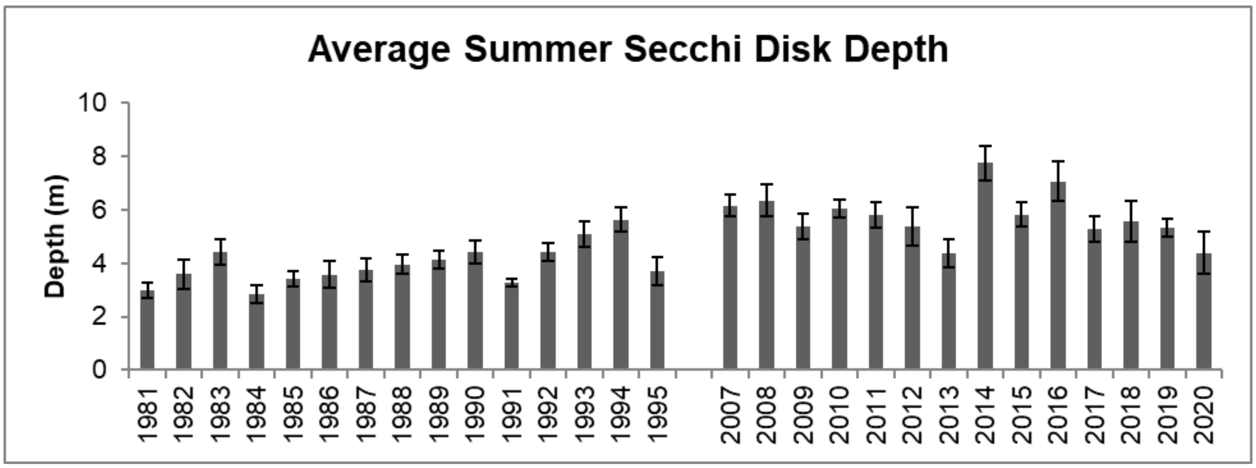

FIG. 7.1.5. July – September average Secchi depths (m).

7.2 Spatial and seasonal variability in the feeding ecology of two key invertebrate taxa in Lake Ontario

Project Leads: Don Uzarski and Aaron T. Fisk (Great Lakes Institute for Environmental Research, University of Windsor); Tim Johnson (OMNRF, Aquatic Research and Monitoring Section)
Collaborators: Warren Currie (Fisheries and Oceans Canada)

Studying the ecology of lower trophic level plankton and invertebrate species in Lake Ontario can help us better understand energy flows through the entire Lake Ontario food web. *Mysis diluviana*, a large bodied deep-water zooplankton, is consumed by many fish species and consumes both benthic and pelagic plankton and algae. *Dreissena* species (Zebra [*Dreissena polymorpha*] and Quagga [*Dreissena bugensis*] Mussels), are non-mobile filter feeding mussels that consume suspended particulate organic matter (POM; tiny biological particles suspended in the water column) and small zooplankton, and deposit energy on the lake bottom in their excreted wastes. Improved understanding of how the trophic position (place in the food web) and carbon (energy) sources of these two taxa vary spatially and seasonally in Lake Ontario will help fishery managers refine their understanding of how energy moves through the food web.

Using data collected by the OMNRF and the United States Geological Survey during the Cooperative Science and Monitoring Initiative intensive field collections, we quantified the trophic positions and carbon sources of *Mysis diluviana* and *Dreissena* species using stable isotopes. Stable isotope analyses, a common tool used in the study of food web dynamics, assesses the ratio of heavy to light carbon isotopes ($\delta^{13}C$) and nitrogen isotopes ($\delta^{15}N$). The carbon isotope ratio identifies the source of energy with $\delta^{13}C$ increasing from pelagic (offshore) to benthic (lake bottom) and terrestrial (land-based) sources. The nitrogen isotope ratio suggests an organism's trophic position (place in the food web) increasing from primary consumers to top predators. Preliminary analysis of the data suggested that the trophic position of the two taxa varied by season declining from spring to fall (Fig. 7.2.1), while carbon sources tended to become more benthic as the year progressed. Generalized linear models suggested that carbon sources utilized by, and the trophic positions of, these taxa were influenced by season, ecoregion (spatial regions of the lake defined by properties of the water mass), and water depth.

Additional work undertaken in 2020 and 2021 will focus on assessing the variability in stable isotope ratios in these two taxa groups between the nearshore and offshore environments of the lake. Better understanding the variability in stable isotope ratios in some of the lake's key aquatic taxa groups will refine our understanding of how the Lake Ontario food web functions, the roles different taxa have in the community, and where energy goes in the lake.

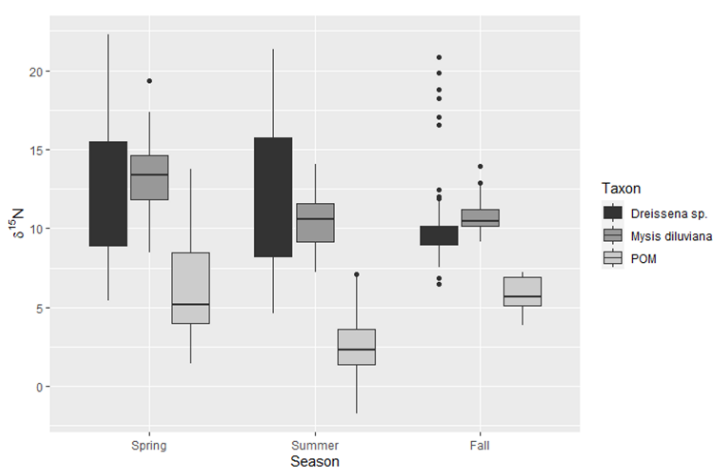

FIG. 7.2.1. Trophic position ($\delta^{15}N$) of *Dreissena* species, *Mysis diluviana*, and particulate organic matter (POM) in the spring, summer, and fall of 2013 in Lake Ontario.

7.3 Diet and prey preference of Alewife (*Alosa pseudoharengus*) in Lake Ontario

Project Leads: Mary Hanley and Tim Johnson (OMNRF, Aquatic Research and Monitoring Section)
Collaborators: Kelly Bowen (Fisheries and Oceans Canada); Carolina Taraborelli and Julie Munro (formerly OMNRF, Aquatic Research and Monitoring Section)

Alewife (*Alosa pseudoharengus*) are a small non-native planktivorous fish common throughout the Great Lakes. They are the most abundant fish in Lake Ontario and are the dominant prey item for many nearshore and offshore fishes (e.g., Walleye [*Sander vitreus*], salmon and trout). Alewife provide a vital link between lower trophic level organisms (e.g., plankton and other invertebrate prey) and upper trophic level organisms (e.g., trout and salmon). Improved understanding of Alewife feeding ecology may give us insight into factors affecting Alewife production (such as changes in their food source) and ultimately help scientists and managers better understand food web dynamics in a changing ecosystem. This study examined Alewife diets to determine if ongoing shifts in the plankton community were reflected in the diets of Alewife, whether Alewife preferentially select some prey items over others, and if current diets are similar to those reported one and two decades earlier.

In 2013, 545 adult and 214 sub-adult Alewife stomach contents were analysed from the west, central, and east regions of Lake Ontario in the spring, summer, and fall. Zooplankton were collected from the same locations and dates. Alewife stomach contents and zooplankton collections were analyzed taxonomically, and biomass was estimated. Alewife diets and zooplankton community composition were characterized and compared to see if diets reflected plankton community composition and abundance, or whether signs of prey selectivity were present.

While Alewife diets were variable, predatory cladocerans (e.g., Spiny Waterflea *Bythotrephes longimanus,* Fishhook Waterflea *Cercopagis pengoi*) were the largest component of diets (by weight) in all regions of the lake and in increasing amounts as the seasons progressed (Fig. 7.3.1). Cyclopoid copepods (e.g., *Diacyclops* thomasi and copepodids) were also consumed in large numbers, although Alewife did not actively select for this group (Fig. 7.3.2).

While adult Alewife diets were dominated by large predatory cladocerans, and adult Alewife may have been preferentially feeding on these plankton, sub-adult Alewife appeared to have a more diverse diet, made up of a larger variety of plankton groups, and physically smaller individuals. Lastly, these diets were more similar to those described in the 1980s and 1990s (large bodied native and invasive cladocerans), than those described in the early 2000s (dominated by *Mysis diluviana*), suggesting Alewife diet is strongly influenced by availability of different prey.

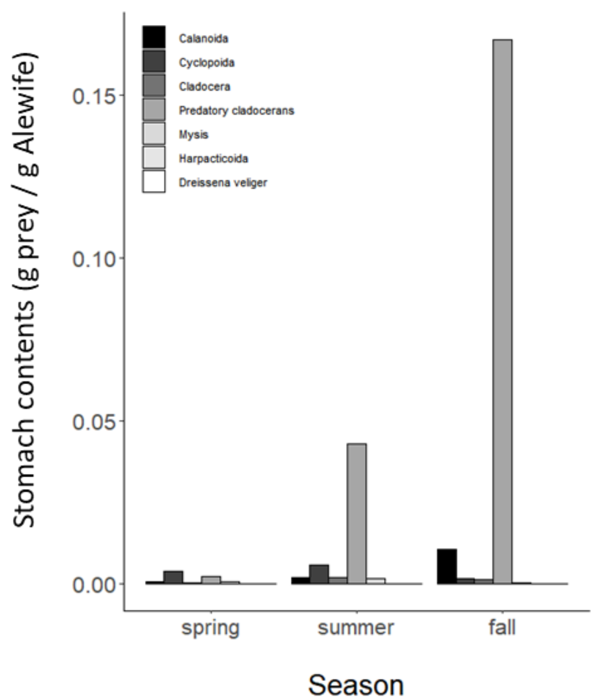

FIG. 7.3.1. Stomach content ration (g prey / g Alewife) for adult and sub-adult Alewife (combined) in different seasons in Lake Ontario in 2013.

Given their central role in the Lake Ontario food web, a better understanding of the dynamics and interactions of the plankton and prey fish communities has potential to provide fishery managers with an early indicator of more rapidly changing conditions at the base of the food web that may ultimately be reflected in top predator growth and production. As such, continued monitoring of lower trophic levels (such as plankton) and diets of the fish that feed upon them should remain important for fishery managers.

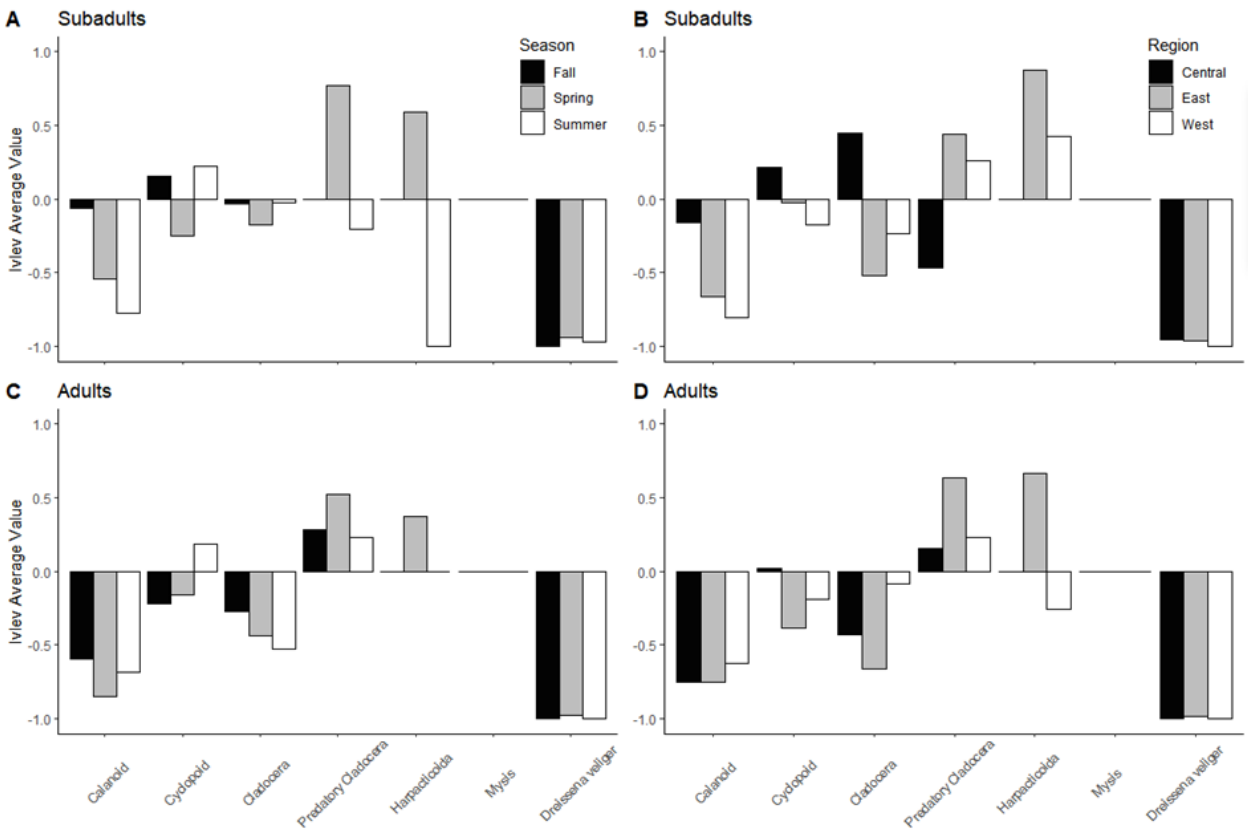

FIG. 7.3.2. Average diet selectivity for subadult (A and B) and adult (C and D) Alewife in Lake Ontario in 2013. The x-axis shows prey family groups by season (A and C) and region (B and D) of the lake. A value of 1 indicates strong selection for that prey group, while a score of -1 indicates full avoidance of that prey group.

7.4 Lake Ontario interbasin fish movement revealed by acoustic telemetry

Project Leads: Adam Rupnik and Tim Johnson (OMNRF, Aquatic Research and Monitoring Section); Aaron Fisk (University of Windsor, Great Lakes Institute for Environmental Research)
Collaborators: Jon Midwood (Fisheries and Oceans Canada); Dimitry Gorsky (United States Fish and Wildlife Service); Bruce Tufts (Queen's University); Erin Brown and Jake La Rose (OMNRF, Lake Ontario Management Unit); Jason Robinson (New York State Department of Environmental Conservation)

Acoustic telemetry is a valuable tool for understanding the movement of fishes throughout Lake Ontario. While the east and west ends of the lake contain many acoustic receivers, the central part of Lake Ontario remains an area where few acoustic receivers are currently deployed. Increased receiver deployment in this area could improve our understanding of where and when fish travel between basins. Investigating interbasin movement of fishes traveling between the eastern and central basins of Lake Ontario could help us identify species-specific seasonal depth corridors, provide insight into what triggers these movements, and determine the frequency of interbasin movements throughout the year.

Acoustic receivers were first deployed near Point Petre, Prince Edward County, in August 2018, in two parallel lines extending from shore out approximately 16 km into Lake Ontario to a water depth of 105 m (Fig. 7.4.1). This receiver array consists of 29 receivers and incorporates four V9 69kHz sentinel tags (to assess detection efficiency / range in the area; sentinel tags alternate signal output to emulate V9 and V13 tags). Most receivers were retrieved and serviced in September 2019, and again in August 2020.

After 26 months of deployment, receivers detected 220 unique individuals representing 13 species of fish (Fig. 7.4.2). Lake Trout (*Salvelinus namaycush*; 90) and Walleye (*Sander vitreus*; 58) were detected most frequently, making up 30% and 47% of detections, respectively. Other species detected included Chinook Salmon (*Oncorhynchus tshawytscha*; 18), Bloater (*Coregonus hoyi*; 13), Rainbow Trout (*Oncorhynchus mykiss*; 12), American Eel (*Anguilla rostrata*; 10), Lake Whitefish (*Coregonus clupeaformis*; 8 individuals), Brown Trout (*Salmo trutta*; 3), Atlantic Salmon (*Salmo salar*; 2), Cisco (*Coregonus artedi*; 2), Coho Salmon (*Oncorhynchus kisutch*; 2), Lake Sturgeon (*Acipenser fulvescens*; 1), and Smallmouth Bass (*Micropterus dolomieu*; 1).

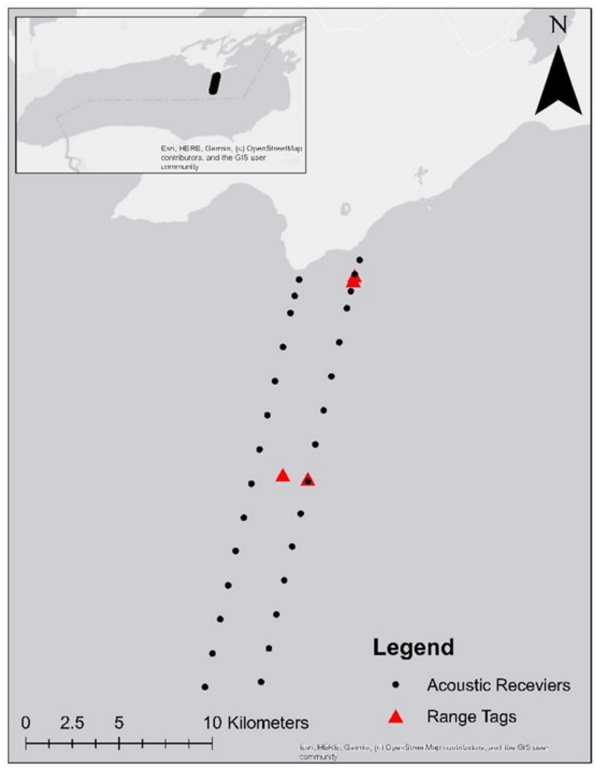

FIG. 7.4.1. Locations of acoustic receivers moored off the south coast of Point Petre, Prince Edward County. A total of 15 VR2W and 14 VR2AR receivers make up this array.

Most salmonid species were detected on deeper receivers (>50 m) throughout the year with the exception being Brown Trout (detected on shallower receivers, <30 m). Walleye were primarily detected in the late summer and fall at an average receiver depth of 30 m (SD = 10 m).

The Smallmouth Bass was detected during the summer months on receivers located between 5 and 30 m deep. The coregonid species (Lake Whitefish, Cisco, and Bloater) were detected on receivers that averaged 24 m deep (SD = 14 m) but were also almost exclusively detected in the late fall when the lake was cooling and fish were presumably moving to spawning locations. Overall, most species were detected over a wide range of receiver depths depending on the season, with the exceptions being Atlantic Salmon (>90 m) and Smallmouth Bass (<30 m).

Movement of fishes throughout the array varied seasonally. Detections increased from August to December 2018, then decreased in January 2019 and remained low throughout the winter months, possibly due to lower detection efficiency in cold water. Detections increased in May 2019, reached a maximum in July 2019, then decreased into the winter months. As with the previous year, detections increased significantly in May 2020, peaked in June, and subsequently decreased into August when the receivers were downloaded.

Directional movement across the array was detected in Walleye, Lake Whitefish, Bloater, Lake Trout, and Chinook Salmon. Generally, fish were last detected on the eastern line of receivers during the fall and early winter suggesting they may be traveling east towards the eastern end of the lake to overwinter. These same fish were detected moving westward early in the spring following a gap in detections during the winter months.

Sentinel tags were used to estimate the effective range and detection efficiency of receivers and tags within the Point Petre array. Two sentinel tags were deployed at one shallow (10 m) and one deep (50 m) location within the array. Detection efficiency varied throughout the study period, diminishing in the winter months (November to May). In shallow water, a detection efficiency of 50% (i.e., half of the transmitted sentinel tag signals were received) was estimated to be 200 m (horizontal distance from a receiver). The lower detection efficiency and range in the shallower water was likely due to higher acoustic noise closer to shore associated with wind, waves, and more turbulent water. Detection range at the deeper site was approximately 1 km. Detection efficiency was significantly reduced during the winter months, likely due to the colder water temperatures (sound signals do not transmit as well when water temperatures are cold).

One of the goals of this study was to assess the feasibility of open-coastal, shallow water receiver deployments. Results from the initial deployment suggest the current mooring system is acceptable for deeper deployments, but not for shallow deployments (i.e., less than 5 m water depth). The shallowest two receivers on the eastern line moved after the initial deployment during the winter months. The shallowest receiver, moored at 5 m depth, moved approximately 1.3 km east of its original location. The second receiver, moored at 9 m deep, was severed from its anchor and washed up on shore in February 2019. This movement was likely caused by winter ice "grabbing" the floats used to suspend the receivers above the lakebed. Deployments at these stations during the summer months stayed in place, suggesting seasonal shallow water deployments may be optimal. New moorings that did not utilize floats to suspend receivers were deployed in November 2019 at the two shallowest locations within the array to see how they would fair through winter conditions. These moorings? will be recovered in 2021.

Lastly, in 2020, an additional 24 receivers (8 VR2W and 16 VR2AR) were deployed in a 7.5 km square grid pattern between this array off of Point Petre and the receiver array deployed near the Duck-Galloo Ridge providing expanded receiver coverage to better assess fish movement throughout the eastern end of Lake Ontario.

Continued monitoring of fish movements with this receiver array and others deployed in Lake Ontario will help us better understand spatial and temporal movements of fishes traveling throughout the lake. Results of acoustic telemetry are contributing to our management of many fish species of recreational, commercial, and ecological significance.

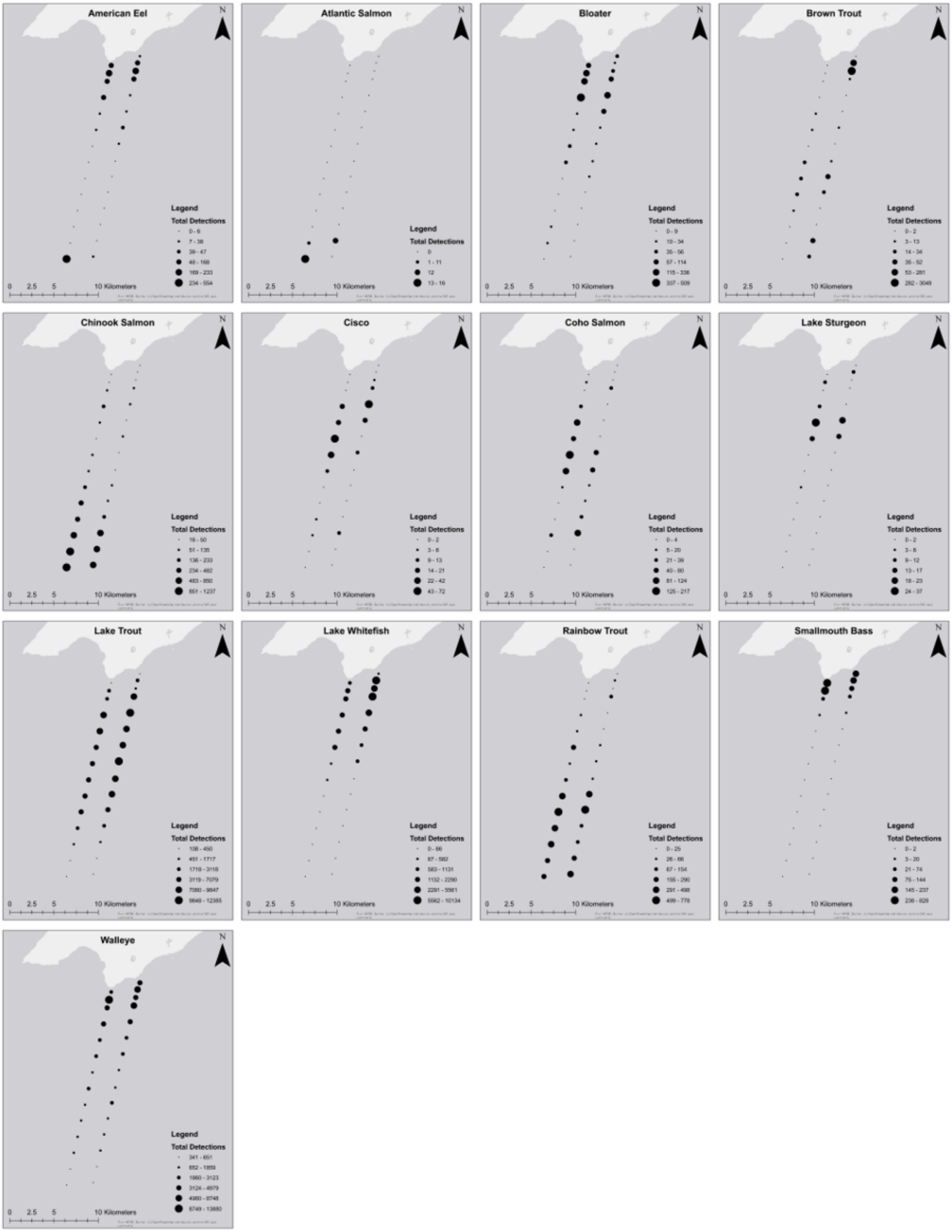

FIG. 7.4.2. Species-specific detections in the Point Petre acoustic array between August 2018 and September 2020. Circle diameter indicates the total number of detections on that receiver. Receiver depth increases with distance from land, with depths ranging from approximately 5 to 105 m.

7.5 Acoustic telemetry and Floy tag reveal spatial use patterns of Atlantic Salmon (*Salmo salar*) in Lake Ontario

Project Leads: Sarah Larocque and Aaron Fisk (University of Windsor, Great Lakes Institute for Environmental Research); Tim Johnson (OMNRF, Aquatic Research and Monitoring Section); Colin Lake (OMNRF, Lake Ontario Management Unit)

Atlantic Salmon (*Salmo salar*), once native to Lake Ontario, were extirpated from the lake in the late 1800s but are now undergoing reestablishment efforts. Since their extirpation, the Lake Ontario fish community has experienced many changes and the present-day species assemblage now includes six salmon and trout species. Atlantic Salmon consume similar prey to the other salmon and trout species; determining the degree of niche overlap of the species would inform fisheries management and aid restoration success. Key to assessing niche overlap is gaining a better understanding of Atlantic Salmon spatial ecology.

To learn more about Atlantic Salmon space use (horizontal and vertical) in Lake Ontario, a combination of acoustic telemetry and Floy tag mark-recapture methods were employed. Fourteen hatchery-raised adult Atlantic Salmon were tagged with acoustic transmitters from 2016 to 2019 (eight transmitters included depth sensors) and were passively monitored on acoustic receivers deployed throughout the western and eastern basins of Lake Ontario. Additionally, 1 915 adult Atlantic Salmon received Floy tags and were released between 2018 and 2020.

Telemetry and tagged fish recaptures provided evidence of cross-lake movements (Fig. 7.5.1). Home ranges did not vary seasonally and encompassed the entire lake (Fig. 7.5.2). Generally, movements were nearshore (<3 km from shore) in spring and summer at approximately 25 m bathymetric depth, with movements closer to shore in the fall, and further offshore (approximately 15 km at 60-80 m bathymetric depths) in winter (Fig. 7.5.3A). Depth use was relatively shallow (<4 m) with occasional deep dives; that pattern was more pronounced in the winter (29 m maximum depth). Small daily vertical movements (1-5 m) were observed, with fish moving deeper during the afternoon (Fig. 7.5.3B).

When compared to the spatial ecology of the other salmon and trout species in Lake

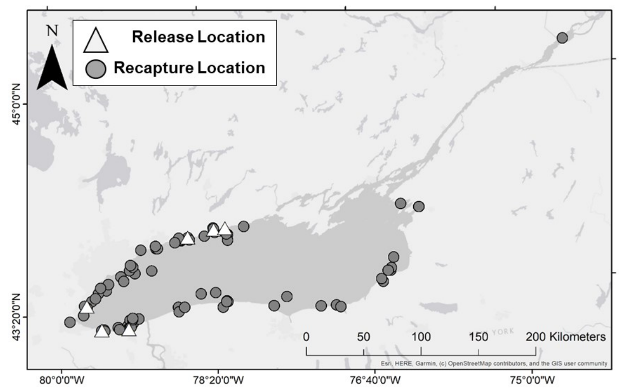

FIG. 7.5.1. Release and recapture locations of Floy tagged Atlantic Salmon (*Salmo salar*) in Lake Ontario, 2018-2020.

Ontario, there appears to be some spatial segregation of Atlantic Salmon from the other species (either horizontally or vertically) during large parts of the year. For example, Atlantic Salmon remain shallower and closer to shore than Chinook Salmon (*Oncorhynchus tshawytscha*), Rainbow Trout (*Oncorhynchus mykiss*), and Lake Trout (*Salvelinus namaycush*) in summer and fall, and appear to remain shallower than Brown Trout (*Salmo trutta*) in summer and fall. However, spatial overlap does likely occur in nearshore waters during the spring with most salmon and trout species when thermal conditions are less constraining.

Better understanding the spatial movements and space-use of the salmon and trout species in Lake Ontario will help further our understanding of niche overlap and potential competition amongst the members of the fish community. This study was the first to provide detailed spatial movement data on Atlantic Salmon in Lake Ontario, and this novel information will support the management of this reintroduced species and the fish community as a whole.

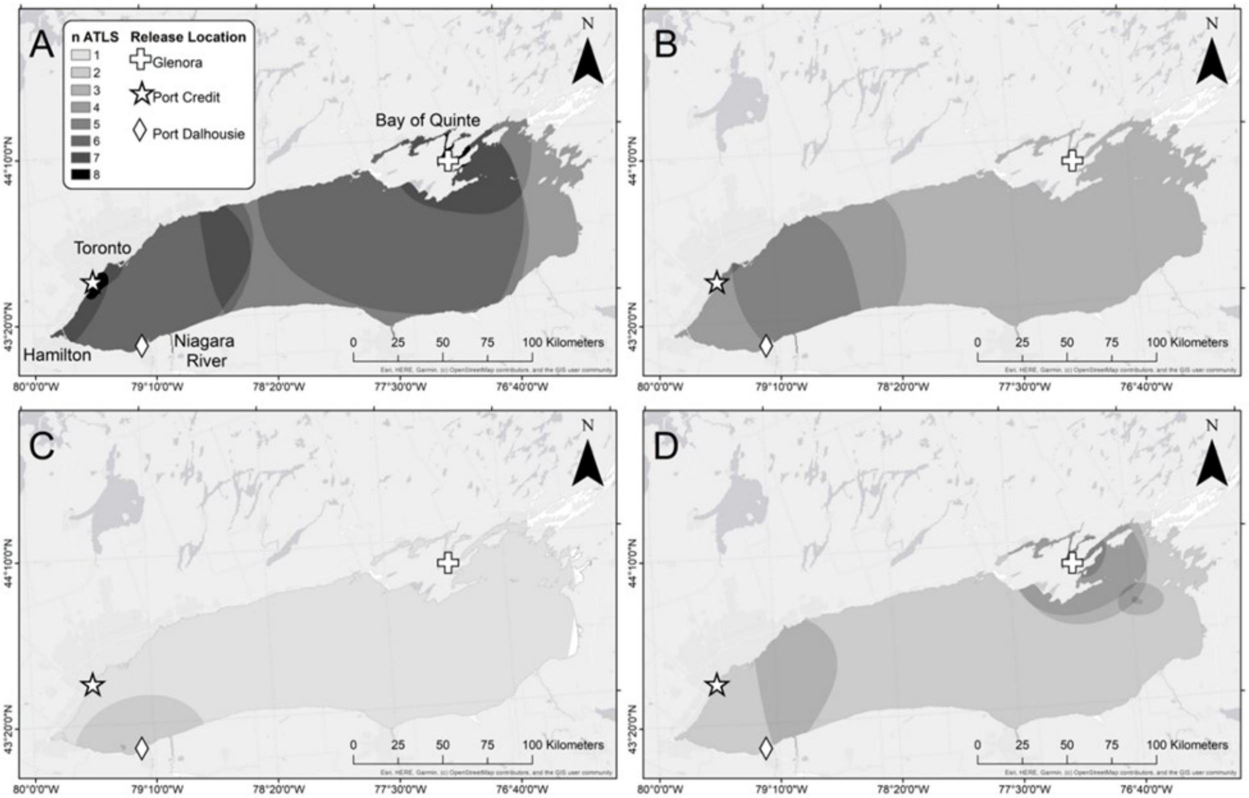

FIG. 7.5.2. Estimated seasonal home ranges (95% autocorrelated kernel density estimation) for Atlantic Salmon (*Salmo salar*) in A) spring (n = 12), B) summer (n = 6), C) fall (n = 3), and D) winter (n = 9) in Lake Ontario. Darker colours indicate areas of high use by individuals.

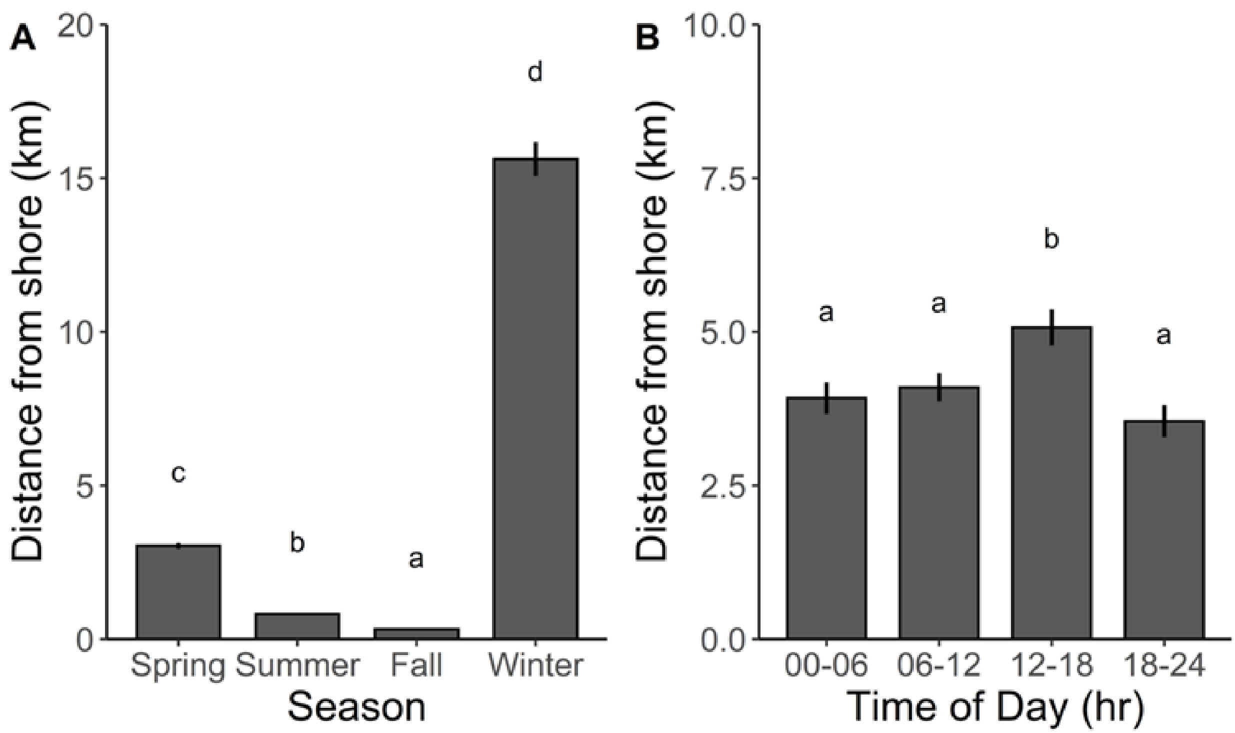

FIG. 7.5.3. Mean (± SE) distance from shore (km) that acoustically tagged Atlantic Salmon (*Salmo salar*) were detected across A) seasons and B) time of day in Lake Ontario, 2016-2019.

7.6 Informing Lake Trout (*Salvelinus namaycush*) restoration in Lake Ontario based on interactions with other top predators in time and space

Project Leads: Silviya Ivanova and Aaron Fisk (University of Windsor, Great Lakes Institute for Environmental Research); Tim Johnson (OMNRF, Aquatic Research and Monitoring Section)
Collaborators: Chris Legard (New York State Department of Environmental Conservation)

Evidence from diets suggests trout and salmon show considerable overlap with respect to food preference. However, we do not know the degree to which spatial and temporal interactions are driving this dietary overlap. Knowing how much species interact, and potentially compete for shared resources, would better inform management planning with respect to restoration plans and stocking strategies. Lake Ontario is home to six salmonid species attracting recreational anglers from across North America. Currently, a number of different fish species, including Lake Trout (*Salvelinus namaycush*) and Chinook Salmon (*Oncorhynchus tshawytscha*) are being stocked in Lake Ontario in an effort to promote restoration of historically important species and support economically important recreational fisheries. The Lake Ontario Lake Trout population was decimated in the 1900s due to sea lamprey, habitat loss, and overfishing, and efforts to rehabilitate the population have been on-going for over 40 years. Chinook Salmon are the most sought–after salmonid species by anglers on Lake Ontario, largely driving the open-lake recreational and charter boat fishery. Understanding the spatial and temporal interactions of Lake Trout with other top predators such as Chinook Salmon is critical to understand potential factors contributing to the future success of both species.

Little is known of Lake Trout and Chinook Salmon seasonal movements and preferred depth and temperature in Lake Ontario. Acoustic telemetry provides a means to begin to understand these behaviours. We are using a fixed-station receiver array in the east and west ends of Lake Ontario (Fig. 7.6.1) to track the movements and behaviour of Lake Trout and Chinook Salmon that have been surgically implanted with acoustic tags. Both Lake Trout and Chinook Salmon have been tagged on a yearly basis since 2017.

We collected and analysed 2.5 years of data to quantify the home range overlap and

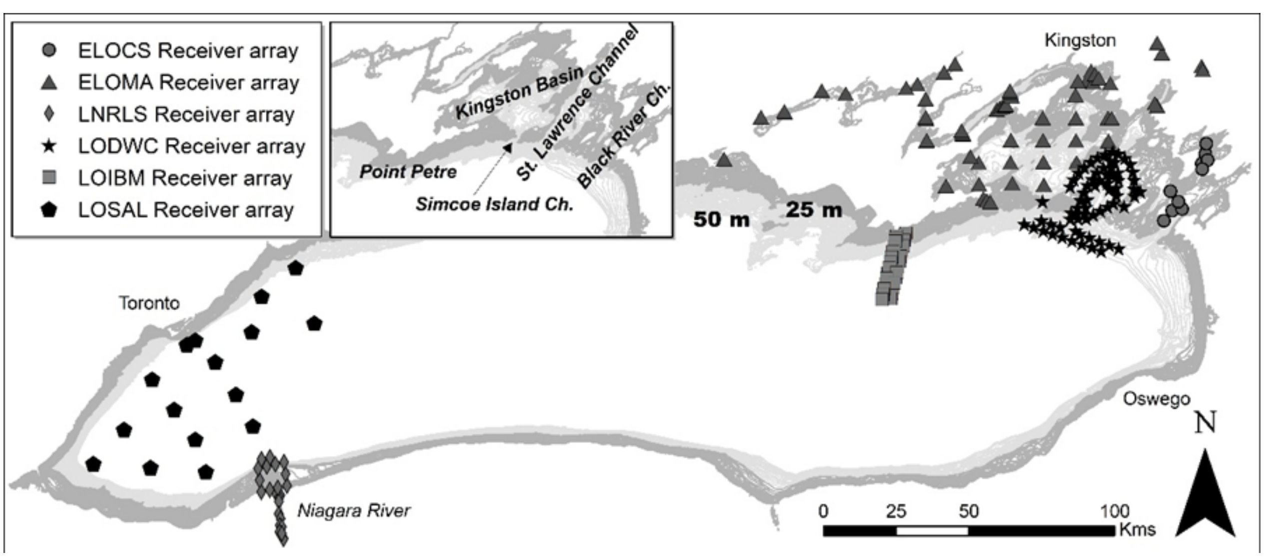

FIG. 7.6.1. Map of receiver arrays in Lake Ontario for 2017-2019. Inset shows the geographical location names of eastern Lake Ontario.

interactions of Lake Trout and Chinook Salmon in eastern Lake Ontario. Lake Trout are a demerso-pelagic fish (they associate with the lake bottom but also venture up in the water column to feed), known to prefer deep, cold waters, and migrate to shallow areas in the fall to spawn, whereas Chinook Salmon are cool water pelagic species (typically are found up in the water column away from the lake bottom, in the offshore areas of the lake).

Seasonal home range overlap (latitude-longitude) between Chinook Salmon and Lake Trout in Lake Ontario occurred only during the summer period (Fig. 7.6.2). Mean (±1 standard deviation; SD) depth for the entire period for Lake Trout was 31.2 ± 13.1 m and for Chinook Salmon 28.6 ± 20.3 m in Lake Ontario (Fig. 7.6.3) with seasonal flip in depth use observed between the two species with Chinook Salmon occupying shallower depths in the summer and deeper depths in the winter, while Lake Trout was shallower in the winter and deeper in the summer.

Overall, 39 (of 42) Lake Trout and 6 (of 17) Chinook Salmon interacted with one another (i.e., were detected in the same place and time). In 2017, interactions occurred during the summer and early fall months over a mean area of 12.0 ± 32.5 km^2. Similar amounts of interaction occurred during the day and night; however, the species were separated by the depth they occupied (Fig. 7.6.4).

This work contributes directly to better understanding Lake Trout and Chinook Salmon ecology in Lake Ontario, providing novel data to inform their respective management objectives. On a broader scale, this research contributes new insights on the interactions of top predator fishes in large lake ecosystems and could aid in developing more adaptive stocking strategies and management plans.

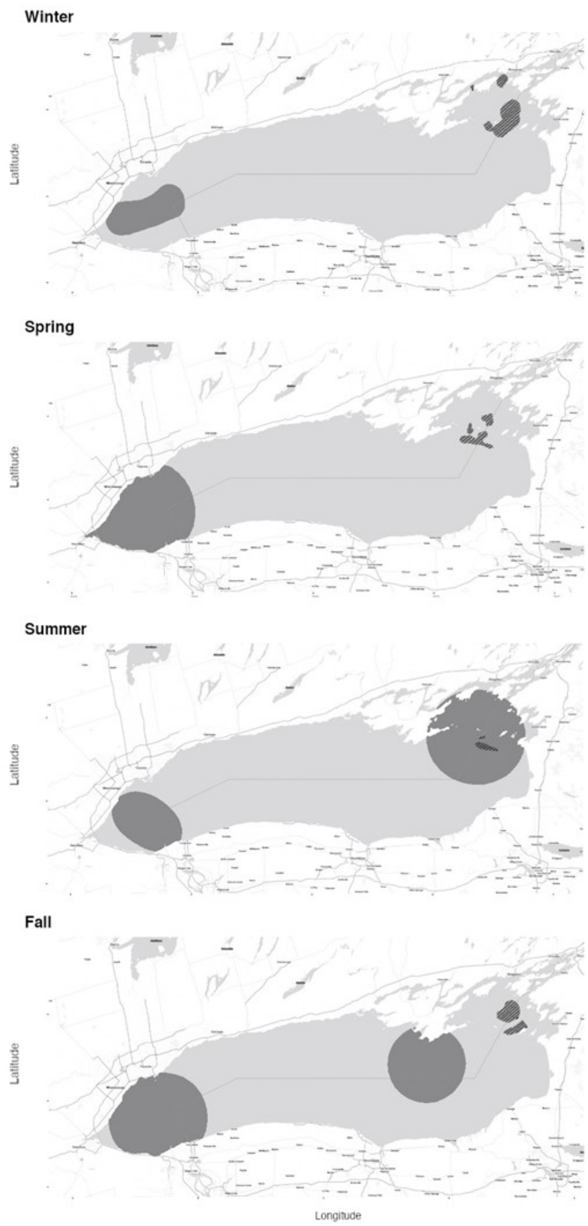

FIG. 7.6.2. Lake Trout (grey with black stripe) and Chinook Salmon (solid grey) seasonal home ranges (50% kernel utilization distribution) in eastern Lake Ontario between 2016 and 2019. Overlap in these two dimensions is seen only for the summer period. Note: all IDs (with and without a depth sensor tag) were included in this analysis.

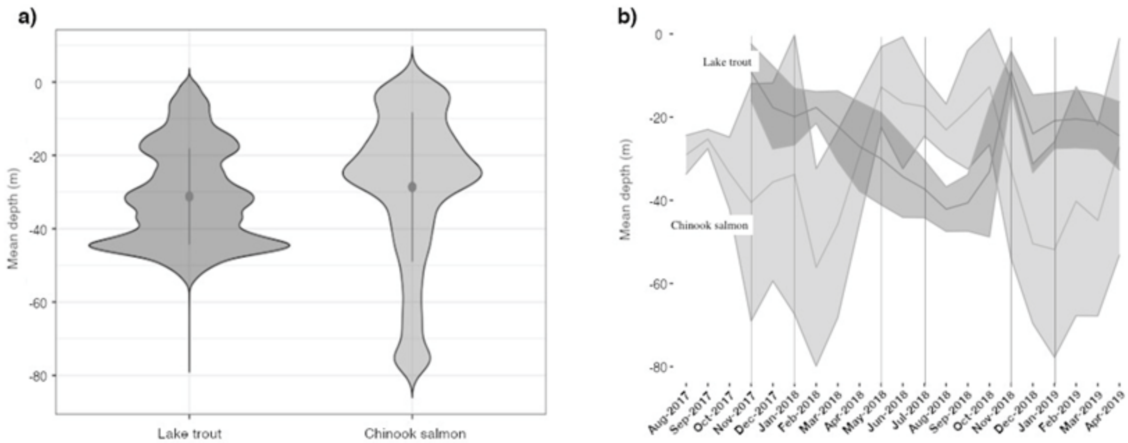

FIG. 7.6.3. Overall and mean monthly depths for Lake Trout (darker grey) and Chinook Salmon (lighter grey) in eastern Lake Ontario for the period of Dec. 1, 2016 to Apr. 30, 2019. a) Overall mean (± 1 SD) depth distributions for the entire study period were 31.2 m (± 13.1) and 28.6 m (± 20.32) for Lake Trout and Chinook Salmon, respectively; b) mean depth and standard deviation binned monthly for the two species. (Note: only individuals with a depth sensor tag were included in this analysis; vertical black lines represent season switch.).

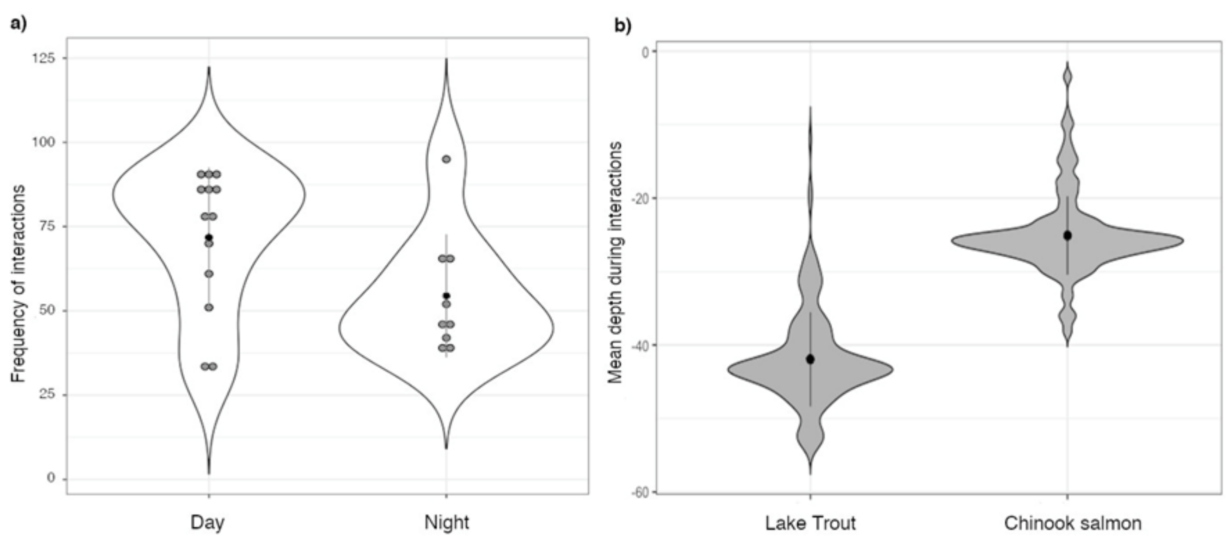

FIG. 7.6.4. Fine-scale interactions between Lake Trout and Chinook Salmon individuals in eastern Lake Ontario. a) Time of day frequency of interactions (days were defined as between the hours of 06:00 and 20:00 during which daylight was present; black circles in violin plots represent the means and whiskers the standard deviation; note: all fish were included in this analysis); b) mean depth distribution for periods of identified interactions for Lake Trout and Chinook Salmon in eastern Lake Ontario. Mean depth during the identified interactions were statistically different between the two species (note: only fish with a depth sensor tag were included in this analysis).

7.7 Food web structure of the Laurentian Great Lakes – a cross-lake comparison (2016 – 2019 Cooperative Science and Monitoring Initiative collections)

Project Leads: Brent Nawrocki and Tim Johnson (OMNRF, Aquatic Research and Monitoring Section)
Collaborators: Aaron Fisk (University of Windsor, Great Lakes Institute for Environmental Research); Yingming Zhao (OMNRF, Aquatic Research and Monitoring Section); Mike Rennie (Lakehead University)

The Great Lakes are heterogenous aquatic ecosystems differing in physical properties, productivity, and stress. Due to these natural differences in lake properties, food web structure and applied ecological metrics (e.g., energy transfer between trophic levels) are likely to differ among and within the Great Lakes.

Samples were collected between April 15 and November 8 from lakes Superior (2016), Huron (2017), Ontario (2018), and Erie (2019) across five standardized ecoregions within each lake (anthropogenic, embayment, inlet, open coastal, and outlet; Fig. 7.7.1). Samples were provided by a variety of agencies including the Ontario Ministry of Natural Resources and Forestry, United States Geological Survey, New York State Department of Environmental Conservation, Michigan Department of Natural Resources, Ohio Department of Natural Resources, and Wisconsin Department of Natural Resources. Sample collections were coordinated to achieve representation of piscivore (fish eating), omnivore (broad diet), invertivore (insect eating), and planktivore (plankton eating) trophic guilds. Species included: Walleye (*Sander vitreus*), Lake Trout (*Salvelinus namaycush*), Smallmouth Bass (*Micropterus dolomieu*), Yellow Perch (*Perca flavescens*), Cisco (*Coregonus artedi*), Lake Whitefish (*Coregonus clupeaformis*), Alewife (*Alosa pseudoharengus*), Rainbow Smelt (*Osmerus mordax*), minnows (*Notropis* spp.), Deepwater Sculpin (*Myoxocephalus thompsonii*), Slimy Sculpin (*Cottus cognatus*), and Round Goby (*Neogobius melanostomus*). Freshwater invertebrate *Dreissenidae* and *Unionidae* were also collected for a standardized isotopic baseline across all lakes and ecoregions.

Carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotopes (mass-dependent elemental molecules present in biological tissue that can be used to estimate energy sources and diets) were used to

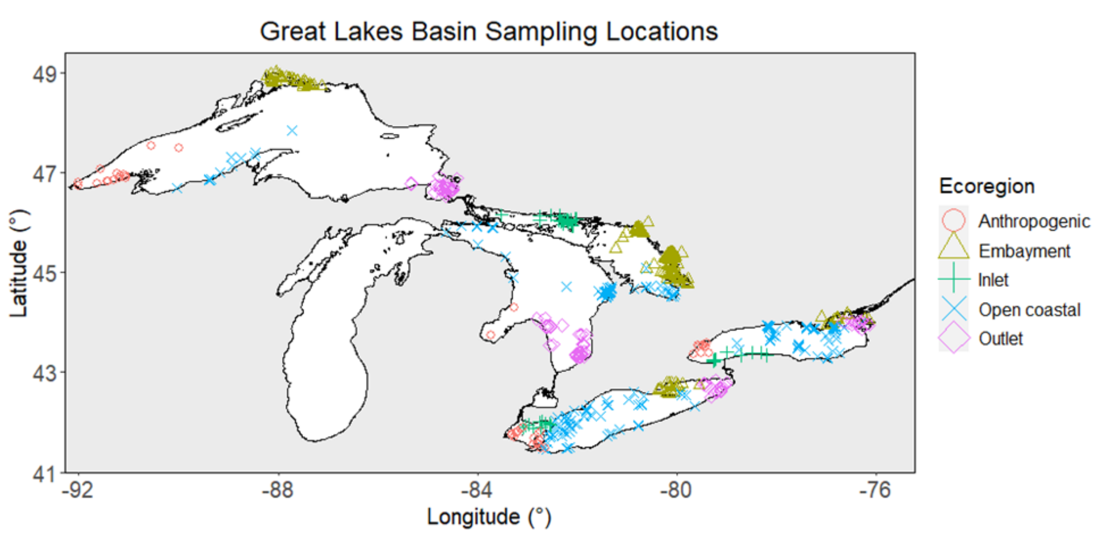

FIG. 7.7.1. Summary of fish and baseline sample collection locations across Great Lakes and ecoregions as a part of the Cooperative Science & Monitoring Initiatives.

reconstruct food webs. Carbon stable isotopes reveal whether individuals feed more nearshore or offshore, while nitrogen stable isotopes represent trophic position (e.g., invertebrates have a low position and fish have a higher position). These two isotope values were used to estimate a species' niche (position in isotopic space), visually represented by an ellipse (Fig. 7.7.2). To adjust for natural differences within and among lakes, stable isotope values were adjusted for differing baseline invertebrate isotope values, as well as lipid content, which allows for comparison of isotopic niches among each ecoregion and lake. These adjusted values were plotted using relative values for each species to make quantitative comparisons among ecoregion and lake-specific isotopic niches (see Fig. 7.7.2b).

Preliminary findings showed an overwhelming degree of overlap in ecoregion-specific niches for mobile species such as Lake Trout (Fig. 7.7.2), as they are likely integrating isotopic signals as they move among different ecoregions. Furthermore, there existed greater separation in Lake Trout isotopic niche placements when the data was unadjusted for differences in baseline and lipid content (Fig. 7.7.2a), while adjusted values showed smaller differences in relative isotopic niches (Fig. 7.7.2b). This suggested that after accounting for intrinsic properties, isotopic niches, and ultimately food web structure can be standardised to facilitate comparison among lakes. Results suggested Lake Trout in Lake Superior were supported more by autochthonous (within the lake) production while Lake Huron and Ontario production was also influenced by nearshore carbon sources. In terms of trophic position, Lake Huron Lake Trout were elevated in ^{15}N suggesting a longer food chain before reaching Lake Trout.

Since the Great Lakes differ in physical properties, it is essential to level the playing-field and account for these differences to correctly represent the individual ecoregion and lake food webs. More specifically, understanding differences within and among the lakes can help identify lake-specific impairments related to environmental stressors, and can aid managers in achieving fish community and environmental objectives.

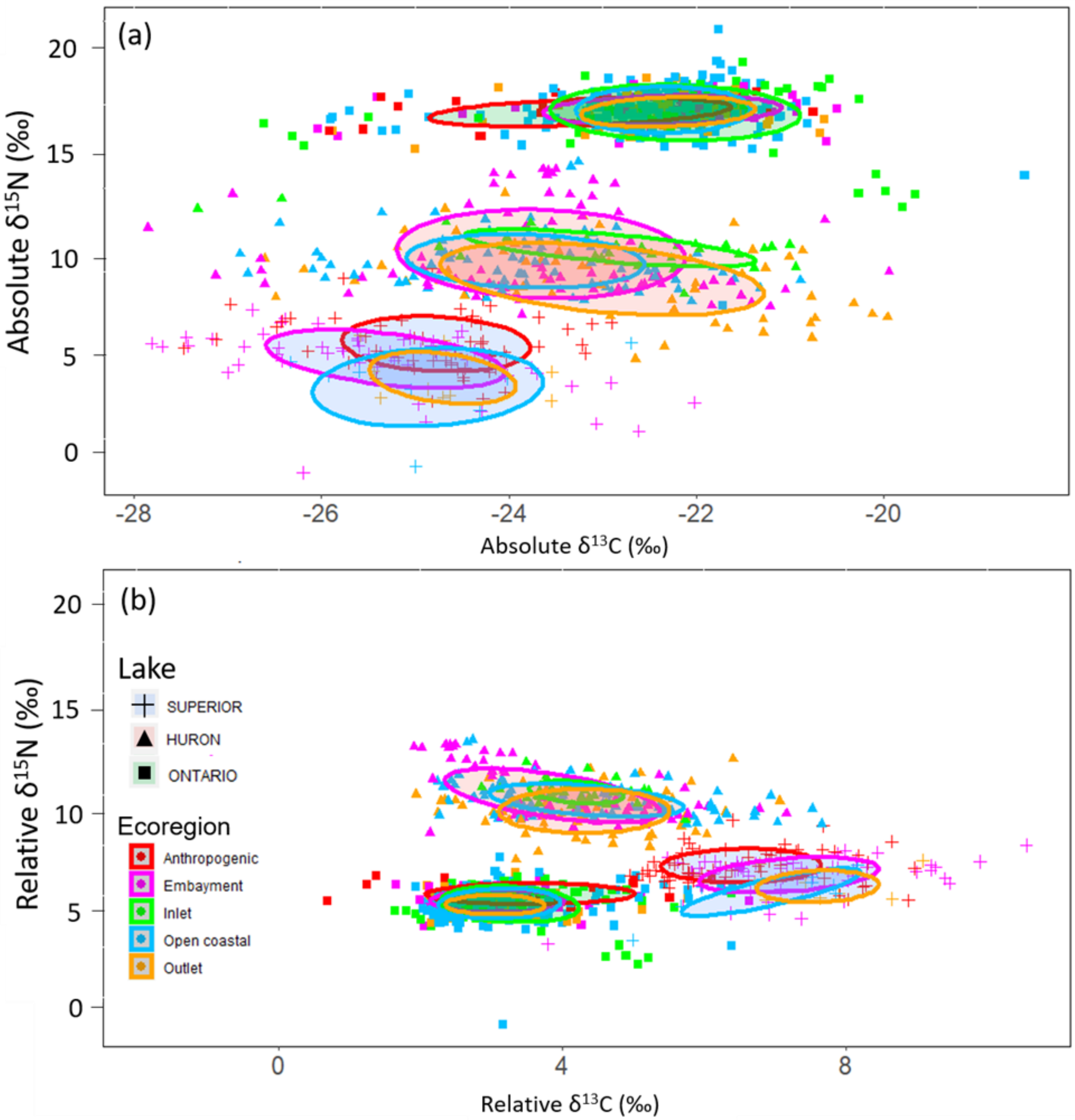

FIG. 7.7.2. Carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotopes of Lake Trout (*Salvelinus namaycush*) for five ecoregions (anthropogenic, embayment, inlet, open coastal, and outlet) across three Great Lakes (Huron, Ontario, Superior). Results for Lake Erie have been delayed due to COVID-related shutdown of analytical labs. Panel (a) shows Lake Trout isotopes that have not been adjusted for lake baseline differences nor lipids, while panel (b) shows Lake Trout isotopes adjusted for both baseline and lipids.

7.8 Reducing the spread of aquatic invasive species: what is the efficacy of decontamination methods recommended for recreational watercraft?

Project Leads: Shrisha Mohit and Shelley Arnott (Queen's University); Tim Johnson (OMNRF, Aquatic Research and Monitoring Section)
Collaborators: Jeff Brinsmead (OMNRF, Natural Heritage Policy Section)

The spread of aquatic invasive plant and animal species threaten both the biodiversity and services derived from freshwater ecosystems. Human activities largely facilitate their dissemination, and recreational boating activities are known to enable the overland dispersal of aquatic invasive species among lakes. Aquatic invasive invertebrates and plants can become attached to, or caught on, boats, trailers, and equipment used in infested lakes. Furthermore, these species can survive transport on fouled watercraft including in humid areas such as the bilge and live wells, and among entangled plants. To prevent spread of unwanted organisms among lakes, the Ontario Ministry of Natural Resources and Forestry recommends that recreational anglers and boaters decontaminate boats, trailers, and fishing or watersports gear. The recommended methods include washing with water at high pressure, rinsing with hot water at greater than 50°C, and / or allowing all parts to air-dry for two to seven days before use at another site. We reviewed all scientific articles on the efficacy of these decontamination methods published to 2019 and found no clear consensus on best practices. Hence, we performed outdoor and laboratory experiments to assess the performance of the recommended decontamination methods from May to October 2019. We included various aquatic invasive invertebrates and plants present in Ontario: Banded Mystery Snails (*Viviparus georgianus*), small and large Zebra Mussels (*Dreissena polymorpha*), Spiny Waterfleas (*Bythotrephes cederstroemi*), Eurasian Watermilfoil (*Myriophyllum spicatum*), Carolina Fanwort (*Cabomba caroliniana*), and European Frogbit (*Hydrocharis morsus-ranae*).

Hot water experiments: We exposed specimens from each species to hot water at temperatures ranging from 25°C to 70°C for 2 to 10 seconds. Results showed that a temperature of at least 60°C was required to cause 100% mortality among all species, except snails which required a minimum temperature of 65°C (Table 7.8.1).

Air-drying experiments: We allowed specimens from each species to air-dry outdoors for periods lasting from 1h to 7 days. After returning the specimens to water, we found no Zebra Mussels or Spiny Waterfleas remaining alive after air-drying for almost 3 days, whereas at least one week was required to prevent survival and growth among the plants (Table 7.8.1). However, we observed a large number of snails surviving after a week of air-drying.

Combination of hot water and air-drying: We exposed all invertebrate and plant specimens to hot water at 25°C to 70°C for 5 seconds, then allowed them to air-dry for 3 hours to 5 days. Overall, our results revealed that 100% mortality can be achieved after a shorter air-drying period if the invertebrates and plants were first exposed to hot water, than if they were only allowed to air-dry. However, despite combining both methods, a large number of snails remained alive if the water temperature and air-drying time were not sufficiently high (Table 7.8.1).

Pressure washing: We determined pressure-washing was an efficient method of removing attached material such as algae and plant fragments from surfaces. Using commercially available pressure washers, we tested water pressure outputs ranging from 50 psi to 1950 psi with the spray nozzle held 30 cm away from the surface. Our results showed that a pressure of approximately 1000 psi removed the greatest amount of attached material, while the highest pressure tested did not produce better results.

Overall, the findings from our study not only help bridge a gap in the scientific knowledge on the efficacy of decontamination measures, but also support the methods recommended in

Ontario and elsewhere. Additionally, we found that practising more than one type of decontamination method can be useful in further reducing aquatic invasive species' survival, especially among hardy species such as aquatic snails. Our study results can help inform future management practices in the fight against aquatic invasive species, via simple but effective decontamination measures that can be easily implemented by recreational boaters.

Table 7.8.1. Minimum required conditions to produce at least 99% mortality for each decontamination method.

	Hot water exposure (temperature, °C)	**Air-drying (duration, days)**	**Combination of hot water exposure and air-drying**
Invertebrates (Zebra Mussels, Spiny Waterfleas)	60	2.5	> 40°C + >2 days of air-drying
Aquatic snails (Banded Mystery Snails)	> 65	unknown	> 70°C, + > 3 days of air-drying
Aquatic plants	60	6.5	> 40°C+ > 3 days of air-drying

7.9 Assessing the vulnerability of Ontario's Great Lakes and inland lakes to aquatic invasive species under climate and human population change

Project leads: Jeff Buckley and Tim Johnson (OMNRF, Aquatic Research and Monitoring Section); Len Hunt and Jenny Rodgers (OMNRF, Centre for Northern Forest Ecosystem Research); Andrew Drake (Fisheries and Oceans Canada)

Aquatic invasive species (AIS) can have a large impact on aquatic ecosystems. Knowing current and future patterns of spread is important for informing management of AIS. However, the potential for AIS spread is mediated by both human activity (e.g., entangling plants transported in boat propellers) and the suitability of the environment (e.g., a preferred water temperature). Additionally, these factors will vary over time due to shifting patterns in population density as well as climate change. Our goal was to develop tools that account for each of these different factors of AIS spread allowing mangers to, for example, identify hotspots of suitability or vulnerable pathways of spread.

We developed models of human spread, physical habitat suitability, climate suitability, and natural dispersal to produce a comprehensive picture of potential invasive species spread due to both natural dispersal and human-mediated spread. Then, we identified important and likely invasion scenarios and investigated spread in each of these scenarios.

The first two scenarios explored the spread of AIS through the release of aquarium fishes and water garden plants. We showed how urban centres are focal points of potential release and spread (Fig. 7.9.1A). Importantly, future human activity is projected to increase and become more concentrated in these urban centres while climate conditions will become more favourable for aquarium fishes (Fig. 7.9.1B) and water garden plants. This may lead to even greater vulnerability to spread through these pathways in the future.

In another scenario, we investigated the general release of invasive fishes and plants through boating pathways. Here we found that spread of invasive fishes through boat-based fishing has the potential for much wider spread compared to spreading of entangling plants through non-fishing recreational boating. Additionally, habitat suitability for invasive fish is expected to increase in northern Ontario leading to greater vulnerability to spread in that area of the province.

The remaining scenarios investigated spread from different sources of initial introduction through the boating pathway. We found that the site of introduction affected the relative speed of AIS spread. For example, AIS introduced in the Bay of Quinte have the potential to spread faster and to a greater geographic extent than those introduced in a similar Great Lakes wetland environment, such as Lake St. Clair (Fig. 7.9.2). In general, we demonstrated how human activity has the potential to increase the rate of AIS spread and how increasing habitat suitability due to climate change may exacerbate this in the future. (A report describing the model and the scenario outputs is in the final stages of production (Buckley *et al.* 2021).)

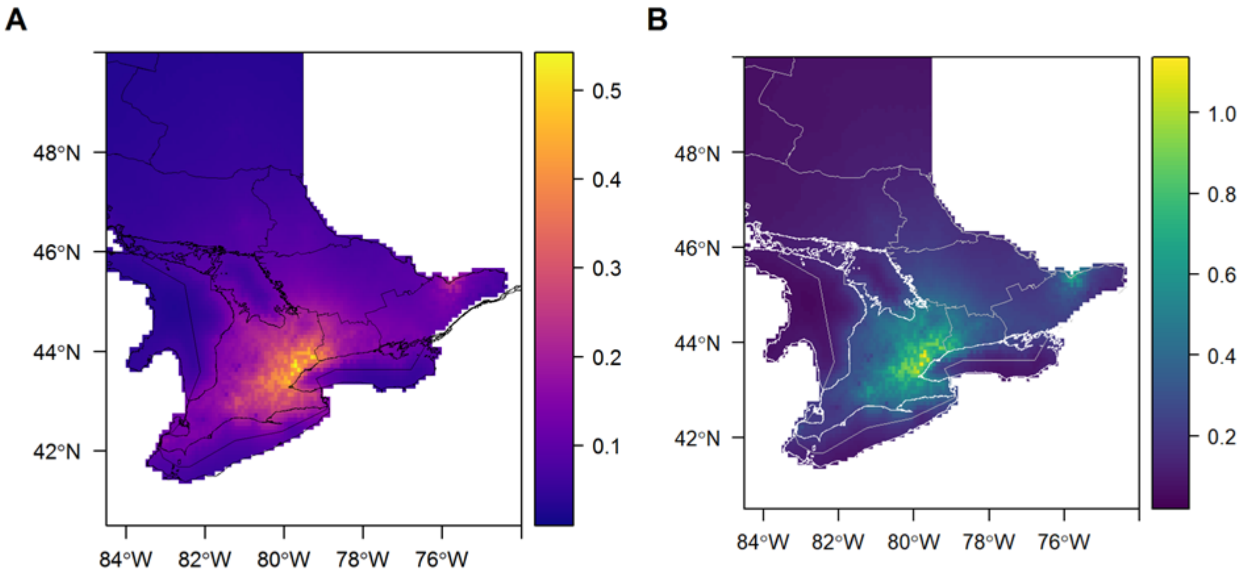

FIG. 7.9.1. Relative dispersal and introduction of known and potential invasive warm-water aquarium fishes. A) overall vulnerability; B) increase in vulnerability in the future (2041).

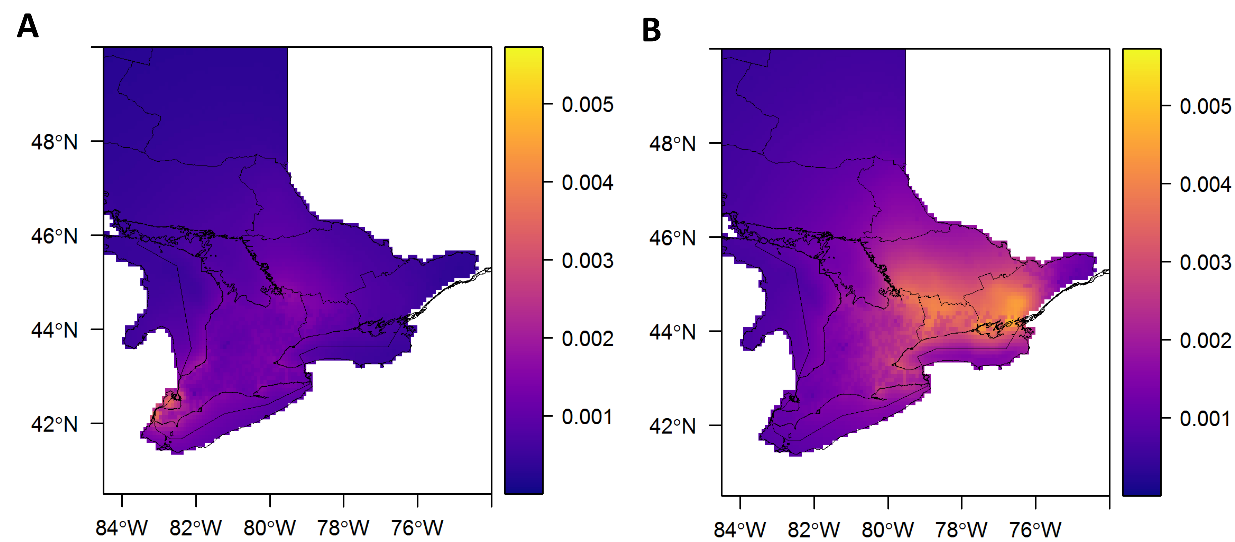

FIG. 7.9.2. Relative vulnerability to known and potential invasive warm-water wetland fishes from natural dispersal and movement by boat-based fishers from initial sources of the St. Clair and Detroit River region (A) or the Bay of Quinte and upper St. Lawrence region (B).

References:

Buckley, J.D., L.M. Hunt, J.A. Rodgers, D.A.R. Drake, and T.B. Johnson. 2021. Assessing the vulnerability of Ontario's Great Lakes and inland lakes to aquatic invasive species under climate and human population change. Ontario Ministry of Natural Resources and Forestry, Science and Research Branch, Peterborough, ON. Climate Change Research Report CCRR-53.

8. Environmental Indicators

8.1 Wind

M. J. Yuille, Lake Ontario Management Unit

National Oceanic and Atmospheric Administration (NOAA) records multiple weather variables using a variety of weather buoys deployed throughout Lake Ontario. Buoy data are available through the National Data Buoy Center webpage hosted by NOAA (http://www.ndbc.noaa.gov/). The Rochester weather buoy (Station ID# 45012; located 37 km offshore, north-northeast of Rochester) records several environmental variables, including wind direction and velocity ($m \cdot s^{-1}$). Wind direction and velocity can affect both the Lake Ontario ecosystem (e.g., thermal mixing, fish distribution) and the recreational fishery (e.g., total angler effort and the distribution of effort on Lake Ontario).

Two indices were developed to provide a wind index on Lake Ontario from 2002 – 2020 (Fig. 8.1.1). Small Craft Wind Warnings are issued for Lake Ontario by Environment Canada when wind velocities measure 20 – 33 knots (http://weather.gc.ca/marine/). The Small Craft Index represents the total number of hours from July 1st to August 31st each year, where the wind velocity was greater than or equal to 20 knots. This index shows that in the last 10 years, 2010, 2011, 2014, 2017 and 2020 had higher than average small craft warnings (Fig. 8.1.1a). In 2020, the number of small craft warning hours was significantly greater than 2019 and above the average for the time series (Fig. 8.1.1a). A second index, the East Wind Index, was calculated to determine relative contribution of east winds to the July/August open water fishing season (Fig. 8.1.1b). This index shows an increase from 2019 to 2020, where relative contribution of east winds in 2020 was comparable to the long-term average (Fig. 8.1.1b).

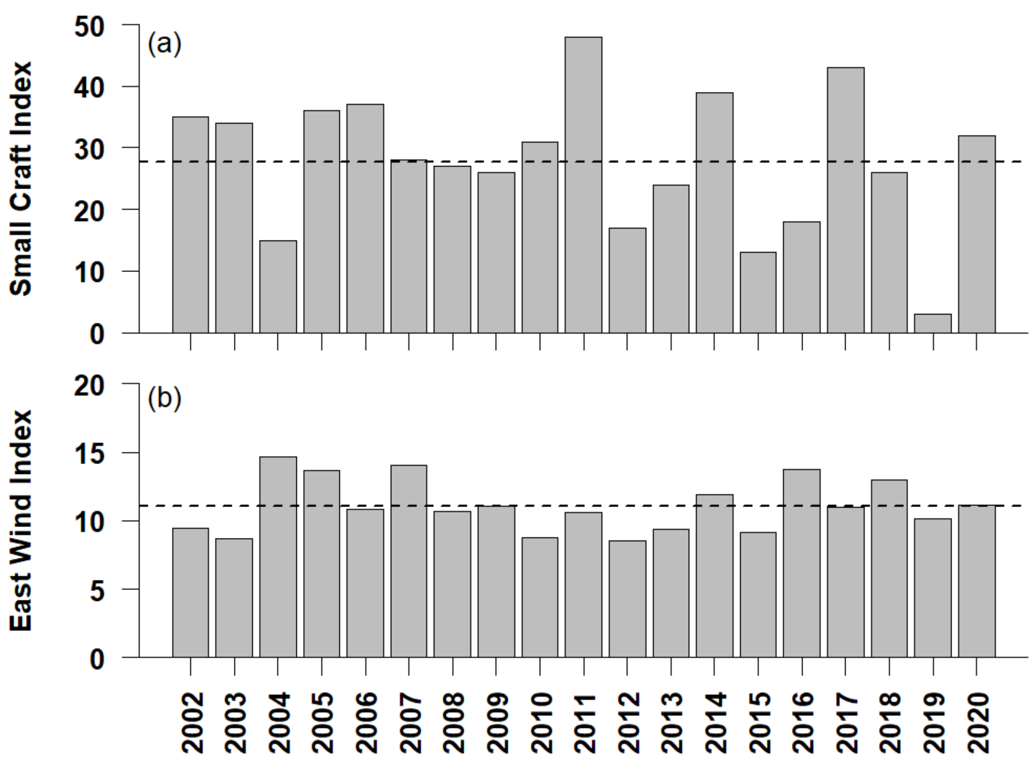

FIG 8.1.1. Lake Ontario wind as characterized by the Small Craft Index (a) and East Wind Index (b)

Section 9. Staff 2020

Glenora Fisheries Station, 41 Hatchery Lane, Picton, ON KOK 2TO
Tel: 613-476-3255 Fax: 613-476-7131

PROVINCIAL SERVICES DIVISION

Fish and Wildlife Service Branch
Lake Ontario Management Unit

Andy Todd	Lake Manager
Dawn Young	Administrative Assistant
Colin Lake	Lead Management Biologist
Jake LaRose	Lake Ontario COA Coordinator
Marc Desjardins	Management Biologist
Jeremy Holden	Assessment Biologist
Mike Yuille	Assessment Biologist
Erin Brown	Assessment Biologist
Steve McNevin	Operations Supervisor
Sonya Kranzl	Operations Coordinator
Kelly Sarley	Support Services/Data Technician
Jon Chicoine	Vessel Master
Nina Jakobi	Great Lakes Technician RT3
Ben Maynard	Great Lakes Technician RT3
Steve Wingrove	Great Lakes Technician RT3
Tyson Scholz	Seasonal Boat Captain RT3
Alan McIntosh	Great Lakes Fisheries Technician RT3
Tim Dale	Great Lakes Fisheries Technician RT3
Scott Brown	Great Lakes Fisheries Technician RT3
Kassandra Robinson	Great Lakes Fisheries Technician RT2
Daniel Jang	Great Lakes Fisheries Technician RT2
Kevin Campbell	Great Lakes Fisheries Technician RT2
Maria Tsinaridis	Great Lakes Fisheries Technician RT2
Megan Murphy	Great Lakes Fisheries Technician RT2

Enforcement Branch

Jeff Fabian	Conservation Officer
Julie Lawrence	A/Enforcement Manager, Peterborough

Science and Research Branch
Aquatic Research and Monitoring Section

Dr. Tim Johnson	Research Scientist
Brent Metcalfe	Research Biologist
Jeff Buckley	Project Biologist (Invasive Species)
Adam Rupnik	Project Biologist (Food Webs)
Brent Nawrocki	Project Biologist (Food Webs)
Mary Hanley	Project Biologist (Food Webs)
Eloise Ashworth	Project Biologist (Food Webs)
Brittany Payne	Summer Student

10. Operational Field and Lab Schedule, 2020

Operational Field and Lab Schedule, 2020 (SPA = Special Purpose Account; COA = Canada Ontario Agreement; CRF = Consolidated Revenue Fund; DFO = Department of Fisheries and Oceans; TRCA = Toronto and Region Conservation Authority; OFAH = Ontario Federation of Anglers and Hunters; OPG = Ontario Power Generation; GLFC = Great Lakes Fishery Commission).

Field and Lab Projects	Dates	Species Assessed, Monitored or Stocked	Project Lead	Operational Lead	Funding Source
Bay of Quinte Ice Angling Survey	Jan-Mar	Walleye / Fish Community	Brown	Kranzl/McNevin	SAP
Atlantic Salmon Marking Program	Feb	Atlantic Salmon	Lake	Wingrove/ Jakobi	SPA
Chinook Salmon Marking Program	Mar	Chinook Salmon	Yuille	Kranzl	SPA
Ganaraska River Fish Counter Salmon and Trout Assessment	May-Nov	Migratory Trout & Salmon	Yuille	Maynard	COA/SPA/CRF
Asian Grass Carp Emergency Response	Apr-Nov	Grass Carp	McNevin	Kranzl/McNevin	SPA
Fish Contaminant Sampling	Jun-Dec	Sport Fish	Brown/Kranzl	Jakobi/Kranzl	SPA
Atlantic Salmon Brood-Stock Tagging	Apr-Nov	Atlantic Salmon	Lake	Kranzl	SPA
Offshore Limnology and Plankton Surveys (Station 81, Uzarski MSc.)	Aug-Oct	Lower Food Web	Dr. Johnson	Metcalfe	SPA
Eastern Lake Ontario Acoustic Telemetry Receiver Array (St. Lawrence Channel/ Rocky Point)	Jun	Multiple Species	Dr. Johnson	Chicoine/Dale	GLFC/COA
Eastern Lake Ontario and Bay of Quinte Fish Community Index Netting Index Netting	Jun-Sep	Fish Community	Brown	Kranzl	SPA
Eastern Lake Ontario and Bay of Quinte Fish Community Index Trawling	Jun-Sep	Fish Community	Brown	Kranzl	SPA
Eastern Lake Ontario Acoustic Telemetry Receiver Array (Point Petre)	Aug	Multiple Species	Dr. Johnson	Chicoine/Dale	COA/SPA
Credit River Fish Counter Salmon and Trout Assessment	May-Nov	Migratory Trout & Salmon	Yuille	Maynard	COA/SPA/CRF
St. Lawrence River Fish Community Index Netting	Sept	Fish Community	Yuille	Wingrove	COA
Lake St. Francis Fish Community Index Netting	Sept	Fish Community	Yuille	Wingrove	COA
Fall American Eel Trap and Transfer	Sept-Oct	American Eel	LaRose	Tsinaridis	OPG
Lake Ontario Fall Benthic Prey Fish Trawling Survey	Sept-Oct	Round Goby/Slimy and Deepwater Sculpin	Holden	Chicoine/Dale	COA
Midwater Trawling for Juvenile Salmonids	Sept	Salmon and Trout	Holden	Chicoine/Dale	COA
Credit River Chinook Salmon Assessment and Egg Collection	Oct	Chinook Salmon	Yuille	Wingrove	SPA
Lake Whitefish Commercial Catch Sampling	Oct-Nov	Lake Whitefish	Brown	Moore	SPA
Cisco Commercial Catch Sampling	Oct-Nov	Cisco	Brown	Moore	SPA
Age and Growth (Lab)	Year-Round	Multiple Species	Kranzl	Operational Team	SPA/COA
Bloater Restoration Stocking	Nov	Bloater	Lake	Chicoine	SPA

11. Primary Publications 2020

Primary Publications of Glenora Fisheries Station Staff[1] in 2020

Elliott, C.W., **Holden, J.P.,** Connerton, M.J., Weidel, B.C., Tufts, B.L. Stationary hydroacoustics demonstrates vessel avoidance biases during mobile hydroacoustic surveys of alewife in Lake Ontario. *Journal of Great Lakes Research*, Volume 47, Issue 2, 2021, pp 514-521. https://doi.org/10.1016/j.jglr.2021.01.013.

Hunt, L., Phaneuf, D., Abbott, J., Fenichel, E., Rodgers, J., Buckley, J., Drake, D. A. R., **Johnson, T. B.** 2020. The influence of human population change and environmental stressors on future recreational fishing activities. Canadian Journal of Fisheries and Aquatic Science (accepted Sept 21, 2020)

Ivanova, S.V., **Johnson T.B.**, **Metcalfe, B.W**., Fisk, A.T. 2020. Spatial distribution of lake trout (*Salvelinus namaycush*) across seasonal thermal cycles in a large lake. Freshwater Biology 66: 615 -627.

Johnson, T.B. 2020. A generous heart and a passion of the Lakes. Aquat. Ecosyst. Health Manage. (published online June 30, 2020). https://www.tandfonline.com/doi/abs/10.1080/14634988.2020.1787650

Kessel, S.T., Crawford, R.E., Hussey, N.E., Ivanova, S.V., **Holden, J.P.,** and Fisk, A.T. Size class segregation of Arctic cod (*Boreogadus saida*) in a shallow High Arctic embayment. *Arctic Science*. **7**(1): 208-216. https://doi.org/10.1139/as-2019-0005

Klinard, N. V., Matley J. K., Ivanova S. V., Larocque S. M., Fisk A. T., **Johnson T. B.** 2020. Application of machine learning to identify predators of stocked fish in Lake Ontario: using acoustic telemetry predation tags to inform management. Journal of Fish Biology 98: 237-250.

Larocque, S. M., **Lake, C.,** Midwood, J. D., Nguyen, V. M., Blouin-Demers, G., & Cooke, S. J. 2020. Freshwater turtle bycatch research supports science-based fisheries management. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *30*(9), 1783-1790.

Larocque, S.M., Fisk A.T., and **Johnson, T.B**. 2020. Trophic niche overlap and abundance reveal potential impact of interspecific interactions on a reintroduced fish. *Can. J. Fish. Aquat. Sci.* (accepted Dec 7. 2020)

Marsden, J. E., Blanchfield, P.J., Brooks, J.L., Fernandes, T., Fisk, A.T., Futia, M.H., Hilna, B.L., Ivanova, S.V., **Johnson, T.B.**, Klinard, N.V., Krueger, C.C., Larocque, S.M., Matley, J.K., McMeans, B., O'Connor, L.M., Raby, G.D., Cooke, S.J., 2021. Using untapped telemetry data to explore the winter biology of freshwater fish. *Reviews in Fish Biology* 31: 115-134.

Mohit, S., **Johnson, T.B.,** Arnott, S.E. 2020. Recreational watercraft decontamination: can current recommendations reduce aquatic invasive species spread? *Management of Biological Invasions* 12: 148-164.

Nawrocki, B.M., **Metcalfe, B.W., Holden, J.P.,** Lantry, B.F., and **Johnson, T.B.** 2020. Spatial and temporal variability in lake trout diets in Lake Ontario as revealed by stomach contents and stable isotopes. *Journal of Great Lakes Research*, 2020. https://doi.org/10.1016/j.jglr.2020.08.004.

O'Malley, B.P., Schmitt, J.D., **Holden, J.P**., and Weidel, B.C. 2020, Morphometric measurements of Cisco (*Coregonus artedi*) from Lake Ontario *2018: U.S. Geological Survey.* https://doi.org/10.5066/P92B534W.

Pratt, T.C., Stanley, D.R., Schlueter, S., **La Rose, J.K.L.**, Weinstock, A., Jacobson, P. T. 2021. Towards a downstream passage solution for out-migrating American eel (*Anguilla rostrata*) on the St. Lawrence River. *Aquaculture and Fisheries*. 6 (2): 151-168.

Raby, G.D., **Johnson, T.B.,** Kessel, S.T., Stewart, T.J., Fisk, A.T. 2020. Pop-off data storage tags reveal niche partitioning between native and non-native predators in a novel ecosystem. *J. Appl. Ecol.* 57: 181-191. DOI: 10.1111/1365-2664.13522.

[1]Names of staff of the Glenora Fisheries Station are indicated in bold.

50968
(0.05 k P.R., 21 11 23)
ISSN 1201-8449