Lake Ontario Fish Communities and Fisheries:

2021 Annual Report of the Lake Ontario Management Unit

Ontario

Cover Photos:

(Left) Rainbow Tout at the Ganaraska River. For more information on migratory salmon and trout assessment and the Lake Ontario stocking program, see Sections 1.4, 1.5 and 6.

(Top Right) MNRF's "Ontario Explorer" conducting bi-national field sampling on Lake Ontario. For more information on spring and fall prey fish assessment, see Sections 1.6 and 1.7.

(Bottom Right) Adult walleye sampled in Hamilton Harbour, Lake Ontario. For more information on nearshore fish assessment and the Lake Ontario stocking program, see Sections 1.3 and 6.

LAKE ONTARIO FISH COMMUNITIES AND FISHERIES:

2021 ANNUAL REPORT OF THE LAKE ONTARIO MANAGEMENT UNIT

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Foreword

The Lake Ontario Management Unit (LOMU) and the Lake Ontario research staff from the Aquatic Research and Monitoring Section (ARMS) operating at the Glenora Fisheries Station, are pleased to provide the 2021 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), the U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS) and many other Ontario provincial ministries and conservation authorities and U.S. state and federal agencies, universities and non-government partners.

Glenora Fisheries Station staff delivered over forty-five field and laboratory projects in 2021 including the comprehensive long-term base monitoring program that spans over five decades. In 2021, assessment of the Canadian waters from the Niagara River to Cornwall included 24 trap net sets, 144 gill net sets in over 107 sites and 210 trawls. Across all programs, 184,235 fish were captured (comprising more than 40 species) and 2,056 calcified structures were processed for age and growth assessment. Over 39,000 video images were recorded and processed from the Ganaraska River and Credit River video fish counter systems. MNRF Fish Culture Section and partners stocked 1.451 million fish (over 41,000 kg) 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, Queen's University and Trent University researchers are using 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 committed staff and partners delivered an exemplary program that 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 2021.

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This Annual Report is available online at: http://www.glfc.org/loc_mgmt_unit/

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 2021, 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 2021, 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

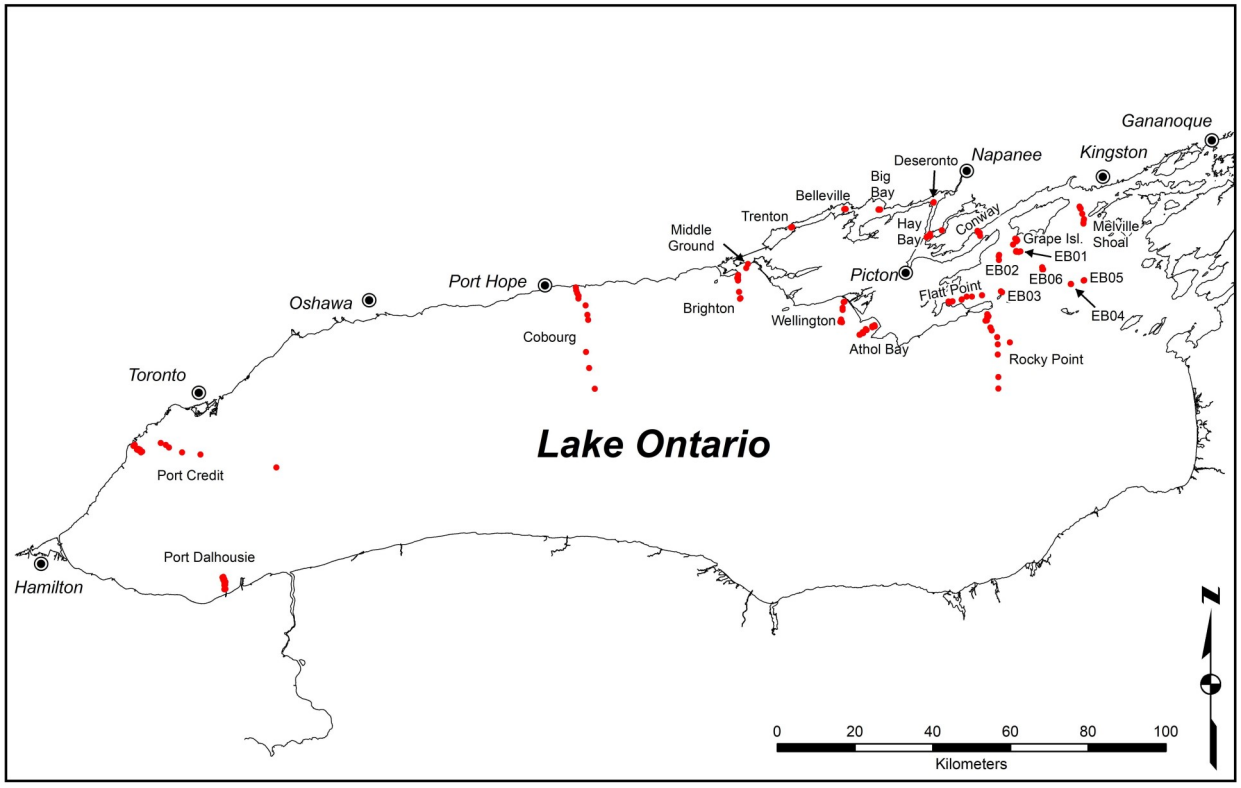


FIG. 1.1.1. Map of Lake Ontario showing fish community index gill netting sites (2021 Bay of Quinte depth stratified random sites excluded).

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 2021, 89 gill net samples occurred from Jun 28 to Aug 24. Thirty-four different species and 6,541 individual fish were caught. Forty-four percent of the observed catch was Alewife, followed by Yellow Perch (18%), White Perch (16%), and Walleye (6%). Species-specific gill net catch summaries are shown by geographic area/site in Tables 1.1.3-1.1.14. Abundance trends for the most common species caught in Kingston Basin and the Bay of Quinte are displayed in Fig. 1.1.2-1.1.3. Selected biological information is also presented for Walleye (Table 1.1.15).

Northeast and Kingston Basin, Lake Ontario

Northeast (Brighton, Middle Ground and Wellington) and Kingston Basin (Melville Shoal, Grape Island and Flatt Point) Nearshore Areas (Tables 1.1.3-1.1.9)

One fixed site (Middle Ground) and Five depth-stratified sampling areas (Melville Shoal, Grape Island, Flat Point, Brighton and Wellington) 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 1.1.10-1.1.11)

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 by depth strata and area are show in Table 1.1.10 and Table 1.1.1, respectively.

Bay of Quinte, Fixed Sites (Conway, Hay Bay and Big Bay; Tables 1.1.12-1.1.14)

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 1992-2021.

Species Highlights

Walleye

Three hundred and ninety-five Walleye were caught and interpreted for age in the 2021 summer index gill nets (Table 1.1.15). One hundred and thirty Walleye (33%) were age-3 (2018 year-class). In the Kingston Basin nearshore gill nets, 96% of Walleye were age-6 or greater, and in the Bay of Quinte gill nets, 80% 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 2021.

						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]	2021 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	1	1		435955	774058	1	Jul 21 - Sep 15	1988	34	yes
Northeastern Lake Ontario	Brighton	Depth stratified area	BR13	12.5	1	1		435911	774071	1	Jul 21 - Sep 15	1988	34	yes
Northeastern Lake Ontario	Brighton	Depth stratified area	BR18	17.5	1	1		435878	774053	1	Jul 21 - Sep 15	1988	34	yes
Northeastern Lake Ontario	Brighton	Depth stratified area	BR23	22.5	1	1		435777	774034	1	Jul 21 - Sep 15	1988	34	yes
Northeastern Lake Ontario	Brighton	Depth stratified area	BR28	27.5	1	2		435624	774004	2	Jul 21 - Sep 15	1988	34	yes
Northeastern Lake Ontario	Middle Ground (MG)	Fixed site	MG05	5	1	2		440054	773906	2	Jul 21 - Sep 15	1979	43	yes
Northeastern Lake Ontario	Wellington (WE)	Depth stratified area	WE08	7.5	1	1		435622	772011	1	Jul 21 - Sep 15	1988	34	yes
Northeastern Lake Ontario	Wellington	Depth stratified area	WE13	12.5	1	1		435544	772027	1	Jul 21 - Sep 15	1988	34	yes
Northeastern Lake Ontario	Wellington	Depth stratified area	WE18	17.5	1	2		435515	772025	2	Jul 21 - Sep 15	1988	34	yes
Northeastern Lake Ontario	Wellington	Depth stratified area	WE23	22.5	1	2		435378	772050	2	Jul 21 - Sep 15	1988	34	yes
Northeastern Lake Ontario	Wellington	Depth stratified area	WE28	27.5	1	2		435348	772066	2	Jul 21 - Sep 15	1988	34	yes
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	1	2		435665	765993	2	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP13	12.5	1	2		435659	765927	2	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP18	17.5	1	2		435688	765751	2	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP23	22.5	1	2		435726	765541	2	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP28	27.5	1	2		435754	765314	2	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Grape Island (GI)	Depth stratified area	GI08	7.5	1	1		440537	764712	1	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI13	12.5	1	1		440523	764747	1	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI18	17.5	1	2		440476	764710	2	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI23	22.5	1	2		440405	764718	2	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI28	27.5	1	2		440470	764796	2	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Melville Shoal (MS)	Depth stratified area	MS08	7.5	1	1		441030	763500	1	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS13	12.5	1	1		441004	763470	1	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS18	17.5	1	2		440940	763460	2	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS23	22.5	1	2		440835	763424	2	Jul 1-Jul 31	1986	36	yes
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS28	27.5	1	2		440792	763424	2	Jul 1-Jul 31	1986	36	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	54	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	6	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	6	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	6	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	54	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 2021.

						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]	2021 Visit
Bay of Quinte	Conway	Depth stratified area	CO08	7.5	1	1		440664	765463	1	Jul 21-Aug 21	1972	50	yes
Bay of Quinte	Conway	Depth stratified area	CO13	12.5	1	1		440649	765452	1	Jul 21-Aug 21	1972	50	yes
Bay of Quinte	Conway	Depth stratified area	CO20	20	1	1		440643	765453	1	Jul 21-Aug 21	1972	50	yes
Bay of Quinte	Conway	Depth stratified area	CO30	30	1	1		440620	765440	1	Jul 21-Aug 21	1972	50	yes
Bay of Quinte	Conway	Depth stratified area	CO45	45	1	1		440601	765402	1	Jul 21-Aug 21	1972	50	yes
Bay of Quinte	Hay Bay (HB)[2]	Depth stratified area	HB08	7.5	1	1		440656	770156	1	Jul 21-Aug 21	1959	63	yes
Bay of Quinte	Hay Bay	Depth stratified area	HB13	12.5	1	1		440575	770400	1	Jul 21-Aug 21	1959	63	yes
Bay of Quinte	Deseronto (DE)	Fixed site	DE05	5	1	1		441035	770339	1	Jul 21-Aug 21	2016	6	yes
Bay of Quinte	Big Bay (BB)	Fixed site	BB05	5	1	1		440920	771360	1	Jul 21-Aug 21	1972	50	yes
Bay of Quinte	Belleville (BE)	Fixed site	BE05	5	1	1		440914	772048	1	Jul 21-Aug 21	2016	6	yes
Bay of Quinte	Trenton (TR)	Fixed site	TR05	5	1	1		440636	773063	1	Jul 21-Aug 21	2016	6	yes
Bay of Quinte	Upper Bay of Quinte (UB)	Depth stratified random site		1-3	4	1				4	Jul 21-Aug 21	2019	3	yes
Bay of Quinte	Upper Bay of Quinte (UB)	Depth stratified random site		3-6	1	1				1	Jul 21-Aug 21	2019	3	yes
Bay of Quinte	Upper Bay of Quinte (UB)	Depth stratified random site		6-12	2	1				2	Jul 21-Aug 21	2019	3	yes
Bay of Quinte	Middle Bay of Quinte (MB)	Depth stratified random site		1-3	2	1				2	Jul 21-Aug 21	2019	3	yes
Bay of Quinte	Middle Bay of Quinte (MB)	Depth stratified random site		3-6	2	1				2	Jul 21-Aug 21	2019	3	yes
Bay of Quinte	Middle Bay of Quinte (MB)	Depth stratified random site		6-12	2	1				2	Jul 21-Aug 21	2019	3	yes
Bay of Quinte	Middle Bay of Quinte (MB)	Depth stratified random site		12-20	2	1				2	Jul 21-Aug 21	2019	3	yes
Bay of Quinte	Lower Bay of Quinte (LB)	Depth stratified random site		1-3	1	1				1	Jul 21-Aug 21	2019	3	yes
Bay of Quinte	Lower Bay of Quinte (LB)	Depth stratified random site		3-6	2	1				2	Jul 21-Aug 21	2019	3	yes
Bay of Quinte	Lower Bay of Quinte (LB)	Depth stratified random site		6-12	3	1				3	Jul 21-Aug 21	2019	3	yes
Bay of Quinte	Lower Bay of Quinte (LB)	Depth stratified random site		12-20	1	1				1	Jul 21-Aug 21	2019	3	yes
Bay of Quinte	Lower Bay of Quinte (LB)	Depth stratified random site		20-35	6	1				6	Jul 21-Aug 21	2019	3	yes
Bay of Quinte	Lower Bay of Quinte (LB)	Depth stratified random site		>35	2	1				2	Jul 21-Aug 21	2019	3	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 2021 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 89 gill nets were set and 34 species comprising 6,541 fish were caught.

Species	Observed Catch	Standard Catch	Mean Weight (g)
Alewife	2,901	9,418	41
Black Crappie	1	3	33
Bluegill	108	212	54
Bowfin	4	4	2,395
Brown Bullhead	17	19	309
Burbot	3	3	3,119
Channel Catfish	5	5	1,719
Chinook Salmon	2	2	118
Cisco	18	23	522
Common Carp	10	10	3,812
Freshwater Drum	197	197	821
Gizzard Shad	84	114	1,066
Golden Shiner	5	17	40
Greater redhorse	1	1	1,282
Lake Sturgeon	1	1	
Lake Trout	65	65	2,844
Lake Whitefish	9	9	875
Largemouth Bass	12	14	556
Lepomis sp.	1	3	169
Longnose Gar	117	131	2,286
Northern Pike	40	42	2,131
Pumpkinseed	93	137	61
Rainbow Smelt	4	4	22
Rainbow Trout	2	2	1,254
River redhorse	1	1	3,007
Rock Bass	32	48	87
Round Goby	16	53	36
Silver Redhorse	2	2	1,013
Smallmouth Bass	60	67	535
Walleye	399	408	1,279
White Bass	16	16	547
White Perch	1,015	1,391	148
White Sucker	108	108	747
Yellow Perch	1,192	3,160	107

TABLE 1.1.3. Species-specific standard catch by depth strata at depth-stratified areas in **Northeastern Lake Ontario** (Middle Ground, Brighton and Wellington) and **Lake Ontario Kingston Basin** (Melville Shoal, Grape Island and Flatt Point) and Nearshore areas, 2021. The total number of species caught and number of gill nets set are indicated.

	Site depth (m)					
Species	5.0	7.5	12.5	17.5	22.5	27.5
Alewife	280.87	2,427.09	1,094.74	1,953.87	2,076.83	917.00
Burbot	-	-	-	1.00	-	2.00
Cisco	-	1.00	1.00	1.00	3.00	4.00
Common Carp	-	1.00	-	-	-	-
Lake Sturgeon	-	-	-	-	-	1.00
Lake Trout	-	-	2.00	1.00	6.00	7.00
Lake Whitefish	-	-	-	2.00	1.00	-
Northern Pike	-	2.00	-	-	-	-
Rainbow Smelt	-	-	-	-	-	1.00
Rock Bass	1.00	15.22	6.30	4.00	1.00	-
Round Goby	-	3.30	6.61	6.61	23.13	13.22
Smallmouth Bass	-	14.30	7.00	2.00	2.00	-
Walleye	-	48.00	25.00	2.00	1.00	-
White Sucker	2.00	2.00	-	-	-	-
Yellow Perch	94.52	10.91	19.52	30.13	27.13	-
Total catch	378	2525	1162	2004	2141	945
Number of species	4	10	8	10	9	7
Number of sets	2	6	6	9	9	10

TABLE 1.1.4 Species-specific catch per gillnet set at **Flatt Point in the Kingston Basin of Lake Ontario**, 1992-2021. 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**	2021
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**	187.36
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**	0.20
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**	0.10
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**	0.30
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**	0.10
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**	0.10
Common Carp	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**	0.10
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**	1.75
Smallmouth Bass	**0.06**	-	0.10	0.05	-	-	-	-	-	-	-	**0.02**	-	0.05	-	-	-	0.05	-	0.05	0.10	-	**0.03**	0.60
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**	1.42
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**	0.20
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**	192
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**	12
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 1.1.5. Species-specific catch per gillnet set at **Grape Island in the Kingston Basin of Lake Ontario**, 1992-2021. 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**	2021
Lake Sturgeon	**0.01**	0.05	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	0.13
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**	253.86
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**	0.13
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**	0.25
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**	0.38
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**	0.13
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**	0.38
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**	2.29
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**	2.73
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**	0.50
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**	2.07
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**	263
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**	11
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20	20	20	20	20	10		8

TABLE 1.1.6. Species-specific catch per gillnet set at **Melville Shoal in the Kingston Basin of Lake Ontario**, 1992-2021. 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**	2021
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**	214.21
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**	0.38
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**	0.75
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**	0.13
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**	4.68
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**	8.63
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**	0.41
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**	229
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**	7
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20	20	20	20	10	5		8

TABLE 1.1.7. Species-specific catch per gillnet set at **Brighton in Northeastern Lake Ontario**, 1992-2021 (no sampling in 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**	2021
Bowfin	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	0.05	-	-	0.10		**0.02**	-
Alewife	**34.82**	49.58	107.40	31.81	22.39	41.27	72.52	3.52	89.17	209.81	67.05	**69.45**	307.74	138.36	295.25	70.48	343.08	191.56	174.10	87.35	54.91		**184.76**	114.50
Gizzard Shad	**0.44**	-	-	-	-	-	-	-	-	-	0.15	**0.02**	-	-	0.05	-	-	0.20	0.05	1.45	-		**0.19**	-
Coho Salmon	**0.004**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-		**-**	-
Chinook Salmon	**0.74**	0.10	0.35	1.25	0.45	0.42	0.20	0.62	0.30	0.05	0.71	**0.44**	0.83	0.10	-	0.20	-	0.20	0.22	0.05	0.70		**0.26**	-
Rainbow Trout	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	0.10	-	-	-	-	-	0.05		**0.02**	-
Atlantic Salmon	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	0.05	-		**0.01**	-
Brown Trout	**0.12**	-	-	0.35	0.20	0.05	0.15	0.10	0.30	0.15	1.25	**0.26**	0.60	0.50	0.15	0.10	0.20	0.20	-	0.30	0.10		**0.24**	-
Lake Trout	**5.22**	1.30	1.05	0.40	0.95	0.15	0.30	0.05	-	0.05	0.10	**0.44**	0.15	0.20	0.10	0.85	0.57	1.09	0.83	0.65	1.65		**0.68**	1.33
Lake Whitefish	**0.42**	0.05	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	0.05	-	-		**0.01**	-
Cisco	**0.12**	-	-	0.05	-	0.10	0.10	0.05	0.25	0.05	-	**0.06**	0.05	-	0.05	0.05	0.10	0.55	0.32	0.40	0.25		**0.20**	-
Round Whitefish	**1.19**	-	0.25	0.05	0.05	-	-	-	-	-	-	**0.04**	-	-	-	-	-	-	-	-	-		**-**	-
Rainbow Smelt	**0.11**	-	-	-	-	-	-	-	-	-	0.10	**0.01**	0.22	-	0.05	-	-	-	0.17	0.10	-		**0.06**	-
Northern Pike	**0.08**	-	-	0.05	-	0.10	-	0.20	0.05	0.05	-	**0.05**	0.05	-	-	0.15	0.30	-	-	0.05	0.05		**0.07**	-
White Sucker	**0.41**	-	0.10	-	0.05	0.15	0.05	0.10	-	-	0.05	**0.05**	0.05	-	-	0.15	-	0.35	-	-	0.10		**0.07**	-
Lake Chub	**-**	-	-	-	-	-	-	-	0.17	-	-	**0.02**	-	-	-	-	-	-	-	-	-		**-**	-
Common Carp	**0.12**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	0.05	-	-	-		**0.01**	-
Brown Bullhead	**0.10**	0.52	0.20	0.85	0.27	0.35	-	0.25	0.22	0.05	-	**0.27**	-	-	-	0.17	-	-	-	-	-		**0.02**	-
Channel Catfish	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-		**-**	-
American Eel	**0.004**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-		**-**	-
Burbot	**0.05**	0.05	-	-	-	-	0.05	0.05	-	-	-	**0.02**	-	-	-	0.05	0.05	0.05	0.15	-	0.10		**0.04**	0.17
White Perch	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-		**-**	-
Rock Bass	**0.88**	-	0.32	0.63	0.76	0.32	0.15	0.32	0.80	0.33	0.33	**0.39**	-	1.65	-	0.22	0.05	0.47	1.52	0.37	0.57		**0.54**	-
Pumpkinseed	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-		**-**	-
Smallmouth Bass	**0.00**	-	-	-	-	-	-	-	-	-	0.05	**0.01**	-	-	-	-	-	-	-	-	-		**-**	116
Yellow Perch	**15.64**	-	0.50	0.50	0.33	1.16	2.99	1.57	4.83	0.17	0.17	**1.22**	-	1.98	2.36	0.17	-	1.54	-	-	-		**0.67**	-
Walleye	**0.44**	-	0.15	0.25	0.50	0.20	0.05	0.75	0.10	-	0.10	**0.21**	-	0.43	0.05	0.15	0.10	0.45	0.20	0.20	0.10		**0.19**	-
Round Goby	**-**	-	-	0.17	0.17	4.45	1.98	0.63	1.70	1.32	0.99	**1.14**	1.21	2.31	0.99	0.17	1.82	3.30	2.64	2.64	1.65		**1.86**	1.10
Freshwater Drum	**0.17**	-	-	0.15	0.10	-	0.05	0.05	-	-	-	**0.04**	-	-	-	-	-	-	-	0.05	-		**0.01**	-
Total catch	**61**	52	110	37	26	49	79	8	98	212	71	**74**	311	146	299	73	346	200	180	94	60		**190**	233
Number of species	**13**	6	9	15	12	12	12	14	11	10	12	**11**	9	8	10	13	9	14	11	13	13		**11**	4
Number of sets		20	20	20	20	20	20	20	20	20	20		20	10	20	20	20	20	20	20	20	-		6

TABLE 1.1.8. Species-specific catch per gill net set at **Middle Ground in Northeastern Lake Ontario**, 1992-2021 (no sampling in 2012 and 2020). Annual catches are averages for 2 gill net gangs set 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 gill nets 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**	2021
Longnose Gar	**-**	-	-	0.25	-	-	-	-	-	-	-	**0.03**	-		-	-	-	-	-	-	-		**-**	-
Alewife	**3.61**	0.83	0.83	-	-	-	-	-	0.83	8.26	3.30	**1.40**	190.83		39.90	23.96	56.17	-	2.48	-	71.87		**48.15**	140.43
Gizzard Shad	**0.39**	-	-	-	-	0.50	-	0.25	-	-	0.25	**0.10**	-		-	-	-	-	0.25	2.25	-		**0.31**	-
Brown Trout	**0.11**	-	-	-	-	-	0.25	-	0.25	0.50	0.25	**0.13**	0.25		-	-	-	-	-	-	0.25		**0.06**	-
Lake Trout	**0.90**	-	-	-	-	-	0.25	-	-	-	-	**0.03**	-		-	-	-	-	-	-	1.25		**0.16**	-
Northern Pike	**0.34**	-	-	0.50	-	0.25	0.25	1.50	1.00	1.25	0.25	**0.50**	1.25		1.25	2.00	1.00	0.50	0.50	0.50	1.25		**1.03**	-
White Sucker	**1.40**	1.50	3.08	-	2.08	0.75	1.25	4.00	2.25	1.00	5.83	**2.17**	3.25		-	-	0.25	3.65	1.00	0.75	1.00		**1.24**	1.00
Silver redhorse	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-		-	-	-	-	-	0.25	-		**0.03**	-
Common Carp	**0.41**	0.50	-	0.75	0.50	-	-	-	-	-	-	**0.18**	-		-	-	0.25	0.75	0.25	-	0.25		**0.19**	-
Brown Bullhead	**1.42**	2.00	0.50	2.15	0.25	1.58	0.83	0.75	0.25	-	-	**0.83**	0.25		-	-	-	-	0.25	-	0.25		**0.09**	-
White Perch	**0.08**	-	-	-	-	-	-	-	-	-	-	**-**	-		0.50	-	-	-	-	0.25	-		**0.09**	-
Rock Bass	**1.47**	1.08	0.25	0.50	0.75	0.50	-	1.08	-	-	0.25	**0.44**	-		0.25	-	-	1.65	1.08	0.25	1.08		**0.54**	0.50
Pumpkinseed	**0.18**	-	-	-	-	-	-	-	-	-	-	**-**	-		-	-	-	-	-	-	-		**-**	-
Bluegill	**0.06**	-	-	-	-	-	-	-	-	-	-	**-**	0.25		-	-	-	-	-	-	-		**0.03**	-
Smallmouth Bass	**0.02**	-	-	-	0.25	-	-	0.25	-	-	-	**0.05**	-		-	-	-	-	-	-	-		**-**	-
Largemouth Bass	**0.06**	-	-	-	-	-	-	-	-	-	-	**-**	-		-	-	-	-	-	-	-		**-**	-
Yellow Perch	**56.68**	43.38	60.90	25.86	68.12	29.34	105.73	29.26	44.35	22.65	13.64	**44.32**	68.09		80.52	25.53	43.78	75.99	38.12	10.86	51.84		**49.34**	47.26
Walleye	**2.44**	0.25	0.50	1.00	0.50	0.75	1.25	3.50	0.75	0.75	0.25	**0.95**	0.25		0.50	2.33	-	4.00	0.50	1.00	3.83		**1.55**	-
Freshwater Drum	**0.57**	-	0.25	-	3.00	0.25	-	0.50	-	0.50	-	**0.45**	-		-	-	-	0.25	-	1.50	-		**0.22**	-
Total catch	**70**	50	66	31	75	34	110	41	50	35	24	**52**	264		123	54	101	87	44	18	133		**103**	189
Number of species	**8**	7	7	7	8	8	7	9	7	7	8	**8**	8		6	4	5	7	9	9	10		**7**	4
Number of sets		4	4	4	4	4	4	4	4	4	4		4	-	4	4	4	4	4	4	4	-		2

TABLE 1.1.9. Species-specific catch per gillnet set at **Wellington in Northeastern Lake Ontario**, 1992-2021 (no sampling in 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**	2021
Alewife	**17.25**	20.85	50.58	62.26	38.23	83.22	137.33	1.54	79.05	447.66	215.85	**113.66**	475.42	140.74	460.72	99.79	245.34	104.95	143.58	44.79	86.81	-	**200.24**	270.55
Gizzard Shad	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	0.05	-	**0.01**	-
Chinook Salmon	**0.33**	0.10	0.20	0.35	1.20	0.10	0.20	0.35	0.45	-	0.10	**0.31**	0.65	-	0.15	0.15	0.15	0.25	0.10	0.52	0.10	-	**0.23**	-
Rainbow Trout	**-**	-	-	-	-	-	-	-	-	-	0.05	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-
Brown Trout	**0.11**	0.15	0.30	0.15	0.40	0.15	-	0.10	0.40	0.45	1.55	**0.37**	0.60	0.80	0.40	0.05	0.15	0.30	-	0.70	0.10	-	**0.34**	-
Lake Trout	**7.58**	2.40	2.20	0.85	1.85	0.45	0.70	0.40	0.05	0.25	0.10	**0.93**	0.25	0.40	0.05	0.20	-	0.05	1.10	1.75	0.05	-	**0.43**	0.63
Lake Whitefish	**0.61**	0.10	0.05	-	-	-	-	-	-	-	-	**0.02**	0.35	-	-	0.20	-	0.05	-	-	0.05	-	**0.07**	-
Cisco	**0.11**	-	-	-	-	-	0.05	-	-	0.05	0.05	**0.02**	0.05	-	-	-	-	0.20	0.35	0.05	0.15	-	**0.09**	0.13
Round Whitefish	**0.06**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-
Rainbow Smelt	**0.07**	-	-	-	-	-	-	-	0.05	0.10	0.17	**0.03**	0.05	0.10	-	0.05	-	0.17	0.47	0.05	-	-	**0.10**	0.13
Northern Pike	**0.01**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	0.05	-	0.05	-	-	-	-	-	-	-	**0.01**	0.13
White Sucker	**0.05**	-	-	-	0.17	-	-	0.05	-	-	-	**0.02**	-	-	-	-	-	-	-	-	0.05	-	**0.01**	-
Greater Redhorse	**-**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-
Lake Chub	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-
Common Carp	**0.02**	-	-	-	-	0.05	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	0.05	-	-	**0.01**	-
Brown Bullhead	**0.00**	0.05	0.10	-	0.05	0.15	-	-	-	-	-	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**	-
Burbot	**0.23**	0.10	0.25	0.05	0.05	-	0.10	-	0.05	-	0.05	**0.07**	-	0.10	-	0.05	-	0.15	0.05	0.05	0.15	-	**0.06**	0.25
White Perch	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-
Rock Bass	**0.35**	0.17	-	0.52	0.10	0.05	-	-	0.58	-	-	**0.14**	-	-	0.05	-	-	0.10	0.10	0.05	0.27	-	**0.06**	-
Smallmouth Bass	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	0.05	-	-	-	-	-	-	-	-	-	**0.01**	-
Yellow Perch	**31.00**	12.67	6.22	17.96	10.31	14.51	7.25	23.48	17.65	25.87	14.11	**15.00**	2.47	19.87	11.71	16.80	7.50	26.95	28.91	5.98	3.39	-	**13.73**	1.78
Walleye	**0.36**	-	0.10	0.20	0.25	0.20	0.10	0.10	-	-	0.05	**0.10**	0.05	-	0.10	0.05	-	0.05	0.10	0.25	0.15	-	**0.08**	0.13
Round Goby	**-**	-	-	0.33	0.99	25.92	18.39	2.03	11.50	1.16	6.94	**6.73**	3.35	2.97	3.30	0.33	2.53	2.64	1.65	1.82	4.79	-	**2.60**	3.30
Freshwater Drum	**0.25**	-	0.05	-	0.05	0.05	-	-	-	-	-	**0.02**	-	0.10	-	-	-	-	-	-	-	-	**0.01**	-
Total catch	**58**	37	60	83	54	125	164	28	110	476	239	**137**	483	165	477	118	256	136	176	56	96	-	**218**	277
Number of species	**11**	9	10	11	12	11	8	8	9	7	11	**10**	12	8	9	10	5	12	10	12	13	-	**10**	9
Number of sets		20	20	20	20	20	20	20	20	20	20		20	10	20	20	20	20	20	20	20	-		8

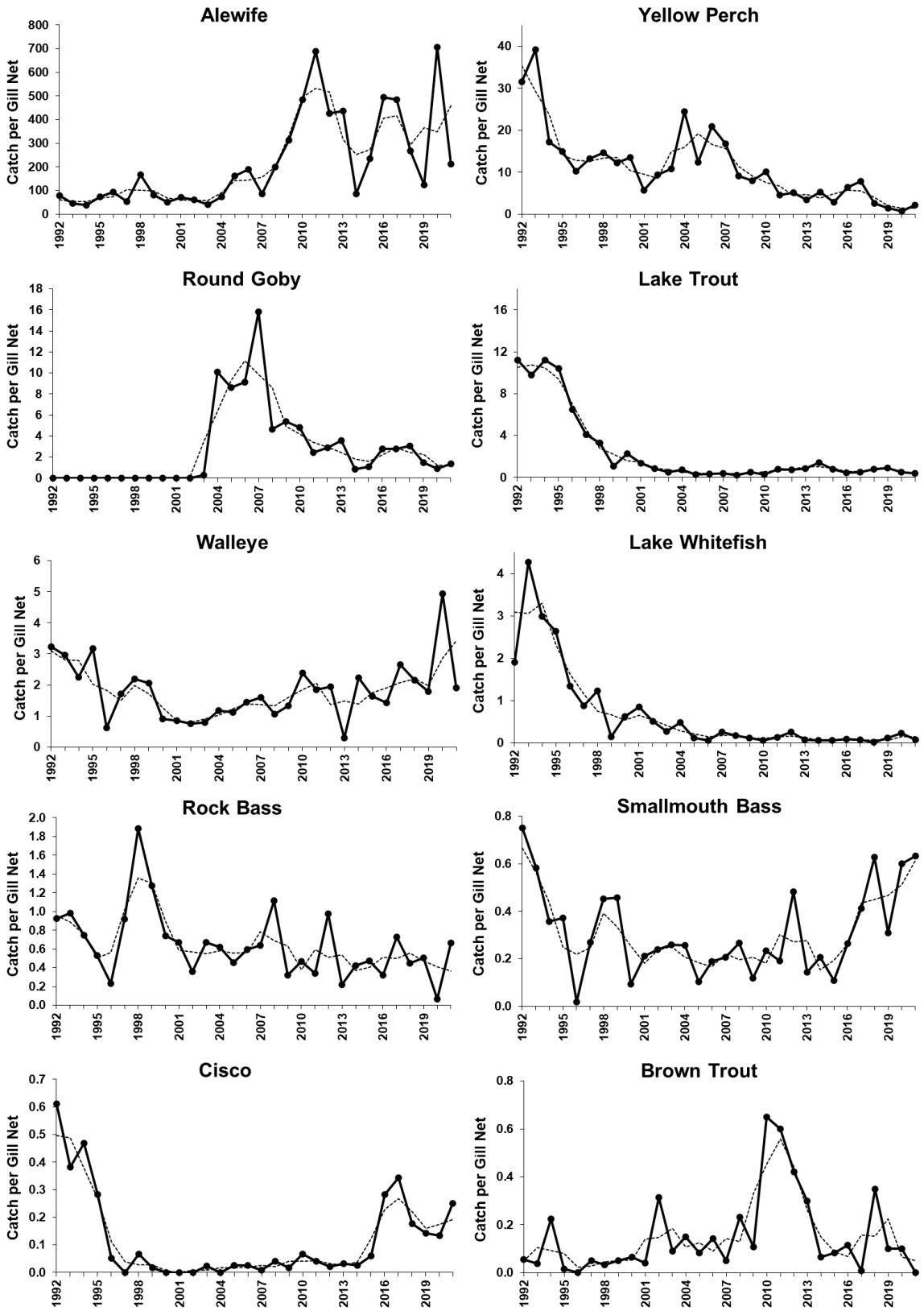


FIG. 1.1.2. Abundance trends for the most common species caught in gill nets at six depth-stratified transects (nearshore out to 30 m) in Northeastern and Kingston Basin Lake Ontario Nearshore (Melville Shoal, Grape Island, Flatt Point, Rocky Point, Wellington and Brighton; see Fig. 1.1.1). In 2020, only Kingston Basin Lake Ontario Nearshore were visited (Melville Shoal, Grape Island, Flatt Point). In 2021, Rocky Point was not visited). 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 1.1.10. Species-specific standard catch by depth at all **Bay of Quinte** gill net site locations (fixed and depth-stratified random sites combined), summer 2021. 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
Alewife	9.91	100.13	475.78	76.17	5.30	-
Black Crappie	-	3.30	-	-	-	-
Bluegill	73.17	82.78	55.74	-	-	-
Bowfin	4.00	-	-	-	-	-
Brown Bullhead	6.00	12.30	1.00	-	-	-
Channel Catfish	2.00	3.00	-	-	-	-
Chinook Salmon	-	-	-	1.00	1.00	-
Cisco	-	-	1.00	11.61	-	-
Common Carp	7.00	2.00	-	-	-	-
Freshwater Drum	62.00	75.00	50.00	10.00	-	-
Gizzard Shad	51.61	42.13	14.61	6.61	-	-
Golden Shiner	16.52	-	-	-	-	-
Greater redhorse	1.00	-	-	-	-	-
Lake Trout	-	-	-	5.00	41.00	3.00
Lake Whitefish	-	-	-	-	5.00	1.00
Largemouth Bass	14.30	-	-	-	-	-
Longnose Gar	92.91	35.91	2.00	-	-	-
Northern Pike	17.00	18.30	5.00	-	-	-
Pumpkinseed	67.96	54.83	14.00	-	-	-
Rainbow Smelt	-	-	-	1.00	2.00	-
Rainbow Trout	-	-	-	-	2.00	-
River redhorse	1.00	-	-	-	-	-
Rock Bass	15.30	4.30	1.00	-	-	-
Silver redhorse	2.00	-	-	-	-	-
Smallmouth Bass	40.61	1.00	-	-	-	-
Walleye	49.30	170.30	106.61	6.00	-	-
White Bass	9.00	5.00	2.00	-	-	-
White Perch	155.57	679.83	494.61	60.61	-	-
White Sucker	2.00	15.00	61.00	27.00	-	-
Yellow Perch	653.39	762.43	1,197.43	281.35	83.09	-
Total catch	1,354	2,068	2,482	486	139	4
Number of species	23	20	17	13	8	3
Number of net sets	7	11	9	6	8	2

TABLE 1.1.11. Seasonal species-specific catch at **upper, middle and lower Bay of Quinte** gill net site locations (fixed and depth-stratified random sites combined), 2021. The total catch and the number of species caught and gill nets set are indicated.

Species	Upper	Middle	Lower
Alewife	-	400.57	266.74
Black Crappie	-	3.30	-
Bluegill	202.09	9.61	-
Bowfin	2.00	2.00	-
Brown Bullhead	11.30	4.00	4.00
Channel Catfish	5.00	-	-
Chinook Salmon	-	-	2.00
Cisco	-	2.00	10.61
Common Carp	6.00	2.00	1.00
Freshwater Drum	114.00	37.00	46.00
Gizzard Shad	55.43	40.30	19.22
Golden Shiner	16.52	-	-
Greater redhorse	1.00	-	-
Lake Trout	-	-	49.00
Lake Whitefish	-	-	6.00
Largemouth Bass	11.30	3.00	-
Longnose Gar	98.52	30.30	2.00
Northern Pike	5.00	32.30	3.00
Pumpkinseed	88.04	45.43	3.30
Rainbow Smelt	-	-	3.00
Rainbow Trout	-	-	2.00
River redhorse	1.00	-	-
Rock Bass	7.30	4.00	9.30
Silver redhorse	2.00	-	-
Smallmouth Bass	41.61	-	-
Walleye	97.61	53.00	181.61
White Bass	15.00	-	1.00
White Perch	900.35	333.43	156.83
White Sucker	35.00	53.00	17.00
Yellow Perch	964.39	1,015.52	997.78
Total catch	2,680	2,071	1,781
Number of species	22	18	20
Number of net sets	13	10	20

TABLE 1.1.12. Species-specific catch per gillnet set at **Conway in the Bay of Quinte**, 1993-2021. 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.

	1993-2000											**2001-2010**											**2011-2021**	
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	**mean**	2021
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**	0.86
Gizzard Shad	**0.01**	-	-	-	0.05	-	-	0.20	0.10	-	-	**0.04**	0.10	-	-	-	-	-	0.05	-	-	-	**0.02**	2.58
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**	0.40
Rainbow Trout	**-**	-	-	-	-	0.05	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	0.20
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**	3.20
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**	0.40
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**	0.40
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**	0.20
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**	1.40
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**	13.12
White Bass	**-**	-	-	-	-	-	-	-	-	-	-	**-**	0.05	-	-	-	-	-	-	0.15	-	-	**0.02**	0.20
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**	29.25
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**	2.40
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**	4.40
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**	59
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**	14
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20	20	20	20	5	5		5

TABLE 1.1.13. Species-specific catch per gillnet set at **Hay Bay in the Bay of Quinte**, 1992-2021. 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**	2021
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**	3.80
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**	1.00
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**	0.50
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**	2.00
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**	6.00
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**	20.26
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**	2.50
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**	146.57
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**	2.00
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**	2.00
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**	187
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**	10
Number of sets		8	8	8	8	8	8	8	8	8	4		8	8	8	8	8	12	12	12	2	2		2

TABLE 1.1.14. Species-specific catch per gillnet set at **Big Bay in the Bay of Quinte**, 1992-2021. 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.

	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**	2021
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**	8.61
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**	3.00
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**	2.00
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**	1.00
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**	92.35
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**	38.13
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**	78.39
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**	7.00
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**	14.00
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**	244
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**	8
Number of sets		8	8	6	6	6	4	6	6	6	6		6	6	6	6	6	8	6	6	1	1		1

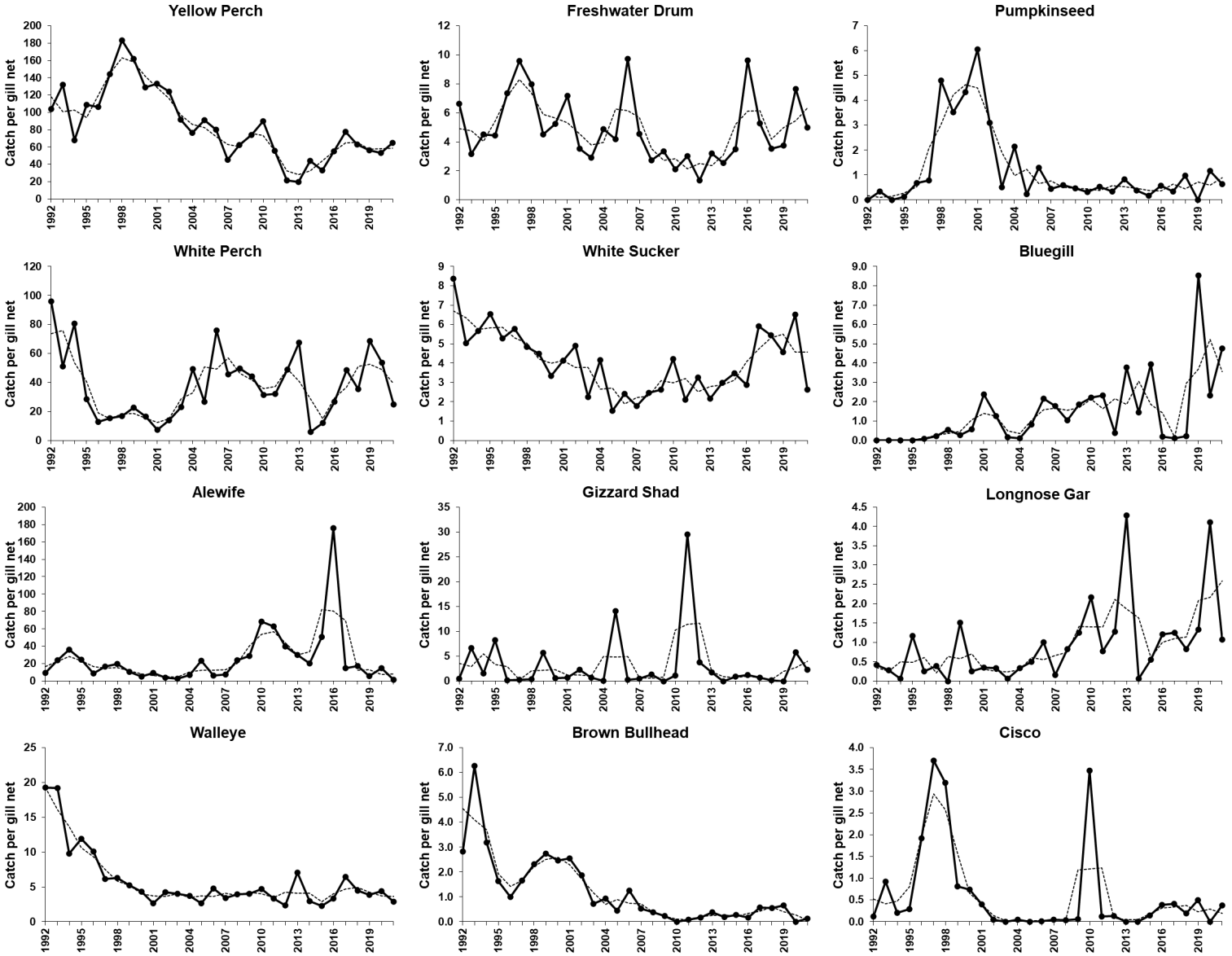


FIG. 1.1.3. Abundance trends (annual means) for the most common species caught in gill nets at three areas in the Bay of Quinte (Conway, Hay Bay and Big Bay; see Fig. 1.1.1). Dotted lines show 3-yr running averages (two years for first and last years graphed).

TABLE 1.1.15. Age distribution of **395 Walleye** sampled from **summer** index gill nets, by region, 2021. 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 weight + 1)/log10(weight). Note that a GSI greater than approximately 0.25 indicates a mature female.

	Age (years) / year-class																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Region	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	Total
Bay of Quinte	29	35	129	39	23	34	20	2	1	2	-	2	1	-	1	-	-	-	-	-	318
Kingston Basin (nearshore)	-	-	1	1	1	14	16	3	3	5	5	1	9	8	5	-	3	1	-	1	77
Total aged	29	35	130	40	24	48	36	5	4	7	5	3	10	8	6	-	3	1	-	1	395
Mean fork length (mm)	247	323	417	483	505	532	564	564	627	631	593	648	637	631	626	-	642	688	-	673	
Mean weight (g)	160	379	831	1,374	1,549	1,980	2,324	2,354	3,423	3,229	3,153	3,553	3,593	3,394	3,127	-	3,451	4,634	-	3,473	
Mean GSI femals	0.06	0.14	0.22	0.30	0.36	0.37	0.37	-	0.43	0.44	-	0.49	0.44	0.47	0.50	-	0.48	0.50	-	-	
Proportion mature	-	0.07	0.15	0.96	1.00	0.94	0.90	-	1.00	1.00		1.00	1.00	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 and 2021, 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 2021 bottom trawl sampling design is shown in Table 1.2.2.

Twenty-eight species and nearly 12,000 fish were caught in 48 bottom trawls in 2021 (August, Table 1.2.3). Yellow Perch (19%), White Perch (15%), Pumpkinseed (13%),

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 1.5" knotted black nylon 1" knotted black nylon	2" knotted nylon (chafing gear)
Codend Mesh Size	0.5" knotted white nylon	0.5" knotless white nylon
Remarks:	Fishing height 2.0 m FISHNET gear dimensions as per Casselman 92/06/08	Fishing height 1.9 m FISHNET gear dimensions 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

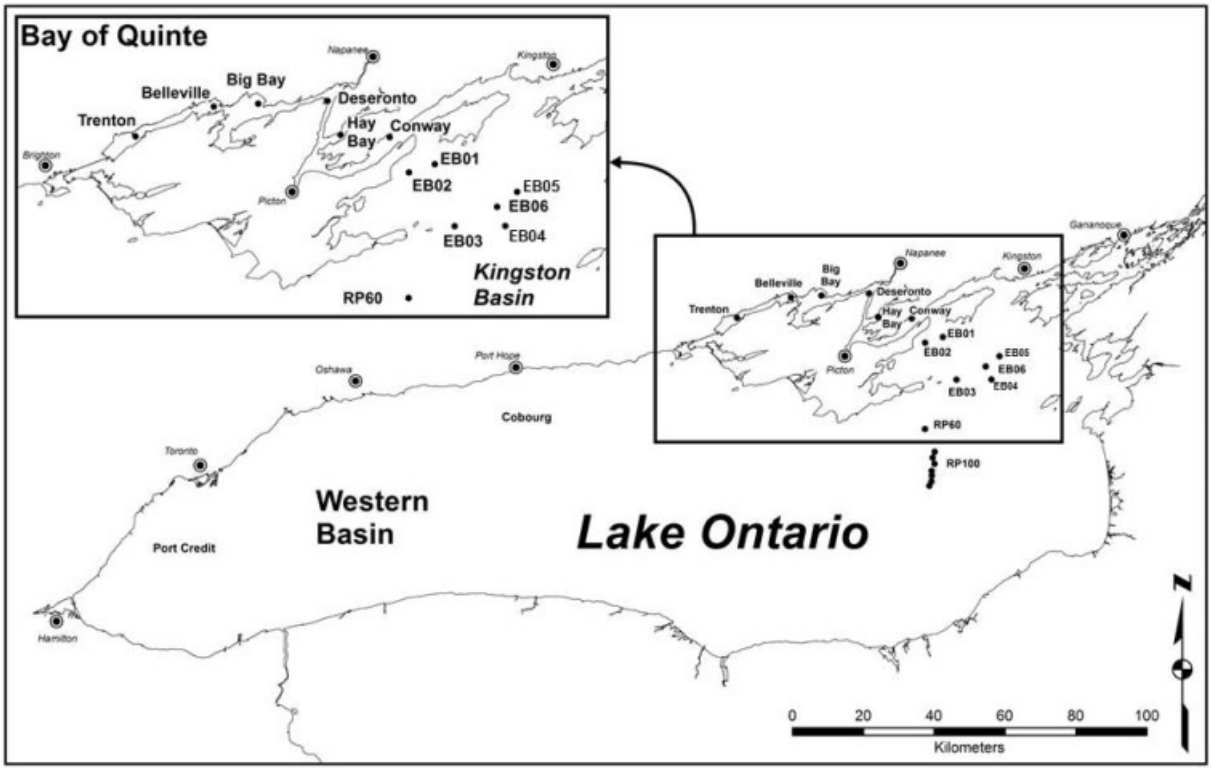


FIG. 1.2.1. Map of north eastern Lake Ontario. Shown are eastern Lake Ontario and Bay of Quinte fish community index bottom trawling site locations.

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 2021 trawls were only conducted in the Bay of Quinte

						Site location						
Region name	Area Name (Area code)	Site name	Depth (m)	Visits*	Replicates x duration	Latitude	Longitude	Visits x reps	Time-frame	Start year	Number years	2021 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	50	yes
Bay of Quinte	Hay Bay (MB)	BQ15	5	2	4 x 6 minutes	440650	770175	8	Aug 1-Sep 15	1972	50	yes
Bay of Quinte	Deseronto (UB)	BQ14	5	2	4 x 6 minutes	441000	770360	8	Aug 1-Sep 15	1972	50	yes
Bay of Quinte	Big Bay (UB)	BQ13	5	2	4 x 6 minutes	440975	771360	8	Aug 1-Sep 15	1972	50	yes
Bay of Quinte	Belleville (UB)	BQ12	5	2	4 x 6 minutes	440920	772010	8	Aug 1-Sep 15	1972	50	yes
Bay of Quinte	Trenton (UB)	BQ11	4	2	4 x 6 minutes	440600	773120	8	Aug 1-Sep 15	1972	50	yes

* Note that each **visit** represents a different **date**.

TABLE 1.2.3. Species-specific total bottom trawl catch in August 2021. Frequency of occurrence (FO) is the number of trawls, out of a possible 48, in which each species (29 species and 11,862 individual fish) was caught.

Species	FO	Catch	Biomass (kg)	Mean weight (g)
Alewife	37	1,216	16.127	13.3
American eel	4	5	7.146	1429.2
Black crappie	6	9	0.325	36.1
Bluegill	30	500	11.636	23.3
Brook silverside	1	2	0.002	1.0
Brown bullhead	30	165	45.502	275.8
Channel catfish	2	2	1.793	896.5
Cisco (Lake	4	9	1.059	117.7
Common carp	2	3	18.500	6166.7
Freshwater drum	32	536	127.113	237.2
Gizzard shad	35	1,200	69.172	57.6
Lake trout	4	6	0.183	30.5
Lake whitefish	2	3	0.081	27.0
Largemouth bass	27	116	0.399	3.4
Lepomis sp.	20	188	0.042	0.2
Logperch	19	192	0.517	2.7
Pumpkinseed	37	1,522	51.320	33.7
Rainbow smelt	7	290	1.220	4.2
Rock bass	2	3	0.078	26.0
Round goby	32	377	12.443	33.0
Smallmouth bass	7	30	0.118	3.9
Spottail shiner	36	701	4.036	5.8
Trout-perch	26	132	0.651	4.9
Walleye	39	360	36.712	102.0
White bass	32	248	1.114	4.5
White perch	41	1,770	72.949	41.2
White sucker	13	30	21.851	728.4
Yellow perch	48	2,240	97.057	43.3
Unknown	4	7	0.001	0.1
Totals		11,862	599.15	

Alewife (10%) and Gizzard shad (10%) collectively made up 67% of the catch by number. Species-specific catches in the 2021 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 2021. 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 2021 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**	2021
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**	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**	43.333
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**	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**	0.000
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**	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**	1.500
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**	1.500
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**	2.250
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**	0.000
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**	41.429
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**	5.667
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**	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	**0.713**	0.000
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**	0.000
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**	0.000
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**	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**	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**	5.800
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**	8.000
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**	0.000
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**	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**	0.000
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**	21.750
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**	1.000
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**	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**	349.250
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**	0.000
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**	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**	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**	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	**312**	481
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**	11
Number of trawls		8	8	12	12	12	12	12	12	12	12		8	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																							
	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**	2021
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**	313.875
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**	197.400
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**	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**	0.000
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**	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**	0.000
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**	1.000
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**	0.000
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**	0.000
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**	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**	47.750	69.750	54.750	47.625	40.000	58.750	33.500	60.057	18.000	70.337	**50.052**	25.625
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**	0.000
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**	2.000
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**	0.000
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**	1.500
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**	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**	1.000
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**	161.125
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**	6.500
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**	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**	0.000
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**	17.200
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**	9.000
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**	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**	1.250
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**	1.750
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**	0.000
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**	251.125
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**	2.000
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**	0.000
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**	1.000
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**	0.000
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**	0.000
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**	7.833
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**	0.000
Total catch	**824**	1,443	1,109	232	1,297	545	1,732	1,938	1,043	1,096	1,338	**1,177**	754	844	823	847	762	1,717	693	1,597	302	509	**885**	1,001
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**	17
Number of trawls		8	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																							
	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**	2021
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**	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**	387.375
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**	151.250
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**	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**	0.000
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**	1.333
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**	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**	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	1.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.113**	0.000
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**	33.375
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**	7.200
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**	0.000
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**	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**	1.000
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**	2.200
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**	464.750
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**	18.429
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**	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**	0.000
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**	47.000
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**	2.800
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**	0.000
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**	1.400
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**	1.000
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**	0.000
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**	332.750
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**	9.250
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**	0.000
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**	1.333
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**	0.000
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**	0.000
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**	3.500
Total catch	**904**	887	900	1,451	3,403	2,021	1,738	2,511	1,863	1,457	605	**1,684**	3,357	1,266	1,981	1,178	1,521	2,140	2,473	1,037	773	1,301	**1,703**	1,466
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**	18
Number of trawls		8	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**	2021
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**	0.000
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**	13.000
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**	174.625
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**	0.000
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**	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**	2.000
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**	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**	1.500
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**	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**	16.125
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**	3.625
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**	1.000
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**	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**	0.000
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**	6.333
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**	444.625
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**	2.500
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**	0.000
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**	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**	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**	10.625
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**	1.833
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**	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**	1.250
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**	0.000
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**	14.333
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**	106.250
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**	11.375
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**	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**	1.000
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**	2.000
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**	3.000
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**	26.000
Total catch	**891**	721	1,511	442	2,301	2,017	1,700	661	1,586	1,543	1,109	**1,359**	2,310	827	1,077	1,498	568	2,024	978	459	609	401	**1,075**	843
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**	20
Number of trawls		8	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.

		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**	2020
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**	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**	0.000
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**	35.000
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**	476.833
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**	0.000
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**	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**	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**	1.000
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**	0.000
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**	8.750
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**	10.167
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**	0.000
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**	0.000
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**	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**	7.143
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**	534.125
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**	6.375
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**	0.000
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**	0.000
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**	0.000
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**	52.125
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**	12.125
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**	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**	4.143
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**	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**	10.000
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**	207.500
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**	19.000
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**	0.000
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**	12.500
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**	0.000
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**	16.000
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**	27.250
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**	0.000
Total catch	**1,042**	453	724	365	2,691	1,318	1,161	1,421	1,571	2,213	1,385	**1,330**	2,193	893	3,897	832	641	680	589	1,409	965	747	**1,285**	1,440
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**	17
Number of trawls		8	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**	2021
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**	17.400
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**	594.625
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**	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**	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**	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**	1.000
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**	0.000
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**	0.000
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**	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**	0.000
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**	7.500
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**	4.833
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**	0.000
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**	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**	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**	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**	2.000
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**	549.125
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**	2.800
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**	0.000
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**	1.500
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**	69.750
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**	43.875
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**	4.286
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**	10.000
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**	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**	4.571
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**	366.125
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**	4.143
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**	0.000
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**	16.750
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**	0.000
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**	0.000
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**	7.250
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**	1.000
Total catch	**1,155**	781	547	1,203	353	1,381	781	751	1,145	2,186	688	**982**	1,849	1,081	1,421	703	1,382	366	454	1,673	532	1,050	**1,051**	1,709
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**	19
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	8	8	8	8	8		8

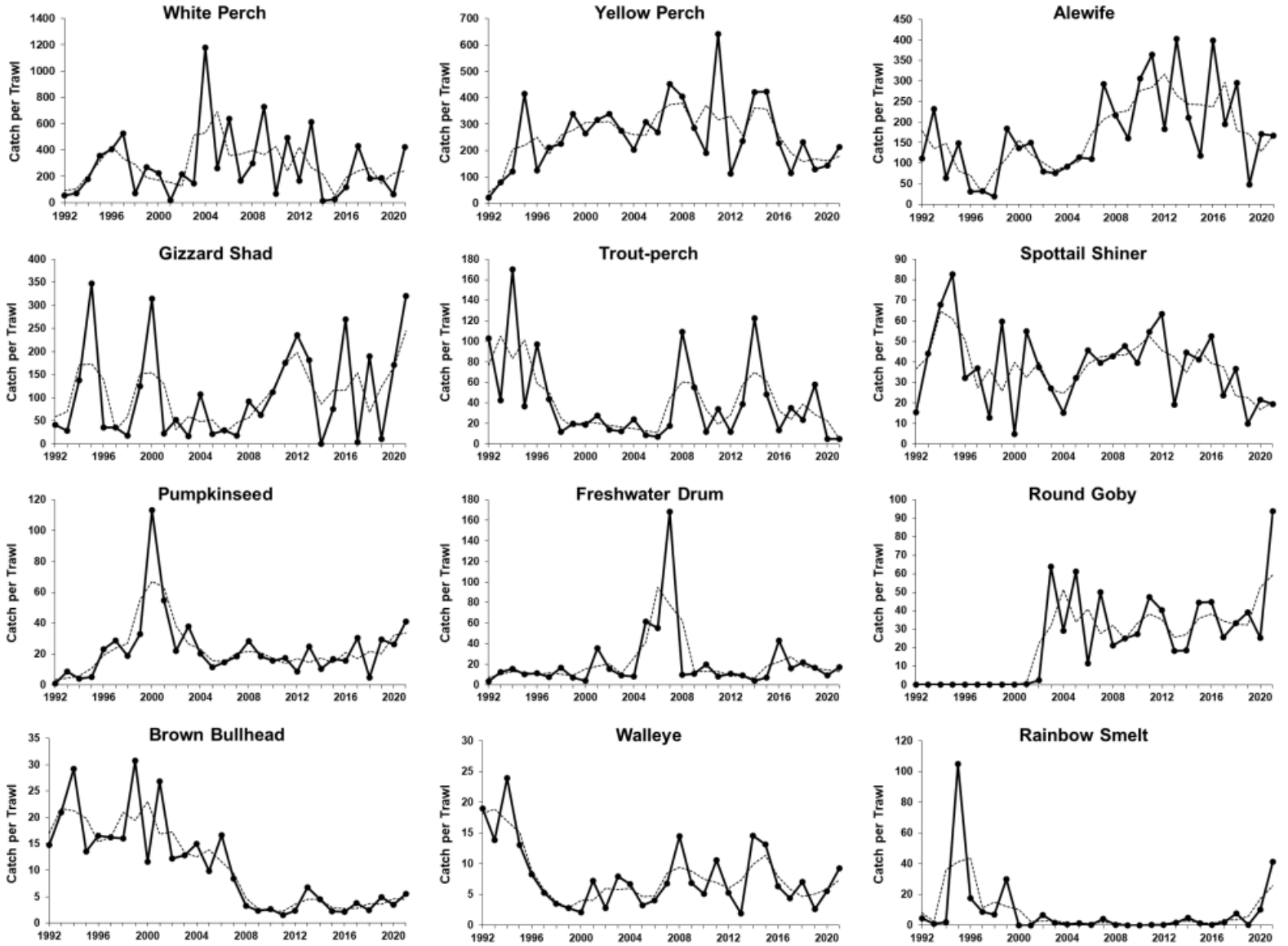


FIG. 1.2.3. Abundance trends (annual means) for the most common species caught in bottom trawls at six sites in the Bay of Quinte (Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton; see Fig. 1.2.1). Values shown here are 3-yr running averages (two years for first and last years graphed).

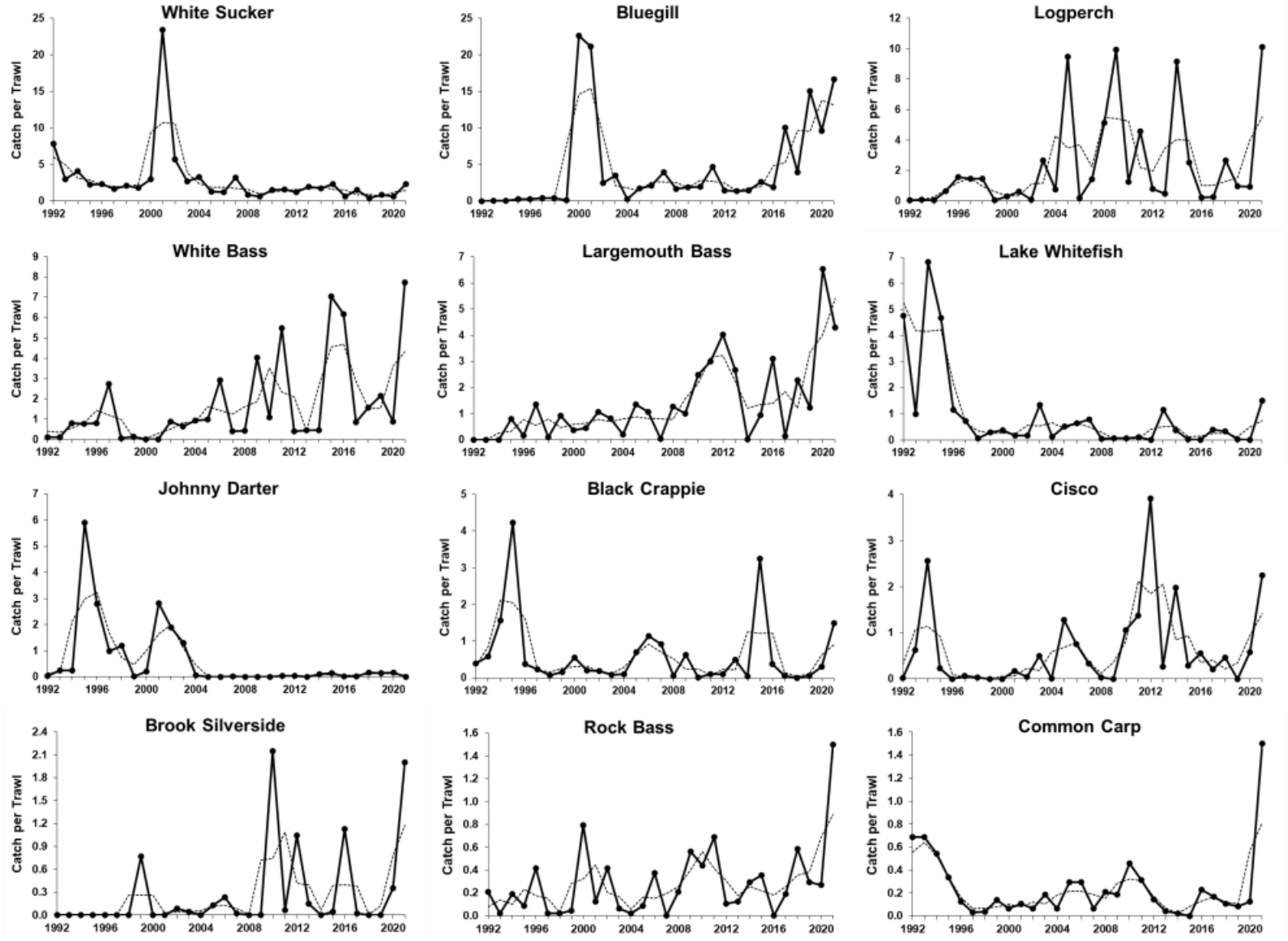


FIG. 1.2.3 (continued). Abundance trends for the most common species caught in bottom trawls at six sites in the Bay of Quinte (Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton; see Fig. 1.2.1). Values shown here are 3-yr running averages (two years for first and last years graphed).

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, 1992-2021. 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
2021	0.8	8	-	0

TABLE 1.2.15. Mean catch-per-trawl of **age-0 Cisco** at Conway in the lower Bay of Quinte, 1992-2021. 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	3.50	8
2021	0.63	8

TABLE 1.2.16. Mean catch-per-trawl of **age-0 Yellow Perch** at six Bay of Quinte sites, 1992-2021. 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
2021	14.75	73.375	49	9.125	27.5	0	29.0	48

TABLE 1.2.17 Mean catch-per-trawl of **age-0 Walleye** at six Bay of Quinte sites, 1992-2021. 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
2021	2.1	7.3	9.5	3.0	0.0	0.0	3.6	48

TABLE 1.2.18. Age distribution of **270 Walleye** sampled from summer bottom trawls, Bay of Quinte, 2021. 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 or otoliths.

Age (years)	0	1	2	3	4	5	6	7
Year-class	2021	2020	2019	2018	2017	2016	2015	2014
Number of fish	175	48	19	23	1	2	1	1
Mean fork length (mm)	104	208	319	401	401	491	530	550
Mean weight (g)	10	91	332	719	761	1,519	1,813	2,058

1.3 Lake Ontario Nearshore Community Index Netting

S. Beech, Lake Ontario Management Unit

In 2021, Nearshore Community Index Netting (NSCIN) was completed at Hamilton Harbour. This was the only site visited in 2021 and none were visited in 2020 due to operational constraints during the COVID-19 pandemic. (Fig. 1.3.1).

NSCIN was first initiated on the upper Bay of Quinte (Trenton to Deseronto), West Lake, and Weller's Bay in 2001, and was expanded to include the middle and lower reaches of the Bay of Quinte (Deseronto to Lake Ontario) in 2002. In 2006, the NSCIN program was conducted on Hamilton and the Toronto Harbour areas thanks to partnerships developed with Fisheries and Oceans Canada and the Toronto and Region Conservation Authority. NSCIN was further expanded to other Lake Ontario nearshore areas in subsequent years (Table 1.3.1).

The NSCIN protocol is a provincial standard methodology that uses 6-foot trap nets and is designed to evaluate the relative abundance and other biological attributes of fish species that inhabit the littoral area. Suitable trap net sites are chosen from randomly selected UTM grids that contain shoreline in the nearshore area.

Ecosystem (i.e., Index of Biotic Integrity or IBI) and fish community (e.g., proportion of piscivore biomass or PPB) level measures have been developed to assess relative health of Lake Ontario's nearshore areas. These assessments are particularly useful to monitor the on-going status of impaired fish communities in Lake Ontario Areas of Concern (AOCs) such as Hamilton and Toronto Harbours.

Hamilton Harbour has been sampled periodically in partnership with the Department of Fisheries and Oceans Canada. Twenty-four trap net sites were sampled on Hamilton Harbour from Aug 23 - 30, 2021 however, one net set was compromised and was excluded from the data summary and analysis. Water temperatures were very high ranging from 22.9 - 26.9°C, compared to 19.5 - 23.4°C in 2019 (Table 1.3.2). Just over 8900 fish comprising 24 species were captured

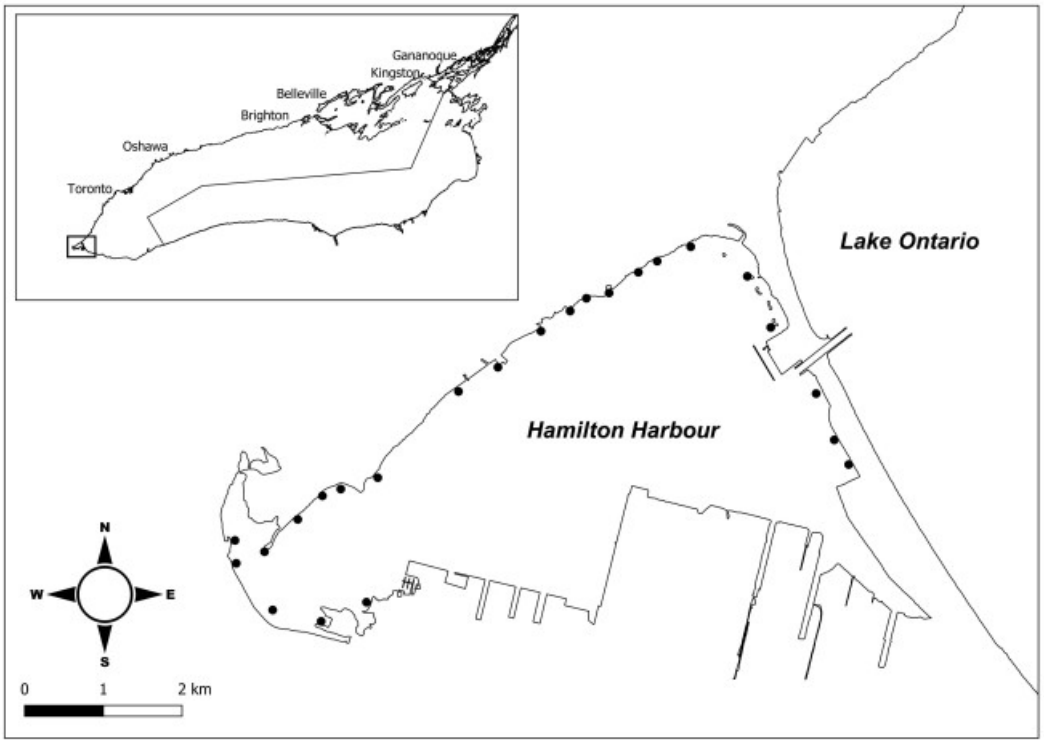


FIG. 1.3.1. Map of Lake Ontario indicating NSCIN trap net locations on Hamilton Harbour, 2021.

(Table 1.3.3). The most abundant species by number were Brown Bullhead (6592), White Perch (752), Bluegill (697), Rudd (151), Channel Catfish (123), Gizzard Shad (86), Pumpkinseed (86) and Walleye (79). Of note, 8 American Eel were captured marking the highest catch of all sampling years.

Survey information and basic catch statistics for Hamilton Harbour sampled in 2021 are given in Tables 1.32 and 1.3.3. Age distribution and length-at-age information is given in Tables 1.3.4 and 1.3.5. Abundance trends for all species are presented in Table 1.3.6 and graphically for selected species in Fig 1.3.2.

Walleye Stocking

Walleye have been stocked into Hamilton Harbour in an effort to establish a native predatory fish and an urban fishery. Current stocking targets are 100,000 summer fingerlings every other year (alternating with Toronto Harbour) (see Section 6).

In 2021, there was a strong showing of age-9, age-5, and age-3 Walleye from the 2012, 2016, and 2018 stocking event, respectively.

TABLE. 1.3.1. Annual NSCIN trap net schedule for Lake Ontario nearshore areas, 2006-2021. The numbers of trap net samples at each area in each year are indicated.

Year	Hamilton Harbour	Toronto Islands	Presqu'ile Bay	Weller's Bay	West Lake	East Lake	Prince Edward Bay	Upper Bay of Quinte	Middle Bay of Quinte	Lower Bay of Quinte	North Channel Kingston
2021	24										
2020											
2019	24	24						36	29	7	
2018	24	24						36			
2017					24	16	24	36			
2016	24	24						36			
2015	24		16	24				36			
2014	24	23						36			
2013					24	16	24	36			
2012	24	24						36			
2011								36	29	7	
2010	24	24						36			
2009							27	36	30	18	25
2008	24							36			
2007		24			18	18		36			
2006	24	24									

TABLE 1.3.2. Survey information for the 2021 NSCIN trap net program on Hamilton Harbour. Shown are the survey dates, the range of observed surface water temperatures, the total number of trap net lifts, and the number of trap net lifts broken down by target sampling depth, and observed substrate and cover types.

Survey dates		Aug. 23-30
Water temperature		22.9 - 26.9
No. of trap net lifts		24
No. of lifts by depth:		
	Target (2-2.5)	4
	Above target	8
	Below target	12
No. lifts by substrate type:		
	Hard	3
	Soft	21
No. lifts by degree cover:		
	None	5
	1-25%	11
	26-75%	5
	76-100%	3

TABLE 1.3.3. Species-specific catch in the 2021 NSCIN trap net program on Hamilton Harbour. Statistics shown include arithmetic and geometric mean catch-per-trap net (CUE), percent relative standard error of mean log10(catch+1), %RSE = 100*SE/mean, and mean fork or total length (mm).

Species	Arithmetic mean	Geometric mean	Relative Standard Error (%)	Mean length (mm)
Brown bullhead	286.609	64.168	47	288
White perch	32.696	14.683	26	195
Bluegill	30.304	12.088	45	125
Rudd	6.565	4.223	28	233
Channel catfish	5.348	5.699	45	582
Gizzard shad	3.739	2.326	33	168
Pumpkinseed	3.739	3.128	69	108
Walleye	3.435	3.774	35	610
Common carp	2.783	2.654	27	482
Bowfin	1.435	2.319	27	588
Carassius auratus x Cyprinus carpio	1.435	1.65	40	432
Rock bass	1.087	1.854	38	192
Goldfish	0.826	1.861	39	323
White bass	0.739	1.668	39	299
Largemouth bass	0.739	2.349	46	211
Yellow perch	0.609	1.622	33	182
Longnose gar	0.565	1.669	37	795
Northern pike	0.391	1.741	41	717
American eel	0.348	1.495	63	853
Black crappie	0.217	1.442	65	190
Freshwater drum	0.217	1.442	65	582
White sucker	0.174	1	46	350
Bigmouth buffalo	0.043	1	93	800
Morone hybrid	0.043	1	93	200
Total catch per net	384			
Number of species	24			
Number of nets	23			
Total catch	8951			

Piscivore Biomass

The amount of piscivores or top predators in a fish community is a key factor in ecosystem health. A proportion of the fish community biomass comprised of piscivores (PPB) greater than 0.20 reflects a healthy trophic structure.

The PPB in 2021 was 0.20 in Hamilton Harbour (Fig 1.3.4). This value was similar to 2019 and is an increase from previous years with the exception of 2012.

The average PPB at Hamilton Harbour remains lower than other sheltered embayments such as the Upper Bay of Quinte. It also remains lower than other exposed embayments with the exception of Toronto Harbour that has a similar average (Fig 1.3.6).

Index of Biotic Integrity

The index of biotic integrity (IBI) is a measure of ecosystem health. Eleven metrics that fall within three categories, including species richness, trophic structure and abundance/ biomass, are used to calculate IBI scores. IBI classes can be described as follows: 0-20 very poor, 20-40 poor, 40-60 fair, 60-80 good, and 80-100 excellent ecosystem health.

The IBI in 2021 for Hamilton Harbour was 51 (fair) (Fig 1.3.3). There has been minimal change in the IBI for Hamilton Harbour since sampling began in 2006.

The average IBI at Hamilton Harbour remained below those of other sheltered Lake Ontario embayment's (Fig. 1.3.5). It remains more similar to other Lake Ontario exposed embayments, specifically Toronto Harbour.

TABLE 1.3.4. Age distribution of selected species caught in Hamilton Harbour, 2021.

	Age (years) / Year class										
	0	1	2	3	4	5	6	7	8	9	10
Species	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Black crappie	-	1	4	-	-	-	-	-	-	-	-
Bluegill	-	10	8	6	5	1	1	-	-	-	-
Largemouth bass	12	1	1	-	-	-	-	1	1	-	1
Northern pike	-	1	2	-	1	1	3	1	-	-	-
Pumpkinseed	-	19	11	-	-	-	-	-	-	-	-
Rock bass	-	2	10	5	2	3	-	-	-	-	-
Walleye	-	-	-	9	-	6	-	-	-	14	-
White bass	-	4	2	-	2	5	-	-	-	-	-
White perch	-	21	5	5	2	5	2	2	-	-	-
Yellow perch	-	6	6	1	1	-	-	-	-	-	-

TABLE 1..3.5. Mean fork length (mm) of selected species caught in Hamilton Harbour, 2021.

	Age (years) / Year class										
	0	1	2	3	4	5	6	7	8	9	10
Species	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Black crappie	-	132	196	-	-	-	-	-	-	-	-
Bluegill	-	109	137	137	155	155	180	-	-	-	-
Largemouth bass	145	154	261	-	-	-	-	444	445	-	469
Northern pike	-	496	627	-	640	721	774	821	-	-	-
Pumpkinseed	-	102	110	-	-	-	-	-	-	-	-
Rock bass	-	144	157	198	218	239	-	-	-	-	-
Walleye	-	-	-	486	-	574	-	-	-	633	-
White bass	-	-	239	-	358	340	-	-	-	-	-
White perch	-	150	188	229	250	245	298	284	-	-	-
Yellow perch	-	162	180	215	277	-	-	-	-	-	-

TABLE 1.3.6. Species-specific abundance trends (mean catch per trap net) in Hamilton Harbour. Annual mean catch per net lift, number of net sets, and number of species are also indicated.

	Year									
Species	2006	2008	2010	2012	2014	2015	2016	2018	2019	2021
Longnose gar	0.47	0.71	0.28	0.67	0.17	0.54	0.75	0.5	0.5	0.56
Spotted gar	-	-	0.04	-	-	-	-	-	-	-
Bowfin	0.58	1.17	2.42	1.17	1.54	0.83	1.33	0.88	1.17	1.44
Alewife	-	-	-	0.04	0.71	13.75	-	-	-	-
Gizzard shad	3.42	0.5	2.38	2.12	1.21	0.33	1.71	2.08	0.58	3.74
Rainbow trout	0.05	0.04	-	-	-	-	-	-	-	-
Brown trout	-	-	-	-	0.04	-	-	-	-	-
Lake trout	0.05	-	-	-	-	-	-	-	-	-
Coregonus sp.	-	-	-	0.25	-	-	-	-	-	-
Northern pike	1.11	1.08	1.08	0.29	0.25	0.54	0.54	0.33	0.71	0.39
Muskellunge	-	0.04	-	-	-	-	-	-	-	-
Suckers	0.05	-	-	-	-	-	-	-	-	-
Quillback	-	0.04	-	-	0.08	-	-	-	0.08	-
White sucker	0.11	0.21	0.46	0.29	2.17	0.62	0.04	0.08	0.04	0.17
Bigmouth buffalo	0.05	-	-	-	0.04	0.04	-	0.04	-	0.04
Silver redhorse	-	0.04	-	-	-	-	-	-	-	-
Shorthead redhorse	0.11	0.04	0.25	-	-	-	-	-	-	-
Greater redhorse	-	-	-	-	0.08	0.04	-	-	0.04	-
Black buffalo	-	-	-	-	-	0.04	-	-	-	-
Minnows	-	0.04	-	-	-	-	-	-	-	-
Goldfish	0.32	0.92	2.71	0.88	0.58	1.08	3.46	4.83	1.5	0.83
Common carp	4.47	3.92	2.2	1.21	2.25	2.38	4.33	4.04	3.17	2.78
Rudd	-	-	-	0.04	-	0.38	3.96	14.75	13.5	6.57
Black bullhead	0.05	-	-	-	-	-	-	-	-	-
Brown bullhead	380.79	189.33	482.67	76.25	251.71	753.79	339.54	355.62	291.17	286.61
Channel catfish	34.84	15.92	8	14.17	49.58	11.25	12.96	3.92	4.42	5.35
American eel	-	-	-	-	0.08	0.12	0.04	0.12	0.08	0.35
White perch	48.42	34.88	84.38	69.92	169.29	132.04	110.88	210.62	129.38	32.7
White bass	2	1.75	1.46	0.29	0.75	0.58	0.5	0.5	1.92	0.74
Morone sp.	-	-	-	-	-	-	-	-	-	0.04
Rock bass	0.58	1.08	1.48	1.17	2	1.04	3.33	2.5	1.08	1.09
Green sunfish	0.05	-	-	-	-	-	-	-	-	-
Pumpkinseed	0.68	1.12	3.33	2.04	1	-	0.67	1	0.08	3.74
Bluegill	4.05	3.21	9.08	14.42	14.96	3.42	17.33	17.25	5.58	30.3
Smallmouth bass	0.11	-	0.12	-	-	-	0.08	0.04	-	-
Largemouth bass	0.26	0.17	0.33	0.25	0.12	0.08	0.17	0.38	0.08	0.74
Black crappie	2.32	0.17	0.42	0.58	0.08	-	0.58	0.58	0.5	0.22
Yellow perch	0.11	0.62	4.16	0.25	1.08	0.71	0.58	0.46	0.04	0.61
Walleye	1.05	0.17	0.04	-	2.46	2.04	4.62	1.83	6.96	3.44
Round goby	0.05	-	-	-	-	-	-	-	-	-
Freshwater drum	1.37	1.71	1.24	0.33	1.08	1.88	1.33	0.46	1.75	0.22
Carassius auratus x Cyprinus carpio	-	-	-	-	-	-	0.25	-	1.96	1.44
Tilapia	-	-	-	-	-	-	-	0.08	-	-
Iridescent Shark Catfish	-	-	-	-	-	-	-	0.04	-	-
Total catch	488	259	609	187	503	928	509	623	466	384
Number of net lifts	19	24	24	24	24	24	24	24	24	23
Number of species	28	25	22	21	25	23	23	25	24	24

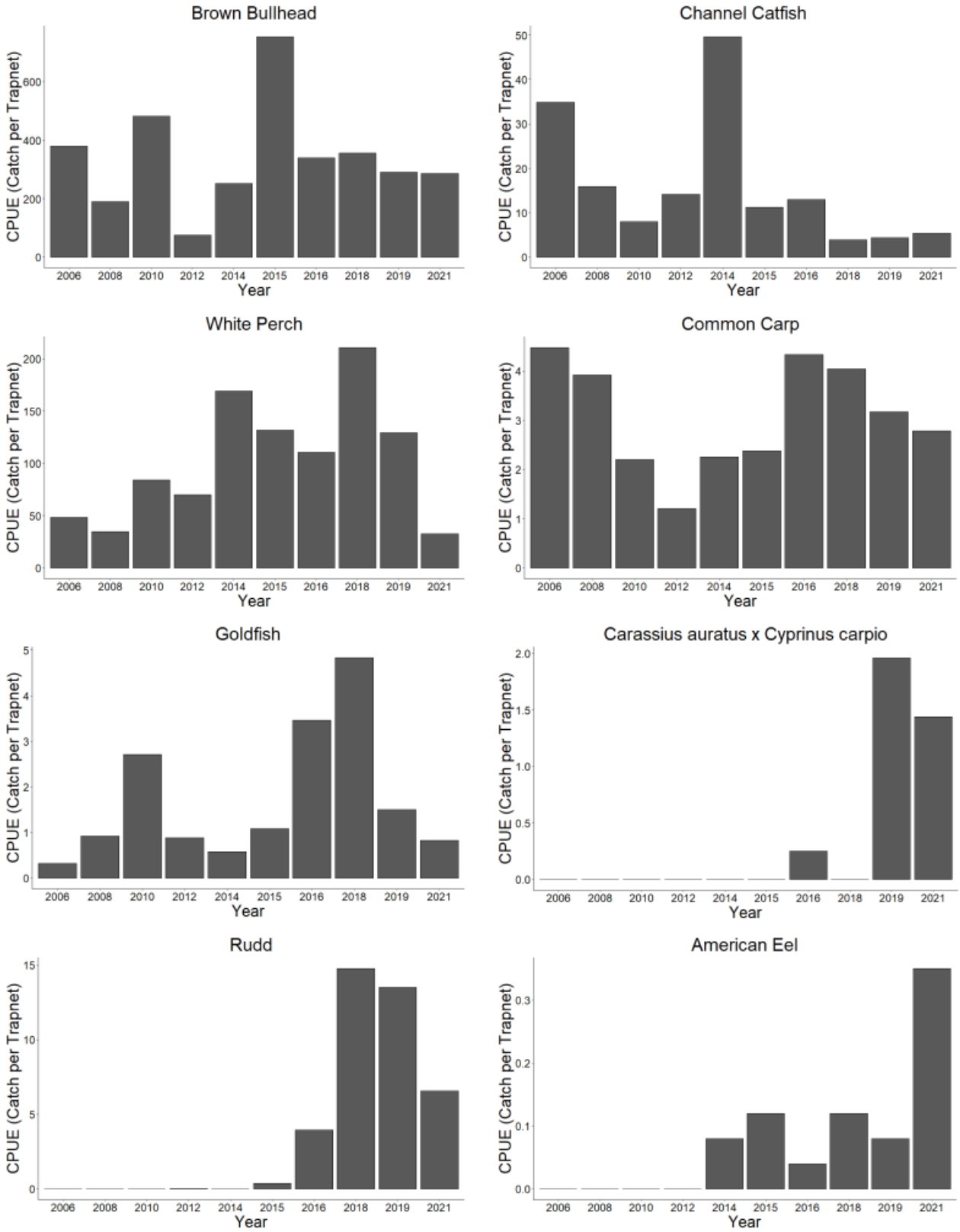


FIG. 1.3.2. Abundance trends for selected species caught in nearshore trap nets in Hamilton Harbour. Values shown are annual arithmetic means.

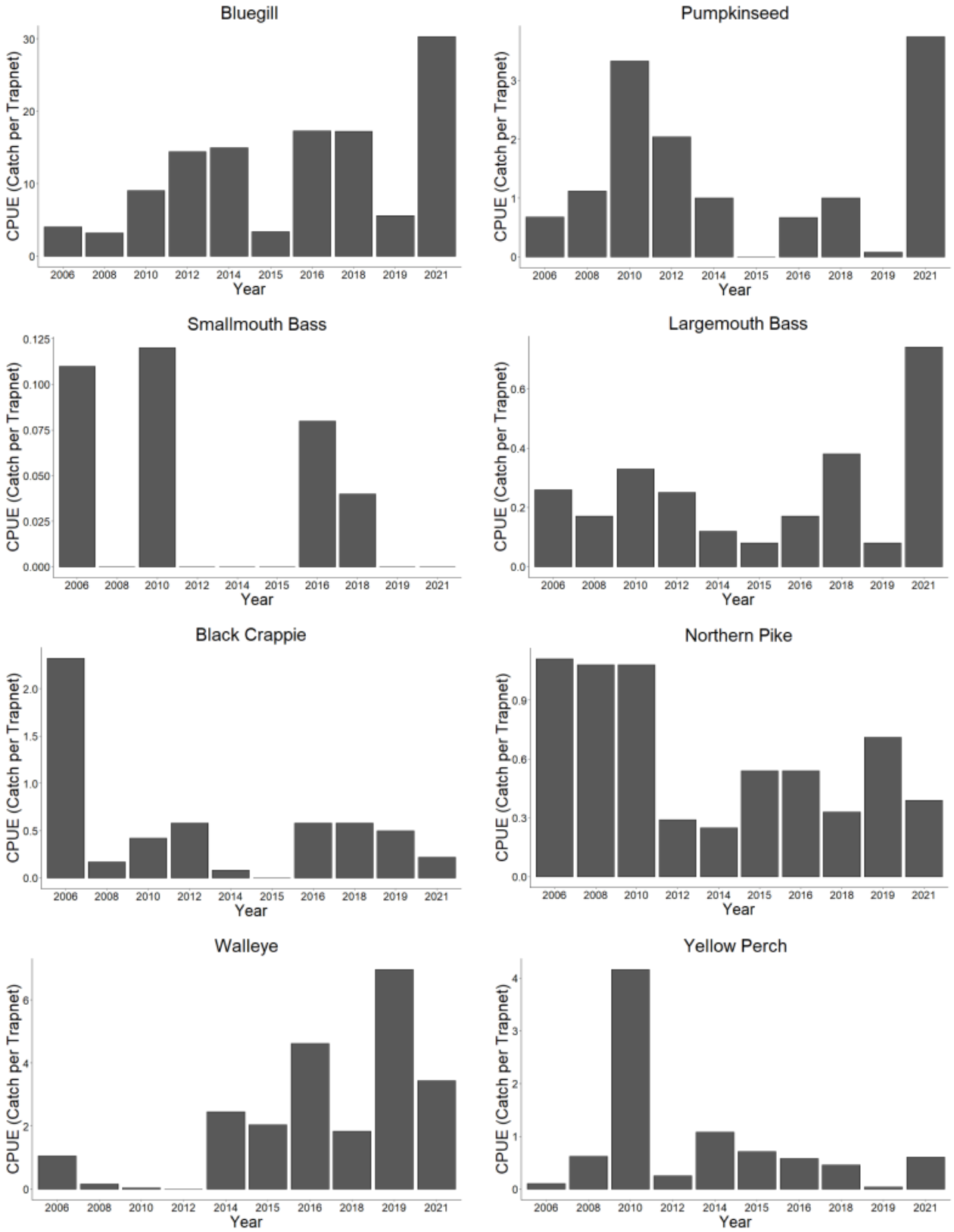


FIG. 1.3.2. (continued) Abundance trends for selected species caught in nearshore trap nets in Hamilton Harbour. Values shown are annual arithmetic means.

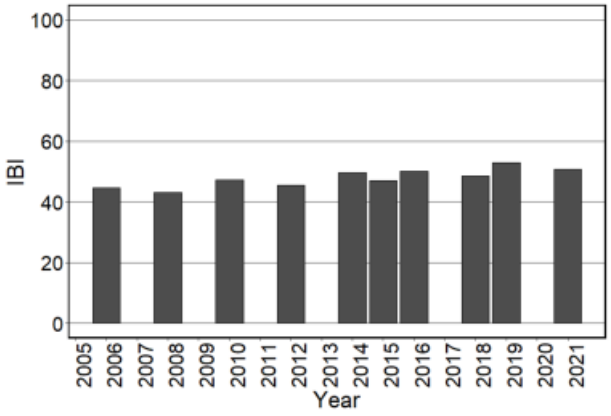


FIG. 1.3.3. Index of biotic integrity (IBI), as a measure of ecosystem health, in the nearshore trap net surveys in Hamilton Harbour through time (2006-2021). IBI classes can be described as follows: 0-20 very poor, 20-40 poor, 40-60 fair, 60-80 good, and 80-100 excellent ecosystem health.

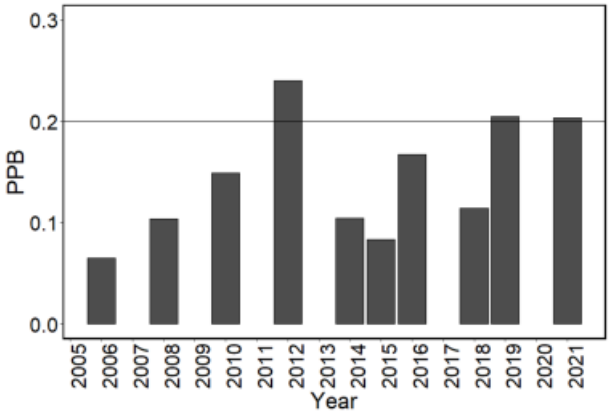


FIG. 1.3.4. Proportion of total fish community biomass represented by piscivore species (PPB) in the nearshore trap net surveys in Hamilton Harbour through time (2006-2021). A PPB>0.2 is indicative of a balanced trophic structure (depicted by a dashed line). Piscivore species included Longnose Gar, Bowfin, Northern Pike, Smallmouth Bass, Largemouth Bass, Walleye and American Eel.

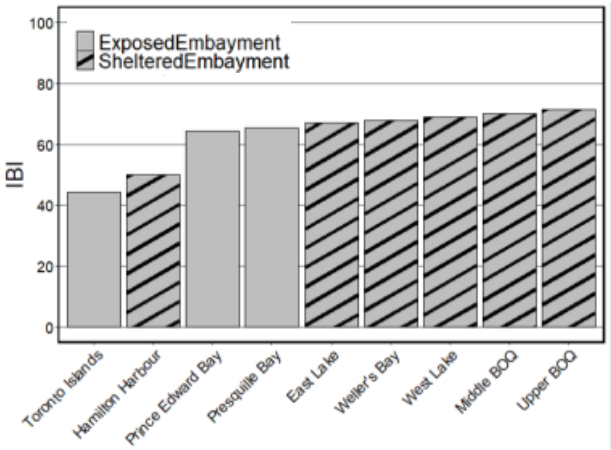


FIG. 1.3.5. Index of biotic integrity (IBI), as a measure of ecosystem health, in the nearshore trap net surveys in exposed and sheltered Lake Ontario embayments (2014-2021). IBI classes can be described as follows: 0-20 very poor, 20-40 poor, 40-60 fair, 60-80 good, and 80-100 excellent ecosystem health.

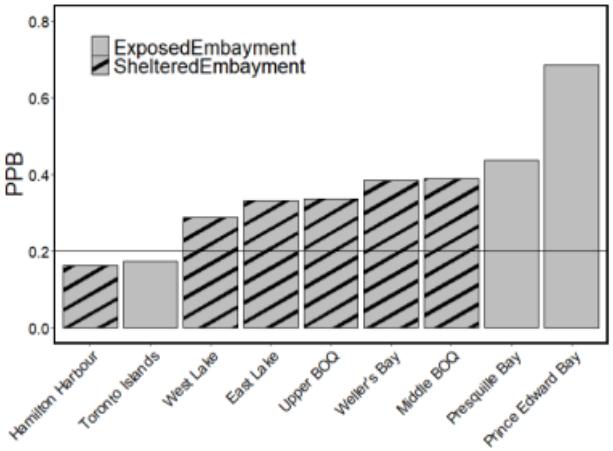


FIG. 1.3.6. Proportion of total fish community biomass represented by piscivore species (PPB) in the nearshore trap net surveys in Lake Ontario exposed and sheltered embayments (2014-2021). A PPB>0.2 is indicative of a balanced trophic structure (depicted by a dashed line). Piscivore species included Longnose Gar, Bowfin, Northern Pike, Smallmouth Bass, Largemouth Bass, Walleye and American Eel.

1.4 Ganaraska River Fishway Migratory Salmon and Trout Assessment

M. J. Yuille, 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 March 24th, 2021 and continued to count fish through to November 9th, 2021. In this time, 37,516 events were recorded (combined up and down events), with a total of 16,012 fish observed migrating upstream through the fishway (Figs. 1.4.1 and 1.4.2). 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.

TABLE 1.4.1. : Observed count and estimated run of Rainbow Trout moving upstream at the Ganaraska River fishway at Port Hope, Ontario during spring, 1974-2021. Estimates for 1980, 1982, 1984, 1986, 1992, and 2002 were interpolated from adjacent years with virtual population analysis.

Year	Observed	Estimated
1974	527	527
1975	591	591
1976	1,281	1,281
1977	2,237	2,237
1978	2,724	2,724
1979	4,004	4,004
1980	--	5,817
1981	7,306	7,306
1982	--	10,127
1983	7,907	7,907
1984	--	8,277
1985	14,188	14,188
1986	--	12,785
1987	10,603	13,144
1988	10,983	15,154
1989	13,121	18,169
1990	10,184	14,888
1991	9,366	13,804
1992	--	12,905
1993	7,233	8,860
1994	6,249	7,749
1995	7,859	9,262
1996	8,084	9,454
1997	7,696	8,768
1998	3,808	5,288
1999	5,706	6,442
2000	3,382	4,050
2001	5,365	6,527
2002	--	5,652
2003	3,897	4,494
2004	4,452	5,308
2005	4,417	5,055
2006	5,171	5,877
2007	3,641	4,057
2008	3,963	4,713
2009	3,290	4,502
2010	4,705	6,923
2011	6,313	9,058
2012	7,256	8,486
2013	8,761	12,021
2014	8,218	9,611
2015	5,890	6,669
2016	4,225	4,987
2017	6,952	--
2018	9,023	--
2019	6,051	--
2020	--	--
2021	6,985	--

September 10th, 2021 marked the most active day during the monitoring period on the fishway with a total of 1,474 salmon and trout observed migrating upstream through the Riverwatcher (Figs. 1.4.1 and 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.

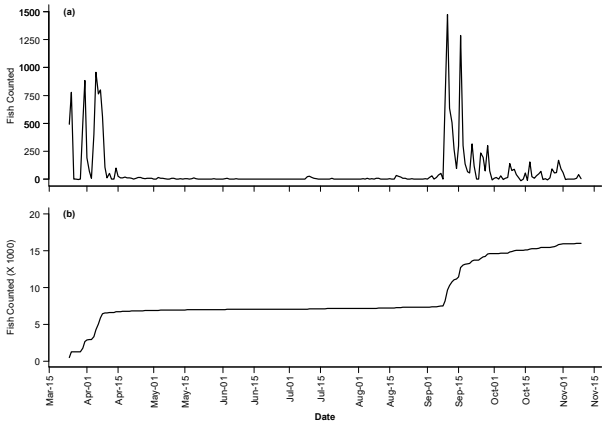


FIG. 1.4.1. (a) Daily and (b) cumulative observed fish counts at the Ganaraska River fishway at Port Hope, Ontario from March 24th to November 9th, 2021.

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 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 March 24th, 2021 to May 21st, 2021 when the Rainbow Trout spawning run ended.

In the spring of 2021, 6,985 Rainbow Trout were observed passing through the Ganaraska Fishway (Table 1.4.1 and Figs. 1.4.3 and 1.4.4). This is comparable to the previous 10-year average (7,047 fish average from 2012 to 2021).

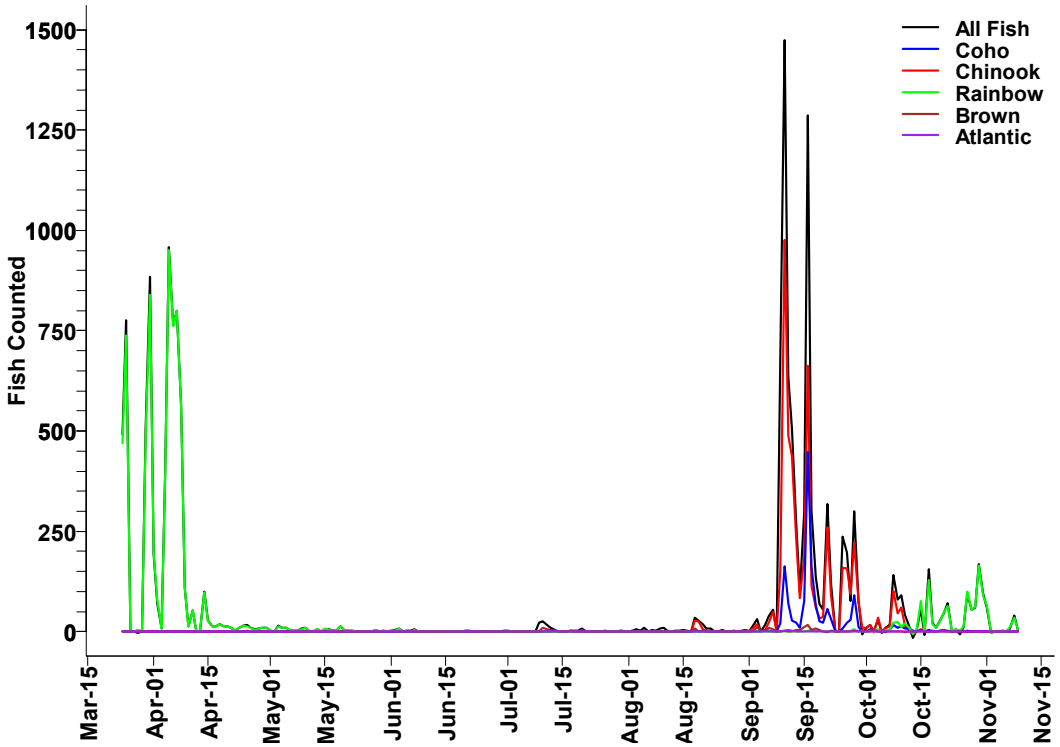


FIG. 1.4.2. Daily counts of each species of salmon and trout observed migrating through the Ganaraska River fishway at Port Hope, Ontario from March 24th to November 9th, 2021.

The total observed run size from 2021 increased 15% from the previous survey in 2019 and is 42% below the peak estimated run in 2013 (Table 1.4.1 and Fig. 1.4.3). In the spring, the fishway was most active early April (Fig. 1.4.4). In just five days (April 4th – April 9th, 2021), 51% of the Rainbow Trout counted passed through the fish counter (Fig. 1.4.4). Rainbow Trout were observed utilising the fishway after the spring monitoring period. Another 1,023 Rainbow Trout migrated through the fishway after the primary spring run, making a total of 8,008 Rainbow Trout identified migrating upstream through the Ganaraska Fishway in 2021.

Rainbow Trout were measured and weighed during the spawning run in most years since 1974. Rainbow Trout body condition was determined as the estimated weight of a 635 mm (25 inch) fish (total length). In 2021, the condition

TABLE 1.4.2. Body condition (estimated weight at 635 mm total length) of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario during spring, 1974-2021.

Year	Male		Female	
	Weight (g)	Sample Size	Weight (g)	Sample Size
1974	3,024	183	3,133	242
1975	2,826	202	3,018	292
1976	3,144	447	3,280	624
1977	2,906	698	3,128	1038
1978	3,053	275	3,271	538
1979	3,132	372	3,285	646
1981	3,131	282	3,304	493
1983	2,884	327	3,025	481
1985	3,118	446	3,274	760
1987	2,875	84	2,966	110
1990	2,851	261	3,043	198
1991	2,793	127	3,032	289
1992	2,946	142	3,072	167
1993	2,899	89	3,093	172
1994	3,088	116	3,274	181
1995	2,947	147	3,019	155
1997	3,107	157	3,109	148
1998	3,014	131	3,081	262
1999	2,990	182	3,149	293
2000	3,049	125	3,190	234
2001	2,865	308	3,022	299
2003	2,972	93	3,095	144
2004	3,008	143	3,155	248
2005	3,911	145	3,061	176
2006	2,936	102	3,099	217
2007	2,854	75	2,972	131
2008	2,846	125	2,996	148
2009	2,753	78	2,954	211
2010	2,989	74	3,102	156
2011	2,913	94	3,083	204
2013	3,044	163	3,178	217
2015	2,752	86	2,921	119
2016	2,801	105	2,942	132
2017	2,877	94	3,016	106
2018	2,785	249	2,930	407
2019	2,853	123	2,956	188
2021	3,091	56	3,404	113
Average	2,974		3,098	

TABLE 1.4.3. Lamprey marks on Rainbow Trout in spring 1974-2021, at the Ganaraska River fishway, at Port Hope, Ontario. Since 1990, A1 and A2 marks were called wounds and the remainder of marks were called scars to fit with historical classification.

Year	Wounds/ fish	Scars/ fish	Marks/ fish	% with wounds	% with scars	% with marks	Sample Size
1974	0.083	0.676	0.759	7.0	33.2	37	527
1975	0.095	0.725	0.820	8.0	37.2	40	599
1976	0.090	0.355	0.445	6.6	23.3	28	1280
1977	0.076	0.178	0.254	6.4	13.5	18	2242
1978	0.097	0.380	0.476	8.1	28.4	34	2722
1979	0.122	0.312	0.434	10.3	22.8	30	3926
1981	--	--	0.516	--	--	36	5489
1983	0.113	0.456	0.569	9.7	33.4	39	833
1985	0.040	0.154	0.193	3.7	11.5	14	1256
1990	0.030	0.071	0.101	2.8	5.8	8	466
1991	0.026	0.076	0.103	2.4	6.4	8	419
1992	0.079	0.117	0.197	6.3	11.1	17	315
1993	0.077	0.126	0.203	6.9	11.5	17	261
1994	0.044	0.141	0.185	4.0	12.4	15	298
1995	0.036	0.026	0.063	3.6	2.6	6	303
1996	0.028	0.025	0.053	2.8	2.5	5	396
1997	0.035	0.132	0.167	3.5	10.3	13	311
1998	0.075	0.092	0.168	6.8	8.5	13	400
1999	0.057	0.157	0.214	5.5	12.4	16	477
2000	0.091	0.191	0.283	8.0	16.9	24	361
2001	0.118	0.138	0.257	10.0	12.5	19	608
2003	0.063	0.134	0.197	5.9	10.9	16	238
2004	0.227	0.316	0.543	17.6	25.0	38	392
2005	0.231	0.433	0.664	17.1	33.6	41	321
2006	0.282	0.379	0.661	22.6	30.1	45	319
2007	0.199	0.534	0.733	15.5	39.3	49	206
2008	0.274	0.682	0.956	18.6	43.8	51	274
2009	0.256	0.377	0.633	20.4	29.8	42	289
2010	0.134	0.394	0.528	10.4	31.2	38	231
2011	0.124	0.235	0.359	10.7	21.8	30	298
2013	0.229	0.071	0.300	17.4	6.8	22	380
2015	0.058	0.238	0.296	4.9	16.5	20	206
2016	0.075	0.280	0.356	7.5	21.8	27	239
2017	0.109	0.183	0.292	10.9	16.8	27	202
2018	0.093	0.108	0.201	8.5	9.9	17	658
2019	0.103	0.186	0.289	8.7	16.4	23	311
2021	0.083	0.065	0.148	8.3	6.5	15	169

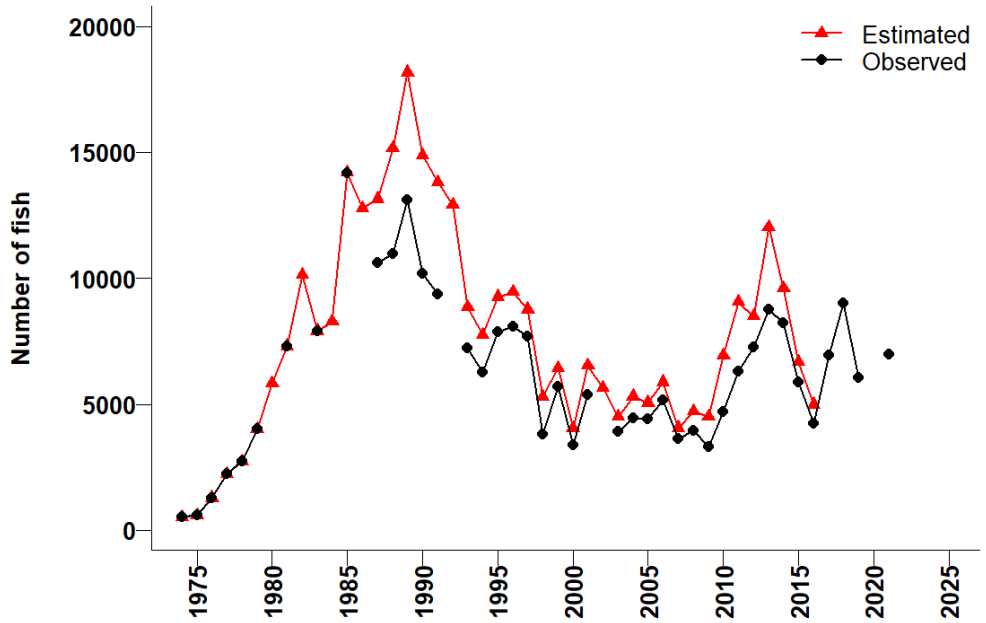


FIG 1.4.3: (a) Daily and (b) cumulative observed counts of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario from March 24th to November 9th, 2021.

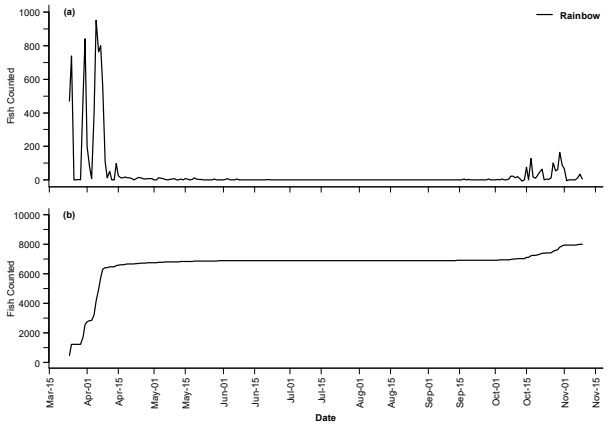


FIG 1.4.4: (a) Daily and (b) cumulative observed counts of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario from March 24th to November 9th, 2021.

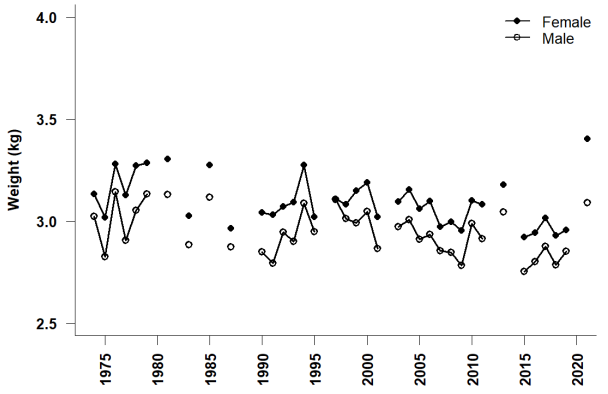


FIG. 1.4.5. Body condition (estimated weight at 635 mm total length) of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario during spring 1974-2021. Open and closed circles represent male and female Rainbow Trout (respectively).

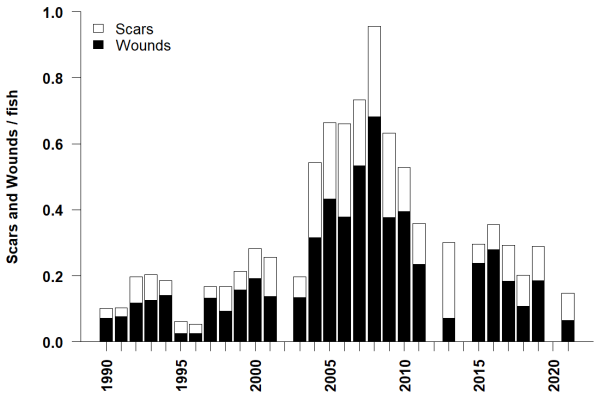


FIG. 1.4.6. Trend in lamprey marks on Rainbow Trout during the spring 1990-2021, at the Ganaraska River fishway at Port Hope, Ontario. Since 1990, A1 and A2 marks (King and Edsall 1979) were called wounds and the remainder of marks were called scars to fit with historical classification.

of male (3,091 g) and female (3,404 g) Rainbow Trout were increased from the previous 2019 survey and were 8% and 13% (respectively) above the previous 10-year average (Fig 1.4.5 and Table 1.4.2).

The proportion of Rainbow Trout with Lamprey marks in the Ganaraska River has been reported since 1974. In 2021, 15% of fish had Lamprey marks (wound or scar), which is 8% lower than the previous survey in 2019 (Fig. 1.4.6 and Table 1.4.3). Lamprey wounds on Ganaraska River Rainbow Trout in 2021 are 9% below the previous 10-year average (24%; Table 1.4.3).

Chinook Salmon

A total of 5,039 Chinook Salmon were identified migrating upstream through the Riverwatcher in the Ganaraska Fishway during the 2021 monitoring period (Fig. 1.4.7). The first Chinook Salmon was observed April 27th, 2021; this is well ahead of the main Chinook Salmon spawning run (Fig. 1.4.7). The last Chinook Salmon migrating upstream through the fishway was observed October 29th, 2021. During the monitoring period, nine 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 1.5 for more information). Detailed sampling of the Ganaraska River Chinook Salmon spawning population did not occur in 2021 as the Chinook Egg Collection program was conducted on the Credit River only (see Section 1.5).

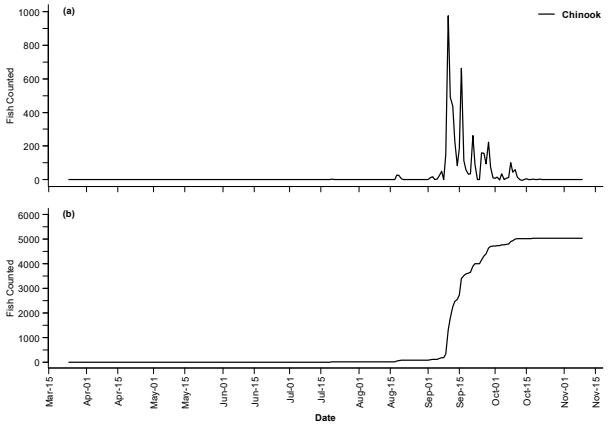


FIG. 1.4.7. (a) Daily and (b) cumulative observed counts of Chinook Salmon at the Ganaraska River fishway at Port Hope, Ontario from March 24th to November 9th, 2021.

Coho Salmon

The first Coho Salmon observed at the Ganaraska Fishway in 2021 was on September 5th. From that time, 1,462 Coho Salmon were identified moving upstream from the Corbett Dam (Fig. 1.4.8). During the monitoring period, six 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.

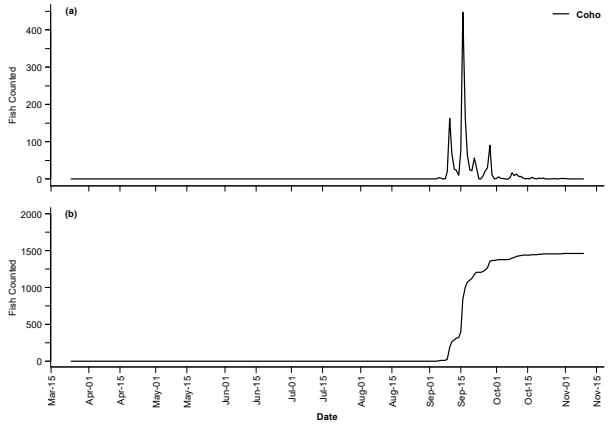


FIG. 1.4.8. (a) Daily and (b) cumulative observed counts of Coho Salmon at the Ganaraska River fishway at Port Hope, Ontario from March 24th to November 9th, 2021.

Brown Trout

The first Brown Trout observed at the Ganaraska Fishway in 2021 was on April 25th. From that time, 161 Brown Trout were identified moving upstream from the Corbett Dam (Fig. 1.4.9). Of the Brown Trout identified passing through the fishway, the majority were observed from mid-August to mid-September (Fig. 1.4.6).

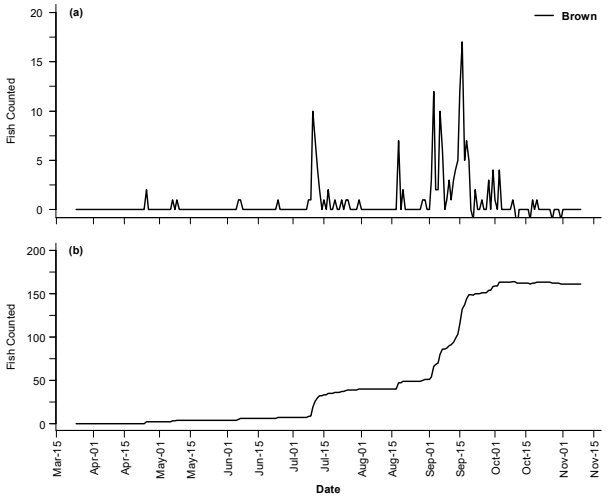


FIG. 1.4.9. (a) Daily and (b) cumulative observed counts of Brown Trout at the Ganaraska River fishway at Port Hope, Ontario from March 24th to November 9th, 2021.

Atlantic Salmon

The first Atlantic Salmon observed at the Ganaraska Fishway in 2021 was on July 13th. A total of four Atlantic Salmon successfully navigated upstream from the Corbett Dam (Fig. 1.4.10). All four fish were observed with an adipose clip, representing fish from 2016, 2017, 2018 and 2019 stocking events.

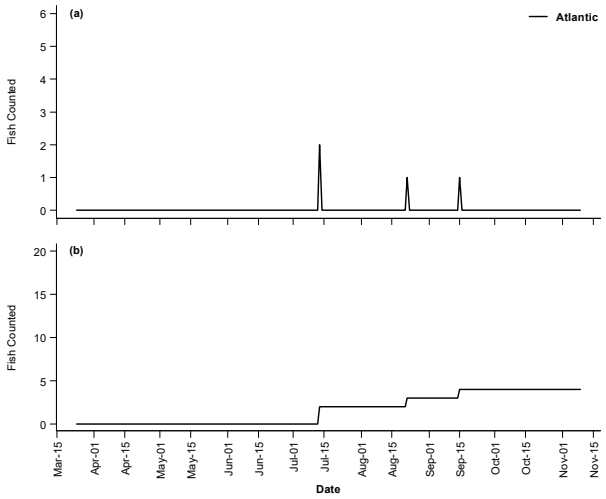


FIG. 1.4.10. (a) Daily and (b) cumulative observed counts of Atlantic Salmon at the Ganaraska River fishway at Port Hope, Ontario from March 24th to November 9th, 2021.

1.5 Credit River Trout and Salmon Assessment

M. J. Yuille, 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 March 29th, 2021 and continued to collect data through to November 3rd, 2021. 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 closed the Streetsville Fishway in the fall, effectively blocking all fish passage from mid-September to the end of Chinook Salmon Egg Collection (see below). In 2018, Aurora District implemented experimental selective passage trials using fishway jump height (*cf* 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 2021. 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 March 29th, 2021. 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. After installation, data were uploaded to the Riverwatcher Daily website every hour until the system was removed from the river on November 3rd, 2021. In this time, a total of 1,582 mature salmon and trout were observed moving upstream through the Streetsville Fishway (Fig. 1.5.1). 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 where the volume of fish moving through the fish counter exceeded the system's ability to count them individually.

October 6, 2021 marked the most active day on the fishway with a total of 130 salmon and trout observed migrating upstream through the Riverwatcher (Fig. 1.5.2). 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

A total of 498 Rainbow Trout were identified migrating upstream through the Streetsville Fishway from April 3rd to November

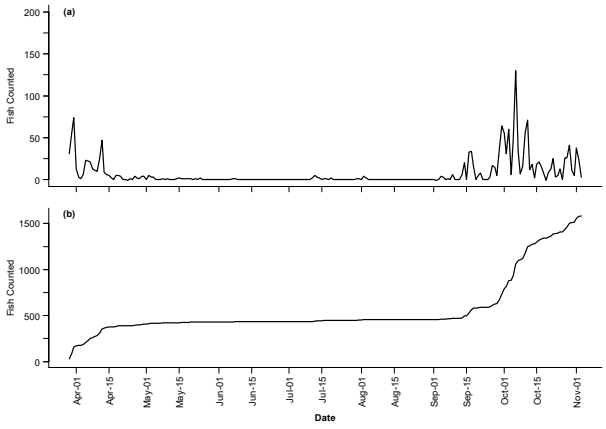


FIG 1.5.1: (a) Daily and (b) cumulative observed fish counts at the Streetsville Fishway, Credit River, Mississauga, Ontario from March 29 to November 3, 2021.

8th, 2019 (Fig. 1.5.3). During the spring migration (March 29 to May 21, 2021), 427 Rainbow Trout (86% of observed Rainbow Trout in 2021) moved upstream through the Streetsville Fishway.

Chinook Salmon

A total of 810 Chinook Salmon were identified migrating upstream through the Riverwatcher in 2021. The first Chinook Salmon was observed September 2, 2021 and the last observed on November 3, 2021 (Fig. 1.5.4). Of the Chinook Salmon that passed through the Streetsville Fishway 120 fish were observed with an adipose clip. Chinook Salmon with the adipose clip represent Ganaraska River egg collections that were subsequently stocked in the Credit River in 2017, 2018 and 2019. Unclipped Chinook Salmon represent fish stocked in the Credit River that originated from the Credit River egg collections (stocked in 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 2021 was on September 14. A total of 25 Coho Salmon were identified exiting the Streetsville Fishway (Fig. 1.5.5). The last Coho Salmon observed moving through Streetsville Fishway was on November 2, 2021. Of the Coho Salmon that passed through the Streetsville Fishway six fish were observed with an adipose clip and seven 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 total spawning population is minimal.

Brown Trout

The first Brown Trout observed at the Streetsville Fishway in 2021 was on May 20. A total of two Brown Trout were identified exiting upstream the Streetsville Fishway (Fig. 1.5.6).

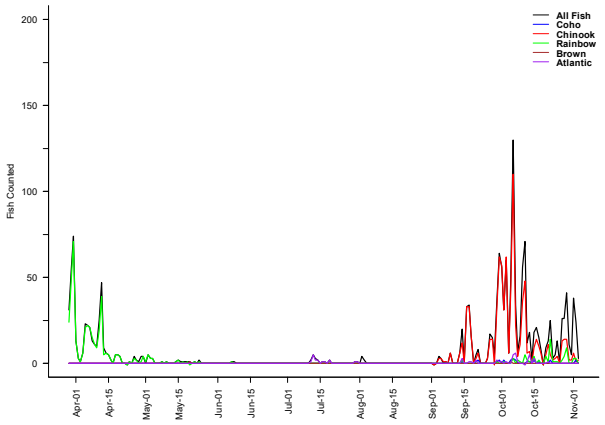


FIG 1.5.2: Daily counts of each species of salmon and trout observed migrating through the Streetsville Fishway, Credit River, Mississauga, Ontario from March 29 to November 3, 2021.

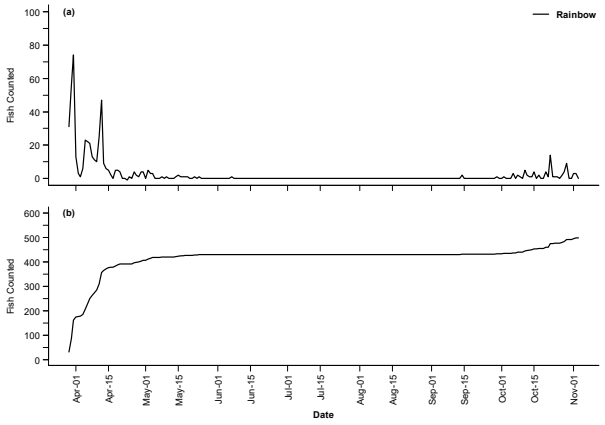


FIG 1.5.3: (a) Daily and (b) cumulative observed counts of Rainbow Trout at the Streetsville Fishway, Credit River, Mississauga, Ontario from March 29 to November 3, 2021.

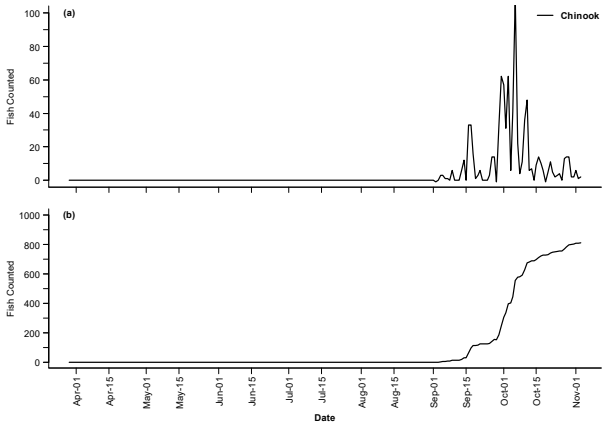


FIG 1.5.4: (a) Daily and (b) cumulative observed counts of Chinook Salmon at the Streetsville Fishway, Credit River, Mississauga, Ontario from March 29 to November 3, 2021.

Atlantic Salmon

The first Atlantic Salmon observed at the Streetsville Fishway in 2021 was on July 11. In total 65 individual Atlantic Salmon were identified on the camera, however, a total of 49 Atlantic Salmon were recorded exiting the Streetsville Fishway (Fig. 1.5.7).

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 spawn collection and detailed sampling. Detailed sampling included collecting data on length, weight, fin clips, coded-wire tag (CWT), lamprey marks and a subsample also had otoliths collected for age determination.

Samples for the 2021 Chinook Salmon index were taken between October 5th and October 14th. Lengths were taken on a total of 807 Chinook Salmon 350 randomly selected fish (non -detailed sampling) and 457 fish where detailed sampling occurred. Of the randomly selected fish, 31% 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 River = 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 and it is rare to observe Chinook Salmon in Lake Ontario older than age-4 so fish observed with an adipose clip would be from the 2017, 2018 and 2019 stocking events (see Section 6.1). To gain

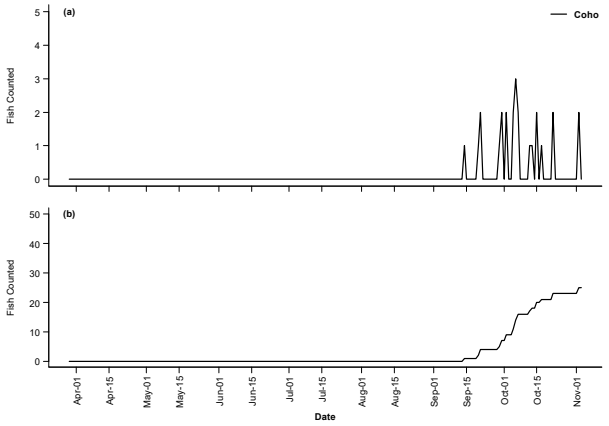


FIG 1.5.5: (a) Daily and (b) cumulative observed counts of Coho Salmon at the Streetsville Fishway, Credit River, Mississauga, Ontario from March 29 to November 3, 2021.

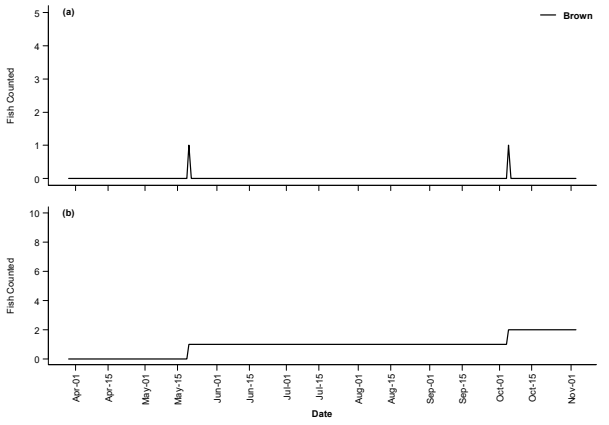


FIG 1.5.6: (a) Daily and (b) cumulative observed counts of Brown Trout at the Streetsville Fishway, Credit River, Mississauga, Ontario from March 29 to November 3, 2021.

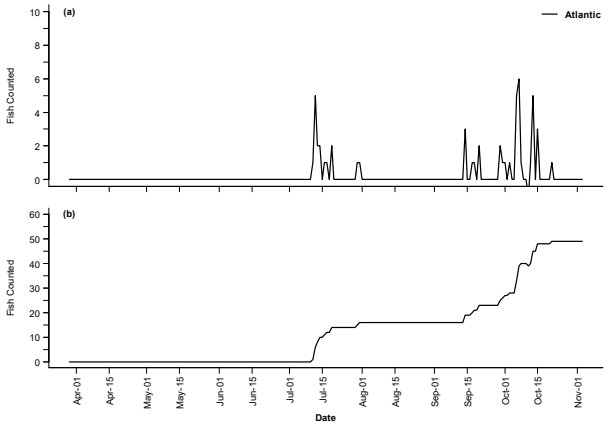


FIG 1.5.7: (a) Daily and (b) cumulative observed counts of Atlantic Salmon at the Streetsville Fishway, Credit River, Mississauga, Ontario from March 29 to November 3, 2021.

more information on adipose clipped fish, all clipped fish encountered were retained for detailed sampling. In total 143 fish with an adipose clip were biologically sampled; 43 were male and 100 were female. In 2021, 75% of the spawning population (clipped and unclipped combined) were three years old, 13% were two years old and 11% were four years old (Fig. 1.5.8).

In 2021, average fork length of Chinook Salmon at age-3 and age-2 males increased from values in 2020 (Fig. 1.5.9). The average fork length of age-2 females (797 mm) declined from 2020 (827 mm) and is comparable to the long-term average of 802 mm. Average length of age-3 females (868 mm) increased from 2020 (841 mm) and is comparable to the long-term mean (868 mm; Fig. 1.5.9). Length of age-2 males (795 mm) increased and is comparable to the long-term average (792 mm). Length of age-3 males (895 mm) and is above the long-term average (883 mm; Fig. 1.5.9).

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 2021, female condition measures increased, while male condition decreased from 2020 (Fig. 1.5.10). Female condition in 2021 (7,973 g) showed a significant increase from 2020 and is above the previous 10-year average (7,645 g). Male condition in 2021 (7,159 g) declined from 2020 is comparable to the previous10-year average (7,226 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).

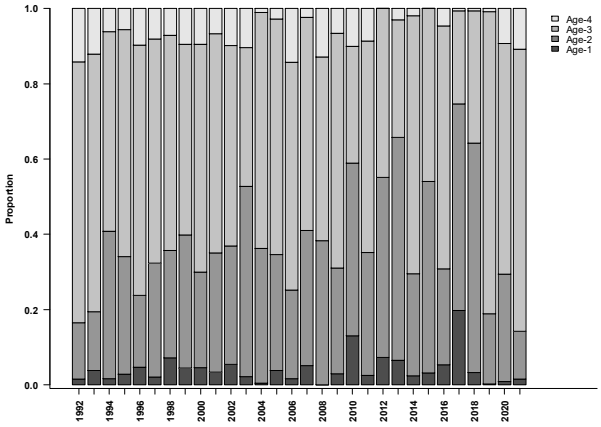


FIG 1.5.8: Age proportions of spawning Chinook Salmon (males and females pooled) sampled during the fall Credit River Chinook Salmon Spawning Index, Credit River, Mississauga, Ontario from 1992 – 2021. The four grey colours correspond to each age where Age 1 is the darkest and Age 4 is the lightest.

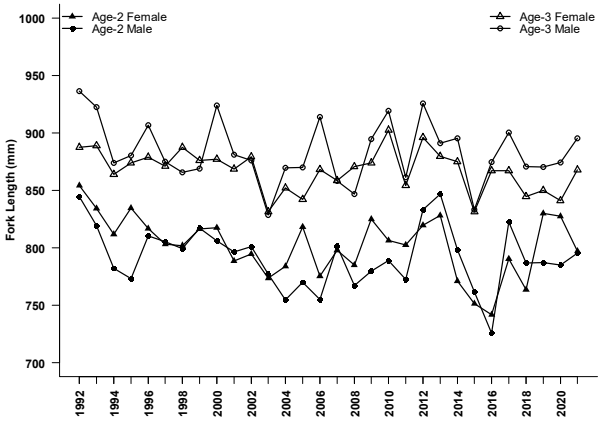


FIG 1.5.9: Mean total length of age-2 and age-3 Chinook Salmon by sex, caught for spawn collection in the Credit River during the fall spawning run (approximately first week of October), 1989-2021.

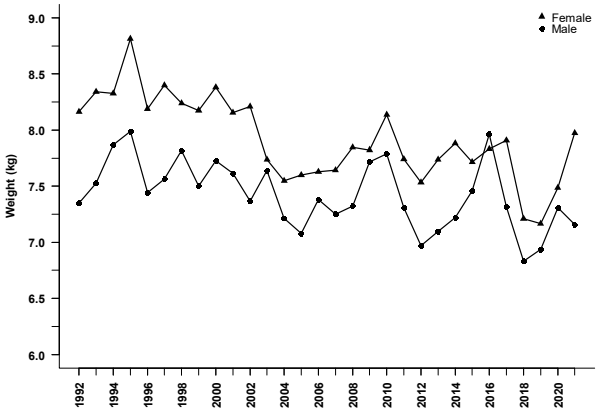


FIG 1.5.10: Condition index as the mean weight of a 914 mm / 36 inch (total length) Chinook Salmon in the Credit River during the spawning run (approximately first two weeks of October), 1989-2021.

1.6 Lake Ontario Spring Prey Fish Assessment

J. P. Holden, Lake Ontario Management Unit

Since 1978 the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Geological Survey (USGS) have annually conducted 100-120 bottom trawl tows, primarily in US waters in April, to provide an index of Alewife abundance as well as biological attributes such as age distribution and body condition. As the dominant prey species in Lake Ontario, understanding Alewife abundance and age structure is important for assessing predator-prey balance and establishing stocking levels of predator species (i.e. Chinook Salmon, Lake Trout).

Since 2016, the survey has been expanded to Canadian waters with the Ontario Ministry of Natural Resources and Forestry (OMNRF) trawling a portion of the Canadian sites (Fig. 1.6.1). A total of 248 sites throughout the lake were sampled in 2021 spanning bottom depths from 5-224m between April 3rd and May 3rd.
The survey generally samples depths in proportion to the lake area however there are differences in how those samples are distributed between depths and jurisdictions. The south shore has well distributed coverage of depths between 8 -200m that can be surveyed at multiple transects. Bottom trawling along the north shore is less uniform due to a lack of suitable soft sediment trawl sites at shallower depths. Attempts to trawl at depths shallower than 80m in the main basin have consistently resulted in snags and torn trawls. During the day, in early spring, most Lake Ontario Alewife are found near the lake bottom in the warmer, deeper water (75m – 150m) thus trawl sites at depths greater than 80m provide suitable index sites for Alewife. Additionally, shallow tows (<40m) in Ontario waters occur disproportionately in the Kingston Basin. Efforts continue to identify suitable trawl locations along the north shore habitats of the main lake.

All vessels followed a standard trawl protocol that utilized a polypropylene mesh bottom trawl referred to as "3N1" (see Table 1.6.1 for trawl dimensions) equipped with rubber discs that elevate the footrope off bottom to minimize catches of Dreissenid mussels. NYSDEC and USGS vessels used USA Jet slotted, metal, cambered trawl doors (1.22m x 0.75m) while OMNRF used comparable Thyborne doors to spread the trawl. Trawl mensuration gear was used to record door spread, bottom time and headrope depth. Sampling protocol seeks a target tow time of 5 minutes but actual bottom time is known to vary with depth.

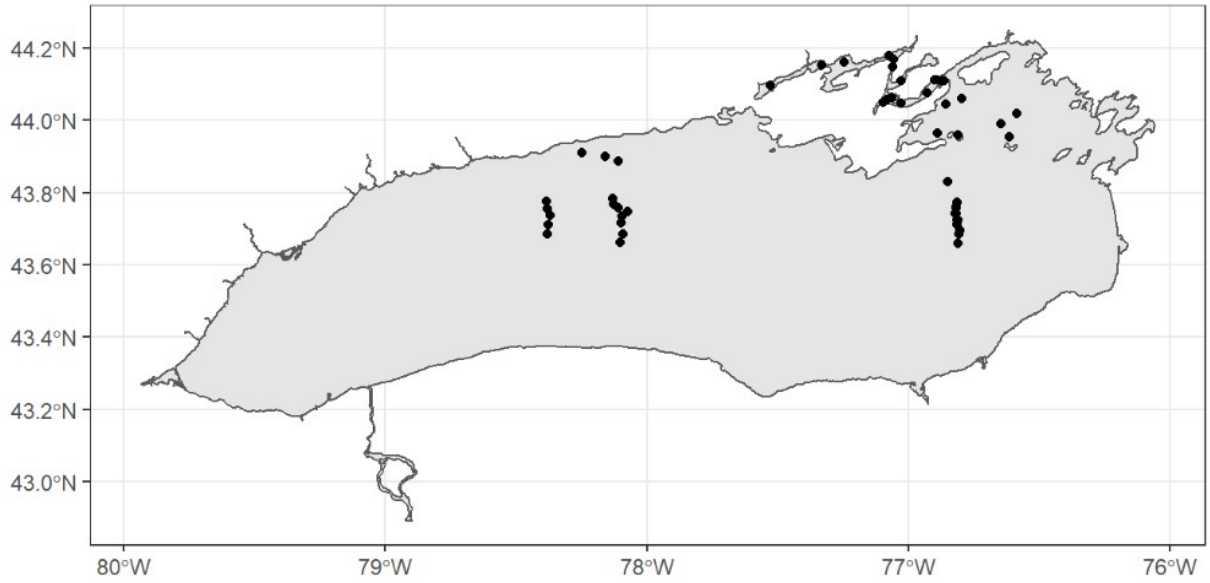


FIG. 1.6.1. Geographic distribution of trawl sites conducted by OMNRF in the Ontario waters of Lake Ontario during the 2021 Lake Ontario Spring Prey Fish Assessment.

Sites were further expanded in 2019 to include more embayments throughout the lake. Within Ontario waters, the majority of these sites were within the Bay of Quinte. Throughout the survey, Alewife were the most abundant species caught (N = 111,730) followed by Deepwater sculpin (N = 8,625); and White perch (N = 2,918). Full catch data presented in Table 1.6.2.

The Lake Ontario Spring 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 1.6.1. Gear specifications for the polypropylene mesh bottom trawl referred to as "3N1" and equipped with rubber discs that elevate the footrope off bottom to minimize catches of Dreissenid mussels.

Component	Description
Headrope length	20 m
Footrope length	22 m
Codend mesh	15.2 mm knotless nylon
Gear height	3.5 m
Fishing width	7 m
Cookie sweep description	Composed of 100 mm diameter rubber discs that sit 0.3 m below the footrope
Door weight	125 kg
Door area	0.93 m^2
Door height	1.2 m

TABLE 1.6.2. Species composition across all trawl sites conducted in Ontario waters of the spring prey fish survey.

Common Name	Total Number of Fish	Total Weight (kg)	Number of Tows
Alewife	111,730	746.7588	34
Deepwater Sculpin	8,625	167.3266	22
White Perch	2,918	305.1001	14
Yellow Perch	1,987	34.3820	16
Rainbow Smelt	1,091	7.7734	38
Freshwater Drum	591	177.3302	8
Trout-perch	399	4.3821	9
Round Goby	260	2.6277	16
Walleye	123	40.3037	11
Pumpkin-seed	99	6.4720	6
Cisco (Lake Herring)	96	3.0508	7
Lake Whitefish	40	4.0169	7
White Sucker	28	10.9126	7
White Bass	19	3.7736	2
Spottail Shiner	15	0.1454	8
Threespine Stickleback	12	0.0187	7
Slimy Sculpin	12	0.0549	6
Brown Bullhead	10	2.9120	4
Rockbass	8	0.9187	4
Lake Trout	4	0.5000	1
Shorthead Redhorse	4	1.9404	1
Bluegill	4	0.1680	1
Gizzard Shad	1	0.0420	1
Emerald Shiner	1	0.0024	1

1.7 Lake Ontario Fall Benthic Prey Fish Assessment

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 an abundances indices for Sculpin sp., Round Goby and Bloater with survey techniques comparable to Lake Michigan.

The Ontario portion of the 2021 survey consisted of 59 trawls conducted from September 13 through September 29 at transects near Port Hope, Rocky Point and in the Kingston Basin (Fig. 1.7.1). 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. In 2021, the survey sites expanded to include 16 sites within the Bay of Quinte and Adolphus Reach. Both new areas utilized the 3N1 trawl (See Table 1.6.1 for description) rather than the Yankee trawl that is standard throughout the survey as the soft substrate at these sites has traditionally fouled the Yankee trawl. The 3N1 has been routinely used at these sites in the spring and has cookie sweeps on

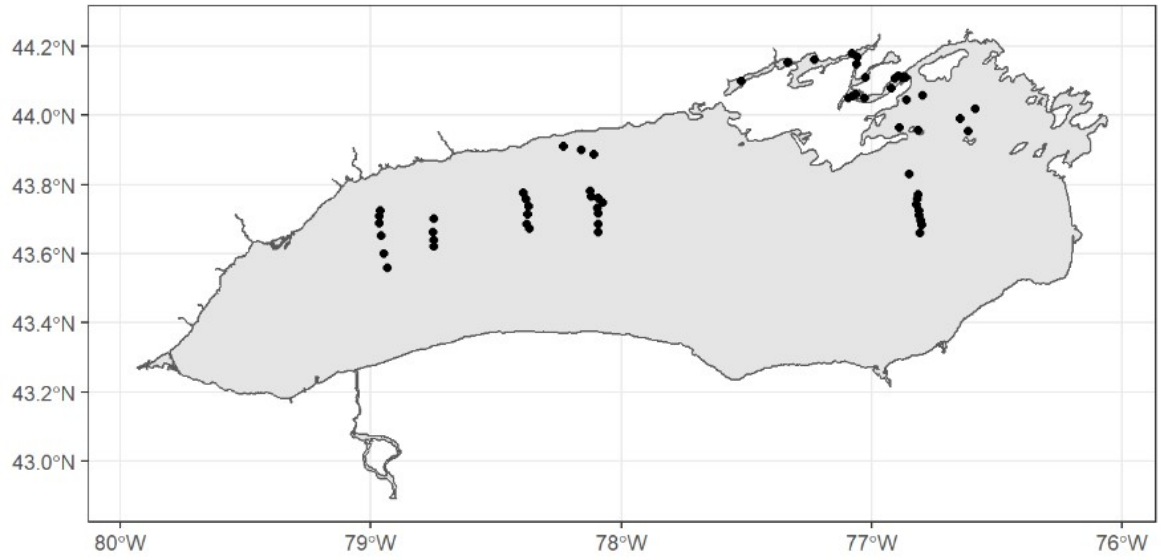


FIG. 1.7.1. Geographic distribution of trawl sites conducted by OMNRF in Ontario waters of Lake Ontario during the 2021 fall benthic prey fish assessment.

the footrope to prevent the trawl from digging in to the substrate. Tow times were reduced to 3 minutes for the Bay of Quinte sites to minimize the number of non-target species captured during the survey while still providing a relative index of species composition between sites and the spring survey.

Round goby were the most abundant species caught (N = 12,862) followed by Deepwater sculpin (N = 9,053); and Alewife (N = 7,208). Full catch data presented in Table 1.7.1.

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 1.7.1. Species composition across all trawl sites conducted in Ontario waters of the fall benthic prey fish survey.

Common Name	Total Number of Fish	Total Weight (kg)	Number of Tows
Round Goby	12,862	25.9420	21
Deepwater Sculpin	9,053	199.5444	35
Alewife	7,208	118.3892	50
Rainbow Smelt	1,357	5.3515	26
Gizzard Shad	992	24.4506	9
White Perch	936	15.8520	9
Yellow Perch	584	7.1747	10
Trout-perch	346	4.2723	4
Pumpkinseed	227	6.2483	7
Slimy Sculpin	226	2.0441	20
Spottail Shiner	133	1.0334	7
Brown Bullhead	59	20.7030	5
Freshwater Drum	47	8.9766	5
Walleye	24	8.6231	6
Largemouth Bass	6	0.1223	3
White Bass	5	0.1192	2
Lake Trout	5	6.2224	3
Lake Whitefish	3	3.0967	2
Cisco (Lake Herring)	2	0.0304	1
White Sucker	2	1.2880	2
Bluegill	2	0.0512	2
Logperch	2	0.0130	1
Carp	1	14.5200	1
Black Crappie	1	0.0522	1

1.8 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 2021, the survey was conducted during the period of September 13th to 15th. 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 initiated in 2002. In total, 129 fish were caught, which included 9 different fish species (Table 1.8.1). The number of fish per net in 2021 (9.30) remains below the time series average for the survey and represents the lowest average catch per net in the time series (Fig. 1.8.1). The dominant species in the catch continues to be Yellow Perch (56% of catch, 15% of biomass; Fig. 1.8.2).

Species Highlights

Yellow Perch

Catches of Yellow Perch have declined from peak levels seen previously in 2008 and 2010 (Fig. 1.8.3). 2021 catches of Yellow Perch (5.23 fish per net) remain below the timer series average (14.95 fish per net) and represent the lowest catches in the time series (Table 1.8.1). The increase in 2019 Yellow Perch catches was driven by an increase in the number of small fish (≤ 220 mm) caught (Fig. 1.8.3). The proportion of large fish (> 220 mm) observed in catches (7% of catch in 2021) remains low (Fig. 1.8.3). Yellow Perch catches in 2021 contained fish from age-1 to age-4 with age-3 fish representing 31% of the total catch (Fig. 1.8.4).

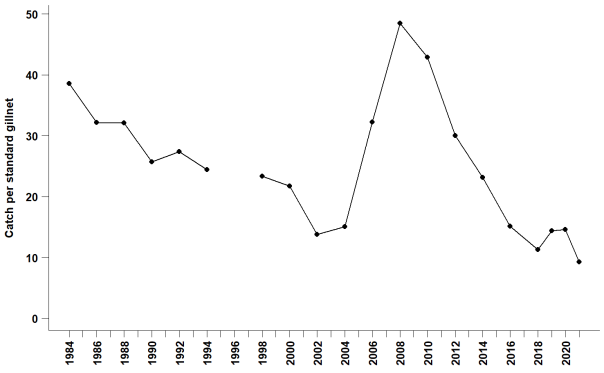


FIG 1.8.1 Average catch per standard gillnet set of all species combined, Lake St. Francis, 1984 – 2021. Survey was not conducted in 1996.

Centrarchids

The centrarchids are represented by six species in Lake St. Francis: Rock Bass, Pumpkinseed, Bluegill, Smallmouth Bass, Largemouth Bass and Black Crappie (Fig. 1.8.5 and 1.8.6). While Rock Bass remain the most abundant of the centrarchids, catches in 2021 (1.31 fish per net) indicated a decrease from the previous survey and remains below the previous 10-year average (2.32 fish per net). Smallmouth Bass catches increased in 2021 compared to the 2020 survey (0.46 compared to 0.27 fish per net, respectively), and are above the previous 10-year average (0.40 fish per net; Fig. 1.8.5). Smallmouth Bass caught in the 2021 survey ranged from age-1 to age-6. In the 2021 survey, no Pumpkinseed, Black Crappie or Largemouth Bass were caught (Figs. 1.8.5 and 1.8.6).

Northern Pike

Northern Pike catches in 2021 represent the lowest catches in the time series (0.08 fish per net; Fig. 1.8.7). Northern Pike abundance has been in decline since the early 1990s and is currently at the lowest levels observed in the 35-year time series (Table 1.8.1). One Northern Pike was caught in 2021, which was five years old. In 2021, there were no small (≤ 500 mm) Northern Pike caught (Fig. 1.8.7). No Muskellunge were caught in 2021.

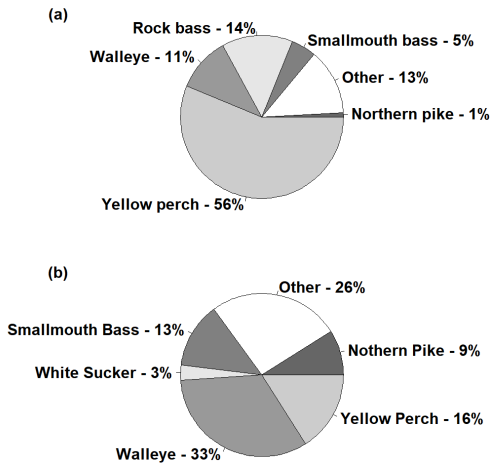


FIG 1.8.2 Species composition by (a) catch and (b) biomass in the 2021 Lake St. Francis community index gill netting program.

Walleye

Walleye represented 11% of the total catch and 35% of total biomass caught in 2021 with 14 individuals caught (Fig. 1.8.2 and Table 1.8.1). The average catch per net declined from 2020 but remains 8% above the previous 10-year average (1.00 fish per net). Generally, catches of small fish (≤ 500 mm) and large (>500 mm) Walleye have been equally represented. In 2021, small fish represented 71% of the catch, while large fish represented the remaining 29% (Fig. 1.8.8). Walleye ages ranged from 2 to 11 years of age with the majority being ages 2 and 3 (Fig. 1.8.9).

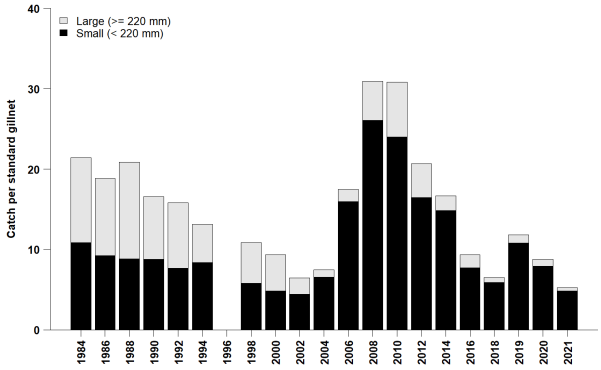


FIG 1.8.3 Catches of small (≤ 220 mm total length) and large (> 220 mm total length) Yellow Perch in the Lake St. Francis community index netting program, 1984 – 2021. Survey was not conducted in 1996.

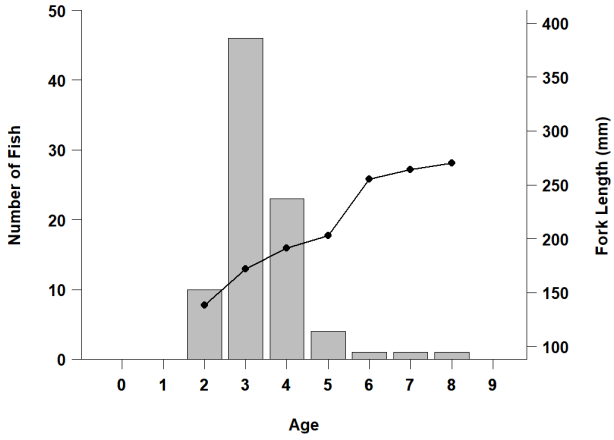


FIG 1.8.4 Age distribution (bars) and mean fork length at age (mm) of Yellow Perch caught in Lake St. Francis, 2021.

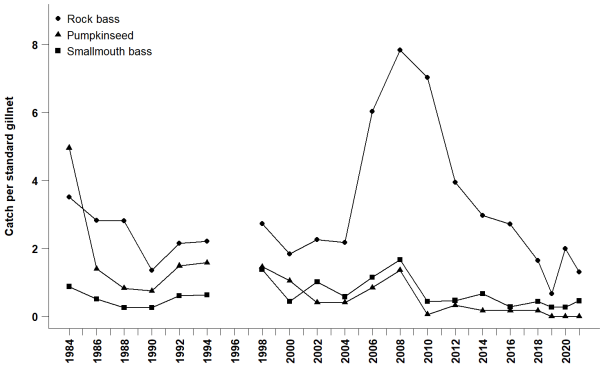


FIG 1.8.5 Rock Bass (circle), Pumpkinseed (triangle) and Smallmouth Bass (square) catches per standard gillnet set in Lake St. Francis, 1984 - 2021.

TABLE 1.8.1. Summary of catches per gillnet set in the Lake St. Francis Fish Community Index Gillnetting Program, 1984 - 2021. All catches prior to 2002 were adjusted by a factor of 1.58 to be comparable to the new netting standard initiated in 2002. No survey was conducted in 1996.

	1984 - 2010	2012	2014	2016	2018	2019	2020	2021
Lake Sturgeon	0.01	0.03	--	0.03	--	--	--	--
Longnose Gar	0.14	0.22	--	0.28	--	0.07	1.13	0.15
Bowfin	--	--	--	--	--	--	--	--
Alewife	0.03	0.14	0.03	--	--	0.2	--	--
Gizzard Shad	--	--	--	0.06	--	--	--	--
Salvelinus sp.	0.00	--	--	--	--	--	--	--
Northern Pike	2.85	0.19	0.31	0.14	0.14	0.2	0.13	0.08
Muskellunge	0.01	--	0.03	--	--	--	--	--
White Sucker	1.45	1.17	1.25	0.56	0.47	0.33	0.67	0.15
Silver Redhorse	0.03	0.06	0.03	0.06	0.11	--	0.07	--
Shorthead Redhorse	--	0.28	0.06	0.03	0.03	0.07	--	0.38
Greater Redhorse	0.01	--	--	--	--	--	--	--
River Redhorse	0.02	--	--	--	--	--	--	--
Moxostoma sp.	0.03	--	--	--	0.11	--	--	--
Common Carp	0.04	--	--	--	--	--	--	--
Golden Shiner	0.01	--	--	0.06	0.22	--	--	--
Creek Chub	0.01	--	--	--	--	--	--	--
Fallfish	0.01	--	--	0.03	0.14	--	0.13	0.54
Brown Bullhead	1.18	0.25	0.14	0.03	--	--	--	--
White Perch	--	--	--	0.03	--	--	0.07	--
Rock Bass	3.44	3.94	2.97	2.72	1.64	0.67	2	1.31
Pumpkinseed	1.28	0.33	0.17	0.17	0.17	--	--	--
Bluegill	0.02	--	--	0.03	--	--	0.07	--
Smallmouth Bass	0.76	0.47	0.67	0.28	0.44	0.27	0.27	0.46
Largemouth Bass	0.19	1.53	--	0.69	0.22	--	0.13	--
Black Crappie	0.04	--	--	0.08	0.03	--	--	--
Yellow Perch	16.92	20.64	16.67	9.36	6.5	11.8	8.8	5.23
Walleye	0.58	0.78	0.81	0.47	1.08	0.8	1.13	1
Freshwater Drum	0.01	--	--	0.03	--	--	--	--
All Species	29.06	30.03	23.14	15.14	11.30	14.41	14.60	9.30
Count of Species	12.85	14	12	20	14	9	12	9

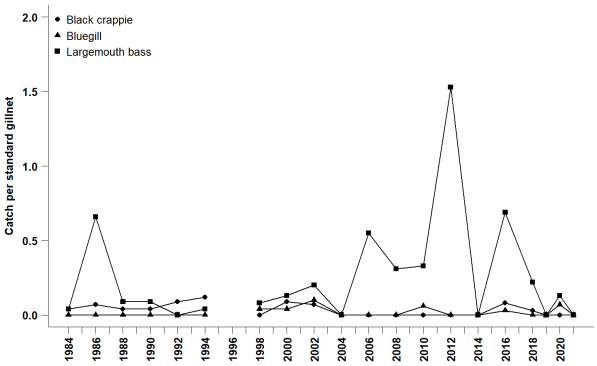


FIG 1.8.6 Black Crappie (circle), Bluegill (triangle) and Largemouth Bass (square) catches per standard gillnet set in Lake St. Francis, 1984 – 2021.

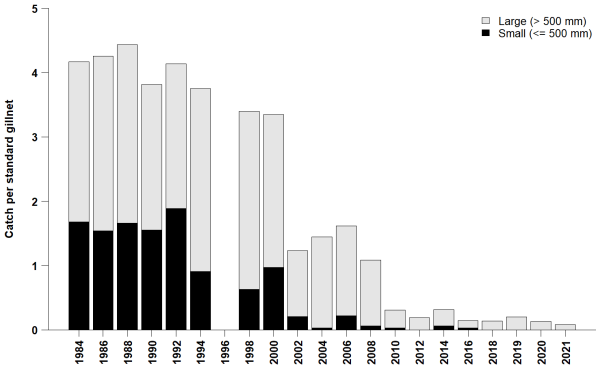


FIG 1.8.7 Catches of small (≤ 500 mm total length) and large (> 500 mm total length) Northern Pike in the Lake St. Francis community index gill netting program, 1984 – 2021. Survey was not conducted in 1996

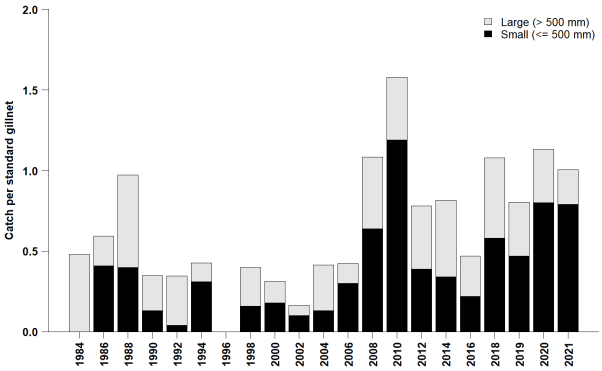


FIG 1.8.8 Catches of small (≤ 500 mm total length) and large (> 500 mm total length) Walleye in the Lake St. Francis community index gill netting program, 1984 – 2021. Survey was not conducted in 1996.

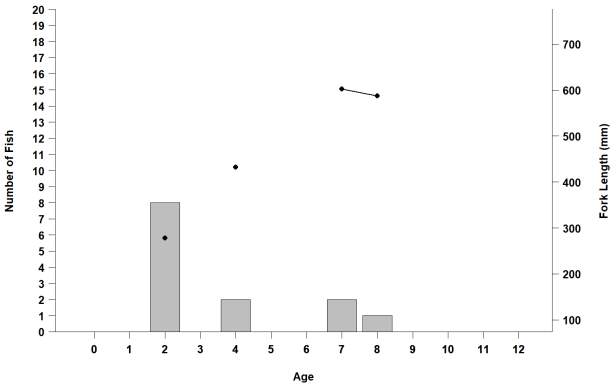


FIG 1.8.9 Age distribution (bars) and mean fork length (circles) at age of Walleye caught in Lake St. Francis, 2021.

1.9 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 2021, the survey was conducted between September 20th and September 29th. 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 981 fish comprising 21 species (summary in Table 1.9.1). The average number of fish per set was 39.24; an increase from the previous 10-year average (36.40 fish per set; Fig. 1.9.1). Yellow Perch remained the dominate species caught in the nets followed by Smallmouth Bass and Rock Bass (Fig. 1.9.2).

Species Highlights

In 2021, Yellow Perch catches decreased 13% from 2020 catch estimates to 18.68 fish per net and represented 48% of the total catch by number and 18% by biomass (Table 1.9.1; Fig. 1.9.2 and 1.9.3). Catches of Yellow Perch in the 2021 Thousand Islands survey are below the previous 10-year average (average of 22.2 from 2011 to 2020). Age distributions and mean length at age for 2021 catches of Yellow Perch are summarized in Tables 1.9.2 and 1.9.3, respectively.

The centrarchids are represented by six species in the upper St. Lawrence: Rock Bass, Pumpkinseed, Bluegill, Smallmouth Bass, Largemouth Bass and Black Crappie (Fig. 1.9.4 and 1.9.5). Rock Bass were the most abundant centrarchid species in the 2021 survey, representing 17% of the total catch by number, whereas Smallmouth Bass represented 31% of the total biomass (Figs. 1.9.2 and 1.9.4). Length at age for Smallmouth Bass is comparable to the time series average for age-1 fish, while age-3 and age-5 length at age are above the time series average (Table 1.9.3 and Fig. 1.9.6). Pumpkinseed continue to decline in 2021 and remain at the lowest level observed in this survey (Fig. 1.9.4). Bluegill, Largemouth Bass and Black Crappie were historically at much lower levels than the former three species. Largemouth Bass catches in 2021 increased from the previous survey and are above the previous 10-year average (0.34 fish per net; Fig 1.9.5).

Northern Pike remain at very low levels, reached after a slow steady decline spanning almost the entire history of the Thousand Islands survey (Fig. 1.9.7). Currently, Northern Pike abundance is at a low point in this survey; roughly 7% of its peak observed in 1989. Total catches of Northern Pike in 2021 were consistent with 2019 and 2020. Catches of small Northern Pike (≤ 500

FIG. 1.9.1: Total number of fish (all species) per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2021.

mm) have been limited over the past 15 surveys, with none being caught in 2021 (Fig 1.9.7). Condition as determined by mean lengths of age-4, age-5 and age-6 Northern Pike has remained above the time series average since 2017 (Fig. 1.9.8 and Tables 1.9.2 and 1.9.3).

Walleye represented 2% of the total catch and 22% of total biomass caught in 2021 with 24 individuals caught. The average catch per net was 0.96, which is above the previous 10-year average (0.61 Walleye per gill net). Catches of small (≤ 500 mm) and large (>500 mm) fish remain stable with 30% and 70% of the catch representing small and large fish (respectively; Fig. 1.9.9). Walleye ages ranged from 1 to 23 years old (Table 1.6.2).

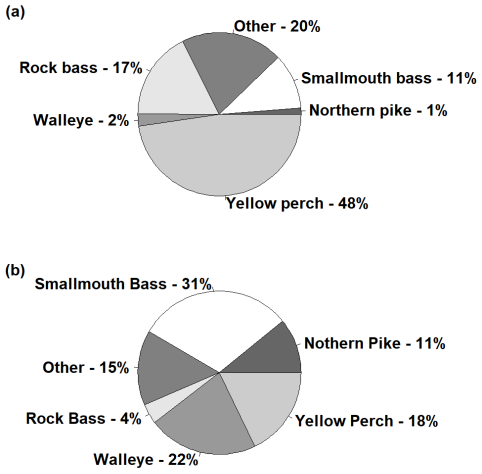


FIG. 1.9.2: Species composition by (a) catch and (b) biomass in the 2021 gillnet survey in the Thousand Island area of the St. Lawrence River.

FIG 1.9.3: Yellow Perch catch per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2021.

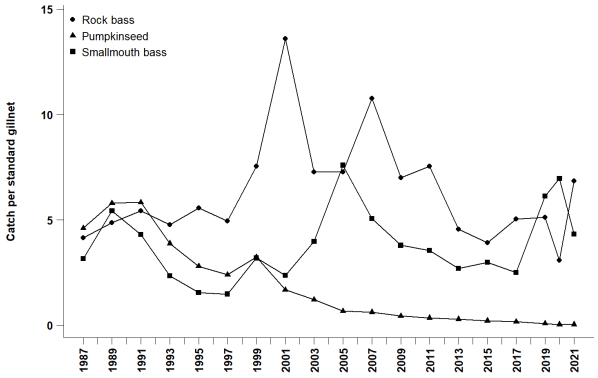


FIG 1.9.4: Rock Bass (circle), Pumpkinseed (triangle) and Smallmouth Bass (square) catches per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2021.

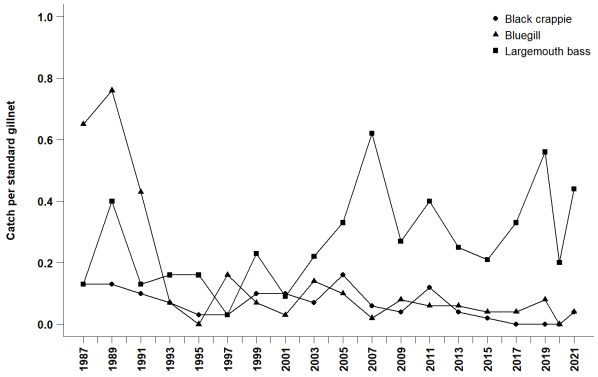


FIG 1.9.5: Black Crappie (circle) Bluegill (triangle) and Largemouth Bass (square) catches per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2021.

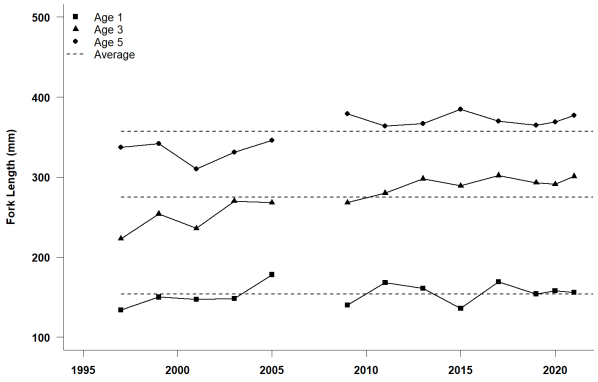


FIG 1.9.6: Mean fork length (mm) of age-1 (square), age-3 (triangle) and age-5 (circle) Smallmouth Bass from 1997 to 2021. Dashed lines represent the average fork length from 1997 to 2021 for the aforementioned ages.

TABLE 1.9.1: Catches per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2021. Catches from multifilament nets (all catches prior to 2001, and a portion of catches in 2001-2005) were adjusted by a factor of 1.58 to monofilament netting standards initiated in 2001.

	1987	1989	1991	1993	1995	1997	1999	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019	2020	2021
Lake sturgeon	--	--	--	--	--	--	0.04	--	0.02	0.02	0.02	0.05	0.05	--	--	--	0.12	--	0.04
Longnose gar	--	--	0.04	--	--	0.04	--	--	0.08	0.05	--	0.04	0.05	--	--	--	0.08	0.08	--
Bowfin	0.08	0.10	--	0.08	0.04	0.07	--	0.02	0.08	0.06	0.09	0.07	0.13	0.02	0.02	0.02	0.04	0.08	--
Alewife	0.49	--	0.11	0.04	0.04	--	--	--	--	0.02	0.14	0.07	--	0.12	0.27	0.46	1.32	--	0.52
Gizzard shad	--	0.38	0.52	--	--	--	0.04	0.11	--	0.05	0.02	--	0.09	0.14	0.12	0.08	--	0.12	5.64
Chinook salmon	--	--	0.04	--	--	--	0.04	0.04	--	--	--	--	0.03	--	--	--	--	--	--
Rainbow trout	--	--	--	--	--	0.04	--	--	--	--	--	--	--	--	--	--	--	--	--
Brown trout	--	0.04	--	--	--	--	--	--	--	--	--	--	0.04	0.02	--	--	--	--	--
Lake trout	--	0.20	--	0.19	0.15	0.16	--	--	--	--	--	--	--	--	--	0.02	--	--	--
Lake herring	--	0.04	--	--	0.07	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chub	--	0.04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Northern pike	4.46	7.10	4.79	4.20	2.80	2.69	2.37	2.00	2.26	1.97	1.42	0.97	1.29	1.10	0.43	0.35	0.44	0.44	0.48
Muskellunge	--	--	0.04	--	0.04	--	--	0.02	0.04	--	--	--	--	--	--	--	--	--	0.04
Chain pickerel	--	--	--	--	--	--	--	--	--	--	--	0.02	--	--	--	--	--	--	--
White sucker	1.09	2.27	1.50	1.74	1.55	1.38	1.96	1.06	1.05	0.70	0.43	0.27	0.66	0.30	0.22	0.33	0.4	0.2	0.28
Silver redhorse	--	--	--	--	--	--	0.25	0.05	--	0.07	0.07	0.02	0.13	0.07	0.03	--	0.04	--	--
Shorthead redhorse	--	--	--	--	--	--	--	--	--	0.04	--	--	--	--	--	--	--	--	--
Greater redhorse	--	--	--	--	--	--	--	0.05	0.12	--	--	--	--	--	--	--	--	--	--
Moxostoma sp.	--	0.15	0.08	0.16	0.36	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Common carp	0.05	0.11	0.11	0.04	0.11	0.42	0.14	0.13	0.13	0.04	0.02	--	0.05	--	--	--	0.04	0.04	0.04
Golden shiner	0.05	0.03	--	0.08	0.04	--	0.04	--	--	0.05	0.07	0.36	0.13	0.09	0.24	0.42	0.12	0.36	0.16
Brown bullhead	2.56	2.04	2.76	1.18	1.06	2.09	4.24	4.64	2.97	5.16	1.27	4.09	1.86	0.66	0.52	0.17	1.24	1.04	0.44
Channel catfish	0.81	0.15	0.59	0.19	0.33	0.33	0.65	0.35	0.39	0.22	0.74	0.61	0.69	0.29	0.22	--	0.08	0.08	--
White perch	0.08	--	0.43	0.04	0.07	--	0.08	0.18	0.02	0.16	--	--	--	0.12	--	--	0.04	0.04	0.04
White bass	0.05	0.83	0.47	0.27	--	0.08	--	--	--	--	--	--	0.32	--	0.03	--	0.04	0.04	--
Rock bass	4.14	5.68	5.90	5.53	6.16	5.60	8.39	14.94	8.26	7.99	12.16	7.88	8.49	5.24	4.50	5.04	5.12	3.08	6.84
Pumpkinseed	4.61	6.62	6.45	4.51	3.07	2.56	3.73	1.86	1.33	0.74	0.70	0.47	0.38	0.33	0.23	0.17	0.08	0.04	0.04
Bluegill	0.65	0.89	0.48	0.07	--	0.20	0.07	0.04	0.14	0.10	0.02	0.09	0.07	0.07	0.05	0.04	0.08	--	0.04
Smallmouth bass	3.16	6.21	4.78	2.70	1.66	1.66	3.45	2.58	4.59	8.38	5.72	4.30	3.97	3.07	3.42	2.5	6.12	6.96	4.32
Largemouth bass	0.13	0.44	0.15	0.20	0.19	0.03	0.26	0.10	0.23	0.36	0.71	0.30	0.41	0.28	0.23	0.33	0.56	0.2	0.44
Black crappie	0.13	0.14	0.11	0.08	0.04	0.04	0.11	0.11	0.08	0.17	0.07	0.05	0.13	0.05	0.02	--	--	--	0.04
Yellow perch	27.79	19.26	17.07	18.85	24.52	23.53	24.89	27.29	22.80	15.81	32.28	23.83	39.65	13.72	14.42	25.96	18.36	21.36	18.68
Walleye	0.21	0.62	0.37	0.37	0.28	0.68	0.07	0.30	0.27	0.25	0.69	0.67	0.88	0.52	0.45	0.38	0.76	0.64	0.96
Round goby	--	--	--	--	--	--	--	--	--	0.86	0.22	0.21	0.02	0.02	0.05	0.02	0.12	0.16	0.08
Freshwater drum	--	0.04	0.11	--	0.04	0.11	--	0.12	0.05	0.33	0.04	0.24	0.13	0.10	0.22	0.02	0.12	0.16	0.08
Total Catch	50.54	53.38	46.90	40.52	42.62	41.71	50.82	55.99	44.91	43.60	56.90	44.61	59.65	26.33	25.69	36.31	35.32	35.12	39.20

TABLE 1.9.2: Age distribution of selected species caught in the Thousand Islands, 2021.

	Year-class/Age																							
	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998
Species	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Yellow Perch	--	2	9	26	28	10	5	3	4	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Walleye	--	4	1	2	1	1		1	1	--	2	--	--	--	--	6	--	3	1	1	--	--	--	1
Northern Pike	--	--	--	2	4	2	3	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Smallmouth Bass	--	35	6	12	13	20	6	7	4	2	2	--	1	--	--	--	--	--	--	--	--	--	--	--

TABLE 1.9.3: Mean fork length (mm) at age of selected species caught in the Thousand Islands, 2021.

	Year-class/Age																							
	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998
Species	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Yellow Perch	--	160	156	162	199	260	274	287	290	266	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Walleye	--	--	310	399	462	469	--	567	609	--	599	--	--	--	--	652	--	678	726	688	--	--	--	660
Northern Pike	--	--	--	599	671	668	670	--	841	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Smallmouth Bass	--	156	323	301	338	377	416	416	430	434	475	--	448	--	--	--	--	--	--	--	--	--	--	--

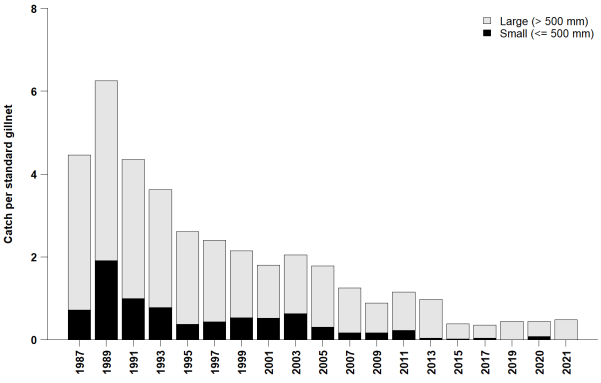


FIG 1.9.7: Catches of small (≤ 500 mm fork length) and large (> 500 mm fork length) of Northern Pike per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2021.

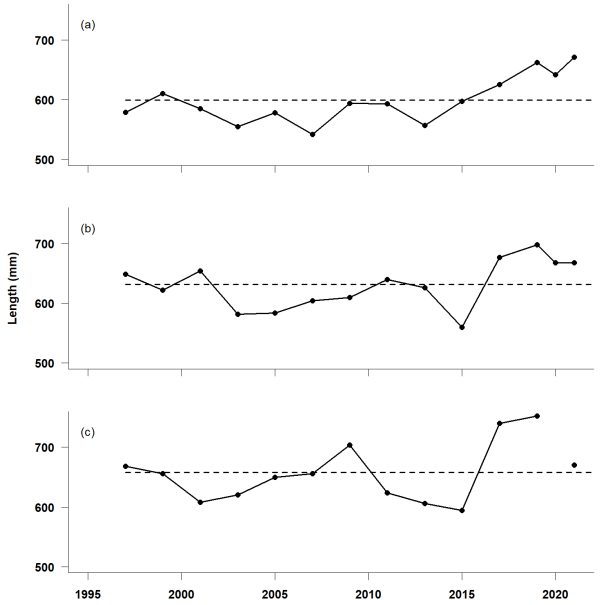


FIG 1.9.8: Mean fork length (mm) of (a) age-4, (b) age-5 and (c) age -6 Northern Pike from 1997 to 2021. Dashed lines represent the average fork length from 1997 to 2021 for the aforementioned ages.

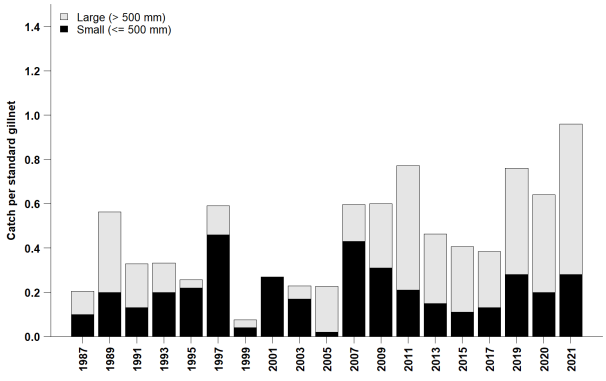


FIG 1.9.9: Catches of small (≤ 500 mm fork length) and large (> 500 mm fork length) of Walleye per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2021.

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.

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.

Other groups 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 and Coho Salmon. The Islington Sportsman Club, Belfountain Community Hatchery and Ontario Streams stock Atlantic 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 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 2021 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 tenth 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. 2.2.1). A total of 9 completed diaries were returned as of February 2021. 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 9 diaries ranged from 2 to 24 trips. Fishing trips were reported for 63 out of a possible 147 calendar days from Aug 7 to Dec 31, 2021. There were one to three volunteer angler boats fishing on each of the 63 days, and a total of

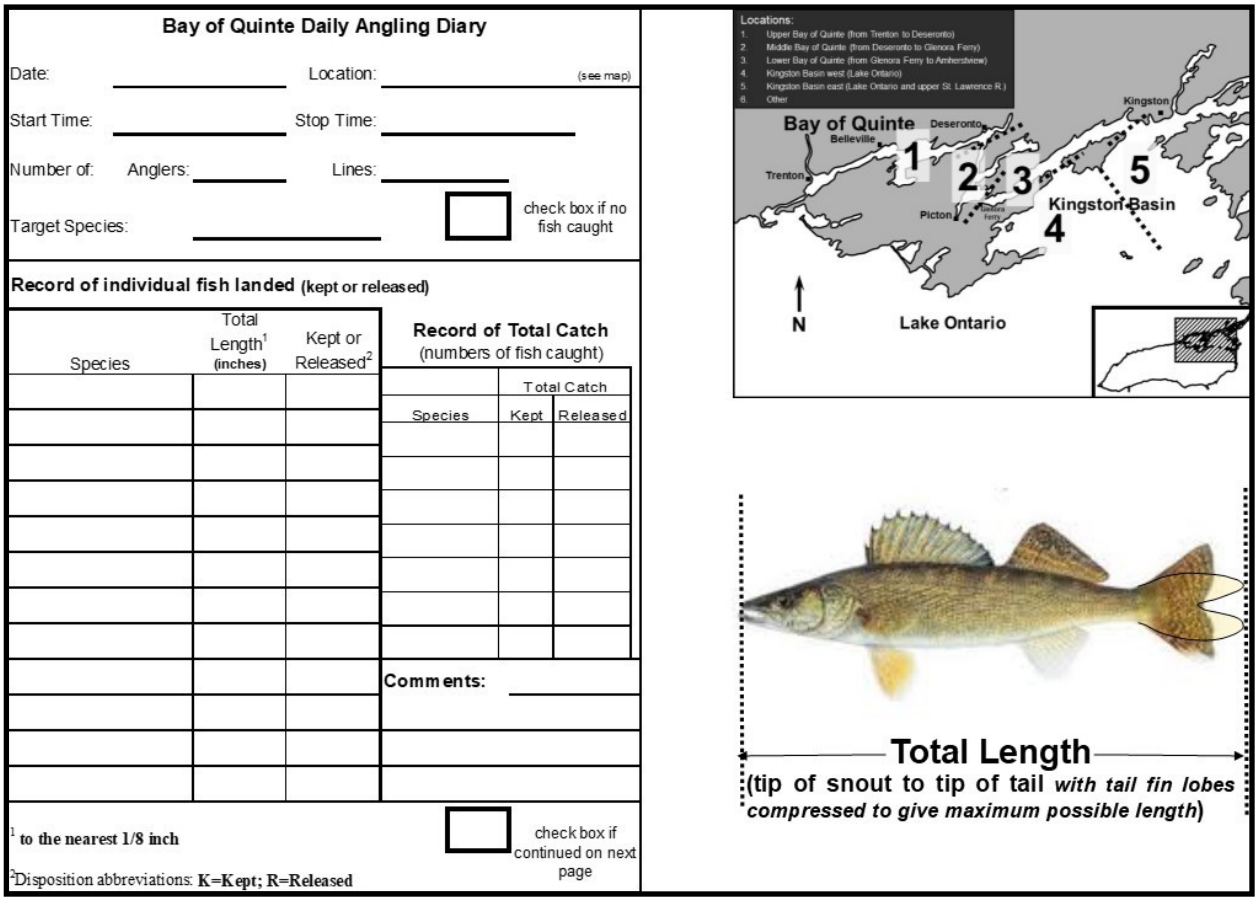


FIG. 2.2.1. Volunteer angler diary used to record information about daily fishing trips and catch.

80 trip reports targeting Walleye; 13 charter boat trips and 67 non-charter boat trips (Table 2.2.1). Of the 80 trips, 46 (58%) were made on Locations 2 and 3 (middle and lower reaches of the Bay of Quinte), and 33 trips (41%) were made in Locations 4 and 5 (Kingston Basin, eastern Lake Ontario; see Fig. 2.2.1). The overall average fishing trip duration was 5.8 hours for charter boats and 5.3 hours for non-charter boats, and the average numbers of anglers per boat trip were 4.9 and 2.3 for charter and non-charter boats, respectively (Table 2.2.1). In Locations 3, 4 and 5, where two lines are permitted, most anglers used two lines.

TABLE 2.2.1. 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 2012-2021 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
2021	Charter	13	5.8	4.9
	Non-charter	67	5.3	2.3

Fishing Effort and Catch

A total of 1,162 angler hours of fishing effort was reported by volunteer anglers (Table 2.2.2). Five species and a total of 256 fish were reported caught by volunteer anglers. The number of Walleye caught was 214; 64 (30%) kept and 150 (70%) released (Table 2.2.3). The next most abundant species caught was Freshwater Drum (32) followed by Smallmouth Bass (6).

Fishing Success

The overall fishing success for Walleye in fall 2021 was 2.7 Walleye per boat trip or 0.173 fish per angler hour of fishing (Table 2.2.2). Seventy-four percent of all boat trips reported catching at least one Walleye ("skunk rate" 26%).

Length Distribution of Walleye Caught

In 2021, seventy-eight percent of Walleye caught by volunteer anglers were between 24 and 31 inches total length. Over the nine years of the volunteer angler diary program 4,097 Walleye lengths have been reported (Fig. 2.2.2). 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 70% of fish greater than 25 inches were released.

TABLE 2.2.2. 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 2012-2021 on the Bay of Quinte and the Kingston Basin, eastern Lake Ontario.

	Year									
Statistic	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Number of diaries	22	19	20	22	11	20	16	21	6	9
Number of boat trips	258	155	210	235	93	164	126	162	69	80
Boat effort (hours)	1,694	941	1,375	1,506	498	1,001	719	297	292	430
Angler effort (hours)	5,915	3,093	5,164	5,266	1,602	3,262	2,143	2,383	769	1,162
Catch	542	574	682	436	184	604	387	489	117	214
Harvest	291	307	336	285	112	350	186	199	29	64
Released	251	267	346	151	72	254	201	290	88	150
Fish per boat trip	2.1	3.7	3.2	1.9	2.0	3.7	3.1	3.0	1.7	2.7
Fish per boat hour	0.305	0.557	0.463	0.307	0.289	0.601	0.615	0.530	0.401	0.432
Fish per angler hour	0.102	0.193	0.137	0.138	0.122	0.210	0.279	0.240	0.152	0.173
"Skunk rate"	36%	19%	27%	34%	44%	24%	25%	27%	41%	26%

TABLE 2.2.3. Number of fish, by species, reported caught (kept and released) by volunteer anglers during late summer and fall 2012-2021 on the Bay of Quinte - Eastern Lake Ontario.

	2012		2013		2014		2015		2016		2017		2018		2109		2020		2021	
Species	Kept	Released	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	0	0
Black crappie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Bowfin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Brown trout	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0
Chinook salmon	0	1	0	0	0	2	0	0	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	0	32
Lake trout	0	1	0	0	0	4	3	10	0	1	1	6	0	0	0	2	0	0	0	0
Lake whitefish	0	1	0	0	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	0	0
Longnose gar	0	0	0	0	0	0	0	0	0	1	0	0	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	0	0
Tiger Muskellunge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Northern pike	1	47	4	20	2	36	2	14	1	18	1	9	0	19	1	11	0	2	0	2
Rainbow trout	0	0	0	0	0	3	0	0	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	0	0
Smallmouth bass	0	0	0	3	1	2	0	1	1	1	0	8	0	6	1	10	0	0	0	6
Sunfish	0	0	0	0	0	0	0	2	0	0	0	2	0	0	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	64	150
White bass	0	0	0	3	0	7	9	5	0	5	6	8	5	6	5	44	0	3	0	2
White perch	0	0	0	12	0	0	1	0	0	11	0	0	0	2	0	9	0	10	0	0
Yellow perch	4	32	2	6	0	0	1	0	0	0	0	0	0	1	8	64	0	0	0	0

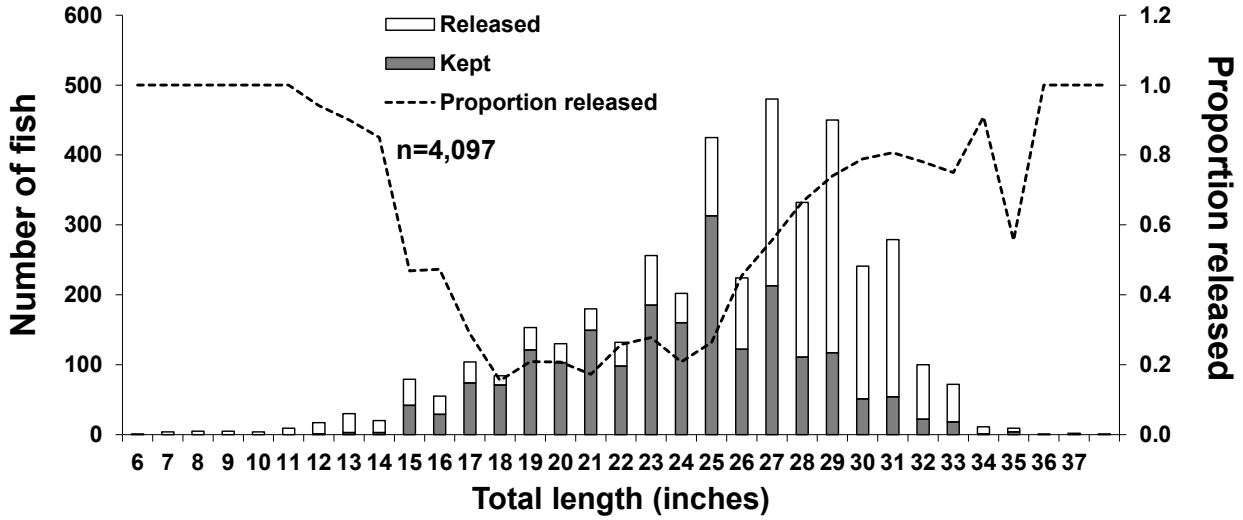


FIG. 2.2.2. Length distribution of 4,097 Walleye caught (kept and released) by volunteer Walleye anglers during late summer and fall 2012-2021 on the Bay of Quinte and the Kingston Basin, eastern Lake Ontario. Also shown is the proportion of fish released (dotted line)

3. Commercial Fishery

3.1 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. 3.1.1). 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 2021, are shown in Tables 3.1.1 (base quota), 3.1.2 (issued quota), 3.1.3 (harvest) and 3.1.4 (landed value).

The total harvest (landed value) of all species was 358,507 lb ($598,700) in 2021, up from 2020 (256,893 lb). The harvest (landed value) for Lake Ontario, the St. Lawrence River, and East and West Lakes was 282,513 lb ($505,053), 41,264 lb ($75,555), and 34,730 lb ($43,120) (Fig. 3.1.2 and Fig. 3.1.3). Lake Whitefish, Yellow Perch, Sunfish and Walleye were the dominant species in the harvest for Lake Ontario. Yellow Perch was dominant in the St. Lawrence River followed by Brown Bullhead. Sunfish was the dominant fish in East and West Lakes.

Major Fishery Trends

Harvest and landed value trends for Lake Ontario (Embayments included) and the St. Lawrence River are shown in Fig. 3.1.4 and Fig.

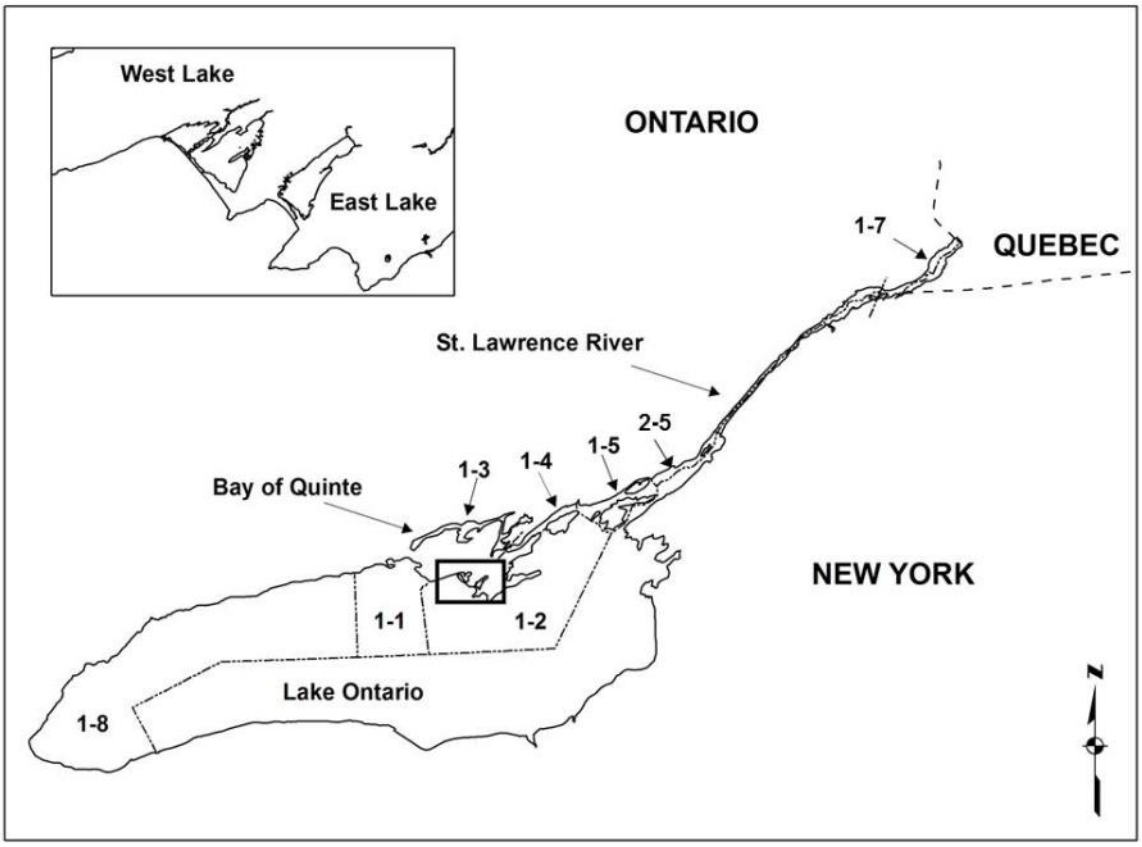


FIG. 3.1.1. Map of Lake Ontario and the St. Lawrence River showing commercial fishing quota zones in Canadian waters.

TABLE 3.1.1. 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), 2021.

	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 3.1.2. 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), 2021.

	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	3,274	140,937	8,751	9,141	0	0	0	0	0	162,102	0	162,102
Sunfish	28,130	0	0	0	0	0	0	14,600	18,080	28,130	0	60,810
Walleye	1,185	16,682	0	33,312	0	0	0	0	0	51,179	0	51,179
Yellow Perch	11,595	33,478	72,809	65,782	33,741	26,500	14,438	896	2,829	183,665	74,679	262,069
Total	46,454	192,598	90,965	108,785	40,826	35,295	19,278	18,596	30,759	438,802	95,399	583,556

TABLE 3.1.3. 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), 2021.

	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	3	0	2,902	4	538	135	198	0	2,308	2,909	871	6,088
Bowfin	29	3	4,723	0	1,383	1,268	36	106	1,724	4,755	2,687	9,272
Brown Bullhead	5	136	5,236	4	3,750	1,144	1,606	0	690	5,381	6,500	12,571
Channel Catfish	0	0	0	0	0	0	0	0	0	0	0	0
Cisco	0	28	224	356	0	0	0	0	10	608	0	618
Common Carp	0	19	453	0	0	0	0	0	14	472	0	486
Freshwater Drum	210	7	9,140	5,009	0	0	0	0	0	14,366	0	14,366
Lake Whitefish	0	84,139	3,341	438	0	0	0	0	0	87,918	0	87,918
Northern Pike	436	157	4,450	1,107	0	0	0	119	521	6,150	0	6,790
Rock Bass	3,332	1,911	5,432	1,148	799	1,067	122	707	2,558	11,823	1,988	17,076
Sunfish	1,474	0	26,548	11	424	668	75	9,252	13,003	28,033	1,167	51,455
Walleye	684	2,592	0	20,125	0	0	0	0	0	23,401	0	23,401
White Bass	0	12	69	712	0	0	0	0	0	793	0	793
White Perch	58	263	15,019	6,247	4	0	0	0	2,855	21,587	4	24,446
White Sucker	108	37	372	2	0	0	0	0	0	519	0	519
Yellow Perch	3,151	9,586	30,460	30,601	9,521	7,717	10,809	104	759	73,798	28,047	102,708
Total	9,490	98,890	108,369	65,764	16,419	11,999	12,846	10,288	24,442	282,513	41,264	358,507

3.1.5. 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. 3.1.4) and the St. Lawrence River (Fig. 3.1.5) respectively. In 2014, harvest declined again in both major geographic areas. In 2015, harvest 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. Since 2018, harvest has been variable in Lake Ontario and decreasing in the St. Lawrence River.

Major Species

For major species, commercial harvest relative to issued and base quota information, including annual trends, is shown in Fig. 3.1.6 to Fig. 3.1.19. 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).

Yellow Perch

Yellow Perch 2021 commercial harvest

TABLE 3.1.4. 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, 2021.

	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	2,909	$3.03	$8,821	871	$3.17	$2,764	6,088	$3.10	$18,891
Bowfin	4,755	$0.40	$1,902	2,687	$0.87	$2,340	9,272	$0.64	$5,891
Brown Bullhead	5,381	$0.27	$1,448	6,500	$0.48	$3,124	12,571	$0.37	$4,712
Channel Catfish	0			0			0	$0.00	$0
Cisco	608	$0.27	$165	0			618	$0.27	$168
Common Carp	472	$0.43	$202	0			486	$0.43	$208
Freshwater Drum	14,366	$0.10	$1,431	0			14,366	$0.10	$1,431
Lake Whitefish	87,918	$1.55	$136,424	0			87,918	$1.55	$136,424
Northern Pike	6,150	$0.26	$1,630	0			6,790	$0.26	$1,799
Rock Bass	11,823	$0.68	$8,032	1,988	$0.63	$1,244	17,076	$0.65	$11,143
Sunfish	28,033	$1.32	$37,124	1,167	$1.22	$1,421	51,455	$1.27	$65,399
Walleye	23,401	$2.10	$49,033	0			23,401	$2.10	$49,033
White Bass	793	$0.45	$355	0			793	$0.45	$355
White Perch	21,587	$0.53	$11,359	4			24,446	$0.53	$12,864
White Sucker	519	$0.10	$52	0			519	$0.10	$52
Yellow Perch	73,798	$3.35	$247,074	28,047	$2.31	$64,663	102,708	$2.83	$290,329
Total	282,513		$505,053	41,264		$75,555	358,507		$598,700

relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.1.6. Overall, 26% (102,708 lb) of the Yellow Perch base quota (392,273 lb) was harvested in 2021. The highest Yellow Perch harvest came from quota zones 1-4. All but one quota zone (1-7) harvested less than 35% of base quota. Trends in Yellow Perch quota (base), harvest and price-per-lb are shown Fig. 3.1.7. In 2019, quota was reduced 20% in quota zone 1-7 and left unchanged in all other quota zones. Harvest increases in 2021 in all quota zones except 2-5 and 1-7 (Fig. 3.1.7). Yellow Perch price-per-lb has been trending higher for the last number of years.

Lake Whitefish

Lake Whitefish 2021 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.1.8. Overall, 65% (87,918 lb) of the Lake Whitefish base quota was harvested in 2021. 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. 3.1.8). 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. 3.1.9. Base quota remained unchanged in 2021 compared to 2020.

Seasonal whitefish harvest and biological attributes (e.g., size and age structure) information are reported in Section 3.2. Lake Whitefish price-per-lb has been trending up since 2004 with a slight decreasing trend since 2018.

Walleye

Walleye 2021 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.1.10. Walleye harvest decreased slightly in 2021. Overall, 49% (23,401 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 transferred among quota zones 1-1, 1-2 and 1-4. In 2021, this resulted in issued quota and harvest being considerably higher than base quota in quota zone 1-4 (Fig. 3.1.10). Trends in Walleye quota (base), harvest and price-per-lb are shown in Fig. 3.1.11. Quota has remained constant since

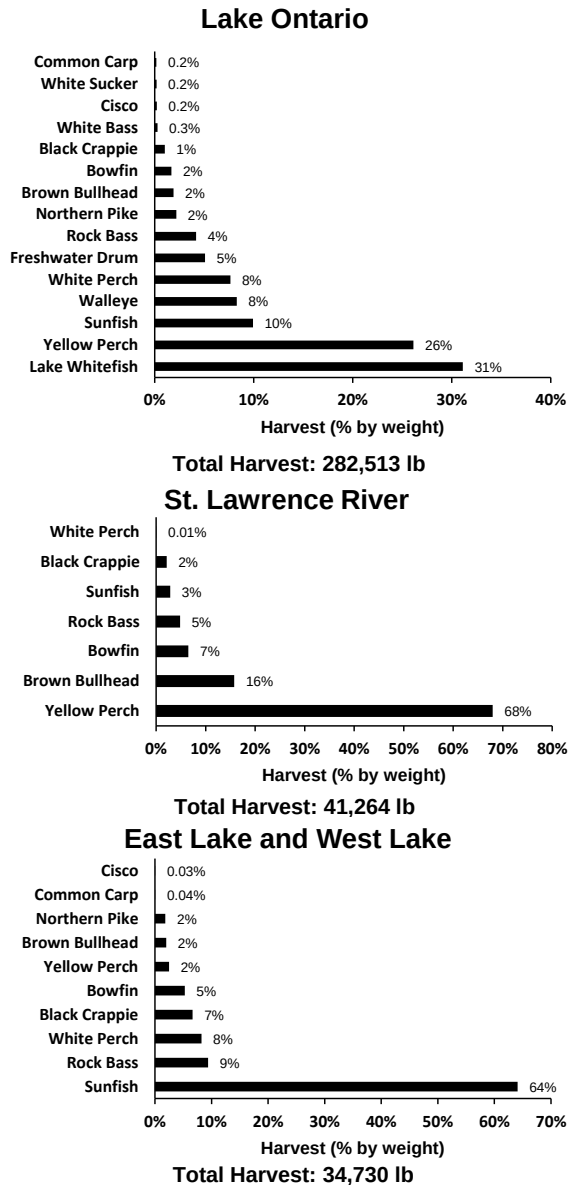


FIG. 3.1.2. Breakdown of 2021 commercial harvest by species **(% by weight**) for Lake Ontario (quota zones 1-1, 1-2, 1-3, 1-4 and 1-8) and the St. Lawrence River (quota zones 1-5, 2-5 and 1-7)

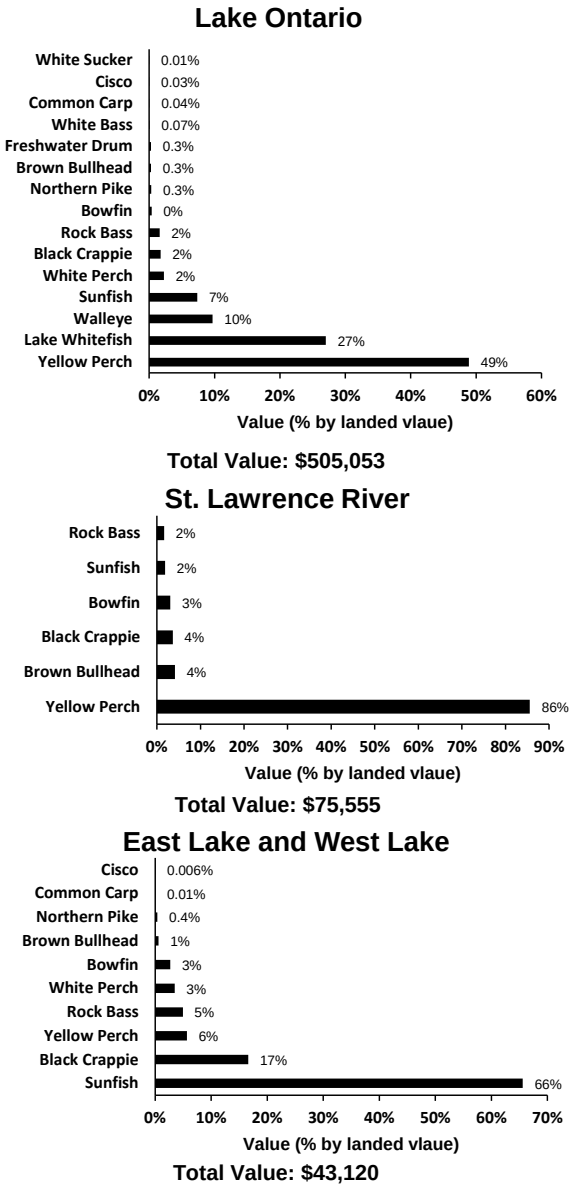


FIG. 3.1.3. Breakdown of 2021 commercial harvest by species **(% by landed value**) for Lake Ontario (quota zones 1-1, 1-2, 1-3, 1-4 and 1-8), the St. Lawrence River (quota zones 1-5, 2-5 and 1-7)

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 has decreased since 2019.

Black Crappie

Black Crappie 2021 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.1.12. Overall, only 8% (6,088 lb) of the Black Crappie base quota (73,013 lb) was harvested in 2021. The highest Black Crappie harvest came from quota zone 1-3 and West Lake. Trends in quota (base), harvest and price-per-lb are shown in Fig. 3.1.13. Black Crappie harvest has been trending down in quota zone 1-3 and though price-per-lb remains high, there was a decrease in 2020 and 2021.

Sunfish

Sunfish 2021 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.1.14. Only quota zones 1-1 (embayment areas only), East Lake and West Lake have quotas for Sunfish; quota is unlimited in the other zones.

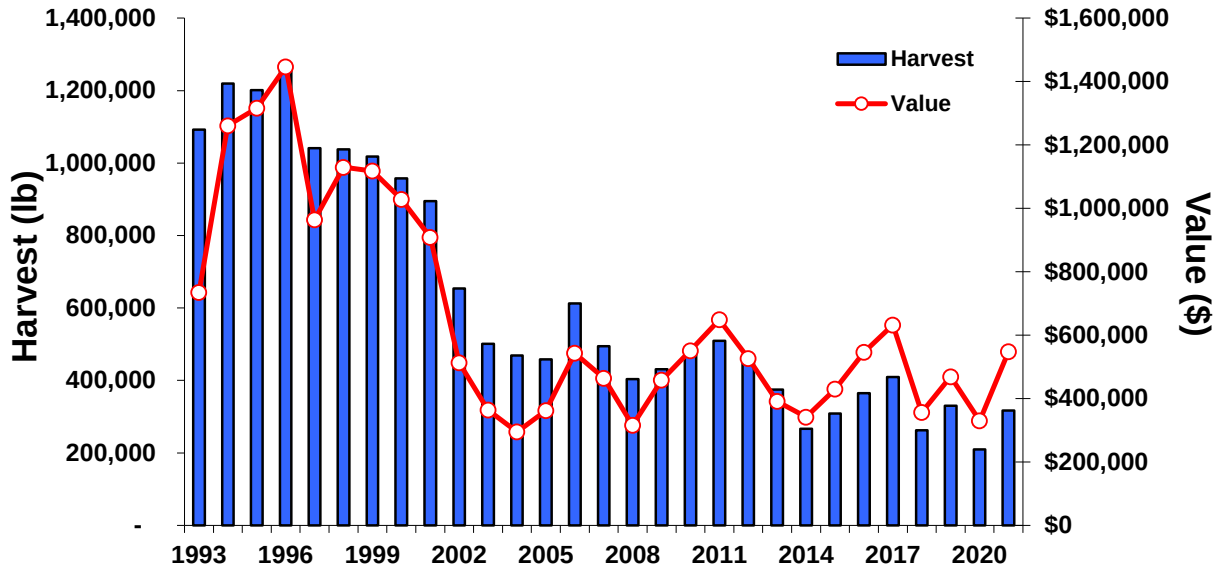


FIG. 3.1.4. Total commercial fishery harvest and value for **Lake Ontario** (Quota Zones 1-1, 1-2, 1-3 ,1-4 and 1-8) and **Embayments** (Quota Zones East Lake and West Lake), 1993-2021.

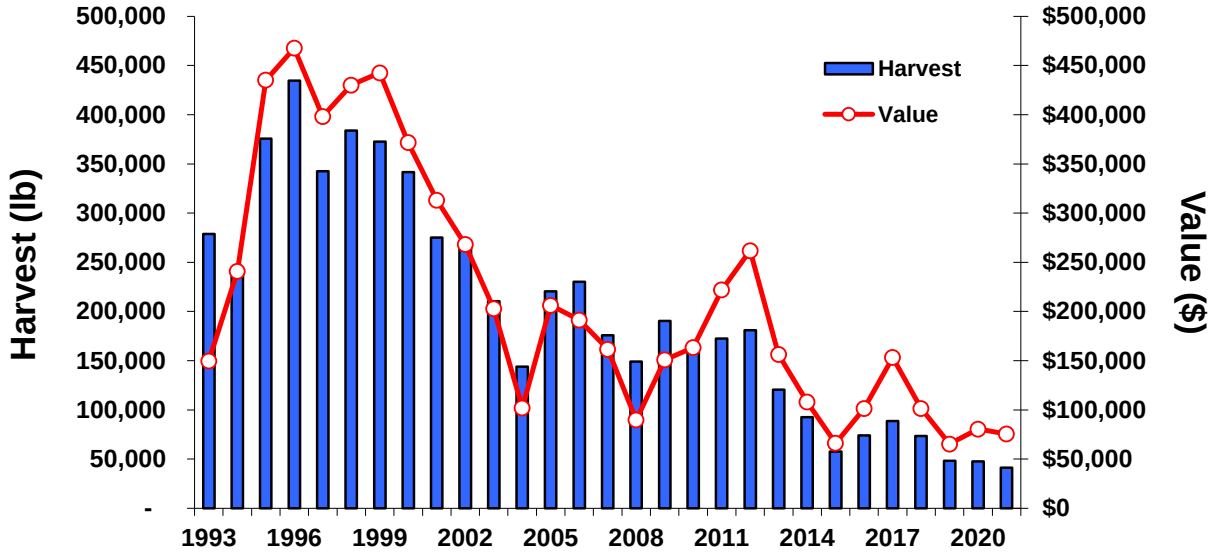


FIG. 3.1.5. Total commercial fishery harvest and value for the **St. Lawrence River** (Quota Zones 1-5, 2-5 and 1-7), 1993-2021.

Most Sunfish harvest was from quota zone 1-3. Trends in Sunfish quota (base), harvest and price-per-lb are shown in Fig. 3.1.15. In 2021, harvest increased in quota zone 1-3 and price-per-lb is currently high and stable.

Brown Bullhead

Brown Bullhead 2021 commercial harvest by quota zone and total for all quota zones combined is shown in Fig. 3.1.16. Quota was removed in quota zones 1-1, East Lake and West Lake in 2016 and is now unlimited in all zones. In 2021, the highest Brown Bullhead harvest came from quota zone 1-3. Trends in Brown Bullhead quota (base), harvest and price-per-lb are shown in Fig. 3.1.17. Current harvest levels are extremely low relative to past levels.

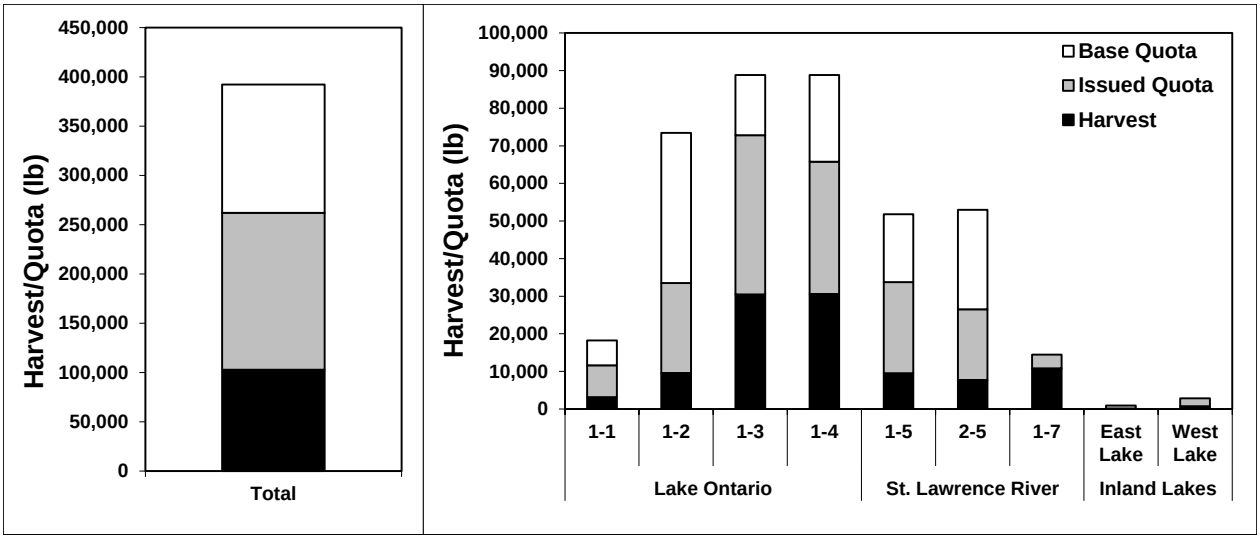


FIG. 3.1.6. **Yellow Perch** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2021.

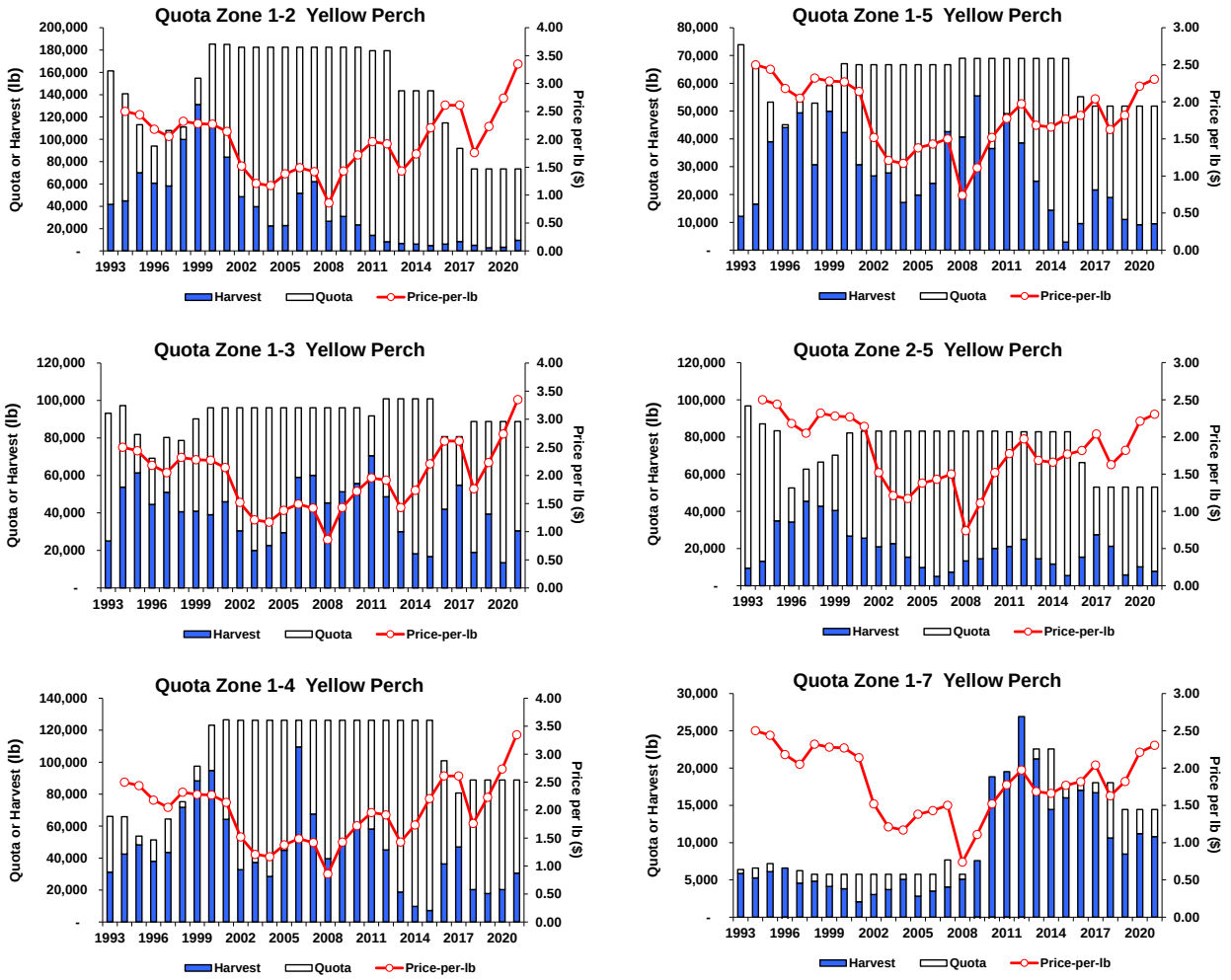


FIG. 3.1.7. Commercial base quota, harvest and price-per-lb for **Yellow Perch** in Quota Zones 1-2, 1-3, 1-4, 1-5, 2-5 and 1-7, 1993-2021.

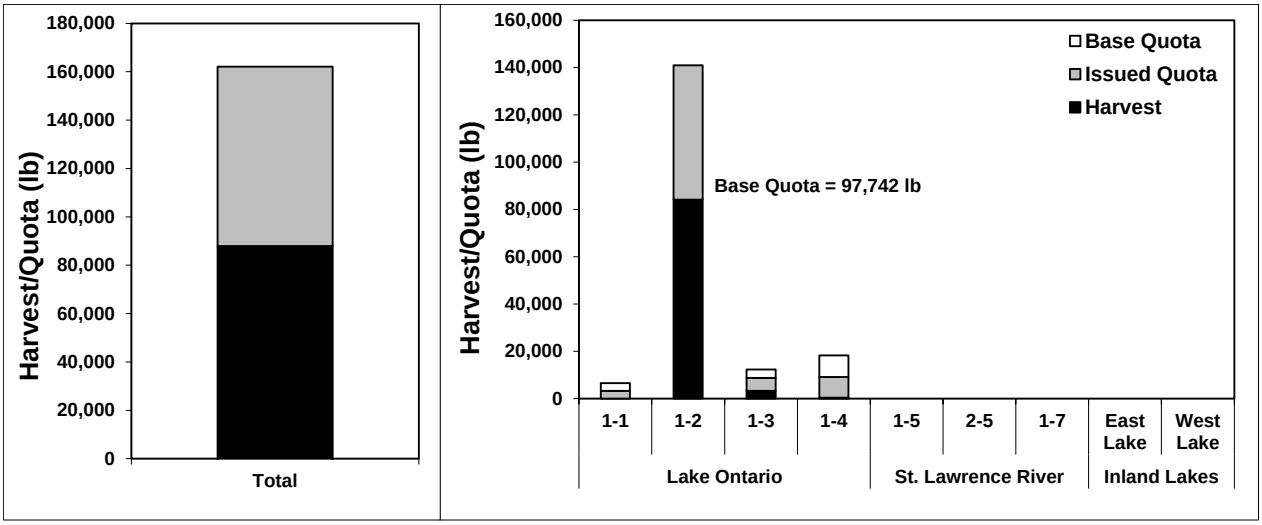


FIG. 3.1.8. **Lake Whitefish** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2021.

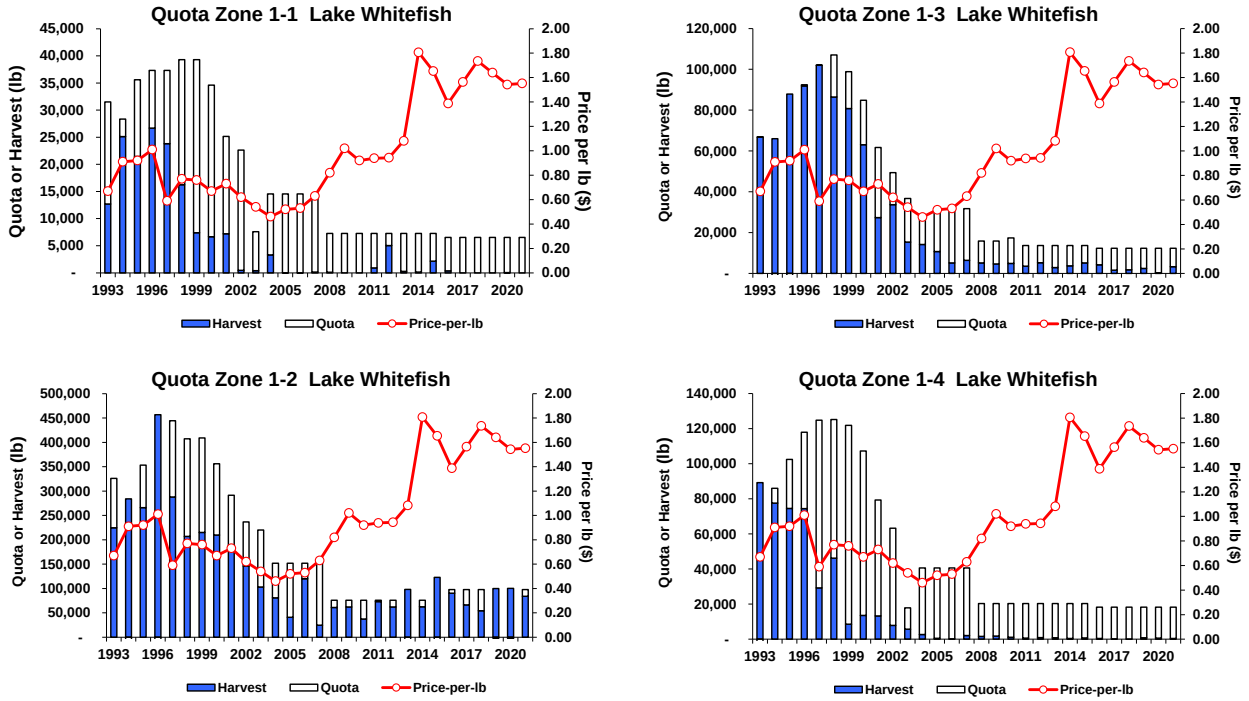


FIG. 3.1.9. Commercial base quota, harvest and price-per-lb for **Lake Whitefish** in Quota Zones 1-1, 1-2, 1-3 and 1-4, 1993-2021.

Northern Pike

Northern Pike 2021 commercial harvest by quota zone is shown in Fig. 3.1.18. Highest pike harvest came from quota zone 1-3. Trends in Northern Pike harvest and price-per-lb are shown in Fig. 3.1.19. Harvest remains low as compared to previous years. Norther Pike is managed as an incidental harvest fishery. In 2018-2021, 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.

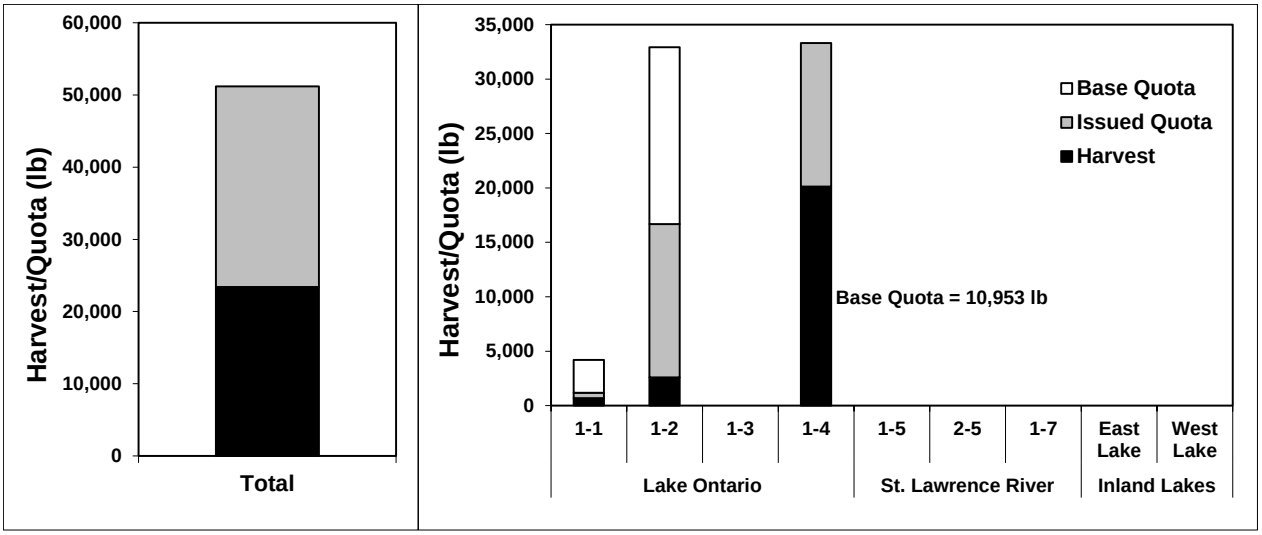


FIG. 3.1.10. **Walleye** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2021.

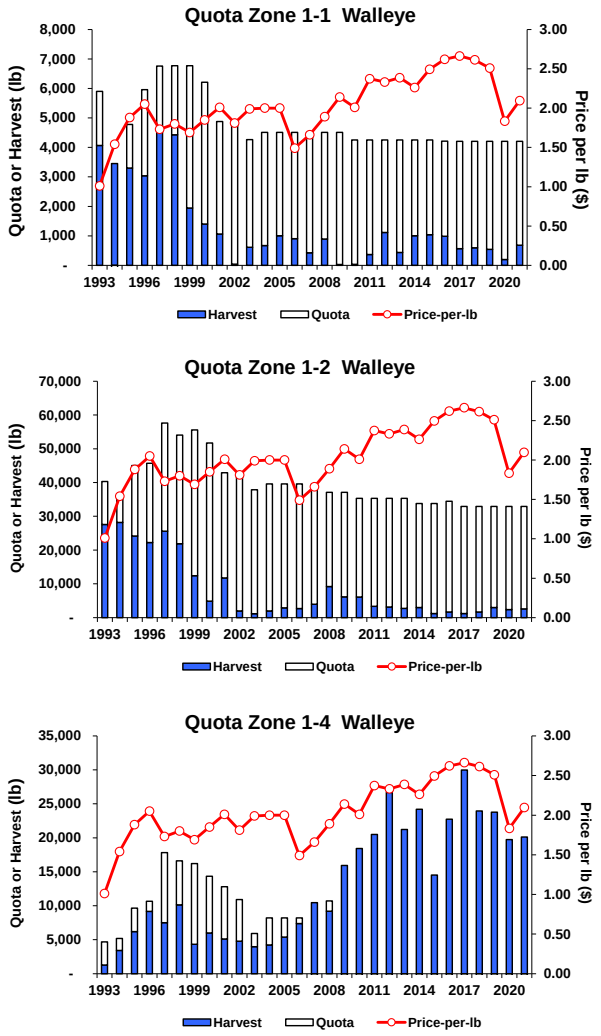


FIG. 3.1.11. Commercial base quota, harvest and price-per-lb for **Walleye** in Quota Zones 1-1, 1-2 and 1-4, 1993-2021.

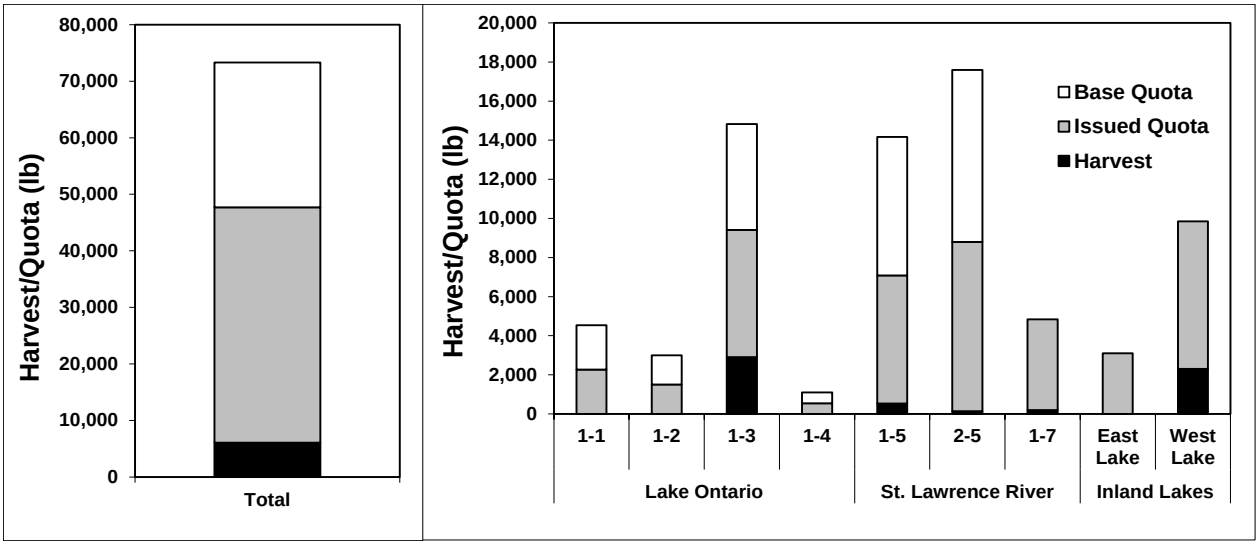


FIG. 3.1.12. **Black Crappie** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2020.

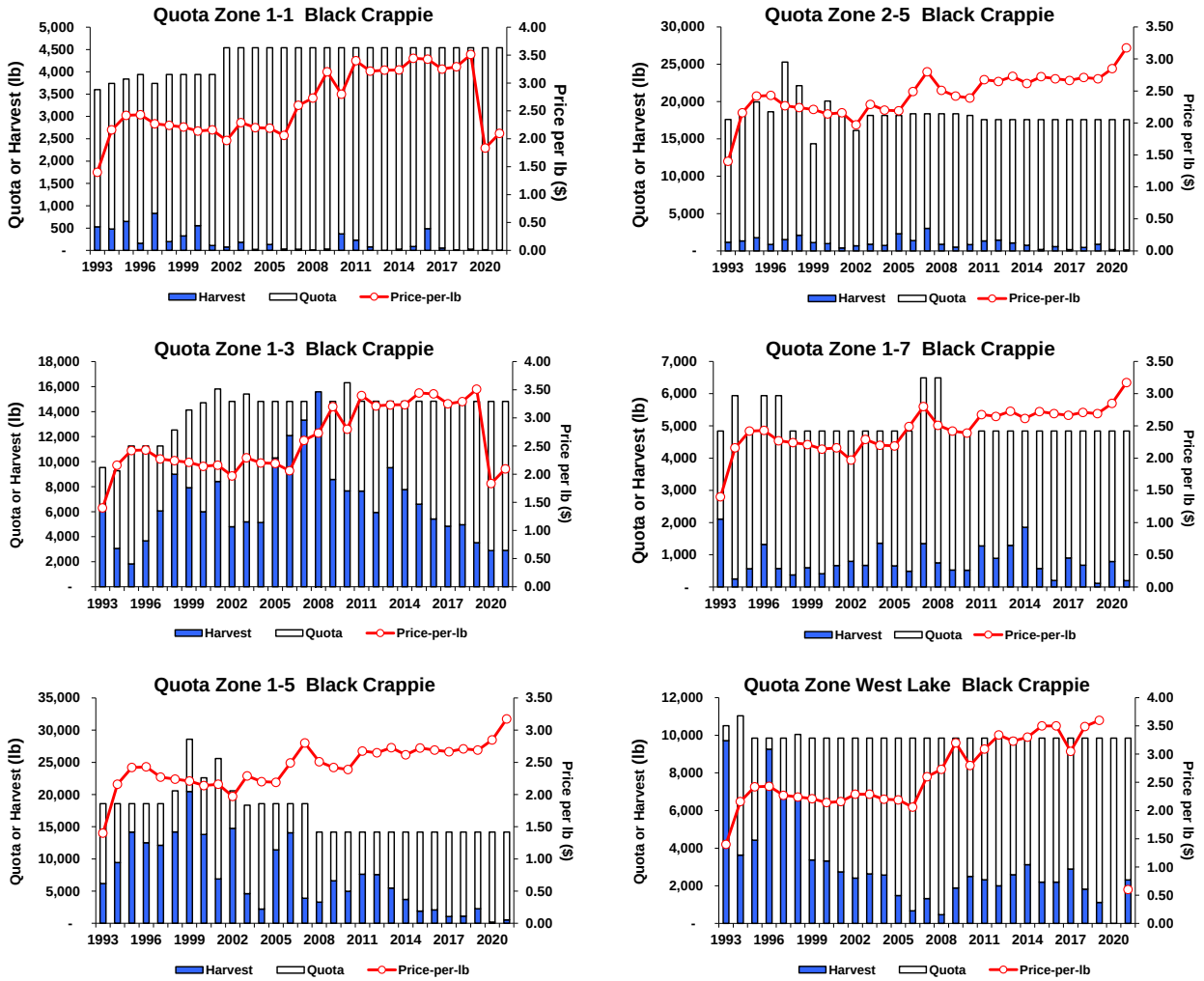


FIG. 3.1.13. Commercial base quota, harvest and price-per-lb for **Black Crappie** in Quota Zones 1-1, 1-3, 1-5, 2-5, 1-7, and West Lake 1993-2021.

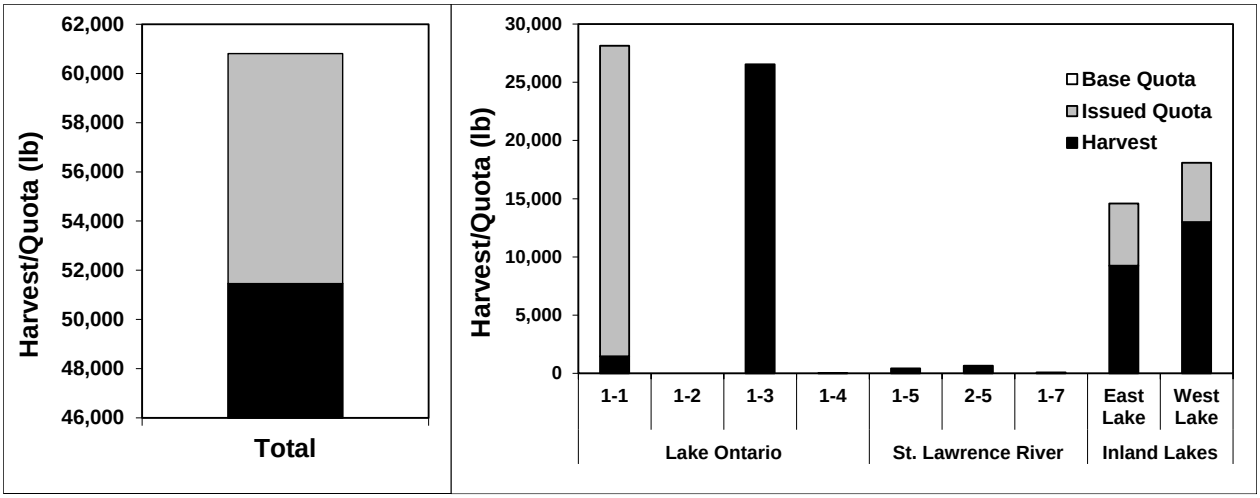


FIG. 3.1.14. **Sunfish** commercial harvest relative to issued and base quota for quota zones 1-1, East Lake and West Lake, 2021. The remaining quota zones have unlimited quota.

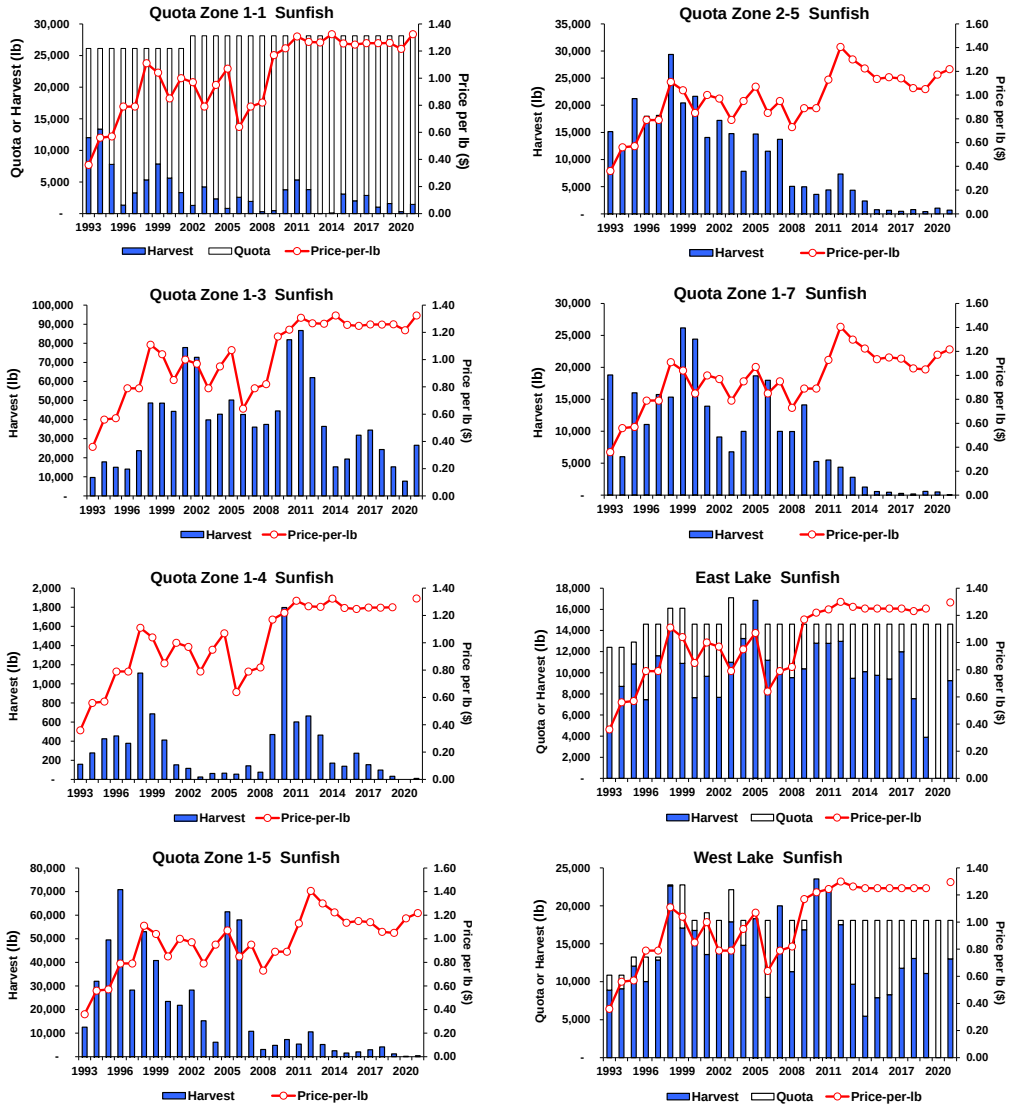


FIG. 3.1.15. Commercial base quota, harvest and price-per-lb for **Sunfish** in Quota Zones 1-1, 1-3, 1-4, 1-5, 2-5, 1-7, East Lake and West Lake 1993-2021.

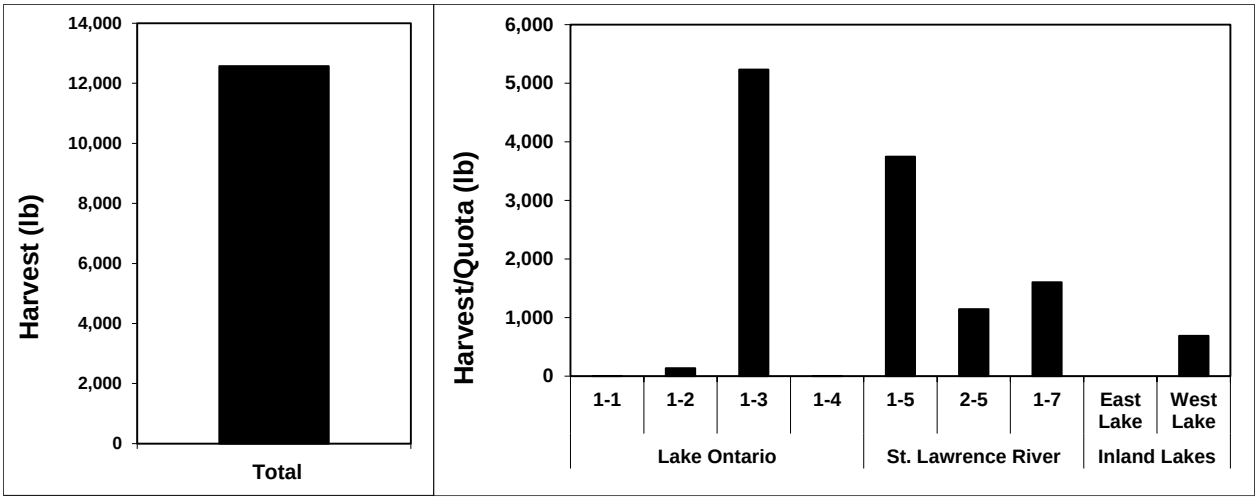


FIG. 3.1.16. **Brown Bullhead** commercial harvest by quota zone, 2021.

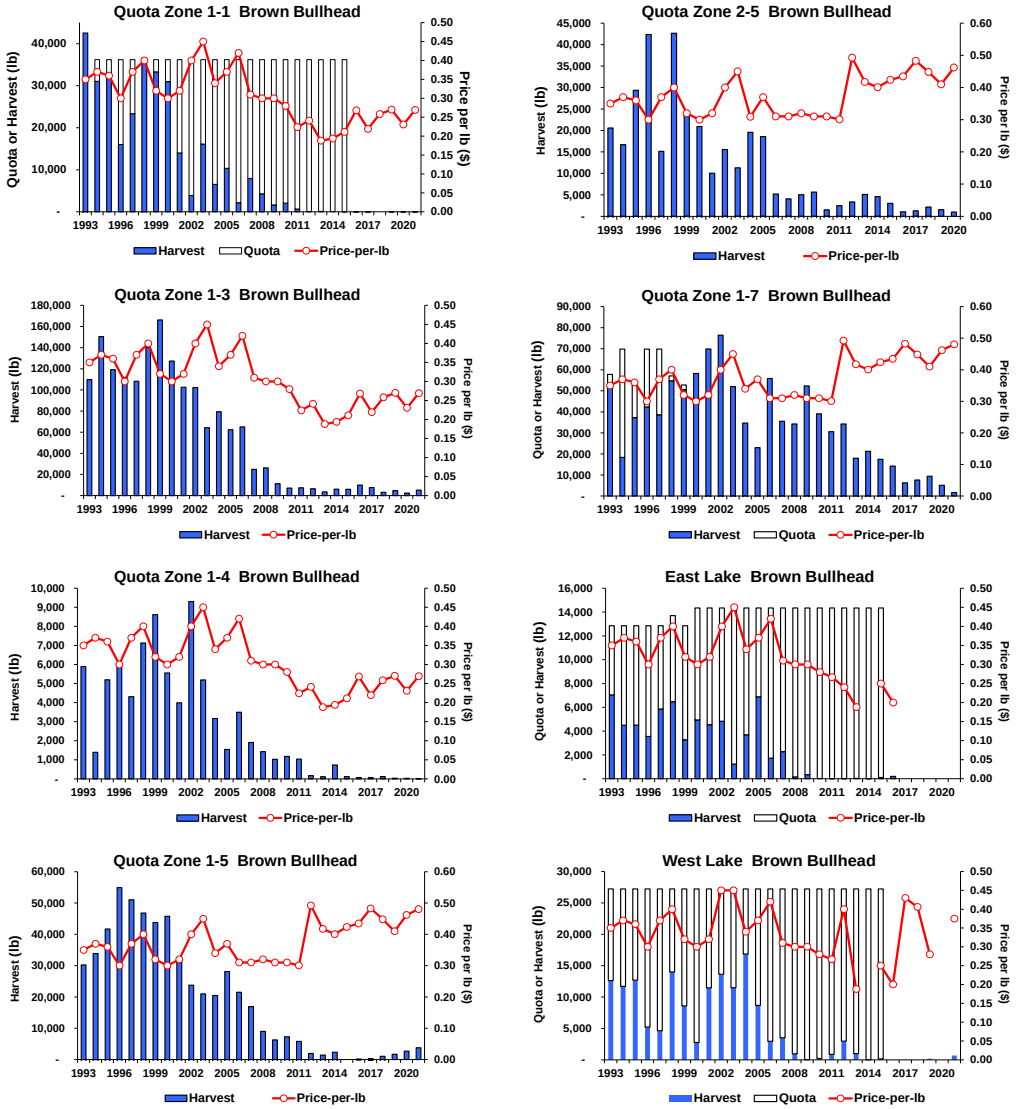


FIG. 3.1.17. Commercial base quota, harvest and price-per-lb for **Brown Bullhead** in Quota Zones 1-1, 1-3, 1-4, 1-5, 2-5, 1-7, East Lake and West Lake 1993-2021.

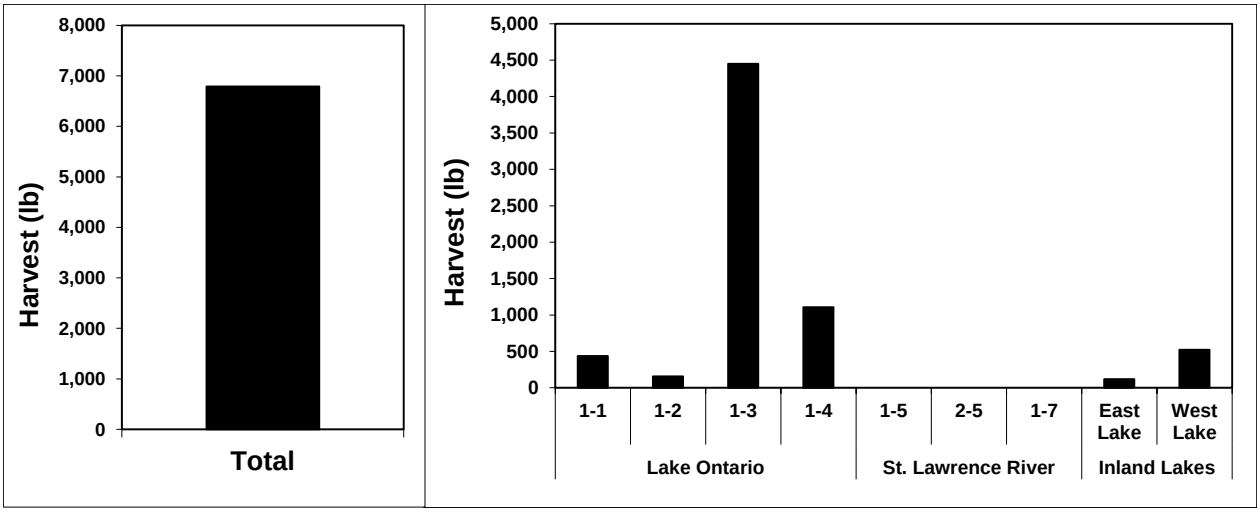


FIG. 3.1.18. **Northern Pike** commercial harvest by quota zone, 2021. In quota zones 2-5 and 1-7 no harvest is permitted; all other zones have unlimited quota.

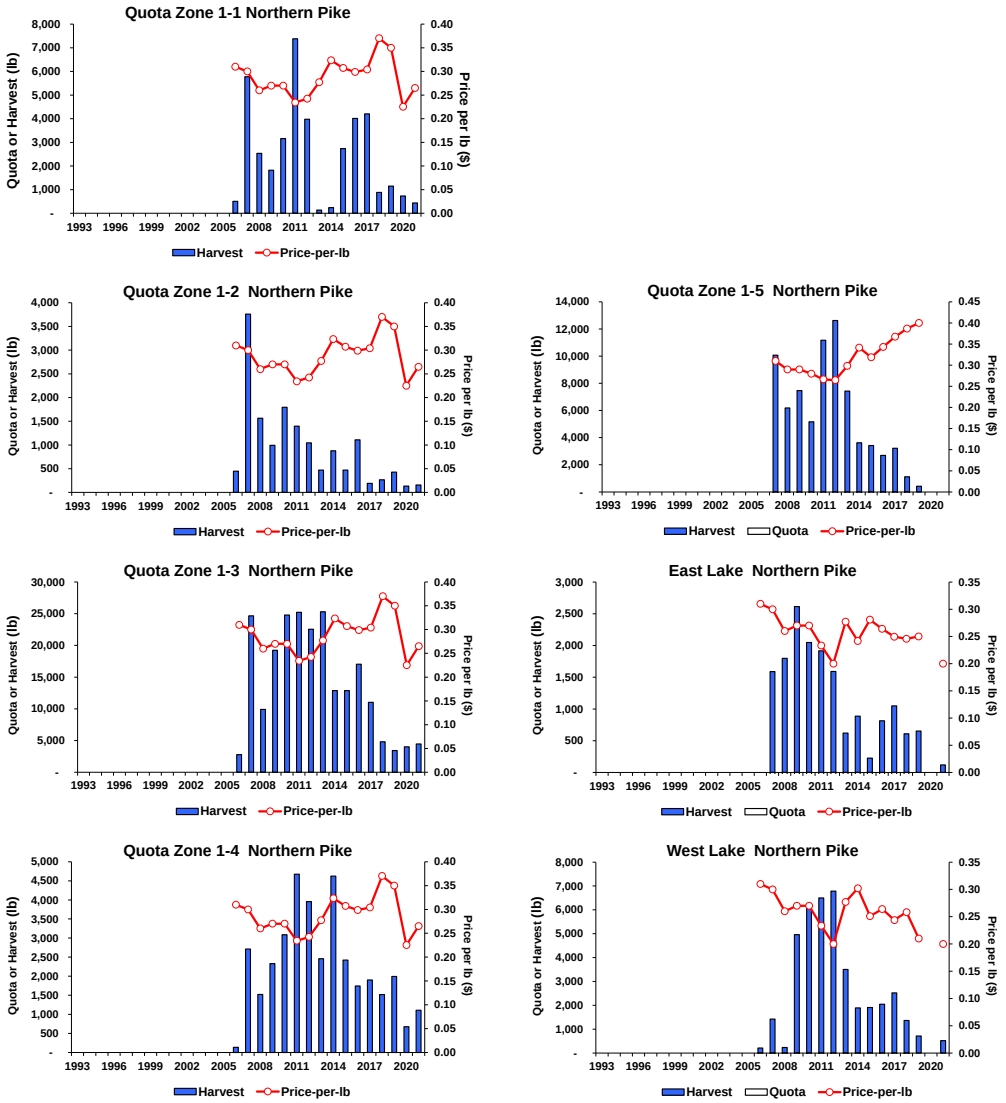


FIG. 3.1.19. Commercial base quota, harvest and price-per-lb for **Northern Pike** in Quota Zones 1-1, 1-2, 1-3, 1-4, 1-5, East Lake and West Lake 1993-2021.

3.2 Lake Whitefish Commercial Catch Sampling

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

Commercially harvested Lake Whitefish are sampled annually for biological information. Biological sampling of the catch is necessary to breakdown total harvest (see Daily Catch Reports; Section 3.1), into size and age-specific harvest.

Commercial Lake Whitefish harvest and fishing effort by gear type, month and quota zone for 2021 is reported in Table 3.2.1. Cumulative daily commercial Lake Whitefish harvest relative to quota 'milestones' is shown in Fig. 3.2.1. Total Lake Whitefish harvest for 2021 was 87,918 lbs; 54% of the issued quota.

Most of the harvest was taken in gill nets, 96% by weight; 4% of the harvest was taken in impoundment gear. Ninety-six percent of the gill net harvest occurred in quota zone 1-2. Fifty 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 3.2.1). 39,265 lbs were harvested before November 1, the date on which an additional 20% of base quota was issued to the "pool" (Fig 3.2.1).

Commercial catch sampling collected biological information from spawning-time fisheries in the Bay of Quinte (quota zone 1-3) from October 27th to November 17th and the south shore of Prince Edward County (quota zone 1-2) from November 4th to November 30th. Biological information is obtained through taking large numbers of length tally measurements as well as a length-stratified sub-sample for more detailed biological sampling for each quota zone. Whitefish length and age distribution information is presented in Fig. 3.2.2 and Fig. 3.2.3. In total, fork length was measured for 6,520 fish and age was interpreted using otoliths for 289 fish (Table 3.2.2, Fig. 3.2.2 and 3.2.3).

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 481 mm and 9.8 years respectively (Fig. 3.2.2). Fish ranged from ages 4 -32 years. The most abundant age-classes in the fishery were ages 5-18 years which together comprised 98.3% of the harvest by number (98% by weight).

TABLE 3.2.1. 2021 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				4				160
	Apr		37				240		
	May		316				4,400		
	Jun		3,755				23,600		
	Jul		7,364				37,400		
	Aug		4,293				13,440		
	Sep		11,465				32,800		
	Oct		***11,692***				***22,400***		
	Nov		***42,222***		371		***35,400***		1,200
	Dec		2,996		51		3,200		800
Impoundment	Mar			27				57	
	Apr			13				68	
	May			4	7			13	5
	Jun				5				3
	Sep			3				1	
	Oct			*282*				97	
	Nov			***2,993***				***117***	
	Dec			19				5	

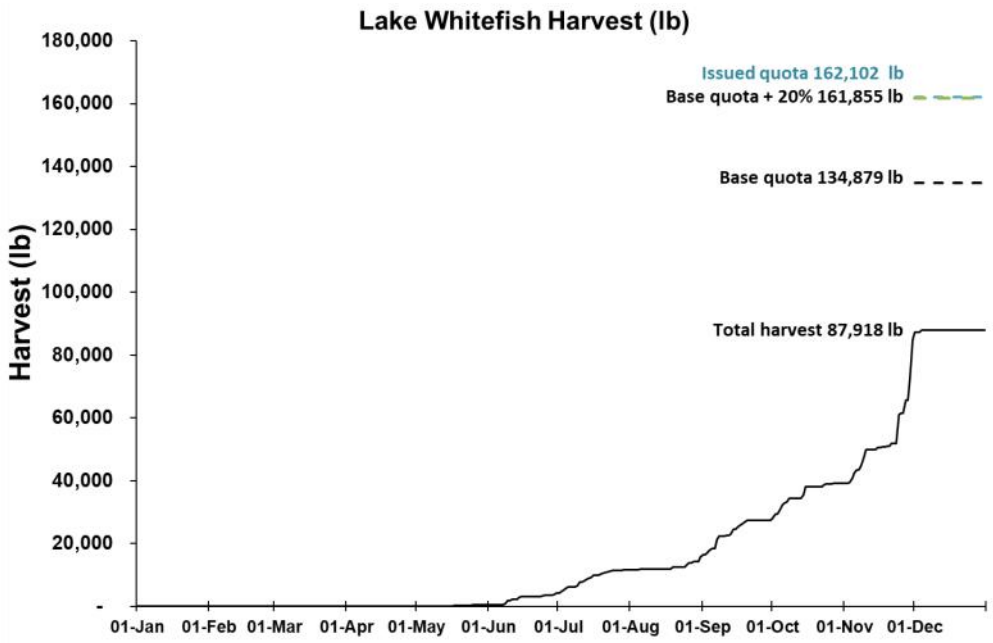


FIG. 3.2.1. Cumulative daily commercial Lake Whitefish harvest (2021) relative to quota 'milestones'.

TABLE 3.2.2. Age-specific vital statistics of Lake Whitefish sampled and harvested including number aged, number measured for length, proportion by number of fish sampled, mean weight (kg) and fork length (mm) of fish sampled, and harvest by number and weight (kg) for quota zone 1-2 and 1-3, 2021.

Quota Zone 1-2 (Lake)

	Sampled					Harvested	
Age (years)	Number lengthed	Number aged	Proportion	Mean Weight (kg)	Mean length (mm)	Number	Weight (kg)
1	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	2		0.000	0.838	408	11	10
5	232	10	0.040	0.962	438	1212	1166
6	1435	49	0.245	1.053	451	7489	7883
7	389	11	0.066	1.040	457	2032	2112
8	637	18	0.109	1.148	461	3326	3818
9	933	23	0.159	1.195	471	4870	5819
10	141	4	0.024	1.160	473	738	857
11	625	14	0.107	1.455	502	3261	4745
12	106	2	0.018	1.256	481	552	693
13	200	4	0.034	1.503	517	1043	1568
14	191	4	0.033	1.694	524	997	1688
15	359	8	0.061	1.490	511	1872	2790
16	204	6	0.035	1.492	518	1065	1590
17	129	4	0.022	1.498	523	673	1007
18	179	4	0.031	1.759	533	934	1643
19	15	1	0.002	1.963	569	76	149
20	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-
23	3		0.000	2.371	577	13	31
24	10	1	0.002	1.994	570	54	108
25	22	1	0.004	1.994	552	116	231
26	12		0.002	1.722	541	60	104
27	-	-	-	-	-	-	-
28	33	2	0.006	2.234	574	173	387
29	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-
31	-	-	-	-	-	-	-
32	3	2	0.001	2.427	611	17	42
Total	5860	168	1			30584	38158
Weighted mean				**1.248**			

Quota Zone 1-3 (Bay)

	Sampled					Harvested	
Age (years)	Number lengthed	Number aged	Proportion	Mean weight (kg)	Mean length (mm)	Number	Weight (kg)
1	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	7	1	0.011	0.969	427	14	13
5	-	-	-	-	-	-	-
6	61	12	0.093	0.988	443	122	120
7	200	36	0.305	1.042	456	398	414
8	185	34	0.281	1.044	456	367	383
9	36	8	0.056	1.399	503	72	101
10	42	8	0.064	1.290	490	83	107
11	20	3	0.031	1.007	445	40	41
12	11	1	0.017	1.015	465	23	23
13	20	5	0.031	1.551	519	41	63
14	21	2	0.032	1.323	504	42	55
15	11	2	0.017	1.620	524	22	35
16	14	2	0.021	1.342	501	27	36
17	5	1	0.008	1.158	476	10	11
18	9	2	0.014	1.597	541	18	29
19	1	-	0.001	1.671	572	1	1
20	5	1	0.007	1.320	486	9	12
21	1	-	0.001	1.496	520	1	1
22	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-
25		-	0.001	2.065	562	1	2
26	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-
28	6	2	0.009	2.408	579	12	29
29	1	1	0.002	2.318	607	3	7
Total	658	121	1			1305	1515
Weighted mean				**1.161**			

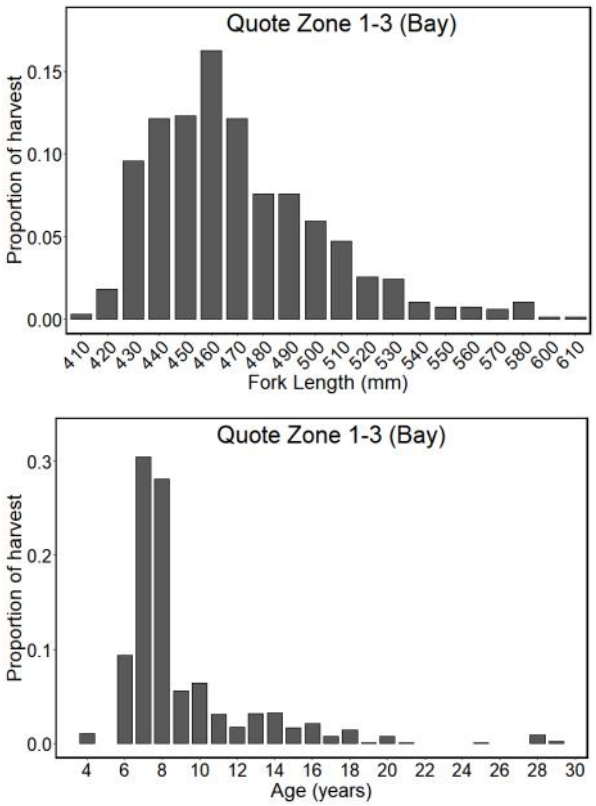


FIG. 3.2.2. Size and age distribution (by number) of Lake Whitefish sampled in quota zone 1-3 during the 2021 commercial catch sampling program.

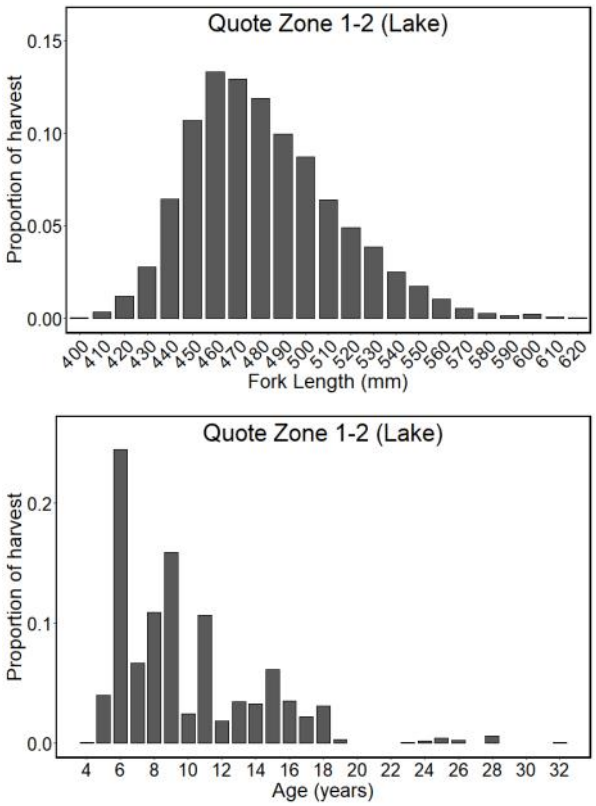


FIG. 3.2.3. Size and age distribution (by number) of Lake Whitefish sampled in quota zone 1-2 during the 2021 commercial catch sampling program.

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

Mean fork length and age for Lake Whitefish harvested in quota zone 1-3 were 470mm and 9 years, respectively (Fig. 3.2.3). Fish ranged from ages 4-29 years. The most abundant age-classes in the fishery were ages 6-14 years which together comprised 91% of the harvest by number (86% by weight).

Condition

Lake Whitefish (Bay of Quinte and Lake Ontario spawning groups; sexes combined) relative weight (see Rennie et al. 2008[1]) is shown in Fig. 3.2.4. Condition declined markedly in 1994 and has remained low but stable.

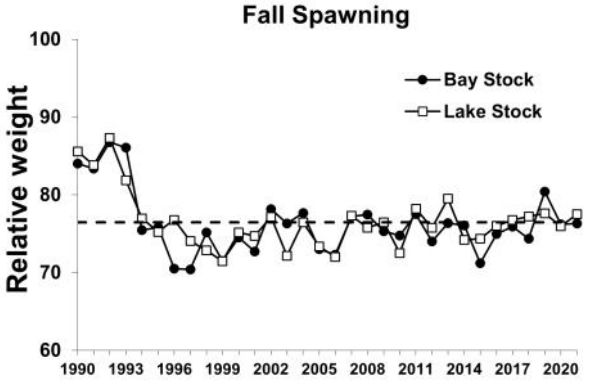


FIG. 3.2.4. Lake Whitefish (sexes combined) relative weight for the Lake Ontario and Bay of Quinte spawning groups (see [1]Rennie et al. 2008), 1990-2021.

[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.*

Diet

Stomach contents were analyzed for 295 Lake Whitefish in 2021. Most stomachs were empty (96%). Fish that contained stomach contents from the Bay of Quinte spawning group (three fish, 2.4%) contained only dressined mussels. Eight fish (4.7%) from the Lake spawning group contained stomach contents. Contents included fish eggs, dreissenid mussels, chronomidae (non-biting midges), *bythotrephes longimanus* (spiny water flea), and *hemimysis anomala* (bloody red shrimp).

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 2021, a total of 2056 structures were processed from 8 different field projects (Table 4.1).

TABLE 4.1. Project-specific summary of age and growth structures interpreted for age (n=2056) in support of 8 different Lake Ontario Management Unit field projects, 2021.

Project	Species	Structure	n
Ganaraska Trout Assessment			
	Rainbow Trout	Scales	168
Lake Ontario and Bay of Quinte Community Index Gillnetting			
	Chinook Salmon	Otoliths	1
	Rainbow Trout	Otoliths	2
	Lake Trout	Otoliths	65
	Lake Whitefish	Otoliths	9
	Cisco	Otoliths	18
	Northern Pike	Cleithra	40
	Smallmouth Bass	Scales	60
	Largemouth Bass	Scales	12
	Yellow Perch	Scales	121
	Walleye	Otoliths	397
Lake Ontario and Bay of Quinte Community Index Trawling			
	Walleye	Otoliths	8
	Walleye	Scales	87
Hamilton Harbour Nearshore Community Index Netting			
	Northern Pike	Cleithra	9
	White Perch	Scales	43
	White Bass	Scales	13
	Rock Bass	Scales	22
	Pumpkinseed	Scales	30
	Bluegill	Scales	31
	Largemouth Bass	Scales	17
	Black Crappie	Scales	5
	Yellow Perch	Scales	14
	Walleye	Otoliths	29
Lake St. Francis Community Index Netting			
	Northern Pike	Cleithra	1
	Smallmouth Bass	Scales	6
	Largemouth Bass	Scales	1
	Yellow Perch	Scales	60
	Walleye	Otoliths	13
Thousand Island Community Index Netting			
	Northern Pike	Cleithra	12
	Smallmouth Bass	Scales	107
	Largemouth Bass	Scales	12
	Yellow Perch	Scales	88
	Walleye	Scales	24
Credit River Chinook Assessment and Egg Collection			
	Chinook Salmon	Otoliths	237
Commercial Catch Sampling			
	Lake Whitefish	Otoliths	294
Total			2056

5. Contaminant Monitoring

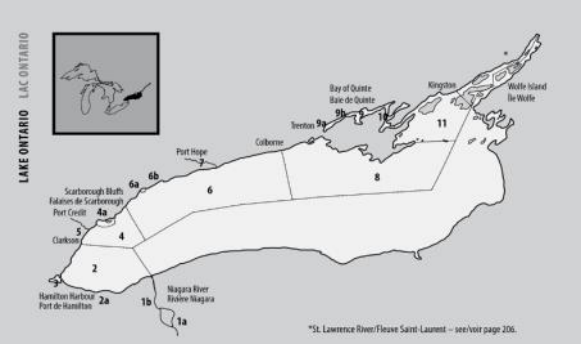
S. Kranzl and E. Brown, Lake Ontario Management Unit

Lake Ontario Management Unit (LOMU) cooperates annually with several agencies to collect fish samples for contaminant testing. In 2021, 159 contaminant samples were collected for Ontario's Ministry of the Environment, Conservation and Parks (MECP) Sport Fish Monitoring program (Table 5.1). Samples were primarily collected using existing fisheries assessment programs on Lake Ontario, Bay of Quinte and the St. Lawrence. Fig 5.1 is a map showing locations ("Blocks") for contaminant sample collections.

A summary of the number of fish samples collected by species, for contaminant analysis by the MECP from 2000 to 2021 is shown in Table 5.2.

TABLE 5.1. Number of fish samples provided to MECP for contaminant analysis, by region and species, 2021.

Region	Block	Species	Total
Hamilton Harbour	3	Brown Bullhead	10
		Largemouth Bass	8
		Walleye	10
Northwestern Lake Ontario	6	Rainbow Smelt	4
Northeastern Lake Ontario	8	Rainbow Smelt	4
Upper Bay of Quinte	9	White Bass	8
Upper Bay of Quinte-	9a	Bluegill	5
Trenton nearshore Area		Brown Bullhead	4
		Channel Catfish	2
		Largemouth Bass	9
		Northern Pike	2
		Rock Bass	2
		Smallmouth Bass	10
		Walleye	10
		White Perch	10
		Yellow Perch	10
Upper Bay of Quinte	9b	Bluegill	2
		Brown Bullhead	1
		Channel Catfish	2
		Largemouth Bass	10
		Northern Pike	2
		Smallmouth Bass	10
		Walleye	10
		Yellow Perch	8
Lower Bay of Quinte	11	Rainbow Smelt	4
Thousand Islands Area	12	Black Crappie	1
		Common Carp	1
Total			159



3. Hamilton Harbour – harbour area

6. Northwestern Lake Ontario – from east of Scarborough Bluffs to Colborne

8. Northeastern Lake Ontario – from east of Colborne to south of the area from Main Duck Island across to Point Traverse

9. Upper Bay of Quinte – open water from Trenton to County Road 49 Bridge

9a. Upper Bay of Quinte – Trenton nearshore Area

9b. Upper Bay of Quinte – Belleville nearshore Area

11. Lower Bay of Quinte/Eastern Lake Ontario – from east of Glenora to Kingston as well as the open water from north of Main Duck Island to Wolfe Island and from across the Main Duck sill to Point Traverse

12. Thousand Islands area – St. Lawrence River from east of Kingston to Brockville

FIG. 5.1. Map showing locations ("Blocks") for contaminant sample collections.

TABLE 5.2. Summary of the number of fish samples collected, by species, for contaminant analysis by the MECP, 2000 - 2021.

	Year																					
Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Black Crappie			20	20	3	20		20		20	29			35	2	14				8		1
Bluegill		26		20	10	23			102	88		40	40	3		10			10	10		7
Brown Bullhead		40	44	40	25	30	33	40	68	63	56	81	34	78	53	52			9	50		15
Brown Trout	40	3	20		31		22	6	29	34	34	12	20	6	10	1			20	6		
Channel Catfish	20	20	7	23		17				8		15	20	4	10			10		9		4
Chinook Salmon	40	3	16		48		29	1	36		39	1	21	6	19	2			21	10		
Cisco																18		20		20		
Coho Salmon		1	3																10			
Common Carp				7													14	8		7		1
Freshwater Drum			43		16		13	2	32	20	37			42	2		12	18		10		
Gizzard Shad																	7	10				
Lake Trout			42		54		38	17	46	20	33	13	18	20	49	10	28	10	29	10		
Lake Whitefish	20													20	17	19	8	11	10	22	5	
Largemouth Bass		4	25	28	20	9	8	89	26	40	28	55	20	11	7	18	20	4	10	37		27
Northern Pike		53	39	60	22	40	22	94	35	28	31	20	34	47	16	18	24	35	5	13		4
Pumpkinseed		60	25	57	8	11	23	78	92	105	19	43	31	14			15	20		12		
Rainbow Smelt																3			4	5		12
Rainbow Trout	40	37	28	20	37	20	29	20	21	20	33		1	22		20			2	11		
Rock Bass		36	30	38	11	21	27	30	20	40	42	80	5	24			20	20	17	57		2
Shorthead Redhorse																				5		
Silver Redhorse							1												9	1	1	
Smallmouth Bass		20	87	22	21	28	35	23	39	40	31	58	15	19	20	20	25	37	16	22		20
Walleye		42	51	40	61	30	62	98	61	40	70	71	24	73	59	67	56	29	53	72		30
White Bass											20									11		8
White Perch		40		40	40	14	21	20	35	20	7			40	8	11	4		4	43		10
White Sucker							1								25	7	21	30	16	14		
Yellow Perch	20	60	66	58	75	40	86	90	60	91	80	20	44	81	22	20	39	50	20	31		18
Total	180	445	546	473	482	303	450	628	702	677	589	509	327	545	319	310	293	312	265	496	6	159

6. Stocking Program

6.1 Stocking Summary

C. Lake , Lake Ontario Management Unit

Fish stocking is a fisheries management tool used to meet specific goals including supporting recreational fisheries and species restoration. In 2021, 1,451,352 fish were stocked into Lake Ontario, equaling 41,208 kilograms of biomass (Figure 6.1.1; Table 6.1.1). Fish are allocated to one of seven sub-zones based on several factors, including: natural reproduction within the zone, size of local fisheries and suitable available habitat (Figure 6.1.2). 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. The Stocking Strategy outlines

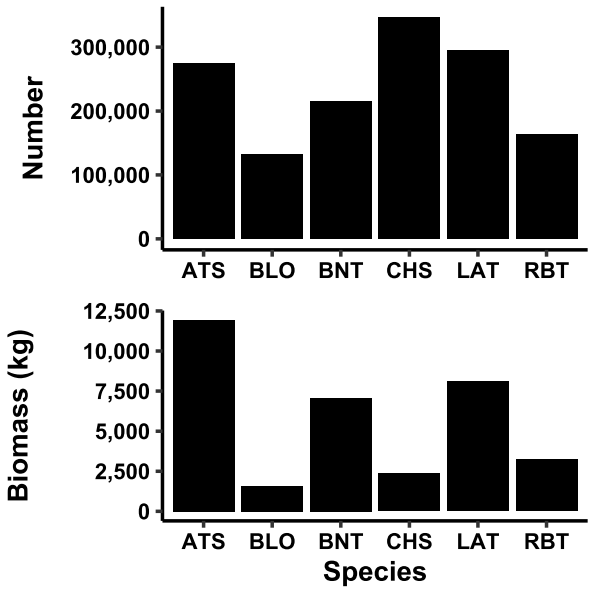


Figure 6.1.1: **TOP**: Number of fish stocked into the Ontario waters of Lake Ontario in 2021 (total = 1,451,352). **BOTTOM**: Biomass of fish stocked into the Ontario waters of Lake Ontario in 2021 (total = 41,208 kg.). Adult, egg and Nonfeeding fry life stages not included in totals. ATS = Atlantic Salmon, BLO = Bloater, BNT = Brown Trout, CHS = Chinook Salmon, LAT = Lake Trout, RBT = Rainbow Trout.

production targets for MNRF Fish Culture Stations (Table 6.1.2). These facilities also provide healthy, disease-free fish (eggs and fry) to a number of facilities participating in the Community Hatchery Program (Table 6.1.3). Stocking events are summarized by species, life

Table 6.1.1: Numbers of fish stocked into the Ontario waters of Lake Ontario in 2021. Numbers reflect both MNRF-produced fish and those raised by community groups.

Species	Life Stage	Number	Biomass (kg)
Atlantic Salmon	Fry	6,728	1
	Spring Fingerling	129,454	384
	Fall Fingerling	32,060	1,553
	Spring Yearling	95,382	6,690
	Fall Yearling	9,699	2,317
	Sub-adult	1,774	985
	Adult	731	2,089
Bloater	Fall Fingerling	113,047	162
	Sub-adult	19,286	1,404
	Adult	22,560	2,835
Brown Trout	Spring Fingerling	35,000	70
	Fall Fingerling	20,000	260
	Spring Yearling	160,600	6,735
	Adult	558	1,295
Chinook Salmon	Spring Fingerling	345,922	2,357
Lake Trout	Spring Yearling	294,376	8,092
Rainbow Trout	Spring Yearling	163,803	3,235
	Adult	372	744
Totals		1,451,352	41,208

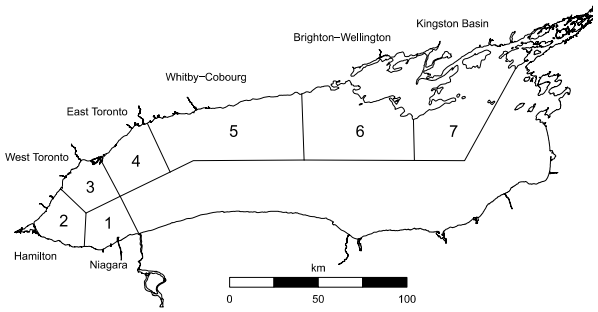


Figure 6.1.2: Map of Lake Ontario stocking zones.

stage and location for native species (Table 6.1.4) and for introduced species (Table 6.1.5). Stocking data for 2021 can be found for all of the Great Lakes on the Great Lakes Fisheries Commission stocking data portal at: http://fsis.glfc.org/stocking/events/2021/.

Table 6.1.2: MNRF fish stocking targets and actual numbers stocked in 2021 (MNRF-produced fish only).

Species/Life Stage	Stocked	Target	Percent
Atlantic Salmon			
Spring Fingerling	118,315	300,000	39%
Fall Fingerling	32,060	70,000	46%
Spring Yearling	95,382	105,000	91%
Fall Yearling	9,699	10,000	97%
Bloater			
All Life Stages	154,893	250,000	62%
Brown Trout			
Spring Yearling	160,600	165,000	97%
Chinook Salmon			
Spring Fingerling	345,922	344,000	101%
Lake Trout			
Spring Yearling	294,376	282,000	104%
Rainbow Trout			
Spring Yearling	146,803	180,000	82%

Table 6.1.3: Fish provided to community hatcheries by MNRF.

Species / Life Stage	Target	Partner
Atlantic Salmon		
Egg	20,000	Belfountain Hatchery
Egg	15,000	Classroom Hatchery Program
Egg	20,000	Islington Sportsman Club
Egg	10,000	Ontario Streams
Egg	70,000	SSFC
Spring Fingerling	5,000	Credit River Anglers Assoc.
Brown Trout		
Egg	48,000	Metro East Anglers
Egg	50,000	Napanee Rod and Gun Club
Rainbow Trout		
Egg	19,000	Metro East Anglers
Egg	5,000	S. Central Ont F&W Assoc.

Figure 6.1.3 shows salmon and trout stocking trends in the Ontario waters of Lake Ontario for the most recent five years, by species and stocking zone.

Atlantic Salmon (275,828; 14,019 kg.) were stocked in support of an ongoing program to restore self- sustaining populations of this native species to Lake Ontario (Section 7). Atlantic Salmon are produced at MNRF hatcheries, with some eggs being delivered to academic and community hatcheries for further rearing. In addition to these regular stocking activities, surplus brood Atlantic Salmon (adults) are occasionally stocked. These fish are tagged, and tracked as part of an angler outreach program (Section 6.3). A developmental issue found in some of the fish early in the rearing process resulted in a shortfall of approximately 100,000 spring fingerlings.

Bloater (154,893; 4,401 kg.) were stocked in 2021. 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. 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 7 for a detailed description of this restoration effort.

Chinook Salmon spring fingerlings (345,922; 2,357 kg.) were stocked to provide put-grow-and-take fishing opportunities. All Chinook Salmon for the Lake Ontario program were produced at Normandale Fish Culture Station. A significant number of Chinook were transferred to volunteer-run net pens to enhance imprinting and growth during the last month of captivity. See Section 6.2 for a full description of the 2021 net pen program.

Coho Salmon are produced by stocking partner Metro East Anglers at the Ringwood Fish Culture Station. Gametes are collected from wild fish and reared at Ringwood. No Coho were produced in 2021.

Lake Trout spring yearlings (294,376; 8,092 kg.) were stocked in 2021 as part of an established, long-term rehabilitation program, supporting of the Lake Trout Stocking Plan (Section 7).

Rainbow Trout (164,175; 3,979 kg.) and Brown Trout (216,158; 8,360 kg.) were stocked at various locations to support shore and boat fisheries. Community hatcheries contribute to the stocking of both species – see Table 6.1.5 for details.

Walleye stocking began in 2012 in an effort to re-establish this native, predatory fish to the fish com - munities 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). In 2021, routine fish health monitoring conducted by MNRF fish culture station staff determined that the young Walleye were potentially exposed to a virus. Out of an abundance of caution, the decision was made to cull the eggs and no Walleye were stocked in 2021.

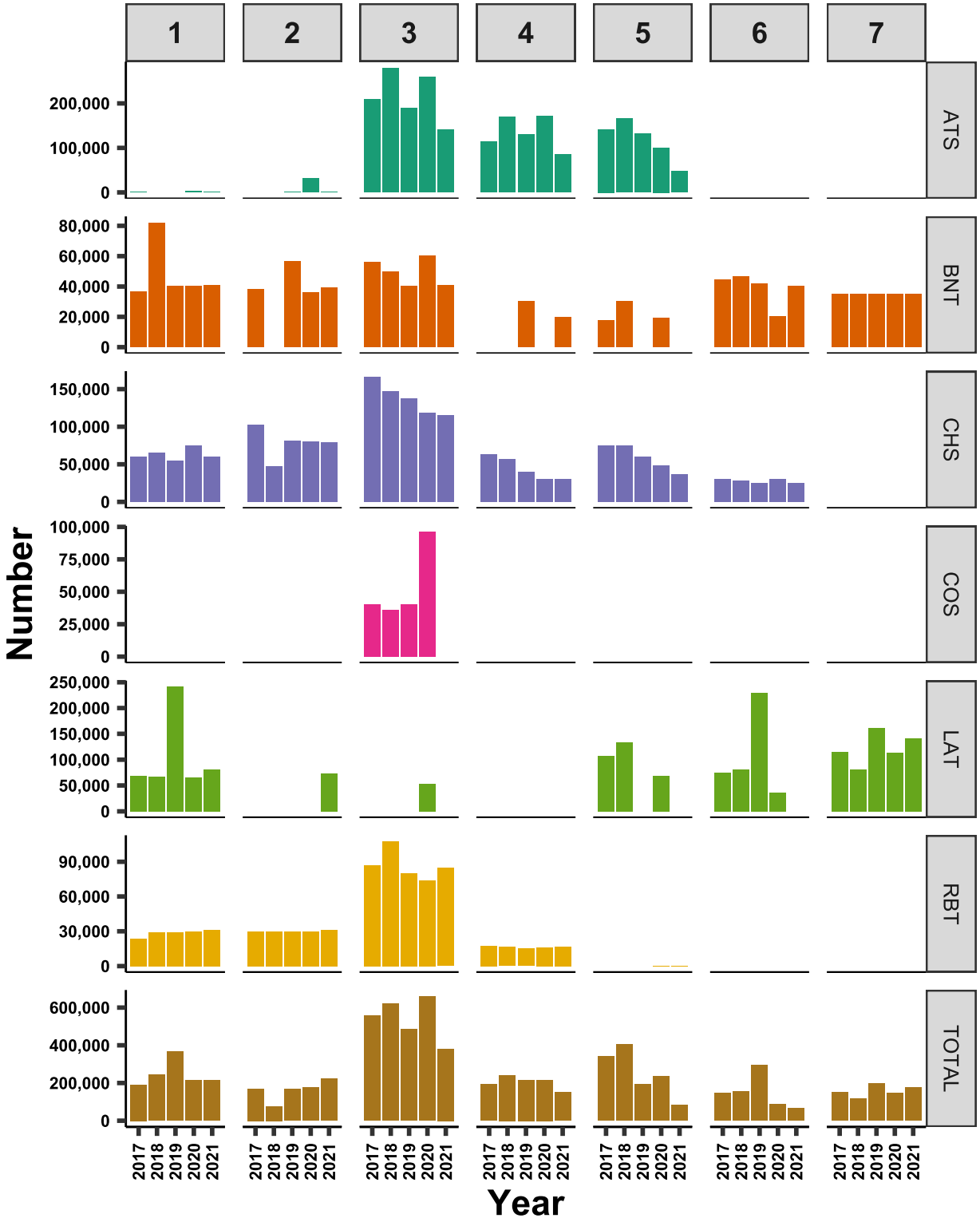


Figure 6.1.3: Numbers of salmon and trout stocked in the Ontario waters of Lake Ontario for the most recent five years. Data are presented by species (rows) and by stocking zone (columns). The bottom panel ("Total") shows the total for all six species for the same time frame. Note that the y-axes are variable.

ATS = Atlantic Salmon, BNT = Brown Trout, CHS = Chinook Salmon, COS = Coho Salmon, LAT = Lake Trout, RBT = Rainbow Trout.

Table 6.1.4. Native fish species stocked into the Ontario waters of Lake Ontario and its tributaries in 2021.

Waterbody	Site	Hatchery	Strain	Marks	Stocking Month	Age (Mos)	Weight (g)	Number
Atlantic Salmon - Fry								
Credit R.	W. Credit - Shaw's Cr. Rd.	Belfountain	Sebago Lk.	--	5	2	0.2	4,716
Credit R.	W. Credit - Winston Churchill	Belfountain	Sebago Lk.	--	5	2	0.3	2,012
Atlantic Salmon - Spring Fingerling								
Credit R.	Black Cr. - 15th Side Rd.	MNRF-NM	LaHave R.	--	5	5	3.6	15,014
Credit R.	Black Cr. - 6th Line	MNRF-NM	LaHave R.	--	5	5	2.5	9,160
Credit R.	Ellie's Ice Cream Parlour	MNRF-NM	LaHave R.	--	5	5	3.7	20,024
Credit R.	Forks	MNRF-NM	LaHave R.	--	5	5	3.6	20,105
Duffins Cr.	E. Duffins Cr. - 5th Conc.	MNRF-NM	LaHave R.	--	6	5	2.5	10,009
Duffins Cr.	E. Duffins Cr. - Michell Cr.	MNRF-NM	LaHave R.	--	6	5	2.5	8,657
Duffins Cr.	Reesor Cr. - Hwy 7	MNRF-NM	LaHave R.	--	6	5	3	10,003
Duffins Cr.	Reesor Cr. - Sideline 34	MNRF-NM	LaHave R.	--	6	5	2.3	10,048
Duffins Cr.	W. Duffins Cr. - Sideline 32	MNRF-NM	LaHave R.	--	6	5	3.6	15,295
Humber R.	Coffey Cr.	Humber R.	Sebago Lk.	--	5	6	0.4	4,175
Humber R.	Coffey Cr. - Finnerty Road	Humber R.	Sebago Lk.	--	5	5	0.3	564
Humber R.	Cold Cr.	Humber R.	Sebago Lk.	--	5	6	0.5	6,400
Atlantic Salmon - Fall Fingerling								
Credit R.	Eldorado Park	MNRF-NM	LaHave R.	--	11	11	48.1	21,059
Duffins Cr.	E. Duffins Cr. - 5th Conc.	MNRF-NM	LaHave R.	--	11	11	57	5,500
Duffins Cr.	E. Duffins Cr. - Paulynn Park	MNRF-NM	LaHave R.	--	11	11	44.6	5,501
Atlantic Salmon - Spring Yearling								
Credit R.	Pt. Credit Hrbr.	MNRF-NM	LaHave R.	AD	6	17	88	530
Credit R.	Pt. Credit Hrbr.	MNRF-NM	LaHave R.	--	5	17	66.5	16,023
Credit R.	Pt. Credit Hrbr.	MNRF-NM	Sebago Lk.	--	4	17	69.4	11,745
Duffins Cr.	Rotary Park Ramp	MNRF-NM	LaHave R.	--	5	17	70.6	19,963
Ganaraska R.	Carscadden Rd.	MNRF-NM	Sebago Lk.	AD	4	17	58	1,028
Ganaraska R.	Ganaraska R.	MNRF-NM	Sebago Lk.	AD	4	17	65.6	985
Ganaraska R.	Hwy 9	MNRF-NM	Sebago Lk.	AD	4	17	65.5	981
Ganaraska R.	Newtonville Rd.	MNRF-NM	Sebago Lk.	AD	4	17	65.6	982
Ganaraska R.	Port Hope - Eldorado Place	MNRF-NM	Sebago Lk.	AD	5	17	73.7	38,183
Ganaraska R.	Quays Branch - 4th Line	MNRF-NM	Sebago Lk.	AD	4	17	61.9	446
Ganaraska R.	Quays Branch - 5th Line	MNRF-NM	Sebago Lk.	AD	4	17	62.1	2,463
Ganaraska R.	Shiloh Rd.	MNRF-NM	Sebago Lk.	AD	3	17	58	1,024
Ganaraska R.	Soper Rd.	MNRF-NM	Sebago Lk.	AD	4	17	58	1,029
Atlantic Salmon - Fall Yearling								
Western Basin	Lakefront Promenade	MNRF-HW	Sebago Lk.	AD	10	23	247.5	2,478
Western Basin	Lakefront Promenade	MNRF-NM	LaHave R.	AD	10	23	238	4,793
Western Basin	Lakefront Promenade	MNRF-NM	Sebago Lk.	AD	10	23	249.6	2,428
Atlantic Salmon - Sub-adult								
Western Basin	Grimsby	MNRF-NM	Sebago Lk.	AD	4	27	747	200
Western Basin	Grimsby	UWO	LaHave R.	--	11	32	250	58
Western Basin	Port Dalhousie East	MNRF-NM	Sebago Lk.	AD	3	26	527	882
Western Basin	Port Dalhousie East	MNRF-NM	Sebago Lk.	--	7	30	986.5	634
Atlantic Salmon - Adult								
Ganaraska R.	Port Hope - Mill St. ramp	MNRF-HW	LaHave R.	--	2	60	2800	637
Western Basin	Port Dalhousie East	MNRF-NM	Sebago Lk.	--	9	56	3360	94

MNRF Fish Culture Stations: CH = Chatsworth, HW = Harwood, NM = Normandale, NB = North Bay, WL = White Lake.
Volunteer and other hatcheries: Belfountain = Belfountain Hatchery, CRAA = Credit River Anglers Association, Islington = Islington Sportsman Club, MEA = Metro East Anglers (Ringwood), SSFC = Sir Sandford Fleming College Hatchery, Springside = Springside Park Hatchery

Table 6.1.4. (cont.) Native fish species stocked into the Ontario waters of Lake Ontario and its tributaries in 2021.

Waterbody	Site	Hatchery	Strain	Marks	Stocking Month	Age (Mos)	Weight (g)	Number
Bloater - Fall Fingerling								
Central Basin	Chub Pt. Road	MNRF-HW	Lk. Michigan	--	7	4	0.4	69,869
Central Basin	Cobourg Hrbr. West	MNRF-HW	Lk. Michigan	--	11	9	2.3	34,871
Central Basin	Cobourg Hrbr. West	MNRF-WL	Lk. Michigan	--	11	7	6.5	8,307
Bloater - Sub-adult								
Central Basin	Cobourg Hrbr. West	MNRF-HW	Lk. Michigan	AD	11	32	67.8	14,464
Central Basin	Cobourg Hrbr. West	MNRF-WL	Lk. Michigan	AD	11	82	86.2	4,822
Bloater - Adult								
Central Basin	Cobourg Hrbr. West	MNRF-CH	Lk. Michigan	AD	11	49	139	20,257
Central Basin	Cobourg Hrbr. West	MNRF-WL	Lk. Michigan	AD	11	43	132.9	2,178
Central Basin	Cobourg Hrbr. West	MNRF-WL	Lk. Michigan	AD	11	76	301.2	125
Lake Trout - Spring Yearling								
Eastern Basin	Amherst Isl. - Big Bar Shoal	MNRF-WL	Seneca Lk.	RPAD	5	16	25	9,800
Eastern Basin	Amherst Isl. - Big Bar Shoal	MNRF-WL	Slate Is.	RPAD	5	17	32	14,058
Eastern Basin	Amherst Isl. - Ferry	MNRF-WL	Seneca Lk.	RPAD	5	16	30	28,800
Eastern Basin	Amherst Isl. - Ferry	MNRF-WL	Slate Is.	RPAD	5	17	34	27,676
Eastern Basin	Long Point	MNRF-WL	Slate Is.	RPAD	5	17	34	22,175
Eastern Basin	Pigeon Isl.	MNRF-HW	Seneca Lk.	RPAD	5	16	48	16,017
Eastern Basin	RP 100	MNRF-WL	Seneca Lk.	RPAD	5	16	30	22,300
Western Basin	Beacon Inn	MNRF-NB	Seneca Lk.	RPAD	5	15	20.4	40,195
Western Basin	Beacon Inn	MNRF-NB	Slate Is.	RPAD	4	15	23.7	40,495
Western Basin	Grimsby - Forty Mile Cr. Park	MNRF-NB	Seneca Lk.	RPAD	5	15	20.4	32,355
Western Basin	Grimsby - Forty Mile Cr. Park	MNRF-NB	Slate Is.	RPAD	4	15	23.7	40,505

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Table 6.1.5. Introduced fish species stocked into the Ontario waters of Lake Ontario and its tributaries in 2021.

Waterbody	Site	Hatchery	Strain	Marks	Stocking Month	Age (Mos)	Weight (g)	Number
Brown Trout - Spring Fingerling								
Eastern Basin	Finkle's Shore Ramp	Springside	Ganaraska R.	--	5	5	2	35,000
Brown Trout - Fall Fingerling								
Central Basin	Frenchman's Bay	MEA-RW	Ganaraska R.	--	11	11	13	20,000
Brown Trout - Spring Yearling								
Central Basin	Athol Bay	MNRF-CH	Ganaraska R.	AD	3	15	42.2	40,262
Western Basin	Bronte Hrbr.	MNRF-CH	Ganaraska R.	AD	3	15	41.5	39,342
Western Basin	Humber Bay Park	MNRF-CH	Ganaraska R.	AD	3	15	42.2	20,155
Western Basin	Lakefront Promenade	MNRF-CH	Ganaraska R.	AD	3	15	41.8	20,127
Western Basin	Port Dalhousie East	MNRF-CH	Ganaraska R.	AD	3	15	42	40,714
Brown Trout - Adult								
Western Basin	Humber Bay Park	MNRF-CH	Ganaraska R.	--	5	77	2360	161
Western Basin	Lakefront Promenade	MNRF-CH	Ganaraska R.	--	5	77	2400	200
Western Basin	Port Dalhousie East	MNRF-CH	Ganaraska R.	--	5	77	2208	197
Chinook Salmon - Spring Fingerling								
Bronte Cr.	4th Side Rd. Bridge	MNRF-NM	Credit R.	--	5	6	4.7	60,041
Central Basin	Bluffer's Park - Netpen	MNRF-NM	Credit R.	--	5	6	7.7	29,910
Central Basin	Oshawa Netpen	MNRF-NM	Credit R.	--	5	6	10.8	18,039
Central Basin	Wellington - Netpen	MNRF-NM	Credit R.	--	5	6	6.9	25,024
Central Basin	Whitby Netpen	MNRF-NM	Credit R.	--	5	6	8.6	18,035
Credit R.	Eldorado Park	MNRF-NM	Credit R.	--	5	6	5.8	80,167
Hamilton Harbour	Grindstone Cr. - Hidden Valley	MNRF-NM	Credit R.	--	5	6	5.8	9,626
Humber R.	Boyd Conservation Area	MNRF-NM	Credit R.	--	5	6	5.8	30,005
Western Basin	Bronte Netpen	MNRF-NM	Credit R.	--	5	6	9.4	10,020
Western Basin	Pt. Credit Netpen	MNRF-NM	Credit R.	--	5	6	8.7	5,042
Western Basin	Pt. Dalhousie Netpen	MNRF-NM	Credit R.	--	5	6	8.1	60,013
Rainbow Trout - Spring Yearling								
Bronte Cr.	2nd Side Rd. Bridge	MNRF-HW	Ganaraska R.	--	5	14	18.8	12,000
Bronte Cr.	2nd Side Rd. Bridge	MNRF-WL	Ganaraska R.	--	5	13	26.5	3,500
Bronte Cr.	4th Side Rd. Bridge	MNRF-HW	Ganaraska R.	--	5	14	18.1	12,050
Bronte Cr.	4th Side Rd. Bridge	MNRF-WL	Ganaraska R.	--	5	13	26.5	3,500
Credit R.	Eldorado Park	MNRF-HW	Ganaraska R.	--	6	15	15	24,936
Credit R.	Huttonville	MNRF-NB	Ganaraska R.	--	5	13	12.4	1,613
Credit R.	Norval	MNRF-HW	Ganaraska R.	--	6	15	15	26,047
Humber R.	E. Branch Islington	MNRF-HW	Ganaraska R.	--	6	15	24	14,999
Humber R.	King Vaughan Line	MNRF-HW	Ganaraska R.	--	6	14	18	16,913
Rouge R.	Morningside Creek	MEA-RW	Ganaraska R.	--	5	12	20	17,000
Western Basin	Port Dalhousie East	MNRF-WL	Ganaraska R.	--	5	13	26.5	31,245
Rainbow Trout - Adult								
Central Basin	Lakeport	MNRF-HW	Ganaraska R.	--	6	74	2000	372

MNRF Fish Culture Stations: CH = Chatsworth, HW = Harwood, NM = Normandale, NB = North Bay, WL = White Lake.
Volunteer and other hatcheries: Belfountain = Belfountain Hatchery, CRAA = Credit River Anglers Association, Islington = Islington Sportsman Club, MEA = Metro East Anglers (Ringwood), SSFC = Sir Sandford Fleming College Hatchery, Springside = Springside Park Hatchery

6.2 Chinook Salmon Net Pen Program

C. Lake, Lake Ontario Management Unit

The stocking net pen is a floating enclosure that is tied to a pier or other near shore structure used to temporarily house and acclimatize young Chinook Salmon prior to their release into Lake Ontario.

The fish are held in the net pen for approximately 4-5 weeks, and are tended by local angler groups who monitor the health of the fish and ensure that the fish are fed and the pens are cleaned regularly. Several of the clubs also use the net pens as an outreach tool, involving their local community during delivery and/or release of the fish. Up to eight net pen sites are located around the lake (Figure 6.2.1), however not every site is necessarily used each year. In 2021, Port Darlington did not participate. The program was not run in 2020 due to COVID-19.

Compared to fish released directly from the hatchery, net pen fish are larger, survive better and may have a greater degree of site fidelity, or imprinting, to the stocking site based on marking experiments con- ducted by the New York Department of Environmental Conservation (NYSDEC). Because of their time in the net pens as young fish, it is expected that sexually mature fish will return to the area and provide a quality near shore fall fishery for anglers. A thorough review of the history of the program was described in the 2014 Annual Report.

A total of 166,083 Chinook Salmon were released from 7 sites (15 net pens, total) in 2021. This represents 48% of the total number (345,922) of Chinook Salmon stocked in the Ontario waters of Lake Ontario in 2021 (Figure 6.2.2). Fish were reared and delivered by MNRF staff at the Normandale Fish Culture Station, and survival and growth was good at all sites.

Fish were delivered at an average size of 3.2g., and kept in the net pens for an average of 32.6 days, gaining an average of 5.4g across all sites. In 2021, volunteers spent a total of 228 days caring and feeding for the penned fish. See Tables 6.2.1 and 6.2.2 for site-specific data on project duration and growth. Long-term trends in pen duration and growth are illustrated in Figures 6.2.3 and 6.2.4, respectively.

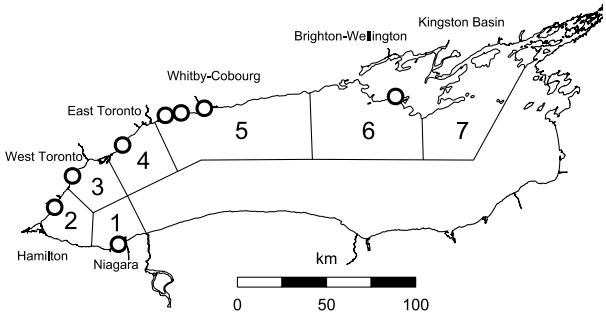

FIG. 6.2.1. Map of Lake Ontario stocking zones and net pen sites.

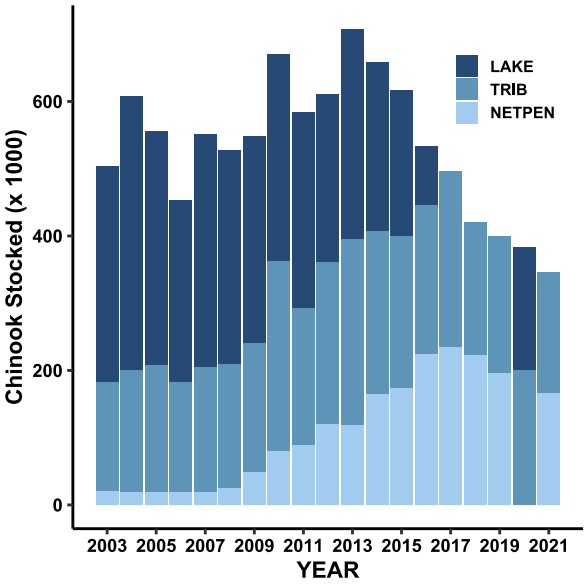

FIG. 6.2.2. Number of Chinook Salmon released from Ontario net pens versus those stocked in tributaries or directly into Lake Ontario.

Table 6.2.1: Pen program fish delivery and release dates.

Site	Group*	Pens	Stocking Date	Release Date	Days
Wellington	CLOSA	2	06-Apr	08-May	33
Oshawa	MEA	2	12-Apr	15-May	34
Whitby	MEA	2	12-Apr	15-May	34
Credit	PCSTA	1	13-Apr	15-May	33
Bronte	HRSTA	1	13-Apr	15-May	33
Bluffers	MEA	3	13-Apr	13-May	31
Dalhousie	SCFGC	4	14-Apr	13-May	30

* CLOSA = Central Lake Ontario Sport Anglers, MEA = Metro East Anglers, PCSTA = Port Credit Salmon and Trout Anglers, HRSTA = Halton Region Salmon and Trout Association, SCFCG = St. Catharines Fish and Game Club

Table 6.2.2. Fish delivery size, growth and total numbers by pen site.

Site	Group	Stocking Size (g)	Release Size (g)	Growth (g)	Number
Credit	PCSTA	3.1	8.7	5.6	5,042
Bronte	HRSTA	3.1	9.4	6.3	10,020
Whitby	MEA	3.3	8.6	5.3	18,035
Oshawa	MEA	3.3	10.8	7.5	18,039
Wellington	CLOSA	3.1	6.9	3.8	25,024
Bluffers	MEA	3.2	7.7	4.5	29,910
Dalhousie	SCFGC	3.2	8.1	4.9	60,013

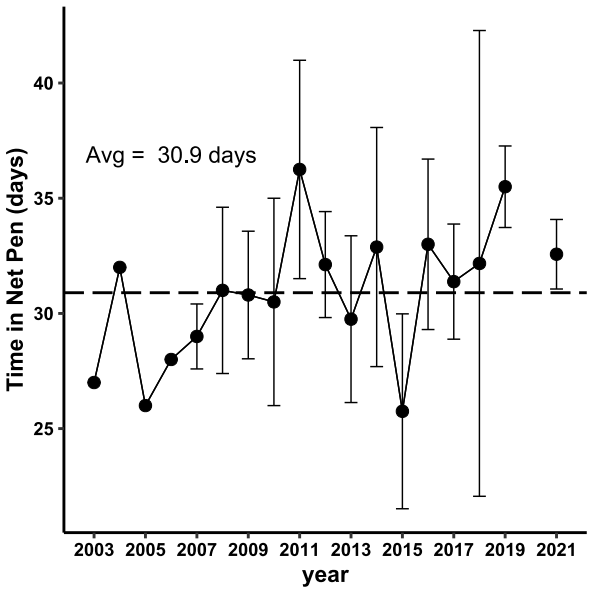

FIG. 6.2.3. Average duration for all years of the stocking net pen program.

For the duration of the time in the net pen, fish health is paramount. To help ensure fish remain healthy, a maximum of 15,000 fish are placed in each net pen, keeping the overall density under the guideline of 32g of fish per litre of water. Net pen sizes have been standardized, and each have a volume of approximately 4,000 litres. Figure 6.2.5 shows the average density of fish (at time of release) in the net pens.

Each site is issued a combination temperature/ dissolved oxygen data logger, allowing the water quality at the various net pen sites to be monitored and compared (see Figure 6.2.6 for temperature; see 6.2.7 for dissolved oxygen).

The loggers are suspended mid-depth inside the net pen, and measurements are recorded every five minutes. This continuous monitoring helps explain differences in growth at the various sites, and can offer some insight in the rare instances when fish health issues occur.

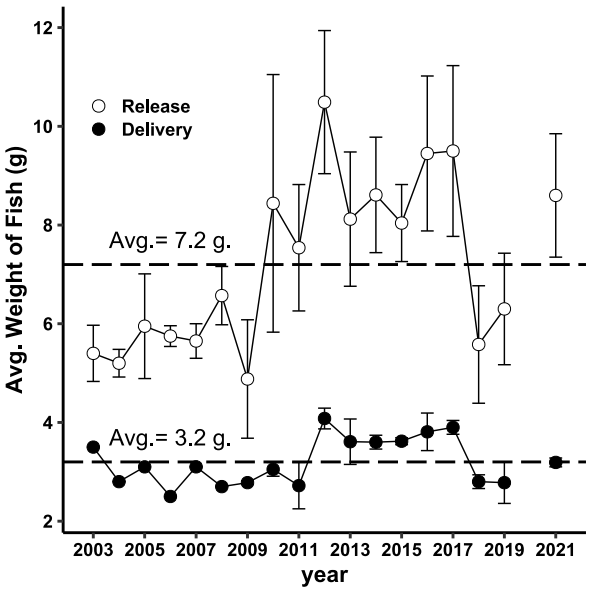

FIG. 6.2.4. Chinook size at delivery and release size for all years of the net pen program.

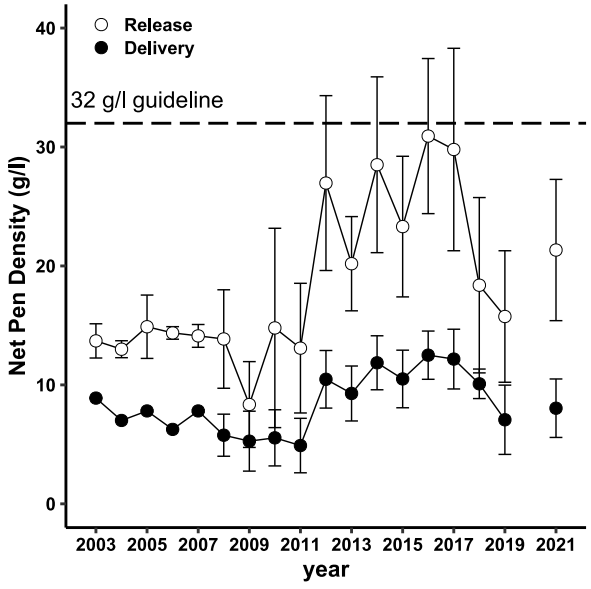

FIG. 6.2.5. Average density (g/l) of Chinook Salmon held per stocking net pen. The guideline is represented by the dashed line.

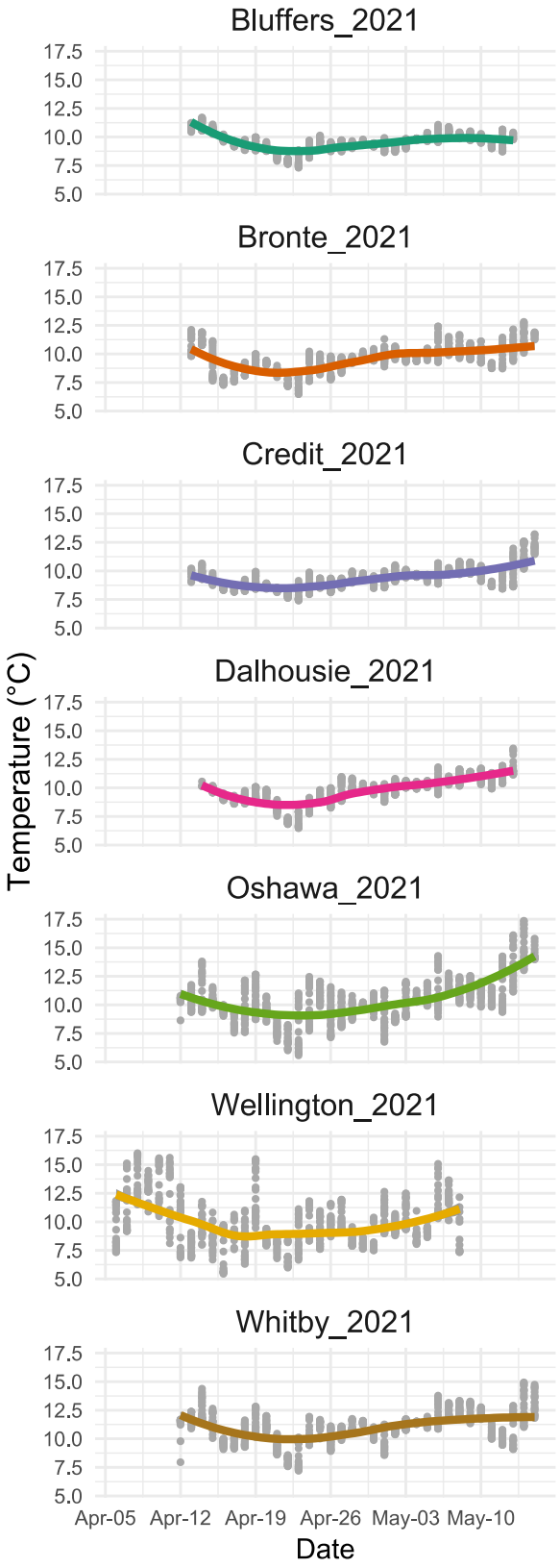

Figure 6.2.6. Temperature data for the net pen program.

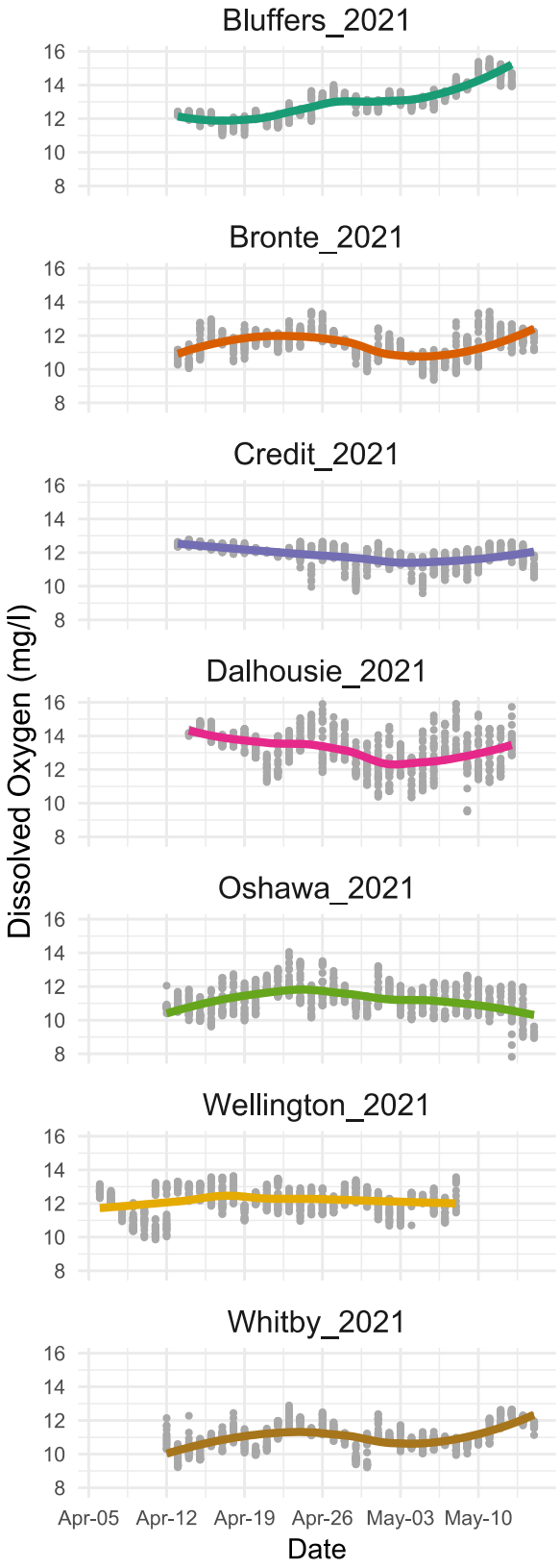

Figure 6.2.7. Dissolved oxygen data for the net pen program.

6.3 Atlantic Salmon Surplus Brood Stock Tagging

C. Lake, Lake Ontario Management Unit

In order to support ongoing stocking efforts, the Ministry of Natural Resources and Forestry maintains Atlantic Salmon 'brood stock' in several provincial fish culture stations. Brood stock are adult (sexually mature) fish that are kept in the hatchery so that their offspring can be raised and released at various life stages.

Once brood stock near the end of their lifespan, the quality of their gametes may decline. Keeping these large fish in a hatchery environment right up to the end of their lives is costly in terms of space and food. It's more efficient to 'retire' these fish a bit early in favour of younger, more productive individuals.

To make the best use of these 'surplus' fish, they were released into Lake Ontario to provide angling opportunities. Fish were tagged near the dorsal fin with a coloured streamer tag labelled with a unique identifying number and phone number printed on it.

In 2021, two locations (Port Dalhousie and Port Hope) were stocked, and recapture reports indicate that these fish can move widely throughout the Lake (Figure 6.3.1).

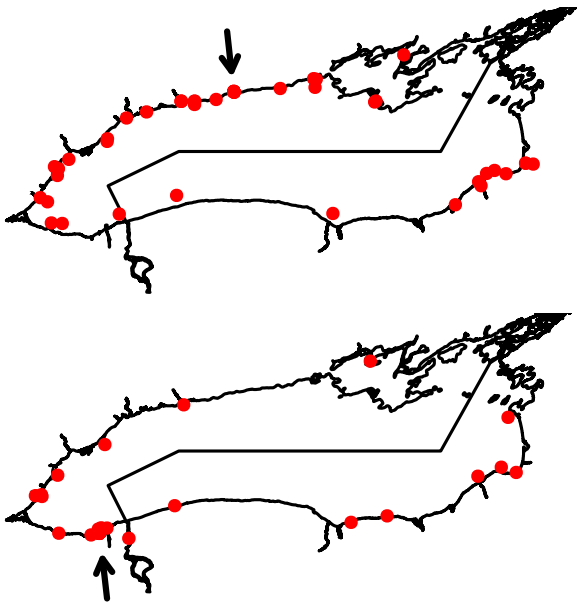

Figure 6.3.1. Recapture locations (n=102) of fish stocked in **2021 only**. Arrows indicate stocking location (top = Port Hope, bottom = Port Dalhousie).

When anglers report catching one of these fish, basic information on movement and survival can be calculated. See Table 6.2.1 for numbers released since the start of the brood retirement project. Numbers caught by year and location are given in Table 6.2.2, and the resulting recapture rate is given in Table 6.2.3. Note that fish may be caught in years subsequent to their stocking year, so recapture values may change in future reports.

Table 6.3.1. Numbers of tagged brood stock Atlantic Salmon stocked by location and year.

Location	2018	2019	2020	2021	Total
Bronte Harbour	196	---	---	---	196
Cobourg Marina	---	556	---	---	556
Grimsby	---	300	---	---	300
Newcastle	---	249	---	---	249
Port Dalhousie	96	164	313	1,081	1,654
Port Hope	---	93	215	600	908
Total	292	1,362	528	1,681	3,863

Table 6.3.2. Numbers of tagged brood stock Atlantic Salmon recaptured by stocking location and year.

Location	2018	2019	2020	2021	Total
Bronte Harbour	6	---	---	---	6
Cobourg Marina	---	24	---	---	24
Grimsby	---	14	---	---	14
Newcastle	---	14	---	---	14
Port Dalhousie	5	13	12	52	82
Port Hope	---	-	10	50	60
Total	11	65	22	102	200

Table 6.3.3. Recapture percentages of tagged brood stock Atlantic Salmon by stocking location and year.

Location	2018	2019	2020	2021	Total
Bronte Harbour	3.1%	---	---	---	3.1%
Cobourg Marina	---	4.3%	---	---	4.3%
Grimsby	---	4.7%	---	---	4.7%
Newcastle	---	5.6%	---	---	5.6%
Port Dalhousie	5.2%	7.9%	3.8%	4.8%	5.0%
Port Hope	---	0.0%	4.6%	8.3%	6.6%
Total	3.8%	4.8%	4.2%	6.1%	5.2%

All project data can be found here - https://geohub.lio.gov.on.ca/datasets/ mnrf::lake-ontario-tagged-atlantic-salmon/about

7. Species Rehabilitation

7.1 Introduction

C. Lake, Lake Ontario Management Unit

Lake Ontario has a long history of fish community changes caused by introduced species (intentionally and unintentionally introduced), 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 community monitoring and sustainable harvest management. 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 American Eel, Bloater and Lake Trout. 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.

7.2 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 LOSLR 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 several 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 as a need in the Ontario Power Generation American Eel Action Plan.

Trap and Transport (T&T) of large yellow eels, in its current form, was initiated in 2008 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 Saint Francis (LSF) are permitted to retain and deliver large, healthy eel incidentally caught during their commercial fishing operations in exchange for payment by Ontario Power Generation (OPG). Eel are then transported and released below the furthest downstream dam in the St Lawrence River 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.

Eel T&T forms part of the current American Eel Implementation Plan developed by 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.

Both spring and fall T&T programs were conducted in 2021, with updated COVID-19 safety measures in place to protect fishers, consultants and staff. In 2021 OPG introduced a limit of 7000 eel for the T&T program (total for spring and fall). Once the limit was reached, T&T operations would cease and eel would no longer be accepted. Spring T&T began on April 6, and transported 2575 large, healthy eel before ending on June 16. Fall T&T transported 4320 eel between when the program started on September 7 and when it ended on October 8. During the 15 weeks of T&T conducted in 2021, at total of 6895 eel were transported to Lac St. Louis downstream of the Beauharnois Generating Station. This represents the second highest number of eel transported by the program since 2008 (Figure 7.2.1). Weights from a random sample of one hundred eel were also measured to help plan an eel tagging and movement study in 2022. Measured eel weights ranged from 1211g to 3105g, with a median of 1832g. 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.

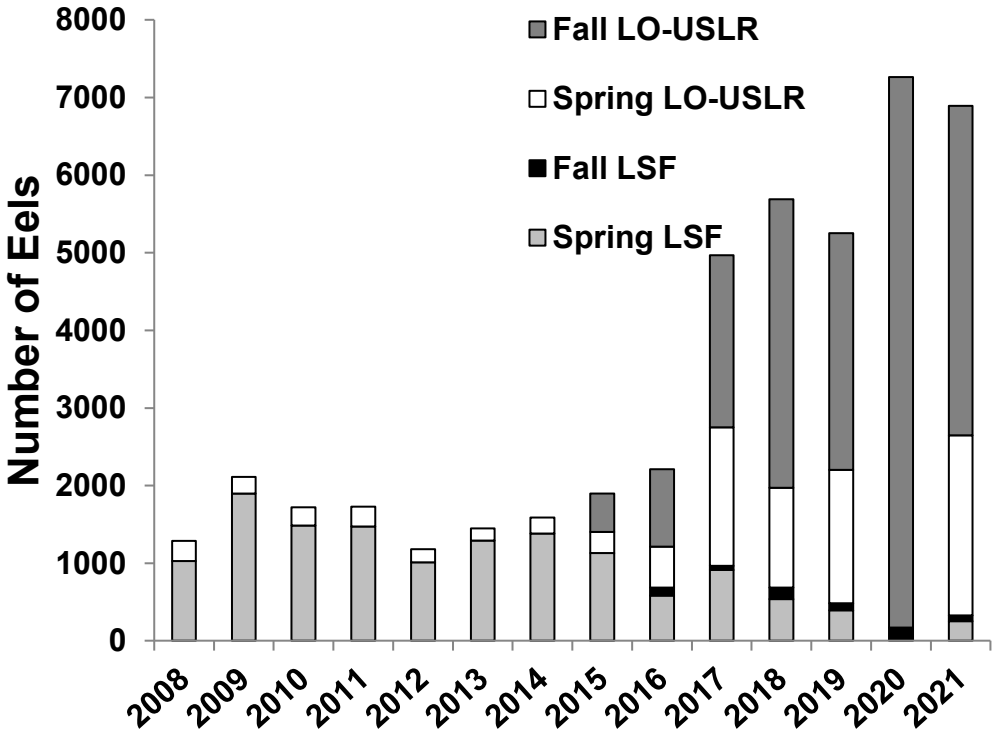

FIG 7.2.1. Total number of eels collected in the Trap and Transport program from 2008-2021. Each total is divided into the locations (Lake St Francis, Lake Ontario-Upper St Lawrence River) at which the eels were captured in commercial fishery nets and the season (Spring and Fall) of collections.

7.3 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 6. No Bloater were caught during the spring and fall bottom trawl surveys (Sections 1.6 and 1.7) conducted in partnership with the USGS and NYSDEC.

7.4 Lake Trout Restoration

J.P. Holden and C. Lake, 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). The spatial extent of those programs in 2020 was limited. In 2021, the scope of these programs increased, however, there were still relatively few main lake gill netting sites visited (Fig.7.4.1).

As a result of the smaller program in 2021, only data for the 'LAKE' catch trend was calculated for 2021 (Fig. 7.4.2). Catches by sampling region are also summarized (Fig. 7.4.3.).

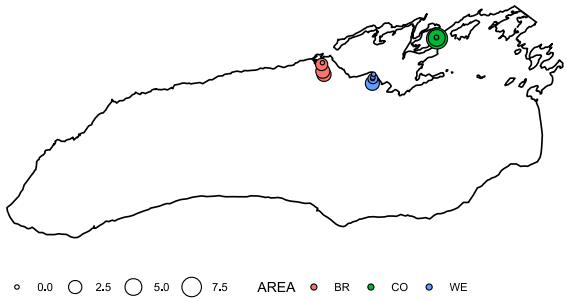

FIG 7.4.1: Main lake gill netting sites in the 2021 Fish Community Index Gill Netting (Section 1.1) program. Points are scaled to Lake Trout catch (N) per 24-hour standard gill net set where the temperature at the net was 15°C or colder.

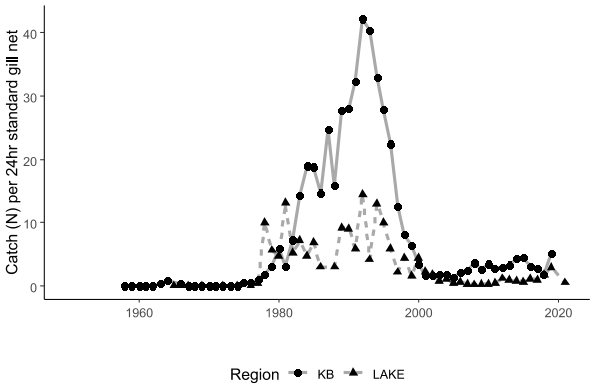

FIG 7.4.2: Main lake gill netting sites in the 2021 Fish Community Index Gill Netting (Section 1.1) program. Points are scaled to Lake Trout catch (N) per 24-hour standard gill net set where the temperature at the net was 15°C or colder.

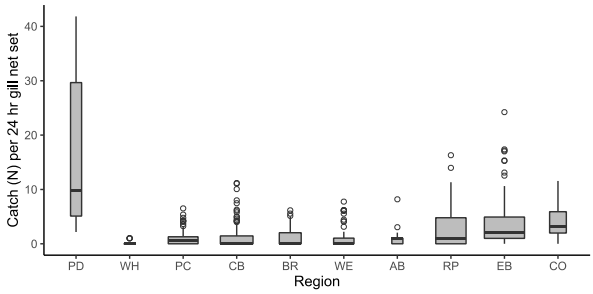

FIG 7.4.3: Relative abundance of Lake Trout captured in the Ontario waters of Lake Ontario from 2015 to 2021 from Fish Community Index Gill Netting (Section 1.1) nets in the main basin fishing in water temperatures 15°C or colder by geographic region (geographic regions sampled in 2021 indicated in Fig. 7.4.1). Box widths are scaled to the relative number of gill nets fished at a site as effort varied between sites. Boxes encompass 50% of the observations (25th to 75th percentile) with the median catch indicated by the solid line. Whiskers indicate 1.5 * the interquartile range and values beyond that range are plotted individually as open circles

8. Research Activities

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

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

Microscopic phytoplankton and zooplankton are essential components of aquatic food webs. Prey fish (e.g., Cisco [*Coregonus artedi*] and Alewife [*Alosa pseudoharengus*]) rely on zooplankton for energy and they in turn provide energy to top consumers (e.g., Chinook Salmon [*Oncorhynchus tshawytscha*] and Walleye [*Sander vitreus*]). Ecological changes, such as invasive species and nutrient reductions, can rapidly impact lower trophic levels with impacts extending from the bottom up to top consumers. Therefore, continued monitoring of lower trophic positions and the factors that impact them is essential for fisheries management.

Valuable long-term data about lower trophic positions in Lake Ontario is collected through the Station 81 program. Sampling was conducted at Station 81 from 1981 – 1995 by Fisheries and Oceans Canada (DFO). Sampling resumed in 2007 as a partnership between NDMNRF's Aquatic Research and Monitoring Section, NDMNRF's Lake Ontario Management Unit, and DFO. Two additional sampling locations were added in 2017 (T4L and NYSDEC) to understand spatial differences in lake conditions. All three sampling locations are in eastern Lake Ontario (Fig. 8.1.1). Station 81 is near the centre of the Kingston Basin (44° 01.02'N, 76° 40.23'W) in approximately 34 m water depth. T4L is located west of the Duck-Galloo Ridge in 57 m of water, just outside the eastern basin (43° 49.67'N, 76° 41.68'W). The NYSDEC site is in the St. Lawrence Channel (43° 55.20'N, 76° 31.00'W) in 53 m of water.

In 2021, the Station 81 site was sampled biweekly, between May 4th and November 4th. The T4L and NYSDEC sites were not sampled due to COVID-19 related constraints. During each site visit, the lake's physical properties were determined, including temperature, amount of dissolved oxygen, and Secchi disk depth (an index of water clarity). Samples of phytoplankton and zooplankton were collected to determine species composition and biomass. Water samples were also collected to determine phosphorus and nitrogen (nutrient) concentrations.

Phosphorus is an important plant nutrient

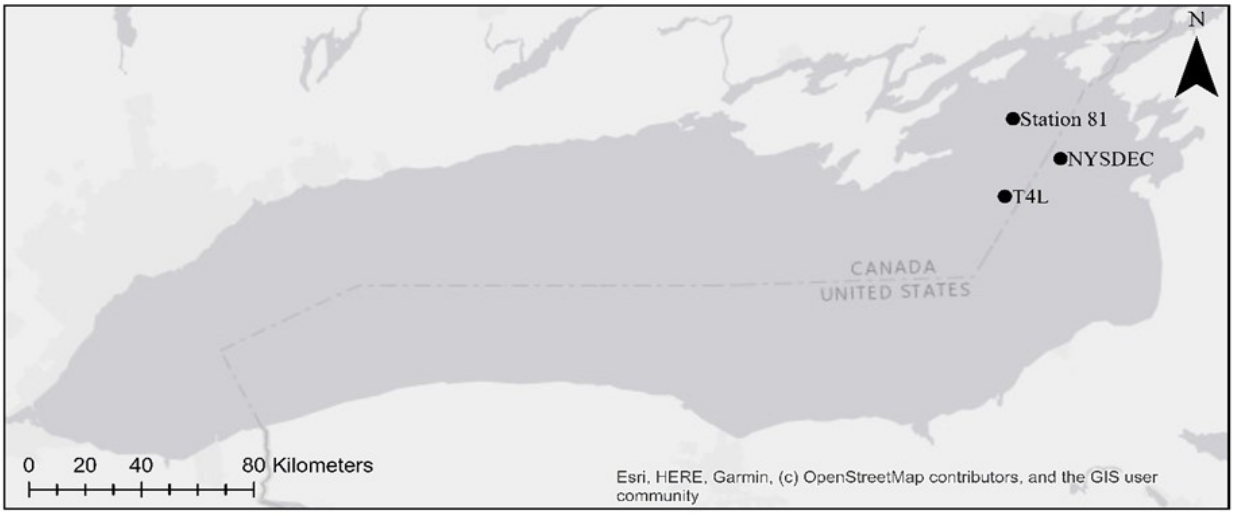

FIG. 8.1.1. Map of Lake Ontario showing the location of the three sites sampled as part of the Station 81 program.

that often limits primary productivity (phytoplankton and algae growth) in aquatic systems. Too much phosphorus can cause harmful algal blooms and anoxic (low oxygen) conditions that harm fish. In response to high phosphorus concentrations in the late 1970s, binational efforts were initiated to reduce phosphorous loading in the Great Lakes. The target of 10 µg/L of total phosphorus and 2.6 µg/L of Chlorophyll *a* (a measure of phytoplankton biomass) were established for Lake Ontario. The average spring total phosphorous level declined through the 1980s and early 1990s and has been variable during the recent time period (i.e., the past 15 years; Fig. 8.1.2). Average spring Chlorophyll *a* in the recent time period is less than in the 1980s and 1990s and is now at or below target concentrations (Fig 8.1.2). Consistent with reduced productivity, Secchi disk depth (water clarity) is greater in the recent time period (Fig 8.1.2).

When the Station 81 program resumed in 2007, we identified dramatic declines in zooplankton abundance and a change in the community composition relative to 1981-1995. This change was due in part to the invasion of dreissenid (Zebra and Quagga, *Dreissena bugensis* and *Dreissena polymorpha*) mussels. Monitoring has also identified more recent changes. Zooplankton biomass, averaged across the May to October field season, recovered in 2019 to levels more typically seen between 2010 and 2015 (Fig 8.1.3A). Much of this 2019 recovery was due to calanoid biomass (an order of copepods, a group of zooplankton arthropods). Examining zooplankton on a seasonal basis revealed additional trends (Fig 8.1.3B). In the spring, the community was dominated by copepods (calanoids and cyclopoids) and the overall biomass was low (generally <10 mg/m^3). Summer biomass was comprised of a mixture of taxa, including invasive predatory cladocerans (*Cercopagis pengoi* and *Bythotrephes longimanus*) and veligers ('baby' Zebra and Quagga Mussels). In 2019, the mean summer zooplankton biomass reached 36.5 mg/m^3, the highest level since 2012, but dropped to more moderate levels (23.0 mg/m^3) in 2020. Fall zooplankton biomass generally declined since 2015, ranging between 8 and 18 mg/m^3. In fall 2019 and 2020, there were few cladocerans present. In contrast, fall veliger biomass was higher in 2020 than the previous five years.

Station 81 is a long-term monitoring program that provides valuable information about the composition and health of the base of Lake Ontario's food web. Continued maintenance and analysis of these long-term datasets will ensure that resource managers are best equipped to identify and respond to changes that may impact Lake Ontario's ecosystem and fisheries.

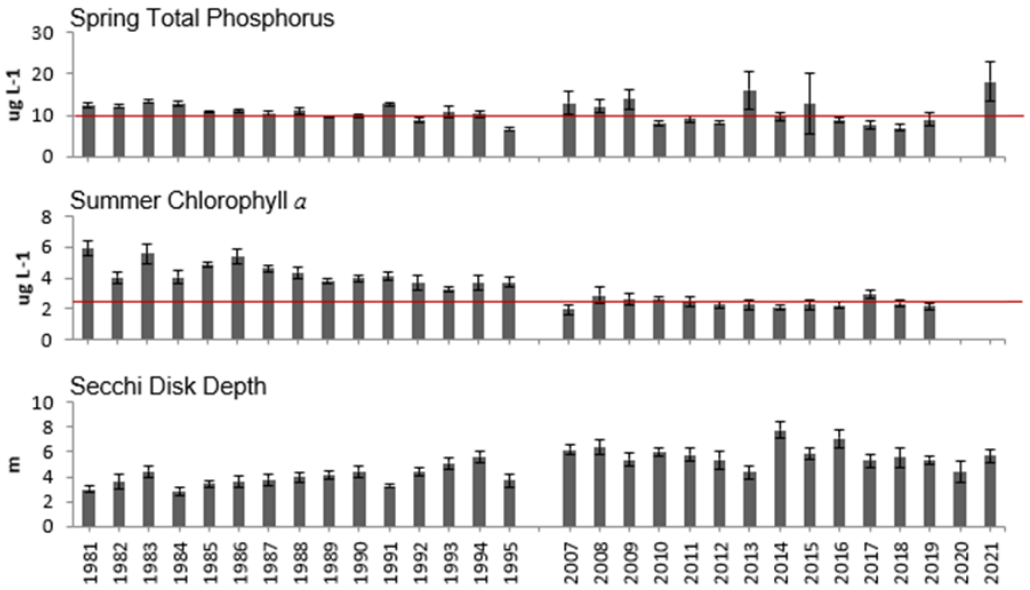

FIG. 8.1.2. Spring total phosphorous (µg/L), summer Chlorophyll a (µg/L), and Secchi disk depth (m) averaged across sampling trips at Station 81 (mean ± SE). Spring is early May to late June and summer is late June to late September. Red solid horizontal lines are the total phosphorus and Chlorophyll a target levels.

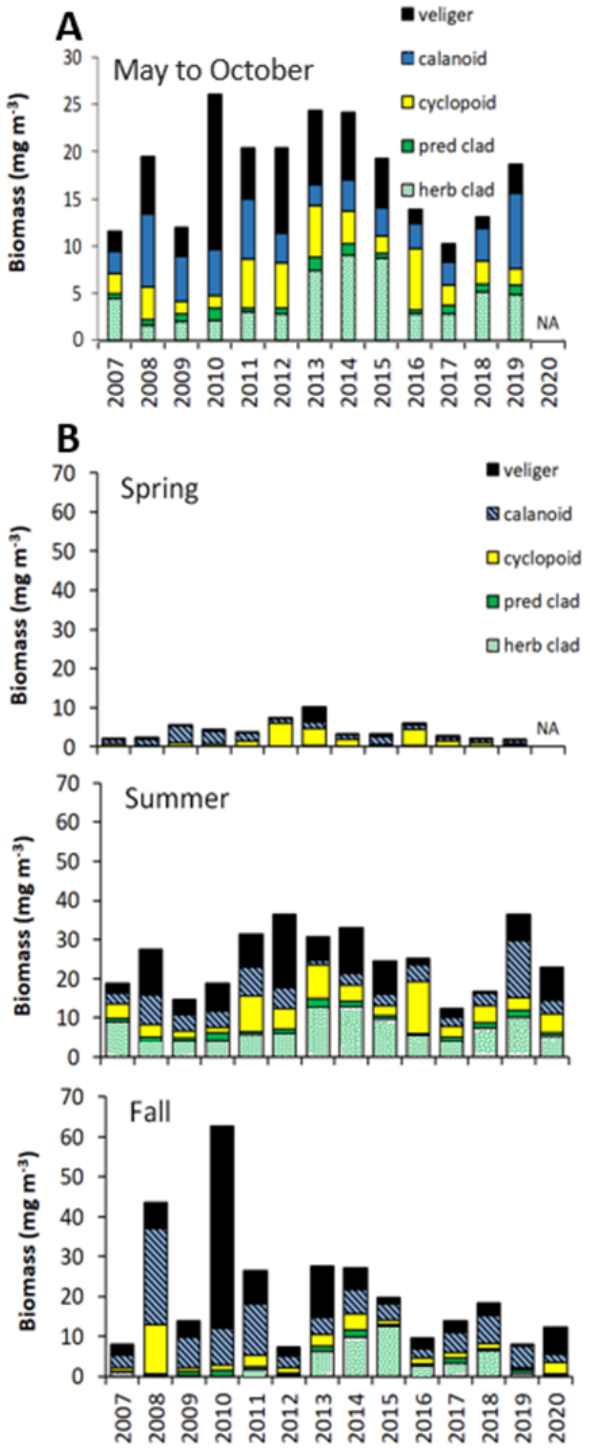

FIG. 8.1.3: Biomass of zooplankton taxa at Station 81 as an average over the May - Oct. field season (A) or divided by season (B). Spring is late April to mid-June; summer is mid-June to mid-Sept.; fall is mid-September to early Nov. The 2020 May - Oct. and spring averages are not available as samples were not collected in May and June due to COVID-19 restrictions.

8.2 Spatial and seasonal variability in the trophic relationships of two important invertebrate taxa, their carbon sources, and trophic positions in Lake Ontario

Project Leads: Donald Uzarski and Aaron Fisk (Great Lakes Institute for Environmental Research, University of Windsor); Tim Johnson (Aquatic Research and Monitoring Section, OMNDMNRF)
Collaborators: Brian O'Malley and Brian Weidel (Great Lakes Science Center, U.S. Geological Survey); Sarah Larocque (Great Lakes Laboratory for Fisheries and Aquatic Sciences, DFO)

Mysis (Mysis diluviana) and dreissenid mussels (Zebra [*Dreissena polymorpha*] and Quagga [*Dreissena bugensis*] Mussels) are two important invertebrate taxa in the food webs of the Great Lakes but there are uncertainties about the seasonal and spatial variability of their role in the ecosystem. To address this, we quantified $\delta^{13}C$, a metric identifying the source of food, and $\delta^{15}N$, a metric of the organism's trophic position in the food web, in these species across five spatial regions and three seasons in Lake Ontario. Particulate organic matter (POM, tiny living and dead matter that fuels the base of the food web) was also analysed across site depth and season from one ecoregion for use as an isotopic baseline for comparison.

Fatty tissues can affect $\delta^{13}C$, misrepresenting the carbon source of an organism. To remove this bias, we developed lipid normalization models for each taxon. The models we developed for *Mysis* and dreissenids better estimated lipid corrected $\delta^{13}C$ than previously published models developed for other taxa or marine invertebrates. The use of these models will improve Great Lakes interpretation of stable isotope analyses for these important freshwater invertebrates.

Much of the spatial and seasonal variation seen in *Mysis* and dreissenid stable isotope values was explained by variation in baseline POM. Variation in POM is attributed to variation in inorganic carbon and nitrogen, and phytoplanktonic succession through season, depth, and ecoregion. *Mysis* $\delta^{13}C$ was most affected by site depth and ecoregion, while $\delta^{15}N$ decreased across season (Fig 8.2.1). Dreissenid stable isotopes varied significantly between ecoregion, season, and site depth, with $\delta^{15}N$ increasing significantly with site depth. The diet of *Mysis* was more pelagic (offshore, in the water column) compared to dreissenids based on $\delta^{13}C$ with highest $\delta^{13}C$ in the Deep Hole ecoregion compared to the rest of the lake. Trends in *Mysis* stable isotopes deviated little from the baseline, while dreissenids showed more variation, demonstrating the importance of collected isotopic baselines appropriate to the pelagic or benthic pathways.

These results provide important insights into the food web dynamics at the base of the food web. Understanding what is happening at the base of the food web is critical to understand factors influencing production of higher trophic levels such as fishes.

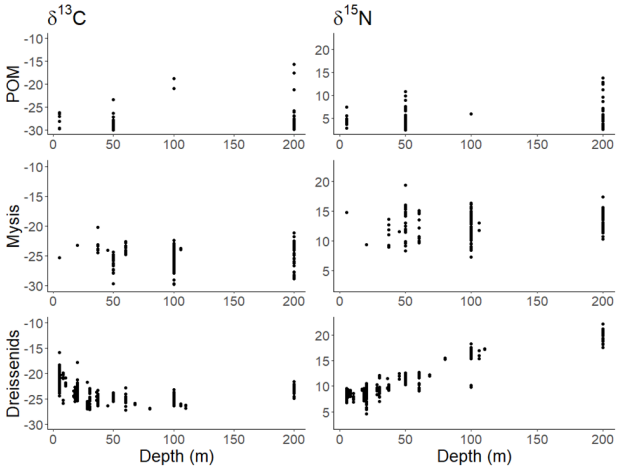

FIG. 8.2.1: POM, *Mysis diluviana*, and dreissenid lipid normalized $\delta^{13}C$ and $\delta^{15}N$ by site depth across all seasons and ecoregions in Lake Ontario in 2012 and 2013.

8.3 Reducing the spread of aquatic invasive species: assessing the efficacy of decontamination methods recommended for recreational watercraft

Project Leads: Shrisha Mohit and Shelley Arnott (Queen's University); Tim Johnson (Aquatic Research and Monitoring Section, OMNDMNRF)
Collaborators: Jeff Brinsmead (Biodiversity and Invasive Species Section, OMNDMNRF)

The spread of aquatic invasive species (AIS) is a threat to the biodiversity of invaded environments and the services derived from these ecosystems. It is well-known that human activities have largely facilitated the spread of AIS to new environments. Recreational boating activities enable the overland dispersal of AIS among disconnected lakes, as invertebrates and plants can become attached to, caught on, or carried within watercraft and equipment used in invaded waterbodies. As AIS can survive transport between waterbodies on fouled watercraft, numerous resource management agencies worldwide recommend decontaminating boats and equipment by washing them at high pressure, rinsing with hot water, or air-drying all parts for up to seven days to reduce or prevent this means of spreading AIS among lakes. However, there is a lack of studies assessing the efficacy of these recommended decontamination methods, and a consideration of the ease of implementation for recreational boaters, under realistic conditions. Hence, we conducted experiments addressing this knowledge gap using AIS present in Ontario, namely Zebra Mussels (*Dreissena polymorpha*), Banded Mystery Snails (*Viviparus georgianus*), Spiny Waterfleas (*Bythotrephes cederstroemi*), Eurasian Watermilfoil (*Myriophyllum spicatum*), Carolina Fanwort (*Cabomba caroliniana*), and European Frogbit (*Hydrocharis morsus-ranae*).

Pressure washing: Using commercially available pressure washers, we found that washing surfaces at high pressures of 900 psi to 1200 psi removed the maximum amount of biological material (90%) from surfaces, whereas higher pressure (approximately 2000 psi) did not produce better results.

Hot water: We exposed specimens from each species to a range of water temperatures for brief durations replicating rinsing time. Our results showed that exposure for 2 seconds to 10 seconds to water at a minimum of 60°C caused almost 100% mortality among all species tested, except Banded Mystery Snails which required water at 65°C and above. We also acclimated groups of Zebra Mussels, Banded Mystery Snails, and Eurasian Watermilfoil to temperatures ranging from 15°C to 30°C, replicating seasonal variation in environmental temperatures during the boating season, to determine if acclimation temperature affects their resistance to decontamination by hot water. We found that acclimation before hot water exposure had little effect on the minimum hot water temperature required for no survival.

Air-drying: Both invertebrate and plant specimens were allowed to air-dry outdoors for durations from hours to over a week to simulate an air-drying decontamination protocol. Air-drying durations of at least 60 hours for Zebra Mussels and Spiny Waterfleas, and at least 6 days among aquatic plants were required to produce complete mortality, whereas survival remained high among snails after a week of air-drying.

Combining treatments: We exposed invertebrate and plant specimens to hot water (25°C to 70°C for 5 seconds) before allowing them to air-dry (3 hours to 5 days). Sequentially applying these two decontamination methods proved to be more effective than either method separately against all species tested, reducing either the minimum water temperature or the air-drying duration necessary for no survival.

The findings from our experiments are valuable as they could inform management strategies to mitigate the spread of AIS. Although individual methods can be effective, unsafe and impractical water temperatures or air-drying durations may often be required for resistant species such as banded mystery snails. As our study has shown that different species exhibit different tolerances to decontamination methods, and that combining methods should improve decontamination efficacy by lowering temperatures and exposure durations, we believe that the best approach is to sequentially implement

several simple measures that utilize tools and resources available to recreational boaters (Fig. 8.3.1).

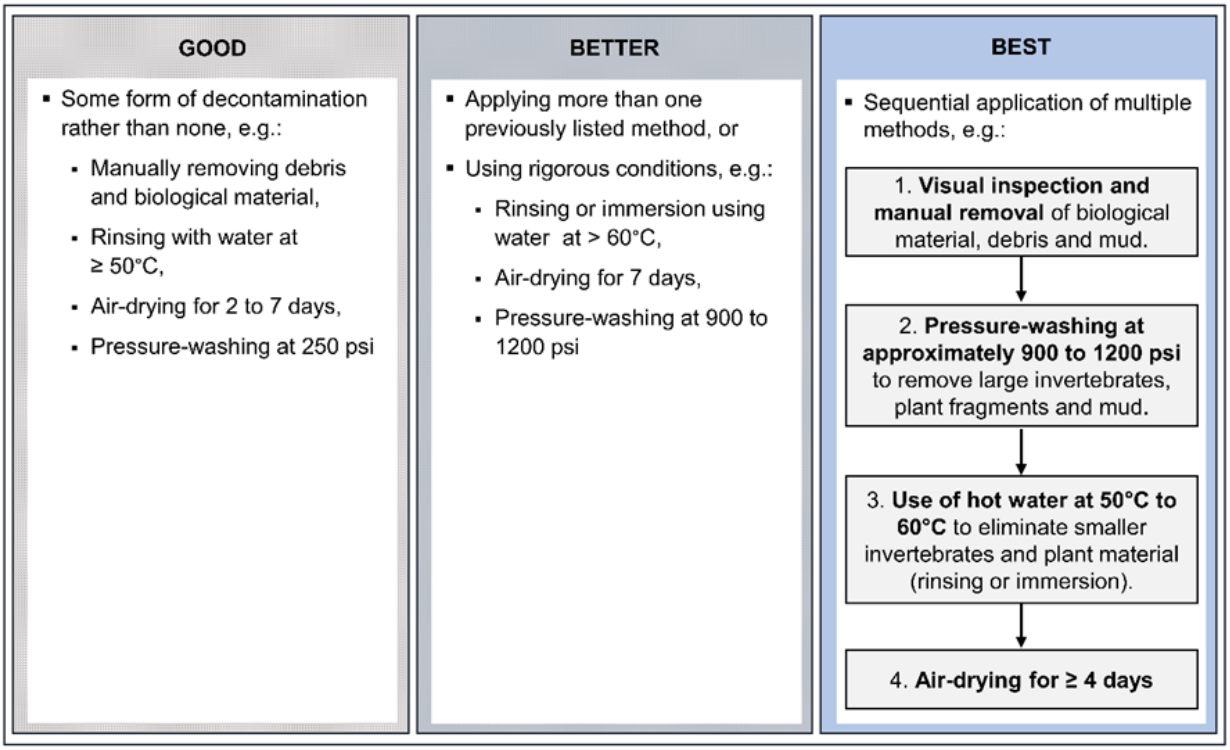

FIG. 8.3.1: Potential approaches to the implementation of decontamination methods with good, better, and best efficacy in reducing the number of viable specimens of aquatic invasive species.

8.4 Assessing post-release behaviour of stocked bloater (Coregonus hoyi) within Lake Ontario using acoustic telemetry

Project Leads: Adam Rupnik, Emma Bloomfield, and Tim Johnson (Aquatic Research and Monitoring Section, OMNDMNRF); Matt Brailey, Justin Chan, Tim Drew, Kevin Loftus, Kyle Reynolds, Brian Rosborough, Amanda Ross, Jenny Smith, Chris Weaver, Chris Wilson, and Tim Drew (Fish Culture Section, OMNDMNRF)

Bloater (*Coregonus hoyi*) is a planktivorous, pelagic fish native to Lake Ontario that inhabit the deep, offshore sections of the lake. This fish was historically abundant, but experienced significant population decline by the 1950s and were extirpated (locally extinct) by 1984. Bloater is a valuable prey species for many of Lake Ontario's top predators, and as such, the goal of re-establishing a self-sustaining population has been a binational effort between the Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry (OMNDMNRF), 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). Bloater reintroduction began in 2012 and has continued through annual stocking of reared individuals.

Between November 8th and 10th, 2021, approximately 32,000 Bloater aged two to four were released off the west breakwall of the Cobourg marina (43.9525°N 78.1683°W). Sixty of these fish were acoustically tagged (20 in each of the 2017, 2018, and 2019 year-classes). Half of these fish (tagged and untagged) were released during the day (November 8th at approximately 14:00) and the other half at night (November 9th at approximately 19:00). Ten 69kHz acoustic receivers were deployed in proximity to the release site to monitor post-release behaviour. Nine of the ten receivers were deployed prior to release, while one was deployed for approximately one hour at each release event and site. A receiver was also deployed at the release site for approximately one hour on December 1st (two weeks post-release). Receivers were deployed approximately two to three kilometers away from the release site in two concentric semi-circles (shore to shore) providing detection coverage around the entire release area.

Of the 60 tagged bloater, 49 were detected following release (Fig. 8.4.1). It was not unusual for tags to be missed on the release receiver due to a combination of increased noise from stocking, physical barriers to detection (stocked fish), as well as tag signal collisions (a large number of tags all transmitting signals concurrently and interfering with the reception of each other). However, it is worth noting that these 11 undetected tags were also not detected on any of the offshore receivers within the first two weeks

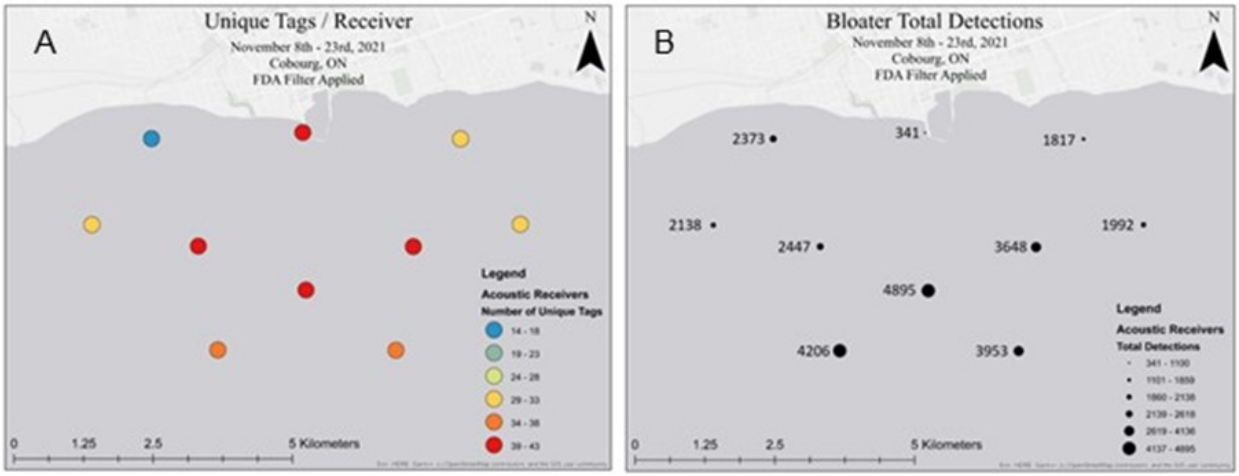

FIG. 8.4.1: Number of unique tags detected per receiver (A) and total number of detections of Bloater (Coregonus hoyi) per receiver (B) following release on November 8-9, 2021. Both day and night releases are pooled.

post-release. When a receiver was deployed at the release site on December 1st, three fish that had previously been detected on offshore receivers were detected but no others (i.e., no tags that may have been associated with mortality at the release point). This suggests the majority of the tagged bloater survived past the initial release although the fate of the 11 undetected fish remains a mystery.

A total of 22 (of 30) daytime and 25 (of 30) nighttime released Bloater were detected on offshore acoustic receivers. Two Bloater could not be assigned to a release category (day or night) as they weren't detected until approximately one-week post-release. Anecdotal observations suggest the daytime release group moved deeper in the water column (likely to avoid avian predators and to find darker habitat) while the nighttime release group were still present (visible) swimming along the armour stone approximately 40 minutes post-release.

Average time to first detection outside the release receiver was faster for the daytime release (0.77 hours) than the night release (2.90 hours) suggesting the day release group dispersed much quicker than those fish released at night. Based on detection times and receiver distance, Bloater appeared to move at a rate of approximately 1 km/h when orienting to their novel environment. The daytime release group were detected on eight of the nine receivers within one hour, while those released at night were only detected on two of the nine receivers within the first hour, suggesting more rapid, widespread movement of the day release group.

The directionality of movement was also different between day and night release groups. Both groups seemed to favour the offshore receivers south of the release site (i.e., straightest access to deep water). However, the day release group was detected more uniformly throughout the array, while the night release group appeared to orient more quickly in moving in an offshore direction (Fig. 8.4.2). There were no apparent differences in the short-term dispersal between year classes.

After 48 hours post-release, most Bloater had effectively dispersed from the receiver array (Fig. 8.4.3). However, four fish were detected on November 23rd (two weeks post-release) and three fish were detected on the release receiver while monitoring on December 1st. The fish detected on December 1st were different individuals than those detected on the November 23rd, suggesting Bloater were initially moving outside of the detection array, though some may have remained in the general area in close proximity to shore. All the Bloater detected after November 15th (7 days post release) were from the nighttime stocking event.

Restoring a self-sustaining population of Bloater to Lake Ontario will help to increase the diversity of prey available to the predator fish community, reduce the impacts of thiaminase deficiency in top predators caused by other prey species (Alewife [*Alosa pseudoharengus*], Rainbow Smelt [*Osmerus mordax*]), and improve the strength and resilience of the Lake Ontario ecosystem.

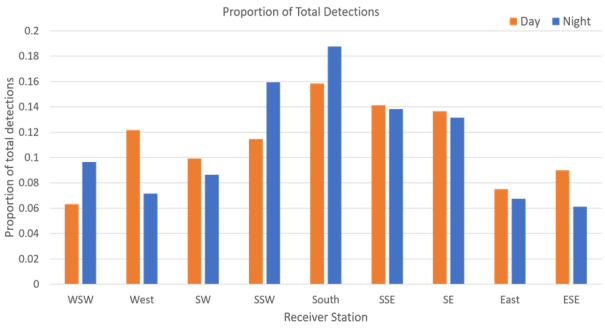

FIG. 8.4.2: Proportion of detections of acoustically tagged Bloater (Coregonus hoyi) during the first 12 hours post release, for fish released during the daytime and nighttime at Cobourg Nov 8-9, 2021.

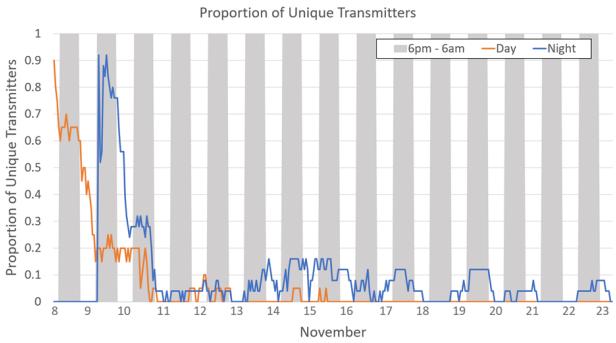

FIG. 8.4.3: Proportion of unique tags by date for daytime and nighttime release groups of Bloater (Coregonus hoyi) at Cobourg, November 8-23, 2021.

8.5 Inter-basin movement of fish revealed by acoustic telemetry

Project Leads: Adam Rupnik and Tim Johnson (Aquatic Research and Monitoring Section, OMNDMNRF); Aaron Fisk (Great Lakes Institute for Environmental Research, University of Windsor)
Collaborators: Jon Midwood and Sarah Larocque (Fisheries and Oceans Canada); Mike Connerton (New York State Department of Environmental Conservation); Silviya Ivanova (Great Lakes Institute for Environmental Research, University of Windsor); Dimitry Gorsky (U.S. Fish and Wildlife Service); Bruce Tufts (Queen's University); Erin Brown and Jake La Rose (Lake Ontario Management Unit, OMNDMNRF); Scott Minihkeim (U.S. Geological Survey)

The use of acoustic telemetry to understand the movement and behaviour of fishes is a rapidly growing practice among researchers in the Great Lakes. The number of acoustic receivers deployed throughout Lake Ontario increased to ~435 in 2021 and now covers virtually the entire lake. Visibly, the greatest change in 2021 was the addition of 31 offshore receivers in the central portion of the lake, connecting the pre-existing offshore receiver arrays on the east and west ends. By increasing the connectivity of these receiver networks, investigators will benefit from the more complete offshore coverage documenting year-round movements of tagged fish.

A subset of the lake-wide receiver network is associated with the LOIBM (Lake Ontario Inter-basin Movement) array. Initially deployed in August 2018, near Point Petre, Prince Edward County, this array consists of two parallel lines of receivers extending from ~5 m to 105 m depth. These 29 receivers (14 VR2AR and 15 VR2W) and four V9 (69kHz) alternating sentinel test tags were designed to identify species-specific seasonal depth corridors, with the sentinel tags providing continuous shallow- and deep-water detection efficiency estimates. A somewhat differently configured double line of receivers runs from Point Traverse (ON) to Southwick Beach (NY), with additional receivers deployed on a 7.5 km square grid between these two linear arrays. This report summarises fish detections on this subset of the Lake Ontario GLATOS array (glatos.glos.us).

Between 2018 and 2021, this subset of Lake Ontario receivers detected 13 different species (of 27 species that have been tagged in Lake Ontario since 2010), and 358 unique individuals. The species most often detected were Lake Trout (*Salvelinus namaycush;* 138 individuals and 59% of the total detections), Lake Whitefish (*Coregonus clupeaformis*; 18 individuals, 23% of detections), and Walleye (*Sander vitreus*; 89 individuals, 11% of detections). Other species detected included Bloater (*Coregonus hoyi*; 33 individuals), Chinook Salmon (*Oncorhynchus tshawytscha*; 25 individuals), American Eel (*Anguilla rostrata*; 16 individuals), Rainbow Trout (*Oncorhynchus mykiss*; 13 individuals), Cisco (*Coregonus artedi*; 11 individuals), Brown Trout (*Salmo trutta*; 4 individuals), Lake Sturgeon (*Acipenser fulvescens*; 4 individual), Smallmouth Bass (*Micropterus dolomieu*; 3 individual), Atlantic Salmon (*Salmo salar*; 2 individuals) and Coho Salmon (*Oncorhynchus kisutch*; 2 individuals) that collectively generated 7% of the detections.

Total detections per receiver were mapped to view areas with higher concentrations of transmitter activity (Fig. 8.5.1). To avoid biases associated with differences in deployment dates within the expanded array, only detections from 2020 – 2021 were investigated. The majority of detections were situated midway along the Duck-Galloo line. This apparent "offshore" corridor may be associated with fish orienting to the St. Lawrence trench – the deep underwater river valley that crosses this otherwise "shallow" (20m deep) ridge between the eastern basin and the main basin of Lake Ontario. Recent research has shown the St. Lawrence trench is the primary route of access for Lake Trout moving from the deep, main basin to spawning grounds in the eastern basin in the fall. In contrast, the highest density of detections occurred closer to shore along the LOIBM double line south of Point Petre. Not surprisingly, this different pattern is attributed to different species – predominantly Lake Whitefish that aggregate along the south shore of Prince Edward County to spawn, and seasonal

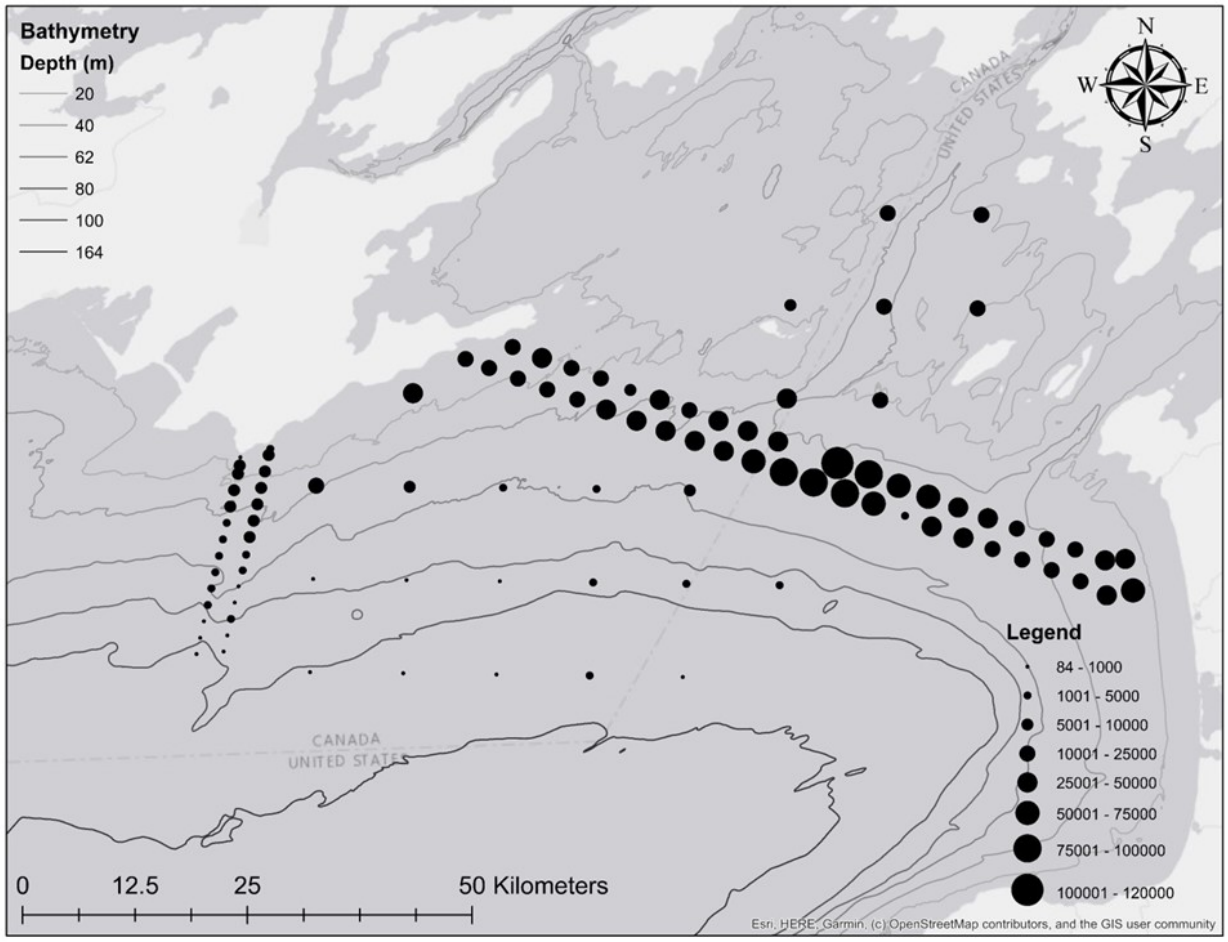

FIG. 8.5.1: Total fish detections per receiver on LOIBM and LODWC array receivers in Lake Ontario between June 2020 and July 2021.

Walleye movements between the eastern and main basins. Fewer detections were reported on receivers >60 m; however, tagged fish were detected on all receivers currently deployed.

Fish distribution by receiver depth was calculated for each species and compared across thermal seasons (Winter Isothermal: Jan 1st – April 30th; Spring Warming: May 1st – June 30th; Summer Stratified: July 1st – Nov 1st; Autumn Cooling: Nov 2nd – Dec 31st). It is important to remember these distributions are for the lake depth where the receiver was located, and not the depth of the fish within the water column. Further, only the receivers along the Point Petre double line array were used for this analysis to eliminate any biases associated with uneven depth distributions of receivers. Results are for all detections from 2018 through 2021.

Salmonid species were most frequently detected on receivers in deeper water (>45 m) with the exception of Brown Trout, which had a shallower average receiver depth of 17 m (SD = 12 m). Walleye were detected most frequently between August and December on receivers at an average depth of 33 m (SD = 24 m). Smallmouth Bass were primarily detected in shallow waters at an average depth of 10 m (SD = 6 m). Coregonids (Bloater, Cisco, Lake Whitefish) were detected primarily in late fall, likely seeking out spawning habitat as the lake cooled, but also infrequently in early spring with a combined average depth of 24 m (SD = 15 m).

As the thermal structure of the lake changed seasonally, so did the depth ranges in which fish were detected (Fig. 8.5.2). Walleye and Lake Trout occupied slightly shallower waters between January and June but moved into deeper waters for the latter part of the year. Lake Whitefish occupied deeper water during the isothermal months (Jan 1st – April 30th) but moved into shallow waters during the spring warming season

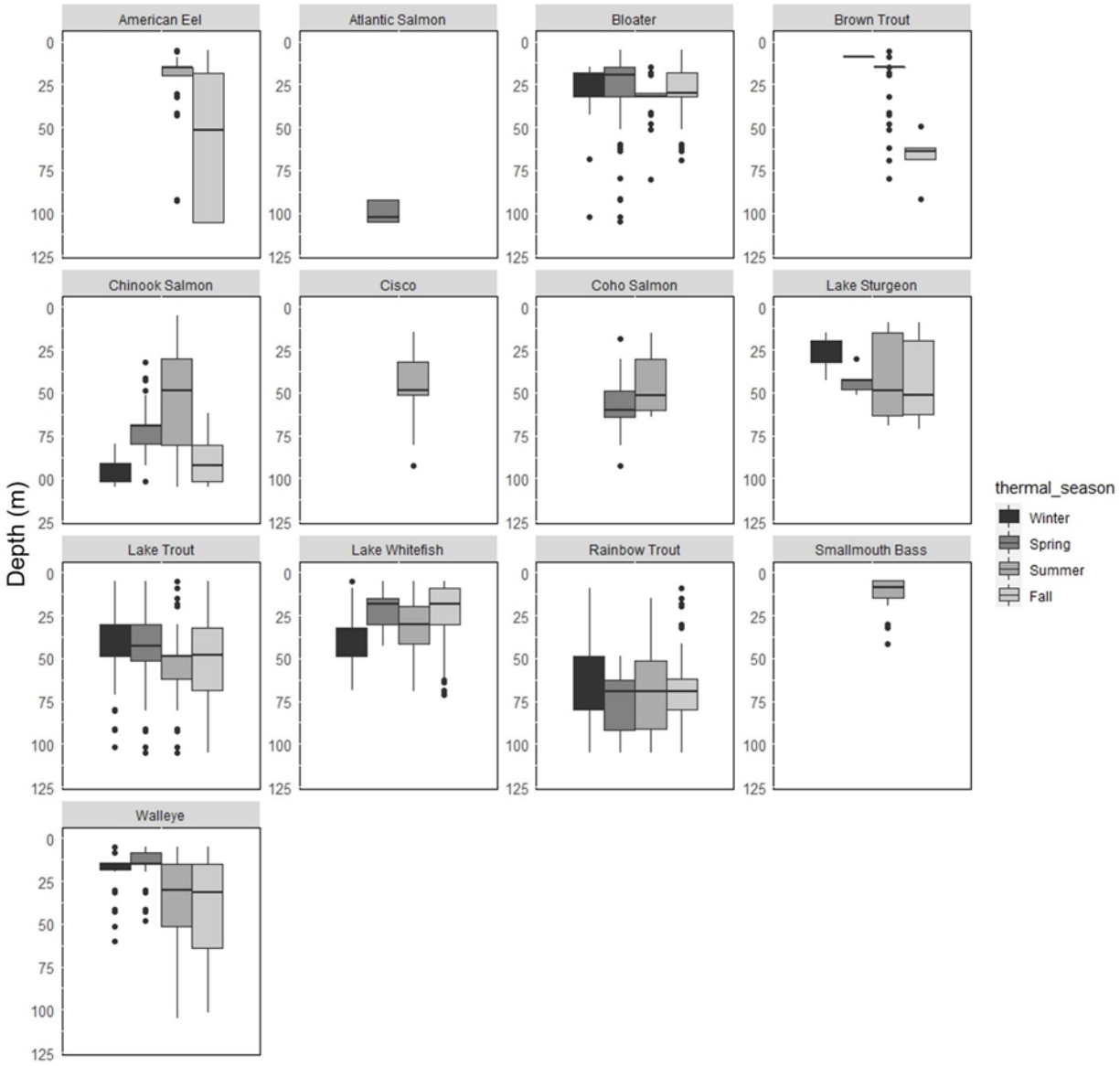

FIG. 8.5.2: Distribution of detections of fishes based on receiver depth for each thermal season (Isothermal Winter: Jan 1st – April 30th, Spring Warming: May 1st – June 30th, Summer Stratification: July 1st – Nov 1st, and Autumn Cooling: Nov 2nd – Dec 31st). The box for each species represents the interquartile range (middle half of all depths), with the horizontal black line being the mean. Lines represent the range of receiver -depths detecting that species, and dots represent extreme values.

(May 1st – June 30th). They spent the summer months in deeper waters and were detected in slightly shallower waters as summer progressed into fall; the later season associated with movement to spawning areas. Rainbow Trout, on average, occupied deeper waters between May and November and slightly shallower waters during the shoulder seasons. In contrast, Chinook Salmon were detected between 91 – 97 m during the fall and winter, and at substantially shallower receiver depths during the spring and summer. Lake Sturgeon were detected in shallower waters during the isothermal season (Jan 1st – April 30th) than throughout the rest of the thermal seasons. Other species including Bloater appeared to occupy more consistent depths throughout the year. Presence of fish within the array varied seasonally. Detections increased in April / May, peaked in August, and reached their lowest levels in Jan / Feb. This pattern recurred among years.

Sentinel tags were used to estimate the detection efficiency and range of receivers along the Point Petre array. Two sentinel tags were

deployed, one at a shallow site (10 m) and one at a deeper site (50 m) within the array. Detection efficiency varied through time and generally diminished during the colder, winter months (November to May). Shallow water detection efficiency was estimated to be 50% at approximately 200 m from the receiver, while deeper water detection efficiency was estimated to be > 50% 1 km from the receiver. Reduced efficiency at the shallow site is likely due to increased noise from wave action, turbulent waters, and sound propagating off the limestone lakebed. Colder water temperatures have been shown to reduce the effectiveness of sound propagation through water, likely the cause for the drop in efficiency throughout the winter months. Sentinel tags will continue to be monitored for changes in detection efficiency.

An additional goal of this research is to continually evaluate the feasibility of open-coastal, shallow water receiver deployments. Results from initial deployments suggested that mooring systems may be moved by winter ice ("grabbing" the floats used to suspend the receivers) or during strong storm events. No movement was observed during the summer months. In 2020, a modified low-profile mooring design that did not include a float was tested. Neither of the two moorings could be located in September 2020 using visual means and side-scan sonar, though one (of 2) was recovered in spring 2021 with the aid of an ROV (remotely piloted underwater video system). The mooring had been displaced several hundred metres, suggesting that even low-profile mooring systems remain vulnerable to displacement. Contributing to the difficulty in locating these moorings was the accumulation of algae periphyton, camouflaging the mooring with the lakebed. In 2021, the two shallowest VR2W receivers were replaced with VR2TX receivers that contain an internal beacon to facilitate locating them. Receivers were easily detected at distances of several hundred metres, but precise location remains challenging for heavily encrusted moorings that still require visual detection to enable recovery for servicing. The VR2TX receivers were removed in October and will be redeployed in April owing to ongoing concerns about mooring displacement by ice and storm events.

In 2021, 31 additional acoustic-release receivers were deployed within the central and south- eastern regions of Lake Ontario in a 15 km square grid pattern (Fig. 8.5.3). These receivers

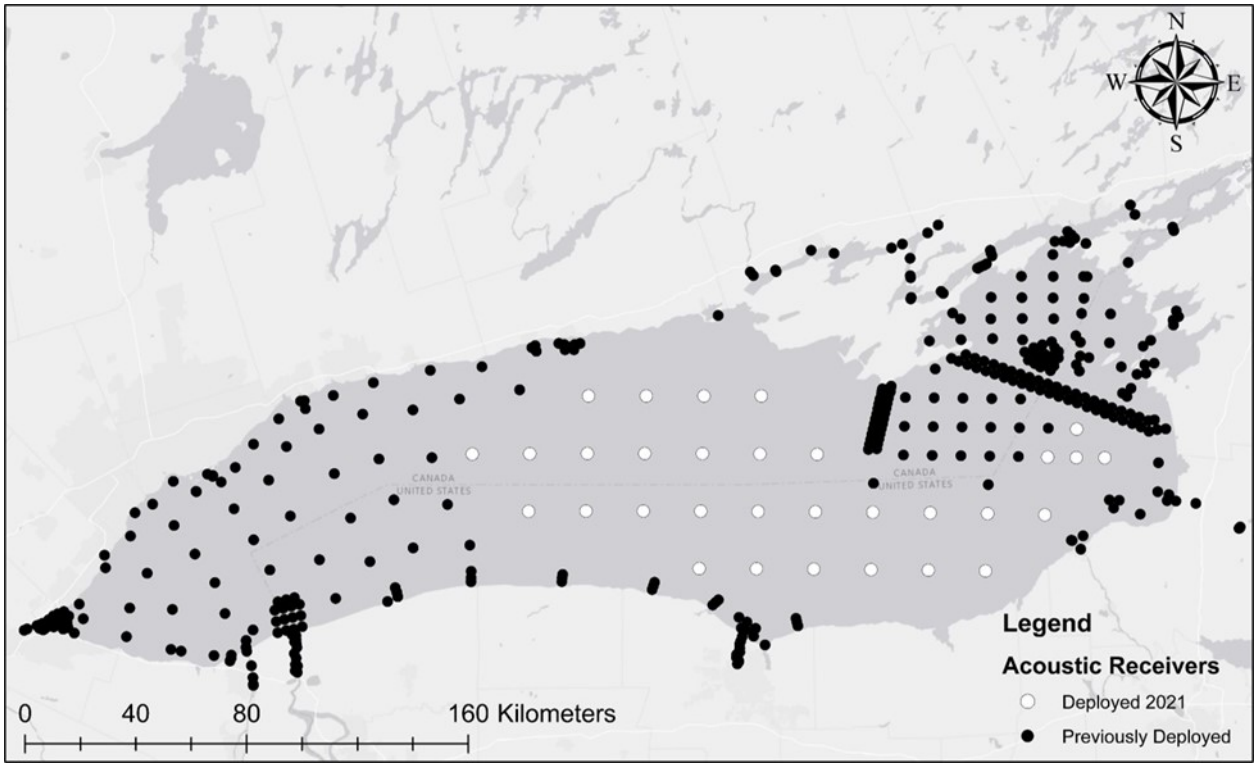

FIG. 8.5.3: Additional receivers deployed in 2021 (white circles) as part of an international effort to increase receiver coverage in central Lake Ontario (previously deployed receivers = black circles).

were deployed as part of a binational effort to increase offshore receiver coverage to effectively cover the entire lake. In addition, supported by a GLOS (Great Lakes Observing System) grant, 13 strings of temperature, light, and water level loggers were affixed to key acoustic release moorings in Lake Ontario. These loggers will measure light and thermal properties from 10 m below the surface to the lake bottom. These logger strings will provide valuable continuously-recorded information useful in understanding physical and biological processes in Lake Ontario throughout the year.

Continuing to utilize and expand receiver coverage within Lake Ontario allows for greater insight into seasonal and spatial behaviours and movement patterns of now 27 species of fish that have been tagged in Lake Ontario informing stocking, harvest, and management objectives for these species.

8.6 Food web structure of the Laurentian Great Lakes – a cross lake comparison

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

The Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry (OMNDMNRF) has aimed to address the need for standardized food web metrics among the Laurentian Great Lakes. The Great Lakes are complex aquatic ecosystems differing in physical properties (e.g., depth, temperature), productivity (e.g., nutrients, land use), and stressors (e.g., development, contaminants). Due to these intrinsic differences in lake properties, food web structure and applied ecological metrics (i.e., energy transfer between trophic levels) are likely to differ among and within the Great Lakes.

Biological samples were collected from five standardized ecoregions (Anthropogenic, Embayment, Inlet, Open Coastal, and Outlet) with each of lakes Superior, Huron, Ontario, and Erie between April and November (Fig. 8.6.1). Samples were provided by a variety of agencies including the OMNDMNRF, U.S. Geological Survey (USGS), New York State Department of Environmental Conservation (NYSDEC), Michigan Department of Natural Resources (MDNR), Ohio Department of Natural Resources (ODNR), and Wisconsin Department of Natural Resources (WDNR) (Fig. 8.6.2). Sample

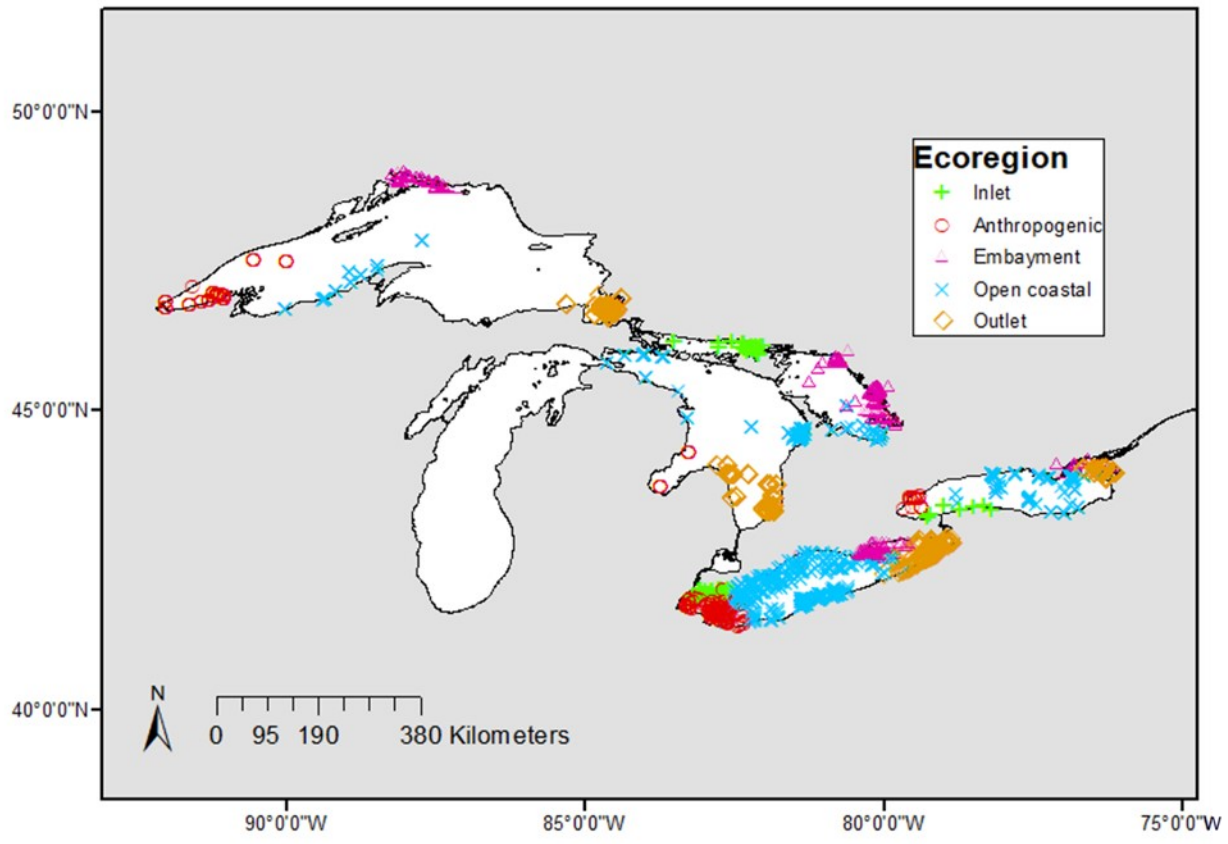

FIG. 8.6.1: Sample collection sites for twelve fish taxa and Zebra Mussels (*Dreissena polymorpha*) across five ecoregions (Inlet, Anthropogenic, Embayment, Open Coastal, and Outlet) among lakes Superior, Huron, Erie, and Ontario between 2016-2019.

collections were coordinated to achieve representation of piscivore (fish-eating), omnivore (broad diet), insectivore (insect-eating), and planktivore (plankton-eating) trophic guilds, and include: 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*), shiners (*Notropis* spp.), Deepwater Sculpin (*Myoxocephalus thompsonii*), Slimy Sculpin (*Cottus cognatus*), and Round Goby (*Neogobius melanostomus*). Zebra mussels (*Dreissena polymorpha*) were collected as a baseline species from each ecoregion and lake.

Carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotopes were used to reconstruct food webs. Carbon stable isotopes reveal whether individuals feed more nearshore or offshore, while nitrogen stable isotopes represent trophic position (e.g., insects at the bottom of the food chain and fish at the top). These two isotope values are used to generate an isotopic niche for each species (a graphical representation of what it eats). Lake-specific food webs showed similar structure (i.e., similar placements of top predator fish relative to prey species); however, carbon and nitrogen ranges differed among lakes (Fig. 8.6.2).

A larger isotopic niche width (SEA_B, Fig. 8.6.3) suggests a greater range in resource use within a species population. In general, the range in Round Goby resource use was greatest in Lake Huron, smallest in Lake Ontario, and varied within (among ecoregions) in Lake Erie (Fig. 8.6.3a). Rainbow Smelt (Fig. 8.6.3b) and Lake Trout (Fig. 8.6.3c) resource use range also differed between both lakes and among ecoregions. Mobile species (e.g., Lake Trout) are expected to have a larger range in resource use due to the ability to utilize resources from different ecoregions within the lake; however, species with a smaller home range

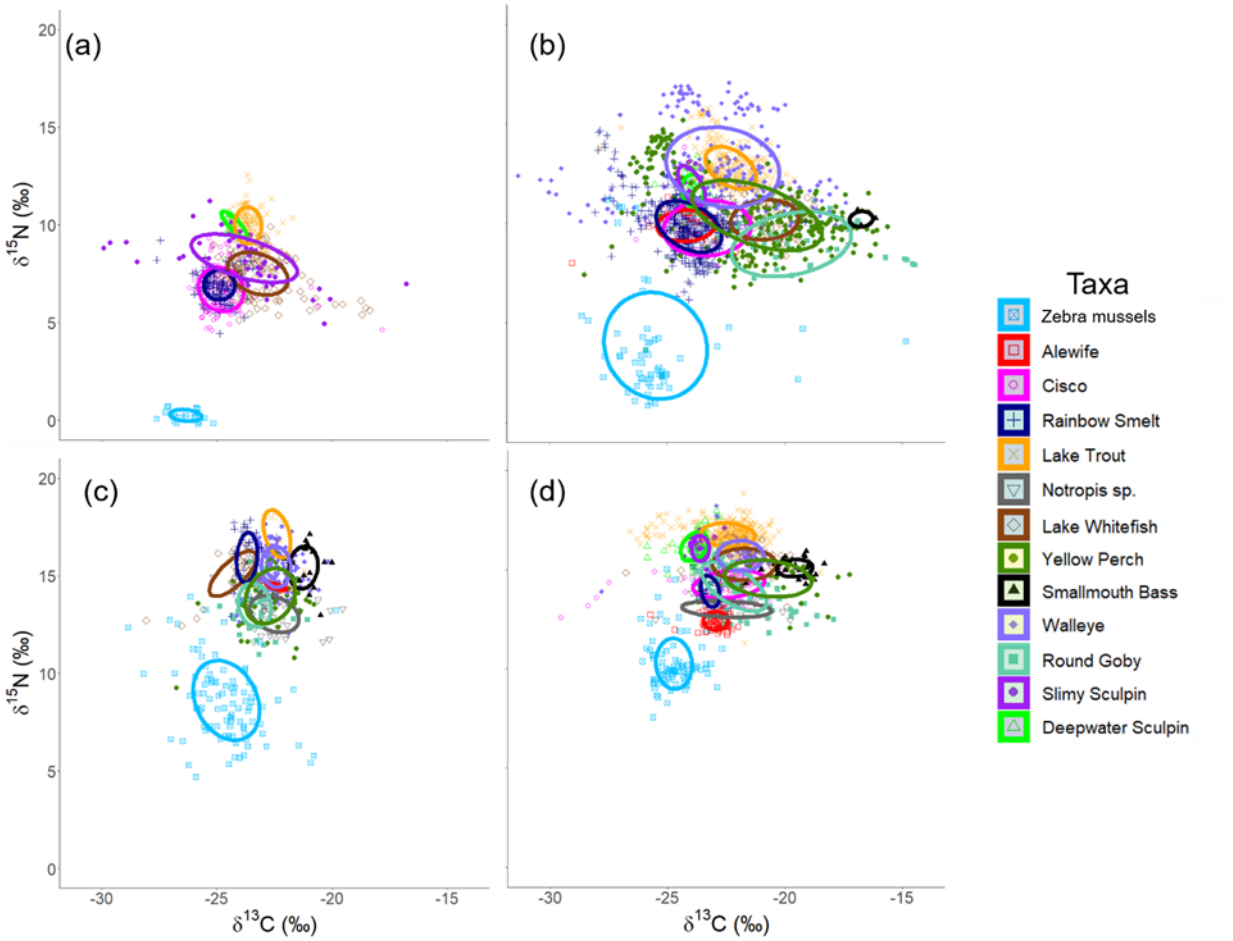

FIG. 8.6.2: Stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotopes of twelve fish taxa and Zebra Mussels (*Dreissena polymorpha*) across (a) Lake Superior, (b) Lake Huron, (c) Lake Erie, and (d) Lake Ontario.

in this study had larger (i.e., Round Goby) and more spatially-varied (i.e., Rainbow Smelt) niche width values. This may be due to fish with smaller home ranges incorporating ecoregion-specific prey, resulting in broader resource use driven by individuals within a population, while Lake Trout are likely incorporating resources and diet items from across lake basins, resulting in a general average of diet and resources.

Since the Great Lakes differ in physical properties, it is essential to identify and account for these differences in ecoregion and lake-specific food webs prior to comparison. Understanding the differences in diet and resource use of fish taxa within and among the lakes allows for identification of lake-specific impairments related to environmental stressors, including reviewing progress towards fish community and environmental objectives.

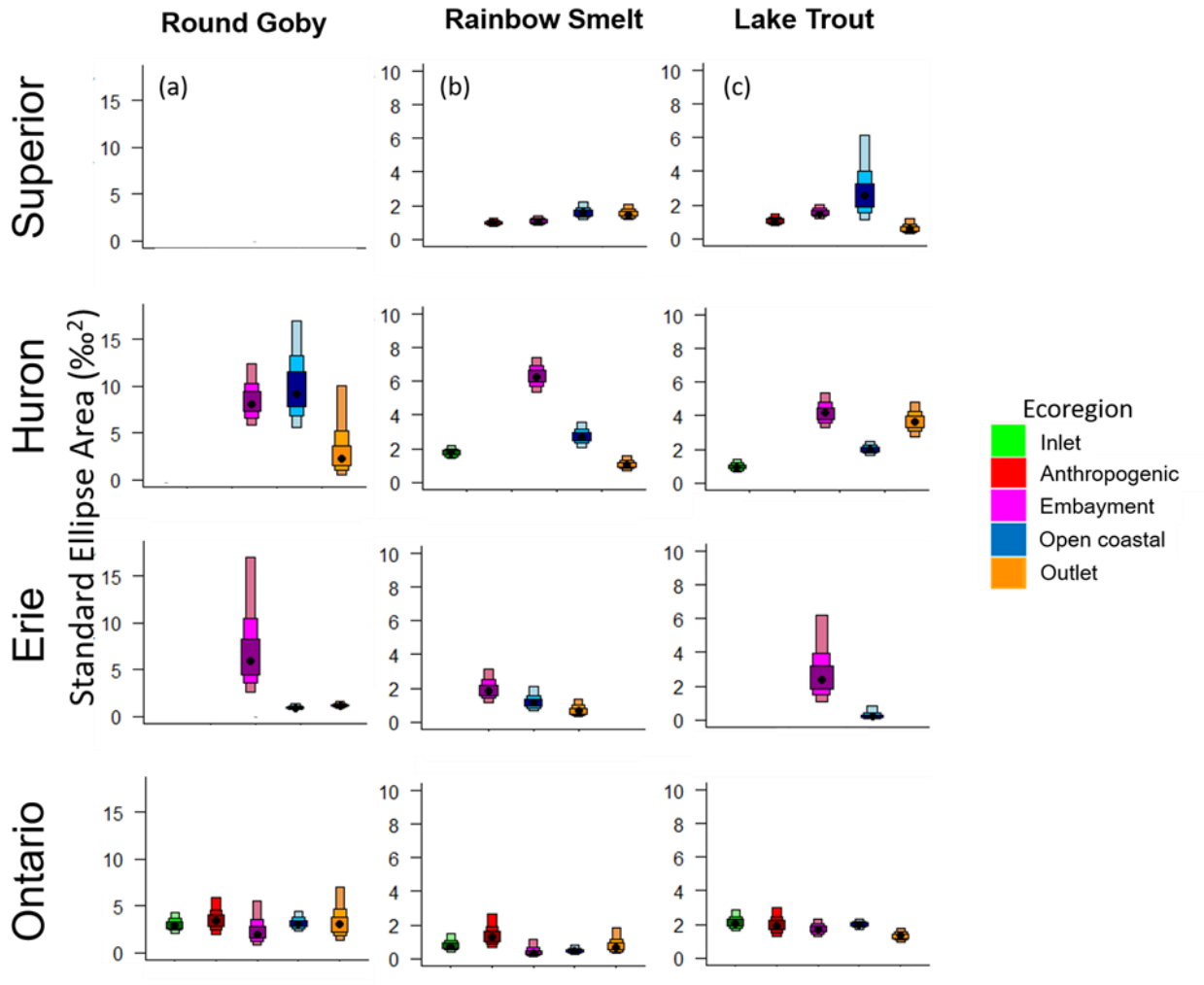

FIG. 8.6.3: Isotopic niche width (SEA_B) estimates from carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotopes of three fish taxa; (a) Alewife (*Alosa pseudoharengus*), (b) Rainbow Smelt (*Osemrus mordax*), and (c) Lake Trout (*Salvelinus namaycush*) for five ecoregions (Anthropogenic, Embayment, Inlet, Open Coastal, and Outlet) across four Great Lakes (Superior, Huron, Erie, Ontario).

8.7 Effects of sex, temperature, and body size on standard metabolic rate in adult Walleye (Sander vitreus)

Project Leads: Megan Murphy and Graham Raby (Trent University); Tim Johnson (Aquatic Research and Monitoring Section, OMNDMNRF)
Collaborators: Aaron T. Fisk (Great Lakes Institute for Ecological Research, University of Windsor); Matthew M. Guzzo (Department of Ecology and Evolutionary Biology, University of Toronto); Charles P. Madenjian (Great Lakes Science Center, U.S. Geological Survey)

Understanding the underlying factors that determine growth, reproduction, survival, and adaptation in fishes is crucial for the management of socially, economically, and ecologically important fish. As a prominent top-predatory, sport and commercial fish of the Great Lakes, sustainable management of Walleye (*Sander vitreus*) is of great importance. To properly manage a fish species, we must fully understand the biological processes driving that fish's survival and behaviour. In fisheries research we use bioenergetic modeling to predict potential energetic outcomes, given other known energetic parameters for a fish. For example, using the known standard metabolic rate of a fish species, we can predict outcomes of reproduction, growth, survival, and movement for that species. However, without accurate measurements of standard metabolic rate we can not make accurate predictions of those outcomes. There are currently no standard metabolic rate estimates to use in bioenergetic modeling for Walleye. Therefore, management of Walleye could be improved by developing estimates of standard metabolic rate for the species.

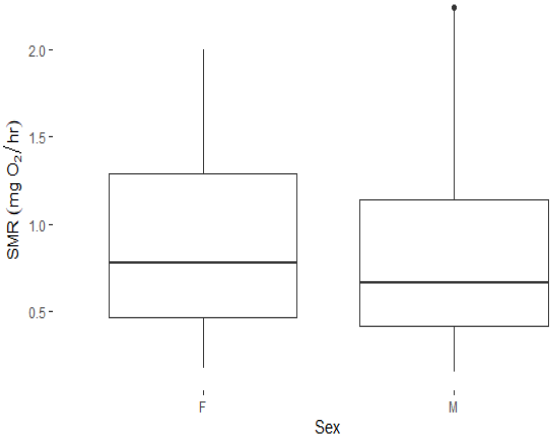

FIG. 8.7.1: Standard metabolic rate (SMR) of adult, hatchery-reared, male (right), and female (left) Walleye (*Sander vitreus*) from White Lake Fish Culture Station, 2020. Solid horizontal lines indicate mean, boxes quartiles, and bars outliers.

To derive estimates of standard metabolic rate for adult Walleye, we conducted respirometry on both hatchery-reared and wild adult Walleye. Specifically, we set out to assess if sex, temperature, and / or body-size affect the standard metabolic rate of the species as a whole, and if there are any differences between hatchery-reared and wild Walleye. Experiments with wild Walleye were conducted at the Glenora Fisheries Station in the fall of 2021, and analysis is currently in preliminary stages. Data for hatchery-reared fish were collected at the White Lake Fish Culture Station in the fall of 2020 and preliminary results for these Walleye are provided here. Our preliminary analysis suggests no perceived difference between adult, hatchery-reared male and female standard metabolic rate (Fig. 8.7.1). However, analysis does suggest a strong relationship between standard metabolic rate and temperature for both male and female adult Walleye. As temperature increases so does Walleye standard metabolic rate (Fig. 8.7.2). Further, our analysis indicates that there is no consistent relationship between standard metabolic rate and body-size (weight) for male or female adult Walleye (Fig. 8.7.3).

The preliminary results from this project contribute to our understanding of the biological processes influencing Walleye production by providing some of the first estimates of standard metabolic rate for the species. At the core, the standard metabolic rate estimates provide information surrounding energy allocation and use in Walleye, and therefore aid in understanding factors like reproduction, growth, survival, and movement. The continuation of this project and future bioenergetic studies for Walleye should remain a priority for fisheries managers, anglers, and Walleye enthusiasts alike.

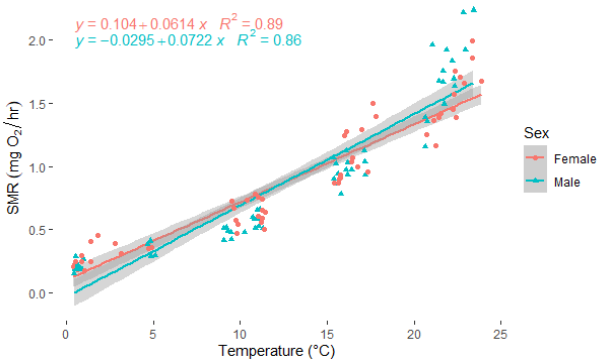

FIG. 8.7.2: Standard metabolic rate (SMR) in relation to trial temperatures (°C) of adult, hatchery-reared, male (triangle), and female (circle) Walleye (*Sander vitreus*) from White Lake Fish Culture Station, 2020.

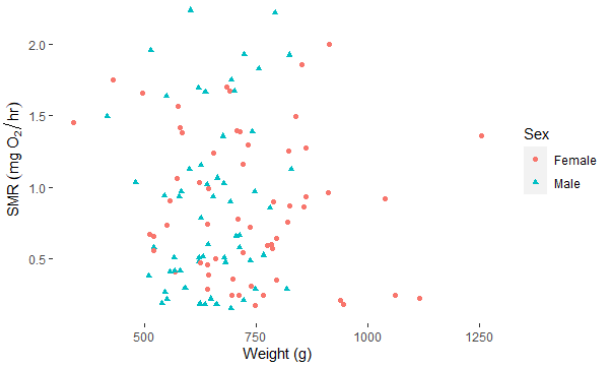

FIG. 8.7.3: Standard metabolic rate (SMR) in relation to body size (weight) of adult, hatchery-reared, male (triangle), and female (circle) Walleye (*Sander vitreus*) from White Lake Fish Culture Station, 2020.

8.8 How might Lake Trout (Salvelinus namaycush) and Chinook Salmon growth change in Lake Ontario under a warming climate

Project Leads: Silviya Ivanova and Aaron Fisk (Great Lakes Institute for Environmental Research, University of Windsor); Tim Johnson (Aquatic Research and Monitoring Section, OMNDMNRF)

Lake surface water temperatures are increasing faster than atmospheric temperatures. With the decrease of winter ice and lengthening of the summer season, these warmer temperatures are also penetrating the depths resulting in a warmer hypolimnion (deep, colder waters below the thermocline). Fish are cold-blooded organisms and thus vital rates governing metabolism, consumption, and growth (collectively termed bioenergetics) are strongly influenced by temperature. Expected climate-driven increases in water temperature will increase metabolic rate for predators resulting in greater demand for prey to maintain growth. Knowing how species' growth would be affected by the increasing temperatures and what role diet plays, would help inform management planning with respect to mitigating the effects of climate change. Lake Ontario is home to six salmonid species that attract recreational anglers from across North America and all six are likely to be affected by the increased water temperatures. Two of these salmonids are Lake Trout (Salvelinus namaycush) and Chinook Salmon (Oncorhynchus tshawytscha), and both are being stocked in Lake Ontario to promote restoration of historically important species and support economically important recreational fisheries, respectively. Understanding how the growth of Lake Trout and Chinook Salmon under present-day conditions may change under different future scenarios is critical to discerning factors that would contribute to the success of both species in a warmer climate.

Existing studies have used optimum temperatures obtained in lab settings to model the growth of the species, but their use introduces bias in the results as many factors, such as prey distribution and competitive interactions, may influence the actual temperatures occupied by the fish. Using data from pop-off data storage tags (see section 9.2 of the 2016 Lake Ontario Management Unit Annual Report) and acoustic telemetry (see section 7.6 of the 2020 Lake Ontario Management Unit Annual Report) we used observed, rather than estimated, water temperature data to project growth of Lake Trout and Chinook Salmon. We compared growth between i) present (2010-2019) environmental conditions with Round Goby (Neogobius melanostomus) established and incorporated in the diet of Lake Trout (Fig. 8.8.1) and ii) future (2060) conditions with different scenarios of water temperature warming, with or without Bloater (Coregonus hoyi) re-establishment (Table 8.8.1 and Fig. 8.8.1). We estimated the maximum weight for both species in their lifespan and the percent change in food consumption for an adult individual of each species.

Our results showed that Lake Trout are currently occupying temperatures below the predicted optimum resulting in lower growth, while Chinook Salmon occupy temperatures close to their optimum with growth very near their potential under present conditions (Fig. 8.8.2). Our future scenarios considering warmer temperatures and shifts in diet would result in increased growth for Lake Trout, but reduced growth for Chinook Salmon, and that prey quality (a diet that incorporated bloater) was more important in sustaining or enhancing growth for both species than the effects of expected temperature change.

This work provided quantitative measures of the potential effects of climate change on two important top predators in Lake Ontario, and the potential to mitigate some of the effects through reintroduction of energy rich prey such as Bloater.

TABLE 8.8.1: Summary of scenarios used in the bioenergetics modelling of Lake Trout (*Salvelinus namaycush*) and Chinook Salmon (*Oncorhynchus tshawytscha*) in Lake Ontario.

Scenarios	Temperature used	Prey proportion change from present
Present (2010-2019)	Observed	--
Future Low	Observed +0.4ºC	No
Future Low w/ Bloater	Observed +0.4ºC	Yes
Future High	Observed +1.0ºC	No
Future High w/ Bloater	Observed +1.0ºC	Yes

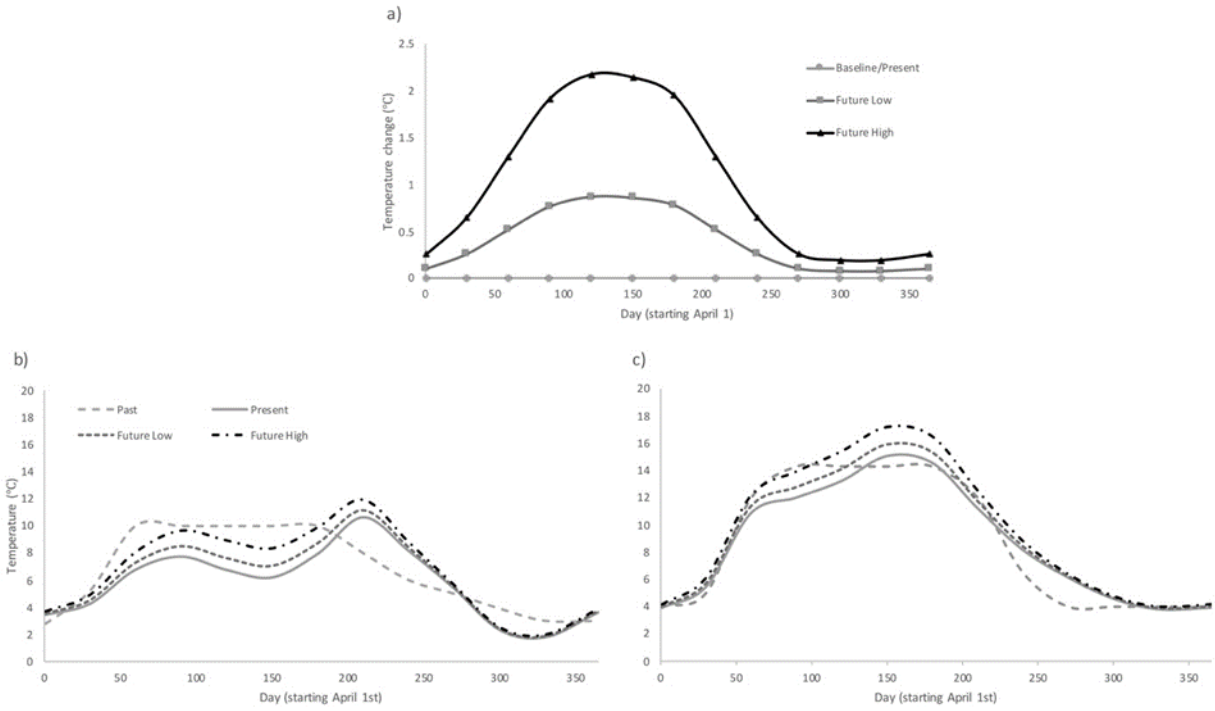

FIG. 8.8.1: Monthly distribution of temperatures (increase above baseline where baseline is the present) for the future low and future high scenarios in Lake Ontario (a), and monthly temperatures experienced by Lake Trout (*Salvelinus namaycush*) (b) and Chinook Salmon (*Oncorhynchus tshawytscha*) (c) for the different scenarios. Note: ***Past*** represents the assumed thermal optima temperatures and the species occupying the warmest temperature available in the habitat up to but not exceeding the physiological optimum. ***Present*** represents the environmental conditions of 2010-2019 including observed temperatures occupied by the species. ***Future low and high*** scenarios, represent a mean annual increase of 0.4°C and 1.0°C, respectively added to the present temperatures.

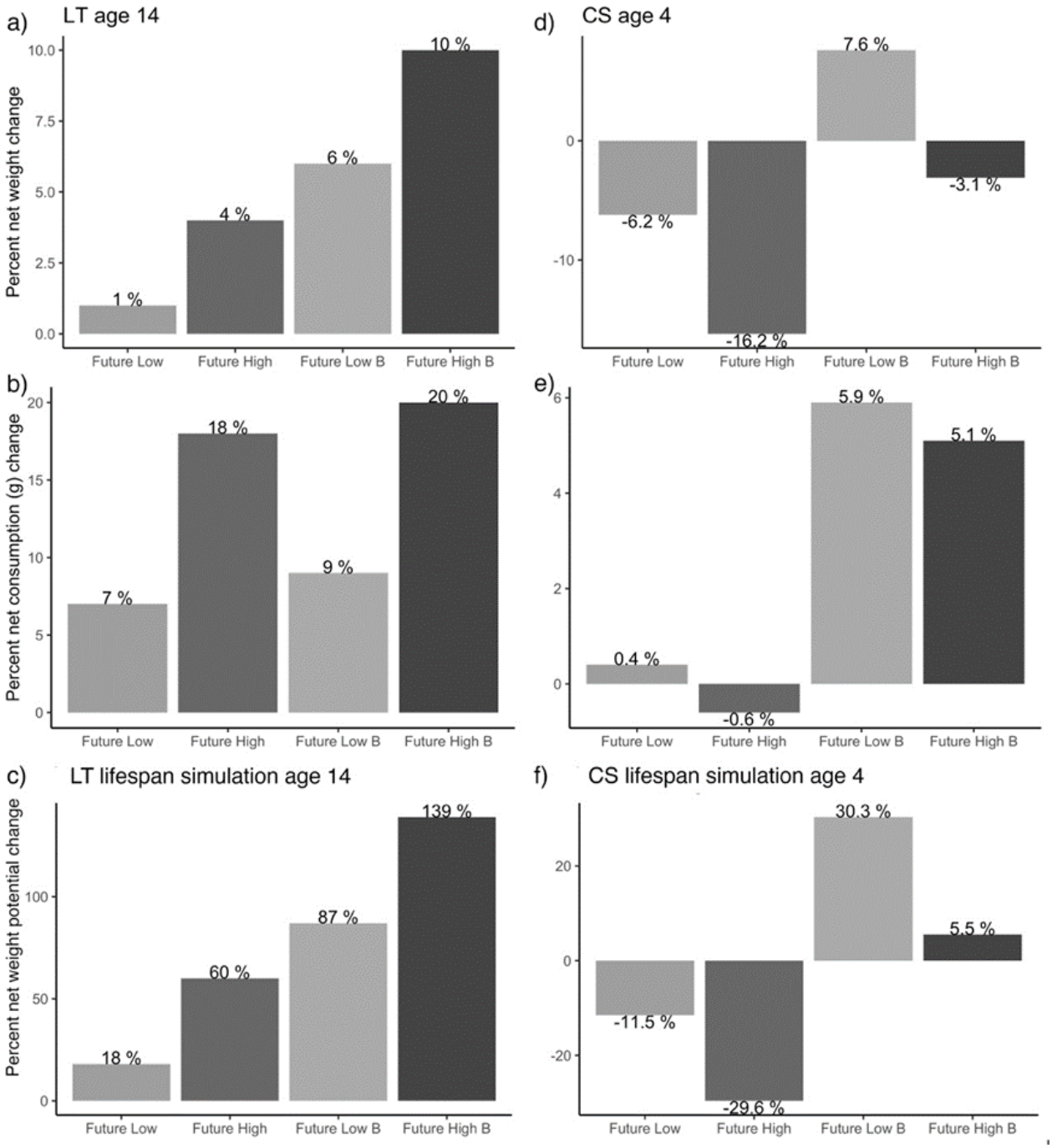

FIG. 8.8.2: Net change in weight, consumption, and feeding rate for Lake Trout (*Salvelinus namaycush*) (a-c) and Chinook Salmon (*Oncorhynchus tshawytscha*) (d-f) in Lake Ontario for all future scenarios. Note: 'B' stands for diet change to include Bloater (*Coregonus hoyi*); low and high future scenarios involve 0.4°C and 1.0°C mean water temperature increase, respectively; ***percent net weight change*** – present (used here as baseline) scenario adult (age 13 Lake Trout (a) and 3 for Chinook Salmon (d)) starting weight is used to calculate an age 14 or 4 adult's weight under a future scenario by maintaining feeding rate, then the difference between the baseline and the future scenario weights is converted to percentage. ***Percent net consumption change*** (b and e) - Adult consumption and feeding rate at age 14 and 4 for Lake Trout and Chinook Salmon, respectively, from baseline was compared to the same of future scenarios. ***Percent net weight potential change*** (c and f) – Adult weight at age 14 and 4 for Lake Trout and Chinook Salmon, respectively, from the baseline lifespan simulation was compared to the same age of a future scenario lifespan simulation.

9. Environmental Indicators

9.1 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 – 2021 (Fig. 9.1.1). 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. 9.1.1a). In 2021, the number of small craft warning hours was significantly lower than 2020 and below the average for the time series (Fig. 9.1.1a). 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. 9.1.1b). This index shows an increase from 2020 to 2021, where relative contribution of east winds in 2021 was above the time series average (Fig. 9.1.1b).

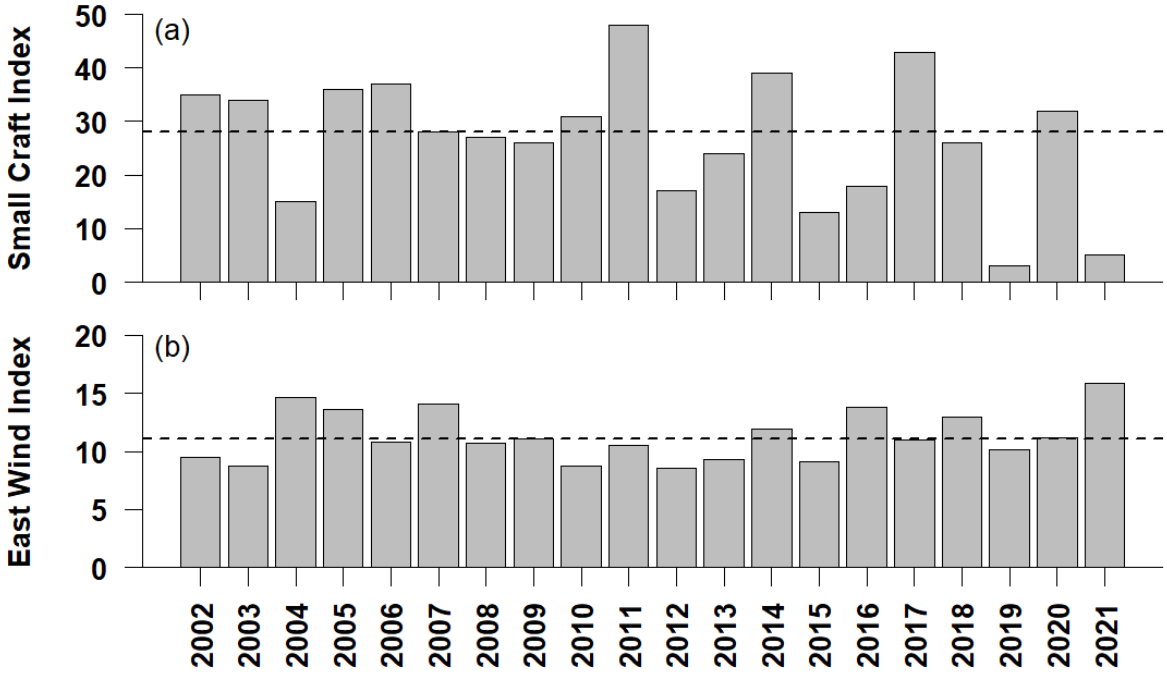

FIG 9.1.1. Lake Ontario wind as characterized by the Small Craft Index (a) and East Wind Index (b). The Small Craft Index represents the total number of hours from July 1st to August 31st each year (2002 – 2021), where the wind velocity was ≥ 20 knots. The East Wind Index represents the number of hours from July 1st to August 31st each year (2002 – 2021) that an eastern wind predominated. Data provided by National Data Buoy Center, NOAA (http://www.ndbc.noaa.gov/).

Section 10. Staff 2021

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11. Operational Field and Lab Schedule, 2021

Operational Field and Lab Schedule, 2021 (SPA = Special Purpose Account; COA = Canada Ontario Agreement; CRF = Consolidated Revenue Fund; DFO = Department of Fisheries and Oceans; OPG = Ontario Power Generation).

Field and Lab Projects	Dates	Species Assessed, Monitored or Stocked	Project Lead	Operational Lead	Funding Source
Ganaraska River Fish Counter Salmon and Trout Assessment	Mar-Nov	Migratory Trout & Salmon	Yuille	Maynard	COA/SPA/ CRF
Ganaraska Fishway Rainbow Trout Assessment	Mar-Apr	Rainbow Trout	Yuille	Maynard	SPA
Ganaraska River Evaluation of Fishway Performance	Apr-Nov	Migratory Trout & Salmon	Yuille/ Maynard	Maynard	COA
Walleye Egg Collection	Mar-Apr	Walleye	Brown	Wingrove	SPA
Foodweb Dynamics in Lake Ontario	Apr-Nov	Fish Community	Dr. Johnson	Metcalfe/Rupnik	COA/SPA
Asian Grass Carp Emergency Response	Apr-Nov	Grass Carp	McNevin	Kranzl/McNevin	SPA
Chinook Salmon Net Pens	Apr	Chinook Salmon	Lake	Lake	SPA
Lake Ontario Spring Prey Fish Trawling Survey	Apr	Alewife/Smelt	Holden	Chicoine/Scholz	SPA
Fish Contaminant Sampling	Apr-Dec	Sport Fish	Brown/Kranzl	Jakobi/Kranzl	SPA
St 81- Offshore Limnology and Zooplankton Survey	May-Oct	Lower Food Web	Dr. Johnson	Metcalfe	SPA
Lake Trout Tug Stocking	May	Juvenile Lake Trout	Lake	Chicoine	SPA
Spring American Eel Trap and Transfer	Apr-Jun	American Eel	LaRose	Tsinaridis	OPG
Eastern Lake Ontario and Bay of Quinte Fish Community Index Netting	Jun-Nov	Fish Community	Kranzl	Wingrove	SPA
Eastern Lake Ontario and Bay of Quinte Fish Community Index Trawling	Jun-Sep	Fish Community	Kranzl	Wingrove	SPA
Acoustic Telemetry Receiver Servicing	Aug	Multiple Species	Dr. Johnson	Chicoine/Scholz	COA/SPA
Credit River Fish Counter Salmon and Trout Assessment	Mar-Nov	Migratory Trout & Salmon	Yuille	Maynard	COA/SPA/ CRF
Hamilton Harbour Nearshore Community Index Netting	Aug	Nearshore Fish Community	Beech	Moore/Jang	COA/DFO
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
Pelagic Midwater Trawling	Sept	Various Pelagic Species	Holden	Chicoine/Scholz	COA
Lake Ontario Fall Benthic Prey Fish Trawling Survey	Sept-Oct	Round Goby/Slimy and Deepwater Sculpin	Holden	Chicoine/Scholz	COA
Credit River Chinook Salmon Assessment and Egg Collection	Oct	Chinook Salmon	Yuille	Huff	SPA
Lake Whitefish Acoustic Tagging	Nov	Lake Whitefish	Dr. Johnson	Kranzl/Metcalfe	COA / SPA
Lake Whitefish Commercial Catch Sampling	Oct-Nov	Lake Whitefish	Brown	Moore	SPA
Age and Growth (Lab)	Year-Round	Multiple Species	Kranzl	Operational Team	SPA/COA

12. Primary Publications 2021

Primary Publications of Glenora Fisheries Station Staff[1] in 2021

Ashworth, E.C. and **T.B. Johnson**. 2021. Summary review of the ecology and behavioural traits of tench (Tinca tinca) in native and invaded habitat ranges, with comparison to Great Lake fishes of interest. Ontario Ministry of Natural Resources and Forestry, Science and Research Branch, Peterborough, ON. Science and Research Information Report IR-23. 25 p + append.

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. 100 p.

Elliott, C., M. Ridgway, **E. Brown**, B. Tufts. 2021. Spatial ecology of Bay of Quinte walleye (Sander vitreus): Annual timing, extent, and patterns of migrations in eastern Lake Ontario. Journal of Great Lakes Research. 48. 10.1016/j.jglr.2021.10.022.

Futia, M.H., S.F. Colborne, A.T. Fisk, D. Gorsky, **T.B. Johnson**, B.F. Lantry, J.R. Lantry, J. Rinchard. 2021. Similarities and differences among three diet analyses provide insight into feeding habits of a freshwater piscivore, Salvelinus namaycush. Ecological Indicators 127: 107728. https://doi.org/10.1016/j.ecolind.2021.107728

Hunt, L., D. Phaneuf, J. Abbott, E. Fenichel, J. Rodgers, J. Buckley, D.A.R. Drake, **T.B. Johnson**. 2021. The influence of human population change and aquatic invasive species establishment on future recreational fishing activities to the Canadian portion of the Laurentian Great Lakes. Can. J. Fish. Aquat. Sci. 78: 232-244 https://doi.org/10.1139/cjfas-2020-0159.

Ivanova, S. V., **T. B. Johnson**, A. T. Fisk. 2021. Movement ecology of a potamodromous top predator in a large lake: synchrony and coexistence of distinct migratory patterns. Transactions of the American Fisheries Society 150: 748-760. https://doi.org/10.1002/tafs.10325

Ivanova, S. V., S.M. Larocque, A.T. Fisk, **T.B. Johnson**. 2021. Spatiotemporal interactions of native and introduced salmonid top predators in a large lake: Implications for species restoration. Can. J. Fish. Aquat. Sci. 78(8): 1158-1167. https://doi.org/10.1139/cjfas-2020-0447

Kuai, Y., N. V. Klinard, A.T. Fisk, **T.B. Johnson**, E.A. Halfyard, D. Webber, S. Smedbol, M. Wells. 2021. Strong thermal stratification reduces detection efficiency and range of acoustic transmitters in a large freshwater lake. Animal Biotelemetry 9(1). https://doi.org/10.1186/s40317-021-00270-y

Larocque, S.M., A.T. Fisk, **T.B. Johnson**. 2021. Evaluation of muscle lipid extraction and non-lethal fin tissue use for carbon, nitrogen, and sulfur isotope analyses in adult salmonids. Rapid Communication in Mass Spectrometry. 35(12) https://doi.org/10.1002/rcm.9093

Marsden, J.E., P.J. Blanchfield, J.L. Brooks, T. Fernandes, A. T. Fisk, M. H. Futia, B.L. Hilna, S. V. Ivanova, **T. B. Johnson**, N. V. Klinard, C. C. Krueger, S. M. Larocque, J. K. Matley, B. McMeans, L. M. O'Connor, G. D. Raby, S. J. Cooke. 2021. Using untapped telemetry data to explore the winter biology of freshwater fish. Rev. Fish Biol. 31: 115-134. https://doi.org/10.1007/s11160-021-09634-2(0123456789().

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

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