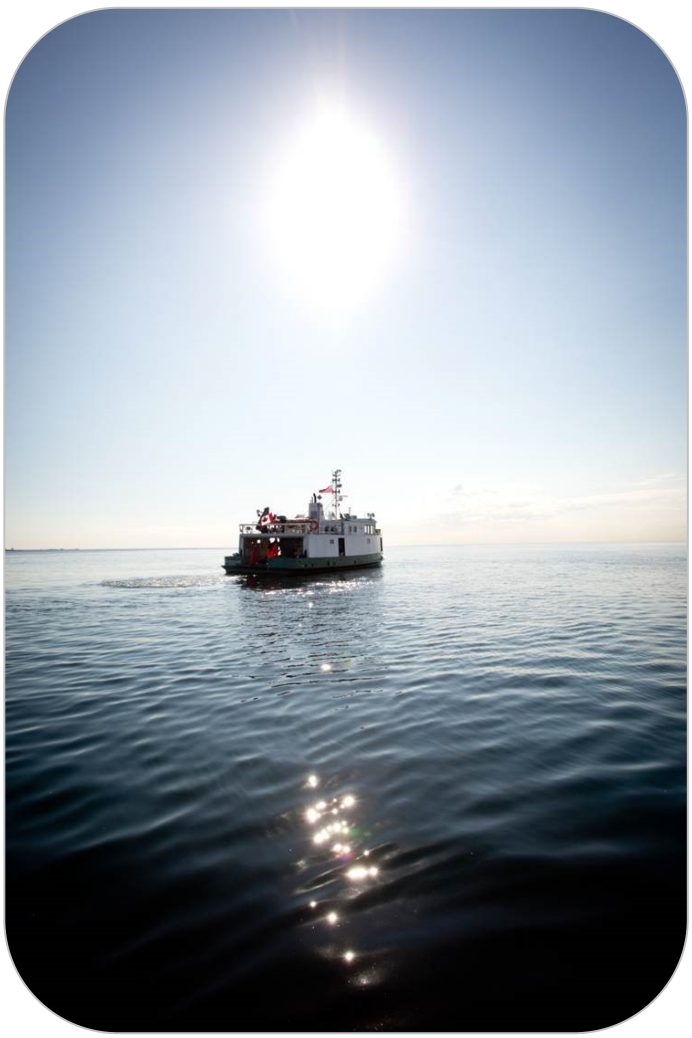
Lake Ontario Fish Communities and Fisheries:

2017 Annual Report of the Lake Ontario Management Unit



Ontario

Cover Photos:

(Left) MNRF's "Ontario Explorer" on Lake Ontario

(Right top) Walleye equipped with acoustic telemetry transmitter and external tag, April 13, 2017

(Right bottom) LOMU field crew conducting Bay of Quinte angler survey, June 12, 2017

LAKE ONTARIO FISH COMMUNITIES AND FISHERIES:

2017 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 are pleased to provide the 2017 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 many 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.

LOMU continues to deliver a comprehensive long-term base monitoring program while also incorporating new technologies to improve our understanding of the fish community. New in the 2017 Report are results from the first full year of assessment of migratory salmonids in the Ganaraska River using the Vaki Riverwatcher video fish counter. Also, Lake Sturgeon, American Eel, Walleye, Lake Whitefish and bass were implanted with acoustic telemetry tags to learn more about their movements and habitat use.

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, 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 the activities and findings of the Lake Ontario Management Unit from 2017.

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

1. Index Fishing Projects

1.1 Ganaraska Fishway Rainbow Trout Assessment

M.J. Yuille, Lake Ontario Management Unit

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 2017, the Pulsar fish counter was installed on March 26th, 2017 and ran until March 28th, 2017, when the new Riverwatcher fish counting system was installed. The Riverwatcher actively counted and recorded fish from March 28th to May 2nd, 2017 when the Rainbow Trout spawning run ended. The new Riverwatcher fish counting system was the primary counter used for the majority of this year's spring Rainbow Trout spawning run on the Ganaraska. The system was brought online March 28th and continued to monitor fish activity in the Ganaraska fishway until November 8th, 2017 (Section 1.12).

In 2017, 6,952 Rainbow Trout were observed passing through the Ganaraska fishway (Table 1.1.1). This is below the average for the previous 10 years (7,103 fish on average from 2007 to 2016). From 2009 to 2013, the Rainbow Trout run in the Ganaraska River increased; since this time it has declined (Fig. 1.1.1). The total estimated run size from 2017 increased 39% from 2016 and is 43% below the peak in 2013 (Table 1.1.1. and Fig. 1.1.1). The 2017 spawning run estimate marks the first spawning run increase on the Ganaraska River since the 2013 peak. The fishway was most active mid-April, which is comparable to previous runs (Fig. 1.1.2). In just four days (April 10th – April 13th, 2017), 51% of the Rainbow Trout counted passed through the fish counter (Fig. 1.1.2).

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) total length fish. In 2017, the condition of male (2,842 g) and female (2,981 g) Rainbow Trout were slightly higher than 2016 values and comparable to the previous 10-year average (Fig 1.1.3 and Table 1.1.2).

The proportion of Rainbow Trout with Lamprey marks in the Ganaraska River has been reported since

TABLE 1.1.1. Observed count and estimated run of Rainbow Trout moving upstream at the Ganaraska River fishway at Port Hope, Ontario during spring, 1974-2017. Estimates for 1980, 1982, 1984, 1986, 1992, and 2002 were interpolated from adjacent years with virtual population analysis. Estimate for 2017 utilized the Riverwatcher fish counting system.

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	--

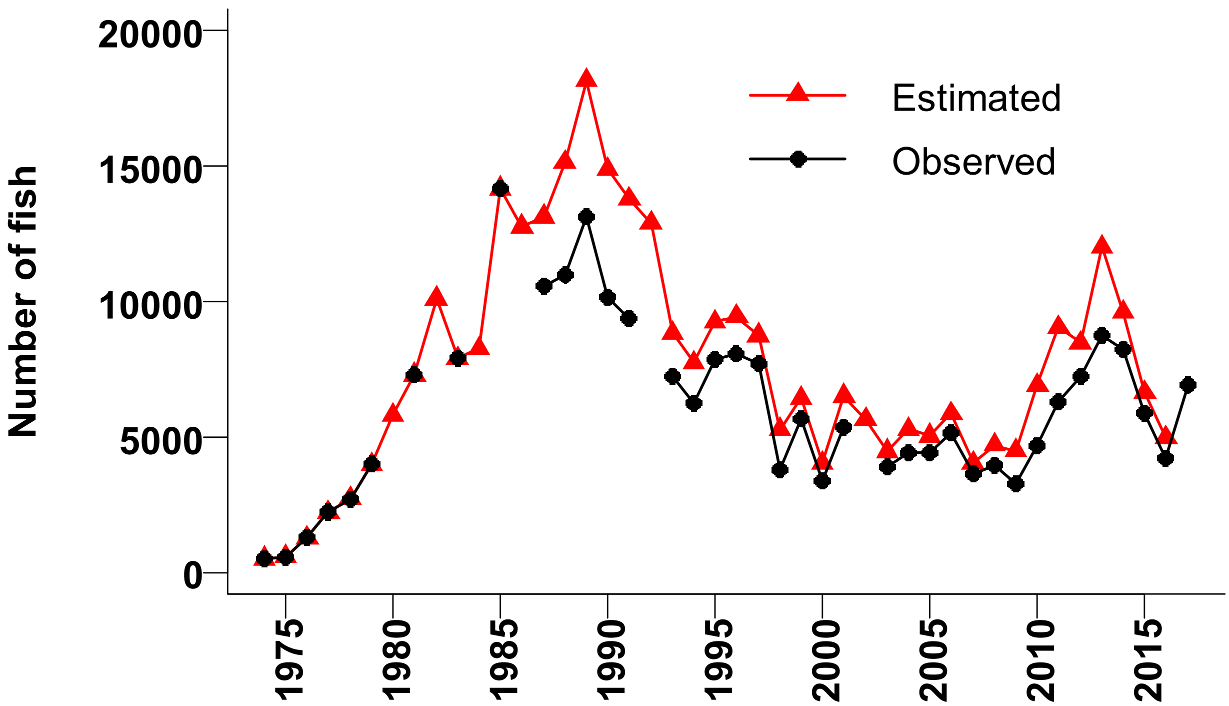

FIG. 1.1.1. Estimated and observed run of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario during spring 1974-2017.

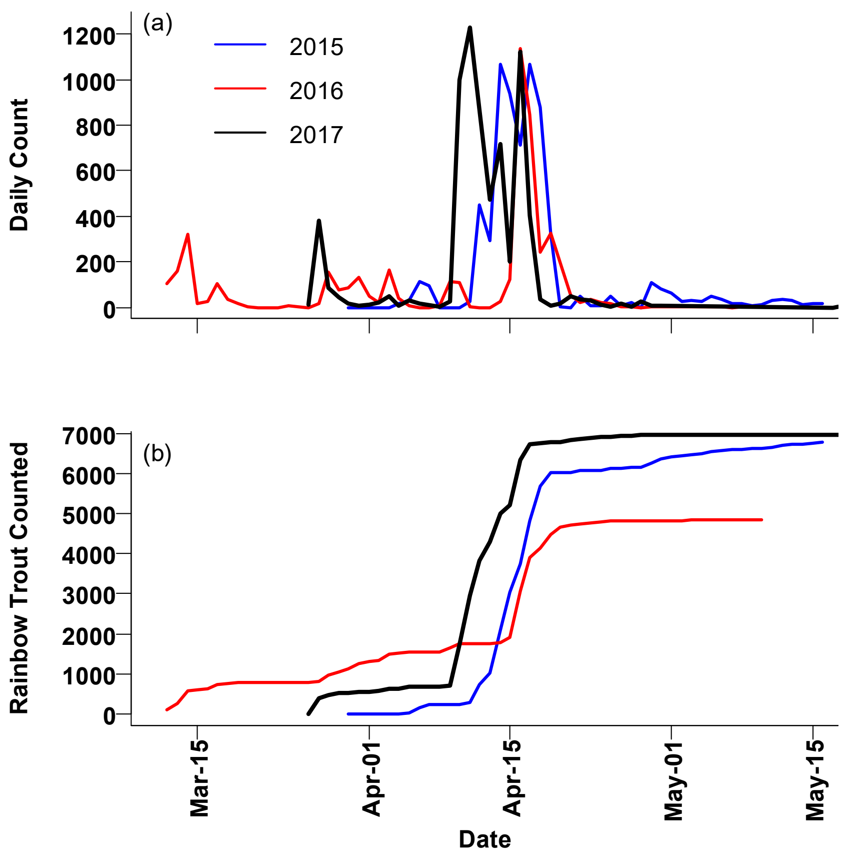

FIG. 1.1.2. Daily count (a) and cumulative count (b) of Rainbow Trout passing through the fish counter in the Ganaraska River fishway at Port Hope, Ontario during spring over the past three years.

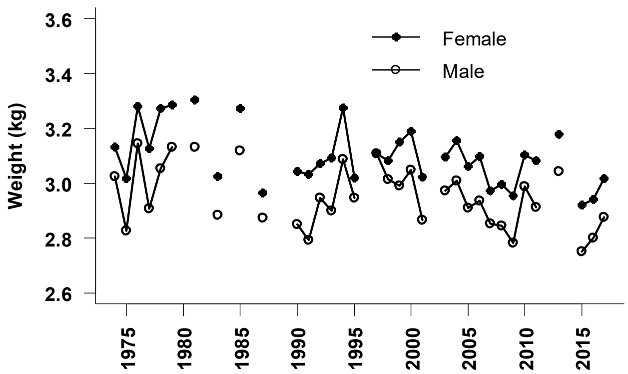

FIG. 1.1.3.Body condition (estimated weight at 635 mm total length) of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario during spring 1974-2017. Open and closed circles represent male and female Rainbow Trout (respectively).

TABLE 1.1.2. Body condition (estimated weight at 635 mm total length) of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario during spring, 1974-2017.

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
Average	2,979		3,098	

1974. In 2017, 27% of fish had Lamprey marks (wound or scar), which is unchanged from 2016 (Fig. 1.1.4). Lamprey wounds on Ganaraska River Rainbow Trout in 2017 remain below the previous 10 year average (35%; Table 1.1.3).

TABLE 1.1.3. Lamprey marks on Rainbow Trout in spring 1990-2017, 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

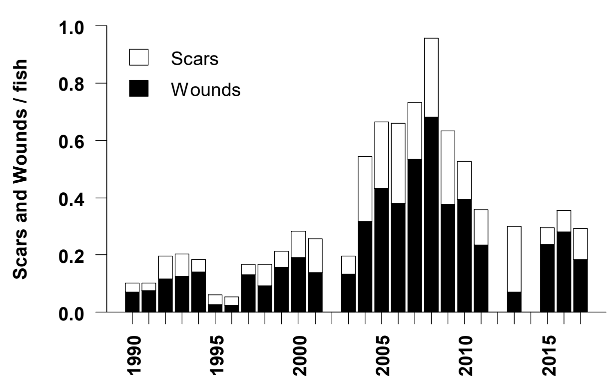

FIG. 1.1.4. Trend in lamprey marks on Rainbow Trout during the spring 1990-2017, at the Ganaraska River fishway at Port Hope, Ontario. Since 1990, A1 and A2 marks (King and Edsall 1979) were called wounds and the remainder of marks were called scars to fit with historical classification.

King, E.L. Jr. and Edsall, T.A. 1979. Illustrated field guide for the classification of sea lamprey attack marks on great lakes lake trout. GLFC Special Publication 79-1.

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

J. A. Hoyle, Lake Ontario Management Unit

The Lake Ontario and Bay of Quinte annual 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. 1.2.1 and the basic sampling design is summarized in Table 1.2.1. Included in the design are fixed, single-depth sites and depth-stratified sampling areas. In 2017, each site or area was visited from one to three times within specified time-frames, and with one to three gill net gangs set during each visit.

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 1.2.1). This increases the probability of encountering a wide-range of water temperatures across the depth ranges sampled, both seasonally and by geographic area. In 2017, the Bay of Quinte (Trenton, Belleville, Big Bay, Deseronto, and Hay Bay areas) was also sampled in late October/early November. Seasonal sampling at these Bay of Quinte sites will help better assess seasonal fish distribution and abundance patterns.

Monofilament gill nets with standardized specifications are used (monofilament mesh replaced multifilament in 1992; only catches from 1992-present are tabulated below). 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

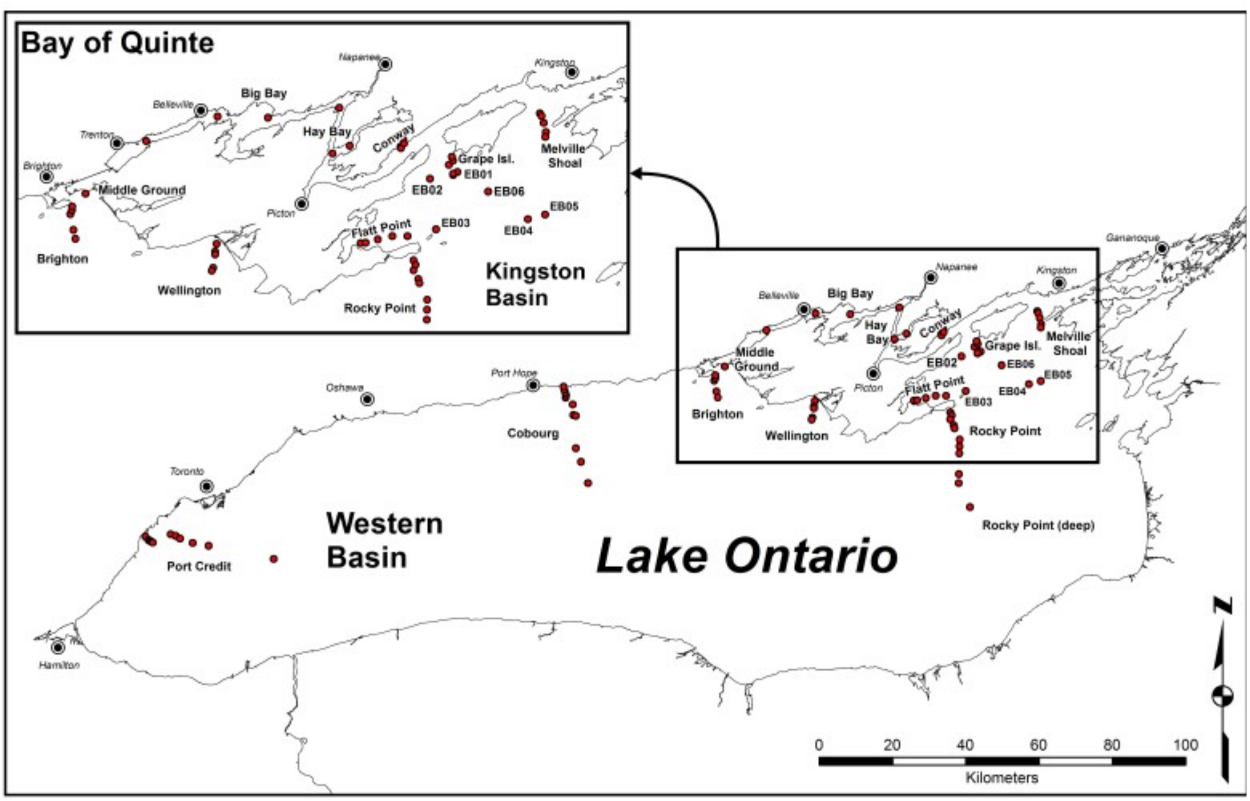

FIG. 1.2.1. Map of north eastern Lake Ontario. Shown are eastern Lake Ontario and Bay of Quinte fish community index gill netting sites.

TABLE. 1.2.1. 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 and the number of prior years that netting has occurred.

						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)	Visits x Replicates	Time-frame	Start-up year	Number years[4]
Northwestern Lake Ontario	Port Credit (PC)	Depth stratified area	PC08	7.5	1	2		433230	793476	2	Jul 1-Jul 31	2014	4
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC13	12.5	1	2		433182	793403	2	Jul 1-Jul 31	2014	4
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC18	17.5	1	2		433164	793355	2	Jul 1-Jul 31	2014	4
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC23	22.5	1	2		433156	793335	2	Jul 1-Jul 31	2014	4
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC28	27.5	1	2		433143	793308	2	Jul 1-Jul 31	2014	4
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC40	40	1		3	433269	792976	3	Jul 1-Jul 31	2016	2
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC50	50	1		3	433249	792874	3	Jul 1-Jul 31	2016	2
Northwestern Lake Ontario	Port Credit	Depth stratified area	0060	60	1		3	433213	792808	3	Jul 1-Jul 31	2014	4
Northwestern Lake Ontario	Port Credit	Depth stratified area	0080	80	1		3	433190	792515	3	Jul 1-Jul 31	2014	4
Northwestern Lake Ontario	Port Credit	Depth stratified area	0100	100	1		3	433162	792161	3	Jul 1-Jul 31	2014	4
Northwestern Lake Ontario	Port Credit	Depth stratified area	0140	140	1		3	433065	790735	3	Jul 1-Jul 31	2014	4
Northeastern Lake Ontario	Cobourg (CB)	Depth stratified area	CB08	7.5	2	2		435701	781167	4	Jul 1-Sep 15	2010	8
Northeastern Lake Ontario	Cobourg	Depth stratified area	CB13	12.5	2	2		435661	781157	4	Jul 1-Sep 15	2010	8
Northeastern Lake Ontario	Cobourg	Depth stratified area	CB18	17.5	2	2		435622	781136	4	Jul 1-Sep 15	2010	8
Northeastern Lake Ontario	Cobourg	Depth stratified area	CB23	22.5	2	2		435584	781109	4	Jul 1-Sep 15	2010	8
Northeastern Lake Ontario	Cobourg	Depth stratified area	CB28	27.5	2	2		435549	781110	4	Jul 1-Sep 15	2010	8
Northeastern Lake Ontario	Cobourg	Depth stratified area	CB40	40	1		3	435454	780943	3	Jul 1-Jul 31	2016	2
Northeastern Lake Ontario	Cobourg	Depth stratified area	CB50	50	1		3	435299	780924	3	Jul 1-Jul 31	2016	2
Northeastern Lake Ontario	Cobourg	Depth stratified area	0060	60	1		3	435257	780916	3	Jul 1-Jul 31	2014	4
Northeastern Lake Ontario	Cobourg	Depth stratified area	0080	80	1		3	434813	780919	3	Jul 1-Jul 31	2014	3
Northeastern Lake Ontario	Cobourg	Depth stratified area	0100	100	1		3	434589	780857	3	Jul 1-Jul 31	2014	3
Northeastern Lake Ontario	Cobourg	Depth stratified area	0140	140	1		3	434310	780728	3	Jul 1-Jul 31	2014	3
Northeastern Lake Ontario	Brighton (BR)	Depth stratified area	BR08	7.5	2	2		435955	774058	4	Aug 1-Sep 15	1988	30
Northeastern Lake Ontario	Brighton	Depth stratified area	BR13	12.5	2	2		435911	774071	4	Aug 1-Sep 15	1988	30
Northeastern Lake Ontario	Brighton	Depth stratified area	BR18	17.5	2	2		435878	774053	4	Aug 1-Sep 15	1988	30
Northeastern Lake Ontario	Brighton	Depth stratified area	BR23	22.5	2	2		435777	774034	4	Aug 1-Sep 15	1988	30
Northeastern Lake Ontario	Brighton	Depth stratified area	BR28	27.5	2	2		435624	774004	4	Aug 1-Sep 15	1988	30
Northeastern Lake Ontario	Middle Ground (MG)	Fixed site	MG05	5	2	2		440054	773906	4	Aug 1-Sep 15	1979	39
Northeastern Lake Ontario	Wellington (WE)	Depth stratified area	WE08	7.5	2	2		435622	772011	4	Aug 1-Sep 15	1988	30
Northeastern Lake Ontario	Wellington	Depth stratified area	WE13	12.5	2	2		435544	772027	4	Aug 1-Sep 15	1988	30
Northeastern Lake Ontario	Wellington	Depth stratified area	WE18	17.5	2	2		435515	772025	4	Aug 1-Sep 15	1988	30
Northeastern Lake Ontario	Wellington	Depth stratified area	WE23	22.5	2	2		435378	772050	4	Aug 1-Sep 15	1988	30
Northeastern Lake Ontario	Wellington	Depth stratified area	WE28	27.5	2	2		435348	772066	4	Aug 1-Sep 15	1988	30
Northeastern Lake Ontario	Rocky Point (RP)	Depth stratified area	RP08	7.5	2	2		435510	765220	4	Jul 21-Sep 15	1988	30
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP13	12.5	2	2		435460	765230	4	Jul 21-Sep 15	1988	30
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP18	17.5	2	2		435415	765222	4	Jul 21-Sep 15	1988	30
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP23	22.5	2	2		435328	765150	4	Jul 21-Sep 15	1988	30
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP28	27.5	2	2		435285	765135	4	Jul 21-Sep 15	1988	30
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0040	40	1		3	435190	765040	3	Jul 1-Jul 31	2016	2
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0050	50	1		3	435090	765030	3	Jul 1-Jul 31	2016	2
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0060	60	1		3	434950	765029	3	Jul 1-Jul 31	1997	21
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0080	80	1		3	434633	765006	3	Jul 1-Jul 31	1997	21
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0100	100	1		3	434477	764998	3	Jul 1-Jul 31	1997	21
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0140	140	1		3	434122	764808	3	Jul 1-Jul 31	1997	21
Kingston Basin (nearshore)	Flatt Point (FP)	Depth stratified area	FP08	7.5	2	2		435665	765993	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP13	12.5	2	2		435659	765927	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP18	17.5	2	2		435688	765751	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP23	22.5	2	2		435726	765541	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP28	27.5	2	2		435754	765314	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Grape Island (GI)	Depth stratified area	GI08	7.5	2	2		440537	764712	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI13	12.5	2	2		440523	764747	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI18	17.5	2	2		440476	764710	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI23	22.5	2	2		440405	764718	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI28	27.5	2	2		440470	764796	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Melville Shoal (MS)	Depth stratified area	MS08	7.5	2	2		441030	763500	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS13	12.5	2	2		441004	763470	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS18	17.5	2	2		440940	763460	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS23	22.5	2	2		440835	763424	4	Jul 1-Jul 31	1986	32
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS28	27.5	2	2		440792	763424	4	Jul 1-Jul 31	1986	32
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	2
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	50
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	2
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	2
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	2
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	50

TABLE. 1.2.1 (continued). Sampling design of the Lake Ontario fish community index gill netting program (Bay of Quinte) 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 and the number of prior years that netting has occurred.

Region name	Area Name (Area code)	Design	Site name	Depth (m)	Visits	Replicates by net size[3] 465 feet	500 feet	Site location (approx) Latitude (dec min)	Longitude (dec min)	Visits x Replicates	Time-frame	Start-up year	Number years[4]
Bay of Quinte	Conway	Depth stratified area	CO08	7.5	2	2		440664	765463	4	Jul 21-Aug 21	1972	46
Bay of Quinte	Conway	Depth stratified area	CO13	12.5	2	2		440649	765452	4	Jul 21-Aug 21	1972	46
Bay of Quinte	Conway	Depth stratified area	CO20	20	2	2		440643	765453	4	Jul 21-Aug 21	1972	46
Bay of Quinte	Conway	Depth stratified area	CO30	30	2	2		440620	765440	4	Jul 21-Aug 21	1972	46
Bay of Quinte	Conway	Depth stratified area	CO45	45	2	2		440601	765402	4	Jul 21-Aug 21	1972	46
Bay of Quinte	Hay Bay (HB)[2]	Depth stratified area	HB08	7.5	4	2		440656	770156	8	Jun 15-Jul 15 (1 visit); Jul 21-Aug 21 (2 visits); Oct 15-Nov 15 (1 visit)	1959	59
Bay of Quinte	Hay Bay	Depth stratified area	HB13	12.5	4	2		440575	770400	8	Jun 15-Jul 15 (1 visit); Jul 21-Aug 21 (2 visits); Oct 15-Nov 15 (1 visit)	1959	59
Bay of Quinte	Deseronto (DE)	Fixed site	DE05	5	3	2		441035	770339	6	Jun 15-Jul 15 (1 visit); Jul 21-Aug 21 (1 visit); Oct 15-Nov 15 (1 visit)	2016	2
Bay of Quinte	Big Bay (BB)	Fixed site	BB05	5	4	2		440920	771360	8	Jun 15-Jul 15 (1 visit); Jul 21-Aug 21 (2 visits); Oct 15-Nov 15 (1 visit)	1972	46
Bay of Quinte	Belleville (BE)	Fixed site	BE05	5	3	2		440914	772048	6	Jun 15-Jul 15 (1 visit); Jul 21-Aug 21 (1 visit); Oct 15-Nov 15 (1 visit)	2016	2
Bay of Quinte	Trenton (TR)	Fixed site	TR05	5	3	2		440636	773063	6	Jun 15-Jul 15 (1 visit); Jul 21-Aug 21 (1 visit); Oct 15-Nov 15 (1 visit)	2016	2

[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.

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 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 1.2.1). 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 1.2.1. Gill net set duration usually ranges from 18-24 hr but can be up to three days for the deep-water Lake Ontario sites (40-140 m) at Rocky Point, Cobourg and Port Credit.

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 2017, 324 gill net samples were made from 19-Jun to 2-Nov. Thirty-two different species and over 37,000 individual fish were caught. About 82% of the observed catch was alewife (Table 1.2.2). Species-specific gill net catch summaries are shown by geographic area/ site in Tables 1.2.3-1.2.24.

Selected biological information is also presented below for Lake Whitefish, Cisco and Walleye.

Lake Ontario

Northeast (Brighton, Wellington and Rocky Point) and Kingston Basin (Melville Shoal, Grape Island and Flatt Point) Nearshore Areas (Tables 1.2.3-1.2.8 inclusive)

Six depth-stratified sampling areas (Melville Shoal, Grape Island, Flat Point, Rocky Point, Wellington and Brighton) 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

TABLE 1.2.2. Species-specific catch per gill net set in 2017 from June 19 to November 2. "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 324 gill nets were set and 32 species comprising 37,008 fish were caught.

Species	Observed catch	Standard catch	Mean weight (g)
Sea Lamprey	1	1	155
Longnose Gar	125	157	1,552
Bowfin	1	1	1,982
Alewife	30,327	83,336	37
Gizzard Shad	274	283	818
Chinook Salmon	31	40	830
Rainbow Trout	2	2	1,805
Brown Trout	7	7	2,300
Lake Trout	372	390	3,371
Lake Whitefish	34	34	1,092
Cisco	181	188	427
Rainbow Smelt	13	22	39
Northern Pike	22	22	3,201
White Sucker	243	245	567
Silver Redhorse	5	5	1,225
Common Carp	3	3	7,959
Brown Bullhead	18	20	362
Channel Catfish	12	12	1,206
Burbot	4	4	2,463
White Perch	1,213	1,713	108
White Bass	30	30	211
Morone sp.	1	1	145
Rock Bass	83	131	80
Pumpkinseed	45	59	65
Bluegill	14	19	56
Smallmouth Bass	50	52	965
Largemouth Bass	9	11	367
Black Crappie	3	3	147
Yellow Perch	2,363	6,052	70
Walleye	974	995	1,588
Round Goby	176	556	39
Freshwater Drum	338	345	985
Deepwater Sculpin	32	32	31
Lake Whitefish x Cisco	2	2	1,955

open-coastal waters out to about 30 m water depth in the eastern half of Lake Ontario. Results were summarized and presented graphically (Fig. 1.2.2) to illustrate abundance trends of the most abundant fish species.

Many species showed peak abundance levels in the early 1990s followed by dramatic abundance decline. Alewife, the most common species caught, has occurred at very high abundance levels after 2008 until 2014 when abundance declined precipitously. Alewife abundance increased in 2015 and again in 2016, and remained stable in 2017. Yellow Perch abundance increased slightly in 2017. In 2014, Round Goby abundance declined after 2007, remained low in 2015, increased in 2016, and remained stable in 2017. Lake Trout abundance remained low in 2017. Walleye catch increased in 2017. Lake Whitefish remain at a very low abundance level. Rock Bass and Smallmouth Bass abundance increased in 2017. Chinook Salmon and Brown Trout abundance declined in 2017.

Middle Ground (Table 1.2.9)

Middle Ground represents one of our longest running gill netting locations. Nine species were caught at Middle Ground in 2017. Yellow Perch dominated the catch.

Kingston Basin—Deep Sites (EB02 and EB06; Tables 1.2.10 and 1.2.11)

Two single-depth sites (EB02 and EB06) are used to monitor long-term trends in the deep water fish community the Kingston Basin. Results were summarized and presented graphically (Fig. 1.2.3) to illustrate abundance trends of the most abundant species (Alewife, Lake Trout, Lake Whitefish, Yellow Perch, Rainbow Smelt, Cisco, Chinook Salmon and Round Goby). Alewife catches were variable with high catches in some years: 1998-1999, 2010, 2012, 2016 and 2017. Lake Trout, Lake Whitefish, Rainbow Smelt, and Cisco abundance declined throughout the 1990s and remained low during the years that followed except that Cisco abundance increased markedly over the last three years. Chinook Salmon catches were relatively high in 2016 and 2017. Round Goby catch increased in 2017.

TABLE 1.2.3. Species-specific catch per gillnet set at **Brighton in Northeastern Lake Ontario**, 1992-2017. 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 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
Bowfin	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	0.05	-
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
Gizzard Shad	**0.44**	-	-	-	-	-	-	-	-	-	0.15	**0.02**	-	-	0.05	-	-	0.20	0.05
Coho Salmon	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
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
Rainbow Trout	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	0.10	-	-	-	-
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	-
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
Lake Whitefish	**0.42**	0.05	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	0.05
Cisco (Lake Herring)	**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
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
Northern Pike	**0.08**	-	-	0.05	-	0.10	-	0.20	0.05	0.05	-	**0.05**	0.05	-	-	0.15	0.30	-	-
White Sucker	**0.41**	-	0.10	-	0.05	0.15	0.05	0.10	-	-	0.05	**0.05**	0.05	-	-	0.15	-	0.35	-
Lake Chub	**-**	-	-	-	-	-	-	-	0.17	-	-	**0.02**	-	-	-	-	-	-	-
Common Carp	**0.12**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	0.05	-
Brown Bullhead	**0.10**	0.52	0.20	0.85	0.27	0.35	-	0.25	0.22	0.05	-	**0.27**	-	-	-	0.17	-	-	-
Channel Catfish	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
American Eel	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Burbot	**0.05**	0.05	-	-	-	-	0.05	0.05	-	-	-	**0.02**	-	-	-	0.05	0.05	0.05	0.15
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
Pumpkinseed	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Smallmouth Bass	**0.00**	-	-	-	-	-	-	-	-	-	0.05	**0.01**	-	-	-	-	-	-	-
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	-
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
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
Freshwater Drum	**0.17**	-	-	0.15	0.10	-	0.05	0.05	-	-	-	**0.04**	-	-	-	-	-	-	-
Total catch	**61**	52	110	37	26	49	79	8	98	212	71	**74**	311	146	299	73	346	200	180
Number of species	**13**	6	9	15	12	12	12	14	11	10	12	**11**	9	8	10	13	9	14	11
Number of sets		20	20	20	20	20	20	20	20	20	20		20	10	20	20	20	20	20

TABLE 1.2.4. Species-specific catch per gillnet set at **Wellington in Northeastern Lake Ontario**, 1992-2017. 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 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
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
Gizzard Shad	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
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
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	-
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
Lake Whitefish	**0.61**	0.10	0.05	-	-	-	-	-	-	-	-	**0.02**	0.35	-	-	0.20	-	0.05	-
Cisco	**0.11**	-	-	-	-	-	0.05	-	-	0.05	0.05	**0.02**	0.05	-	-	-	-	0.20	0.35
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
Northern Pike	**0.01**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	0.05	-	0.05	-	-	-	-
White Sucker	**0.05**	-	-	-	0.17	-	-	0.05	-	-	-	**0.02**	-	-	-	-	-	-	-
Greater Redhorse	**-**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-
Lake Chub	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Common Carp	**0.02**	-	-	-	-	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
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
Smallmouth Bass	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	0.05	-	-	-	-	-	-
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
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
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
Freshwater Drum	**0.25**	-	0.05	-	0.05	0.05	-	-	-	-	-	**0.02**	-	0.10	-	-	-	-	-
Total catch	**58**	37	60	83	54	125	164	28	110	476	239	**137**	483	165	477	118	256	136	176
Number of species	**11**	9	10	11	12	11	8	8	9	7	11	**10**	12	8	9	10	5	12	10
Number of sets		20	20	20	20	20	20	20	20	20	20		20	10	20	20	20	20	20

TABLE 1.2.5. Species-specific catch per gillnet set at **Rocky Point (nearshore sites only) in Northeastern Lake Ontario**, 1992-2017. 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 2-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
Alewife	**131.93**	105.42	141.61	86.90	155.51	293.30	142.82	135.36	231.74	176.68	662.38	**213.17**	530.40	127.84	512.07	192.74	135.43	225.92	69.31
Chinook Salmon	**0.23**	-	0.10	0.25	0.55	0.15	0.27	0.10	0.15	-	0.70	**0.23**	0.20	-	0.25	0.15	0.05	0.43	0.15
Rainbow Trout	**-**	-	-	-	-	-	0.05	-	-	-	-	**0.01**	-	-	0.05	-	-	-	-
Atlantic Salmon	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Brown Trout	**0.09**	-	1.20	0.05	0.25	0.25	0.45	0.10	0.50	-	0.80	**0.36**	1.55	1.10	0.95	0.05	0.15	0.15	-
Lake Trout	**5.40**	1.67	0.80	0.10	0.60	-	0.47	0.05	0.25	0.05	0.32	**0.43**	1.35	4.10	0.75	1.90	1.10	0.40	0.20
Lake Whitefish	**0.69**	0.05	-	0.30	0.10	0.05	0.10	0.05	0.25	0.45	-	**0.14**	0.10	0.30	0.10	0.10	-	-	-
Cisco	**0.07**	-	-	-	-	-	-	-	-	-	-	**-**	0.05	-	-	-	-	0.05	0.20
Chub	**-**	0.17	-	-	-	-	-	-	-	-	-	**0.02**	-	-	-	-	-	-	-
Rainbow Smelt	**0.03**	-	-	-	-	-	-	-	0.17	-	-	**0.02**	-	-	-	-	-	-	-
White Sucker	**0.04**	0.05	-	-	-	-	-	0.05	-	-	-	**0.01**	-	-	-	-	-	-	0.05
Lake Chub	**0.11**	-	0.17	-	-	-	-	0.05	-	-	-	**0.02**	-	-	-	-	-	-	-
Common Carp	**0.01**	-	-	-	0.10	0.05	-	-	-	-	-	**0.02**	-	-	-	-	-	-	0.05
Brown Bullhead	**-**	-	-	-	0.05	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-
Channel Catfish	**-**	-	-	-	-	-	-	-	-	0.05	-	**0.01**	-	-	-	-	-	-	-
Stonecat	**0.01**	0.70	0.17	0.05	-	0.10	0.05	0.27	-	-	-	**0.13**	-	-	-	-	-	-	-
Burbot	**0.28**	0.15	0.35	0.10	0.05	0.30	-	-	-	-	0.05	**0.10**	-	-	-	0.05	-	0.05	-
White Perch	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	0.05				
Rock Bass	**0.31**	0.32	0.53	0.87	0.05	0.35	0.55	0.63	0.86	0.32	0.86	**0.53**	0.05	0.73	0.48	0.27	0.98	0.17	0.65
Smallmouth Bass	**1.05**	0.70	0.65	0.67	0.80	0.42	0.42	0.52	0.55	0.15	0.50	**0.54**	0.20	0.53	0.37	0.10	0.10	0.77	1.07
Yellow Perch	**0.06**	-	-	-	-	0.17	0.81	0.88	0.22	0.33	1.75	**0.42**	0.60	0.66	-	-	-	0.17	0.17
Walleye	**0.67**	-	0.25	0.10	0.80	1.60	0.65	0.85	0.65	0.15	0.45	**0.55**	0.10	0.20	0.70	1.10	1.15	0.20	1.75
Round Goby	**-**	-	-	-	-	2.15	8.48	71.25	9.50	28.26	15.93	**13.56**	6.54	7.60	13.88	4.51	0.83	7.07	8.26
Freshwater Drum	**0.19**	0.10	0.05	0.05	0.30	-	0.10	-	0.20	0.15	0.15	**0.11**	-	-	-	-	-	-	-
Total catch	**141**	109	146	89	159	299	155	210	245	207	684	**230**	541	143	530	201	140	235	82
Number of species	**10**	10	11	11	12	12	13	13	12	10	11	**12**	11	9	11	10	8	11	11
Number of sets		20	20	20	20	20	20	20	20	20	20		20	10	20	20	20	20	20

TABLE 1.2.6. Species-specific catch per gillnet set at **Flatt Point in the Kingston Basin of Lake Ontario**, 1992-2017. 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 2-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
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
Chinook Salmon	**0.16**	-	-	-	0.35	0.05	-	0.10	-	-	0.05	**0.06**	0.05	0.15	-	-	-	-	-
Rainbow trout	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.15					
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
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
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
Cisco (Lake Herring)	**0.83**	-	-	0.10	-	0.05	-	-	-	-	-	**0.02**	-	0.05	0.05	-	-	0.15	0.05
Coregonus sp.	**0.00**	0.05	-	-	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-
Rainbow Smelt	**0.22**	-	-	-	-	-	0.05	-	0.05	-	0.10	**0.02**	-	-	-	-	-	-	-
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
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	-	-
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
Smallmouth Bass	**0.06**	-	0.10	0.05	-	-	-	-	-	-	-	**0.02**	-	0.05	-	-	-	0.05	-
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
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	-
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
Freshwater Drum	**0.08**	-	-	-	-	-	-	-	-	-	-	**-**	0.05	-	-	-	-	0.05	-
Total catch	**119**	60	14	19	149	179	269	172	308	314	638	**212**	923	828	341	15	298	493	891
Number of species	**10**	11	9	11	10	11	11	11	11	10	11	**11**	12	14	8	6	9	10	9
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20	20	20

TABLE 1.2.7. Species-specific catch per gillnet set at **Grape Island in the Kingston Basin of Lake Ontario**, 1992-2017. 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 2-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
Lake Sturgeon	**0.01**	0.05	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-
Alewife	**116.14**	155.14	15.03	47.83	42.83	225.83	376.62	153.49	358.67	244.82	719.98	**234.02**	1,244.67	675.03	463.46	43.11	225.54	1,135.89	930.37
Chinook Salmon	**0.02**	-	-	-	-	0.15	-	0.10	-	-	-	**0.03**	-	-	-	-	-	-	-
Brown Trout	**0.02**	-	-	-	0.05	0.05	0.10	-	-	-	0.05	**0.03**	0.25	0.10	0.10	0.10	-	-	-
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
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
Cisco (Lake Herring)	**0.08**	-	-	-	-	-	-	-	-	-	0.15	**0.02**	0.05	-	0.10	0.05	-	0.40	0.25
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
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
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
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
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
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
Freshwater Drum	**0.28**	0.05	-	0.20	-	-	0.05	-	0.05	-	0.05	**0.04**	-	-	-	-	-	-	-
Total catch	**146**	161	36	71	139	243	407	180	370	253	731	**259**	1,252	681	471	48	232	1,141	937
Number of species	**11**	9	9	16	11	11	11	11	10	8	11	**11**	11	10	10	9	8	10	10
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20	20	20

TABLE 1.2.8. Species-specific catch per gillnet set at **Melville Shoal in the Kingston Basin of Lake Ontario**, 1992-2017. 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 2-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
Lake Sturgeon	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	0.05	-
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
Gizzard Shad	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Chinook Salmon	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	0.05	-
Rainbow Trout	**-**	-	-	-	-	-	-	0.05	-	-	-	**0.01**	-	-	-	-	-	-	-
Brown Trout	**-**	-	-	-	-	-	0.05	-	0.10	-	0.15	**0.03**	0.05	0.05	-	0.05	-	-	-
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
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
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	-
White Sucker	**0.03**	0.05	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	0.05
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
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
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
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
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
Freshwater Drum	**0.09**	0.05	-	0.05	-	-	-	0.22	-	-	0.10	**0.04**	0.05	-	-	-	0.05	-	-
Total catch	**118**	61	72	40	149	210	253	137	164	516	662	**227**	691	243	560	122	187	821	741
Number of species	**12**	12	9	12	9	7	8	10	10	8	12	**10**	10	9	6	8	10	10	9
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20	20	20

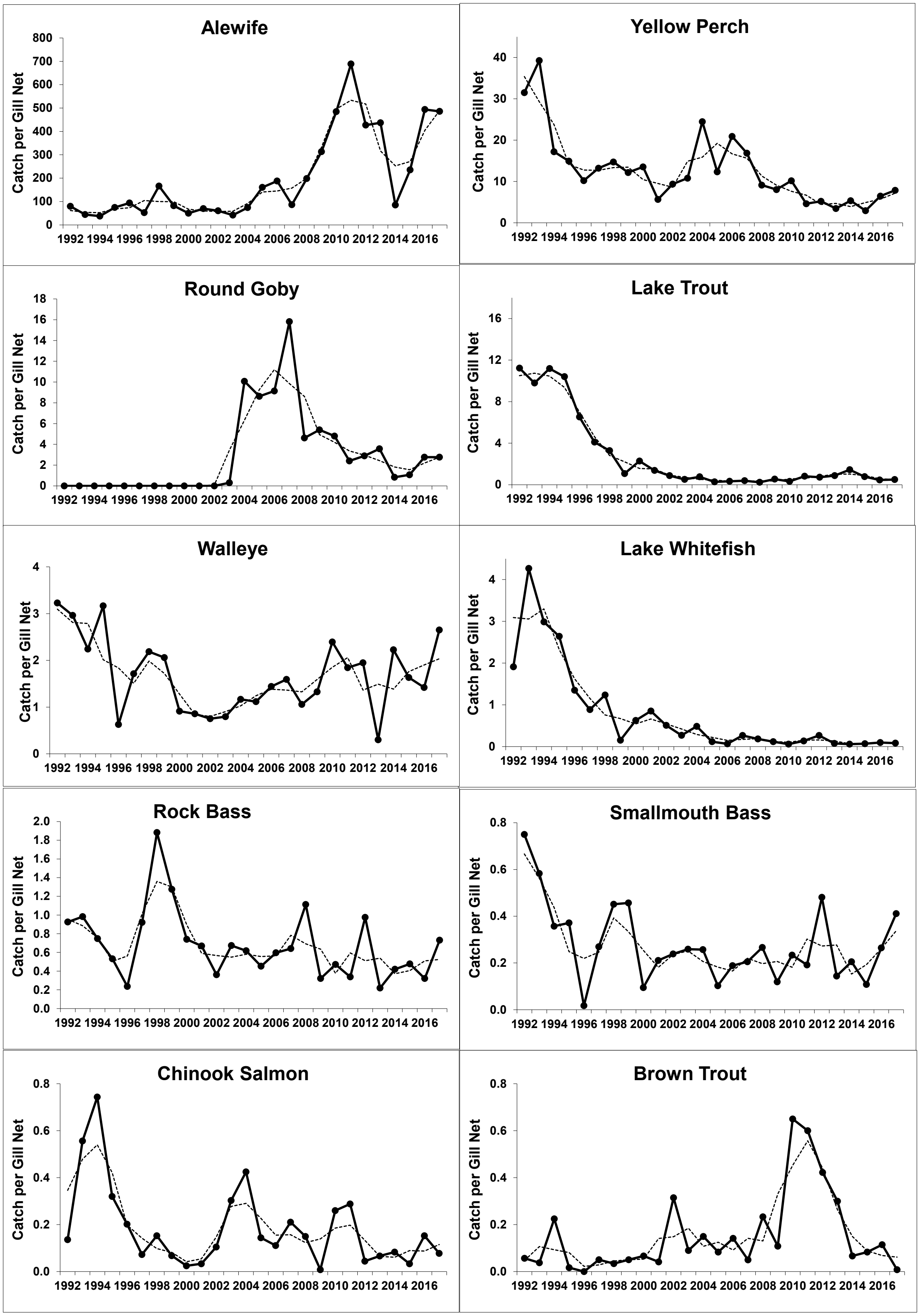

FIG. 1.2.2. Abundance trends for the most common species caught in gill nets at six depth-stratified transects (nearshore out to 30 m) in northeastern Lake Ontario (Melville Shoal, Grape Island, Flatt Point, Rocky Point, Wellington and Brighton; see Fig. 1.2.1). Annual catch per gill net values are unweighted means. Dotted lines show 3-yr running averages (two years for first and last years graphed).

TABLE 1.2.9. Species-specific catch per gill net set at **Middle Ground in Northeastern Lake Ontario**, 1992-2017 (no sampling in 2012). Annual catches are averages for 2 gill net gangs set during each of 1-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gill nets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
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
Gizzard Shad	**0.39**	-	-	-	-	0.50	-	0.25	-	-	0.25	**0.10**	-		-	-	-	-	0.25
Brown Trout	**0.11**	-	-	-	-	-	0.25	-	0.25	0.50	0.25	**0.13**	0.25		-	-	-	-	-
Lake Trout	**0.90**	-	-	-	-	-	0.25	-	-	-	-	**0.03**	-		-	-	-	-	-
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
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
Common Carp	**0.41**	0.50	-	0.75	0.50	-	-	-	-	-	-	**0.18**	-		-	-	0.25	0.75	0.25
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
White Perch	**0.08**	-	-	-	-	-	-	-	-	-	-	**-**	-		0.50	-	-	-	-
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
Pumpkinseed	**0.18**	-	-	-	-	-	-	-	-	-	-	**-**	-		-	-	-	-	-
Bluegill	**0.06**	-	-	-	-	-	-	-	-	-	-	**-**	0.25		-	-	-	-	-
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
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
Freshwater Drum	**0.57**	-	0.25	-	3.00	0.25	-	0.50	-	0.50	-	**0.45**	-		-	-	-	0.25	-
Total catch	**70**	50	66	31	75	34	110	41	50	35	24	**52**	264		123	54	101	87	44
Number of species	**8**	7	7	7	8	8	7	9	7	7	8	**8**	8		6	4	5	7	9
Number of sets		4	4	4	4	4	4	4	4	4	4		4	-	4	4	4	4	4

TABLE 1.2.10. Species-specific catch per gillnet set at **EB02 in the Kingston Basin of Lake Ontario**, 1992-2017. Annual catches are averages for 3-8 gillnet gangs set during each of 2-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
Sea Lamprey	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Lake Sturgeon	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Alewife	**40.00**	17.83	0.25	0.25	8.67	1.75	4.50	3.25	2.92	7.46	157.00	**20.39**	2.45	60.75	9.13	1.50	15.21	356.88	30.95
Chinook Salmon	**0.05**	0.25	-	0.04	0.04	-	-	0.04	-	0.13	0.08	**0.06**	-	0.13	0.04	-	0.17	0.11	0.22
Rainbow Trout	**-**	-	-	-	-	-	-	-	-	-	-	**-**	0.04	-	-	-	-	-	-
Atlantic Salmon	**-**	-	-	-	-	-	-	-	0.04	-	-	**0.00**	-	-	-	-	-	-	-
Brown Trout	**0.02**	0.08	-	-	-	-	-	-	0.04	-	0.21	**0.03**	0.04	-	-	-	0.08	-	0.11
Lake Trout	**20.57**	1.58	0.75	1.54	0.88	0.42	1.50	2.08	3.58	2.33	1.63	**1.63**	2.10	0.88	2.38	4.17	4.88	1.78	2.73
Lake Whitefish	**3.76**	0.25	0.42	0.08	0.17	-	0.25	0.17	0.46	0.08	0.04	**0.19**	0.13	-	-	0.13	-	-	-
Cisco	**0.20**	-	-	-	0.04	-	-	-	-	-	0.21	**0.03**	0.04	-	0.08	-	0.21	1.00	0.67
Rainbow Smelt	**0.56**	-	-	-	0.04	0.04	0.08	0.04	-	0.17	0.17	**0.05**	-	-	0.04	-	0.04	-	-
Burbot	**0.05**	0.08	-	-	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-
Trout-perch	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
White Perch	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Rock Bass	**-**	-	-	-	-	-	-	-	-	-	0.04	**0.00**	-	-	-	-	-	-	-
Smallmouth Bass	**-**	-	-	-	-	-	-	-	-	0.04	-	**0.00**	-	-	-	-	0.04	-	-
Yellow Perch	**0.09**	-	0.28	0.04	2.92	0.50	0.71	0.17	0.42	0.13	0.25	**0.54**	0.04	0.13	0.04	-	0.04	0.22	-
Walleye	**0.04**	-	-	-	0.04	-	-	-	0.04	-	-	**0.01**	-	-	-	-	-	-	-
Round Goby	**-**	-	-	-	0.13	0.04	0.17	0.08	-	-	0.04	**0.05**	-	-	0.04	0.04	-	-	-
Freshwater Drum	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Sculpin sp.	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Total catch	**65**	20	2	2	13	3	7	6	8	10	160	**23**	5	62	12	6	21	360	35
Number of species	**7**	6	4	5	9	5	6	7	7	7	10	**7**	7	4	7	4	8	5	5
Number of sets		12	12	24	24	24	24	24	24	24	24		24	16	24	24	24	9	9

TABLE 1.2.11. Species-specific catch per gillnet set at **EB06 in the Kingston Basin of Lake Ontario**, 1992-2017. Annual catches are averages for 3-8 gillnet gangs set during each of 2-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
Sea Lamprey	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Lake Sturgeon	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Alewife	**28.50**	15.67	0.58	0.79	2.79	1.88	2.46	6.44	11.25	1.29	75.88	**11.90**	17.96	13.19	13.75	1.46	1.08	33.78	253.98
Chinook Salmon	**0.02**	-	-	-	-	0.08	-	-	0.04	-	-	**0.01**	0.08	0.19	0.08	-	-	0.11	-
Rainbow Trout	**-**	-	-	-	-	-	-	0.04	-	-	-	**0.00**	-	-	0.04	-	-	-	-
Brown Trout	**-**	-	0.08	-	-	0.04	-	0.08	0.04	0.04	0.04	**0.03**	-	0.13	-	-	0.04	-	-
Lake Trout	**21.88**	1.58	2.33	2.04	2.79	2.04	2.46	2.63	3.38	2.96	4.96	**2.72**	3.29	4.44	4.13	4.08	5.04	4.11	0.67
Lake Whitefish	**6.36**	0.58	0.42	0.25	2.54	0.29	0.33	0.42	1.79	0.46	0.92	**0.80**	0.92	0.75	0.50	0.13	0.17	0.11	0.11
Cisco	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.19	0.17	-	0.50	0.11	2.78
Rainbow Smelt	**0.52**	-	-	-	-	-	0.04	-	-	0.04	-	**0.01**	0.04	0.06	0.04	-	-	-	-
Common Carp	**-**	-	-	-	0.04	-	-	-	-	-	-	**0.00**	-	-	-	-	-	-	-
American Eel	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Burbot	**0.13**	0.17	0.08	0.04	0.04	-	-	-	-	-	-	**0.03**	-	-	-	-	-	-	-
White Perch	**0.01**	-	-	0.04	-	-	-	-	-	-	-	**0.00**	-	-	-	-	-	-	-
Yellow Perch	**-**	-	-	0.04	-	-	-	-	0.21	-	-	**0.03**	-	-	-	-	-	-	-
Walleye	**0.01**	-	-	-	-	-	0.04	-	-	-	-	**0.00**	0.04	-	-	-	-	-	-
Round Goby	**-**	-	-	-	-	0.04	0.13	0.26	-	-	0.08	**0.05**	0.17	-	-	-	-	-	0.37
Lake Whitefish x Cisco	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	0.11
Total catch	**57**	18	4	3	8	4	5	10	17	5	82	**16**	23	19	19	6	7	38	258
Number of species	**6**	4	5	6	5	6	6	6	6	5	5	**5**	7	7	7	3	5	5	5
Number of sets		12	12	24	24	24	24	24	24	24	24		24	16	24	24	24	9	9

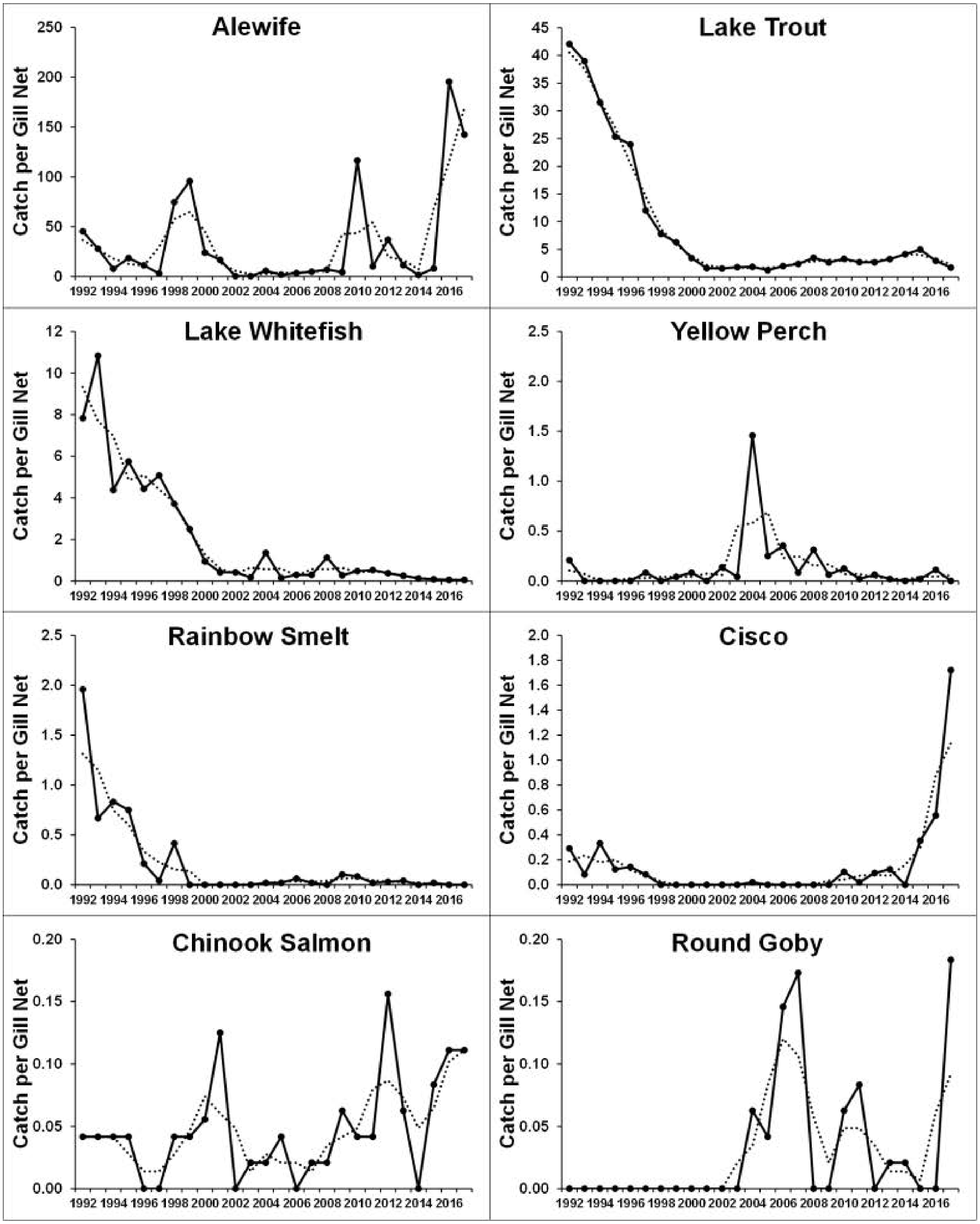

FIG. 1.2.3. Abundance trends (annual means) for the most common species caught in gill nets at the Kingston Basin deep sites, in eastern Lake Ontario (EB02 and EB06; see Fig. 1.2.1). Dotted lines show 3-yr running averages (two years for first and last years graphed).

Kingston Basin (additional sites sampled in 2017; Table 1.2.12)

As in 2016, four additional Kingston Basin deep gill net sampling sites were netted in 2017; EB01, EB03, EB04 and EB05). The sampling included a seasonal component (Jun-Sep). Together, along with EB02 and EB06, this netting provided a more complete description of the Kingston Basin deep-water fish community (Table 1.2.12). Overall, the dominant species were Alewife, Lake Trout, and Cisco; of note, Alewife catches were high in June and July, and low in August.

Lakewide Depth Stratified Transects (Rocky Point, Cobourg, Port Credit; Tables 1.2.13-1.2.15)

In 2017, for the fourth consecutive year, three lake-wide depth-stratified gill net transects, spanning a wide depth range (7.5-140 m), were sampled. Alewife, Chinook Salmon, Lake Trout, Round Goby, and Deepwater Sculpin were caught at three lake-wide transects. Cisco and Common Carp were caught only in the eastern-most transect (Rocky Point). Brown Trout was caught only at the central transect (Cobourg). Sea Lamprey, Gizzard Shad, Rainbow Trout and White Perch were caught only in the west at Port Credit.

Rocky Point—Deep Sites (Table 1.2.16)

Ten species have been captured at the Rocky Point deep sampling sites since 1997. Alewife and Lake Trout were the two most abundant species. Lake Trout abundance was relatively stable from 1997-2002, declined significantly through 2004 and recovered in the years following. Round Goby appeared for the first time in 2012 (at the 60 m site) and were captured again in 2015 and 2016 but not in 2017. Unlike Cobourg and Port Credit deep gill net sites (see below), Deepwater Sculpin had never been caught in the Rocky Point gill net sites but were caught in 2015 and in 2017.

Cobourg (Tables 1.2.17 and 1.2.18)

Nearshore sites (7.5-27.5 m): Alewife dominated the catch at the Cobourg nearshore sites but the salmonid fish community was also well represented (Table 1.2.17). Eight species were caught in 2017. Alewife catch declined significantly from 2010-2014, increased in 2015 and 2016, and remained high in 2017.

Deep sites (40-140 m): Four species were caught at the Cobourg deep sites in 2017: Alewife, Lake Trout, Round Goby and Deepwater Sculpin. Alewife abundance was high in 2017 (Table 1.2.18).

Port Credit (Tables 1.2.19 and 1.2.20)

Port Credit was sampled for the first time in 2014; sampling occurred again each year since with two additional deep sampling depths added (40 and 50 m) in 2016.

Nearshore sites (7.5-27.5 m): Eleven species were caught in 2017. Alewife dominated the catch. Other species caught included Round Goby, White Sucker, Round Goby, Chinook Salmon and Brown Trout (Table 1.2.19).

Deep Sites (40-140 m): Four species were caught at the Port Credit deep sites: Alewife, Lake Trout, Deepwater Sculpin, and Round Goby (Table 1.2.20).

Bay of Quinte (Conway, Hay Bay and Big Bay; Tables 1.2.21-1.2.23 inclusive)

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. 1.2.4 to illustrate abundance trends of the most abundant species from 1992-2017. Yellow Perch abundance peaked in 1998, declined gradually through 2013, and increased over the last four years. In 2014, White Perch abundance declined to its lowest level since 2001, and has recovered each year since. Alewife abundance increased from 2007-2010, declined from 2010-2014, and increased significantly through 2016. Alewife catch was low in 2017. Walleye abundance declined from 1992-2000 but has remained very stable since. Freshwater Drum and Gizzard Shad catches show no remarkable trends. White Sucker abundance declined since 1992, gradually levelling off in recent years but spiked in 2017. Brown Bullhead abundance has declined precipitously to low levels. Bluegill and Pumpkinseed abundance increased in the late-1990s then declined through 2004. Thereafter, Bluegill catches increased but

TABLE 1.2.12. . Species-specific catch per gillnet set at **six sites (EB01, EB02, EB03, EB04, EB05, EB06) in the Kingston Basin of Lake Ontario**, 2017. Catches are averages for 3 gillnet gangs set during each of 3 visits during summer. The total number of species caught and gillnets set each year are indicated.

	EB01			EB02			EB03			EB04			EB05			EB06			
Species	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Total
Alewife	609.25	514.28	-	3.30	87.01	2.54	5.51	137.68	-	337.41	503.36	40.32	244.65	2.20	2.54	556.07	205.87	-	180.67
Chinook Salmon	-	-	-	-	-	0.67	-	0.33	-	-	0.33	2.10	-	-	3.10	-	-	-	0.36
Brown Trout	-	-	-	-	-	0.33	-	-	-	-	-	-	-	-	-	-	-	-	0.02
Lake Trout	3.33	3.33	16.43	4.43	0.33	3.43	6.67	0.67	3.33	5.33	-	-	1.33	-	0.33	0.33	0.67	1.00	2.83
Lake Whitefish	0.33	-	2.33	-	-	-	-	-	-	1.33	0.33	1.00	-	-	0.33	0.33	-	-	0.33
Cisco	-	0.67	1.33	-	0.67	1.33	-	-	-	1.00	1.00	8.33	1.00	2.33	5.67	-	7.33	1.00	1.76
Rainbow Smelt	-	-	-	-	-	-	-	-	-	-	-	0.33	-	-	-	-	-	-	0.02
Yellow Perch	-	-	-	-	-	-	-	-	-	-	6.61	-	-	-	1.10	-	-	-	0.43
Walleye	-	-	-	-	-	-	-	-	0.33	-	-	-	-	-	-	-	-	-	0.02
Round Goby	-	-	-	-	-	-	-	-	-	2.20	1.10	1.10	-	1.10	-	1.10	-	-	0.37
Lake Whitefish x Cisco	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.33	0.02
Total catch	613	518	20	8	88	8	12	139	4	347	513	53	247	6	13	558	214	2	187
Number of species	3	3	3	2	3	5	2	3	2	5	6	6	3	3	6	4	3	3	11
Number of sets	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	54

TABLE 1.2.13. Species-specific catch per gillnet set at **Rocky Point in northeastern Lake Ontario** by site depth, 2017. Catches are averages for 2 or 3 gill net gangs during each of 1 or 2 visits during summer. The total number of species caught and number of gill nets set are indicated.

	Northeast (Rocky Point)										
Site depth (m)	7.5	12.5	17.5	22.5	27.5	40	50	60	80	100	140
Alewife	169.35	49.82	52.22	49.57	25.61	3.00	5.00	14.33	8.67	7.00	5.67
Chinook Salmon	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Trout	0.00	0.00	0.00	0.00	1.00	11.00	10.33	6.67	1.67	0.67	0.33
Cisco	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
White Sucker	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Common Carp	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Bass	0.83	2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Smallmouth Bass	4.33	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellow Perch	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Walleye	6.50	1.00	0.75	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Round Goby	0.83	1.65	12.39	11.57	14.87	0.00	0.00	0.00	0.00	0.00	0.00
Deepwater Sculpin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Total catch	182	57	65	63	42	14	15	21	10	8	7
Number of species	5	8	3	5	5	2	2	2	2	2	3
Number of sets	4	4	4	4	4	3	3	3	3	3	3

TABLE 1.2.14. Species-specific catch per gillnet set at **Cobourg in north central Lake Ontario** by site depth, 2017. Catches are averages for 2 or 3 gill net gangs during each of 1 or 2 visits during summer. The total number of species caught and number of gill nets set are indicated.

	North Central (Cobourg)										
Site depth (m)	7.5	12.5	17.5	22.5	27.5	40	50	60	80	100	140
Alewife	0.83	469.89	345.30	77.58	110.54	963.06	463.67	522.67	60.67	17.33	1.67
Chinook Salmon	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brown Trout	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Trout	0.83	0.00	0.50	0.75	0.50	2.00	4.00	0.33	0.33	0.00	0.00
Smallmouth Bass	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellow Perch	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Walleye	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Round Goby	0.00	4.96	11.57	1.65	14.87	0.33	0.00	0.00	0.00	0.00	0.00
Deepwater Sculpin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	3.00
Total catch	2	475	357	80	126	965	468	523	62	17	5
Number of species	4	4	3	4	3	3	2	2	3	1	2
Number of sets	4	4	4	4	4	3	3	3	3	3	3

TABLE 1.2.15. Species-specific catch per gillnet set at **Port Credit in northwestern Lake Ontario** by site depth, 2017. Catches are averages for 2 or 3 gill net gangs during each of 1 or 2 visits during summer. The total number of species caught and number of gill nets set are indicated.

	Northwest (Port Credit)										
Site depth (m)	7.5	12.5	17.5	22.5	27.5	40	50	60	80	100	140
Sea Lamprey	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alewife	132.02	363.33	211.98	347.80	523.67	78.33	39.67	30.67	37.33	32.67	16.00
Gizzard Shad	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chinook Salmon	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00
Rainbow Trout	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brown Trout	0.00	1.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Trout	0.00	0.00	0.00	0.00	0.50	2.33	2.00	1.33	0.00	0.33	0.00
White Sucker	0.50	2.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
White Perch	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Bass	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Round Goby	2.15	1.65	1.65	12.57	14.87	1.33	0.67	0.00	0.00	0.00	0.00
Deepwater Sculpin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00
Total catch	136	369	217	361	540	82	42	32	37	33	22
Number of species	6	5	7	3	4	3	3	2	1	2	2
Number of sets	4	4	4	4	4	3	3	3	3	3	3

TABLE 1.2.16. Species-specific catch per gillnet set at **Rocky Point (deep sites only) in northeastern Lake Ontario**, 1997-2017 (no sampling in 2006, 2007 or 2010). Annual catches are averages for 2 or 3 gillnet gangs set at each of up to 6 depths (40, 50, 60, 80, 100 or 140 m) during each of 2 visits during early-summer. Mean catches for 1997-2000 and 2001-2010 time-periods are shown in bold. The total number of species caught and gillnets set each year are indicated.

	1997-2000											**2001-2010**							
	mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013	2014	2015	2016	2017
Alewife	**4.69**	12.25	0.38	9.21	14.46	1.83			23.92	40.67		**14.67**	35.13	2.58	13.50	41.46	62.71	42.22	7.28
Lake Trout	**5.05**	6.81	6.25	4.17	2.17	1.83			1.46	1.88		**3.51**	2.42	2.00	5.92	1.46	4.00	7.33	5.11
Lake Whitefish	**0.50**	0.13	-	0.08	-	0.08			0.25	0.50		**0.15**	0.13	-	0.67	0.67	0.29	0.39	-
Cisco (Lake Herring)	**0.13**	-	0.13	0.08	0.21	-			-	-		**0.06**	-	-	-	0.04	0.04	-	-
Coregonus sp.	**-**	-	-	-	-	-			-	-		**-**	-	-	-	-	0.04	-	-
Rainbow Smelt	**0.41**	-	0.19	-	-	-			0.08	0.08		**0.05**	0.08	-	0.08	0.13	-	-	-
Burbot	**0.09**	-	-	-	0.04	-			-	-		**0.01**	-	-	-	-	-	-	-
White Perch	**-**	-	-	-	-	-			-	-		**-**	-	-	-	-	-	0.06	-
Round Goby	**-**	-	-	-	-	-			-	-		**-**	-	0.08	-	-	0.04	0.22	-
Slimy Sculpin	**0.08**	0.06	-	0.04	0.04	-			0.08	-		**0.03**	-	-	-	-	-	-	-
Deepwater Sculpin	**-**	-	-	-	-	-			-	-		**-**	-	-	-	-	0.04	-	0.17
Total catch	**11**	19	7	14	17	4			26	43		**18**	38	5	20	44	67	50	12
Number of species	**6**	4	4	5	5	3			5	4		**4**	4	3	4	5	6	5	3
Number of sets		16	16	24	24	24	-	-	24	24	-		24	12	12	24	24	18	18

TABLE 1.2.17. Species-specific catch per gill net set at **Cobourg (nearshore sites only) in northeastern Lake Ontario**, 2010-2017. Annual catches are averages for 2 gill net 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. The total number of species caught and gill nets set each year are indicated.

	2010	2011	2012	2013	2014	2015	2016	2017
Alewife	351.96	196.13	56.77	23.78	7.48	136.71	271.45	200.83
Gizzard Shad	-	-	-	-	-	-	0.05	-
Coho Salmon	-	-	0.10	-	0.05	-	0.25	-
Chinook Salmon	0.68	2.05	1.82	0.44	0.40	0.20	1.70	0.05
Rainbow Trout	0.51	0.25	0.80	0.05	-	-	0.10	-
Brown Trout	0.13	0.65	0.50	0.42	0.25	0.40	0.65	0.05
Lake Trout	0.37	0.05	-	1.26	0.70	0.37	0.10	0.52
Lake Whitefish	-	0.05	-	-	-	-	0.05	-
Cisco	-	-	-	-	-	-	0.05	-
Round Whitefish	0.07	0.05	-	-	-	-	-	-
Rainbow Smelt	-	0.33	-	-	-	-	-	-
White Sucker	0.10	0.37	0.50	0.26	0.15	0.20	0.05	-
Greater Redhorse	-	-	0.10	-	-	-	-	-
Burbot	-	-	-	-	0.05	-	-	-
Smallmouth Bass	-	0.05	-	-	-	-	-	0.05
Yellow Perch	0.33	-	0.10	-	-	-	-	0.05
Walleye	0.03	-	0.40	-	0.05	0.10	0.10	0.05
Round Goby	2.20	9.91	3.30	0.40	0.17	1.65	2.20	6.61
Freshwater Drum	-	0.05	0.10	-	-	-	-	-
Total catch	356	210	65	27	9	140	277	208
Number of species	10	12	11	7	9	7	12	8
Number of sets	30	20	10	19	20	20	20	20

TABLE 1.2.18. Species-specific catch per gill net set at **Cobourg (deep sites only) in northeastern Lake Ontario**, 1997, 1998, and 2014-2017 Annual catches are averages for 2 or 3 gill net gangs set at each of 4-6 depths (40, 50, 60, 80, 100 and 140 m) during each of 1-2 visits during summer. The total number of species caught and gill nets set each year are indicated.

	1997	1998	2014	2015	2016	2017
Alewife	67.16	42.75	29.75	171.50	23.00	338.18
Brown Trout	-	-	0.08	-	-	-
Lake Trout	0.50	0.88	0.17	0.42	3.11	1.11
Cisco (Lake Herring)	-	0.13	-	-	0.17	-
Rainbow Smelt	2.88	0.50	-	-	-	-
Round Goby	-	-	-	-	-	0.06
Slimy Sculpin	0.06	-	-	-	-	-
Deepwater Sculpin	-	-	3.67	0.25	0.89	0.61
Total catch	71	44	30	172	26	339
Number of species	4	4	4	3	4	4
Number of sets	16	16	12	12	18	18

TABLE 1.2.19. Species-specific catch per gill net set at Port **Credit (nearshore sites only) in northwestern Lake Ontario**, 2014-2017. Annual catches are averages for 2 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during summer. The total number of species caught and gillnets set each year are indicated.

	2014	2015	2016	2017
Sea Lamprey	-	-	-	0.10
Alewife	24.12	358.58	234.44	315.76
Gizzard Shad	-	-	-	0.10
Chinook Salmon	0.10	0.20	0.10	0.50
Rainbow Trout	-	-	-	0.20
Atlantic Salmon	-	0.10	-	-
Brown Trout	-	0.10	-	0.40
Lake Trout	1.20	0.80	0.20	0.10
Longnose Sucker	-	0.20	0.10	-
White Sucker	0.20	1.50	0.20	0.60
White Perch	-	-	-	0.10
Rock Bass	-	-	-	0.10
Round Goby	-	1.32	5.72	6.58
Total catch	26	361	235	318
Number of species	4	8	6	11
Number of sets	10	10	10	10

TABLE 1.2.20. Species-specific catch per gill net set at **Port Credit (deep sites only) in northwestern Lake Ontario**, 2014-2017. Annual catches are averages for 3 gillnet gangs set at each of 4-6 depths (40, 50, 60, 80, 100, and 140 m) during summer. The total number of species caught and gillnets set each year are indicated.

	2014	2015	2016	2017
Alewife	79.92	7.33	4.33	39.11
Chinook Salmon	-	-	0.06	-
Lake Trout	1.17	1.42	2.94	1.00
Burbot	-	-	0.06	-
Round Goby	-	-	-	0.33
Deepwater Sculpin	2.00	1.42	2.06	1.00
Total catch	83	10	9	41
Number of species	3	3	5	4
Number of sets	12	12	18	18

TABLE 1.2.21. Species-specific catch per gillnet set at **Conway in the Bay of Quinte**, 1993-2017. Annual catches are averages for 2-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 20, 30 and 45 m) during each of 2-3 visits during summer. Mean catches for 1993-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1993-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
Sea Lamprey	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	0.05	-	-	-
Lake Sturgeon	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	0.05	-
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
Gizzard Shad	**0.01**	-	-	-	0.05	-	-	0.20	0.10	-	-	**0.04**	0.10	-	-	-	-	-	0.05
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
Rainbow Trout	**-**	-	-	-	-	0.05	-	-	-	-	-	**0.01**	-	-	-	-	-	-	-
Atlantic Salmon	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Brown Trout	**0.29**	0.10	0.05	0.35	0.10	0.25	0.25	0.15	0.45	0.15	0.05	**0.19**	0.40	-	0.05	-	-	-	-
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
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
Cisco	**0.19**	0.20	-	-	-	-	0.05	-	0.10	0.05	0.15	**0.06**	-	0.15	-	-	0.45	0.75	0.58
Coregonus sp.	**0.00**	-	-	-	0.05	-	-	-	-	-	-	**0.01**	-	-	-	0.05	-	-	-
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
Northern Pike	**0.04**	0.05	-	0.05	-	-	-	0.05	0.05	-	0.05	**0.03**	-	-	-	0.10	-	-	-
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
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	-	-	-	-	-	-
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
White Bass	**-**	-	-	-	-	-	-	-	-	-	-	**-**	0.05	-	-	-	-	-	-
Morone sp.	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	0.05
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
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
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
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
Round Goby	**-**	-	1.00	11.00	31.05	0.80	0.15	0.10	0.25	-	0.05	**4.44**	-	0.05	-	-	-	-	-
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
Total catch	**150**	81	89	75	89	105	77	51	106	90	196	**96**	211	128	119	66	144	488	146
Number of species	**13**	19	14	15	15	15	15	18	17	13	16	**16**	16	12	12	11	11	12	14
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20	20	-

TABLE 1.2.22. Species-specific catch per gillnet set at **Hay Bay in the Bay of Quinte**, 1992-2017. 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 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
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
Gizzard Shad	**0.71**	-	0.25	-	-	-	0.50	0.13	0.13	-	-	**0.10**	-	0.38	5.38	-	1.25	-	-
Chinook Salmon	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.13	-	-	0.13	-	-
Rainbow trout	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	0.08	-
Brown Trout	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-	-
Lake Trout	**0.12**	-	-	0.25	-	-	-	-	-	-	-	**0.03**	-	-	-	-	-	0.33	0.08
Lake Whitefish	**0.06**	0.13	-	-	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	0.08	-
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
Coregonus sp.	**0.04**	-	-	-	-	-	-	-	0.13	-	-	**0.01**	-	-	-	-	-	-	-
Rainbow Smelt	**0.19**	-	0.25	-	-	-	0.13	-	-	0.38	-	**0.08**	-	-	-	-	0.13	-	-
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
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
River Redhorse	**-**	-	-	-	-	-	-	0.13	-	-	-	**0.01**	-	-	-	-	-	-	-
Common Carp	**0.23**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	0.13	-	-	-	-
Golden Shiner	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.25	0.13	-	0.50	1.33	-
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	-	-
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
White bass	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.13	-	-	-	0.25	0.25
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
Bluegill	**-**	-	-	-	-	-	-	-	-	-	-	**-**	0.13	-	-	-	-	-	-
Smallmouth Bass	**0.10**	0.13	0.13	-	-	-	-	-	-	-	-	**0.03**	-	-	-	-	-	-	-
Black Crappie	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	0.13	-	-	0.08	-
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
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
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
Total catch	**193**	176	138	127	120	149	116	130	127	111	266	**146**	116	55	79	71	58	183	124
Number of species	**13**	12	14	11	11	10	11	14	12	10	9	**11**	10	11	8	9	11	12	11
Number of sets		8	8	8	8	8	8	8	8	8	4		8	8	8	8	8	12	12

TABLE 1.2.23. Species-specific catch per gillnet set at **Big Bay in the Bay of Quinte**, 1992-2017. Annual catches are averages for 2 gillnet gangs set during each of 2-4 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
Lake Sturgeon	**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
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
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
Lake Whitefish	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.17	-	-	-	-	-
Northern Pike	**0.68**	0.13	0.13	-	0.17	0.17	0.50	0.17	-	-	-	**0.13**	-	-	-	-	-	0.25	0.17
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
Silver Redhorse	**-**	-	-	-	-	-	-	-	-	-	0.17	**0.02**	-	-	-	-	-	-	-
Shorthead Redhorse	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	0.13	-
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
Channel Catfish	**0.37**	-	0.13	-	0.17	-	0.25	-	-	0.17	-	**0.07**	-	-	0.17	0.17	-	0.50	0.67
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
White Bass	**0.08**	-	0.13	-	-	-	-	0.17	0.17	-	-	**0.05**	-	0.17	-	0.33	0.50	1.38	0.17
Rock Bass	**0.26**	-	-	-	-	0.17	-	-	-	-	-	**0.02**	-	-	0.17	-	0.83	-	0.17
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
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
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
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
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
Total catch	**292**	277	270	199	273	249	371	164	223	286	173	**248**	254	189	227	112	137	171	221
Number of species	**14**	14	15	15	16	14	16	13	13	12	12	**14**	11	12	12	12	13	14	15
Number of sets		8	8	6	6	6	4	6	6	6	6		6	6	6	6	6	8	6

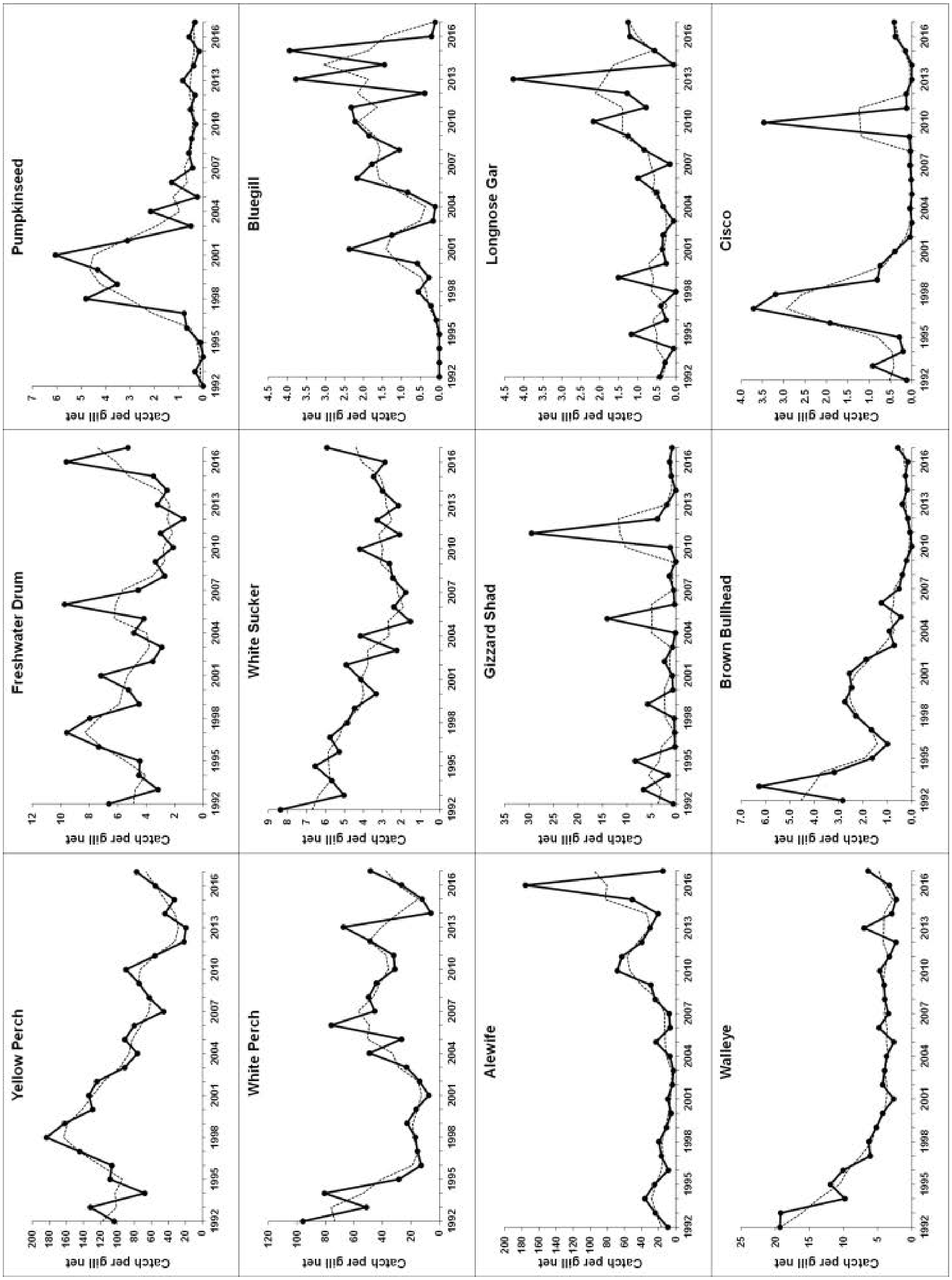

FIG. 1.2.4. Abundance trends (annual means) for the most common species caught in gill nets at three areas in the Bay of Quinte (Conway, Hay Bay and Big Bay; see Fig. 1.2.1). Dotted lines show 3-yr running averages (two years for first and last years graphed).

Pumpkinseed catches did not until 2016 and 2017 when Bluegill abundance was low. Cisco catches increased in the late-1990s then declined; most recently Cisco catch increased in 2015, 2016 and again in 2017.

Bay of Quinte (additional gill netting in 2017; Table 1.2.24)

Three additional upper Bay of Quinte gill net sampling sites were netted in 2016 and 2017. The 2017 sampling included a seasonal component (June, August and October/November sampling). Together, along with Big Bay, this netting provided a more complete description of the upper Bay of Quinte fish community (Table 1.2.24). Overall, the dominant species were Yellow Perch, White Perch, Walleye, Alewife, Gizzard Shad, Freshwater Drum and Longnose Gar. Alewife were abundant only in June.

Species Highlights

Lake Whitefish

Thirty three Lake Whitefish were caught and were interpreted for age in the 2017 index gill nets (Table 1.2.25). Fish ranged in age from 2-24 years. Fifteen year-classes were represented. Six (18%) whitefish were from the 2012 year-class.

Cisco

One hundred and fifty nine Cisco were caught and were interpreted for age in the 2017 index gill nets (Table 1.2.26). Fish ranged in age from 1-15 years. Fifteen year-classes were represented. One hundred and four (65%) Cisco were from the 2014 year-class.

Walleye

Four hundred and six Walleye were caught and interpreted for age in the 2017 summer index

TABLE 1.2.24. Species-specific catch per gill net set at **upper Bay of Quinte** gill net site locations (**Trenton, Belleville, Big Bay and Deseronto**) in June and August, 2017. The total catch and the number of species caught and gill nets set are indicated.

	Trenton			Belleville			Big Bay				Deseronto			
Species	Jun	Aug	Oct	Jun	Aug	Oct	Jun	Jul	Aug	Nov	Jun	Aug	Nov	Total
Longnose Gar	7.15	26.11	1.00	10.50	22.61	-	1.65	6.96	2.65	-	-	-	-	6.05
Bowfin	0.50	-	-	-	-	-	-	-	-	-	-	-	-	0.04
Alewife	16.52	-	4.96	1.65	-	-	9.91	-	0.50	-	168.87	-	-	15.57
Gizzard Shad	29.50	15.50	9.15	60.00	1.00	1.00	2.00	2.50	2.00	0.50	-	13.30	1.00	10.57
Chinook Salmon	-	-	0.50	-	-	-	-	-	-	-	-	-	0.50	0.08
Lake Whitefish	-	-	0.50	-	-	-	-	-	-	0.50	-	-	0.50	0.12
Cisco	-	-	-	-	-	0.50	-	-	-	3.00	-	-	12.00	1.19
Northern Pike	2.50	-	1.00	-	-	-	-	-	0.50	-	-	-	0.50	0.35
White Sucker	1.00	-	1.50	2.65	2.50	2.50	7.00	10.50	8.00	5.50	5.50	4.00	1.50	4.01
Silver Redhorse	2.00	-	-	0.50	-	-	-	-	-	-	-	-	-	0.19
Common Carp	-	-	-	-	-	-	-	-	-	-	0.50	-	-	0.04
Brown Bullhead	2.50	-	-	0.50	-	0.50	-	3.65	1.50	-	-	-	1.00	0.74
Channel Catfish	-	0.50	-	2.00	-	0.50	0.50	0.50	1.00	-	-	-	-	0.38
White Perch	15.91	27.28	55.54	49.72	52.15	15.91	81.63	146.72	195.98	18.26	8.00	87.80	6.30	58.56
White Bass	-	-	-	1.50	1.00	-	-	-	0.50	1.00	0.50	9.00	-	1.04
Rock Bass	5.80	-	3.30	4.65	-	0.50	-	-	0.50	-	0.50	0.50	0.50	1.25
Pumpkinseed	4.50	4.15	3.15	-	1.00	-	0.50	-	1.50	-	2.15	10.46	-	2.11
Bluegill	6.30	0.50	-	1.00	-	-	-	-	1.00	-	-	0.50	-	0.72
Largemouth Bass	2.00	-	-	-	-	-	-	-	-	-	-	3.65	-	0.43
Black Crappie	-	-	-	-	-	-	-	-	-	-	-	1.50	-	0.12
Yellow Perch	25.98	14.22	43.46	71.48	4.96	19.17	24.17	34.39	51.00	3.15	348.67	126.80	104.96	67.11
Walleye	4.00	9.00	8.00	11.00	6.00	13.15	5.00	6.65	16.15	45.65	29.50	22.15	35.50	16.29
Freshwater Drum	10.15	1.00	-	47.00	8.50	1.65	12.00	9.50	13.00	1.50	7.50	20.50	0.50	10.22
Lake Whitefish x Cisco	-	-	-	-	-	-	-	-	-	-	-	-	0.50	0.04
Total catch	136	98		264	100		144	221			572	300		197
Number of species	-	-		-	-		-	-			-	-		-
Number of sets	2	2		2	2		2	4			2	2		18

gill nets (Table 1.2.27). One hundred and thirty one Walleye (21%) were age-2 (2015 year-class) and 130 (21%) were age-3 (2014 year-class). In the Kingston Basin nearshore gill nets, 93% (258) of the 276 Walleye were age-5 or greater.

TABLE 1.2.25. Age distribution of **33 Lake Whitefish** sampled from index gill nets, by region, during 2017. Also shown are mean fork length and mean weight.

	Age/year-class															
	2	3	4	5	6	7	8	9	10	11	13	14	15	16	24	Total
Region	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2004	2003	2002	2001	1993	
Northeast									1							1
Kingston Basin (nearshore)			3			2	1	2		1						9
Kingston Basin (deep)	1	1	1	4	2					1	2	1	1	1	2	17
Bay of Quinte		2		2							1	1				6
Total aged	1	3	4	6	2	2	1	2	1	2	3	2	1	1	2	33
Mean fork length (mm)	247	270	363	395	416	433	479	441	409	503	541	520	540	520	591	
Mean weight (g)	149	204	514	679	796	928	1375	1070	728	1621	1811	1619	2052	1664	2813	

TABLE 1.2.26. Age distribution of **159 Cisco** sampled from index gill nets, by region, 2017. Also shown are mean fork length and mean weight.

	Age/year-class															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Region	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	
Northeast		1	6	2		2			1					1		13
Kingston Basin (nearshore)			12	2	1			4	1					2	1	23
Kingston Basin (deep)		2	71	6	1	1	3	4				1	1	2		92
Bay of Quinte	2		15	5			1	1	3	2	2					31
Total aged	2	3	104	15	2	3	4	9	5	2	2	1	1	5	1	159
Mean fork length (mm)	171	246	287	308	289	422	390	392	400	402	392	376	418	421	331	
Mean weight (g)	44	192	290	379	274	1165	841	819	930	999	790	557	1100	971	545	

TABLE 1.2.27. Age distribution of **625 Walleye** sampled from **summer** index gill nets, by region, 2017. 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/year-class																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	22	Total
Region	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1995	
Central														1							1
Northeast		1	4	1	5	4	3	2	6	4			2	7				1	1		41
Middle Ground		1	1																		2
Kingston Basin (nearshore)	2	8	5	3	7	17	15	14	33	36	12	35	16	32	3	12	6	13	6	1	276
Kingston Basin (deep)												1									1
Bay of Quinte	35	121	120	7	10	7	1		1			1		1							304
Total aged	37	131	130	11	22	28	19	16	40	40	12	37	18	41	3	12	6	14	7	1	625
Mean fork length (mm)	253	320	410	492	511	568	594	631	612	637	626	637	626	653	663	628	621	628	612	651	
Mean weight (g)	176	364	817	1416	1824	2508	2968	3476	3240	3587	3421	3587	3340	3938	4086	3391	3436	3430	3083	3618	
Mean GSI (females)	0.08	0.13	0.19	0.25	0.33	0.40	0.44	0.43	0.40	0.42	0.41	0.41	0.37	0.43	0.49	0.38	0.37	0.38	0.50	0.59	
% mature	0	3	15	40	82	100	100	100	83	100	100	90	89	95	100	86	100	100	100	100	

1.3 Lake Ontario and Bay of Quinte Fish Community Index Trawling

J. A. Hoyle, 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 1.3.1).

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. 1.3.1). 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 and 2017 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 or Port Credit. [Note that these sites were sampled in spring and fall prey fish assessments (see Section 1.11 and 1.12)]. 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 2017 bottom trawl sampling design is shown in Table 1.3.2.

Thirty-three species and over 52,000 fish were caught in 78 bottom trawls in 2017 (19-Jun to 7-Sep, Table 1.3.3). White Perch (39%). Alewife (18%), Round Goby (17%) and Yellow Perch (10%), collectively made up 85% of the catch by number. Species-specific catches in the 2017 trawling program are shown in Tables 1.3.4-1.3.16.

TABLE 1.3.1. Bottom trawl specifications used in Eastern Lake Ontario and Bay of Quinte Fish Community sampling.

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

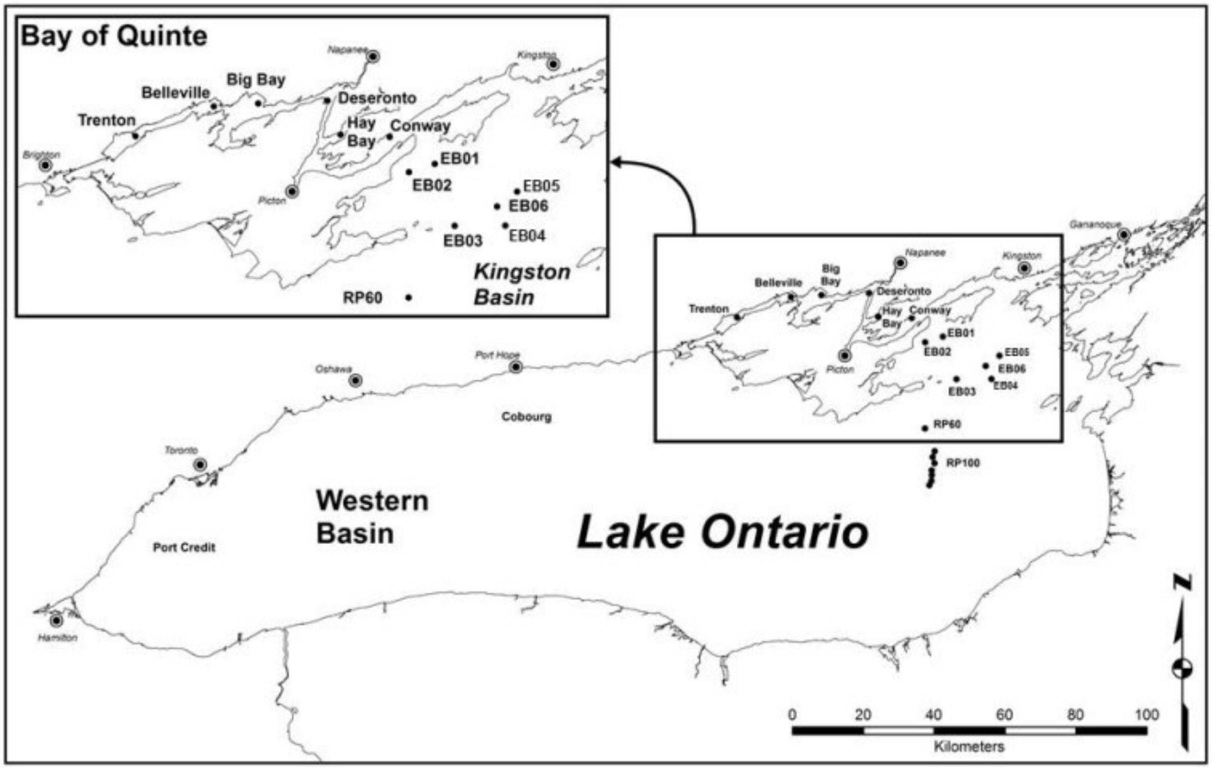

FIG. 1.3.1. Map of north eastern Lake Ontario. Shown are eastern Lake Ontario and Bay of Quinte fish community index bottom trawling site locations.

TABLE 1.3.2. 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 2017 three visits were made to EB03 (Sep) and 4 replicate trawls were conducted during the third visit.

						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
Kingston Basin	Eastern Basin (EB)	EB01	30	3	1 x 5 minute	440400	764720	3	Jun 20-Sep 9		
Kingston Basin	Eastern Basin (EB)	EB02	30	3	1 x 5 minute	440280	765120	3	Jun 20-Sep 9	1972	46
Kingston Basin	Eastern Basin (EB)	EB03	21	3	1 x 5 minute	435780	764810	3	Jun 20-Sep 9	1972	46
Kingston Basin	Eastern Basin (EB)	EB03	21	1	4 x 5 minute	435780	764810	4	Aug 1-Sep 15	1972	46
Kingston Basin	Eastern Basin (EB)	EB04	35	3	1 x 5 minute	435940	763910	3	Jun 20-Sep 9		
Kingston Basin	Eastern Basin (EB)	EB05	33	3	1 x 5 minute	440110	763540	3	Jun 20-Sep 9		
Kingston Basin	Eastern Basin (EB)	EB06	35	3	1 x 5 minute	435940	763910	3	Jun 20-Sep 9	1972	46
Rocky Point	Rocky Point (RP)	0060	60	1	1 x 5 minute	434969	765105	1	July	2014	4
Rocky Point	Rocky Point (RP)	0080	80	1	1 x 5 minute	434627	764887	1	July	2015	3
Rocky Point	Rocky Point (RP)	0090	90	1	1 x 5 minute	434534	764929	1	July	2015	3
Rocky Point	Rocky Point (RP)	0100	100	1	1 x 5 minute	434442	764888	1	July	1997	21
Rocky Point	Rocky Point (RP)	0110	110	1	1 x 5 minute	434335	764942	1	July	2015	3
Rocky Point	Rocky Point (RP)	0120	120	1	1 x 5 minute	434261	764937	1	July	2015	3
Rocky Point	Rocky Point (RP)	0130	130	1	1 x 5 minute	434173	764942	1	July	2015	3
Rocky Point	Rocky Point (RP)	0140	140	1	1 x 5 minute	434105	764983	1	July	2015	3
Bay of Quinte	Conway (LB)	BQ17	21	2	4 x 6 minutes	440650	765420	8	Aug 1-Sep 15	1972	46
Bay of Quinte	Hay Bay (MB)	BQ15	5	2	4 x 6 minutes	440650	770175	8	Aug 1-Sep 15	1972	46
Bay of Quinte	Deseronto (UB)	BQ14	5	2	4 x 6 minutes	441000	770360	8	Aug 1-Sep 15	1972	46
Bay of Quinte	Big Bay (UB)	BQ13	5	2	4 x 6 minutes	440975	771360	8	Aug 1-Sep 15	1972	46
Bay of Quinte	Belleville (UB)	BQ12	5	2	4 x 6 minutes	440920	772010	8	Aug 1-Sep 15	1972	46
Bay of Quinte	Trenton (UB)	BQ11	4	2	4 x 6 minutes	440600	773120	8	Aug 1-Sep 15	1972	46

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

TABLE 1.3.3. Species-specific total bottom trawl catch in 2017 from 19-Jun to 7-Sep. Frequency of occurrence (FO) is the number of trawls, out of a possible 78, in which each species (33 species and 52,277 individual fish) was caught.

Species	FO	Catch	Biomass (kg)	Mean weight (g)
Alewife	43	9,592	32.384	3.4
Gizzard Shad	16	173	0.534	3.1
Brown Trout	1	1	1.552	1,552.1
Lake Trout	1	1	0.000	0.2
Lake Whitefish	2	19	0.131	6.9
Cisco	4	10	0.406	40.6
Coregonus sp.	3	3	0.022	7.3
Rainbow Smelt	19	580	1.163	2.0
White Sucker	26	72	21.362	296.7
Silver Redhorse	1	1	0.091	91.4
Common Carp	5	8	0.045	5.6
Spottail Shiner	38	1,141	7.172	6.3
Brown Bullhead	32	183	49.759	271.9
Channel Catfish	2	2	0.102	51.0
American Eel	3	3	1.245	415.1
Trout-perch	38	1,684	5.488	3.3
White Perch	41	20,623	154.049	7.5
White Bass	12	41	1.710	41.7
Morone sp.	1	5	0.002	0.3
Sunfish	2	9	0.002	0.2
Rock Bass	7	9	0.170	18.9
Pumpkinseed	38	1,464	43.311	29.6
Bluegill	31	480	10.949	22.8
Smallmouth Bass	1	1	2.288	2,287.7
Largemouth Bass	6	7	0.101	14.4
Black Crappie	3	3	0.399	133.0
Lepomis sp.	4	19	0.005	0.3
Yellow Perch	49	5,458	75.081	13.8
Walleye	40	209	49.700	237.8
Johnny Darter	1	1	0.001	1.2
Logperch	10	13	0.062	4.8
Tessellated Darter	1	1	0.002	1.5
Brook Silverside	1	1	0.001	0.8
Round Goby	40	8,641	20.580	2.4
Freshwater Drum	40	763	135.974	178.2
Sculpin sp.	1	1	0.000	0.2
Slimy Sculpin	6	19	0.171	9.0
Deepwater Sculpin	8	1,036	0.010	0.0
Totals		52,277	616	11.8

Lake Ontario

Kingston Basin (Tables 1.3.4 and 1.3.5)

Bottom trawls were conducted at six sites from June to September 2017. Five species were caught with the most abundant species being Round Goby, Rainbow Smelt and Alewife. Round Goby abundance increased through the summer; catches were lowest in June and highest in August. Alewife catches were highest in June and lowest in August. Trend through time catches for most common species are shown in Fig. 1.3.2.

TABLE 1.3.4. Species-specific catch per trawl at six sites (**EB01, EB02, EB03, EB04, EB05, EB06**) in the Kingston Basin of Lake Ontario, 2017. Catches are averages for the number of trawls indicated. The total number of fish and species caught and trawls conducted are indicated.

Species	Month: Jun	Jul	Aug	Total
Alewife	75.50	2.81	0.00	26.10
Lake Trout	0.40	0.00	0.00	0.13
Coregonus sp.	0.00	0.40	0.00	0.13
Rainbow Smelt	0.00	135.61	16.06	50.56
Yellow Perch	0.00	0.40	0.00	0.13
Round Goby	0.40	878.57	892.97	590.65
Sculpin sp.	0.40	0.00	0.00	0.13
Total catch	77	1018	909	668
Number of species	3	4	2	5
Number of trawls	6	6	9	21

EB02 (Table 1.3.6).

Four species: Round Goby, Alewife, Rainbow Smelt and Yellow Perch were caught at EB02 in 2017. Threespine Stickleback, having risen to high levels of abundance in the late 1990s, declined rapidly after 2003 and was absent in the EB02 catches for over 10 years. Slimy Sculpin, another formerly abundant species has also been absent for 10 years.

EB03 (Table 1.3.7)

Three species: Round Goby, Rainbow Smelt and Alewife were caught at EB03 in 2017. Round Goby, having first appeared in the EB03 catches in 2004, now dominate the total catch. Rainbow Smelt abundance was higher in the last three years. As was the case for EB02, Threespine Stickleback have been absent from the EB03 catches for over 10 years.

EB06 (Table 1.3.8)

Four species: Round Goby, Alewife and an unidentified sculpin were caught at EB06 in 2017. Rocky Point (Tables 1.3.9 and 1.3.10).

Rocky Point (Tables 1.3.9 and 1.3.10)

Six species: Deepwater Sculpin, Alewife,

TABLE 1.3.5. Species-specific catch per trawl at six sites (**EB01, EB02, EB03, EB04, EB05, EB06**) by month in the Kingston Basin of Lake Ontario, 2017. Catches are averages for 1 to 4 trawls during each of 3 or 4 visits during summer. The total number of fish and species caught and trawls conducted are indicated.

	EB01			EB02			EB03			EB04			EB05			EB06			Total
Species	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	
Alewife	74.699	0.000	0.000	197.590	7.229	0.000	175.904	7.229	0.000	0.000	2.410	0.000	2.410	0.000	0.000	2.410	0.000	0.000	27.640
Lake trout	2.410	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.142
Coregonus sp.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.410	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.142
Rainbow smelt	0.000	7.229	16.867	0.000	0.000	2.410	0.000	806.415	77.108	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	52.964
Yellow perch	0.000	0.000	0.000	0.000	2.410	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.142
Round goby	0.000	1021.687	1609.433	0.000	77.108	322.892	0.000	4172.651	2407.610	0.000	0.000	470.797	0.000	0.000	491.667	2.410	0.000	55.422	568.560
Sculpin 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	2.410	0.000	0.000	0.142
Total catch	77	1029	1626	198	87	325	176	4989	2485	0	2	471	2	0	492	7	0	55	650
Number of species	2	2	2	1	3	2	1	3	2	0	1	1	1	0	1	2	0	1	5
Number of trawls	1	1	1	1	1	1	1	1	4	1	1	1	1	1	1	1	1	1	21

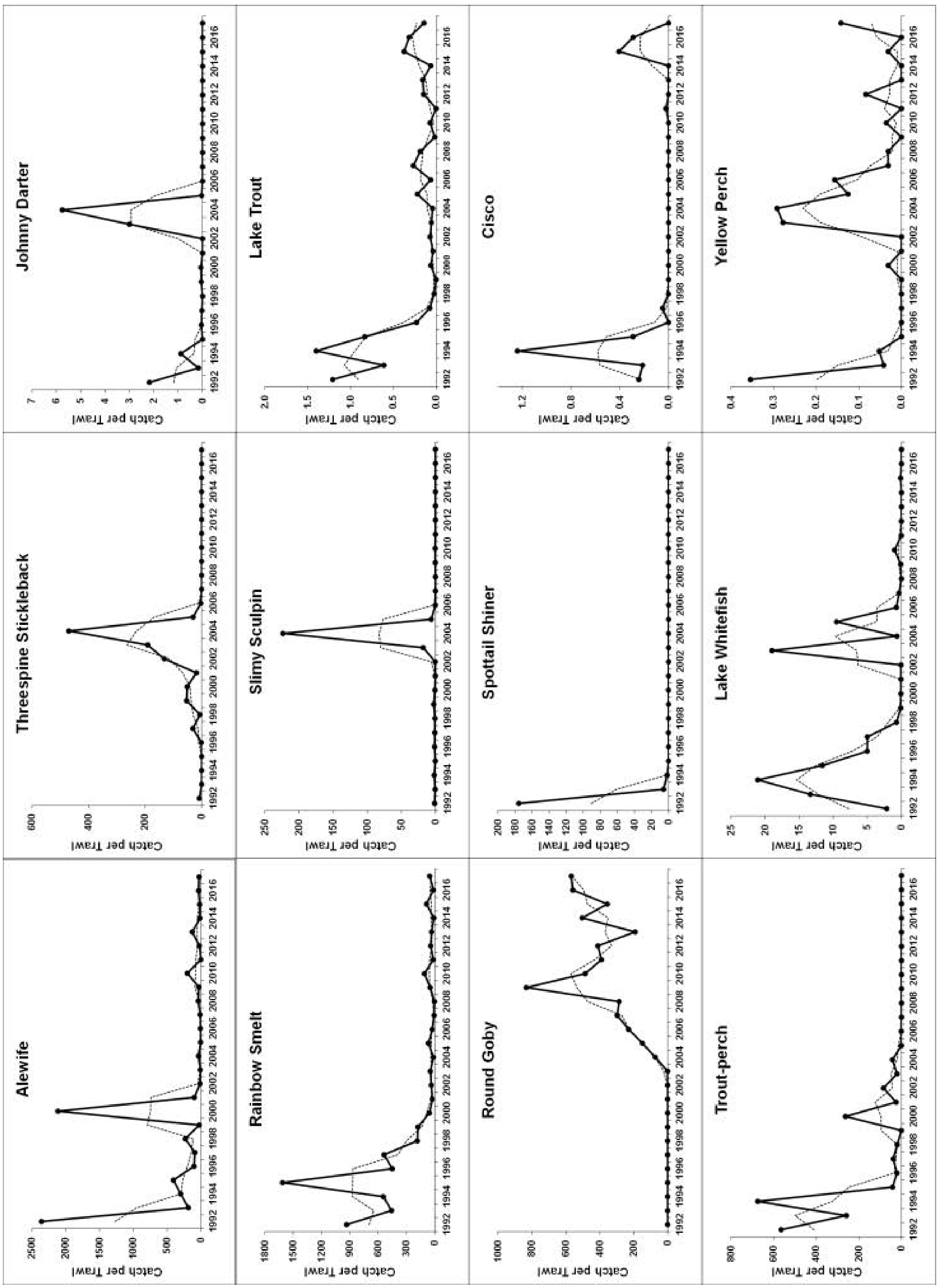

FIG. 1.3.2. Abundance trends (annual means) for the most common species caught in bottom trawls at three to six sites in the Kingston Basin, eastern Lake Ontario (EB01, EB02, EB03, EB04, EB05, EB06); see Fig. 1.3.1). Dotted lines show 3-yr running averages (two years for first and last years graphed).

TABLE 1.3.6. Species-specific catch per trawl (12 min duration; 1/2 mile) by year in the fish community index bottom trawling program during summer at **EB02**, Kingston Basin, Lake Ontario. 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**						
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013	2014	2015	2016	2017
Alewife	**1220.379**	203.397	20.917	19.500	27.100	0.000	0.417	11.000	0.667	72.429	464.097	**81.952**	1.667	24.291	288.143	2.667	44.417	110.093	68.273
Rainbow Trout	**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
Lake Trout	**0.202**	0.000	0.083	0.083	0.000	0.583	0.167	0.583	0.500	0.000	0.167	**0.217**	0.000	0.333	0.333	0.167	0.750	1.000	0.000
Lake Whitefish	**3.203**	0.167	0.000	0.583	0.400	0.250	0.000	0.167	0.000	0.250	0.000	**0.182**	0.000	0.083	0.000	0.000	0.000	0.000	0.000
Cisco (Lake Herring)	**0.362**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.083	0.000	0.000
Coregonus sp.	**0.006**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rainbow Smelt	**440.950**	29.667	7.917	0.917	5.000	19.750	28.750	3.583	5.667	114.416	14.667	**23.033**	1.083	10.333	3.917	8.833	2.917	1.667	0.803
Emerald Shiner	**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
Burbot	**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
Threespine Stickleback	**13.395**	18.750	34.417	49.500	6.200	9.000	0.167	0.000	0.000	0.000	0.000	**11.803**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Trout-perch	**4.675**	0.250	0.000	0.167	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.042**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Yellow Perch	**0.019**	0.000	0.000	0.000	0.700	0.333	0.083	0.000	0.000	0.000	0.083	**0.120**	0.000	0.167	0.000	0.000	0.000	0.000	0.803
Walleye	**0.056**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083	**0.008**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Johnny Darter	**0.077**	0.000	0.000	0.000	0.400	0.000	0.000	0.000	0.000	0.000	0.000	**0.040**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Round Goby	**0.000**	0.000	0.000	0.083	250.100	24.833	40.083	119.750	26.667	169.907	143.933	**77.536**	8.083	77.144	28.500	31.083	76.313	163.026	133.333
Sculpin sp.	**0.046**	0.000	0.000	0.000	0.000	0.000	0.000	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	**2.084**	0.417	0.667	44.083	74.900	0.750	0.167	0.000	0.000	0.000	0.000	**12.098**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Deepwater Sculpin	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.667	0.000	0.000
Total catch	**1685**	253	64	115	365	56	70	135	34	357	623	**207**	11	112	321	43	125	276	203
Number of species	**9**	6	5	8	8	7	7	5	4	4	6	**6**	3	6	4	4	6	4	4
Number of trawls		12	12	12	10	12	12	12	12	12	12		12	12	12	12	12	3	3

TABLE 1.3.7. Species-specific catch per trawl (12 min duration; 1/2 mile) by year in the fish community index bottom trawling program during summer at **EB03**, Kingston Basin, Lake Ontario. 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**						
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013	2014	2015	2016	2017
Alewife	**704.463**	57.375	21.375	8.000	168.385	14.833	15.250	33.917	156.339	0.000	0.250	**47.572**	0.125	33.292	75.500	43.125	1.875	13.857	30.522
Gizzard Shad	**0.000**	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	0.000	0.000
Chinook Salmon	**0.014**	0.000	0.000	0.000	0.000	0.667	0.000	0.000	0.000	0.000	0.000	**0.067**	0.000	0.000	0.000	0.000	0.125	0.000	0.000
Lake Trout	**0.847**	0.000	0.000	0.000	0.000	0.000	0.000	0.250	0.000	0.083	0.000	**0.033**	0.000	0.000	0.125	0.000	0.000	0.000	0.000
Lake Whitefish	**14.412**	0.000	0.000	43.938	2.333	50.000	3.000	1.417	0.000	0.083	4.667	**10.544**	0.125	0.000	0.000	0.000	0.375	0.000	0.000
Cisco	**0.292**	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	1.500	1.000	0.000
Rainbow Smelt	**517.419**	20.000	207.511	109.245	1.917	25.667	20.625	21.500	0.250	11.583	217.947	**63.624**	30.750	3.250	111.500	20.625	343.832	135.829	185.808
White Sucker	**0.093**	0.000	0.000	0.000	0.000	0.000	0.000	0.083	0.000	0.000	0.000	**0.008**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Common Carp	**0.130**	0.000	0.000	0.000	0.000	0.000	0.000	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	**42.456**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.250	0.083	**0.033**	0.375	0.000	0.000	0.125	0.000	0.000	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	0.000
Brook Stickleback	**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
Threespine Stickleback	**32.894**	67.375	680.287	459.421	2781.754	116.083	8.500	0.000	0.000	0.000	0.000	**411.342**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Trout-perch	**689.171**	175.000	592.212	56.298	255.161	3.417	3.750	0.417	0.000	0.000	0.000	**108.625**	0.125	0.000	0.000	0.000	0.000	0.000	0.000
White Perch	**0.032**	0.000	0.000	0.000	0.000	0.000	0.000	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	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083	**0.008**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Smallmouth Bass	**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
Largemouth Bass	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083	**0.008**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Yellow Perch	**0.093**	0.000	0.000	0.625	0.083	0.000	0.500	0.167	0.125	0.000	0.000	**0.150**	0.000	0.000	0.000	0.000	0.125	0.000	0.000
Walleye	**0.236**	0.000	0.000	0.063	0.000	0.000	0.125	0.000	0.000	0.417	0.000	**0.060**	0.250	0.250	0.000	0.000	0.000	0.286	0.000
Johnny Darter	**0.875**	0.000	0.000	9.875	32.833	0.167	0.000	0.000	0.000	0.000	0.000	**4.288**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Round Goby	**0.000**	0.000	0.000	0.000	0.333	732.449	850.448	910.409	1100.409	2552.195	1079.944	**722.619**	2322.465	960.945	410.800	1968.925	1309.488	157.097	2300.515
Freshwater Drum	**0.046**	0.000	0.000	0.000	0.083	0.000	0.125	0.000	0.125	0.000	0.000	**0.033**	0.000	0.250	0.000	0.000	0.500	0.143	0.000
Sculpin sp.	**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	0.000	0.000	0.000
Mottled Sculpin	**0.000**	0.000	0.000	0.688	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.069**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Slimy Sculpin	**0.370**	0.000	0.250	6.750	10.833	0.083	0.000	0.000	0.000	0.000	0.000	**1.792**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total catch	**2004**	320	1502	695	3254	943	902	968	1257	2565	1303	**1371**	2354	998	598	2033	1658	308	2517
Number of species	**10**	4	5	10	10	9	9	9	5	6	7	**7**	8	5	4	4	8	6	3
Number of trawls		8	8	16	12	12	8	12	8	12	12		8	7	8	8	8	7	6

TABLE 1.3.8. Species-specific catch per trawl (12 min duration; 1/2 mile) by year in the fish community index bottom trawling program during summer at **EB06**, Kingston Basin, Lake Ontario. 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**							
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013	2014	2015	2016	2017
Alewife	**85.631**	5.583	0.250	0.083	1.250	0.417	8.000	0.917	0.667	10.833	1.083	**2.908**	0.667	0.625	0.583	0.000	0.000	1.333	0.803
Lake Trout	**0.611**	0.083	0.083	0.083	0.083	0.000	0.000	0.000	0.000	0.000	0.000	**0.033**	0.000	0.125	0.000	0.000	0.250	0.000	0.000
Lake Whitefish	**4.546**	0.000	0.167	0.167	0.250	0.000	0.000	0.083	0.000	0.000	0.083	**0.075**	0.000	0.000	0.000	0.000	0.083	0.000	0.000
Cisco (Lake Herring)	**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
Rainbow Smelt	**743.701**	21.417	6.750	0.250	25.083	142.583	23.917	0.583	1.000	3.500	73.167	**29.825**	18.917	112.933	8.750	0.333	0.000	1.333	0.000
Threespine Stickleback	**7.722**	2.583	47.750	11.417	7.500	13.917	1.083	0.000	0.000	0.000	0.000	**8.425**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Trout-perch	**0.991**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Yellow Perch	**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
Johnny Darter	**0.000**	0.000	0.000	0.000	0.333	0.000	0.000	0.000	0.000	0.000	0.000	**0.033**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Round Goby	**0.000**	0.000	0.000	0.000	0.000	0.000	5.000	82.934	1.667	8.667	877.914	**97.618**	1.917	200.416	208.949	0.333	0.083	453.048	19.277
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	0.803
Slimy Sculpin	**0.083**	0.083	0.000	3.583	399.183	15.750	0.250	0.000	0.000	0.500	1.500	**42.085**	0.000	0.125	0.167	0.000	0.000	0.000	0.000
Deepwater Sculpin	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083	0.167	**0.025**	0.000	0.000	0.000	0.000	2.000	0.000	0.000
Total catch	**843**	30	55	16	434	173	38	85	3	24	954	**181**	22	314	218	1	2	456	21
Number of species	**6**	5	5	6	7	4	5	4	3	5	6	**5**	3	5	4	2	4	3	3
Number of trawls		12	12	12	12	12	12	12	12	12	12		12	8	12	12	12	3	3

Slimy Sculpin, Rainbow Smelt, Brown Trout, and two unidentified Coregonus species were caught at Rocky Point in 2017. Deepwater Sculpin were most common at water depths greater than 90 m. Slimy Sculpin were common at depths less than 110 m.

Bay of Quinte

Conway (Table 1.3.11)

Twelve species were caught at Conway in 2017. The most abundant species were Round Goby, Yellow Perch, Rainbow Smelt and Trout-perch.

Hay Bay (Table 1.3.12)

Sixteen species were caught at Hay Bay in 2017. The most abundant species were Alewife, White Perch and Yellow Perch.

Deseronto (Table 1.3.13)

Twenty-one species were caught at Deseronto in 2017. The most abundant species were White Perch, Alewife and Yellow Perch.

Big Bay (Table 1.3.14)

Seventeen species were caught at Big Bay in 2017. The most abundant species were White Perch, Trout-perch, Spottail Shiner, Yellow Perch and Freshwater Drum.

Belleville (Table 1.3.15)

Seventeen species were caught at Belleville in 2017. White Perch, Trout-perch, Yellow Perch, Pumpkinseed and Freshwater Drum were the most abundant species in the catch.

Trenton (Table 1.3.16)

Seventeen species were caught at Trenton in 2017. The most abundant species were Yellow Perch, Pumpkinseed, White Perch, Alewife, Bluegill, Spottail Shiner and Freshwater Drum.
Species Trends (Fig. 1.3.3).

Bottom trawl results were summarized across the six Bay of Quinte sites and presented graphically to illustrate abundance trends for major species in Fig. 1.3.3. All species show significant abundance changes over the long-term.

TABLE 1.3.9. Species-specific catch per trawl (adjusted to 12 min duration; 1/2 mile) in the fish community index bottom trawling program during summer at **Rocky Point** (multiple water depths), Lake Ontario, 2017. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated.

	Site depth (m)							
Site depth (m)	60	80	90	100	110	120	130	140
Alewife	12	10	10	5	53	22	17	5
Brown trout	0	0	0	0	2	0	0	0
Coregonus sp.	0	0	2	0	0	0	0	0
Rainbow smelt	0	7	12	0	0	2	0	0
Slimy sculpin	7	12	7	12	5	2	0	0
Deepwater sculpin	0	2	46	260	137	318	0	582
Total catch	19	31	77	277	198	345	17	587
Number of species	2	4	4	4	3	3	2	2
Number of trawls	1	1	1	1	1	1	1	1

The most abundant species remain White Perch, Yellow Perch, Alewife and Gizzard Shad. White Perch abundance declined significantly in 2014, remained low in 2015, increased in 2016 and again in 2017. Yellow Perch remain abundant but did decline in 2017 reflecting a poor year-class that year. Alewife abundance remains high. Most centrarchid species are currently at moderate to high levels of abundance as are Trout -perch, Spottail Shiner, Round Goby and Walleye. Species currently at low abundance levels relative to past levels include Brown Bullhead, Rainbow Smelt, White Sucker, Lake Whitefish and Johnny Darter.

Species Highlights

Catches of age-0 fish in 2017 for selected species and locations are shown in Tables 1.3.17-1.3.21 for Lake Whitefish, Cisco, Yellow Perch and Walleye.

Age-0 Lake Whitefish were caught at Conway but not Timber Island in 2017 (Table 1.3.17). Except for the 2003 and 2005 year-classes, age-0 Lake Whitefish catches have been low for more than a decade.

Age-0 Cisco catches at Conway in 2017 were low to moderate relative to recent years (Table 1.3.18).

Age-0 catches of Yellow Perch were very low in 2017 (Table 1.3.19). Following two poor year-classes in 2012 and 2013, the three year-

TABLE 1.3.10. Species-specific catch per trawl (adjusted to 12 min duration; 1/2 mile) by year in the fish community index bottom trawling program during summer at **Rocky Point, 100 m depth only**), eastern Lake Ontario. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated. No sampling in

Species	1997-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2001-2010 mean	2011	2012	2013	2014	2015	2016	2017
Alewife	**2.063**	2.750	0.375	1.500	5.750	0.125		6.875	1.500	0.375		**2.406**	0.500	0.000	84.500	13.000	114.500	0.000	4.819
Lake Trout	**0.063**	0.500	0.000	0.000	0.125	0.000		0.000	0.125	0.000		**0.094**	0.250	0.000	0.000	0.000	0.000	0.000	0.000
Lake Whitefish	**0.094**	0.000	0.125	0.000	0.000	0.000		0.000	0.000	0.000		**0.016**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rainbow Smelt	**200.500**	90.625	37.625	4.125	11.375	5.500		2.250	7.250	6.750		**20.688**	5.500	5.500	11.500	3.333	2.000	3.000	0.000
Threespine Stickleback	**0.000**	0.000	0.000	0.000	0.125	0.125		0.000	0.000	0.000		**0.031**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rock Bass	**0.000**	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000		**0.000**	0.000	0.000	0.000	0.167	0.000	0.000	0.000
Round Goby	**0.000**	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000		**0.000**	0.000	0.000	0.000	0.167	0.000	0.000	0.000
Slimy Sculpin	**5.625**	1.250	0.125	2.250	95.750	14.250		24.750	8.875	5.000		**19.031**	2.250	0.000	12.000	8.000	7.500	5.000	12.048
Deepwater Sculpin	**0.000**	0.000	0.000	0.000	0.000	0.125		0.750	0.250	0.125		**0.156**	7.500	1.500	6.000	3.833	105.000	256.000	260.241
Total catch	**208**	95	38	8	113	20		35	18	12		**42**	16	7	114	29	229	264	277
Number of species	**3**	4	4	3	5	5		4	5	4		**4**	5	2	4	6	4	3	2
Number of trawls		4	4	4	4	4	0	4	4	4	0		4	1	2	6	4	1	1

TABLE 1.3.11. 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.

Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	**403**	412	310	545	197	216	215	238	428	91	212	**286**	780	301	199	309	223	373	197
Number of species	**9**	7	9	12	12	11	14	9	10	7	8	**10**	11	9	10	9	11	10	12
Number of trawls		8	8	12	12	12	12	12	12	12	12		8	8	8	8	8	8	8

TABLE 1.3.12. 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.

Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	**792**	1380	1055	179	1233	466	1598	1749	996	1050	1285	**1099**	706	774	768	800	722	1659	659
Number of species	**15**	16	15	13	15	14	17	17	18	18	18	**16**	17	19	19	15	16	13	16
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	8	8

TABLE 1.3.13. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Deseronto** (5 m depth), Bay of Quinte. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated.

	Year																		
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	**904**	887	900	1451	3403	2021	1738	2511	1863	1457	605	**1684**	3357	1266	1981	1178	1521	2140	2473
Number of species	**16**	20	19	19	16	21	20	16	15	19	20	**19**	20	20	20	18	20	18	21
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	8	8

TABLE 1.3.14. 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.

Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	**891**	721	1511	442	2301	2017	1700	661	1586	1543	1109	**1359**	2310	827	1077	1498	568	2024	978
Number of species	**17**	17	22	15	17	17	20	18	19	16	17	**18**	17	17	19	15	16	19	17
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	8	8

TABLE 1.3.15. 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																	
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	**1042**	453	724	365	2691	1318	1161	1421	1571	2213	1385	**1330**	2193	893	3897	832	641	680	588
Number of species	**18**	19	21	19	16	18	17	18	17	16	19	**18**	18	16	16	15	16	19	17
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	8	8

TABLE 1.3.16. 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																		
Species	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2001-2010 mean	2011	2012	2013	2014	2015	2016	2017
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	1155	781	547	1203	353	1381	781	751	1145	2186	688	982	1849	1081	1421	703	1382	366	454
Number of species	20	20	18	19	15	18	19	15	18	18	20	18	21	19	13	17	18	17	17
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	8	8

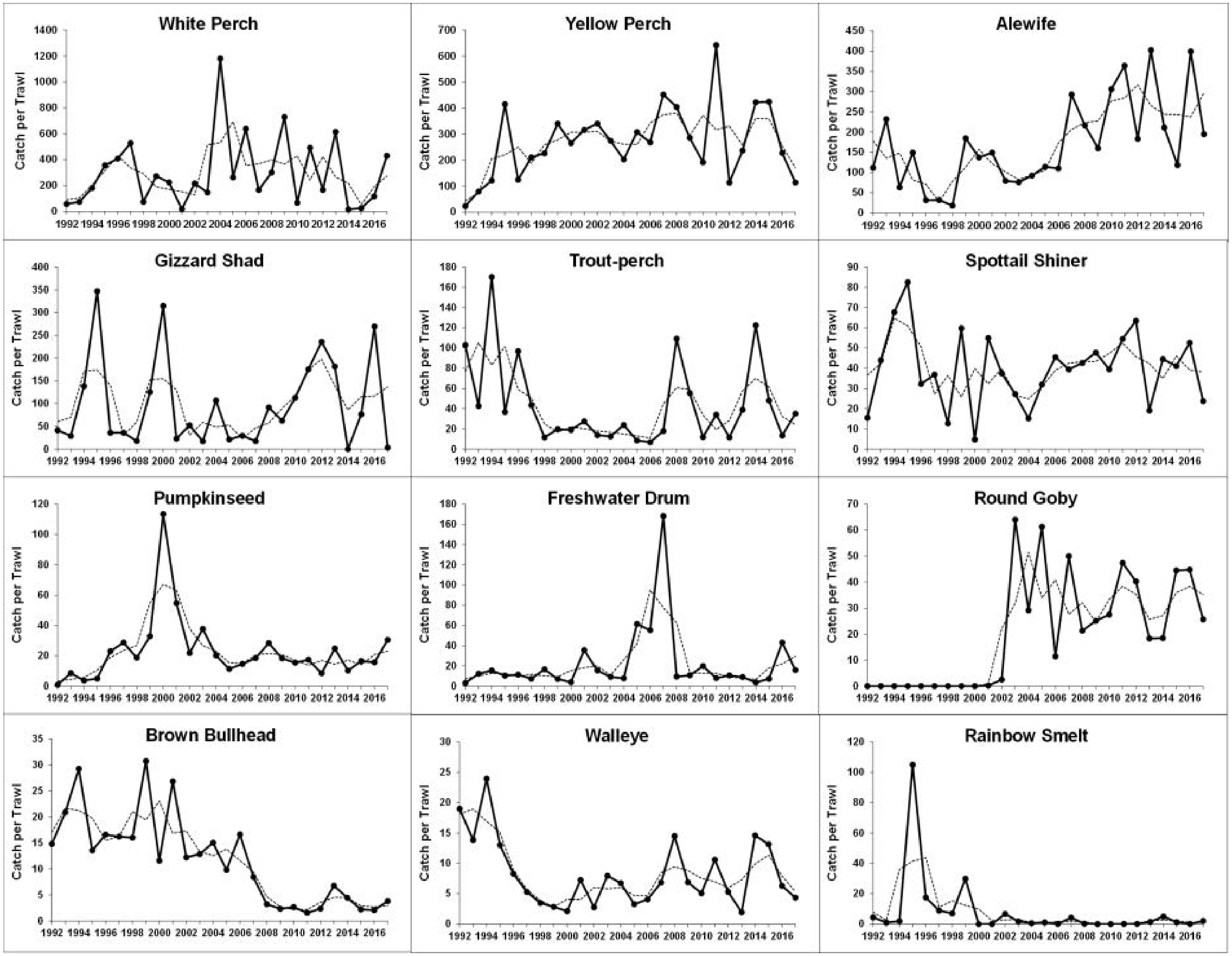

FIG. 1.3.3. Abundance trends (annual means) for the most common species caught in bottom trawls at six sites in the Bay of Quinte (Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton; see Fig. 1.3.1). Values shown here are 3-yr running averages (two years for first and last years graphed).

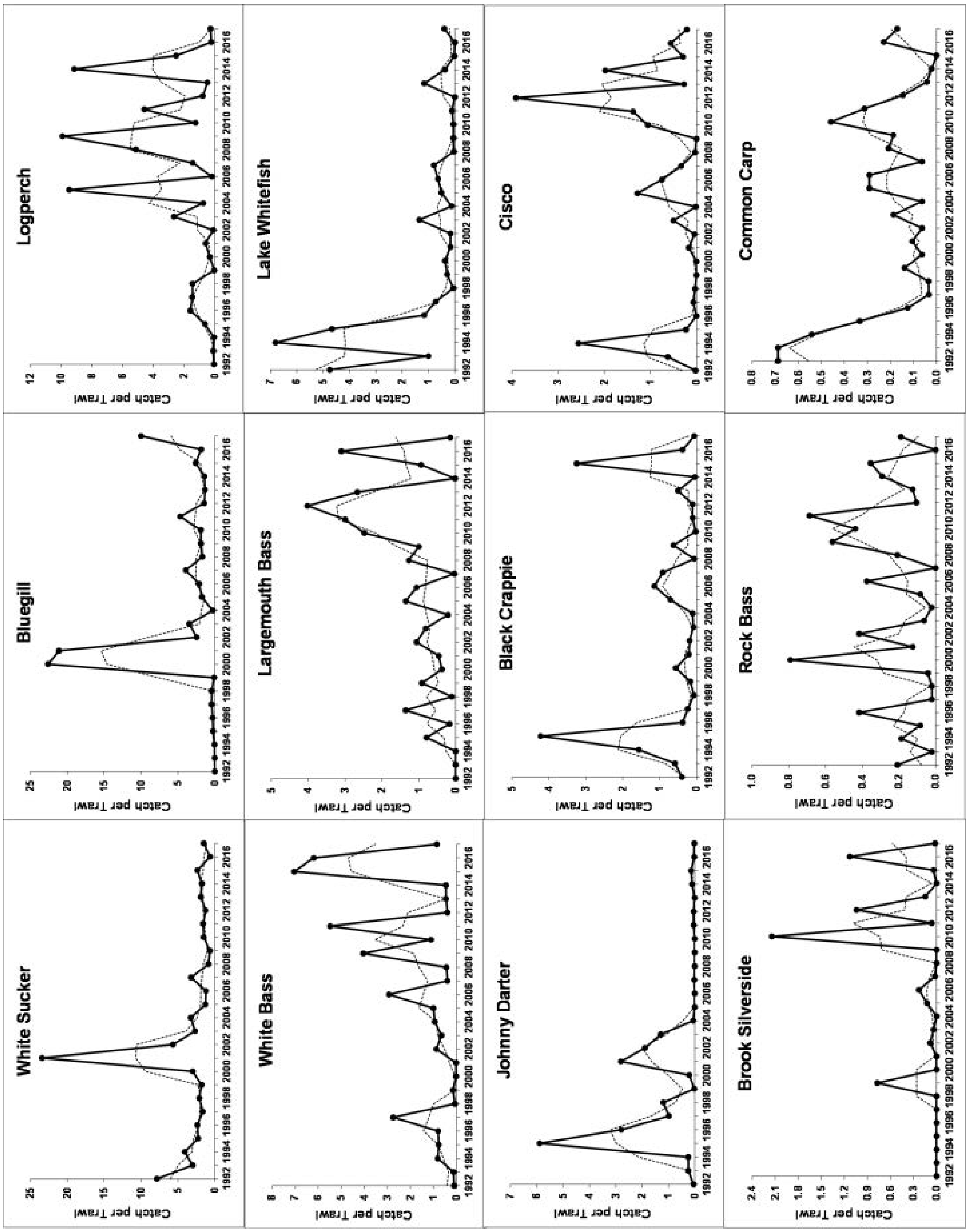

FIG. 1.3.3 (continued). Abundance trends for the most common species caught in bottom trawls at six sites in the Bay of Quinte (Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton; see Fig. 1.3.1). Values shown here are 3-yr running averages (two years for first and last years graphed).

TABLE 1.3.17. 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, 1992-2017. 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.

	Conway	N	EB03 (Timber Island)	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	7
2017	2.4	8	0.0	6

classes from 2014 to 2016 Perch were high.

Following two exceptionally strong year-classes in 2014 and 2015, the age-0 Walleye catch in 2016 was fair and in 2017 was poor (Tables 1.3.20 and 1.3.21).

Round Goby first appeared in bottom trawl catches in the Bay of Quinte in 2001 and in the Kingston Basin of eastern Lake Ontario in 2003. The species was caught at all Bay of Quinte trawling sites by 2003, peaking in abundance, at each site, between 2003 and 2005. Catches have been quite variable since but remain high. Round Goby catches in the Kingston Basin remained high in 2017.

TABLE 1.3.18. Mean catch-per-trawl of **age-0 Cisco** at Conway in the lower Bay of Quinte, 1992-2017. 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.

	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

TABLE 1.3.19. Mean catch-per-trawl of **age-0 Yellow Perch** at six Bay of Quinte sites, 1992-2017. 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

TABLE 1.3.20. Mean catch-per-trawl of **age-0 Walleye** at six Bay of Quinte sites, 1992-2017. 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

TABLE 1.3.21. Age distribution of **208 Walleye** sampled from summer bottom trawls, Bay of Quinte, 2017. Also shown are mean fork length and mean weight. Fish of less than 150 mm fork length were assigned an age of 0, fish between 150 and 290 mm were aged using scales; and those over 290 mm fork length were aged using otoliths.

Age (years)	0	1	2	3	4	5	6	
Year-class	2017	2016	2015	2014	2013	2012	2011	Total
Number of fish	78	50	55	21	1	2	1	208
Mean fork length (mm)	132	244	325	405	380	525	520	
Mean weight (g)	22	141	348	723	683	1719	1957	

1.4 Lake Ontario Nearshore Community Index Netting

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In 2017, Nearshore community index netting NSCIN projects were completed at three nearshore areas: East Lake, West Lake, Prince Edward Bay, and the upper Bay of Quinte (Fig. 1.4.1). 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 Harbour and the Toronto harbour area thanks to partnerships developed with the Fisheries and Oceans Canada and the Toronto and Region Conservation Authority. NSCIN was further expanded to other Lake Ontario nearshore areas in subsequent years as detailed in Table 1.4.1.

The NSCIN protocol uses 6-foot trap nets and is designed to evaluate the 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 netted. 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.

Survey information and basic catch statistics for the four embayments sampled in 2017 are given in Tables 1.4.2 and 1.4.3 respectively. Age distribution and length-at-age information is given in Tables 1.4.4 and 1.4.5. Abundance trends for all species are presented in Table 1.4.6 and graphically for selected species in Fig. 1.4.2.

East Lake

Sixteen trap net sites were sampled on East Lake from Aug 21-25 with water temperatures ranging from 20.9-23.7 ^{o}C (Table 1.4.2). Eight hundred fish comprising 14 species were captured (Table 1.4.3). The most abundant species by number were Bluegill (448), Pumpkinseed (159), Brown Bullhead (47), Largemouth Bass (42), Rock Bass (38), Yellow Perch (21), and Walleye (15).

West Lake

Twenty-four trap net sites were sampled on West Lake from Aug 8-17 with water temperatures ranging from 21.2-24.2 ^{o}C (Table 1.4.2). Nearly 2,200 fish comprising 19 species were captured (Table 1.4.3). The most abundant

TABLE. 1.4.1. Annual NSCIN trap net schedule for Lake Ontario nearshore areas, 2001-2017. 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
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		12	24				36			
2007		24			18	18		36			
2006	19	24									

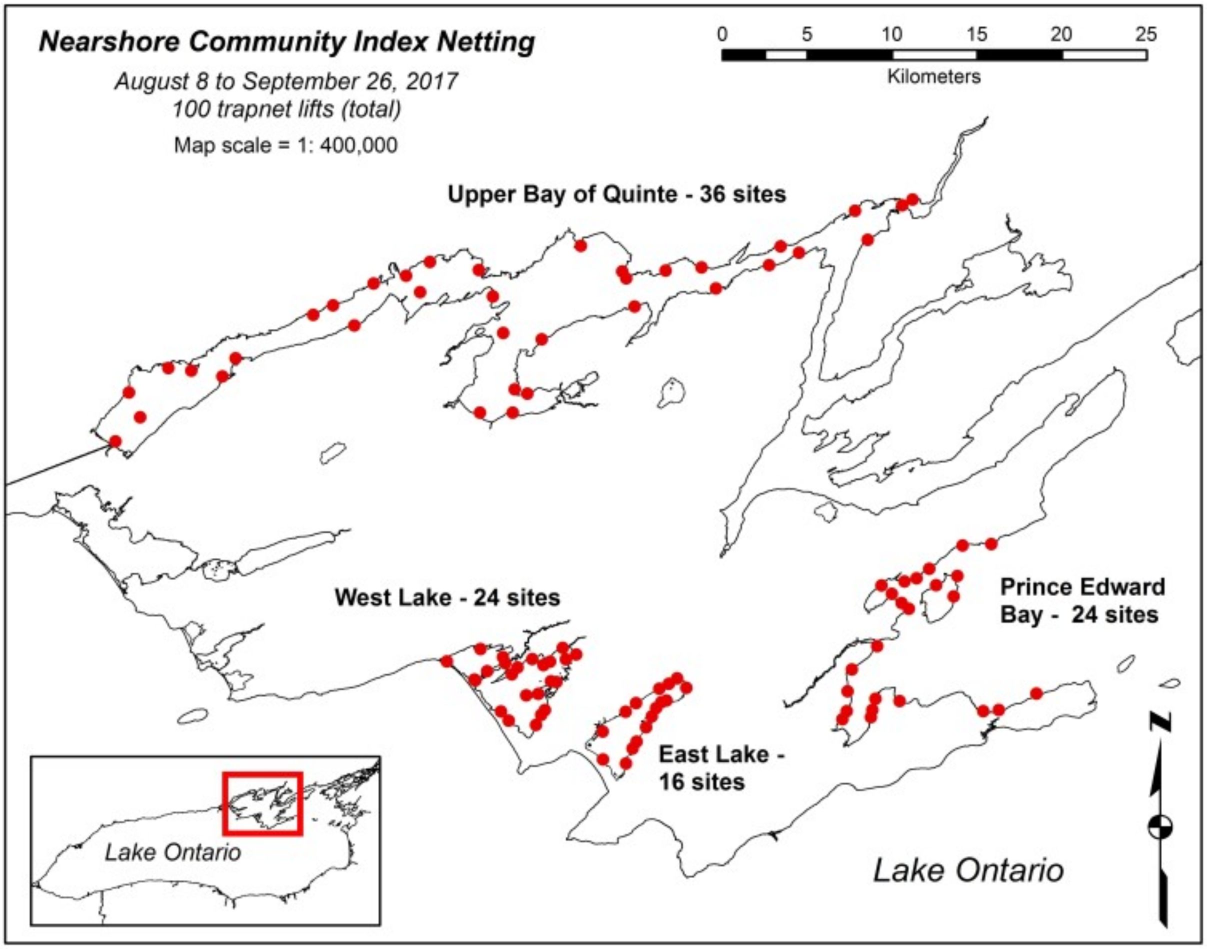

FIG. 1.4.1. Map of Lake Ontario indicating NSCIN trap net locations on East Lake, West Lake, Prince Edward Bay and the upper Bay of Quinte, 2017.

TABLE 1.4.2. Survey information for the 2017 NSCIN trap net program on East Lake, West Lake, Prince Edward Bay and the upper Bay of Quinte. Shown for each embayment 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.

		East Lake	West Lake	Prince Edward Bay	Upper Bay of Quinte
Survey dates		Aug 21-25	Aug 8-17	Sep 11-26	Sep 5-22
Water temperature range (^{o}C)		20.9-23.7	21.2-24.2	18.0-22.1	17.9-23.6
No. of trap net lifts		16	24	24	36
No. of lifts by depth:					
	Target (2-2.5 m)	7	7	8	6
	> Target	4	5	5	19
	< Target	5	12	11	11
No. of lifts by substrate type:					
	Hard	7	13	18	13
	Soft	9	11	6	23
No. of lifts by degree of cover:					
	None	1	2	0	1
	1-25%	9	11	14	9
	26-75%	5	9	9	23
	76-100%	1	2	1	3

TABLE 1.4.3. Species-specific catch in the 2017 NSCIN trap net program on East Lake, West Lake, Prince Edward Bay and the upper Bay of Quinte. 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). A total of 30 species were caught.

	East Lake				West Lake				Prince Edward Bay				Upper Bay of Quinte			
Species	Arithmetic mean	Geometric mean	Relative standard error (%)	Mean length (mm)	Arithmetic mean	Geometric mean	Relative standard error (%)	Mean length (mm)	Arithmetic mean	Geometric mean	Relative standard error (%)	Mean length (mm)	Arithmetic mean	Geometric mean	Relative standard error (%)	Mean length (mm)
Longnose Gar	0.563	0.349	42	770	2.583	1.317	22	716	0.042	0.029	100	590	2.583	0.348	46	884
Bowfin	0.500	0.292	49	546	0.167	0.122	47	488	2.500	1.339	21	560	1.389	0.769	20	554
Alewife					0.083	0.059	69	145	0.042	0.029	100					
Gizzard Shad									0.083	0.059	69	285	0.667	0.173	62	132
Rainbow Trout									0.042	0.029	100	630				
Northern Pike	0.313	0.220	46	524	0.500	0.358	29	553	1.667	1.040	20	617	0.611	0.446	20	630
Muskellunge									0.042	0.029	100	710				
Chain Pickerel									0.042	0.029	100	598				
White Sucker					0.042	0.029	100	480	0.125	0.078	71	403	0.306	0.207	33	370
Silver Redhorse													0.861	0.474	26	494
Shorthead Redhorse													0.444	0.284	30	401
Greater Redhorse													0.222	0.122	51	474
River Redhorse													0.417	0.230	37	567
Common Carp	0.188	0.139	54	670	0.208	0.122	59	688	0.292	0.209	37	680	0.194	0.135	39	696
Golden Shiner									0.042	0.029	100	150	0.028	0.019	100	130
Brown Bullhead	2.938	1.488	26	284	2.583	1.450	19	284	12.458	4.339	17	262	3.667	1.467	19	274
Channel Catfish													1.000	0.557	24	529
American Eel					0.042	0.029	100	920	0.042	0.029	100	900	0.139	0.092	49	853
White Perch					4.417	1.118	32	253					2.917	1.094	23	169
White Bass					0.125	0.091	55	193					0.139	0.084	57	260
Sunfish					0.042	0.029	100	120								
Rock Bass	2.375	1.647	19	183	5.875	3.619	12	160	5.792	2.823	16	178	2.056	0.851	24	169
Pumpkinseed	9.938	8.505	7	153	12.708	8.986	7	158	4.333	1.628	24	142	9.611	4.414	12	146
Bluegill	28.000	24.130	5	137	54.500	47.142	3	149	0.292	0.224	32	159	72.833	14.753	11	141
Smallmouth Bass	0.188	0.091	100	430	0.500	0.257	46	252	3.500	1.538	24	357	0.639	0.289	37	294
Largemouth Bass	2.625	1.764	19	244	1.833	1.259	17	226	1.417	0.939	21	278	4.306	2.121	15	240
Black Crappie	0.063	0.044	100	240	2.292	1.763	12	236	0.958	0.490	33	225	5.111	2.271	15	218
Yellow Perch	1.313	0.779	30	210	0.500	0.303	36	214	0.500	0.257	46	176	2.528	0.789	26	183
Walleye	0.938	0.769	20	363	1.083	0.776	19	374	0.333	0.230	37	458	5.306	2.537	14	438
Freshwater Drum	0.063	0.044	100	660					0.042	0.029	100	570	1.194	0.854	16	499
Total catch per net	50				90				35				119			
Number of species	14				19				22				25			
Number of nets	16				24				24				36			
Total catch	800				2,162				830				4,290			

Table 1.4.4. Age distribution of selected species caught in on East Lake, West Lake, Prince Edward Bay and the upper Bay of Quinte, 2017.

		Age (years) / Year-class									
		1	2	3	4	5	6	7	8	9	10
Location	Species	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
East Lake											
	Pumpkinseed			2	14	8		3	2		
	Bluegill				5	14	6	4	2		
	Smallmouth Bass							1		2	
	Largemouth Bass	9	6	5	5		1	1	2		
	Yellow Perch			8	5	7		1			
	Walleye	1	3	7		2	1				
West Lake											
	Northern Pike	3	1	2	3						
	Pumpkinseed		3	2	13	4	7	5	1		
	Bluegill		2	3	7	7	4	2	1	1	
	Smallmouth Bass	7				2		1			
	Largemouth Bass	7	13	1	2	1					
	Black Crappie		1	4	8	15	2	2			
	Yellow Perch				5	4	3				
	Walleye		8	10	3				1		
Prince Edward Bay											
	Northern Pike		2	9	6	4	5	2	2		
	Chain Pickerel				1						
	Pumpkinseed	1	5	8	9	6					
	Bluegill		1	1	3	2					
	Smallmouth Bass			8	11	7	6	1	1	1	
	Largemouth Bass	8	4	1	2		1	1		4	2
	Black Crappie		6	9	6						
	Yellow Perch		4	7		1					
	Walleye		1	6	1						
Upper Bay of Quinte											
	Northern Pike	1	2	7	6	3	1	1	1		
	Pumpkinseed		3	11	13	6	1				
	Bluegill		3	2	18	20	3				
	Smallmouth Bass	8		7	1			1			
	Largemouth Bass	15	12	4			2				
	Black Crappie	5	6	12	8	3					
	Yellow Perch		3	8	8	5	1	1	1		
	Walleye	2	13	15	2	1	2		2		

Table 1.4.5. Mean fork length (mm) of selected species caught on East Lake, West Lake, Prince Edward Bay and the upper Bay of Quinte, 2017.

		Age (years) / Year-class									
		1	2	3	4	5	6	7	8	9	10
Location	Species	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
East Lake											
	Pumpkinseed			109	146	158		191	182		
	Bluegill				116	139	160	177	170		
	Smallmouth Bass							395		443	
	Largemouth Bass	179	238	250	312		372	368	381		
	Yellow Perch			179	219	233		258			
	Walleye	222	311	366		464	436				
West Lake											
	Northern Pike	442	434	554	579						
	Pumpkinseed		111	148	149	167	177	181	181		
	Bluegill		88	128	131	155	171	182	201	204	
	Smallmouth Bass	202				408		422			
	Largemouth Bass	165	247	280	324	338					
	Black Crappie		206	206	249	262	271	313			
	Yellow Perch				196	216	250				
	Walleye		337	378	390				552		
Prince Edward Bay											
	Northern Pike		536	587	607	612	687	750	674		
	Chain Pickerel				598						
	Pumpkinseed	100	125	130	155	148					
	Bluegill		124	184	152	167					
	Smallmouth Bass			279	331	376	406	432	448	470	
	Largemouth Bass	154	239	214	312		394	400		426	423
	Black Crappie		211	224	246						
	Yellow Perch		179	173		219					
	Walleye		458	452	462						
Upper Bay of Quinte											
	Northern Pike	432	527	604	614	710	847	851	745		
	Pumpkinseed		111	132	143	163	162				
	Bluegill		128	128	151	153	182				
	Smallmouth Bass	221		335	400			465			
	Largemouth Bass	208	277	328			401				
	Black Crappie	152	181	235	224	275					
	Yellow Perch		154	194	209	181	285	278	243		
	Walleye	294	383	454	491	498	564		565		

TABLE 1.4.6. Species-specific abundance trends (mean catch per trap net) on East Lake, West Lake, Prince Edward Bay and the upper Bay of Quinte. Annual total catch per net lift, number of net sets, and number of species are also indicated.

	East Lake			West Lake				Prince Edward Bay			Upper Bay of Quinte															
Species	2007	2013	2017	2001	2007	2013	2017	2009	2013	2017	2001	2002	2003	2004	2005	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Longnose Gar	2.44	5.13	0.56	0.29	2.56	1.83	2.58	0.07	0.13	0.04	0.25	0.33	1.14	1.94	0.39	2.92	0.36	0.44	1.56	0.50	2.08	0.19	1.42	2.22	0.50	2.58
Bowfin	0.28	0.44	0.50	0.29	0.06	0.21	0.17	0.89	1.63	2.50	0.36	0.14	0.58	0.53	0.25	0.92	1.11	0.50	0.81	0.75	0.50	0.92	1.31	0.53	0.75	1.39
Alewife							0.08	8.07		0.04																
Gizzard Shad				0.14	0.11	0.04				0.08	1.11	1.44	2.00	0.06	20.42	0.39	1.00	0.06	0.64	0.14	0.33	0.06	0.25	0.58	1.50	0.67
Rainbow Trout									0.08	0.04																
Lake Trout														0.03												
Lake Whitefish															0.03											
Northern Pike	1.33	0.63	0.31	0.57	2.06	0.58	0.50	1.70	1.46	1.67	1.03	0.58	0.86	0.69	0.64	0.44	0.33	0.28	0.83	0.78	0.53	0.28	0.28	0.28	0.53	0.61
Muskellunge										0.04													0.03			
Chain Pickerel										0.04																
Mooneye											0.03															
Quillback																		0.03						0.03		
White Sucker	1.00	0.25		0.43	0.33	0.29	0.04	0.63	1.50	0.13	1.03	1.47	1.72	1.25	1.11	0.44	0.92	0.64	0.44	0.42	0.72	0.86	0.72	0.25	0.61	0.31
Silver Redhorse								0.04					0.69	0.81	0.28	0.64	0.50	1.44	0.44	0.17	0.47	0.83	0.47	0.11	0.19	0.86
Shorthead Redhorse													0.08	0.47	0.25	0.19	0.33	0.36	0.06	0.19	0.08	0.31	0.17	0.11	0.03	0.44
Greater Redhorse													0.22	0.06			0.08	0.06		0.44	0.28	0.83	0.11	0.14	0.31	0.22
River Redhorse											0.06		0.14	0.17	0.14	0.11	0.44	0.03		0.14	0.08	0.14		0.03	0.47	0.42
Moxostoma sp.											0.78	0.42	0.08													
Common Carp	0.17	0.06	0.19	0.14	0.11	0.33	0.21	0.37	0.63	0.29	0.08	0.11	0.28	0.08	0.11	0.19	0.22	0.19	0.33	0.22	0.47	0.25	0.25	0.11	0.17	0.19
Golden Shiner					0.06			0.04	0.04	0.04	0.03		0.03		0.03		0.22		0.06	0.14	0.03	0.06			0.11	0.03
Fallfish																									0.03	
Brown Bullhead	19.11	10.31	2.94	34.86	12.22	11.33	2.58	55.41	66.04	12.46	167.67	95.83	37.33	20.83	17.89	7.25	6.42	2.56	10.56	13.69	7.11	15.28	6.08	5.75	3.94	3.67
Channel Catfish	0.06				0.06	0.13					2.17	2.17	1.50	1.33	1.72	0.72	0.81	0.28	0.53	0.58	0.31	0.06	0.53	0.19	1.03	1.00
American Eel				0.14		0.04	0.04		0.17	0.04	0.44	0.14		0.03	0.06					0.11	0.03	0.44	0.28	0.03	0.08	0.14
White Perch	0.17	0.06		1.29	10.89	1.04	4.42	0.11	0.21		2.19	2.89	7.69	3.67	2.75	4.61	4.31	3.86	1.69	3.75	3.58	19.42	0.19	0.31	2.58	2.92
White Bass							0.13				0.06	0.14	0.11	0.11	0.19	0.03	0.14			0.17	0.08			0.08	0.28	0.14
Sunfish							0.04																			
Rock Bass	1.78	2.81	2.38	1.57	2.17	2.75	5.88	24.11	3.83	5.79	0.92	0.67	0.64	0.58	0.50	4.83	3.97	3.89	2.44	4.50	1.08	7.97	4.92	2.50	2.25	2.06
Pumpkinseed	38.50	23.69	9.94	15.86	16.61	10.88	12.71	18.15	2.88	4.33	89.39	73.08	26.94	15.33	15.97	18.61	18.14	23.42	29.08	37.53	28.11	14.72	15.25	50.33	25.06	9.61
Bluegill	42.22	21.19	28.00	81.29	29.00	31.21	54.50	0.15	2.13	0.29	169.58	142.64	66.25	75.19	44.44	63.92	159.11	71.75	61.50	136.03	74.92	53.56	75.81	62.89	57.53	72.83
Smallmouth Bass	2.50	0.81	0.19	2.29	0.72	0.08	0.50	1.11	1.42	3.50	0.94	1.67	0.36	1.64	1.11	0.11	0.92	0.56	0.44	0.47	0.14	0.47	0.03	0.06	0.17	0.64
Largemouth Bass	1.89	2.75	2.63	1.71	1.06	1.75	1.83	1.74	2.75	1.42	2.47	6.11	7.92	6.08	2.75	4.53	5.39	4.33	4.25	10.39	2.72	4.33	3.58	3.33	2.42	4.31
Black Crappie	0.11		0.06	6.71	1.72	4.83	2.29	0.74	2.29	0.96	9.81	15.00	10.22	16.11	8.11	12.92	17.33	10.03	7.53	8.64	4.78	11.36	5.36	4.22	3.44	5.11
Yellow Perch	0.33	0.63	1.31	1.00	0.50	0.21	0.50	4.70	0.42	0.50	3.75	3.42	1.94	0.83	1.00	4.72	7.00	2.64	6.11	6.25	1.31	2.69	4.94	3.75	3.86	2.53
Walleye	1.83	1.31	0.94	2.00	1.50	1.25	1.08	0.70	0.08	0.33	3.17	2.47	2.22	2.56	2.14	1.61	2.50	1.75	2.53	2.36	1.44	7.56	1.33	0.94	1.61	5.31
Freshwater Drum	0.17		0.06	0.14	0.17			0.41	0.04	0.04	6.36	3.31	3.81	2.14	4.36	1.25	1.17	1.89	1.97	1.67	2.19	0.94	0.94	0.97	0.72	1.19
Total catch	114	70	50	151	82	69	90	119	88	35	464	354	175	153	127	131	233	131	134	230	133	144	124	140	110	119
Number of net lifts	18	16	16	6	18	24	24	24	24	24	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
Number of species	17	14	14	18	19	18	19	19	19	22	24	21	25	25	25	22	24	23	21	25	25	24	23	25	26	25

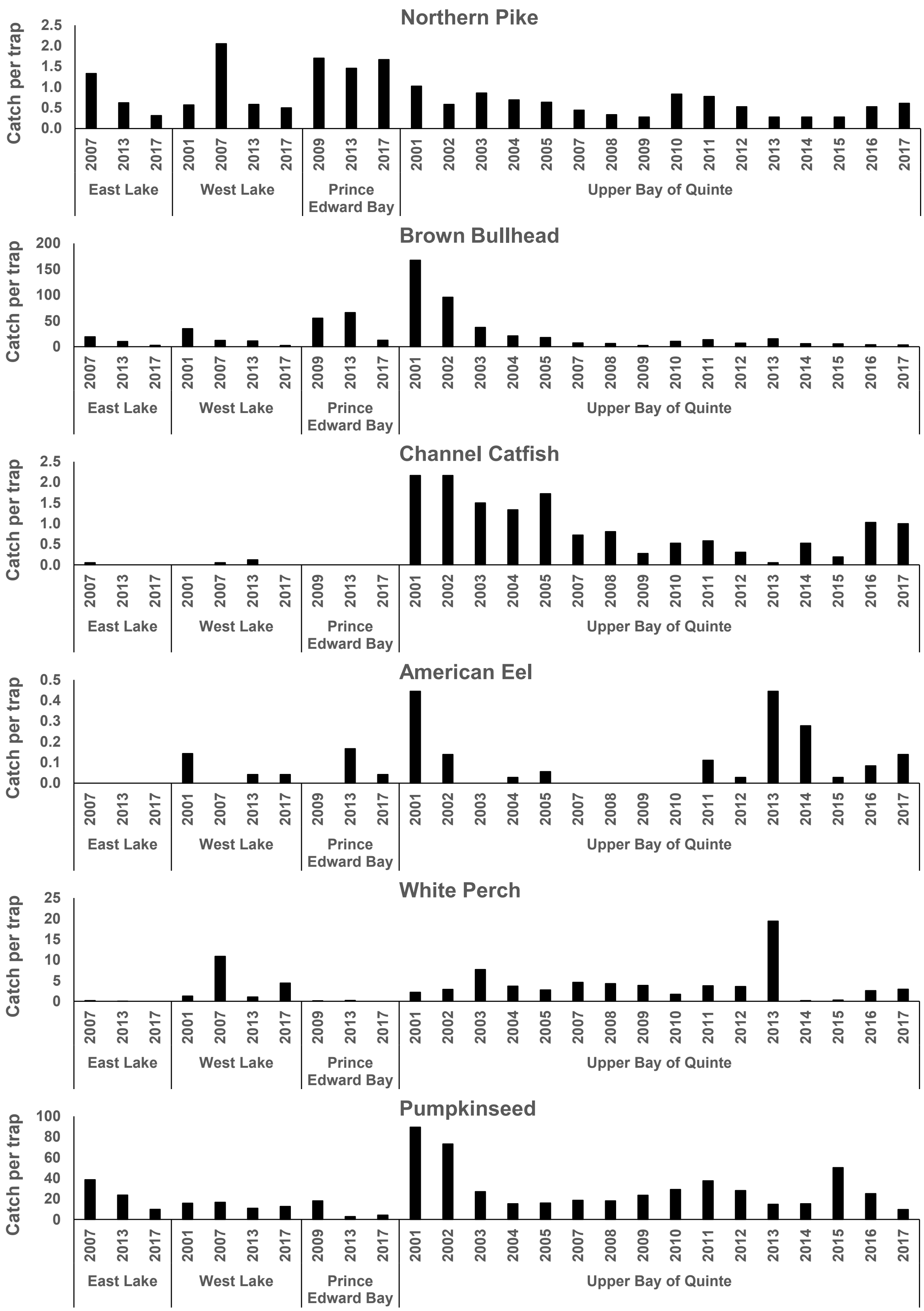

FIG. 1.4.2. Abundance trends for selected species caught in nearshore trap nets on East Lake, West Lake, Prince Edward Bay and the upper Bay of Quinte. Values shown are annual arithmetic means.

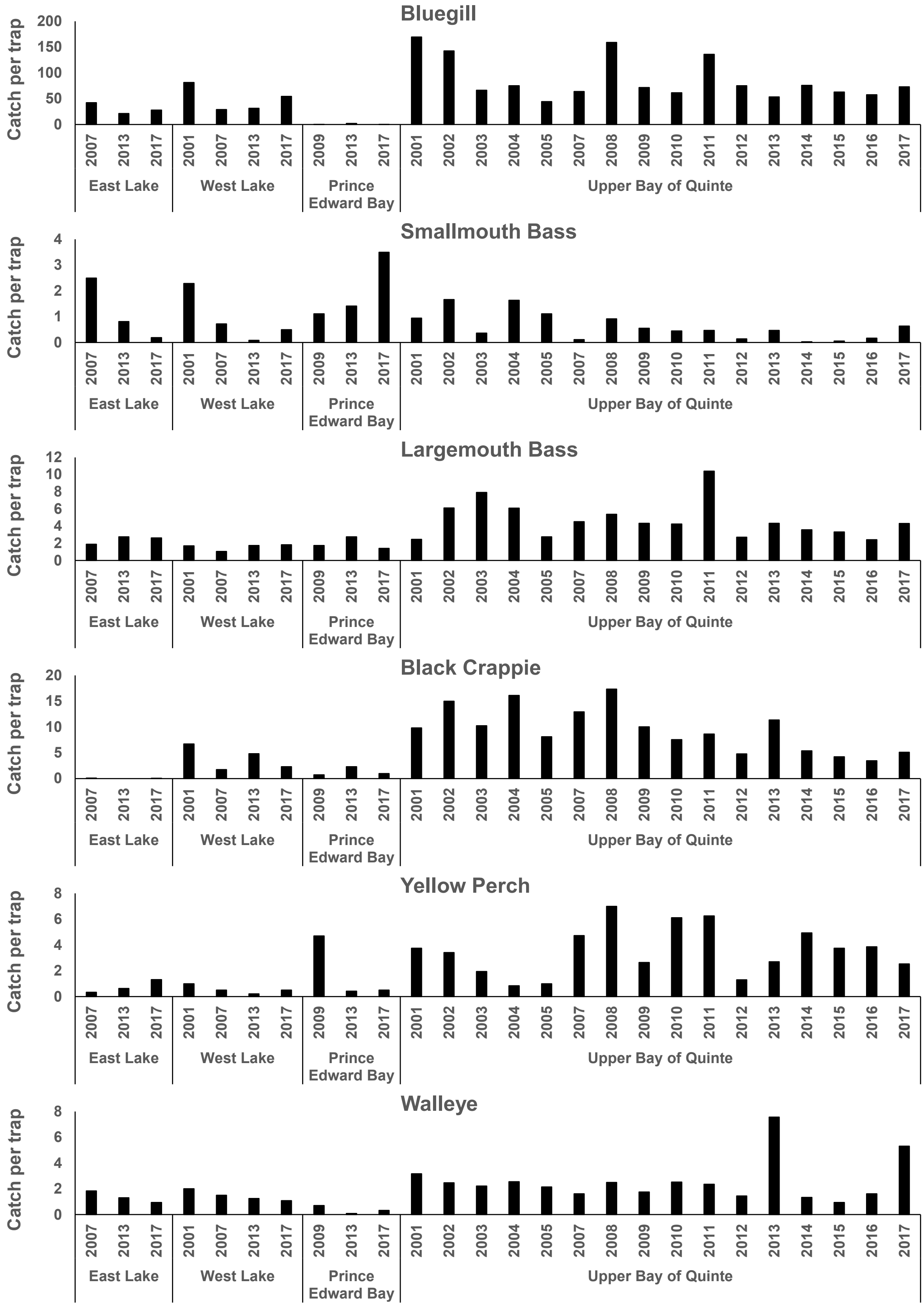

FIG. 1.4.2. (continued) Abundance trends for selected species caught in nearshore trap nets in on East Lake, West Lake, Prince Edward Bay and the upper Bay of Quinte. Values shown are annual arithmetic means.

species by number were Bluegill (1,308), Pumpkinseed (305), Rock Bass (141), White Perch (106), Longnose Gar and Brown Bullhead (62), Black Crappie (55), Largemouth Bass (44), and Walleye (26). One American Eel was captured; total length of the eel was 918 mm and weight was 1,648 g.

Prince Edward Bay

Twenty-four trap net sites were sampled on Prince Edward Bay from Sep 11-26 with water temperatures ranging from 18.0-22.1 ^{o}C (Table 1.4.2). Over 800 fish comprising 22 species were captured (Table 1.4.3). The most abundant species by number were Brown Bullhead (299), Rock Bass (139), Pumpkinseed (104), Smallmouth Bass (84), Bowfin (60), Northern Pike (40), Largemouth Bass (34), and Black Crappie (23). One American Eel was captured; total length of the eel was 899 mm and weight was 1,854 g. Of note was both the capture of a Muskellunge (710 mm fork length to nearest 10 mm), and a Chain Pickerel (598 mm fork length, 2,023 g weight).

Upper Bay of Quinte

Thirty-six trap net sites were sampled on the upper Bay of Quinte from Sep 5-22 with water temperatures ranging from 17.9-23.6 ^{o}C (Table 1.4.2). Nearly 4,300 fish comprising 25 species were captured (Table 1.4.3). The most abundant species by number were Bluegill (2,622), Pumpkinseed (346), Walleye (191), Black Crappie (184), Largemouth Bass (155), Brown Bullhead (132), White Perch (105), Longnose Gar (93), and Yellow Perch (91). Five American Eel were caught. The eel were 666, 768 and 915 mm total length and weighed 637, 1,242 and 1,807 g in weight, respectively.

Northern Pike abundance declined from 2001-2009, increased significantly in 2010, declined from 2010-2013, remained steady until 2015, then increased in 2016 and again in 2017. Brown Bullhead and Channel Catfish declined from 2001 to 2009; Brown Bullhead abundance remained low through 2017 and Channel Catfish increased somewhat in 2016 and 2017. American Eel abundance has declined in 2015 compared to the previous two years but increased in 2016 and again in 2017. White Perch abundance was unusually high in 2013 but very few were caught in 2014 (7) and 2015 (11). In 2016, 93 were caught, and 2017 105 were caught. Pumpkinseed abundance increased in 2015 and deceased in 2016 and 2017. Bluegill abundance was similar to recent years. Smallmouth Bass abundance increased significantly in 2017. Largemouth Bass and Black Crappie abundance increased in 2017. Yellow Perch abundance declined slightly in 2017. Walleye abundance, having been unusually high in 2013, declined in 2014 and 2015, increased in 2016, and again in 2017 thanks to recruitment of very strong 2014 and 2015 year-classes (Table 1.4.6 and Fig. 1.4.2).

Ecosystem Health Indices

Indices have been developed based on the NSCIN trap netting to evaluate ecosystem health in Lake Ontario nearshore areas. The indices vary among nearshore areas with the degree of exposure of the nearshore area sampled to Lake Ontario, and therefore are presented separately below for sheltered and exposed embayments (Figs. 1.4.3 to 1.4.6).

Piscivore Biomass

A proportion of the fish community biomass comprised of piscivores (PPB) greater than 0.20 reflects a healthy trophic structure. The PPBs in 2017 were 0.29, 0.33, 0.68 and 0.41 in East Lake, West Lake, Prince Edward Bay, and the upper Bay of Quinte, respectively. The PPB in these embayments remains well above the 0.2 benchmark for healthy fish communities (Fig. 1.4.3 and 1.4.4).

Index of Biotic Integrity

The index of biotic integrity (IBI) is a measure of ecosystem health. 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 IBIs were 69 (good), 67 (good), 74 (good) and 71 (good) in East Lake, West Lake, Prince Edward Bay, and the upper Bay of Quinte, respectively. The IBIs in these embayments are indicative of healthy aquatic ecosystems (Fig. 1.4.5 and 1.4.6).

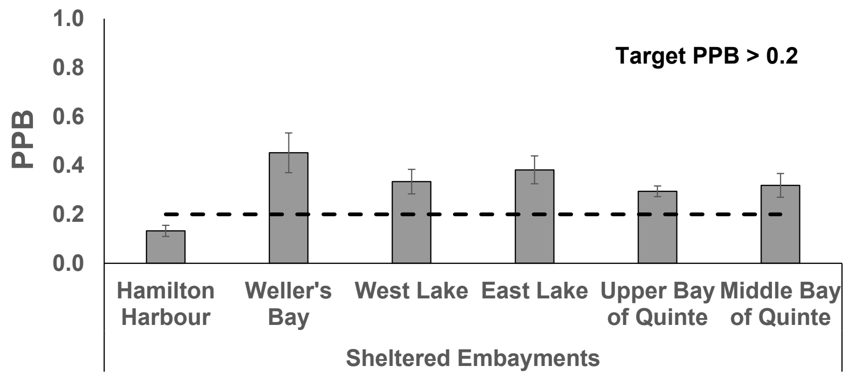

FIG. 1.4.3. Proportion of total fish community biomass represented by piscivore species (PPB) in the nearshore trap net surveys in six sheltered Lake Ontario embayments (2006-2017). A PPB>0.2 is indicative of a balanced trophic structure (depicted by a dashed line). Piscivore species included Longnose Gar, Bowfin, Northern Pike, Smallmouth Bass, Largemouth Bass, and Walleye. Error bars are +-2SE.

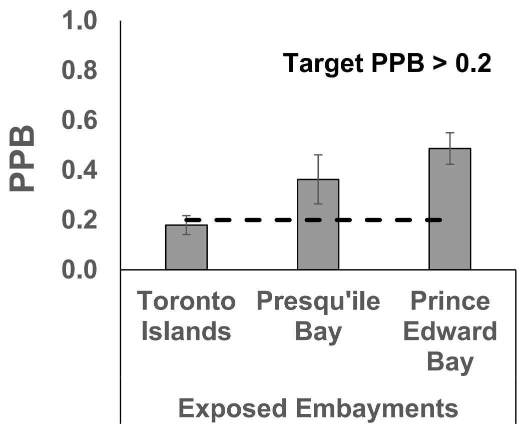

FIG. 1.4.4. Proportion of total fish community biomass represented by piscivore species (PPB) in the nearshore trap net surveys in three exposed Lake Ontario embayments (2006-2017). A PPB>0.2 is indicative of a balanced trophic structure (depicted by a dashed line). Piscivore species included Longnose Gar, Bowfin, Northern Pike, Smallmouth Bass, Largemouth Bass, and Walleye. Error bars are +-2SE.

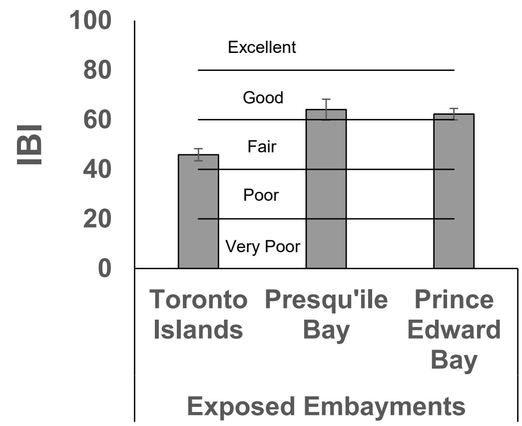

FIG. 1.4.6. Index of biotic integrity (IBI), as a measure of ecosystem health, in the nearshore trap net surveys in three exposed Lake Ontario embayments (2006-2017). IBI classes can be described as follows: 0-20 very poor, 20-40 poor, 40-60 fair, 60-80 good, and 80-100 excellent ecosystem health. Error bars are +-2SE.

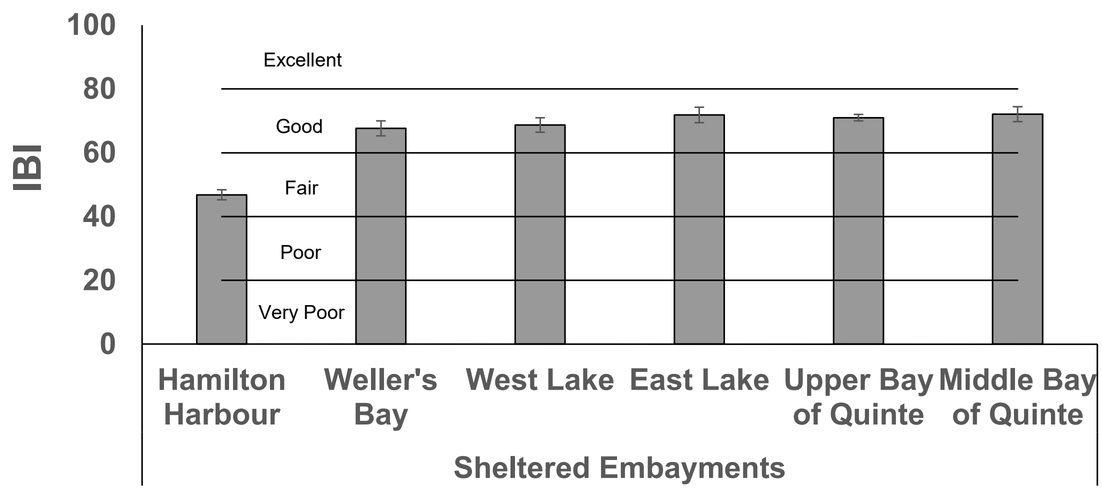

FIG. 1.4.5. Index of biotic integrity (IBI), as a measure of ecosystem health, in the nearshore trap net surveys in five sheltered Lake Ontario embayments (2006-2017). IBI classes can be described as follows: 0-20 very poor, 20-40 poor, 40-60 fair, 60-80 good, and 80-100 excellent ecosystem health. Error bars are +-2SE.

1.5 Upper Bay of Quinte Boat Electrofishing

J. A. Hoyle, Lake Ontario Management Unit

Boat electrofishing was conducted by the Ontario Ministry of Natural Resources and Forestry in September 2017 to sample the upper Bay of Quinte (Trenton to Deseronto) nearshore fish community. The standard Fisheries and Oceans boat electrofishing 100 m shoreline transect protocol was followed. The objective of the survey was to compare fish population and community attributes measured by the electrofishing protocol with that measured by NSCIN trap nets (Nearshore Community Index Netting; see Section 1.4). These two gear types have been independently employed in the Bay of Quinte and other Lake Ontario nearshore areas to evaluate fish community status and ecosystem health generally using community attributes including IBIs (Indices of Biotic Integrity) and piscivore biomass.

The boat electrofishing survey was conducted after sunset at the same locations sampled previously (about one week earlier) with NSCIN trap nets. Thirty-six 100 m shoreline sites were sampled from September 18 to 28. Mean water temperature at the 36 sites was 23.9 ^{o}C. A total of 1,571 fish (mean=44 fish per transect) comprising 29 species were captured (Table 5.1.1). Most abundant species included Yellow Perch (n=697), Brook Silverside (248), Bluegill (104), Largemouth Bass (77), Pumpkinseed (66), White Perch (55), Rock Bass (50), Logperch (45), American Eel (34), Golden Shiner (31), Brown Bullhead (27), Walleye (23), and Spottail Shiner (21). These most abundant species all had a relative standard error of the mean less than 30%. This result suggests that the sampling intensity (36 transects) was appropriate to describe the fish community of the upper Bay of Quinte as sampled by this boat electrofishing gear type. Finer geographic scale resolution may require more intensive sampling.

Boat electrofishing and NSCIN trap net catches for 2017 (36 samples for each gear type) are contrasted in Table 5.1.2. A total of 1,571 fish and 29 species was captured by boat electrofishing compared to 4,290 fish and 25 species by the trap nets (Table 5.1.2). Twenty species were common to both gear types. Nine unique species were captured by boat electrofishing including Alewife, Emerald Shiner, Blackchin Shiner, Spottail Shiner, Yellow Bullhead, Banded Killifish, Logperch, Brook Silverside, and Round Goby. Five unique species were captured by trap nets including Bowfin, Shorthead Redhorse, Greater Redhorse, White Bass, and Smallmouth Bass. Boat electrofishing

TABLE. 1.5.1. Species-specific mean (geometric and arithmetic means) catches in the 2017 boat electrofishing program in the upper Bay of Quinte. Also shown is the relative standard error (%) of the geometric mean catch.

Species	Geometric mean	Arithmetic mean	Relative standard error (%)
Longnose Gar	0.105	0.167	49
Alewife	0.071	0.111	58
Gizzard Shad	0.177	0.444	49
Northern Pike	0.059	0.083	56
White Sucker	0.207	0.333	36
Silver Sedhorse	0.039	0.056	70
River Redhorse	0.019	0.028	100
Common Carp	0.039	0.056	70
Golden Shiner	0.432	0.861	29
Emerald Shiner	0.019	0.028	100
Blackchin Shiner	0.019	0.028	100
Spottail Shiner	0.446	0.583	19
Yellow Bullhead	0.019	0.028	100
Brown Bullhead	0.449	0.750	26
Channel Catfish	0.019	0.028	100
American Eel	0.595	0.944	21
Banded Killifish	0.019	0.028	100
White Perch	0.601	1.528	28
Rock Bass	0.985	1.389	15
Pumpkinseed	0.947	1.833	19
Bluegill	1.145	2.889	21
Largemouth Bass	1.397	2.139	14
Black Crappie	0.019	0.028	100
Lepomis sp.	0.363	0.639	28
Yellow Perch	12.357	19.361	7
Walleye	0.402	0.639	25
Logperch	0.724	1.250	21
Brook Silverside	4.415	6.889	9
Round Goby	0.135	0.194	39
Freshwater Drum	0.216	0.306	30
Total catch per sample		**44**	
Number of species		**29**	
Number of samples		**36**	
Total catch		**1571**	

TABLE. 1.5.2. Species-specific total catches in boat electrofishing and trap net (see Section 1.4 Nearshore Community Index Netting) gear types in the upper Bay of Quinte, 2017. Thirty-six common sampling sites were sampled by each gear type.

Species	Gear type Boat e-fishing	Trap net
Longnose Gar	6	93
Bowfin	-	50
Alewife	4	-
Gizzard Shad	16	24
Northern Pike	3	22
White Sucker	12	11
Silver Redhorse	2	31
Shorthead Redhorse	-	16
Greater Redhorse	-	8
River Redhorse	1	15
Common Carp	2	7
Golden Shiner	31	1
Emerald Shiner	1	-
Blackchin Shiner	1	-
Spottail Shiner	21	-
Yellow Bullhead	1	-
Brown Bullhead	27	132
Channel Catfish	1	36
American Eel	34	5
Banded Killifish	1	-
White Perch	55	105
White Bass	-	5
Rock Bass	50	74
Pumpkinseed	66	346
Bluegill	104	2,622
Smallmouth Bass	-	23
Largemouth Bass	77	155
Black Crappie	1	184
Lepomis sp.	23	-
Yellow Perch	697	91
Walleye	23	191
Logperch	45	-
Brook Silverside	248	-
Round Goby	7	-
Freshwater Drum	11	43
Number species	**29**	**25**
Unique species	**9**	**5**
Common species	**20**	**20**
Total fish caught	**1,571**	**4,290**

tended to capture smaller species and smaller individual fish—76% of the catch was made up of fish between 60 and 170 mm in length—compared to trap net gear. Trap nets tended to capture larger species and larger individual fish—73% of the catch was made up of fish between 110 and 200 mm in length—compared to boat electrofishing (Fig. 1.5.1).

Site-specific Indices of Biotic Integrity (IBI) were calculated for each gear type and a scatter plot presented for the 36 paired samples (Fig. 1.5.2). There was no correlation between IBI values calculated for each gear type. IBI values were 74.7 and 71.1 respectively for boat electrofishing and trap net gear types. Boat electrofishing IBI values ranged from 55.3-92.2 and trap net IBI values ranged from 56.2-91.3 (n = 36).

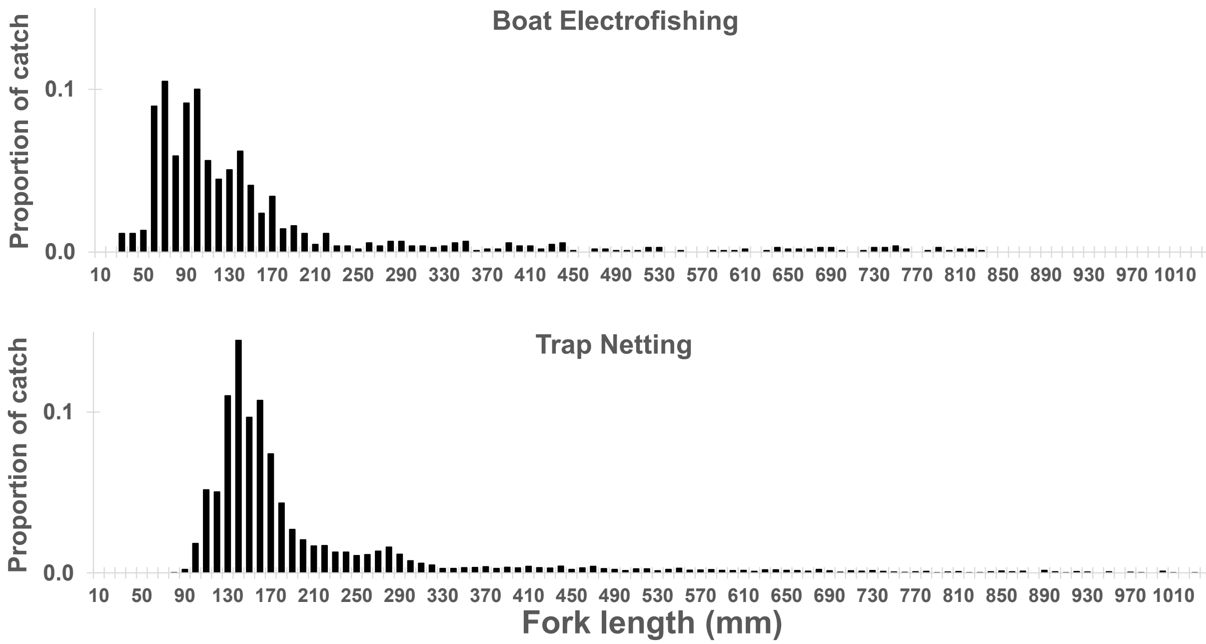

FIG. 1.5.1. Size distribution (fork length in mm) of fish caught during boat electrofishing and trap netting programs in the upper Bay of Quinte, 2017.

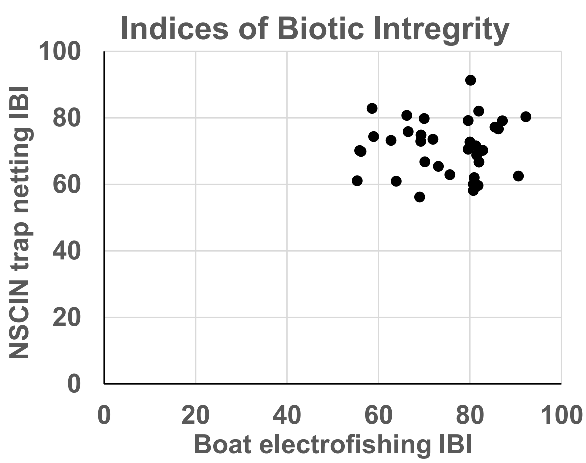

FIG. 1.5.2. Scatter plot of IBI measurements by two gear types from 36 paired sampling sites. IBIs were not significantly correlated ($r^2 = 0.002$, $p = 0.796$).

1.6 Lake Ontario Summer Pelagic Prey Fish Survey

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Hydroacoustic assessments of Lake Ontario prey fish have been conducted since 1991 with a standardized mid-summer hydroacoustic survey first implemented in 1997. The survey is conducted jointly by the Ontario Ministry of Natural Resources and Forestry (MNRF), the New York State Department of Environmental Conservation (NYSDEC) and the US Geological Survey (USGS). Midwater trawling was routinely conducted during the early years of the survey but was discontinued in 2005. In 2016, midwater trawling was conducted in the eastern portion of the lake with an emphasis on assessing Cisco and Bloater. Efforts were expanded in 2017 to include a portion of the north shore around Cobourg. Midwater trawl catches are primarily used to inform apportionment of generalized abundance estimates obtained from hydroacoustics to species specific abundance. Acoustic analysis parameters are included in Table 1.6.1.

The index survey consists of five, north-south, shore-to-shore transects in the main lake, and one transect in the Kingston Basin (Fig. 1.6.1). Additional near-shore assessment supplements the broader survey and provides greater detail on the spatial extent of Cisco. Hydroacoustic data were collected beginning at approximately one hour after sunset from 10 m of depth on one shore and running to 10 m of depth on the opposite shore at or until approximately one hour before sunrise. Since 2005, transects have been randomly selected from within 15 km corridors. The corridor approach was adopted to include a random component to the survey while accommodating logistical constraints such as suitable ports. A dogleg at the southern portions of transects 3, 4 and 5 is used to increase the length of the transect that occurs in less than 100 m of water along the southern shore which has a much steeper slope than the northern shore. Temperature profiles were conducted at multiple intervals along each transect. Historical midwater trawling data (2000 to 2004) showed a thermal separation between the two primary species of interest, Alewife and Rainbow Smelt. Midwater tows in depths where water temperatures were 9° C or warmer were dominated by catches of Alewife (95% total catch weight of prey fish species) whereas tows in depths at temperatures below 9°C captured mostly Rainbow Smelt (84%). This thermal separation of the two dominant species coupled with target strengths thresholded to ranges consistent with prey fish species has been used as a means of species apportionment throughout the period when midwater trawling wasn't conducted.

The survey transects included acoustic data collected over 311 km plus an additional 247 km collected paired with midwater trawl tows (Fig.

TABLE 1.6.1. Description of midwater trawl.

Component	Description
Vessel Tow Speed	3.5 kts
Headrope length	18.3m
Footrope length	18.3m
Front Mesh	101 mm
Cod End	12.7 mm
Wing Spread	7 m
Net Height	6 m
Door Area	1.25 m^2
Note:	22.5 kg of weight were hung from each wing to spread the trawl

FIG. 1.6.1. The Lake Ontario Lake-wide prey fish survey uses cross-lake hydroacoustic transects. Transect corridors are logistically constrained but utilize a random starting point within the corridor for each annual survey.

1.6.2). The degree of coverage (Λ) for the survey transects was 0.18 and 0.41 when all acoustic data is included in the estimates. There were 58 midwater tows conducted which captured seven species of fish. A description of the midwater trawl gear is included in Table 1.6.1. Alewife, Rainbow Smelt and Cisco were the most frequently caught and most abundant species (Table 1.6.2). Tows in the surface layer (at or above 10˚C) were 99% Alewife. Tows in deep layer (below 10˚C) were also 95% Alewife however we hypothesize that net contamination from the upper layer significantly impacts this interpretation. Headrope and footrope temperatures were not recorded on all tows and thus a fishing temperature of 9˚C at the footrope and a net with a vertical opening of 5-7m is likely fishing some portion of the net in temperatures greater than 9˚C water. In the future we expect to have temperature loggers on both the footrope and headrope to better quantify this potential bias. Additionally there is potential for vertical contamination during the let out and haul in portions of the tow as the net descends to the target fishing depth. During this period the net must pass through the warm portion of the water column in order to reach the cooler depths. A tow conducted in 2016 with no fishing time (trawl let out to 34 m fishing depth then immediately returned) captured Alewife, Cisco and Rainbow Smelt which indicates that the net fishes during at either or both the let out or haul in period of the tow. Catches of Rainbow Smelt and Cisco were predominantly (88% for each) caught in tows conducted in less than 9˚C water.

Summary size data for all species are presented in Table 1.6.3. The length distribution shows a clear size separation between Cisco and both Alewife and Rainbow Smelt (Fig.1.6.3). The thermal separation between Alewife and Rainbow Smelt and the size difference between these species and Cisco supports the current approach

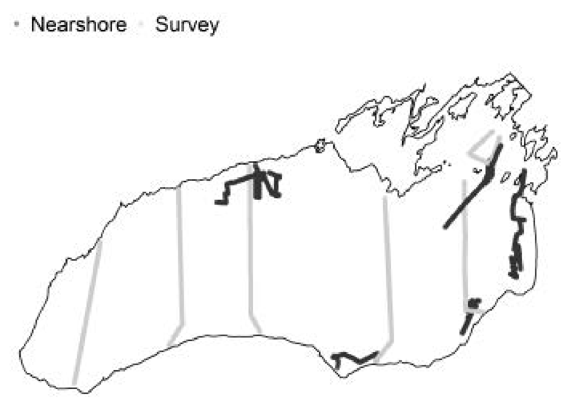

FIG. 1.6.2. Spatial coverage of acoustic data collected in 2017. Transects are categorized as 'survey' and 'nearshore' to delineate the traditional survey transects from the additional near-shore acoustics that was paired with midwater trawling.

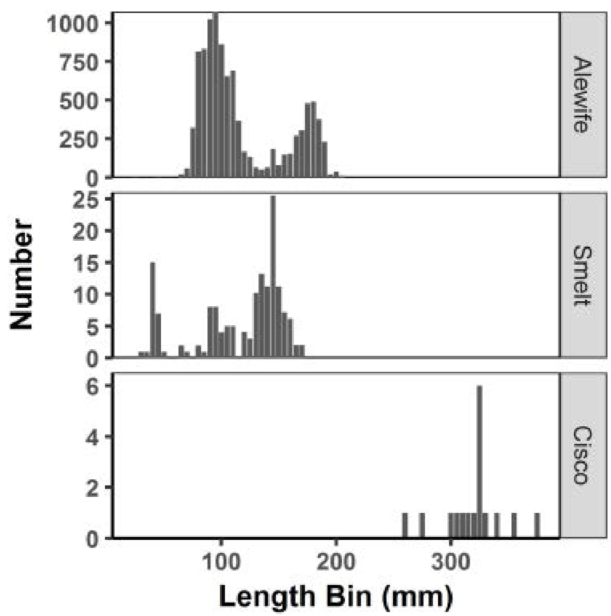

FIG. 1.6.3. Length frequency of Alewife, Rainbow Smelt and Cisco caught in midwater tows.

TABLE 1.6.2. Summary of catch data for all species captured in midwater trawls.

Species name	Catch total in trawls below 10˚C	Catch total in trawls 10˚C and above	Total catch all trawls
Alewife	3547	6433	9980
Rainbow Smelt	138	19	157
Cisco	15	2	17
Chinook Salmon	2	1	3
Round Goby	2	0	2
Gizzard Shad	0	1	1
Threespine Stickleback	1	0	1

TABLE 1.6.3. Summary of biological data for species sampled in midwater trawls.

Species name	Number sampled	Mean total length	Max total length	Min total length	Mean weight
Alewife	227	146	201	25	24.8
Chinook Salmon	3	508	860	140	3329.0
Cisco	17	318	371	257	271.4
Gizzard Shad	1	145	145	145	27.0
Rainbow Smelt	45	85	169	30	7.0
Round Goby	1	30	30	30	0.1

of species apportionment of acoustic density estimates (Table 1.6.4).

Alewife index of abundance in 2017 (1.183 billion) increased relative to 2016 estimates (Fig. 1.6.4). The increase in population is likely explained by increases in the age-1 population of Alewife. Differences between target strength distributions over the most recent years, where recruitment to age-1 in 2014 and 2015 was low, supports this assumption (Fig. 1.6.5), see also Section 7.6). Alewife showed a bimodal distribution with bottom depth (Fig. 1.6.6). Distribution of Alewife throughout the lake during the survey period varies from year to year and no consistent spatial trend has been found. The inclusion of the additional shallow transects resulted in a marginally lower estimate (1.102 billion). Midwater trawl catches expanded to a whole-lake population (1.743 billion) suggest a slightly higher abundance than the acoustic estimate but was not conducted in a random fashion and is likely biased slightly high due to effort being concentrated in depths less than 70m where acoustic estimates show higher abundances.

The acoustic abundance of Alewife is presented as an index of abundance as it produces a significantly lower abundance than spring trawl estimates. Vertical gillnets and towed up-looking acoustics show that a large proportion (on average 50%) of Alewife occupy the near-surface portion of the water column (<4 m depth) and are not detectable with the down-looking transducer used in the survey. While a significant proportion of the Alewife biomass is detected in this portion of the water column, the conversion still does not reconcile the difference between bottom trawl and acoustics population estimates. Stationary up-looking data is being analyzed to investigate the role that boat avoidance may contribute to explaining the differences.

TABLE 1.6.4. Acoustic parameter settings and target strength thresholds used for the 2017 survey.

Parameter	Specification
Sounder	BioSonics DT-X
Transducer frequency	120 kHZ split beam
Ping Rate	1 ping per second
Pulse Width	0.4 milliseconds
Analytical Software	Echoview (version 8.0)
Alewife target threshold range	-50 to -39dB, water temp. > 9°C
Rainbow Smelt target threshold range	-52 to -39dB, water temp. =< 9°C
Cisco target threshold range	-39 to -30dB, all water temps.

Rainbow Smelt abundance (15.1 million) in 2017 decreased relative to 2016 estimates (Fig. 1.6.7). Inclusion of the additional near-shore transects resulted in a larger population estimate (50.3 million). The largest midwater trawl catches of Rainbow Smelt occurred in the eastern portion of the Lake (Mexico Bay and Oak Orchard, NY).

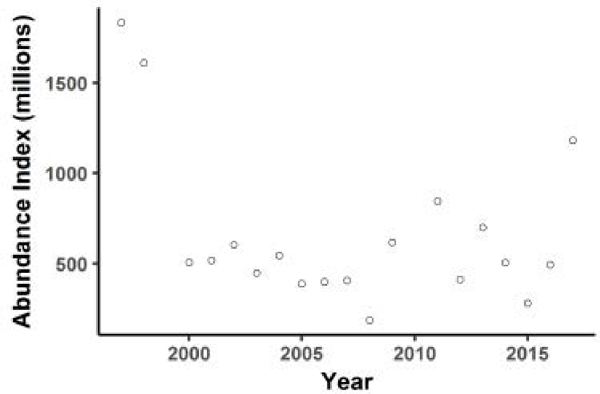

FIG. 1.6.4. Abundance index (in millions of fish) of yearling-and-older Alewife. Summer acoustic estimates were not conducted in 1999 and 2010.

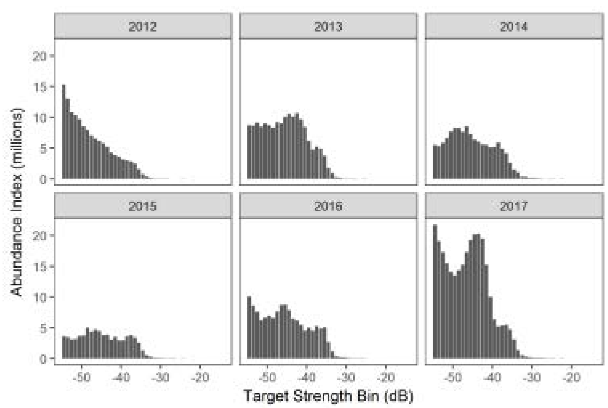

FIG. 1.6.5. Relative size distribution of Alewife inferred by target strength for surveys conducted from 2012 to 2017.

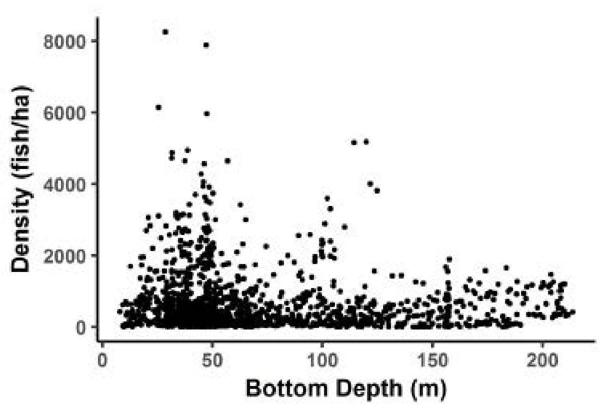

FIG. 1.6.6. Relative distribution of Alewife (fish/ha) throughout the lake by bottom depth.

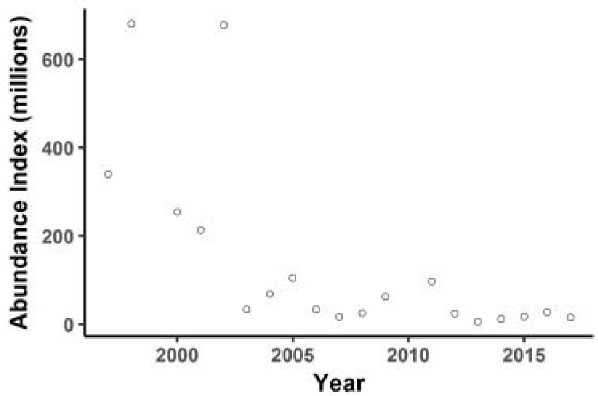

FIG. 1.6.7. Abundance (in millions of fish) of yearling-and-older Rainbow Smelt from 1997-2017. Summer acoustic estimates were not conducted in 1999 and 2010.

Only one Rainbow Smelt was caught in MNRF tows conducted near Cobourg.

Cisco were infrequently caught during previous midwater trawling efforts (2000-2004). Catches of Cisco were geographically confined to transects along the eastern shore of Lake Ontario in 2016. The majority of Cisco were caught within the same geographic area in 2017 although one Cisco was caught near Cobourg. Cisco catches in 2017 (N total = 15, mean CUE = 0.15 fish/5 min tow) were well below catches observed in 2016 (N total = 361, mean CUE = 3.83 fish/5 min tow). Acoustic estimates, using only the near-shore transects however show a mean density of 45 cisco/hectare which is higher than 2016 estimates.

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

M.J. Yuille, Lake Ontario Management Unit

Every other year in early fall, the Lake Ontario Management Unit conducts an index gillnet survey in the Thousand Islands. 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 2017, the survey was conducted between September 11th and September 28th. Forty eight sets were made, using standard gillnets consisting of 25-foot panels of monofilament meshes ranging from 1.5 to 6 inches in half-inch increments. The average set duration was 21 hours (range 18.8 – 23.2). The overall catch was 1,745 fish comprising 19 species (summary in Table 1.7.1). The average number of fish per set was 36.4, which is higher than the previous survey in 2015 and comparable to the mean catch over the previous 10 years (34.8 fish per set; Fig. 1.7.1). Yellow Perch remained the dominate species caught in the nets followed by: Rock Bass and Smallmouth Bass (Fig. 1.7.2). Less common species included Walleye, Northern Pike and

TABLE 1.7.1. Catches per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2017. 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
Lake Sturgeon	--	--	--	--	--	--	0.04	--	0.02	0.02	0.02	0.05	0.05	--	--	--
Longnose Gar	--	--	0.04	--	--	0.04	--	--	0.08	0.05	--	0.04	0.05	--	--	--
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
Alewife	0.49	--	0.11	0.04	0.04	--	--	--	--	0.02	0.14	0.07	--	0.12	0.27	0.46
Gizzard Shad	--	0.38	0.52	--	--	--	0.04	0.11	--	0.05	0.02	--	0.09	0.14	0.12	0.08
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
Cisco	--	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
Muskellunge	--	--	0.04	--	0.04	--	--	0.02	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
Silver Redhorse	--	--	--	--	--	--	0.25	0.05	--	0.07	0.07	0.02	0.13	0.07	0.03	--
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	--	--	--
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
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
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	--
White Perch	0.08	--	0.43	0.04	0.07	--	0.08	0.18	0.02	0.16	--	--	--	0.12	--	--
White Bass	0.05	0.83	0.47	0.27	--	0.08	--	--	--	--	--	--	0.32	--	0.03	--
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
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
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
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
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
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	--
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
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
Round Goby	--	--	--	--	--	--	--	--	--	0.86	0.22	0.21	0.02	0.02	0.05	0.02
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
Total Catch	51	53	47	41	43	42	51	56	45	44	57	45	60	26	26	36

Brown Bullhead; remaining species comprised the remaining 8% of the total catch (Fig. 1.7.2).

Species Highlights

In 2017, Yellow Perch catches increased from 12.4 fish per gillnet to 26.0 fish per gillnet and represented 71% of the total catch by number (Table 1.7.1; Fig. 1.7.2 and 1.7.3). In the 2017 Thousand Islands survey, average Yellow Perch catch per net (26.0) were above the average catch from the previous five netting surveys (average of 24.8 from 2007 to 2015).

The centrarchids are represented by six species in the upper St. Lawrence: Rock Bass, Pumpkinseed, Bluegill, Smallmouth Bass, Largemouth Bass and Black Crappie (Fig. 1.7.4 and 1.7.5). While Rock Bass remain the most abundant of the centrarchids, catches in 2017 were 65% of the previous decade. Smallmouth Bass saw a small decrease in the 2017 catch and have been in decline since 2005 (Fig. 1.7.4). Growth as determined by mean lengths of age-1 (169 mm in 2017) and age-3 (302 mm in 2017) Smallmouth Bass increased from the previous survey and are above the long-term average (Tables 1.7.2 and 1.7.3 and Fig. 1.7.6). Size of age-5 Smallmouth Bass remains stable and above the long-term average (Table 1.7.3 and Fig. 1.7.6) Pumpkinseed continue to decline in 2017 and

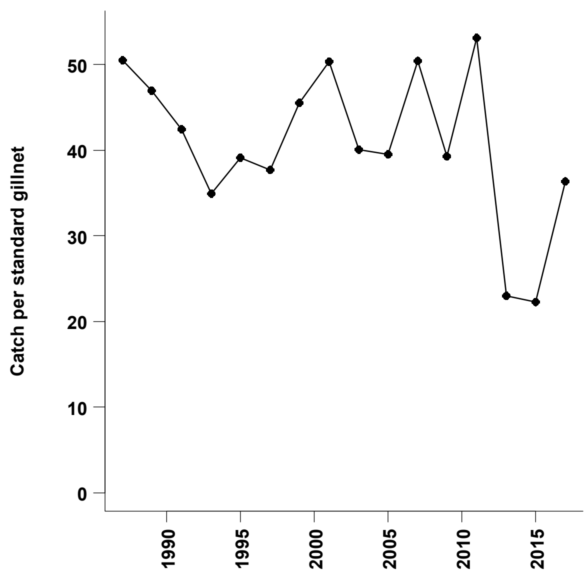

FIG. 1.7.1. Total number of fish (all species) per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2017.

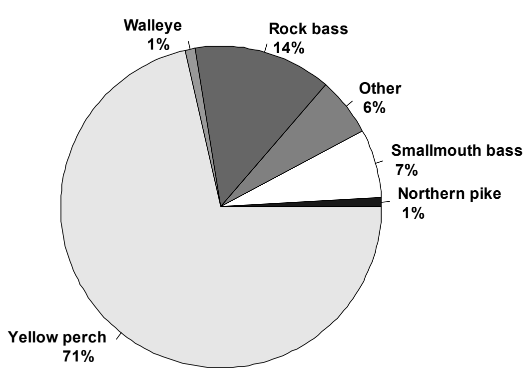

FIG. 1.7.2. Species composition in the 2017 gillnet survey in the Thousand Island area of the St. Lawrence River.

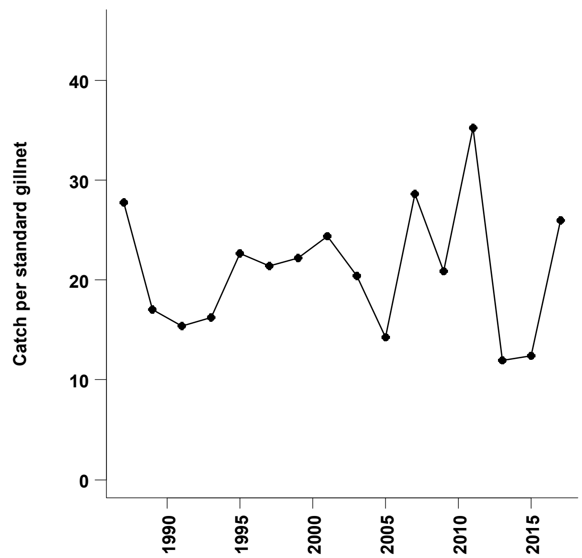

FIG. 1.7.3. Yellow Perch catch per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2017.

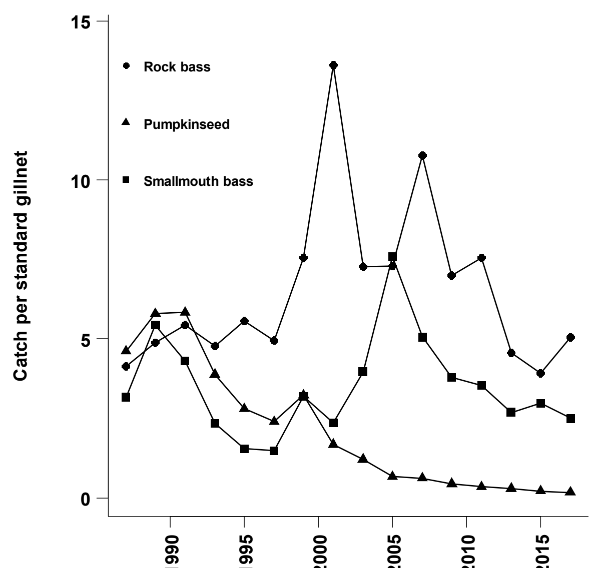

FIG. 1.7.4. Centrarchid catches per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2017.

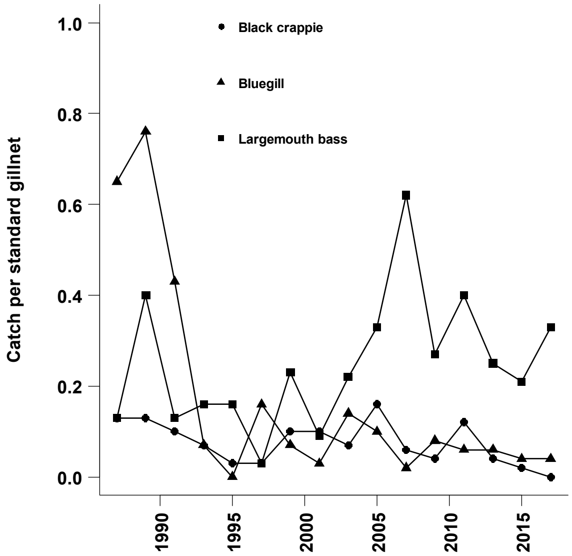

FIG. 1.7.5. Centrarchid catches per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2017.

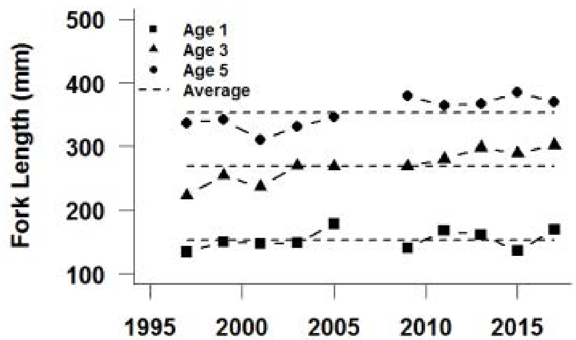

FIG. 1.7.6. Mean fork length (mm) of age-1 (square), age-3 (triangle) and age-5 (circle) Smallmouth Bass from 1997 to 2017. Dashed lines represent the average fork length from 1997 to 2017 for the aforementioned ages.

TABLE 1.7.2. Age distribution of selected species caught in the Thousand Islands, 2017.

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

TABLE 1.7.3. Mean fork length (mm) of selected species caught in the Thousand Islands, 2017.

	Year-class/Age																		
	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999
Species	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Yellow Perch	--	--	155	200	224	235	271	283	302	282	315	--	--	--	--	--	--	--	--
Walleye	--	--	381	--	438	530	523	605	--	--	645	--	--	--	640	--	576	--	650
Northern Pike	285	431	486	555	625	677	740	648	675	630	--	--	--	--	--	--	--	--	--
Smallmouth Bass	--	169	238	302	321	370	406	434	442	457	480	465	--	--	--	--	--	--	--

remain at the lowest level observed in this survey (Fig. 1.7.5). Bluegill, Largemouth Bass and Black Crappie were historically at much lower levels than the former three species, and remain so. While Largemouth Bass had a moderate increase over the last decade, the abundance in 2017 increased from the previous survey in 2015 (Fig. 1.7.5).

Northern Pike remain at very low levels, reached after a slow steady decline spanning almost the entire history of the Thousand Islands survey (Fig. 1.7.7). Currently, Northern Pike abundance is at the lowest observed in this survey; roughly 5% of its peak observed in 1989. Condition as determined by mean lengths of age-4, age-5 and age-6 Northern Pike has increased above the long-term average in the 2017 survey (Fig. 1.7.8 and Tables 1.7.2 and 1.7.3). From the last survey in 2015, mean lengths at age-4, age-5 and age-6 Northern Pike increased 7%, 9% and 14% (respectively; Fig. 1.7.8).

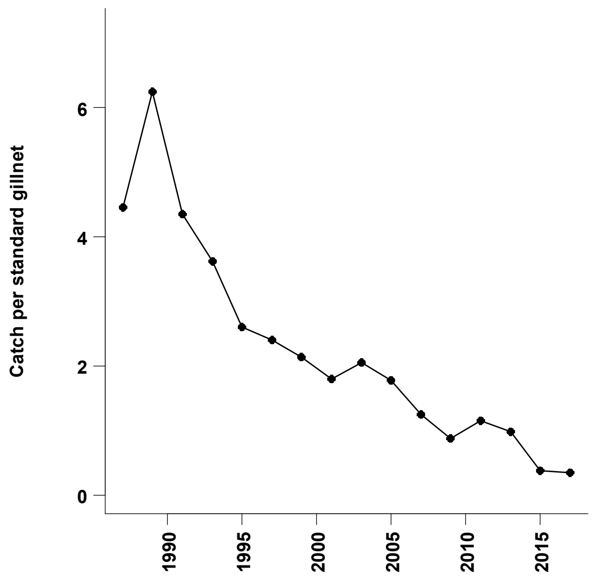

FIG. 1.7.7. Northern Pike catch per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2017.

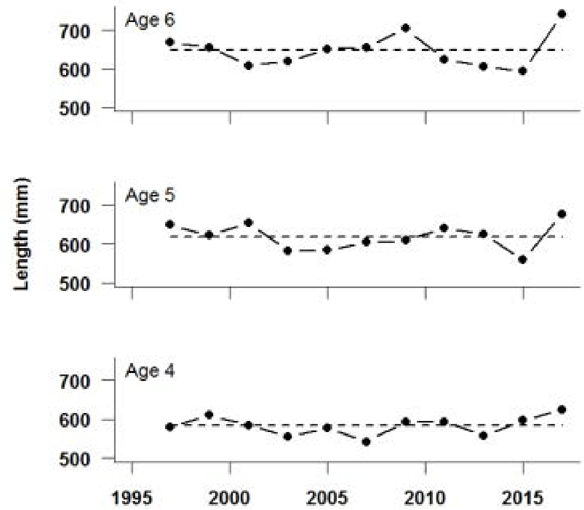

FIG. 1.7.8. Mean fork length (mm) of age-4, age-5 and age-6 Northern Pike from 1997 to 2017. Dashed lines represent the average fork length from 1997 to 2017 for the aforementioned ages.

1.8 Credit River Chinook Salmon Spawning Index

M.J. Yuille and J.P. Holden, 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. Chinook Salmon are captured during the fall spawning run at the beginning of October using electrofishing gear. 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 2017 Chinook Salmon index were taken between October 10th – 19th. Lengths were taken on 628 Chinook Salmon with detailed sampling occurring on 377 of these fish. Of the 628 Chinook Salmon selected for lengths, 45 (7.2%) Chinook Salmon were observed with an adipose clip. To increase the diversity of the Chinook Salmon egg collection, LOMU began collecting Chinook Salmon eggs and milt from the Ganaraska River in addition to the Credit River. Fish that were stocked into the Credit River that were collected from the Ganaraska River had their adipose removed prior to stocking. This allows LOMU staff to identify the stock origin (Credit River/Wild = adipose fin intact; Ganaraska = adipose removed/clip) of the mature Chinook Salmon in the Credit River during the spawn/egg collection. Stocking of Ganaraska River Chinook Salmon into the Credit River began in 2015, so fish observed with an adipose clip would be from the 2015 or 2016 stocking events (see Section 6.1). Of the 45 fish observed with an adipose clip, 29 were biologically sampled in detail. All fish were male and of the 29, 86% were from the 2016 stocking event (age-1) and 14% were from the 2015 stocking event (age-2).

In 2017, mean length of Chinook Salmon increased in age-2 males and females as well as age-3 males (Fig. 1.8.1). The mean length of age-3 females declined slightly in 2017 (Fig. 1.8.1). The mean length of age-3 males (892 mm)

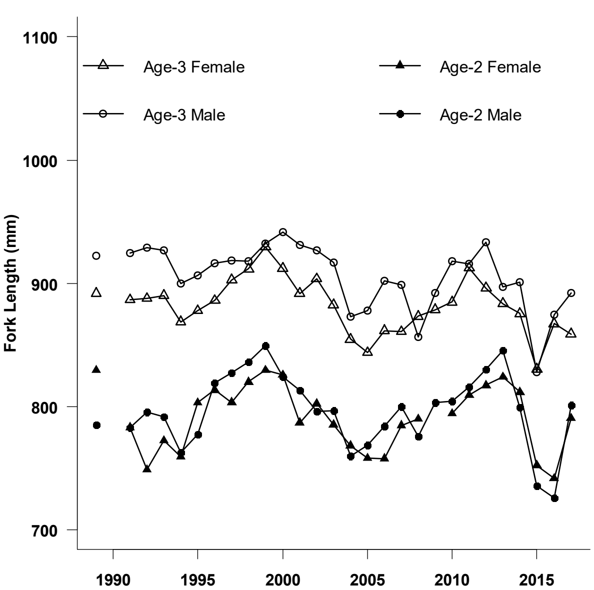

FIG. 1.8.1. Mean total length of age-2 and age-3 Chinook Salmon by sex, caught for spawn collection in the Credit River during the fall spawning run (approximately first week of October), 1989-2017.

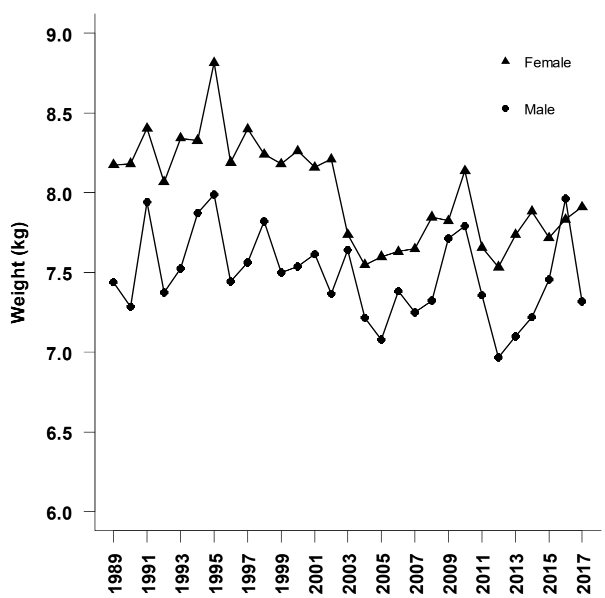

FIG. 1.8.2. Condition index as the mean weight of a 914 mm / 36 inch (total length) Chinook Salmon in the Credit River during the spawning run (approximately first week of October), 1989-2017.

increased from 2016 and is 1% below the long term average of 906 mm. Average length of age-3 females (859 mm) declined from 2016 and is 3% below the long-term mean (Fig. 1.8.1). Length of age-2 females (791 mm) and males (801 mm) increased from 2016 and both are now to at their respective long-term means (Fig. 1.8.1).

The estimated weight (based on a log-log regression) of a 914 mm / 36” (total length) Chinook Salmon is used as an index of condition. In 2017, female condition was higher than 2016 values and has been increasing since 2015 (Fig. 1.8.2). A sharp decline in male condition was observed in 2017 (Fig. 1.8.2). Female condition in 2017 (7,910 g) is comparable to the average condition from 2007 to 2016 (7,796 g). Male condition (7,317 g) declined 8% and is 2% below the average condition over the past 10 years (2007 – 2016). It should be noted that the absolute difference between maximum and minimum condition for female (1995 and 2007) and male (1995 and 2012) Chinook Salmon in this time series is 1,020 g and 1,280 g (respectively).

1.9 Juvenile Chinook Salmon Assessment

M. J. Yuille, Lake Ontario Management Unit

In recent years, the Lake Ontario Chinook Salmon Mass Marking Study indicated 40-60% of the Chinook Salmon in Lake Ontario originated from agency stocking programs and the remainder were of naturalized origin. In addition, many naturalized Chinook Salmon have been collected during electrofishing programs conducted in Lake Ontario tributaries. In 2014, a program was initiated to assess naturalized production of juvenile Chinook Salmon in Lake Ontario streams. This program was based on previous surveys conducted during spring 1997 to 2000.

In 2017, modifications to the survey resulted in the sampling of six Lake Ontario tributaries, which included: Bronte Creek, Credit River, Duffins Creek, Wilmot Creek, Ganaraska River and Shelter Valley Creek. The Juvenile Chinook Salmon assessment program changed in 2017. Each of the six Lake Ontario tributaries were electrofished with the objectives of: providing presence/absence data regarding natural production of juvenile salmonids and collecting Chinook Salmon smolts for otolith microchemistry research. At a coarse level, this technique may be used to distinguish between stocked and naturalized fish based on the chemical composition of the otolith, allowing us to track the contribution of naturalized fish to the Lake Ontario recreational fishery without the need of fin clips. Once refined, this technique may allow the Lake Ontario Management Unit to determine which tributaries naturally produced salmon and trout originate.

During 2017, juvenile Chinook Salmon were surveyed by electrofishing in six Lake Ontario tributaries (Table 1.9.1). The survey took place on three days during May 3rd to May 17th, 2017. With the exception of Shelter Valley Creek, only one site was visited per tributary.

Age-0 Chinook Salmon were caught in all six tributaries visited (Table 1.9.1). Yearling Rainbow Trout as well as Age-0 and yearling Coho Salmon were observed at Wilmot Creek and Shelter Valley Creek. Age-0 Brown Trout were observed at the Credit River and Wilmot Creek. A single yearling Atlantic Salmon was observed on the Ganaraska River. This fish is a result of stocking yearling Atlantic Salmon up river from the electrofishing location prior to the Juvenile Chinook Salmon assessment program being conducted. In 2017, field crews targeted Chinook Salmon smolts for the otolith microchemistry project, thus only observed catches of salmon and trout have been reported (Table 1.9.1). The otoliths from these fish provide a microchemical baseline representing the tributary in which they were collected. Results will be made available in the following years.

Year to year variability in abundance of Chinook Salmon in Lake Ontario streams is still not well understood. Moreover, a widespread increase in Chinook Salmon abundance across streams may be consistent with ecosystem changes in Lake Ontario over the last 20 years. Assessment of naturalized Chinook Salmon production in streams should provide additional insights into wild and naturalized fish production. Additionally, this program is providing essential baseline information for the development of a new assessment technique that will aid in estimating Chinook Salmon natural production in Lake Ontario.

TABLE 1.9.1. Location, sampling date and catch by species of fish in Lake Ontario tributaries during electrofishing surveys in 2017.

				Coho salmon		Chinook salmon		Rainbow trout		Atlantic salmon		Brown trout	
Site	Latitude	Longitude	Date	Age-0	1+	Age-0	1+	Age-0	1+	Age-0	1+	Age-0	1+
	Bronte Creek												
BN04	43° 24.35'	79° 44.47'	May 15	--	--	39	--	--	--	--	--	--	--
	Credit River												
CR01	43° 37.68'	79° 44.21'	May 16	--	--	42	--	--	--	--	--	1	--
	Duffins Creek												
DU06	43° 51.21'	79° 03.74'	May 16	--	--	65	--	--	--	--	--	--	--
	Wilmot Creek												
WM10	43° 54.81'	78° 36.60'	May 4	5	1	35	--	--	21	--	--	1	--
	Ganaraska River												
GN10	43° 59.36'	78° 19.72'	May 17	--	--	34	--	--	--	--	1	--	--
	Shelter Valley Cr.												
SE07	43° 59.12'	78° 00.10'	May 17	9	--	21	--	--	--	--	--	--	--
SE09	44° 00.04'	77° 59.70'	May 3	46	--	18	--	--	110	--	--	--	--

1.10 Lake Ontario Spring Prey Fish Trawling

J. P. Holden, Lake Ontario Management Unit
B.C. Weidel, Lake Ontario Biological Station, USGS
M.J. Connerton, Cape Vincent Fisheries Station, NYSDEC

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 early spring, 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 safe 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 (MNRF) trawling a portion of the Canadian sites. Trawling at Hamilton and shallow Toronto sites was conducted by the USGS, while deep Toronto sites, Oshawa, Cobourg, Prince Edward County, and in the Kingston Basin were sampled by MNRF (Fig. 1.10.1). A total of 204 sites conducted throughout the lake were sampled in 2017 (69 in Canadian waters, 135 in US waters) spanning bottom depths from 8-225m (25-743 ft) between April 2th and May 27th. The increased effort in Canadian waters in 2017 (69 compared to 46 in 2016) is a result of 4 new transects being added (indicated by solid fill in Fig. 1.10.1).

The survey generally samples depths in proportion to the lake area however there are differences in how those samples are distributed between jurisdictions. The south shore has well distributed coverage as most depths between 8-200 m can be surveyed at each transect. Bottom trawling along the north shore is less uniform due to a lack of suitable trawl sites at shallower depths. Attempts to trawl at depths shallower than 80m at the current sites have consistently resulted in snags and torn trawl nets. During the day, in early spring, most Lake Ontario Alewife are found near the lake bottom in the warmer, deeper water (75 m – 150 m) thus trawl sites at depths greater than 80 m provide suitable index sites for Alewife. Additionally, shallow tows (<40 m) in Ontario waters occur disproportionately in the Kingston Basin. Efforts continue to identify suitable trawl locations along the north shore portion of the main Lake.

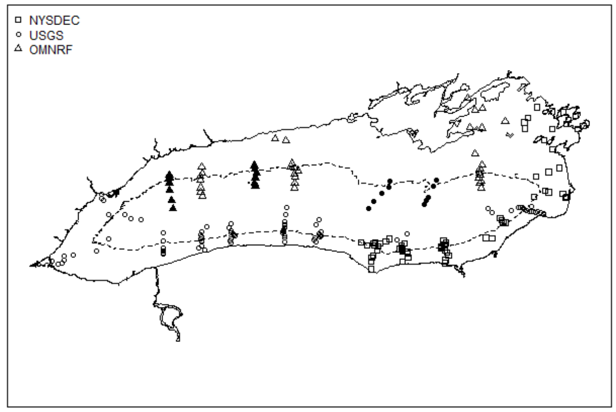

FIG. 1.10.1. Geographic distribution of trawl sites conducted by MNRF, USGS and NYSDEC. Solid fill indicates new transects added in 2017.

TABLE 1.10.1. 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

All vessels followed a standard trawl protocol that utilized a polypropylene mesh bottom trawl referred to as “3N1” (see Table 1.10.1 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 (1.22 m x 0.75 m) while MNRF used comparable Thyborne doors to spread the trawl. Trawl mensuration gear was used to record door spread, bottom time and headrope depth. A target of 10 min tow time was set for the survey although trawl times were reduced on transects with large catches, and total catches were standardized to the 10-minute tow time.

Species diversity varied between sites and depths. Overall 19 species of fish were captured in the survey however 11 species were caught in five or fewer trawls. Alewife, Rainbow Smelt, and Round Goby were the most commonly encountered species occurring in 55, 54 and 40% of the trawls respectively. The ten most common species are listed in Table 1.10.2. Frequency of occurrence (the proportion of trawls a species is observed in) however is highly influenced by species and depth (Fig. 1.10.2). Alewife were captured in 100% of the trawls conducted in depths >60 m. Similarly, Deepwater Sculpin were captured in depths <60 m but captured in all tows >140 m. Rainbow Smelt occur more frequently in shallow depths and Round Goby and Slimy Sculpin occupying intermediate depths but with a more patchy distribution (i.e. not captured in all tows in a depth bin).

Overall Alewife dominate the catches making up 95% of the catch (by numbers, 93% by weight, Table 1.10.3). Deepwater Sculpin, a species not captured throughout most of the time series except in recent years, was the second most abundant species in the survey, although, the expansion of the survey throughout the lake has primarily focused on adding deep sites and large, shallower areas such as the Bay of Quinte have not been sampled in this survey.

TABLE 1.10.2. Ten most common species caught during the 2017 spring bottom trawl survey.

Species	Number of trawl sites	Percentage of sites
Alewife	112	55%
Rainbow Smelt	110	54%
Round Goby	81	40%
Deepwater Sculpin	73	36%
Slimy Sculpin	35	17%
Yellow Perch	30	15%
Lake Trout	23	11%
Threespine Stickleback	19	9%
Lake Whitefish	4	2%
Spottail Shiner	4	2%

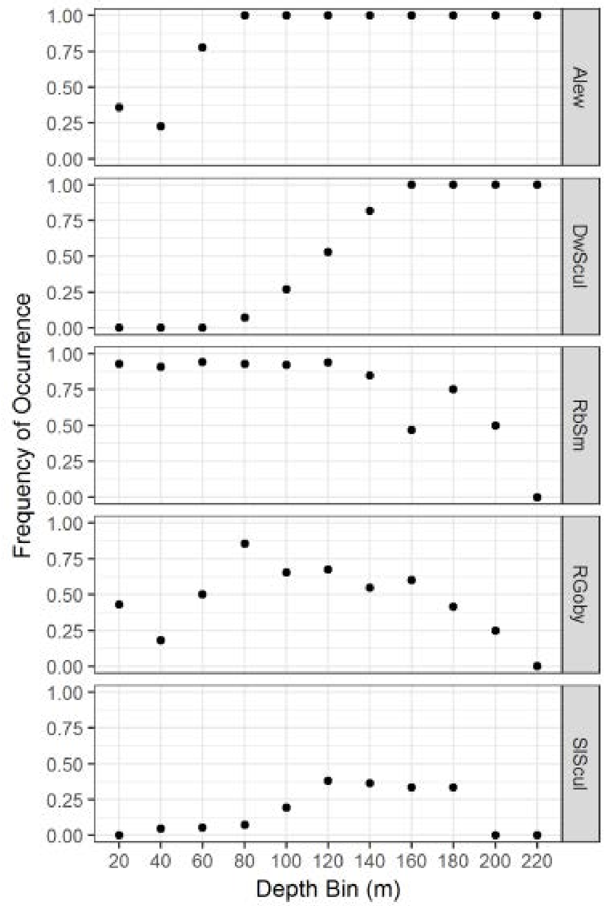

FIG. 1.10.2. Frequency of occurrence by depth for Alewife (Alew), Deepwater Sculpin (DwScul), Rainbow Smelt (RbSm), Round Goby (RGoby), and Slimy Sculpin (SlScul).

TABLE 1.10.3. Total catch and weight of the ten most abundant species caught during the 2017 spring bottom trawl survey.

Species	Total number caught	Total weight (kg) caught
Alewife	671,868	8,176
Deepwater Sculpin	13,273	264
Round Goby	12,757	199
Rainbow Smelt	6,513	50
Yellow Perch	792	13
Slimy Sculpin	587	22
Trout-perch	203	3.0
Spottail Shiner	189	1.8
Threespine Stickleback	87	0.2
Lake Trout	62	14

1.11 Lake Ontario Fall Benthic Prey Fish Trawling

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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 Assessment 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 - 150 m. 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 MNRF and New York Department of Environmental Conservation (NYSDEC). This section will emphasize lake wide results and species specific trends are reported in the Status of Stocks section of this report (Section 7.6).

The 2017 survey consisted of 137 trawls conducted from September 25 through October 12 throughout the entire lake (Fig. 1.11.1). The survey generally samples depths in proportion to the lake area however there are differences in how those samples are distributed between jurisdictions. Shallow tows (<40 m) in Ontario waters are largely confined to the Kingston Basin and were not conducted in 2017. Efforts continue to find suitable trawl locations along the north shore portion of the main lake to improve the spatial coverage of this survey.

All vessels used a similar trawl (3/4 Yankee Standard, See Table 1.3.1 for specifications) however doors varied between

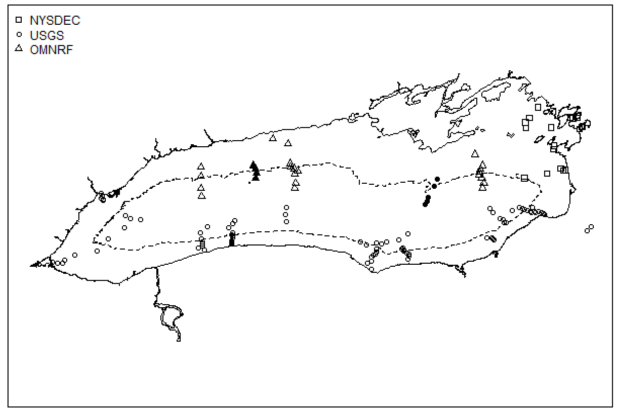


Fig. 1.11.1. Geographic distribution of trawl sites conducted by MNRF, USGS and NYSDEC. Filled shapes indicate new survey sites in 2017.

vessels. Depth loggers and wing sensors were used on all trawls to provide estimates of true bottom time and net opening in order to standardize catches between vessels.

Overall 25 fish species were captured in the survey however 13 species were encountered in five or fewer trawls. The sites with the greatest species diversity (max. = 12 species) were all near shore areas (bottom depth < 20 m) (Fig. 1.11.2). Alewife was the most common species encountered in catches (82% of trawls) followed by Rainbow Smelt (55%), Round Goby (55%), Deepwater Sculpin (47%) and Slimy Sculpin (35%) (Table 1.11.1). Deepwater Sculpin, a species not detected in Lake Ontario for much of the current assessment era, was the most abundant species captured (by number of fish) followed by Round Goby, Alewife, Rainbow Smelt and Trout-perch (Table 1.11.2). The survey however does conduct more tows in deep water than shallow waters and avoids rocky areas that especially Round Goby are thought to inhabit at higher density.

While not caught in as great of numbers compared to spring trawling (Section 1.10), Alewife are caught in a greater proportion of the nets and across a broader range of depths (Fig. 1.11.3). The distribution across a wider depth range is in part explained by a strong relationship

TABLE 1.11.1. The ten most common species captured in the fall trawl survey.

Species	Number of Trawl Sites	Percentage of Sites
Alewife	113	82%
Rainbow Smelt	76	55%
Round Goby	76	55%
Deepwater Sculpin	65	47%
Slimy Sculpin	48	35%
Lake Trout	18	13%
Yellow Perch	18	13%
White Perch	9	7%
White Sucker	8	6%
Carp	7	5%

TABLE 1.11.2. The ten most abundant species captured in the fall trawl survey.

Species	Total number Caught	Total weight (kg) caught
Deepwater sculpin	15,081	373
Round goby	10,271	76
Alewife	6,863	148
Rainbow smelt	1,913	14
Trout-perch	1,505	13
Slimy sculpin	1,182	14
White perch	960	81
Yellow perch	566	36
Threespine stickleback	255	0.4
White sucker	157	78

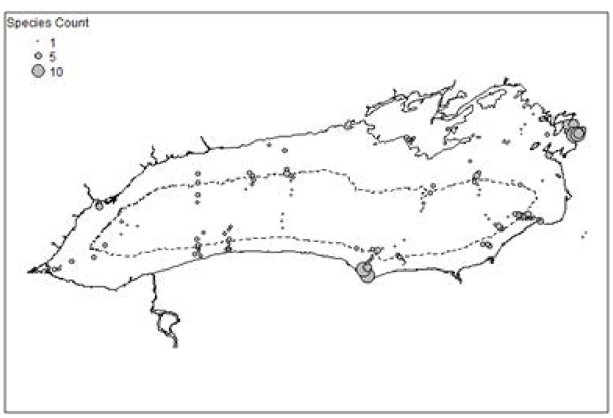


FIG. 1.11.2. Species diversity per trawl site. Points are scaled to number of species caught ranging from 1 to 12 species at the most diverse site.

between size and depth (Fig. 1.11.4, left panel) with small fish, including young-of-the-year, occurring in shallower depths (< 50 m). Deepwater Sculpin also exhibit a strong relationship with depth where larger fish occur at greater depths (Fig. 1.11.4, right panel).

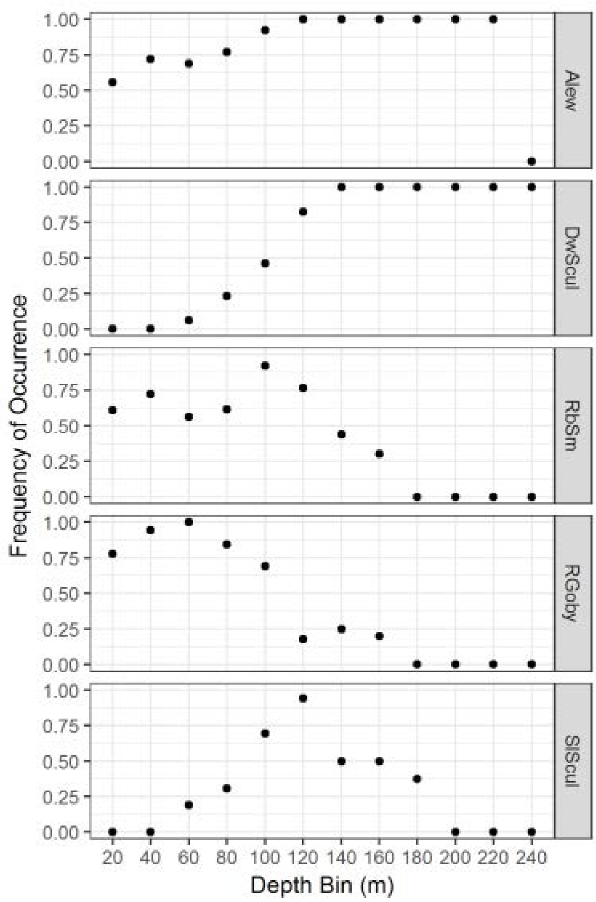


FIG. 1.11.3. Frequency of occurrence by depth for Alewife (Alew), Deepwater Sculpin (DwScul), Rainbow Smelt (RbSm), Round Goby (RGoby), and Slimy Sculpin (SlScul).

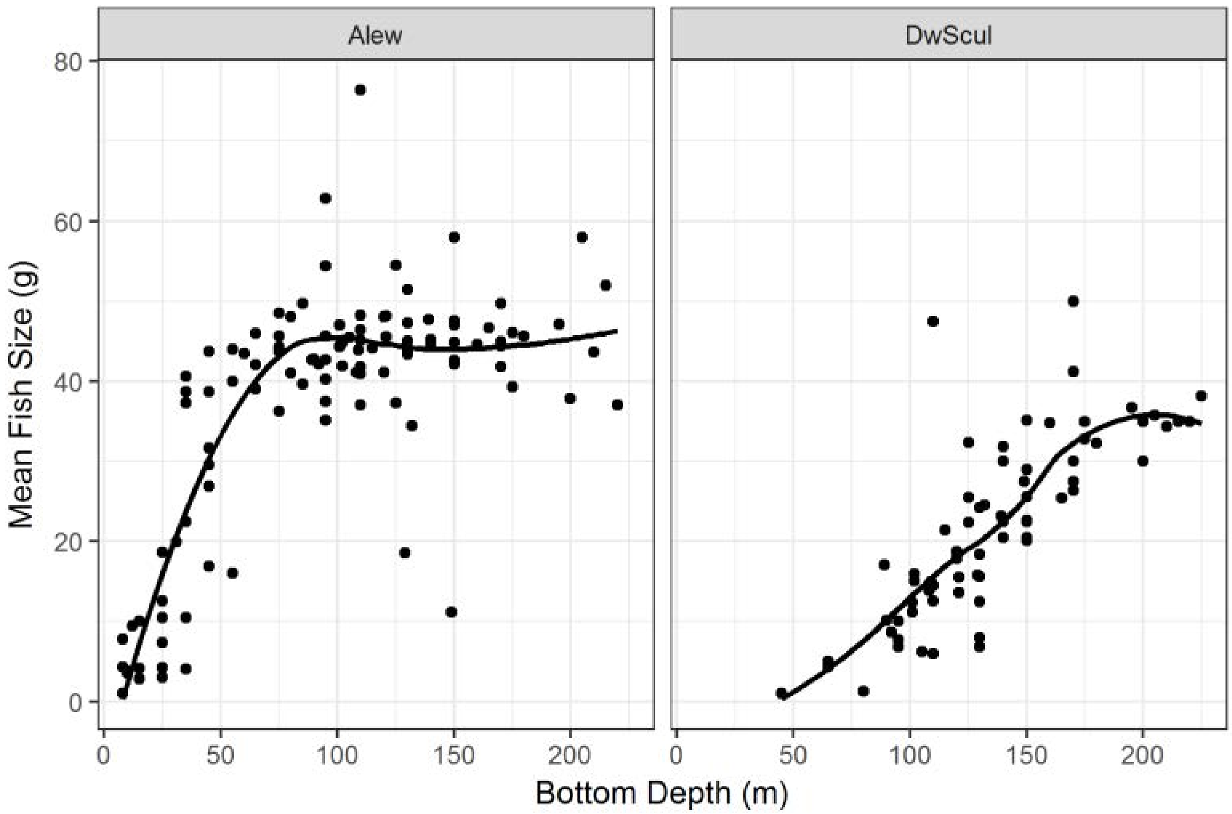


FIG. 1.11.4. Mean individual weight of Alewife (Alew) and Deepwater Sculpin (DwScul) by bottom depth. Trend line is a loess fit.

1.12 Ganaraska River Fish Counter

M.J. Yuille Lake Ontario Management Unit, MNRF

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 purchased new in-river fish counting technology to assess salmon and trout activity in the Ganaraska River fishway, Corbett Dam, Ganaraska River, Port Hope (Fig. 1.12.1). 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.

FIG. 1.12.1. VAKI Riverwatcher fish counter and frame custom designed for the Ganaraska Fishway.

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 (Fig. 1.12.2). The Riverwatcher was installed on March 28th, 2017 and continued to count fish through to November 8th, 2017. In this time, a total of 20,697 fish were observed moving upstream through the Ganaraska fishway (Fig. 1.12.3). This number is a conservative estimate. During periods of heavy rainfall river flows increased, making the water cloudy. As the water became less clear, the light from the infrared counting sensors could not penetrate through the water, thus fish could not be counted. During these periods of high flow and turbid water, we did not have the capacity to count fish as they moved through the fishway. Additionally, there were occasions throughout the monitoring period where the volume of fish moving through the fish counter exceeded the system's ability to count them individually. Calibration of the system using manual hand counts was initiated in 2017 and will be the focus of the 2018 season, to provide estimates of fish missed during these periods of high turbidity and

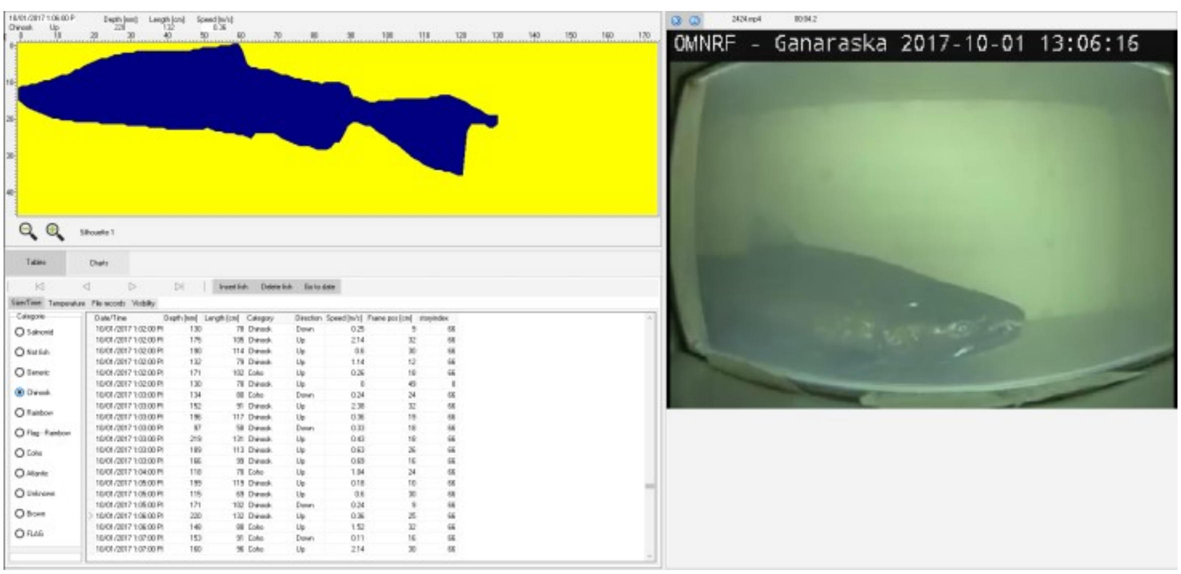


FIG. 1.12.2. Silhouette and video image collected by the Riverwatcher fish counter, which automatically counts and lengths each fish as well as provides LOMU staff the opportunity to identify the fish species.

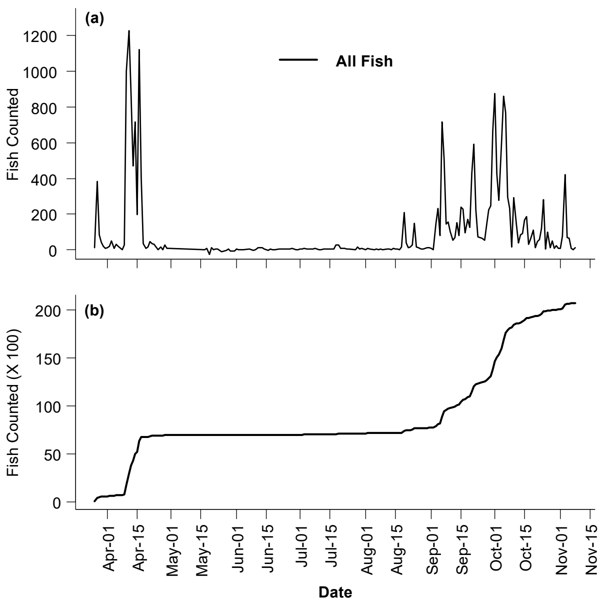


FIG. 1.12.3. (a) Daily and (b) cumulative observed fish counts at the Ganaraska River fishway at Port Hope, Ontario from March 28th to November 8th, 2017.

high fish volume.

April 11th, 2017 marked the most active day on the fishway with a total of 1,228 Rainbow Trout observed migrating upstream through the Riverwatcher. In the fall, October 1st, 2017 recorded the most fish migrating upstream through the Riverwatcher with 877 salmon and trout (Figs. 1.12.3 and 1.12.4). Throughout the monitoring period, data on Rainbow Trout, Chinook Salmon, Coho Salmon and Brown Trout were collected. The following paragraphs provide species specific observations.

Rainbow Trout

A total of 8,897 Rainbow Trout were identified migrating upstream through the Ganaraska Fishway from March 26th to November 8th, 2017. The spring Rainbow Trout run constitutes 78% of the total number of Rainbow Trout counted in 2017. For more information on the spring Rainbow Trout run, see Section 1.1. 2017 marks the first year that the fishway has been monitored throughout the spring summer and fall seasons. A total of 1,945 Rainbow Trout migrated upstream through the Ganaraska Fishway after the spring run (Fig. 1.12.5). The majority of Rainbow Trout using the fishway in the fall were observed after both Chinook and Coho Salmon runs had subsided (Fig. 1.12.4).

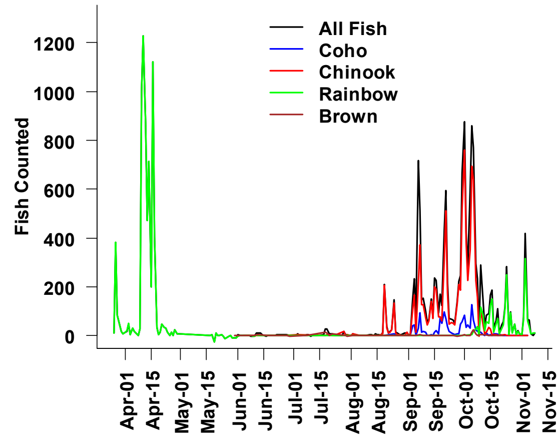


FIG. 1.12.4. Daily counts of each species of salmon and trout observed migrating through the Ganaraska River fishway at Port Hope, Ontario from March 28th to November 8th, 2017.

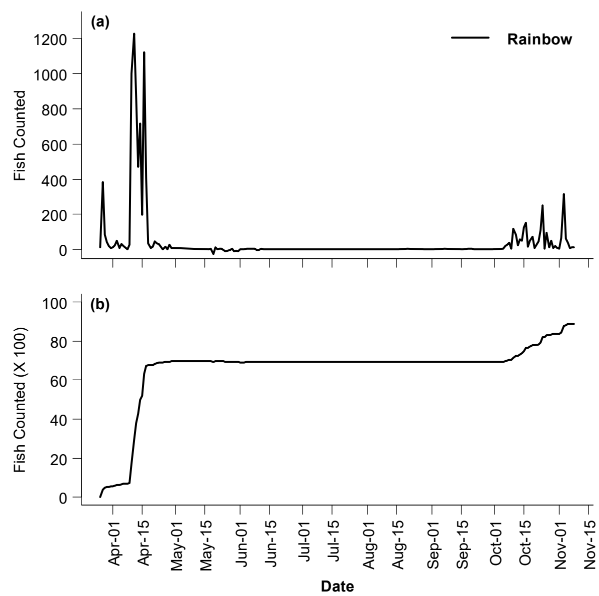


FIG. 1.12.5. (a) Daily and (b) cumulative observed counts of **Rainbow Trout** at the Ganaraska River fishway at Port Hope, Ontario from March 28th to November 8th, 2017.

Chinook Salmon

A total of 8,646 Chinook Salmon were identified migrating upstream through the Riverwatcher in 2017. The first Chinook Salmon was observed June 4th, 2017, however 92% of the run occurred between September 1st to October 10th, 2017 (Fig. 1.12.6). Staff sampled a total of 475 Chinook Salmon from October 2nd to October 18th, 2017. From the total, 60 fish were sampled in detail and the ages of these Chinook Salmon were interpreted from otoliths. Using this information, an age-length-key was created to assign ages to the remaining 415 Chinook Salmon. Through this process it was determined that the 2017 fall Chinook run was comprised of 9% age-1 (all male), 36% age-2 (73% male and 27% female), 51% age 3 (50% male and 50% female) and 4% age-4 (all female; Fig. 1.12.7). In 2017, the average weight for age-2 males and females was 5,326 g and 6,807 g (respectively) and the average weight for age-3 males and females was 7,153 g and 7,865 g (respectively).

Coho Salmon

The first Coho Salmon observed at the Ganaraska Fishway in 2017 was on August 19th. From that time, 1,325 Coho Salmon were identified moving upstream from the Corbett Dam (Fig. 1.12.8). The last Coho Salmon observed moving through Corbett Dam was on November 4th, 2017. There were three pulses of Coho Salmon, occurring over a few days in early September, mid-September and early October (Fig. 1.12.8).

Brown Trout

The first Brown Trout observed at the Ganaraska Fishway in 2017 was on May 30th. From that time, 149 Brown Trout were identified moving upstream from the Corbett Dam (Fig. 1.12.9). The last Brown Trout observed moving through Corbett Dam was on October 22nd, 2017. Of the Brown Trout identified passing through the fishway, the majority were observed in mid-July and early October (Fig. 1.12.9).

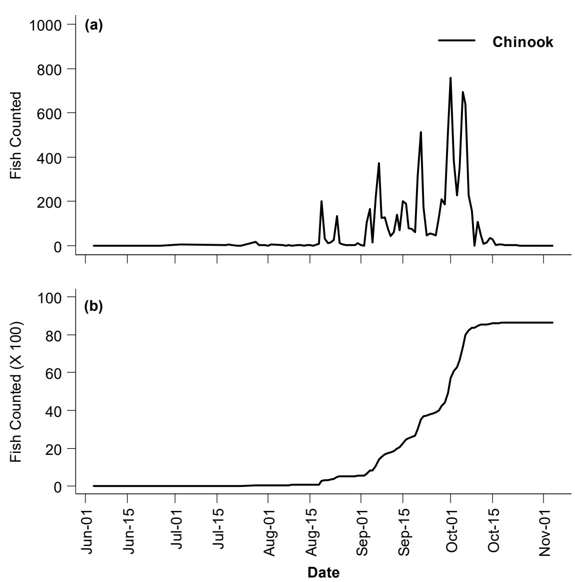


FIG. 1.12.6. (a) Daily and (b) cumulative observed counts of **Chinook Salmon** at the Ganaraska River fishway at Port Hope, Ontario from June 4th to November 4th, 2017.

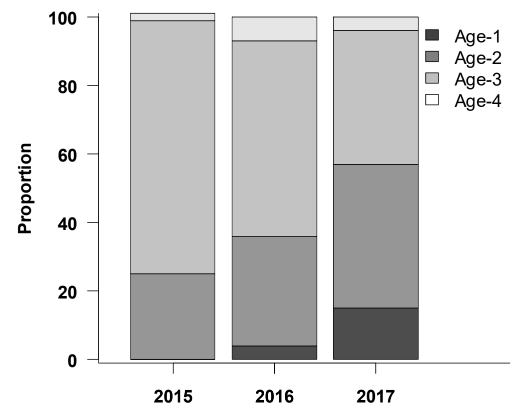


FIG. 1.12.7. Age distribution for **Chinook Salmon** (males and females pooled) sampled during the fall Ganaraska River Chinook Salmon Egg Collection, Ganaraska fishway at Port Hope, Ontario 2015 – 2017.

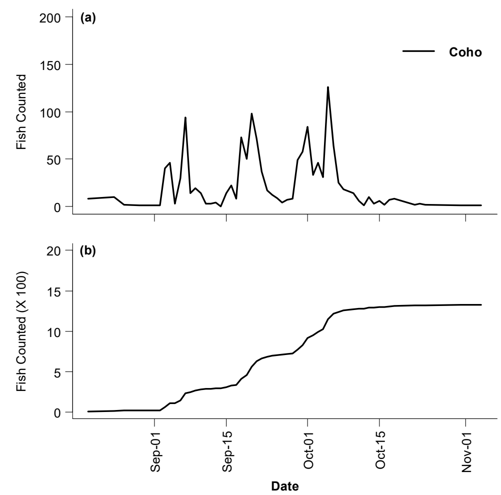


FIG. 1.12.8. (a) Daily and (b) cumulative observed counts of **Coho Salmon** at the Ganaraska River fishway at Port Hope, Ontario from August 19th to November 4th, 2017.

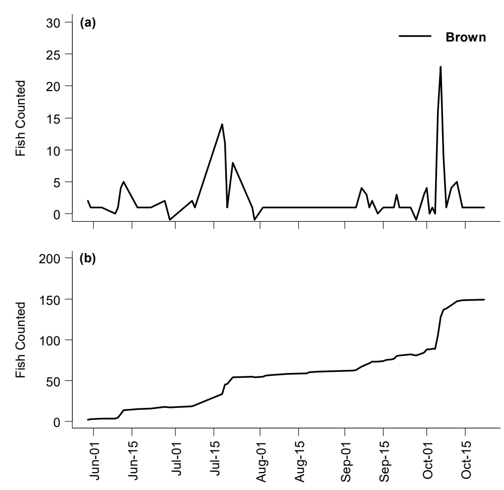


FIG. 1.12.9. (a) Daily and (b) cumulative observed counts of **Brown Trout** at the Ganaraska River fishway at Port Hope, Ontario from March May 30th to October 22nd, 2017.

2. Recreational Fishery

2.1 Fisheries Management Zone 20 Council (FMZ20) / Volunteer Angling Clubs

C. Lake, Lake Ontario Management Unit

Fisheries Management Zone 20 (FMZ20) Council provides recommendations to the Lake Ontario Manager regarding the management of the Lake Ontario recreational fishery. The FMZ 20 Council has spent many hours reviewing information, attending meetings, listening to issues, discussing options and providing advice. Some of the topics the council discussed in 2017 included: Northern Pike harvest management in the Bay of Quinte, adult Walleye harvest assessment in eastern Lake Ontario, and Largemouth and Smallmouth Bass angling seasons.

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 (Section 6.2). Others help with the annual delivery of our stocking program through the operation of community based hatcheries. The Napanee Rod and Gun Club helps MNRF meet its stocking targets by rearing Brown Trout. The Credit River Anglers stock Rainbow Trout and Coho Salmon. The Metro- East Anglers, through their operation of the Ringwood hatchery, help the province meet its Rainbow Trout, Brown Trout, Atlantic Salmon, and Coho Salmon targets. Volunteers at the Ganaraska River-Corbett Dam Fishway assist MNRF staff install, maintain and operate the new fish counter. Numerous anglers / clubs also participate regularly by supplying catch and harvest information in our volunteer angler diary programs.

2.2 Bay of Quinte Open-water Angling Survey

J. A. Hoyle, Lake Ontario Management Unit

The Bay of Quinte open-water recreational angling fishery was monitored from May 6 (Walleye angling “opening-weekend”) until December 10, 2017. The last sampling day was December 3 but volunteer angler diaries (see Section 2.3) indicated that angling continued until December 10. A roving survey design was employed from Trenton to Lake Ontario (“upper gap”; Fig. 2.2.1). Angling effort was measured using on-water fishing boat activity counts. Boat angler interviews provided information on catch/harvest rates and biological characteristics of the harvest. The survey consisted of sampling four days per week (two weekdays and both weekend days). Sampling was stratified by geographic area (18 areas; Fig. 2.2.1), season (five seasons: (1) May 6-7, (2) May 8-Jun 16, (3) Jun 17-Aug 13, (4) Aug 14-Oct 15 and (5) Oct 16-Dec 10, and day-type (weekdays and weekend days). A total of 4,281 anglers in 1,919 boats were interviewed by field crews during the survey (Table 2.2.1). Thirty-three percent of anglers interviewed were local, 59% were from Ontario (outside the local area), 4% were from elsewhere in Canada, and 4% were from the US. Total angling effort was estimated to be 279,005 angler hours for all anglers. Anglers caught 24 different species (Table 2.2.2). Eighty percent of anglers indicated that they were targeting Walleye, 23% were targeting Largemouth Bass, 7% were targeting Yellow Perch, and 5% were targeting Northern Pike. Fishing effort was 219,731 hours for anglers targeting Walleye, 64,649 hours for anglers targeting Largemouth Bass, 18,616 for anglers targeting Yellow Perch, and 14,627 for anglers targeting Northern Pike (Table 2.2.2 and

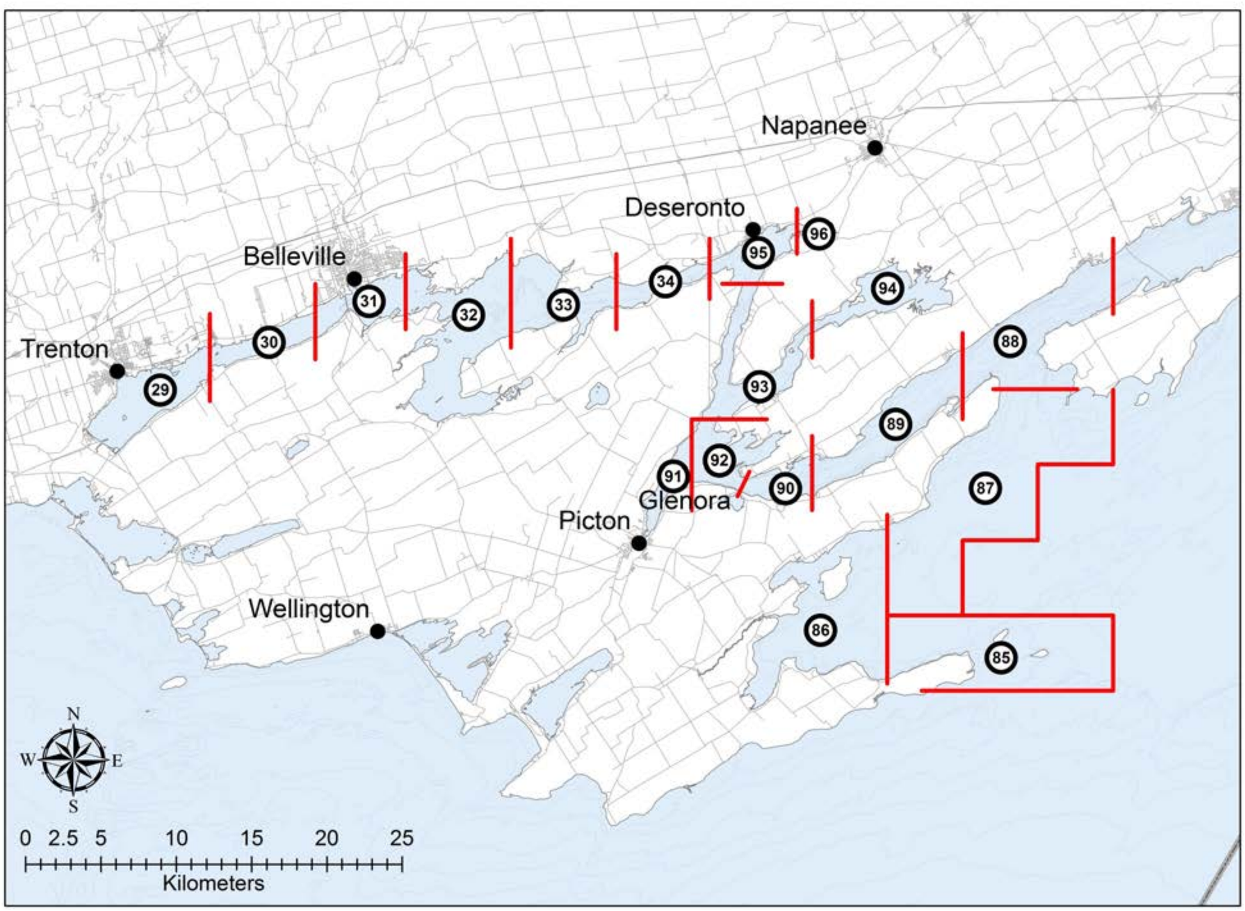


FIG. 2.2.1. Map of the Bay of Quinte showing angling survey areas.

TABLE 2.2.1. Total estimated angling effort (angler hours), number of boats checked and anglers interviewed, number of anglers per boat, and number of rods per angler for the open-water recreational fishery on the Bay of Quinte, 2017. Note that the use of 2-lines is only permitted east of Glenora (survey areas 90, 89, 88, 87, 86, 85; Fig. 2.2.1).

Total angling effort (hours)	279,006
Number of boats checked	1,919
Number of anglers interviewed	4,281
Anglers per boat	2.23
Rods per angler	1.10

Table 2.2.3). Numbers of Walleye caught and harvested were 102,351 and 52,651 respectively. Numbers of Walleye caught and harvested per hour by anglers targeting Walleye were 0.461 and 0.239, respectively. Numbers of Largemouth Bass caught and harvested were 36,997 and 8,580 respectively. Numbers of Largemouth Bass caught and harvested per hour by anglers targeting Largemouth Bass were 0.531 and 0.129 respectively. Anglers also caught 261,747 Yellow Perch, 5,027 Northern Pike and 28,160 White Perch (Table 2.2.2).

TABLE 2.2.2. Species-specific statistics for the open-water recreational fishery on the Bay of Quinte, 2017. Statistics shown are: targeted angling effort (angler hours), proportion of anglers targeting each species, catch and harvest by all anglers, proportion of catch caught by anglers targeting that species, proportion of fish kept, and the number of fish caught per angler hour (CUE) by anglers targeting that species.

	Angler effort		Catch				
Species	Hours	Prop targeted	Catch	Prop targeted	Harvest	Prop kept	CUE
Longnose Gar	663	0.002	274	0.792	18	0.07	0.327
Bowfin	-		32	-	-	-	
Alewife	-		172	-	89	0.52	
Gizzard Shad	-		49	-	-	-	
Chinook Salmon	224	0.001	42	0.879	37	0.88	0.166
Brown Trout	224	0.001	6	1.000	6	1.00	0.028
Lake Trout	484	0.002	55	0.901	49	0.90	0.101
Lake Whitefish	-		27	-	4	0.16	
Northern Pike	14,627	0.053	5,027	0.420	506	0.10	0.144
Common Carp	-		46	-	-	-	
Catfish	352	0.001	1,312	0.980	367	0.28	3.655
Brown Bullhead	-		279	-	108	0.39	
Channel Catfish	361	0.001	657	-	133	0.20	-
White Perch	2,767	0.010	28,160	0.161	3,464	0.12	1.638
White Bass	-		1,621	-	25	0.02	
Sunfish	627	0.002	7,379	-	1,843	0.25	3.062
Rock Bass	385	0.001	3,838	0.104	50	0.01	1.042
Pumpkinseed	388	0.001	3,568	0.078	179	0.05	0.718
Bluegill	168	0.001	3,151	0.042	23	0.01	0.781
Smallmouth Bass	5,532	0.020	1,582	0.508	103	0.07	0.145
Largemouth Bass	64,649	0.236	36,997	0.927	8,580	0.23	0.531
Black Crappie	184	0.001	188	0.088	50	0.27	0.090
Yellow Perch	18,616	0.068	261,747	0.149	16,497	0.06	2.100
Walleye	219,731	0.802	102,351	0.989	52,651	0.51	0.461
Round Goby	-		306	-	14	0.05	
Freshwater Drum	2,901	0.011	12,053	0.084	491	0.04	0.348

TABLE 2.2.3. Angling statistics for Walleye and Largemouth Bass by season surveyed during the open-water recreational fishery on the Bay of Quinte, 2017. "Targeted" statistics refer to anglers targeting the indicated species (Walleye or Largemouth Bass).

	Season					
Angling Statistic	May 6-7	May 8-Jun 16	Jun 17-Aug 13	Aug 14-Oct 15	Oct 16-Dec 10	Total
Walleye:						
Catch by All Anglers	1,783	53,627	34,833	7,857	4,251	102,351
Catch by Targeted Anglers	1,783	53,540	33,858	7,851	4,178	101,211
Harvest by All Anglers	1,276	24,401	19,781	4,657	2,536	52,651
Harvest by Targeted Anglers	1,276	24,314	19,715	4,657	2,497	52,460
Targeted Effort (angler hours)	12,477	77,462	55,463	39,333	34,995	219,731
Targeted Effort (rod hours)	12,477	77,497	55,463	43,292	48,247	236,976
All Effort (angler hours)	12,629	78,281	91,901	55,729	40,466	279,006
Targeted CUE	0.143	0.691	0.610	0.200	0.119	0.461
All Anglers CUE	0.141	0.685	0.379	0.141	0.105	0.367
Targeted HUE	0.143	0.691	0.610	0.200	0.119	0.239
All Anglers HUE	0.101	0.312	0.215	0.084	0.063	0.189
Largemouth Bass:						
Catch by All Anglers	92	769	27,270	6,250	2,615	36,997
Catch by Targeted Anglers	-	75	25,601	6,019	2,615	34,311
Harvest by All Anglers	-	-	5,387	1,386	1,806	8,580
Harvest by Targeted Anglers	-	-	5,126	1,386	1,806	8,319
Targeted Effort (angler hours)	-	374	42,577	16,508	5,189	64,649
Targeted Effort (rod hours)	-	374	42,577	16,694	4,571	64,216
All Effort (angler hours)	12,629	78,281	91,901	55,729	40,466	279,006
Targeted CUE		0.200	0.601	0.365	0.504	0.531
All Anglers CUE	0.007	0.010	0.297	0.112	0.065	0.133
Targeted HUE		0.200	0.601	0.365	0.504	0.129
All Anglers HUE	0.000	0.000	0.059	0.025	0.045	0.031

The seasonal and regional patterns of Walleye and Largemouth Bass angling effort are depicted in Fig. 2.2.2 and Fig. 2.2.3. Targeted Walleye angling is highest in May and June. Most Walleye angling effort occurs in the upper and middle regions of the Bay of Quinte but a spike in effort also occurs in the lower Bay from mid-October through December (Fig. 2.2.2). Some Walleye angling effort also occurs in August and September in Lake Ontario (area 85). Targeted Largemouth Bass angling is highest from June through August in the upper Bay of Quinte (Fig. 2.2.3).

The size distributions of Walleye, Largemouth Bass and Yellow perch harvested by anglers and sampled by field crews are shown in Fig. 2.2.4. The size distribution (three categories: less than 19 inches total length, 19 to 25 inches and greater than 25 inches) reported to be released by anglers is shown in Fig. 2.2.3. The age distributions of Walleye and Largemouth Bass sampled are shown in Fig. 2.2.6. Age-2 and 3 year -old Walleye (2015 and 2014 year-classes respectively) dominated the harvest.

Eleven percent of anglers interviewed after mid-October reported that they were participants in the Bay of Quinte Volunteer Angler Diary Program (see Section 2.3).

Open-water angling fishery trend statistics from 1988-2017 are shown graphically in Fig. 2.2.7 and from 1957-2017 in Table 2.2.4.

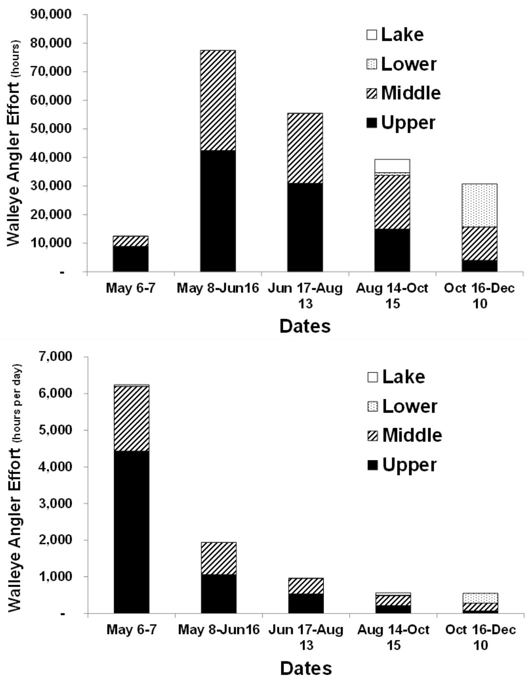


FIG. 2.2.2. Targeted Walleye angling effort (hours, upper panel; hours per day, lower panel) by season and region surveyed in the open-water recreational fishery on the Bay of Quinte, 2017 (regions include the survey areas indicated in Fig. 2.2.1 as follows: Upper = 29, 30, 31, 32, 33, 34, 95, 96; Middle = 91, 92, 93, 94; Lower = 88, 89, 90; Lake = 85, 86, 87; note that the Lake areas were only sampled in season 4).

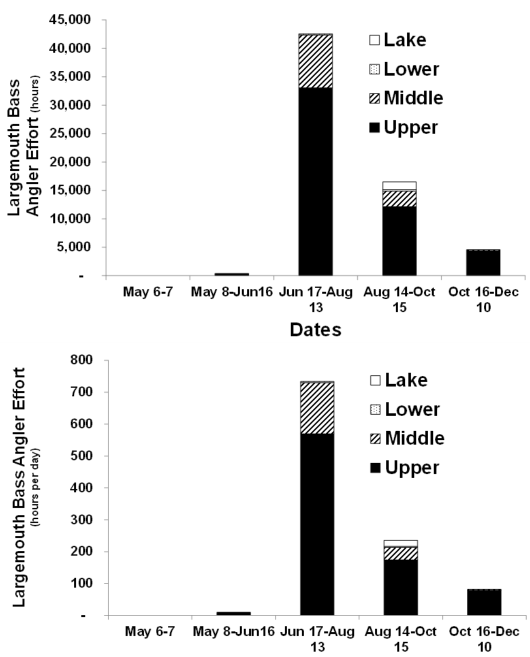


FIG. 2.2.3. Targeted Largemouth Bass angling effort (hours, upper panel; hours per day, lower panel) by season and region surveyed in the open-water recreational fishery on the Bay of Quinte, 2017 (regions include the survey areas indicated in Fig. 2.2.1 as follows: Upper = 29, 30, 31, 32, 33, 34, 95, 96; Middle = 91, 92, 93, 94; Lower = 88, 89, 90; Lake = 85, 86, 87; note that the Lake areas were only sampled in season 4).

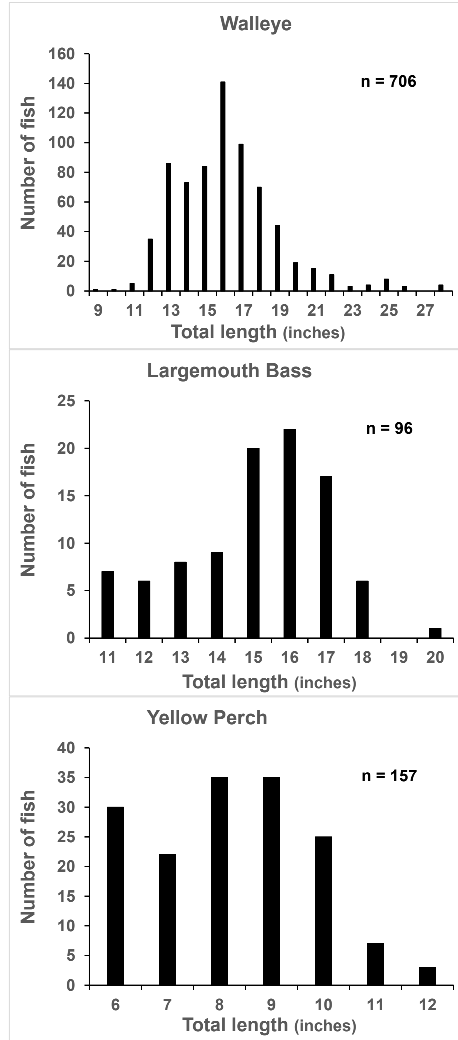


FIG. 2.2.4. Size distributions of Walleye (n=706), Largemouth Bass (n=96) and Yellow Perch (n=157) sampled during the open-water recreational fishery on the Bay of Quinte, 2017.

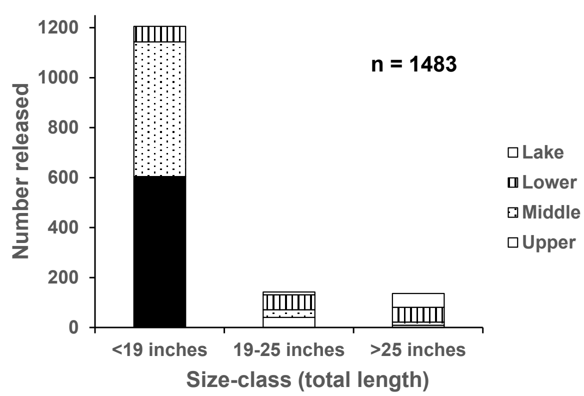
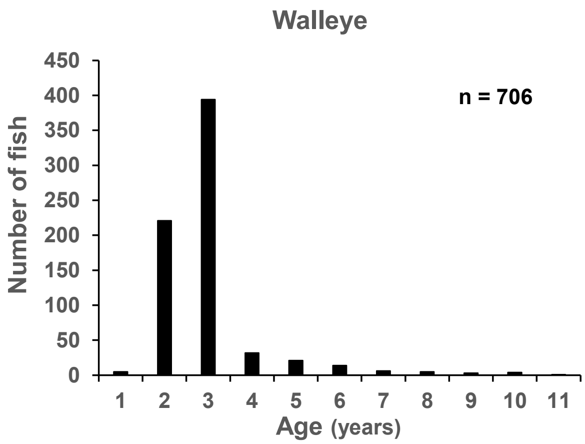


FIG. 2.2.5. Size distribution of Walleye (n=1,483; three size categories: less than 19 inches total length, 19 to 25 inches and greater than 25 inches) reported top be released by anglers during the open-water recreational fishery on the Bay of Quinte, 2017. Also depicted is the survey areas where the Walleye were sampled as follows: Upper is survey areas 29, 30, 31, 32, 33, 34, 95, 96; Middle is areas 93, 94, 92, 91; Lower is areas 90, 89, 88; and Lake is areas 86, 85 as illustrated in Fig 2.1.1.



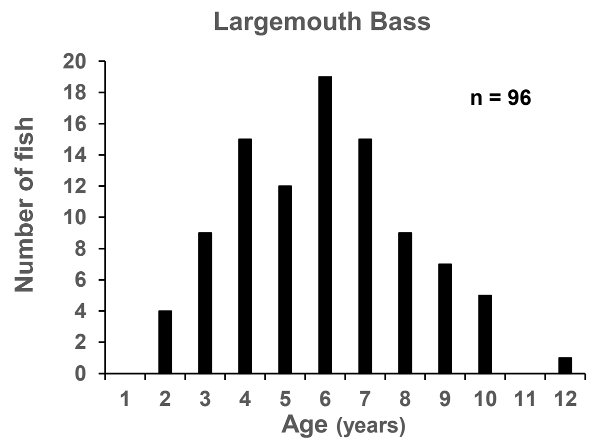


FIG. 2.2.6. Age distributions of Walleye and Largemouth Bass sampled during the open-water recreational fishery on the Bay of Quinte, 2017.

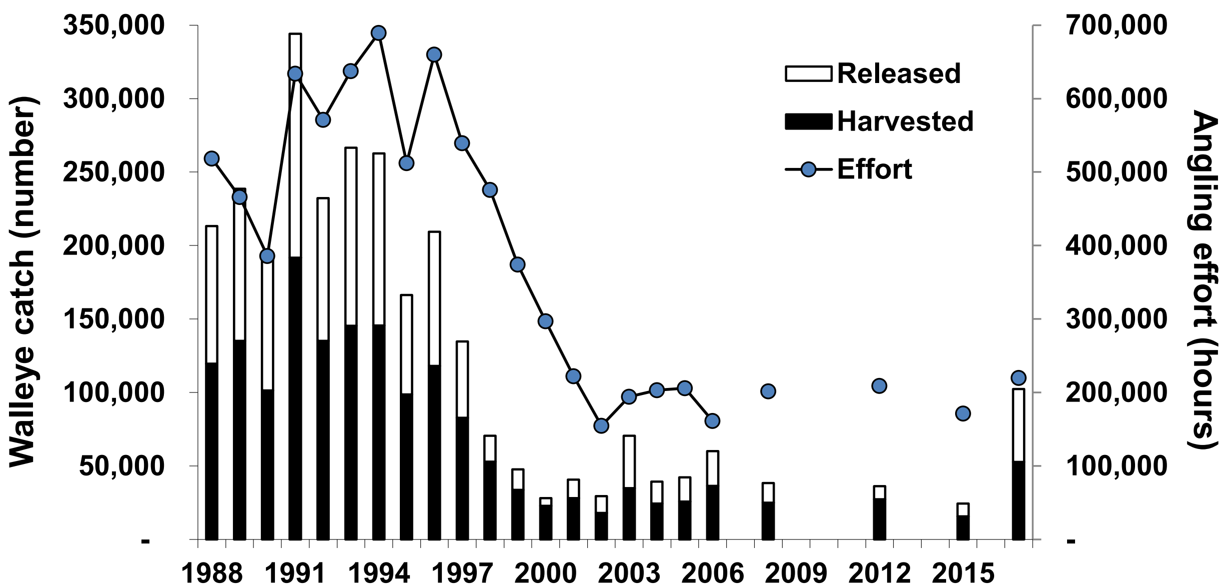


FIG. 2.2.7.Trends in Walleye angling effort and catch (released and harvested), 1988-2017 for the open-water recreational fishery on the Bay of Quinte.

TABLE 2.2.4. Bay of Quinte open-water angling fishery statistics, 1957-2017, including angling effort (angler hours), both for all anglers and targeted walleye anglers, walleye catch and harvest rates (number of fish per hour), walleye catch and harvest (number of fish), and the mean weight (kg) of harvested walleye.

	All anglers	Walleye Anglers					
	Total effort	Effort	Catch rate	Harvest rate	Catch	Harvest	Mean weight (kg)
1957		128,040		0.299		38,318	0.638
1958		105,219		0.155		16,274	0.818
1959		67,000		0.254		17,037	0.963
1960						10,467	0.939
1961						22,117	0.596
1962						9,767	0.795
1963						2,466	1.422
1976		64,096		0.064		4,089	
1979		114,637		0.132		15,133	0.631
1980		321,388		0.598		192,305	0.464
1981		319,401		0.508		162,140	0.741
1982		382,306		0.236		90,182	1.030
1984		451,581		0.227		102,379	0.912
1985		442,717		0.263		116,415	0.859
1986		554,213		0.232		128,341	0.933
1987		589,163		0.172		101,092	0.756
1988		518,404	0.411	0.231	213,144	119,608	0.785
1989		466,008	0.512	0.290	238,549	135,151	0.760
1990		385,656	0.497	0.263	191,496	101,422	0.710
1991		634,101	0.543	0.302	344,156	191,785	0.789
1992		571,079	0.407	0.236	232,179	135,040	0.952
1993	644,477	637,401	0.417	0.227	265,551	144,476	0.912
1994	693,731	689,543	0.378	0.209	260,805	144,449	0.763
1995	519,276	512,054	0.320	0.189	163,875	96,631	0.710
1996	665,436	660,005	0.317	0.179	209,303	117,999	0.781
1997	544,476	539,276	0.250	0.154	134,672	82,821	0.747
1998	481,553	475,678	0.148	0.111	70,489	52,810	0.670
1999	379,012	374,128	0.127	0.090	47,562	33,575	0.958
2000	309,259	296,841	0.094	0.077	28,004	22,791	0.939
2001	247,537	222,052	0.182	0.126	40,512	28,037	0.916
2002	177,092	154,570	0.186	0.113	28,813	17,480	0.915
2003	219,684	194,169	0.344	0.178	66,706	34,543	0.637
2004	241,700	203,082	0.193	0.119	39,155	24,260	0.870
2005	225,385	205,933	0.204	0.125	42,031	25,757	0.693
2006	180,907	161,190	0.372	0.225	59,966	36,329	0.700
2008	209,153	201,669	0.187	0.124	37,710	24,929	1.069
2012	235,937	209,040	0.173	0.130	36,208	27,222	1.012
2015	186,081	171,337	0.142	0.091	24,370	15,632	1.399
2017	279,006	219,731	0.461	0.239	101,211	52,460	0.726

2.3 Bay of Quinte Volunteer Walleye Angler Diary Program

J. A. Hoyle, Lake Ontario Management Unit

A volunteer angler diary program was conducted during late-summer and fall 2017 on the Bay of Quinte and 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 mature Walleye occurs in the eastern Lake Ontario; this component of the fishery was also targeted for volunteer anglers. This was the sixth year of the diary program. Anglers that volunteered to participate were given a personal diary and asked to record information about their daily fishing trips and catch (see Fig. 2.3.1). A total of 23 diaries were returned as of February 2018. We thank all volunteer anglers for participating in the program. A map showing the distribution of volunteer addresses of origin is shown in Fig. 2.3.2.

Objectives of the diary program included:

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

Three of the 23 returned diaries reported zero fishing trips. The number of fishing trips reported in each of the remaining 20 diaries ranged from two to 27 trips. Fishing trips were reported for 81 out of a possible 121 calendar days from Aug 12 to Dec 10, 2017. There were from one to eight volunteer angler boats fishing on each of the 81 days, and a total of 164 trip reports targeted at Walleye; 77 charter boat trips and 87 non-charter boat trips (Table 2.3.1). Of

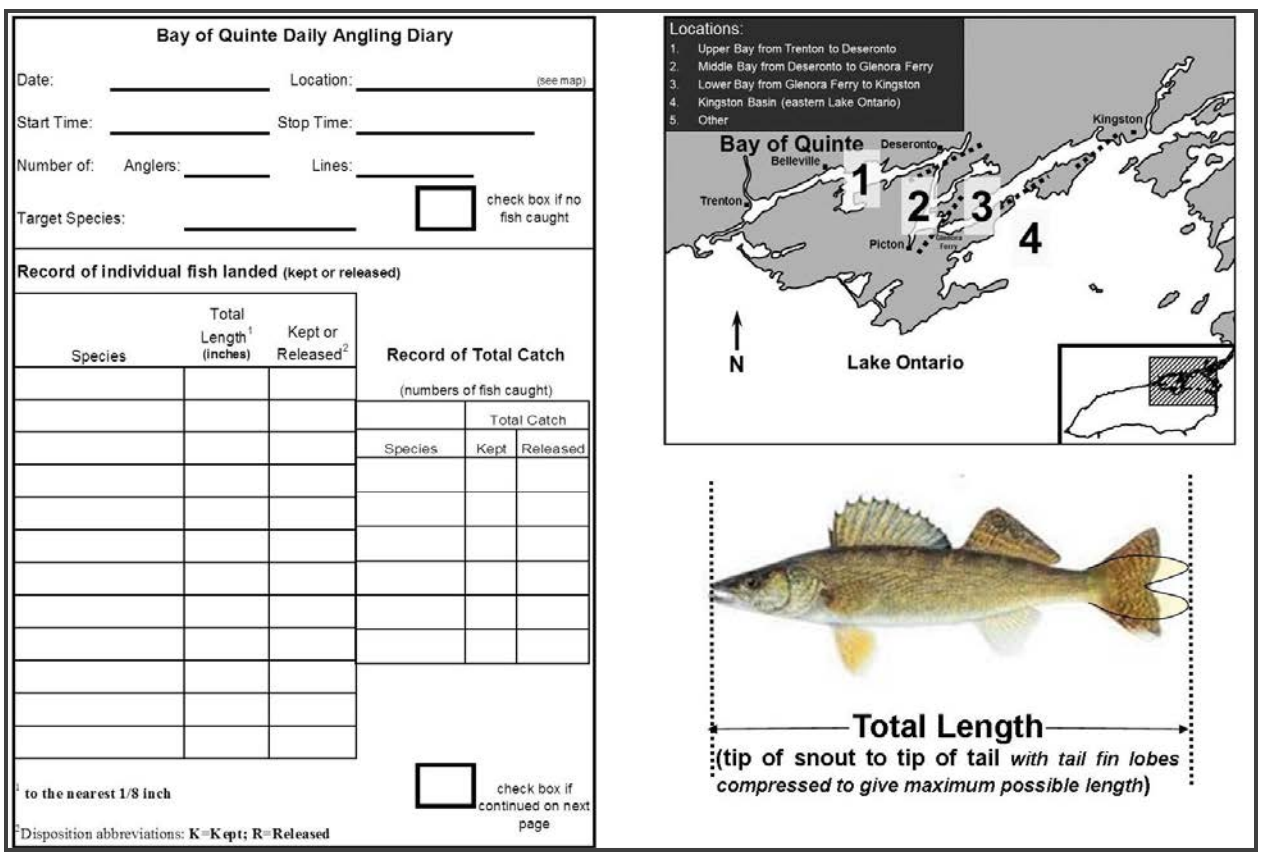


FIG. 2.3.1. Volunteer angler diary used to record information about daily fishing trips and catch.

FIG. 2.3.2. Map showing the distribution of volunteer addresses of origin. Image courtesy of Google Earth.

the 164 trips, 117 (68%) were made on Locations 2 and 3 (middle and lower reaches of the Bay of Quinte), and 54 trips (31%) were made in Location 4 (eastern Lake Ontario; see Fig. 2.3.1). The overall average fishing trip duration was 6.2 hours for charter boats and 6.0 hours for non-charter boats, and the average numbers of anglers per boat trip were 4.0 and 2.0 for charter and non-charter boats, respectively (Table 2.3.1). In Locations 3 and 4, where two lines are permitted, most anglers used two lines (1.8 rods per angler on average).

Fishing Effort

A total of 3,262 angler hours of fishing effort was reported by volunteer anglers (Table 2.3.2). The seasonal pattern of fishing effort is shown in Fig. 2.3.3. Most fishing effort occurred in Location 3 (42%; lower Bay) (Fig. 2.3.4). Location 4 (eastern Lake Ontario) showed increased fishing effort (20% of total effort) compared to previous years.

Catch

Seven species and a total of 703 fish were reported caught by volunteer anglers. The number of Walleye caught was 604; 350 (58%) kept and 254 (42%) released (Table 2.3.3). The next most abundant species caught was Freshwater Drum (58) followed by Northern Pike (9), White Bass (8), and Smallmouth Bass (8).

Fishing Success

The overall fishing success for Walleye in

Table 2.3.1. Reported total number of boat trips, average trip duration, and average number of anglers per trip for charter and non-charter Walleye fishing trips during fall 2012-2017 on the Bay of Quinte.

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	5.5	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	1.9
2017	Charter	77	6.2	4.0
	Non-charter	87	6.0	2.0

Table 2.3.2. Reported total number of diaries (with at least one reported fishing trip), boat trips and effort, total angler effort, total number of Walleye caught, harvested, and released, average number of Walleye caught per boat fishing trip, average number of Walleye caught per boat hour, average number of Walleye caught per angler hour, and the "skunk" rate (percentage of trips with no Walleye catch) for Walleye fishing trips during fall 2012-2017 on the Bay of Quinte.

	Year					
Statistic	2012	2013	2014	2015	2016	2017
Number of diaries	22	19	20	22	11	20
Number of boat trips	258	155	210	235	93	164
Boat effort (hours)	1,694	941	1,375	1,506	498	1,001
Angler effort (hours)	5,915	3,093	5,164	5,266	1,602	3,262
Catch	542	574	682	436	184	604
Harvest	291	307	336	285	112	350
Released	251	267	346	151	72	254
Fish per boat hour	2.1	3.7	3.2	1.9	2.0	3.7
Fish per boat trip	0.305	0.557	0.463	0.307	0.289	0.601
Fish per angler hour	0.102	0.193	0.137	0.138	0.122	0.210
"Skunk rate"	36%	19%	27%	34%	44%	24%

fall 2017 was 3.7 Walleye per boat trip or 0.210 fish per angler hour of fishing (Table 2.3.2). Seventy-six percent of all boat trips reported catching at least one Walleye ("skunk rate" 24%). Seasonal fishing success, for geographic Locations 2, 3 and 4 combined, is shown in Fig. 2.3.5. Success was highest in the second half of August through the first half of October, declined in the second half of October, and was high in the second half of November and early December (by angler hour). Fishing success was high in locations 2 (middle Bay; 4.2 Walleye per boat trip

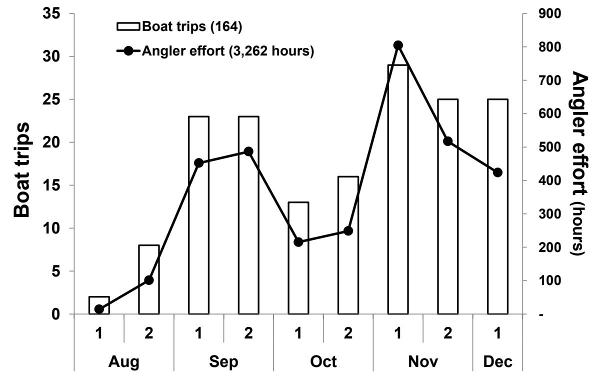


FIG. 2.3.3. Seasonal breakdown (summarized by first and second half of each month from the first half of Aug to the first half of Dec) of fishing effort (boat trips and angler hours) reported by volunteer Walleye anglers during fall 2017 on the Bay of Quinte.

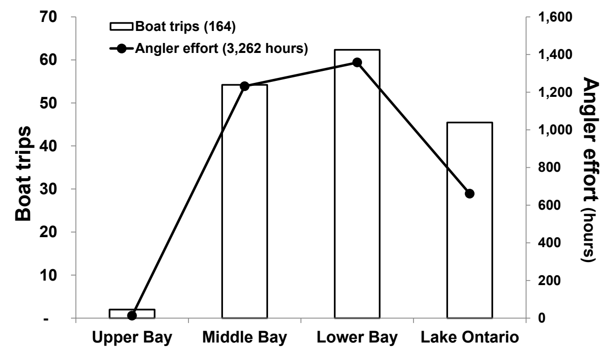


FIG. 2.3.4. Geographic breakdown of fishing effort (boat trips and angler hours) reported by volunteer Walleye anglers during fall 2017 on the Bay of Quinte.

TABLE 2.3.3. Number of fish, by species, reported caught (kept and released) by volunteer anglers during the fall Walleye diary program, 2012 -2017.

	2012		2013		2014		2015		2016		2017	
Species	Kept	Released	Kept	Released	Kept	Released	Kept	Released	Kept	Released	Kept	Released
Longnose Gar	0	0	0	0	0	0	0	0	0	1	0	0
Chinook Salmon	0	1	0	0	0	2	0	0	0	0	0	0
Rainbow Trout	0	0	0	0	0	3	0	0	0	0	0	0
Brown Trout	1	0	0	0	0	1	1	0	0	0	0	0
Lake Trout	0	1	0	0	0	4	3	10	0	1	1	6
Lake Whitefish	0	1	0	0	0	0	0	0	0	0	0	0
Northern Pike	1	47	4	20	2	36	2	14	1	18	1	9
White Perch	0	0	0	12	0	0	1	0	0	11	0	0
White Bass	0	0	0	3	0	7	9	5	0	5	6	8
Morone sp.	1	15	0	0	0	0	0	0	0	0	0	0
Sunfish	0	0	0	0	0	0	0	2	0	0	0	2
Smallmouth Bass	0	0	0	3	1	2	0	1	1	1	0	8
Largemouth Bass	0	0	0	0	0	0	0	0	0	0	0	0
Yellow Perch	4	32	2	6	0	0	1	0	0	0	0	0
Walleye	292	252	307	267	338	350	285	151	112	72	350	254
Freshwater Drum	1	43	0	25	1	53	8	81	0	38	0	58

or 0.234 fish per angler hour) and 3 (lower Bay; 4.8 Walleye per boat trip or 0.231 fish per angler hour).

Length Distribution of Walleye Caught

Ninety-five percent of Walleye caught by volunteer anglers were between 14 and 30 inches in total length (Fig. 2.3.6). Over the six years of the volunteer angler diary program 2,893 Walleye lengths have been reported (Fig. 2.3.7). The proportion of Walleye released was highest for smallest and largest fish and lowest for fish of intermediate size. Only 22% of fish caught that were between 16 and 25 inches were released. In contrast, 64% of fish less than 16 inches or greater than 25 inches were released.

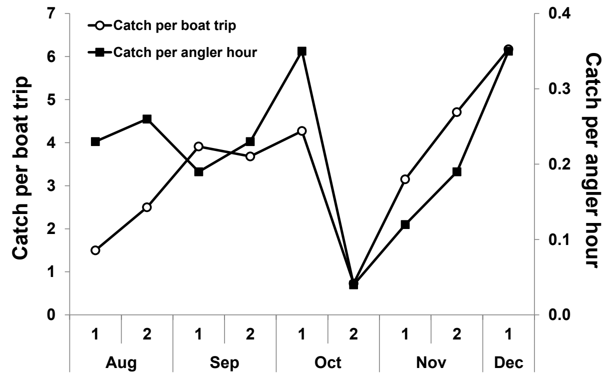


FIG. 2.3.5. Walleye fishing success (catch per boat trip and per angler hour) reported by volunteer Walleye anglers in areas 2, 3 and 4 during fall 2017 on the Bay of Quinte (summarized by first and second half of each month from the first half of Aug to the first half of Dec).

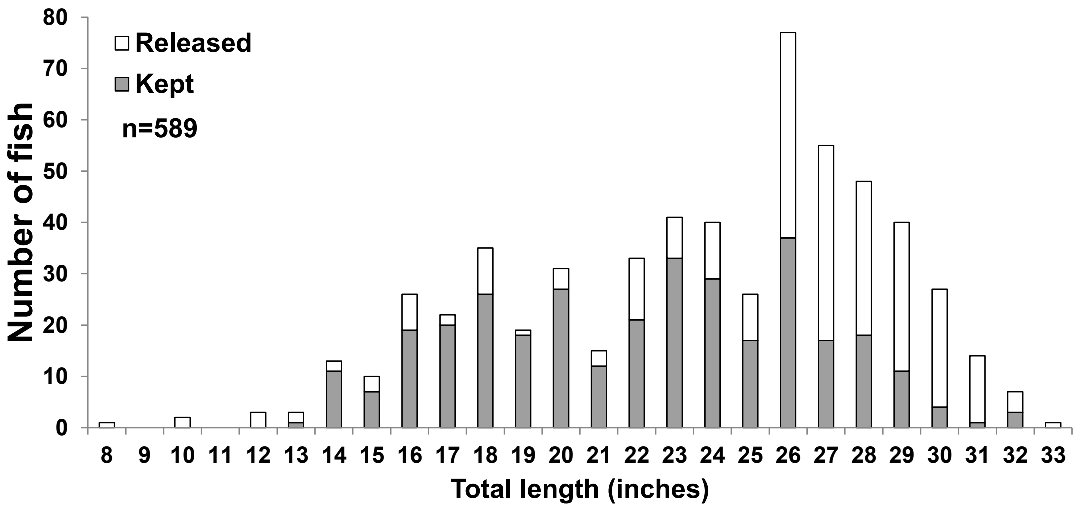


FIG. 2.3.6. Length distribution of 589 Walleye caught (kept and released) by volunteer Walleye anglers during fall 2017 on the Bay of Quinte.

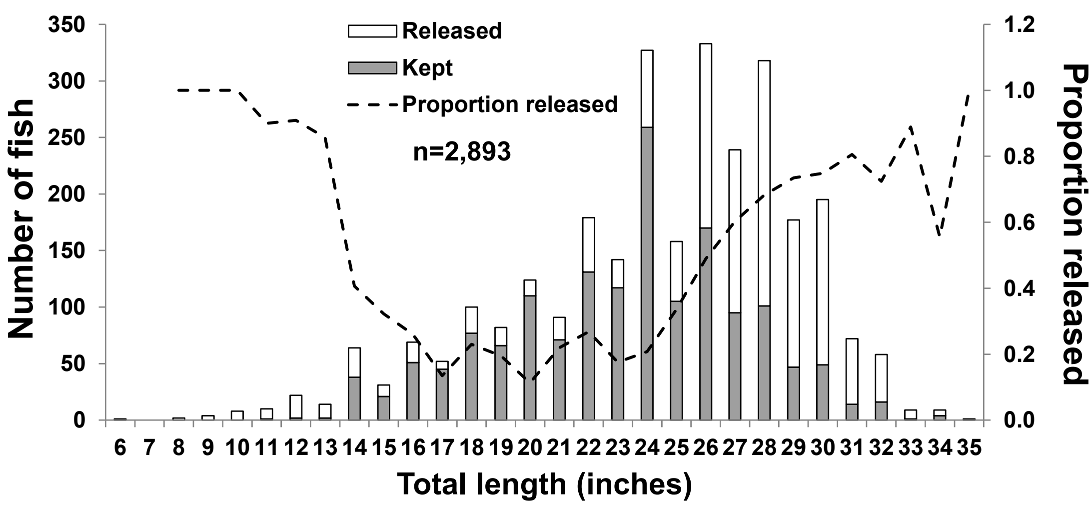


FIG. 2.3.7. Length distribution of 2,304 Walleye caught (kept and released) by volunteer Walleye anglers during fall 2012 to 2017 on the Bay of Quinte. Also shown is the proportion of fish released (dotted line)

2.4 Lake Ontario Chinook Salmon Tournament Sampling

M. J. Yuille, Lake Ontario Management Unit

Since 2010, the Lake Ontario Management Unit has been attending Lake Ontario fishing tournaments to sample Chinook Salmon throughout the summer. On average LOMU visits six tournaments a season and collects biological information on harvested angler caught fish. Initially, LOMU attended the tournaments to increase coded wire tag recovery during the Mass Marking Program (see Section 7.1). The program has continued as it provides insight into the age structure, condition and health of Lake Ontario salmon and trout throughout the summer months. With the exception of years when LOMU conducts the Western Basin Angler Survey (Section 7.1), these tournament sampling events provide the only window for viewing Chinook health and condition throughout the summer.

In 2017, LOMU staff attended six tournaments (Table 2.4.1) and sampled 88 Chinook Salmon. The average total length and weight for a Chinook Salmon sampled in the 2017 tournaments was 824 mm (32") and 7,203 g (15.88 lbs), respectively (Table 2.4.2). The heaviest fish sampled by LOMU in the 2017 tournaments weighed 14,340 g (31.61 lbs).

Chinook Salmon body condition was determined as the estimated weight (g) of a 914 mm (36") total length fish (Fig. 2.4.1). Overall, Chinook Salmon body condition declined from 2010 to 2014 to its lowest value in the time series (Fig. 2.4.1). Since 2014, Chinook Salmon body condition has increased to the highest value in the time series, which was observed in 2017. It should be noted that despite the variability observed from year to year, the absolute difference in body condition from 2010 to 2017 is 475 g (1 lb).

The Lake Ontario Management Unit would like to thank all of the tournament organizers, volunteers and anglers involved in making this program a success over the past eight years.

TABLE 2.4.1. Tournaments attended by the Lake Ontario Management Unit in 2017.

Date	Tournament
03-Jun-17	Strait Line Anglers Salmon Challenge
17-Jun-17	6th Annual Veteran's Salmon Derby
24-Jun-17	Port Credit Pen Derby
22-Jul-17	Bluffers Pen Tournament
26-Aug-17	Bronte Pen Derby

FIG. 2.4.1. Body condition (estimated weight at 914 mm (36") total length) of Lake Ontario Chinook Salmon sampled through June to August, 2010 – 2017.

TABLE 2.4.2. Summary of summer Chinook Salmon sampling on Lake Ontario, 2010 – 2017.

Year	n	Total Length (mm)	Weight (g)		
			Avg.	Min.	Max.
2010	405	733	5828	220	17720
2011	220	831	6584	400	16000
2012	221	864	7723	340	15140
2013	340	872	8017	390	15960
2014	127	768	5983	55	14700
2016	118	811	6924	410	15013
2017	88	824	7203	400	14340

3. Commercial Fishery

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

A. Todd and J.A. Hoyle, Lake Ontario Management Unit

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

The committee met twice during 2017 (January 5 and October 26). Topics of discussion at these LOLC meetings included commercial harvest summaries, status of fish stocks (including Yellow Perch, Lake Whitefish, Sunfish, Walleye, and Black Crappie), quotas and "pools", eel status and trap and transfer program, and Northern Pike harvest management.

3.2 Quota and Harvest Summary

J. A. Hoyle, Lake Ontario Management Unit

Lake Ontario supports a commercial fish industry; the commercial harvest comes from the Canadian waters of Lake Ontario east of Brighton (including the Bay of Quinte, East and West Lakes) and the St. Lawrence River (Fig. 3.2.1). The waters west of Brighton (quota zone 1-8) currently have no commercial licences. Commercial harvest statistics for 2017 were obtained from the commercial fish harvest information system (CFHIS) which is managed, in partnership, by the Ontario Commercial Fisheries Association (OCFA) and MNRF. Commercial quota, harvest and landed value statistics for Lake Ontario, the St. Lawrence River and East and West Lakes, for 2017, are shown in Tables 3.2.1 (base quota), 3.2.2 (issued quota), 3.2.3 (harvest) and 3.2.4 (landed value).

The total harvest of all species was 498,148 lb ($779,593) in 2017, up 59,322 lb (14%) from 2016. The harvest (landed value) for Lake Ontario, the St. Lawrence River, and East and West Lakes was 368,546 lb ($581,469), 88,751 lb ($153,247), and 40,851 lb ($49,824), respectively (Fig. 3.2.2 and Fig. 3.2.3). Yellow Perch, Lake Whitefish, Sunfish and Walleye were the dominant species in the harvest for Lake Ontario. Yellow Perch was dominant in the St. Lawrence River. Sunfish was the dominant fish in East and West Lakes.

Major Fishery Trends

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

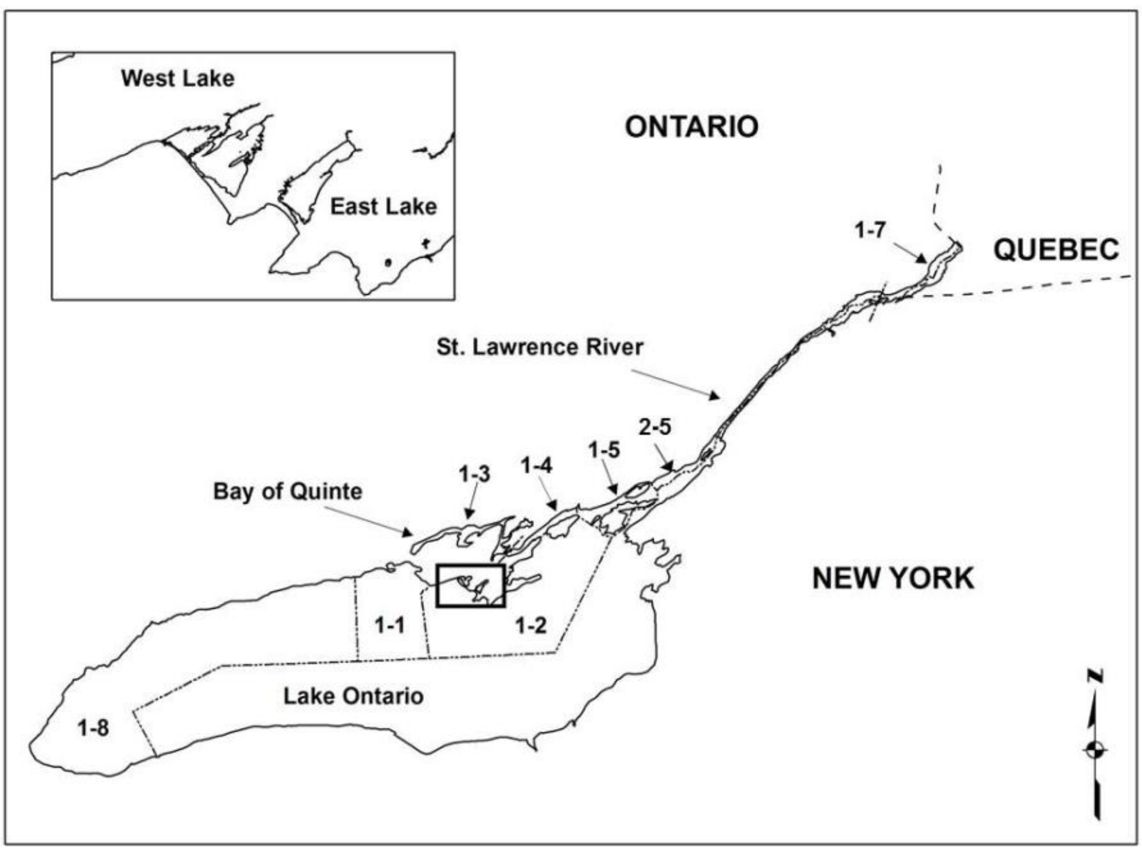


FIG. 3.2.1. Map of Lake Ontario and the St. Lawrence River showing commercial fishing quota zones in Canadian waters.

TABLE 3.2.1. Commercial fish **base quota** (lb), by quota zone, in the Canadian waters of Lake Ontario and the St. Lawrence River, East and West Lakes (two Lake Ontario embayments), 2017.

	Lake Ontario					St. Lawrence River			East Lake	West Lake	Base Quota by Waterbody		
Species	1-1	1-2	1-3	1-4	1-8	1-5	2-5	1-7	1	1	Lake Ontario	St. Lawrence River	Total
Black Crappie	4,540	3,000	14,824	1,100	0	14,170	17,590	4,840	3,100	9,850	23,464	36,600	73,014
Bowfin	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown Bullhead	0	0	0	0	0	0	0	0	0	0	0	0	0
Lake Whitefish	6,549	97,745	12,307	18,282	0	0	0	0	0	0	134,883	0	134,883
Sunfish	28,130	0	0	0	0	0	0	0	14,600	18,080	28,130	0	60,810
Walleye	4,209	32,931	0	10,952	0	0	0	0	0	0	48,092	0	48,092
Yellow Perch	22,778	91,823	80,741	80,749	0	51,787	53,000	18,048	896	2,829	276,091	122,835	402,651
Total	66,206	225,499	107,872	111,083	0	65,957	70,590	22,888	18,596	30,759	510,660	159,435	719,450

TABLE 3.2.2. Commercial fish **issued quota** (lb), by quota zone, in the Canadian waters of Lake Ontario and the St. Lawrence River, East and West Lakes (two Lake Ontario embayments), 2017.

	Lake Ontario					St. Lawrence River			East Lake	West Lake	Issued Quota by Waterbody		
Species	1-1	1-2	1-3	1-4	1-8	1-5	2-5	1-7	1	1	Lake Ontario	St. Lawrence River	Total
Black Crappie	2,270	1,500	10,388	600	0	7,085	8,795	4,840	3,100	9,850	14,758	20,720	48,428
Bowfin	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown Bullhead	0	0	0	0	0	0	0	0	0	0	0	0	0
Lake Whitefish	2,069	116,797	7,628	10,961	0	0	0	0	0	0	137,455	0	137,455
Sunfish	28,130	0	0	0	0	0	0	0	14,600	18,080	28,130	0	60,810
Walleye	2,523	10,304	0	38,546	0	0	0	0	0	0	51,373	0	51,373
Yellow Perch	15,085	51,853	84,568	80,749	0	46,441	48,701	18,048	896	2,829	232,255	113,190	349,170
Total	50,077	180,454	102,584	130,856	0	53,526	57,496	22,888	18,596	30,759	463,971	133,910	647,236

TABLE 3.2.3. Commercial **harvest** (lb), by quota zone, for fish species harvested from the Canadian waters of Lake Ontario and the St. Lawrence River, East and West Lakes (two Lake Ontario embayments), 2017.

	Lake Ontario					St. Lawrence River			East Lake	West Lake	Totals		
Species	1-1	1-2	1-3	1-4	1-8	1-5	2-5	1-7	1	1	Lake Ontario	St. Lawrence River	All Waterbodies
Black Crappie	55	0	4,839	69	0	1,049	898	162	0	2,890	4,963	2,109	9,962
Bowfin	0	0	3,111	2	0	1,258	1,386	192	326	701	3,113	2,836	6,976
Brown Bullhead	34	9	7,602	71	0	287	1,281	6,256	0	4	7,716	7,824	15,544
Common Carp	454	47	3,237	6,282	0	0	289	0	14	142	10,020	289	10,465
Freshwater Drum	177	2	8,005	18,162	0	33	0	0	0	0	26,346	33	26,379
Cisco	17	231	1,546	1,220	0	0	0	0	0	20	3,014	0	3,034
Lake Whitefish	0	66,348	1,626	268	0	0	0	0	0	0	68,242	0	68,242
Northern Pike	4,204	191	11,018	1,900	0	3,220	0	0	1,048	2,521	17,313	3,220	24,102
Rock Bass	2,375	302	4,206	1,010	0	977	1,590	172	1,241	1,159	7,893	2,739	13,032
Sunfish	2,883	1	34,502	154	0	2,956	469	265	11,991	11,786	37,540	3,690	65,007
Walleye	565	1,189	0	29,987	0	0	0	0	0	0	31,741	0	31,741
White Bass	1	421	278	6,868	0	1	0	0	0	0	7,568	1	7,569
White Perch	7	30	4,979	2,781	0	39	0	0	668	3,310	7,797	39	11,814
White Sucker	368	243	15,678	4,521	0	173	21	0	229	74	20,810	194	21,307
Yellow Perch	4,226	8,349	54,879	47,016	0	21,661	27,427	16,689	316	2,411	114,470	65,777	182,974
Total	15,366	77,363	155,506	120,311	0	31,654	33,361	23,736	15,833	25,018	368,546	88,751	498,148

TABLE 3.2.4. Commercial **harvest (lb), price per lb, and landed value** for fish species harvested from the Canadian waters of Lake Ontario and the St. Lawrence River, and the total for all waterbodies including East and West Lakes, 2017.

	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	4,963	$3.25	$16,126	2,109	$2.66	$5,620	9,962	$3.05	$30,406
Bowfin	3,113	$0.35	$1,098	2,836	$0.67	$1,905	6,976	$0.53	$3,694
Brown Bullhead	7,716	$0.22	$1,693	7,824	$0.48	$3,778	15,544	$0.43	$6,706
Common Carp	10,020	$0.16	$1,562	289	$0.40	$116	10,465	$0.16	$1,651
Freshwater Drum	26,346	$0.11	$2,771	33	$0.10	$3	26,379	$0.11	$2,773
Cisco	3,014	$0.30	$900	0			3,034	$0.30	$906
Lake Whitefish	68,242	$1.56	$106,703	0			68,242	$1.56	$106,703
Northern Pike	17,313	$0.30	$5,264	3,220	$0.37	$1,183	24,102	$0.30	$7,277
Rock Bass	7,893	$0.67	$5,261	2,739	$0.82	$2,243	13,032	$0.70	$9,178
Sunfish	37,540	$1.26	$47,233	3,690	$1.14	$4,207	65,007	$1.23	$79,867
Walleye	31,741	$2.66	$84,511	0			31,741	$2.66	$84,511
White Bass	7,568	$0.46	$3,484	1	$0.75	$1	7,569	$0.46	$3,493
White Perch	7,797	$0.46	$3,590	39	$0.40	$16	11,814	$0.49	$5,763
White Sucker	20,810	$0.11	$2,393	194	$0.11	$21	21,307	$0.11	$2,442
Yellow Perch	114,470	$2.61	$298,881	65,777	$2.04	$134,158	182,974	$2.37	$434,222
Total	368,546		$581,469	88,751		$153,251	498,148		$779,593

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 and again in 2017.

Major Species

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

Yellow Perch

Yellow Perch 2017 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.6. Overall, 45% (182,975 lb) of the Yellow Perch base quota (402,651 lb) was harvested in 2017 up from only 28% harvested the previous year. The highest Yellow Perch harvest came from quota zones 1-3 and 1-4. Greater than 50% of base quota was harvested in five quota zones.

Trends in Yellow Perch quota (base), harvest and price-per-lb are shown Fig. 3.2.7. Quota was reduced 20% in 2017 in quota zones 1-1, 1-2, 1-4, 2-5, East and West Lakes, reduced 6% in quota zone 1-5, and left unchanged in quota zones 1-3 and 1-7. Harvest increased in 2017 in most quota zones (Fig. 3.2.7).

Lake Whitefish

Lake Whitefish 2017 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.8. Overall, 51% (68,242 lb) of the Lake Whitefish base quota was harvested in 2017. 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 significantly higher than base quota in quota zone 1-2 (Fig. 3.2.8). Relatively small proportions of base quota were harvested in quota zones 1-1, 1-3 and 1-4.

Trends in Lake Whitefish quota (base), harvest and price-per-lb are shown in Fig. 3.2.9. Base quota remained unchanged in 2017 compared to 2016. In 2017, an additional 20% of base quota was issued to a “pool” on November 1.

Seasonal whitefish harvest and biological attributes (e.g., size and age structure) information are reported in Section 3.3. Lake Whitefish price-

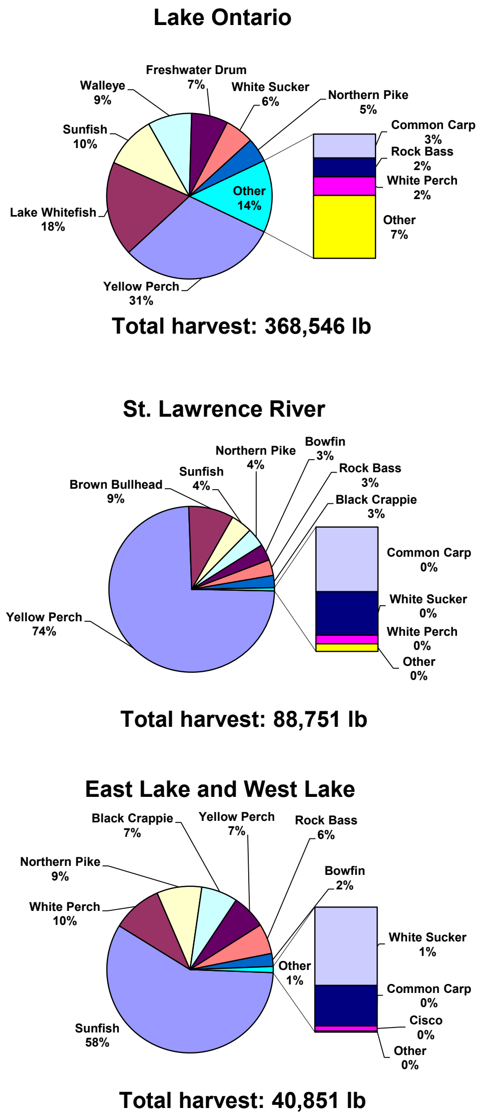


FIG. 3.2.2. Pie-charts showing breakdown of 2017 commercial harvest by species **(% by weight)** for Lake Ontario (quota zones 1-1, 1-2, 1-3, 1-4 and 1-8), the St. Lawrence River (quota zones 1-5, 2-5 and 1-7), and for East and West Lakes combined.

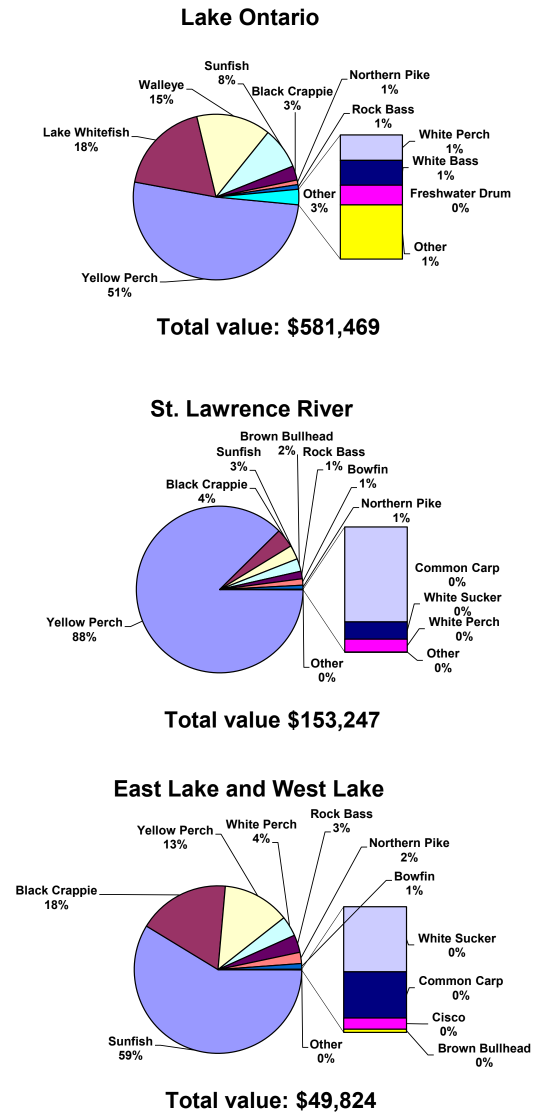


FIG. 3.2.3. Pie-charts showing breakdown of 2017 commercial harvest by species **(% by landed value)** for Lake Ontario (quota zones 1-1, 1-2, 1-3, 1-4 and 1-8), the St. Lawrence River (quota zones 1-5, 2-5 and 1-7), and for East and West Lakes combined.

per-lb increased somewhat in 2017 compared to 2016.

Walleye

Walleye 2017 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.10. Walleye harvest increased in 2017. Overall, 66% (31,741 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 2017, this resulted in issued quota and harvest being considerably higher than base quota in quota zone 1-4 (Fig. 3.2.10).

Trends in Walleye quota (base), harvest and price-per-lb are shown in Fig. 3.2.11. Quota has remained constant since the early 2000s (just under 50,000 lb for all quota zones combined).

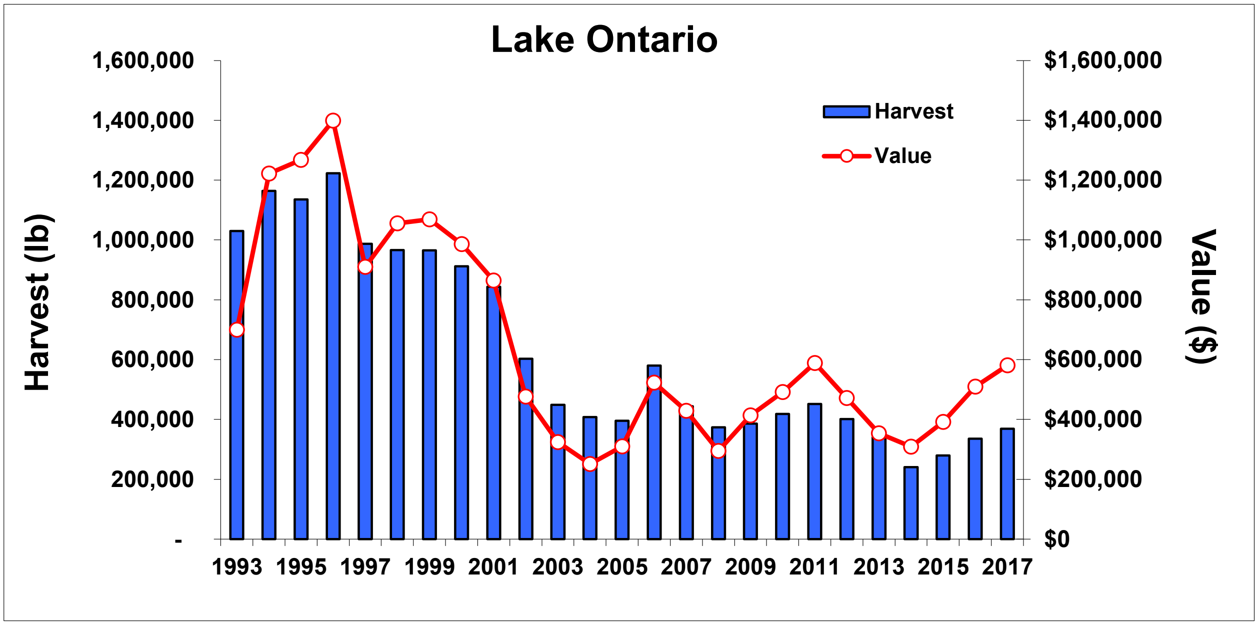


FIG. 3.2.4. Total commercial fishery harvest and value for **Lake Ontario** (Quota Zones 1-1, 1-2, 1-3 ,1-4 and 1-8) 1993-2017.

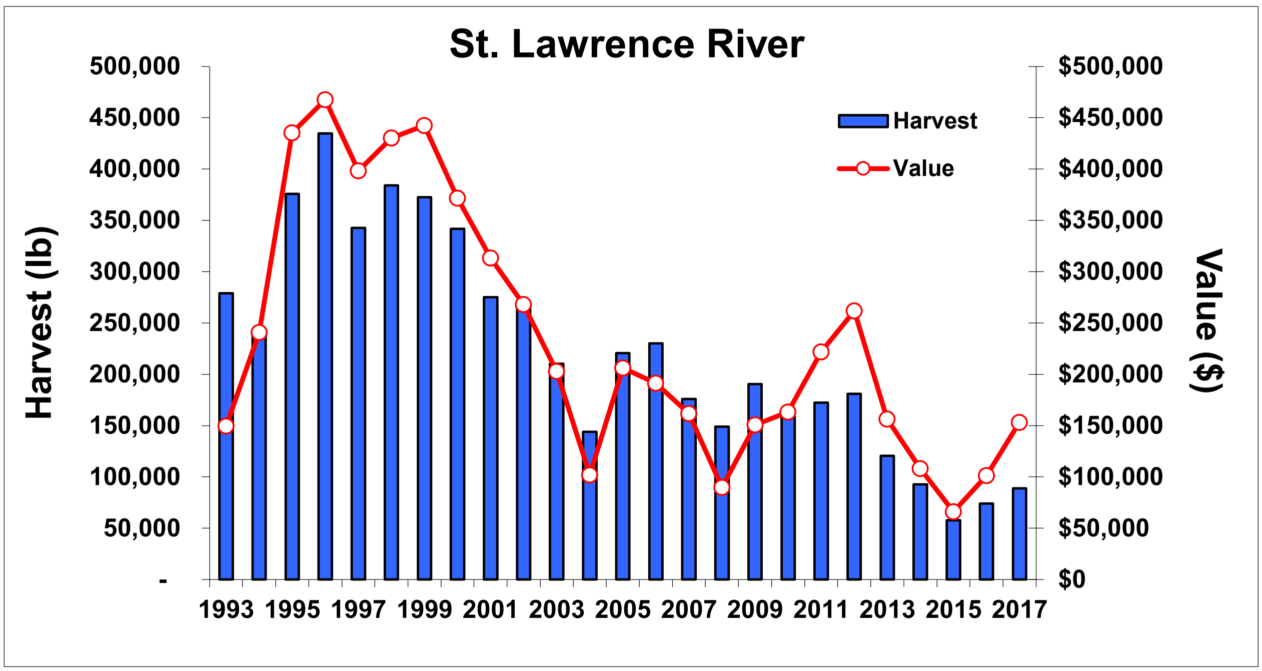


FIG. 3.2.5. Total commercial fishery harvest and value for the **St. Lawrence River** (Quota Zones 1-5, 2-5 and 1-7), 1993-2017.

Walleye price-per-lb has been trending higher for the last number of years.

Black Crappie

Black Crappie 2017 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.12. Overall, only 14% (9,962 lb) of the Black Crappie base quota (73,314) was harvested in 2017. The highest Black Crappie harvest came from quota zones 1-3 and West Lake. Only a very small proportion of base quota was harvested in other quota zones.

Trends in Black Crappie quota (base), harvest and price-per-lb are shown in Fig. 3.2.13. Black Crappie harvest has been trending down the

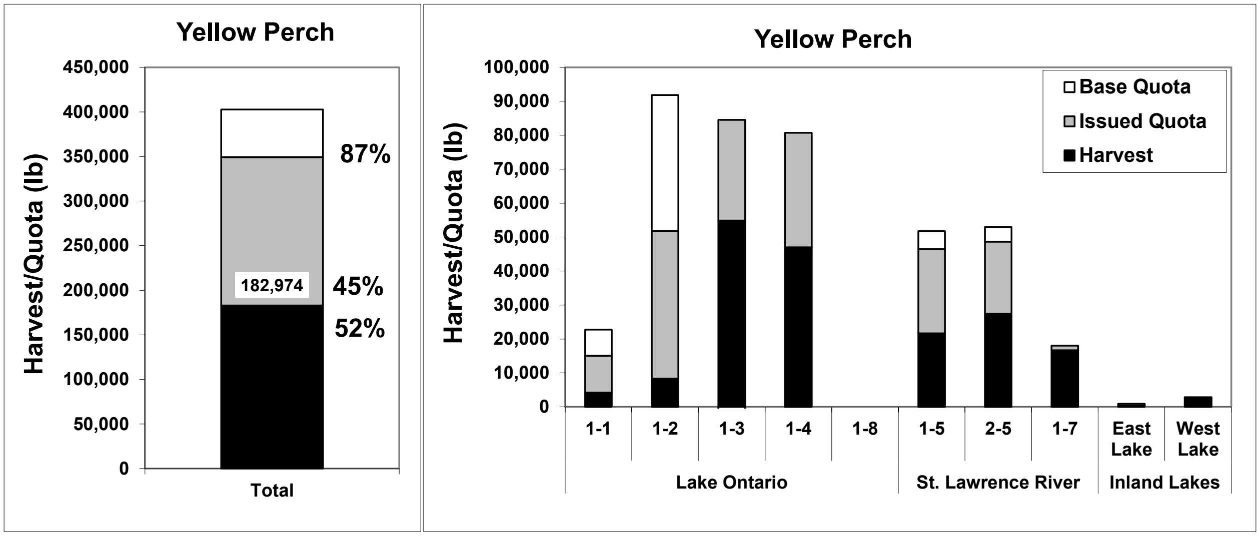


FIG. 3.2.6. **Yellow Perch** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2017.

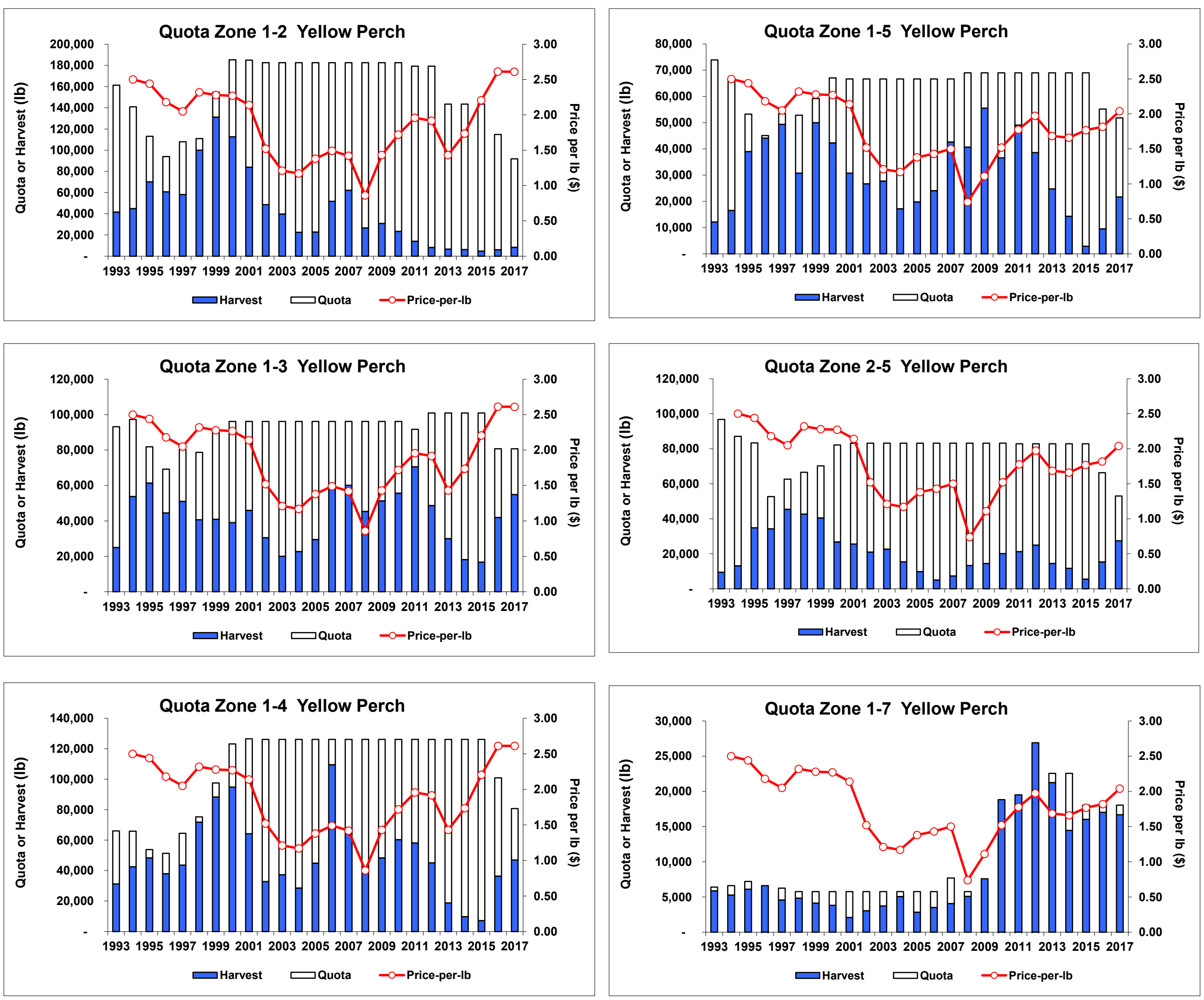


FIG. 3.2.7. Commercial base quota, harvest and price-per-lb for **Yellow Perch** in Quota Zones 1-2, 1-3, 1-4, 1-5, 2-5 and 1-7, 1993-2017.

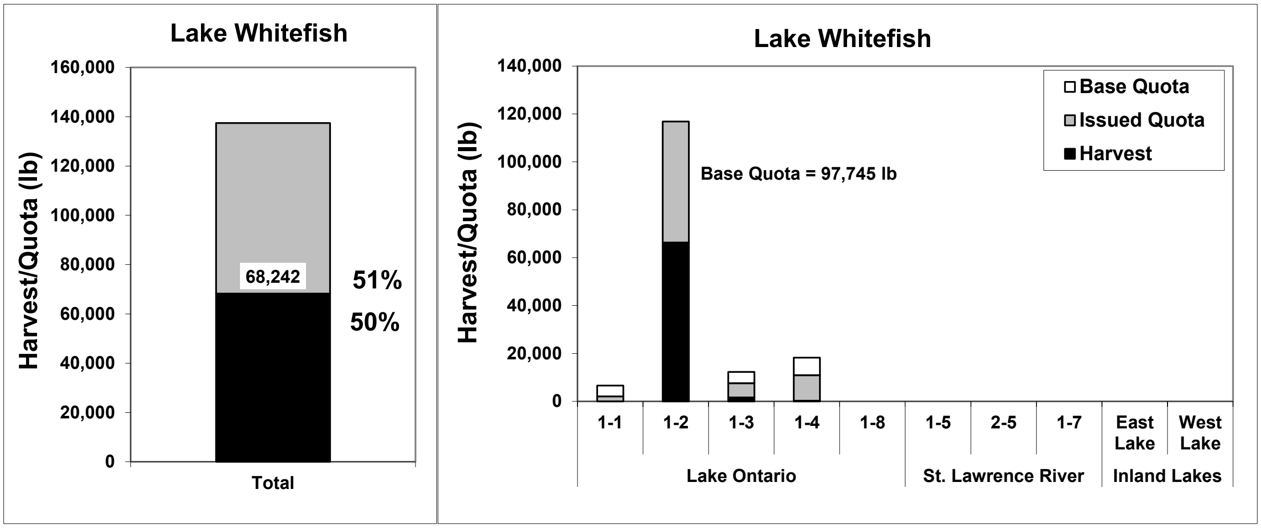


FIG. 3.2.8. **Lake Whitefish** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2017.

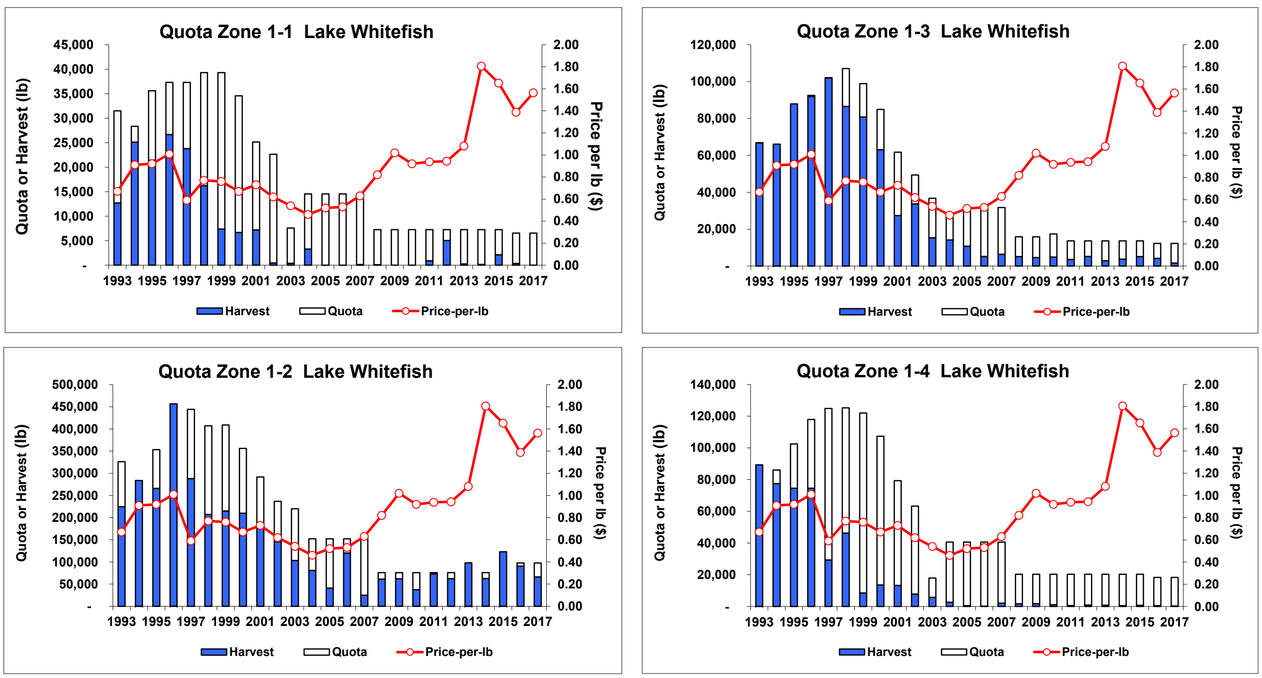


FIG. 3.2.9. Commercial base quota, harvest and price-per-lb for **Lake Whitefish** in Quota Zones 1-1, 1-2, 1-3 and 1-4, 1993-2017.

last few years in quota zone 1-3 but remains steady n West Lake. Price-per-lb is currently high.

Sunfish

Sunfish 2017 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.14. Only quota zones 1-1 (embayment areas only), East Lake and West Lake have quotas for Sunfish; quota is unlimited in the other zones. Most Sunfish harvest comes from quota zone 1-3, East Lake and West Lake.

Trends in Sunfish quota (base), harvest and price-per-lb are shown in Fig. 3.2.15. In 2017, harvest increased in quota zone 1-3, East and West Lakes. Sunfish price-per-lb is currently high.

Brown Bullhead

Brown Bullhead 2017 commercial harvest by quota zone and total for all quota zones

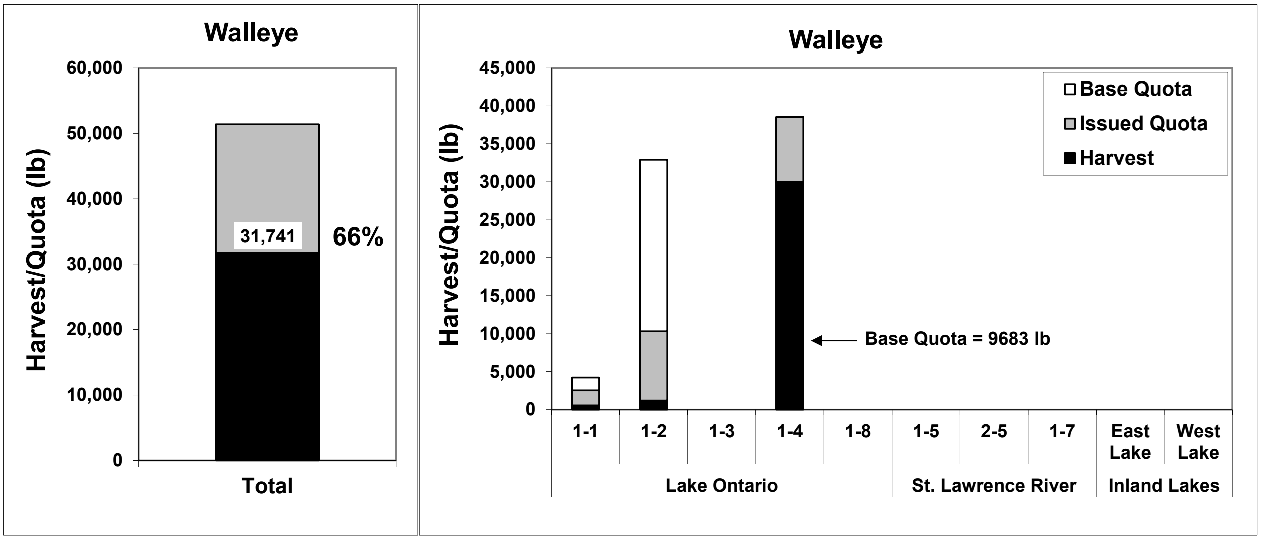
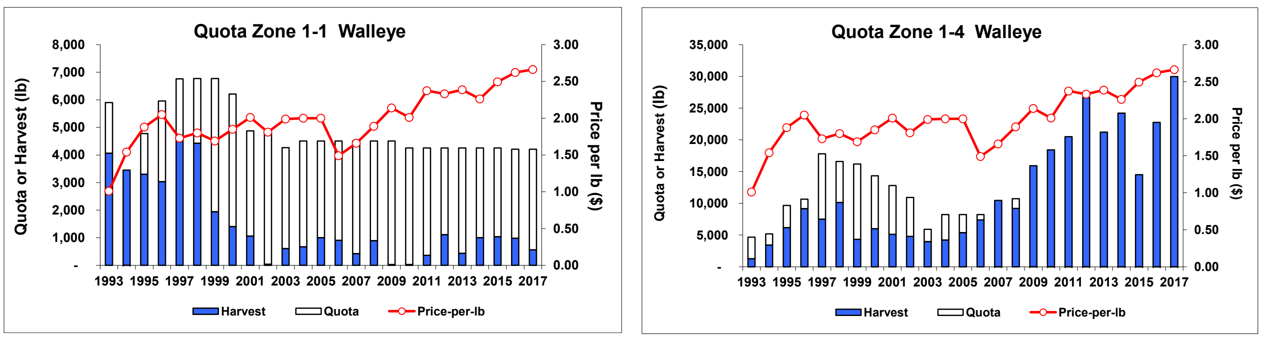


FIG. 3.2.10. **Walleye** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2017.



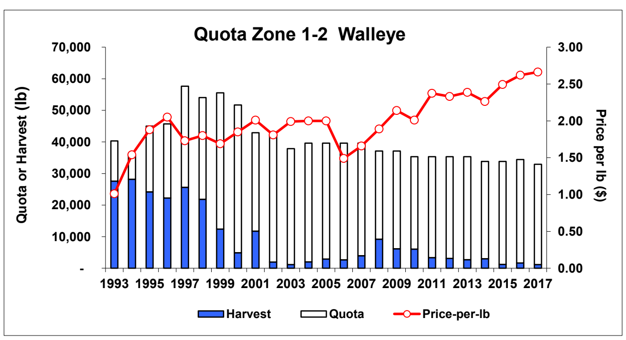


FIG. 3.2.11. Commercial base quota, harvest and price-per-lb for **Walleye** in Quota Zones 1-1, 1-2 and 1-4, 1993-2016.

combined is shown in Fig. 3.2.16. Quota was removed in quota zones 1-1, East Lake and West Lake in 2016 and is now unlimited in all zones. Highest Brown Bullhead harvest came from quota zones 1-3 and 1-7.

Trends in Brown Bullhead quota (base), harvest and price-per-lb are shown in Fig. 3.2.17.

Current harvest levels are extremely low relative to past levels.

Northern Pike

Northern Pike 2017 commercial harvest by quota zone is shown in Fig. 3.2.18. Highest pike harvest came from quota zone 1-3.

Trends in Northern Pike harvest and price-per-lb are shown in Fig. 3.2.19. In 2017, harvest declined in all quota zone 1-3 and increased in quota zones 1-1, 1-5, East and West Lakes.

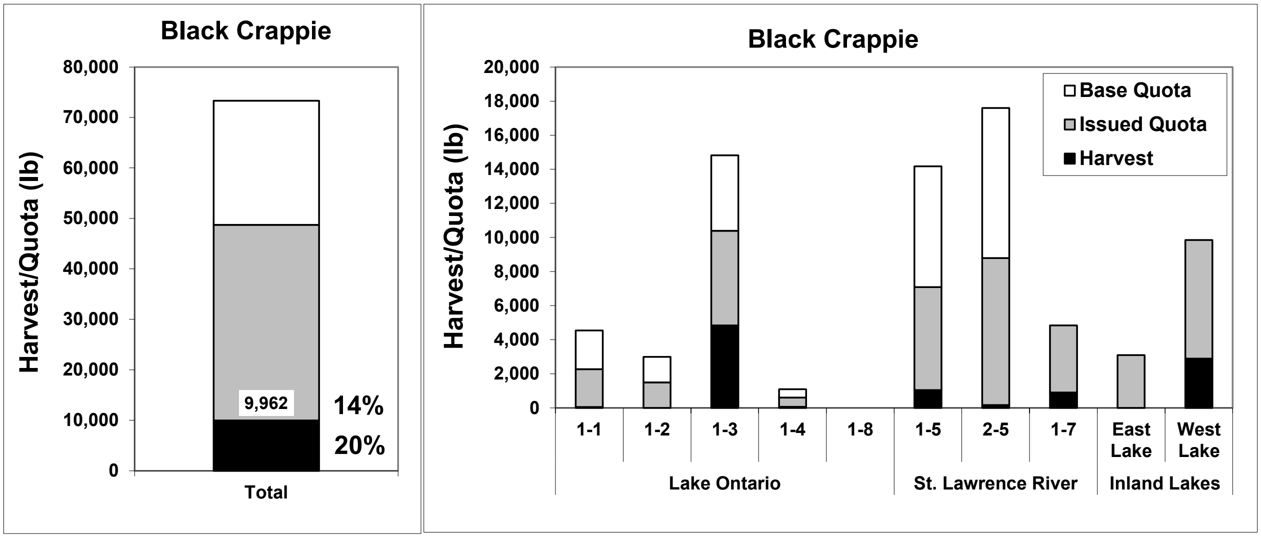


FIG. 3.2.12. **Black Crappie** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2017.

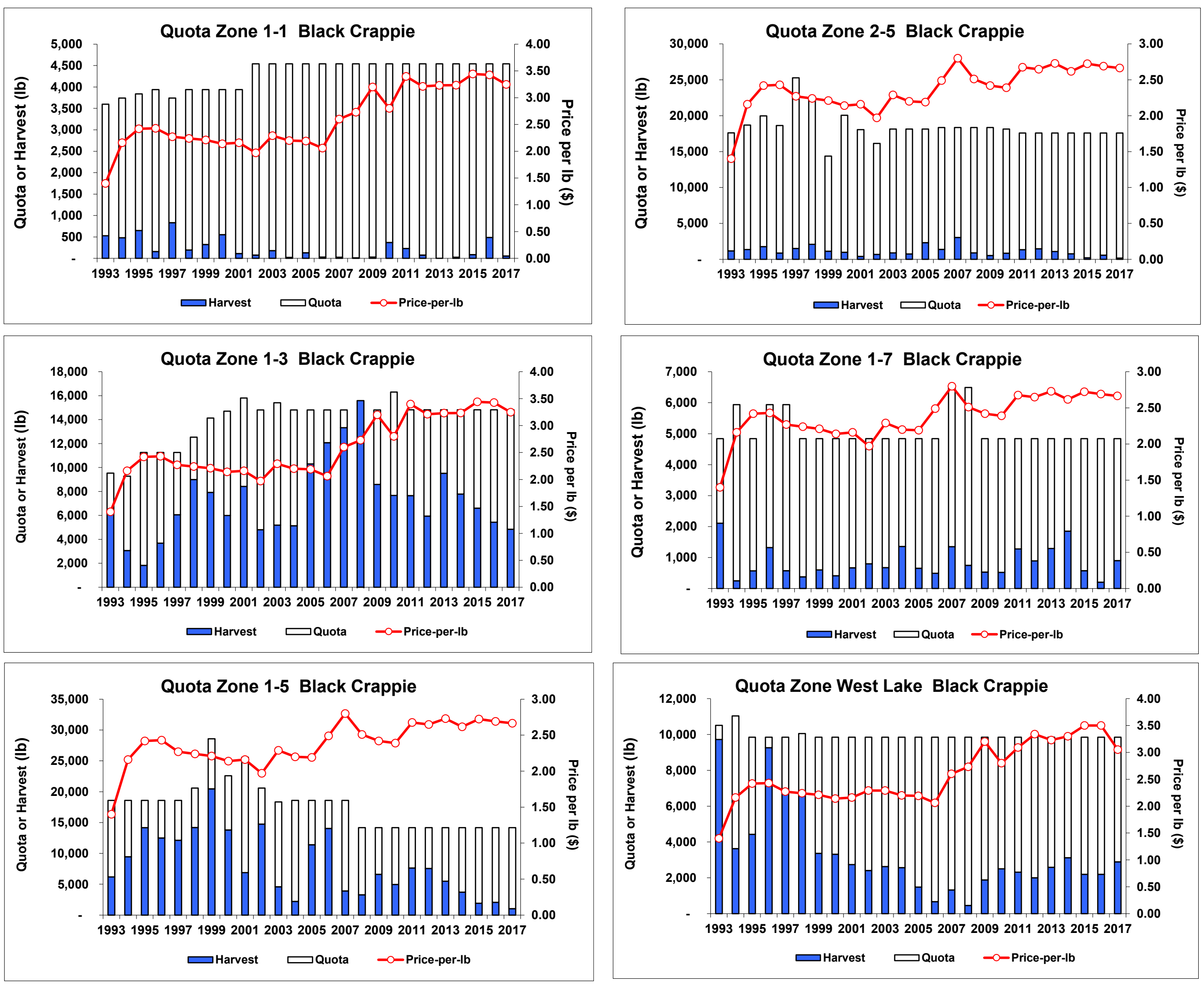


FIG. 3.2.13. Commercial base quota, harvest and price-per-lb for **Black Crappie** in Quota Zones 1-1, 1-3, 1-5, 2-5, 1-7 and West Lake, 1993-2017.

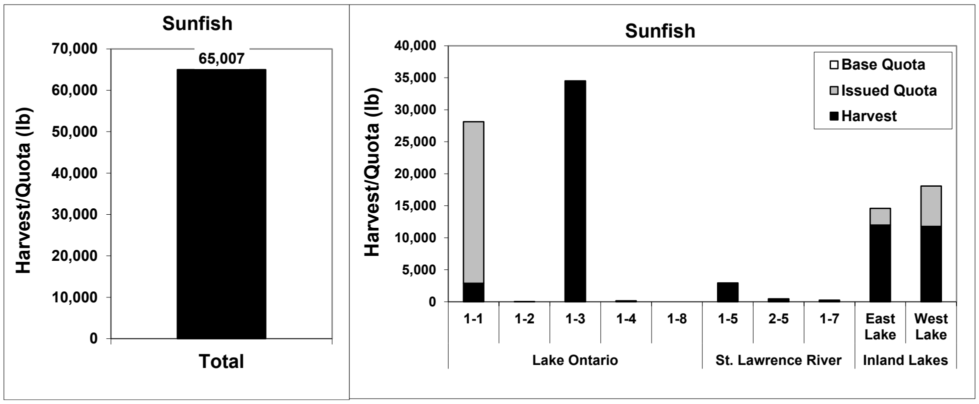


FIG. 3.2.14. **Sunfish** commercial harvest relative to issued and base quota for quota zones 1-1, East Lake and West Lake, 2017. The remaining quota zones have unlimited quota.

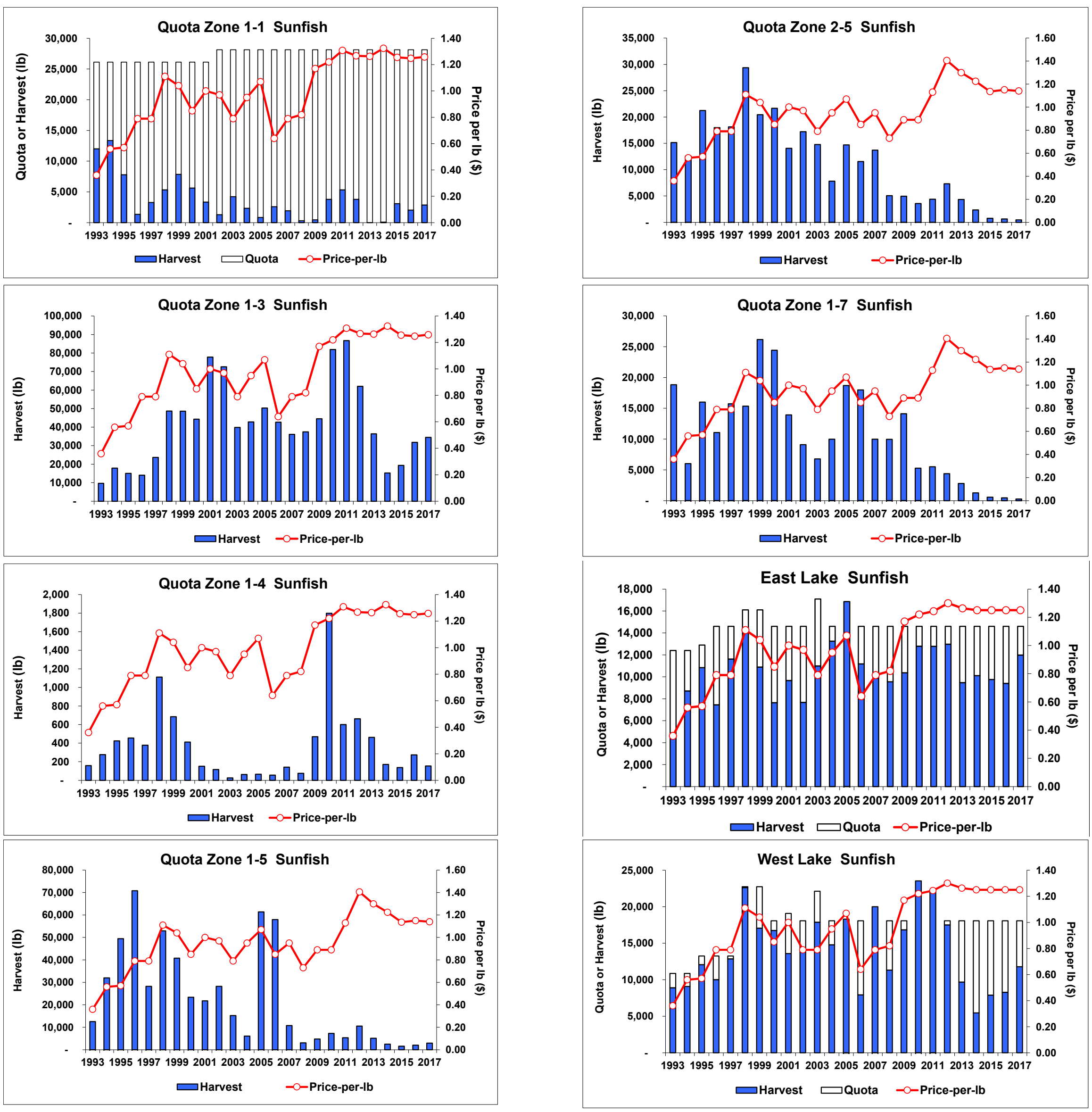


FIG. 3.2.15. Commercial base quota, harvest and price-per-lb for **Sunfish** in Quota Zones 1-1, 1-3, 1-4, 1-5, 2-5 and 1-7, East Lake and West Lake, 1993-2017.

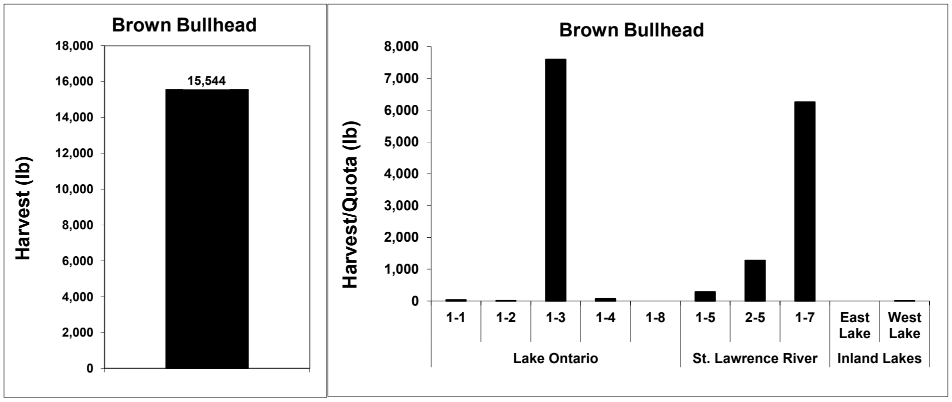


FIG. 3.2.16. **Brown Bullhead** commercial harvest by quota zone, 2017.

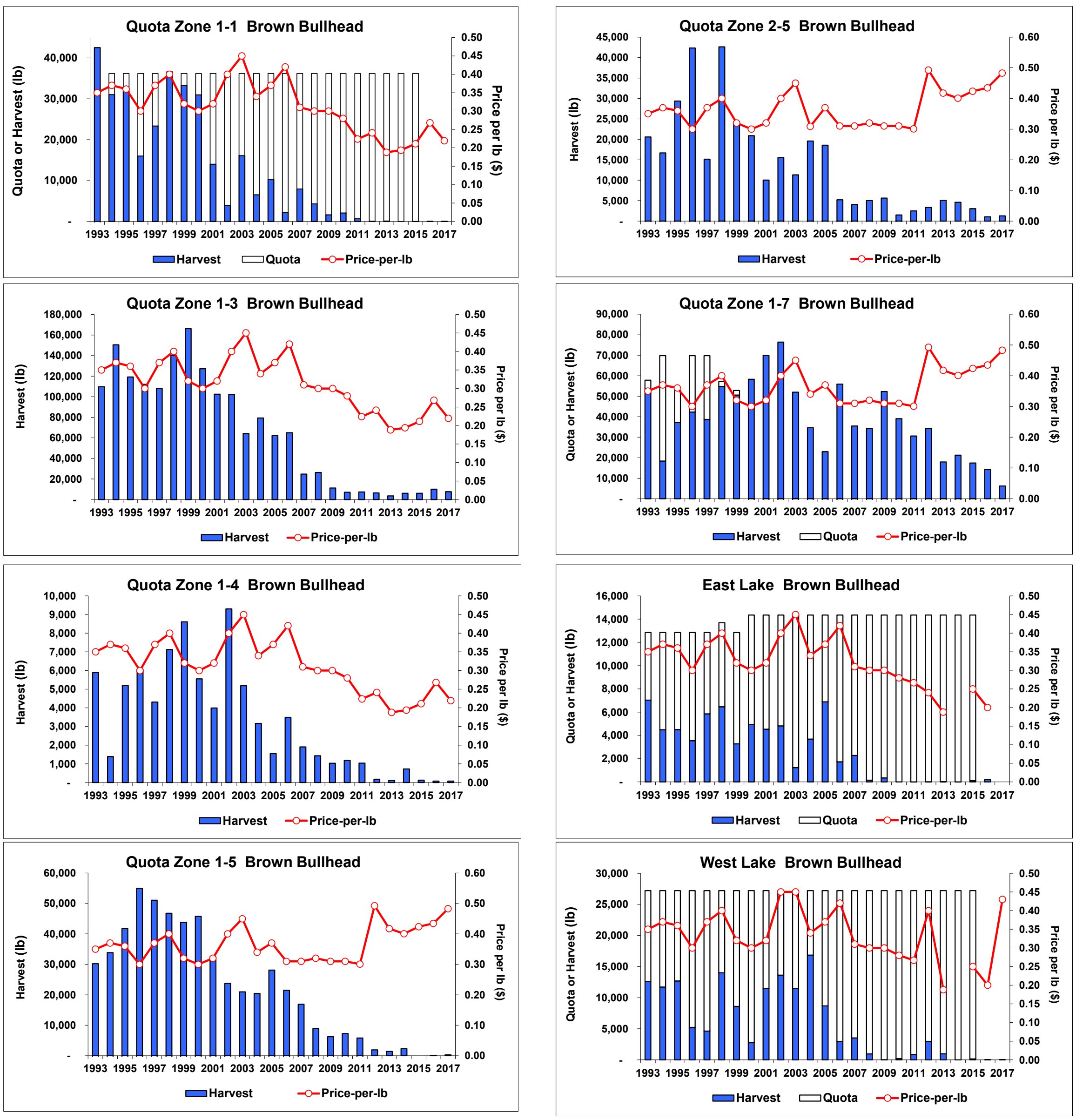


FIG. 3.2.17. Commercial base quota, harvest and price-per-lb for **Brown Bullhead** in Quota Zones 1-1, 1-3, 1-4, 1-5, 2-5 and 1-7, East Lake and West Lake, 1993-2017.

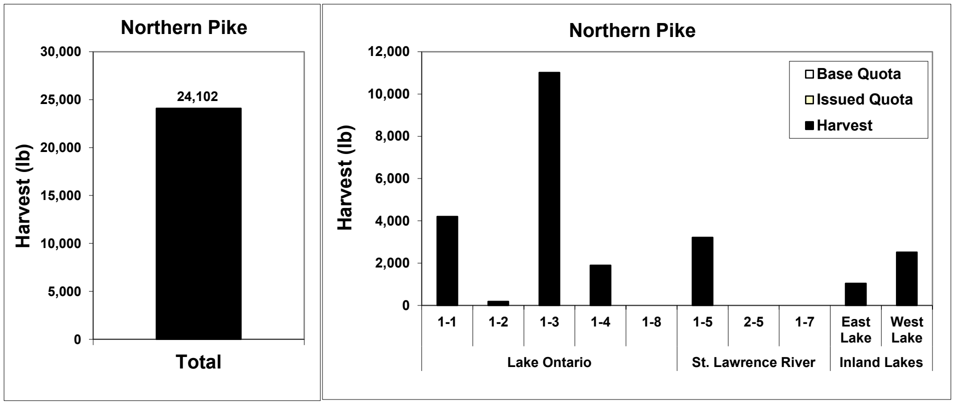


FIG. 3.2.18. **Northern Pike** commercial harvest by quota zone, 2017. In quota zones 2-5 and 1-7 no harvest is permitted; all other zones have unlimited quota.

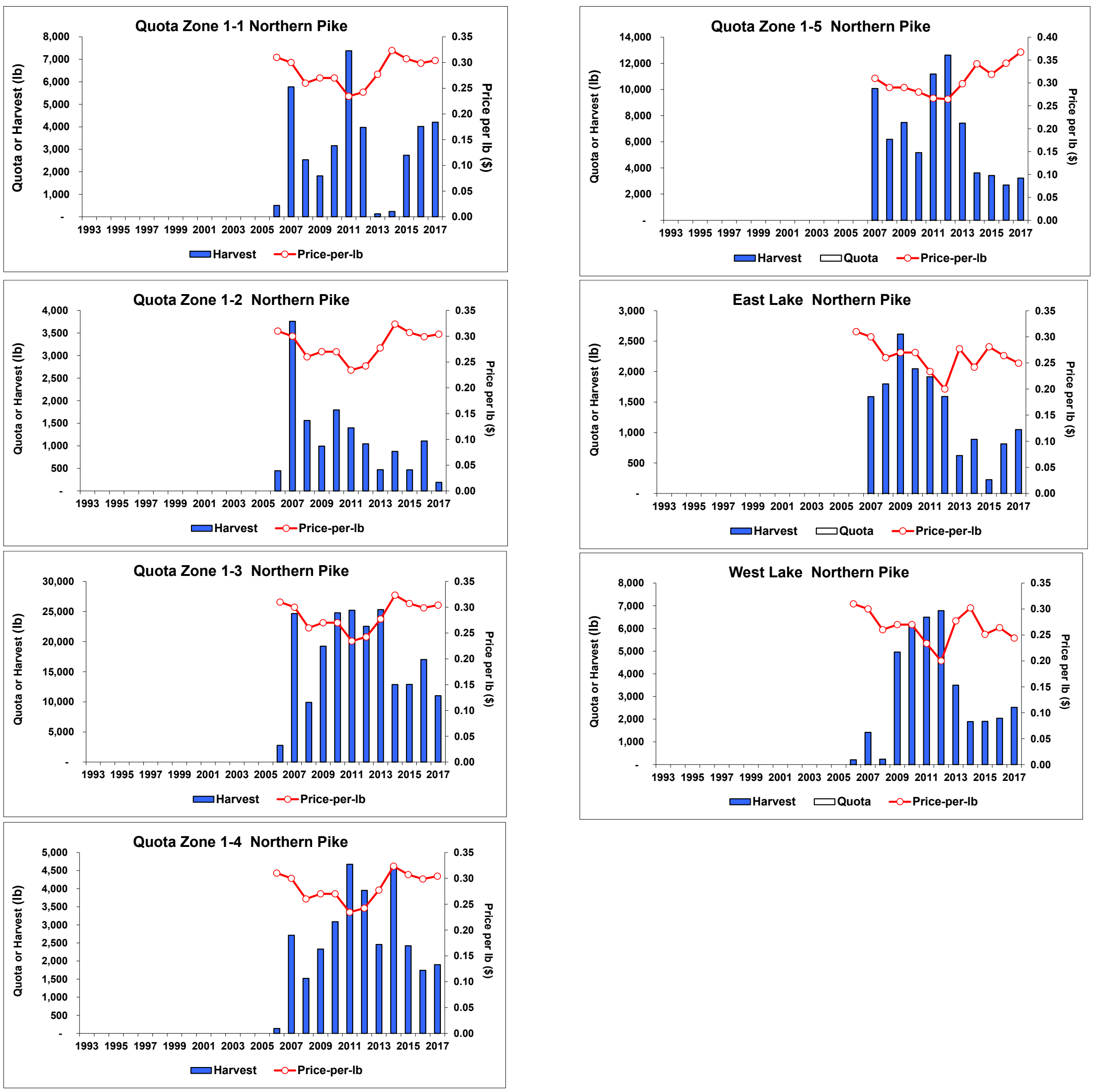


FIG. 3.2.19. Commercial base quota, harvest and price-per-lb for **Northern Pike** in Quota Zones 1-1, 1-2, 1-3, 1-4, and 1-5, East Lake and West Lake, 1993-2017.

3.3 Lake Whitefish Commercial Catch Sampling

J. A. Hoyle, Lake Ontario Management Unit

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

Commercial Lake Whitefish harvest and fishing effort by gear type, month and quota zone for 2017 is reported in Table 3.3.1. Cumulative daily commercial Lake Whitefish harvest relative to quota 'milestones' is shown in Fig. 3.3.1. Total Lake Whitefish harvest for 2017 was 68,240 lbs; 50% of the issued quota.

Most of the harvest was taken in gill nets, 98% by weight; 2% of the harvest was taken in impoundment gear. Ninety-seven percent of the gill net harvest occurred in quota zone 1-2. Eighty percent of the gill net harvest in quota zone 1-2 was taken in November and December. In quota zone 1-3 most impoundment gear harvest and effort occurred in November (Table 3.3.1). About 12,000 lbs were harvested before November 1, the date on which an additional 20% of base quota was issued to the "pool" (Fig 3.3.1).

Biological sampling focused on the November spawning-time gill net fishery on the south shore of Prince Edward County (quota zone 1-2), and the October/November spawning-time impoundment gear fishery in the Bay of Quinte (quota zone 1-3). The Lake Whitefish sampling design involves obtaining large numbers of length tally measurements and a smaller length-stratified sub-sample for more detailed biological sampling for the lake (quota zone 1-2) and bay (quota zone 1-3) spawning stocks. Whitefish length and age distribution information is presented in Fig. 3.3.2 and Fig. 3.3.3. In total, fork length was measured for 2,550 fish and age was interpreted using otoliths for 194 fish (Table 3.3.2, Fig. 3.3.2 and 3.3.3).

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

The mean fork length and age of Lake Whitefish harvested during the gill net fishery in quota zone 1-2 were 483 mm and 10.2 years respectively (Fig. 3.3.2). Fish ranged from ages 4 -28 years. The most abundant age-classes in the fishery were aged 5-14 years which together comprised 88% of the harvest by number (96% by weight).

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

		Harvest (lbs)			Effort (number of yards or nets)		
Gear type	Month	1-2	1-3	1-4	1-2	1-3	1-4
Gill net	Mar	3			80		
	Apr	34			320		
	May	157		10	1,780		600
	Jun	4,205			28,040		
	Jul	3,457			20,100		
	Aug	3,206			22,400		
	Sep	822		87	5,000		900
	Nov	***31,956***		89	***23,350***		360
	Dec	***22,509***		68	***17,500***		520
Impoundment	Apr		13			30	
	Jun			9			2
	Oct		8	3		26	7
	Nov		***1,543***	2		***71***	6

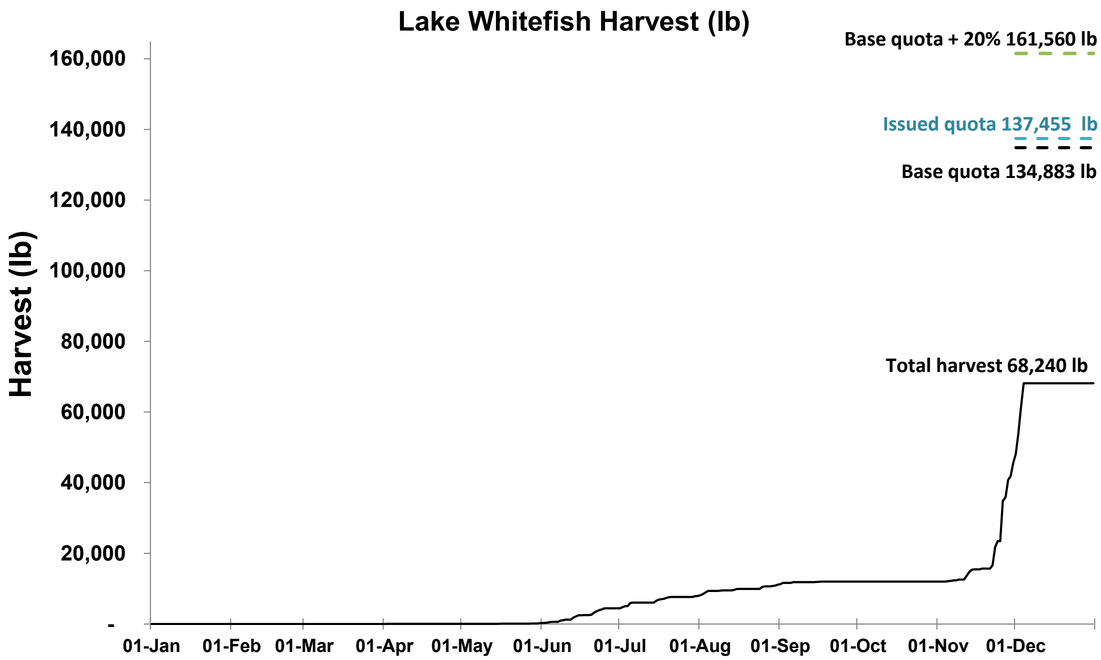


FIG. 3.3.1. Cumulative daily commercial Lake Whitefish harvest (2017) relative to quota 'milestones'.

TABLE 3.3.2. Age-specific vital statistics of **Lake Whitefish** sampled and harvested including number aged, number measured for length, and proportion by number of fish sampled, harvest by number and weight (kg), and mean weight (kg) and fork length (mm) of the harvest for quota zones 1-2 and 1-3, 2017.

	Quota zone 1-2 (Lake stock)								Quota zone 1-3 (Bay stock)						
	Sampled			Harvested					Sampled			Harvested			
Age (years)	Number aged	Number lengthed	Proportion	Number	Weight (kg)	Mean weight (kg)	Mean length (mm)	Age (years)	Number aged	Number lengthed	Proportion	Number	Weight (kg)	Mean weight (kg)	Mean length (mm)
1	-	-	0.000	-	-			1	-	-	0.000	-	-		
2	-	-	0.000	-	-			2	1	4	0.011	7	6	0.864	451
3	-	-	0.000	-	-			3	-	-	0.000	-	-		
4	1	18	0.008	189	188	0.995	445	4	7	30	0.089	55	49	0.883	439
5	17	403	0.182	4,252	4,482	1.054	452	5	13	74	0.218	135	152	1.124	456
6	4	95	0.043	1,003	1,022	1.018	449	6	12	42	0.126	78	83	1.070	453
7	25	439	0.199	4,639	5,203	1.122	464	7	6	21	0.061	38	42	1.110	474
8	10	239	0.108	2,527	2,982	1.180	475	8	9	33	0.098	61	63	1.034	455
9	2	37	0.017	391	476	1.217	491	9	17	53	0.156	97	112	1.160	471
10	5	79	0.036	837	1,328	1.587	512	10	3	11	0.031	20	25	1.275	489
11	9	170	0.077	1,798	2,571	1.430	499	11	5	17	0.050	31	48	1.551	500
12	4	87	0.039	919	1,362	1.482	503	12	4	16	0.047	29	32	1.081	462
13	8	186	0.084	1,961	2,722	1.388	496	13	3	6	0.018	11	22	1.918	554
14	15	220	0.099	2,321	3,789	1.632	521	14	6	20	0.061	38	64	1.714	540
15	-	-	0.000	-	-			15	-	-	0.000	-	-		
16	-	-	0.000	-	-			16	2	4	0.013	8	14	1.709	555
17	1	31	0.014	329	405	1.232	498	17	-	-	0.000	-	-		
18	1	8	0.004	88	167	1.894	543	18	-	-	0.000	-	-		
19	-	-	0.000	-	-			19	-	-	0.000	-	-		
20	-	-	0.000	-	-			20	-	-	0.000	-	-		
21	2	24	0.011	254	276	1.088	463	21	-	-	0.000	-	-		
22	3	49	0.022	512	976	1.905	536	22	-	-	0.000	-	-		
23	3	24	0.011	249	396	1.586	544	23	-	-	0.000	-	-		
24	3	25	0.011	262	472	1.801	551	24	-	-	0.000	-	-		
25	4	42	0.019	448	782	1.746	537	25	-	-	0.000	-	-		
26	-	-	0.000	-	-			26	2	4	0.012	7	15	2.040	585
27	1	25	0.011	262	328	1.249	491	27	-	-	0.000	-	-		
28	1	10	0.005	110	169	1.540	533	28	-	-	0.000	-	-		
29	-	-	0.000	-	-			29	-	-	0.000	-	-		
30	-	-	0.000	-	-			30	-	-	0.000	-	-		
31	-	-	0.000	-	-			31	1	3	0.009	6	16	2.996	598
Total	118	2,212	1	23,352	30,095			Total	90	338	1	620	737		
Weighted mean						**1.289**		Weighted mean						**1.189**	

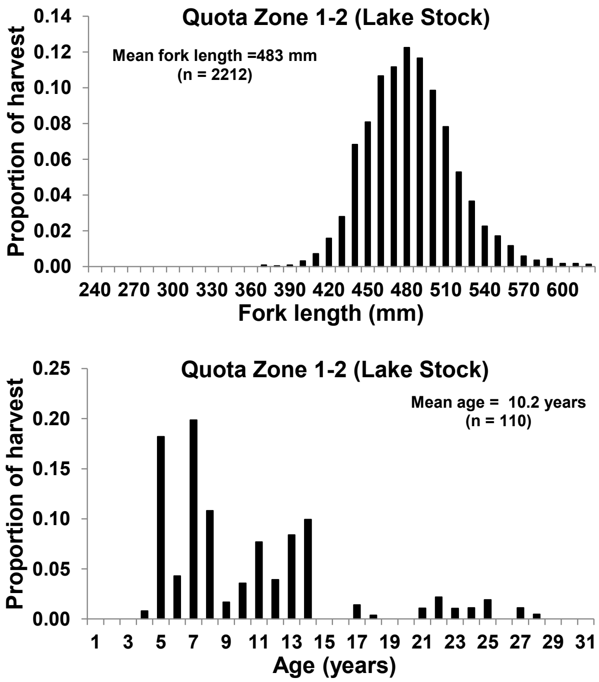


FIG. 3.3.2. Size and age distribution (by number) of **Lake Whitefish** sampled in quota zone 1-2 during the 2017 commercial catch sampling program.

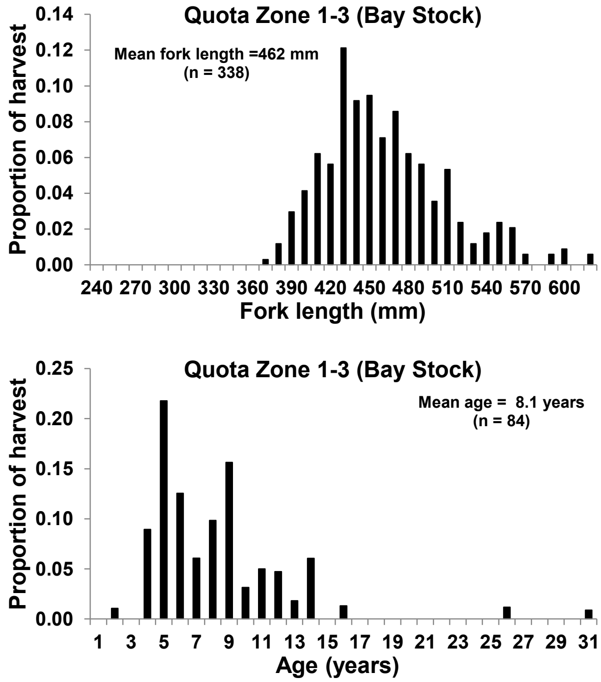


FIG. 3.3.3. Size and age distribution (by number) of **Lake Whitefish** sampled in quota zone 1-3 during the 2017 commercial catch sampling program.

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

Mean fork length and age were 462 mm and 8.1 years, respectively (Fig. 3.3.3). Fish ranged from ages 2-31 years. The most abundant age-classes in the fishery were aged 4-14 years which together comprised 96% of the harvest by number (94% by weight).

Condition

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

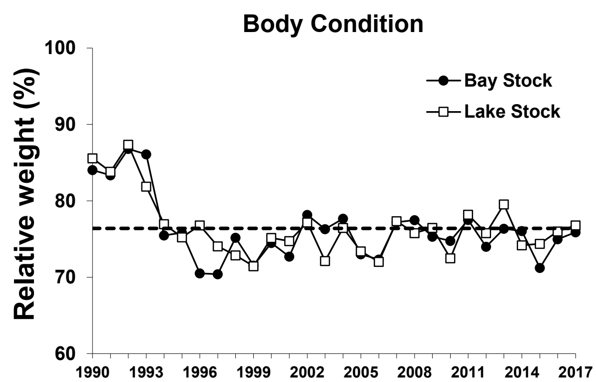


FIG. 3.3.4. **Lake Whitefish** (Lake Ontario and Bay of Quinte spawning stocks and sexes combined) relative weight (see [1]Rennie et al. 2008), 1990-2017.

[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.*

3.4 Cisco Commercial Catch Sampling

J. A. Hoyle, Lake Ontario Management Unit

Cisco appear to have increased in abundance in recent years (see Section 1.2 and 1.3). A small incidental commercial harvest of Cisco occurs in quota zone 1-3 where the species is taken in the fall Lake Whitefish targeted fishery. A sample of Cisco was taken in this fishery to examine age-class composition.

In total, fork length was measured for 592 fish and age was interpreted using otoliths for 109 fish (Fig. 3.4.1).

The mean fork length and age of Cisco harvested during the impoundment gear fishery in quota zone 1-3 were 327 mm and 4.3 years respectively (Fig. 3.4.1). Fish ranged from ages 2 -15 years. The most abundant age-classes in the fishery were aged 3 and 4 years which together comprised 78% of the harvest by number. Age-3 fish from the 2014 year-class were very numerous.

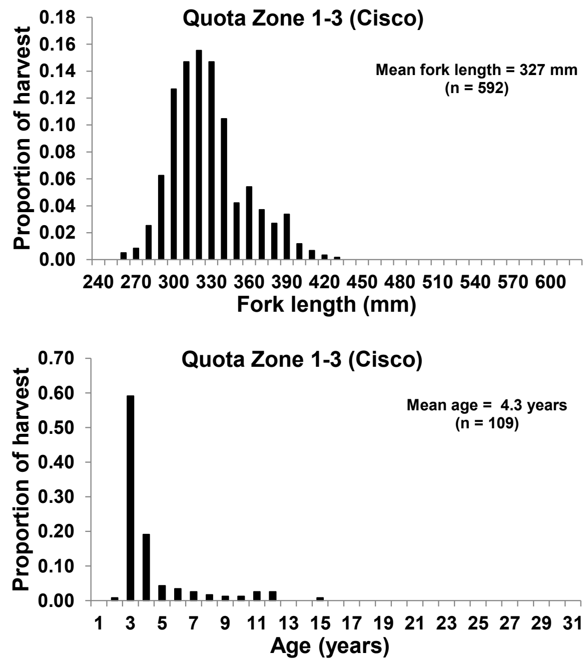


FIG. 3.4.1. Size and age distribution (by number) of **Cisco** sampled in quota zone 1-3 during the 2017 commercial catch sampling program.

4. Age and Growth Summary

S. Kranzl and J. A. Hoyle, 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. Coded wire tags, embedded in the nose of fish prior to stocking, are sometimes employed to uniquely identify individual fish (e.g., to determine stocking location and year, when recovered). In 2017, a total of 3,051 structures were processed from 11 different field projects (Table 4.1).

TABLE 4.1. Project-specific summary of age and growth structures interpreted for age (n=3,051) in support of 11 different Lake Ontario Management Unit field projects, 2017 (CWT, Code Wire Tags).

Project	Species	Structure	n
Ganaraska Rainbow Trout Assessment			
	Rainbow Trout	Scales	103
Lake Ontario and Bay of Quinte Community Index Gillnetting			
	Walleye	Otoliths	625
	Lake Whitefish	Otoliths	33
	Lake Trout	Otoliths	106
	Cisco	Otoliths	159
	Lake Trout	CWT	81
Lake Ontario and Bay of Quinte Community Index Trawling			
	Walleye	Otoliths	4
	Walleye	Scales	130
Prince Edward Bay Nearshore Community Index Netting			
	Northern Pike	Cleithra	30
	Chain Pickerel	Cleithra	1
	Pumpkinseed	Scales	30
	Bluegill	Scales	7
	Smallmouth Bass	Scales	39
	Largemouth Bass	Scales	21
	Black Crappie	Scales	23
	Yellow Perch	Scales	12
	Walleye	Otoliths	8
Upper Bay of Quinte Nearshore Community Index Netting			
	Northern Pike	Cleithra	22
	Pumpkinseed	Scales	34
	Bluegill	Scales	46
	Smallmouth Bass	Scales	17
	Largemouth Bass	Scales	33
	Black Crappie	Scales	34
	Yellow Perch	Scales	27
	Walleye	Otoliths	37

TABLE 4.1. *continued.*

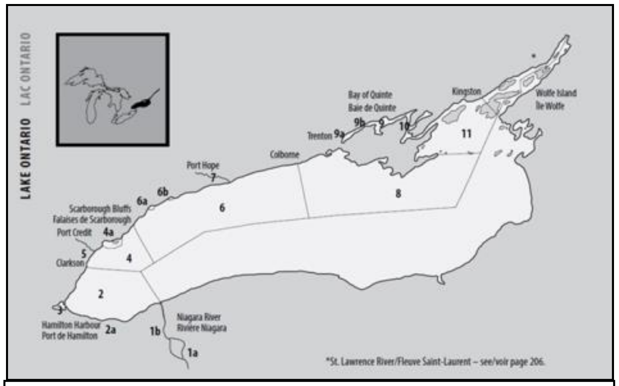
Project	Species	Structure	n
East Lake Nearshore Community Index Netting			
	Northern Pike	Cleithra	5
	Pumpkinseed	Scales	29
	Bluegill	Scales	31
	Smallmouth Bass	Scales	3
	Largemouth Bass	Scales	29
	Black Crappie	Scales	1
	Yellow Perch	Scales	21
	Walleye	Otoliths	14
Bay of Quinte On Water Creel			
	Largemouth Bass	Scales	95
	Walleye	Scales	364
Thousand Islands Community Index Netting			
	Northern Pike	Cleithra	21
	Smallmouth Bass	Scales	82
	Largemouth Bass	Scales	16
	Yellow Perch	Scales	75
	Walleye	Otoliths	18
Credit River Chinook Assessment and Egg Collection			
	Chinook Salmon	Otoliths	51
Ganaraska Chinook Assessment and Egg Collection			
	Chinook Salmon	Otoliths	59
Commercial Catch Sampling			
	Lake Whitefish	Otoliths	195
	Cisco	Otoliths	109
Total			3051

5. Contaminant Monitoring

S. Kranzl and J. A. Hoyle, Lake Ontario Management Unit

Lake Ontario Management Unit (LOMU) cooperates annually with several agencies to collect fish samples for contaminant testing. In 2017, 328 contaminant samples were collected for Ontario's Ministry of the Environment and Climate Change (MOECC) Guide to Eating Ontario Fish 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 MOECC from 2000 to 2017 is shown in Table 5.2.



9. Upper Bay of Quinte – open water from Trenton to County Road 49 Bridge
10. Middle Bay of Quinte – from County Road 49 Bridge to Glenora
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 5.1. Number of fish samples provided to MOECC for contaminant analysis, by region and species, 2017.

Region	Block	Species	Total
Upper Bay of Quinte	9	Channel Catfish	10
		Common Carp	8
		Cisco	10
		Freshwater Drum	10
		Gizzard Shad	10
		Lake Whitefish	2
		Northern Pike	5
		Pumpkinseed	10
		Smallmouth Bass	7
		Walleye	9
		Yellow Perch	10
		White Sucker	10
Middle Bay of Quinte	10	Cisco	10
		Freshwater Drum	5
		Lake Whitefish	1
		Northern Pike	5
		Walleye	10
		Yellow Perch	10
		White Sucker	10
Lower Bay of Quinte/ Eastern Lake Ontario	11	Freshwater Drum	3
		Lake Trout	10
		Lake Whitefish	8
		Northern Pike	10
		Pumpkinseed	10
		Smallmouth Bass	10
		Walleye	10
		Yellow Perch	10
		White Sucker	10
Thousand Islands area	12	Largemouth Bass	4
		Northern Pike	15
		Rock Bass	20
		Smallmouth Bass	20
		Walleye	16
		Yellow Perch	20
Total			328

TABLE 5.2. Summary of the number of fish samples collected, by species, for contaminant analysis by the MOECC, 2000 - 2017.

	Year																	
Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Black Crappie			20	20	3	20		20		20	29			35	2	14		
Bluegill		26		20	10	23			102	88		40	40	3		10		
Brown Bullhead		40	44	40	25	30	33	40	68	63	56	81	34	78	53	52		
Brown Trout	40	3	20		31		22	6	29	34	34	12	20	6	10	1		
Channel Catfish	20	20	7	23		17				8		15	20	4	10			10
Chinook Salmon	40	3	16		48		29	1	36		39	1	21	6	19	2		
Cisco																18		20
Coho Salmon		1	3															
Common Carp				7													14	8
Freshwater Drum			43		16		13	2	32	20	37			42	2		12	18
Gizzard Shad																	7	10
Lake Trout			42		54		38	17	46	20	33	13	18	20	49	10	28	10
Lake Whitefish	20													20	17	19	8	11
Largemouth Bass		4	25	28	20	9	8	89	26	40	28	55	20	11	7	18	20	4
Northern Pike		53	39	60	22	40	22	94	35	28	31	20	34	47	16	18	24	35
Pumpkinseed		60	25	57	8	11	23	78	92	105	19	43	31	14			15	20
Rainbow Smelt																3		
Rainbow Trout	40	37	28	20	37	20	29	20	21	20	33		1	22		20		
Rock Bass		36	30	38	11	21	27	30	20	40	42	80	5	24			20	20
Silver Redhorse							1											
Smallmouth Bass		20	87	22	21	28	35	23	39	40	31	58	15	19	20	20	25	37
Walleye		42	51	40	61	30	62	98	61	40	70	71	24	73	59	67	56	45
White Bass											20							
White Perch		40		40	40	14	21	20	35	20	7			40	8	11	4	
White Sucker							1								25	7	21	30
Yellow Perch	20	60	66	58	75	40	86	90	60	91	80	20	44	81	22	20	39	50
Total	180	445	546	473	482	303	450	628	702	677	589	509	327	545	319	310	293	328

6. Stocking Program

6.1 Stocking Summary

C. Lake , Lake Ontario Management Unit

In 2017, MNRF stocked approximately 2 million fish into Lake Ontario (Table 6.1.1; Fig. 6.1.1). This number of fish equaled approximately 47,700 kilograms of biomass added to the Lake (Fig. 6.1.1). Figure 6.1.2 shows stocking trends in the Ontario waters of Lake Ontario from 1968 to 2017. Table 6.1.2 provides detailed information on fish stocking by both species and life-stage for 2017.

A total of 495,685 (4,080 kg) Chinook Salmon spring fingerlings were stocked at various locations to provide put-grow-and-take fishing opportunities. This was slightly higher than the new interim target of 470,000 (25,685, or 5.5% over-target). The new target was set based on a 20% reduction from our previous target of 600,000. The new target was reduced by a further 10,000 to offset an increased allocation to the net pen program. The stocking reduction was done as a precaution in response to projected poor Alewife year-classes. Although we were slightly over our Chinook target for 2017, we only stocked 50% of our Coho target (see below).

All Chinook Salmon for the Lake Ontario program were produced at Normandale Fish Culture Station. About 235,000 (47% of total stocking) Chinook Salmon were held in pens at eight sites in Lake Ontario for a short period of time prior to stocking. It is expected that pen-imprinting will help improve returns of mature adults to these areas in the fall, thereby enhancing local near shore and tributary fishing opportunities. See section 6.2 for a detailed report of the 2017 net pen program.

Atlantic Salmon were stocked in support of an ongoing program to restore self-sustaining populations of this native species to the Lake Ontario basin (Section 8.2). Approximately 411,000 (14,899 kg) Atlantic Salmon of various life stages were stocked in 2017 into various

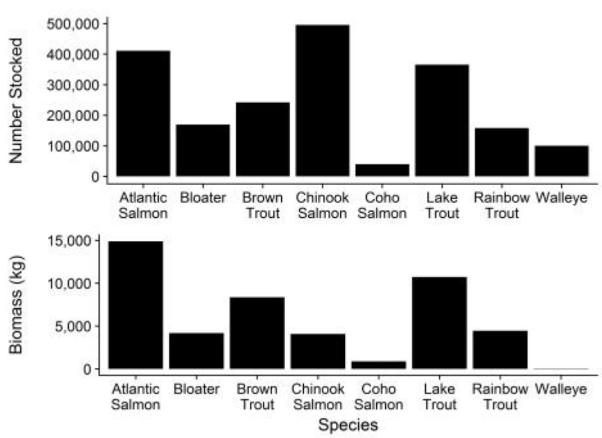


FIG. 6.1.1. TOP: Number of fish stocked into the Ontario waters of Lake Ontario in 2017. Total=1,982,508 fish. BOTTOM: Biomass of fish stocked into the Ontario waters of Lake Ontario in 2017. Total = 47,745 kg.

TABLE 6.1.1. Fish stocked into the Ontario waters of Lake Ontario in 2017, and targets for 2018. Numbers reflect both MNRF-produced fish, and those raised by community groups. Specific details can be found in Table 6.1.2.

Species	Life Stage	2017	2018
Atlantic Salmon	Spring Fingerling	184,218	300,000
	Fall Fingerling	80,359	89,500
	Spring Yearling	142,312	107,000
	Adult	4,316	
	Atlantic Salmon Total	411,205	496,500
Bloater	Sub Adult	53,969	
	Fall Yearling	115,428	250,000
	Adult	93	
	Bloater Total	169,490	250,000
Brown Trout	Spring Fingerling	50,000	50,000
	Spring Yearling	173,741	165,000
	Fall Yearling	18,600	
	Brown Trout Total	242,341	215,000
Chinook Salmon	Spring Fingerling	495,685	470,000
Coho Salmon	Fall Fingerling	40,110	80,000
Lake Trout	Fall Fingerling	19,878	
	Spring Yearling	345,559	352,000
	Lake Trout Total	365,437	352,000
Rainbow Trout	Spring Yearling	157,084	158,000
	Sub Adult	1,097	
	Rainbow Trout Total	158,181	158,000
Walleye	Non-feeding Fry [1]	1,080,000	1,000,000
	Summer Fingerling	100,059	100,000
	Walleye Total	100,059	100,000
Grand Total		1,982,508	2,121,500

[1] Non-feeding fry not included in totals.

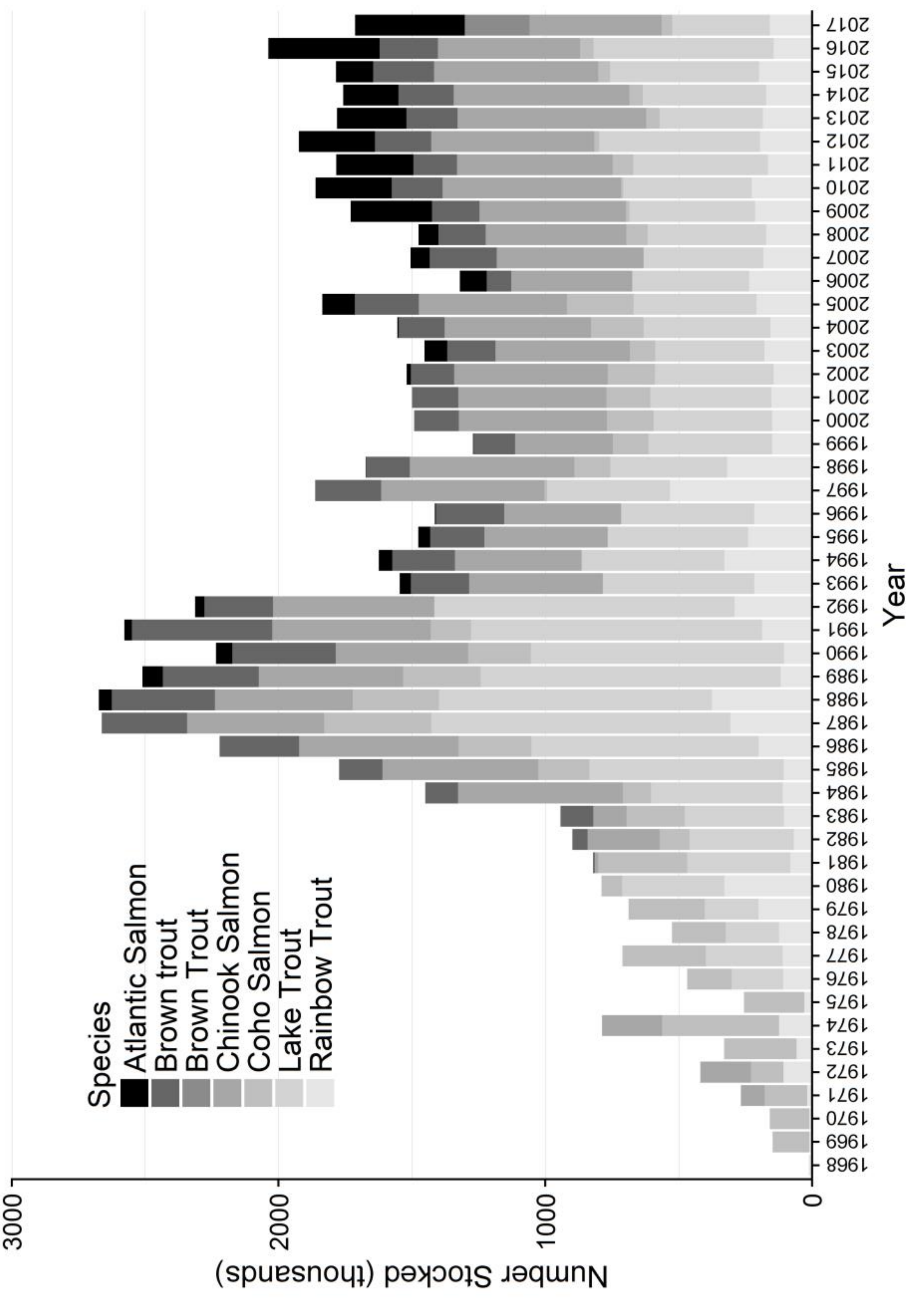


FIG. 6.1.2. Trends in salmon and trout stocking in the Ontario waters of Lake Ontario; 1968 – 2017.

tributaries including: Credit River, Duffins Creek and Cobourg Brook. For the second consecutive year, the Ganaraska River was stocked with advanced life stages (spring yearlings and older), with the goal of establishing a fishery. MNRF is working cooperatively with the Ontario Federation of Anglers and Hunters and a network of other partners to plan and deliver this phase of Atlantic Salmon restoration, including setting stocking targets to help meet program objectives. Atlantic Salmon are produced at both MNRF and partner facilities. Three Atlantic Salmon brood stocks from different source populations in Nova Scotia, Quebec and Maine are currently housed at MNRF's Harwood and Normandale Fish Culture Stations. All fish have been genotyped to facilitate follow-up assessment on stocked fish and their progeny in the wild.

Over 365,000 (10,726 kg) Lake Trout spring yearlings were stocked in the spring of 2017 as part of an established, long-term rehabilitation program, supporting of the Lake Trout Stocking Plan (Section 8.5). Three strains, originating from Seneca Lake, Slate Islands and Michipicoten Island are stocked as part of our annual target. The 2017 target was reduced by 20% in anticipation of possible poor Alewife year classes.

Approximately 170,000 (4,186 kg) Bloater were stocked in 2017. This small relative of the Lake Whitefish was an important prey item for Lake Trout until the late 1950's when both species were extirpated. A coordinated program involving staff from the US and Canada resulted in the initial stocking of approximately 15,000 Bloater in 2013. MNRF Fish Culture Section staff continue to work with our partner agencies to advance our understanding of the complicated process of rearing Bloater. See section 8.4 for a detailed description of this restoration effort.

Rainbow Trout (158,000; 4,457 kg) and Brown Trout (242,000; 8,466 kg) were stocked at various locations to support shore and boat fisheries. Community hatcheries contribute to the stocking of both of these species – see Table 6.1.2 for details. Coho Salmon were produced by stocking partners Metro East Anglers (approximately 40,000 fall fingerlings; 885 kg) and the Credit River Angler Association (110 fall fingerlings).

Walleye were stocked into Toronto Harbour in an effort to re-establish this native, predatory fish and to promote urban, near-shore angling. Walleye stocking is planned to alternate annually between Toronto Harbour and Hamilton Harbour (first stocked in 2012). Toronto Harbour received approximately 1,000,000 Walleye fry in the spring of 2017, followed by over 100,000 fingerlings stocked in July.

MNRF remains committed to providing diverse fisheries in Lake Ontario and its tributaries, based on wild and stocked fish, as appropriate. Detailed information about MNRF's 2017 stocking activities is found in Table 6.1.2.

FIG. 6.1.2. Fish stocked in the Ontario waters of Lake Ontario and its tributaries during 2017.

Species	Lifestage	Waterbody	Site	Month Stocked	Hatchery	Strain	Age (Months)	Weight (g)	Biomass (kg)	Marks	Number
ATLANTIC SALMON											
Atlantic Salmon	Spring Fingerling	Cobourg Br.	Ball's Mill	5	Normandale	Sebago	6	5	111	-	20,787
Atlantic Salmon	Spring Fingerling	Cobourg Br.	Hie - McNichol Properties	5	Normandale	LaHave	5	3	36	-	10,235
Atlantic Salmon	Spring Fingerling	Credit R.	Black Cr. - 6th Line	5	Normandale	LaHave	5	3	46	-	15,000
Atlantic Salmon	Spring Fingerling	Credit R.	Ellie's Ice Cream Parlour	5	Normandale	LaHave	5	3	52	-	14,982
Atlantic Salmon	Spring Fingerling	Credit R.	Forks of the Credit	5	Normandale	LaHave	5	3	39	-	12,490
Atlantic Salmon	Spring Fingerling	Credit R.	Forks of the Credit - Meadow	5	Normandale	Lac Saint-Jean	6	1	2	-	2,191
Atlantic Salmon	Spring Fingerling	Credit R.	Forks of the Credit - Meadow	5	Normandale	Sebago	6	6	117	-	19,934
Atlantic Salmon	Spring Fingerling	Credit R.	Forks of the Credit - Stuck Truck	5	Normandale	LaHave	5	2	35	-	15,690
Atlantic Salmon	Spring Fingerling	Credit R.	Forks of the Credit Provincial Park	5	Belfountain Hatchery	LaHave	2	-	1	-	2,727
Atlantic Salmon	Spring Fingerling	Credit R.	West Credit - Belfountain	5	Belfountain Hatchery	LaHave	2	-	1	-	3,027
Atlantic Salmon	Spring Fingerling	Credit R.	West Credit - Belfountain	5	Normandale	LaHave	5	3	50	-	14,988
Atlantic Salmon	Spring Fingerling	Credit R.	West Credit - Shaw's Creek Rd.	5	Belfountain Hatchery	LaHave	2	-	1	-	2,491
Atlantic Salmon	Spring Fingerling	Credit R.	West Credit - Winston Churchill Blvd.	5	Belfountain Hatchery	LaHave	2	-	1	-	3,377
Atlantic Salmon	Spring Fingerling	Duffins Cr.	East Duffins Cr. - Claremont Field Centre	5	Normandale	LaHave	5	3	43	-	15,006
Atlantic Salmon	Spring Fingerling	Duffins Cr.	East Duffins Crk. - Durham Outdoor Centre	5	Normandale	LaHave	5	2	19	-	9,985
Atlantic Salmon	Spring Fingerling	Duffins Cr.	West Duffins Cr. - Sideline 32	5	Normandale	LaHave	5	4	36	-	9,995
Atlantic Salmon	Spring Fingerling	Duffins Cr.	West Duffins Cr. - Sideline 32	5	Normandale	Sebago	6	7	77	-	11,313
						Sub total:			**667**		**184,218**
Atlantic Salmon	Fall Fingerling	Cobourg Br.	Danforth Rd.	10	Normandale	LaHave	9	44	664	-	15,000
Atlantic Salmon	Fall Fingerling	Credit R.	Eldorado Park	10	Normandale	LaHave	9	38	590	AD	15,095
Atlantic Salmon	Fall Fingerling	Credit R.	Norval	10	Normandale	LaHave	9	35	171	-	4,876
Atlantic Salmon	Fall Fingerling	Credit R.	Terra Cotta	10	Normandale	LaHave	9	39	605	AD	14,995
Atlantic Salmon	Fall Fingerling	Duffins Cr.	East Duffins Cr. - 5th Conc.	10	Normandale	LaHave	9	43	740	-	16,392
Atlantic Salmon	Fall Fingerling	Duffins Cr.	West Duffins Cr. - Wixon Cr.	10	Normandale	LaHave	9	44	143	-	2,997
Atlantic Salmon	Fall Fingerling	Duffins Cr.	West Duffins Cr. - Wixon Cr.	10	Normandale	Sebago	10	33	367	-	11,004
						Sub total:			**3,280**		**80,359**
Atlantic Salmon	Spring Yearling	Cobourg Br.	Danforth Rd.	4	Normandale	LaHave	15	50	401	-	7,959
Atlantic Salmon	Spring Yearling	Cobourg Br.	Division St.	4	Normandale	LaHave	15	67	241	-	3,595
Atlantic Salmon	Spring Yearling	Cobourg Br.	Hie - McNichol Properties	4	Normandale	LaHave	15	65	240	-	3,674
Atlantic Salmon	Spring Yearling	Credit R.	Eldorado Park	4	Normandale	Lac Saint-Jean	16	31	113	AD	3,694
Atlantic Salmon	Spring Yearling	Credit R.	Eldorado Park	3	Normandale	LaHave	15	55	387	-	6,994
Atlantic Salmon	Spring Yearling	Credit R.	Eldorado Park	4	Normandale	LaHave	15	45	133	AD	2,938
Atlantic Salmon	Spring Yearling	Credit R.	Glen Williams	4	Normandale	LaHave	15	59	410	-	7,002
Atlantic Salmon	Spring Yearling	Credit R.	Inglewood	3	Normandale	LaHave	15	54	381	-	7,006
Atlantic Salmon	Spring Yearling	Credit R.	Norval	7	Credit River Anglers Assoc.	LaHave	12	29	176	-	5,814
Atlantic Salmon	Spring Yearling	Credit R.	Norval	4	Normandale	LaHave	15	62	417	-	7,201
Atlantic Salmon	Spring Yearling	Credit R.	Norval	10	Normandale	Sebago	10	42	434	-	11,106
Atlantic Salmon	Spring Yearling	Credit R.	Norval	4	Normandale	Sebago	16	78	183	AD	2,349
Atlantic Salmon	Spring Yearling	Credit R.	Paper Mill	6	Credit River Anglers Assoc.	LaHave	18	30	105	-	3,495
Atlantic Salmon	Spring Yearling	Credit R.	Terra Cotta	3	Normandale	LaHave	15	50	353	-	7,003
Atlantic Salmon	Spring Yearling	Duffins Cr.	East Duffins Cr. - 5th Conc.	4	Normandale	LaHave	15	59	417	-	7,089
Atlantic Salmon	Spring Yearling	Duffins Cr.	East Duffins Cr. - Paulynn Park	4	Normandale	LaHave	15	65	400	-	6,198
Atlantic Salmon	Spring Yearling	Ganaraska R.	Newtonville Rd.	3	Ringwood (OFAH 2006)	LaHave	16	110	119	AD	1,085
Atlantic Salmon	Spring Yearling	Ganaraska R.	Newtonville Rd.	3	Ringwood (OFAH 2006)	Sebago	16	110	101	AD	915
Atlantic Salmon	Spring Yearling	Ganaraska R.	Shiloh Rd.	4	Normandale	Lac Saint-Jean	17	47	366	AD	7,964
Atlantic Salmon	Spring Yearling	Ganaraska R.	Shiloh Rd.	4	Normandale	Sebago	16	67	1,806	AD	27,231
Atlantic Salmon	Spring Yearling	Ganaraska R.	Shiloh Rd.	3	Ringwood (OFAH 2006)	LaHave	16	110	716	AD	6,510
Atlantic Salmon	Spring Yearling	Ganaraska R.	Shiloh Rd.	3	Ringwood (OFAH 2006)	Sebago	16	110	604	AD	5,490
						Sub total:			**8,503**		**142,312**
ATLANTIC SALMON (continued)											
Atlantic Salmon	Adult	Credit R.	Forks of the Credit	4	Normandale	Lac Saint-Jean	28	430	246	AD	572
Atlantic Salmon	Adult	Credit R.	Forks of the Credit - Stuck Truck	5	Normandale	Lac Saint-Jean	39	2,429	165	-	68
Atlantic Salmon	Adult	Credit R.	Forks of the Credit Provincial Park	4	Normandale	Lac Saint-Jean	28	454	246	AD	543
Atlantic Salmon	Adult	Credit R.	Grange Sideroad	4	Normandale	Lac Saint-Jean	28	454	232	AD	511

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FIG. 6.1.2. Fish stocked in the Ontario waters of Lake Ontario and its tributaries during 2017 *continued*.

Species	Lifestage	Waterbody	Site	Month Stocked	Hatchery	Strain	Age (Months)	Weight (g)	Biomass (kg)	Marks	Number
Atlantic Salmon	Adult	Credit R.	McLaren Rd.	4	Normandale	Lac Saint-Jean	28	430	262	AD	608
Atlantic Salmon	Adult	Credit R.	West Credit - Shaw's Creek Rd.	4	Normandale	Lac Saint-Jean	46	2,544	262	-	110
Atlantic Salmon	Adult	Humber R.	King Vaughan Line	4	Harwood	Lac Saint-Jean	55	1,832	188	-	101
Atlantic Salmon	Adult	Ontario, L.	Port Dalhousie East	12	Normandale	Sebago	24	472	848	AD	1,803
						Sub total:			**2,449**		**4,316**
								Spring Fingerling:	667		184,218
								Fall Fingerling:	3,280		80,359
								Spring Yearling:	8,503		142,312
								Adult:	2,449		4,316
						Atlantic Salmon Total:			**14,899**		**411,205**
BLOATER											
Bloater	Fall Yearling	Ontario, L.	Cobourg - 100	11	Chatsworth	Lake Michigan	19	22	1,192	-	54,021
Bloater	Fall Yearling	Ontario, L.	Cobourg - 100	11	Harwood	Lake Michigan	19	27	1,671	-	61,407
						Sub total:			**2,863**		**115,428**
Bloater	Sub Adult	Ontario, L.	Cobourg - 100	11	White Lake	Lake Michigan	20	24	997	-	41,502
Bloater	Sub Adult	Ontario, L.	Main Duck Isl.	11	White Lake	Lake Michigan	24	74	306	-	12,467
Bloater	Adult	Ontario, L.	Main Duck Isl.	8	White Lake	Lake Michigan	52	228	20	-	93
						Sub total:			**1,323**		**54,062**
								Fall Yearling:	2,863		115,428
								Sub Adult and Adults:	1,323		54,062
						Bloater Total:			**4,186**		**169,490**
BROWN TROUT											
Brown Trout	Spring Fingerling	Ontario, L.	Finkle's Shore Ramp	6	Springside Park Hatchery	Ganaraska River	6	2	50	-	25,000
Brown Trout	Spring Fingerling	Ontario, L.	Millhaven Wharf	6	Springside Park Hatchery	Ganaraska River	6	2	50	-	25,000
						Sub total:			**100**		**50,000**
Brown Trout	Spring Yearling	Ontario, L.	Athol Bay	3	Chatsworth	Ganaraska River	15	48	2,125	-	44,298
Brown Trout	Spring Yearling	Ontario, L.	Bronte Harbour	3	Chatsworth	Ganaraska River	15	45	1,725	-	37,979
Brown Trout	Spring Yearling	Ontario, L.	Humber Bay Park	3	Chatsworth	Ganaraska River	15	48	885	-	18,410
Brown Trout	Spring Yearling	Ontario, L.	Lakefront Promenade	3	Chatsworth	Ganaraska River	15	48	1,750	-	36,406
Brown Trout	Spring Yearling	Ontario, L.	Port Dalhousie East	3	Chatsworth	Ganaraska River	15	41	1,500	-	36,648
						Sub total:			**7,985**		**173,741**
Brown Trout	Fall Yearling	Credit R.	Norval	11	Credit River Anglers Assoc.	Ganaraska River	12	28	31	-	1,100
Brown Trout	Fall Yearling	Ontario, L.	Whitby Harbour	10	Ringwood (OFAH 2006)	Ganaraska River	10	20	350	-	17,500
						Sub total:			**381**		**18,600**
								Spring Fingerling:	100		50,000
								Spring Yearling:	7,985		173,741
								Fall Yearling:	381		18,600
						Brown Trout Total:			**8,466**		**242,341**
Chinook Salmon											
Chinook Salmon	Spring Fingerling	Bronte Cr.	2nd Side Road Bridge	5	Normandale	Lake Ontario	5	9	163	-	18,999
Chinook Salmon	Spring Fingerling	Bronte Cr.	4th Side Road Bridge	5	Normandale	Lake Ontario	5	8	401	-	51,146
Chinook Salmon	Spring Fingerling	Credit R.	Eldorado Park	4	Normandale	Ganaraska River	5	6	343	AD	54,026
Chinook Salmon	Spring Fingerling	Credit R.	Eldorado Park	4	Normandale	Lake Ontario	5	7	161	-	23,790
Chinook Salmon	Spring Fingerling	Credit R.	Norval	4	Normandale	Lake Ontario	5	6	502	-	77,838
Chinook Salmon	Spring Fingerling	Hamilton Harbour	Grindstone Cr.	5	Normandale	Lake Ontario	5	8	11	-	1,476
Chinook Salmon	Spring Fingerling	Hamilton Harbour	Grindstone Cr.	5	Normandale	Lake Ontario	5	9	133	-	15,479

Continued on next page

FIG. 6.1.2. Fish stocked in the Ontario waters of Lake Ontario and its tributaries during 2017 *continued*.

Species	Lifestage	Waterbody	Site	Month Stocked	Hatchery	Strain	Age (Months)	Weight (g)	Biomass (kg)	Marks	Number
Chinook Salmon	Spring Fingerling	Highland Cr.	Colonel Danforth Park	5	Normandale	Lake Ontario	5	8	150	-	17,752
						Sub total:			**1,864**		**260,506**
Chinook Salmon	Spring Fingerling	Ontario, L.	Bluffer's Park - Netpen	5	Ontario, L.	Lake Ontario	6	11	513	-	44,981
Chinook Salmon	Spring Fingerling	Ontario, L.	Bronte Harbour - Netpen	5	Ontario, L.	Lake Ontario	6	8	127	-	15,082
Chinook Salmon	Spring Fingerling	Ontario, L.	Oshawa Harbour - Netpen	5	Ontario, L.	Lake Ontario	6	12	308	-	25,054
Chinook Salmon	Spring Fingerling	Ontario, L.	Port Credit Marina - Netpen	5	Ontario, L.	Lake Ontario	6	9	88	-	10,009
Chinook Salmon	Spring Fingerling	Ontario, L.	Port Dalhousie East - Netpen	5	Ontario, L.	Lake Ontario	6	8	451	-	60,029
Chinook Salmon	Spring Fingerling	Ontario, L.	Port Darlington - Netpen	5	Ontario, L.	Lake Ontario	6	10	243	-	25,002
Chinook Salmon	Spring Fingerling	Ontario, L.	Wellington Channel - Netpen	5	Ontario, L.	Lake Ontario	6	8	231	-	30,021
Chinook Salmon	Spring Fingerling	Ontario, L.	Whitby Harbour - Netpen	5	Ontario, L.	Lake Ontario	6	10	255	-	25,001
						Sub total:			**2,216**		**235,179**
								Direct stocking:	1,864		260,506
								Net Pen:	2,216		235,179
						Chinook Salmon Total:			**4,080**		**495,685**
Coho Salmon											
Coho Salmon	Fall Fingerling	Credit R.	Norval	11	Credit River Anglers Assoc.	Lake Ontario	12	44	5	AD	110
Coho Salmon	Fall Fingerling	Credit R.	Norval	10	Ringwood (OFAH 2006)	Lake Ontario	10	22	880	AD	40,000
						Coho Salmon Total:			**885**		**40,110**
Lake Trout											
Lake Trout	Fall Fingerling	Ontario, L.	Amherst Island	11	Harwood	Seneca Lake	9	21	425	LVAD	19,878
						Sub total:			**425**		**19,878**
Lake Trout	Spring Yearling	Ontario, L.	Amherst Island	4	White Lake	Seneca Lake	15	22	1,516	RPAD	68,905
Lake Trout	Spring Yearling	Ontario, L.	Brighton - Offshore	4	Harwood	Seneca Lake	14	36	1,831	RPAD	50,202
Lake Trout	Spring Yearling	Ontario, L.	Cobourg Harbour Pier	4	North Bay	Seneca Lake	14	28	1,855	RPAD	65,097
Lake Trout	Spring Yearling	Ontario, L.	Cobourg Harbour Pier	4	North Bay	Slate Island	14	28	1,197	RPAD	42,155
Lake Trout	Spring Yearling	Ontario, L.	Jordan Harbour	3	Chatsworth	Seneca Lake	15	30	2,050	RPAD	69,015
Lake Trout	Spring Yearling	Ontario, L.	Main Duck Isl.	4	Harwood	Seneca Lake	14	39	1,012	RPAD	26,185
Lake Trout	Spring Yearling	Ontario, L.	Pt. Petre	4	Harwood	Seneca Lake	14	35	840	RPAD	24,000
						Sub total:			**10,301**		**345,559**
								Fall Fingerling:	425		19,878
								Spring Yearling:	10,301		345,559
						Lake Trout Total:			**10,726**		**365,437**
Rainbow Trout											
Rainbow Trout	Spring Yearling	Bronte Cr.	2nd Side Road Bridge	5	Harwood	Ganaraska River	12	19	292	-	15,004
Rainbow Trout	Spring Yearling	Bronte Cr.	4th Side Road Bridge	5	Harwood	Ganaraska River	12	20	297	-	14,999
Rainbow Trout	Spring Yearling	Credit R.	Eldorado Park	5	Harwood	Ganaraska River	12	28	710	-	25,000
Rainbow Trout	Spring Yearling	Credit R.	Norval	3	Credit River Anglers Assoc.	Ganaraska River	14	56	189	-	4,925
Rainbow Trout	Spring Yearling	Credit R.	Norval	5	Harwood	Ganaraska River	12	29	724	-	24,992
Rainbow Trout	Spring Yearling	Humber R.	East Branch Islington	5	Harwood	Ganaraska River	12	20	318	-	15,905
Rainbow Trout	Spring Yearling	Humber R.	King Vaughan Line	4	Harwood	Ganaraska River	12	27	405	-	15,000
Rainbow Trout	Spring Yearling	Ontario, L.	Port Dalhousie East	5	Harwood	Ganaraska River	12	30	702	-	23,759
Rainbow Trout	Spring Yearling	Rouge R.	Robinson Cr.	5	Ringwood (OFAH 2006)	Ganaraska River	11	25	438	-	17,500
						Sub total:			**4,075**		**157,084**

Continued on next page

FIG. 6.1.2. Fish stocked in the Ontario waters of Lake Ontario and its tributaries during 2017 *continued*.

Species	Lifestage	Waterbody	Site	Month Stocked	Hatchery	Strain	Age (Months)	Weight (g)	Biomass (kg)	Marks	Number
Rainbow Trout	Sub Adult	Credit R.	Eldorado Park	6	Harwood	Ganaraska River	24	348	174	-	500
Rainbow Trout	Sub Adult	Credit R.	Norval	6	Harwood	Ganaraska River	24	348	208	-	597
						Sub total:			**382**		**1,097**
								Spring Yearling:	4,075		157,084
								Sub Adult:	382		1,097
						Rainbow Trout Total:			**4,457**		**158,181**
Walleye											
Walleye	Non-feeding Fry	Ontario, L.	Toronto Harbour - Unwin Ave.	5	White Lake	Bay of Quinte	1	-	11	-	1,080,000
Walleye	Summer Fingerling	Ontario, L.	Toronto Harbour - Polson St.	7	White Lake	Bay of Quinte	3	-	46	-	100,059
					Walleye Total (not including non-feeding fry):				**46**		**100,059**

6.2 Chinook Salmon Net Pen Imprinting Project

C. Lake, Lake Ontario Management Unit

The net pen is a floating enclosure that is tied to a pier or other nearshore structure, and is used to temporarily house and acclimatize young Chinook Salmon prior to their release. The fish are held in the net pens for approximately 4-5 weeks, and are managed by local angler groups, who monitor the health of the fish and ensure 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.

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 conducted by the New York Department of Environmental Conservation (NYSDEC). As a result of their time in the net pens as young fish, it is expected that mature fish will return to the area and provide a quality near shore fall fishery for anglers.

Net pens were first used in the Ontario waters of Lake Ontario in 2003, when pens were installed in Barcovan and Wellington. Beginning in 2008, the program expanded west across a number of locations. The program has evolved over the years, with some sites dropped while other sites have been added or expanded. A thorough review of the history of the program was described in the 2014 Annual Report.

2017 Net Pen Program

A total of 235,179 Chinook Salmon were held at 8 sites (18 net pens) in 2017. This represents 47% of the total number stocked (495,685; Fig. 6.2.1a). Overall, fish growth and health was reported as good, with few mortalities. Fish were delivered to the pens at 3.8 g and weighed 9.45 g when released 33 days later (average values across all pen sites). Table 6.2.1 shows site-specific details on fish size, duration of penning, and numbers released. Combination temperature/dissolved oxygen data loggers were deployed into one net pen per site so that the health and growth of the fish can be better understood. Degree days, a metric that incorporates site temperature and length of time in the pen, was calculated and included in Table 6.2.1. Examining degree days helps make between-site comparisons easier when looking at fish growth.

The net pen program has increased considerably over the years, with more net pen sites and a greater percentage of Chinook Salmon allocated to the program. In order to ensure good fish health and growth, a maximum density of 32

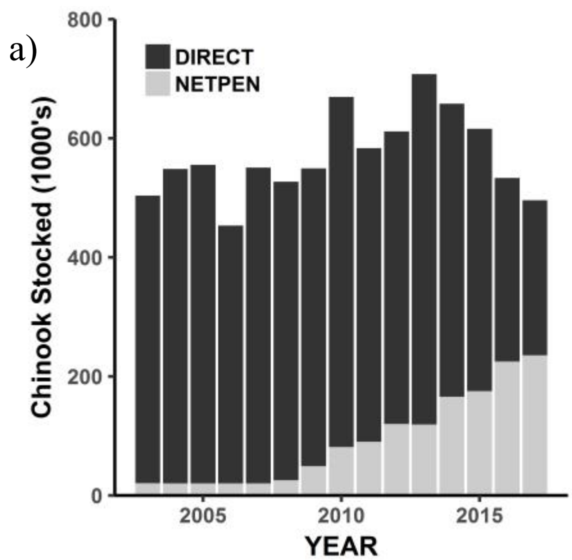

FIG. 6.2.1a. Number of Chinook Salmon released (2003-2017) from Ontario net pens versus those stocked directly.

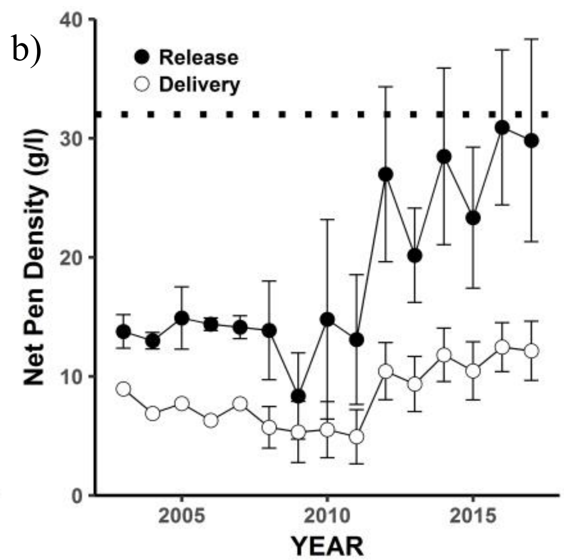

FIG. 6.2.1b. Average density (g/l) of Chinook Salmon held per net pen. The guideline of 32 g/l is represented by the dashed line.

g/l (grams of fish per liter of water) is used as a guide. The volume of the standard net pen is 4000 liters, so the maximum number of 8.0 g fish that should be held in an individual net pen is 16,000. Each location also deploys a temperature-dissolved oxygen sensor into the pen with the Chinook fingerlings for the duration of the project. The loggers are then downloaded and analyzed by MRNF staff. This information helps understand relative growth rates of the fish between various sites, and could be helpful in the event that unusual die-offs occur.

The Ontario program has taken a conservative approach, generally stocking a maximum of 15,000 fish in a pen. Figure 6.2.1b shows the average density of fish (at time of release) in the net pens, with the guideline (32 g/l) denoted by the horizontal dotted line. The average net pen density has been below the guideline every year, but has increased in recent years.

TABLE. 6.2.1. Summary data of the 2017 Chinook Salmon net pen program.

Pen Site	Volunteer Group	# Stocked into pens	Number of pens	Date stocked	Size at stocking (g)	Date released	Days held	Degree days	Size at release (g)	Growth in pen (g)	Mort. (# fish)	Mortality (%)	Number released
Bluffer's Park	MEA	44,981	3	Apr 09	4.1	May 10	32	287	11.4	7.3	0	0%	44,981
Bronte Harbour	HRSTA	15,082	2	Apr 08	4.0	May 07	30	277	8.4	4.4	0	0%	15,082
Oshawa Harbour	MEA	25,054	2	Apr 04	3.8	May 07	34	319	12.3	8.6	0	0%	25,054
Port Credit	PCSTA	10,009	1	Apr 08	4.0	May 06	29	299	8.8	4.8	0	0%	10,009
Port Dalhousie	SCFGC	60,048	4	Apr 06	3.7	May 05	30	251	7.5	3.8	19	0.03%	60,029
Port Darlington	MEA	25,002	2	Apr 05	4.0	May 03	29	264	9.7	5.7	0	0%	25,002
Wellington	CLOSA	30,125	2	Apr 04	3.8	May 04	31	265	7.7	3.9	104	0.35%	30,021
Whitby Harbour	MEA	25,001	2	Apr 05	3.8	May 10	36	358	10.2	6.4	0	0%	25,001
Average		29,413	2.3	-	3.9	-	31	290	9.5	5.6	15	0.05%	29,397
Total		235,302	18	-	-	-			-		123	-	235,179

Volunteer Groups: CLOSA (Central Lake Ontario Salmon Anglers); HRSTA (Halton Region Salmon and Trout Assoc.); MEA (Metro East Anglers); PCSTA (Port Credit Salmon & Trout Assoc.); SCFGC (St. Catharines Fish & Game Club)

7. Stock Status

7.1 Chinook Salmon

M. J. Yuille and J. P. Holden, Lake Ontario Management Unit

Chinook salmon were stocked in Lake Ontario beginning in 1968 to suppress an over-abundant Alewife population, provide a recreational fishery and restore predator-prey balance to the fish community. At present Chinook Salmon are the most sought after species in the main basin recreational fishery, which is supported by a mix of stocked and naturalized fish. Salmon returning to rivers to spawn also support an important shore and tributary fisheries. Ontario's Chinook Salmon stocking levels have remained relatively constant since 1985 (500,000 fish target; Fig. 7.1.1), however cuts to NY stocking rates were agreed upon during lake wide cuts in 1996. In 2017, stocking levels of Chinook Salmon were reduced 20% by both OMNRF and NYSDEC (Sections 6.1). Despite recent stable stocking levels, Chinook Salmon CUE in the Fish Community Index Gill Netting has been variable. Catches in 2017 declined from 2016, but are comparable to catches in 2015 (Fig. 7.1.2).

Chinook Salmon mark and tag monitoring data were reported from five Lake Ontario Management Unit (LOMU) surveys: i) Western Lake Ontario Boat Angling Survey (Section 2.2 of 2016 Annual Report), ii) Chinook Salmon Angling Tournament and Derby Sampling (Section 2.4), iii) Lake Ontario Volunteer Angler Diary Program (Section 2.3 of 2016 Annual Report), iv) Eastern Lake Ontario and Bay of Quinte Fish Community Index Gill Netting (Section 1.2) and v) Credit River Chinook Salmon Spawning Index (Section 1.8). Community Index Gill Netting (Section 1.2) catches small Chinook Salmon and complements the angler based programs that catch larger fish (Fig. 7.1.3).

The year 2016 marked the end of the Chinook Salmon coded wire tag (CWT) study. In general, the maximum age of a Lake Ontario Chinook Salmon is 4 years old. The last stocking event related to the Mark and Tag program was in 2011, thus all fish associated with this program left the Lake Ontario ecosystem in the fall of 2015. New York State Department of Environmental Conservation (NYSDEC) will be collaborating with the Lake Ontario Management

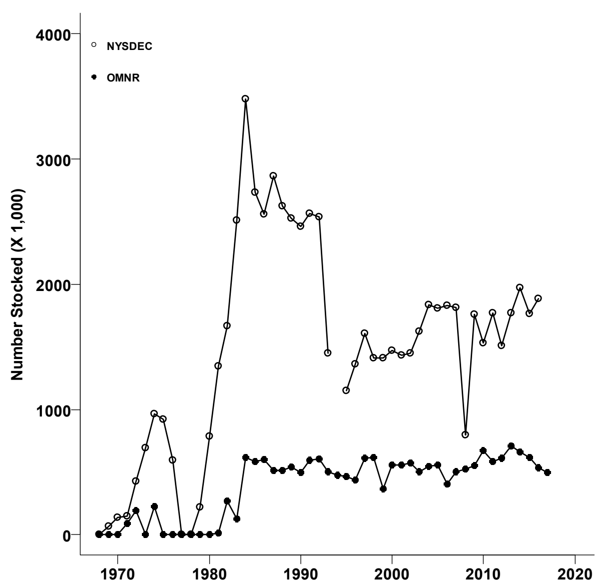

FIG. 7.1.1. Number of Chinook Salmon stocked by New York State Department of Environmental Conservation (NYSDEC) and MNRF from 1968 – 2017 (Section 6.1).

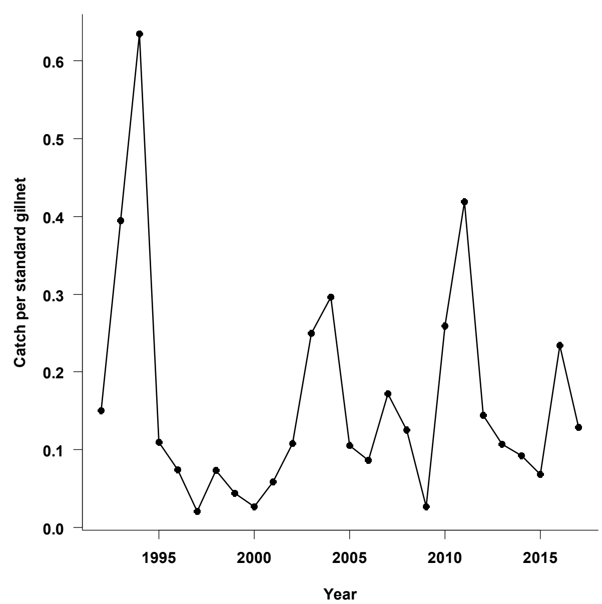

FIG. 7.1.2. Number of Chinook Salmon caught per gill net (CUE) from the Fish Community Index Gill Netting Program (see Section 1.2) from 1992 – 2017.

Unit in writing a final report on the Chinook Salmon CWT study in the near future. CWTs were collected from the Chinook Salmon Mark and Tag program from 2009 to 2015 and have shown a mixed population of Chinook Salmon (natural reproduced, stocked by New York and stocked by Ontario) originating from geographically widespread stocking locations. The mark and tag monitoring program has confirmed that Chinook Salmon returns to the Credit River tend to originate from fish stocked in the Credit River with a few strays from Bronte Creek stocking locations.

Currently, there are two assessment programs on Lake Ontario that involve adipose clipped Chinook Salmon. The Lake Ontario Management Unit continued to collect Chinook Salmon on the Ganaraska River in 2017 with the goal of diversifying Chinook Salmon gamete sources. In contrast to the Credit River, where adult returns are predominantly stocked fish, adult Chinook Salmon returning to the Ganaraska River to spawn are naturalized. Chinook Salmon stocked by LOMU into the Credit River that originated from the Ganaraska River Egg Collection (Sections 1.12 and 6.1) received an adipose clip prior to stocking. LOMU started collecting Chinook Salmon gametes on the Ganaraska River in 2015 and the first stocking event on the Credit River using these fish was in the spring of 2016 (Section 6.1). In addition, NYSDEC has been stocking Chinook and Coho Salmon with adipose clips and CWTs to assess the effectiveness of net pen stocking. Anglers that observed fish with an adipose clip in 2017 could be catching fish associated with either of the aforementioned programs.

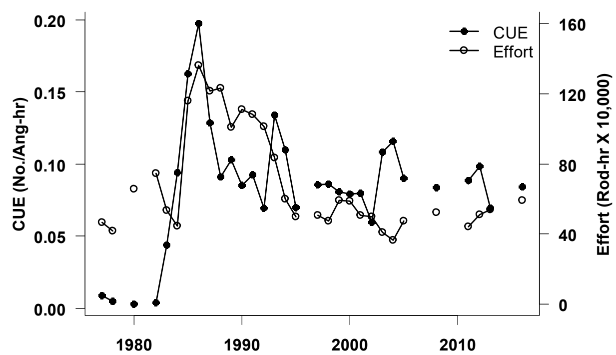

FIG 7.1.4. Catch rate (CUE) of Chinook Salmon and annual total effort (rod-hrs) in the Ontario waters of Lake Ontario (excluding the Eastern Basin), 1977 to 2016.

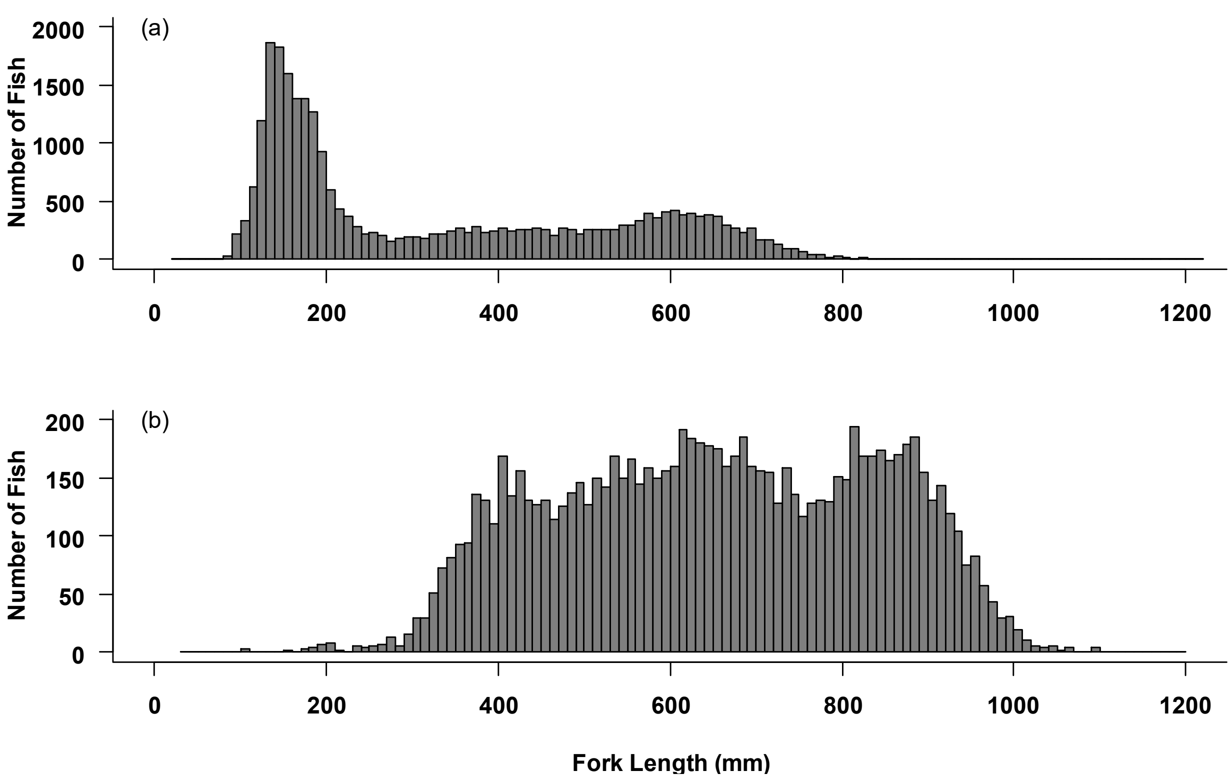

FIG 7.1.3. Size distribution (fork length in mm) of Chinook Salmon caught (a) in the Fish Community Index Gill Netting Program from 1992 – 2016 (Section 1.2) and (b) by anglers in the Western Lake Ontario Angler Survey from 1995 to 2016.

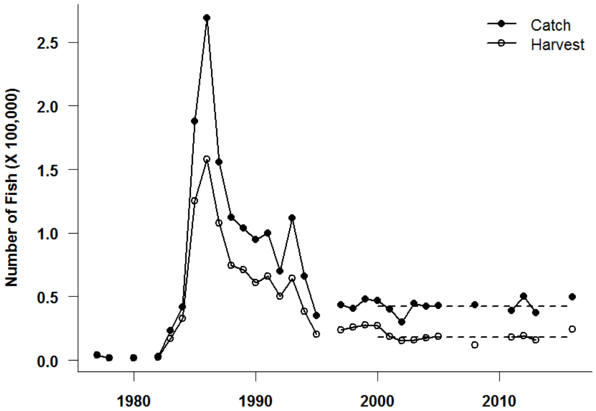

FIG 7.1.5. Number of Chinook Salmon caught (closed circle) and harvested (open circle) annually in the Ontario waters of Lake Ontario (excluding he Eastern Basin), 1977 to 2016. Dashed line represents the mean catch and harvest from 1997 to 2016.

Catch per unit effort (CUE), total catch and total harvest is assessed by the Western Lake Ontario Boat Fishery. This program is on a three-year rotation schedule and was last conducted in 2016. In 2016, total effort increased slightly from 2013 (Fig. 7.1.4), but total catch and harvest were 8% and 9% above the mean through 1997 to 2016 (Fig. 7.1.5). Release rates in both the Western Lake Ontario Boat Fishery and the Lake Ontario Volunteer Angler Program have generally increased through time. In 2016, the release rates in the Western Lake Ontario Boat Fishery declined to 50% from the 2004 to 2016 average of 59%. Chinook Salmon release rates reported in the Lake Ontario Volunteer Angler Program were lower in 2016 (55%) compared to 2015 (68%) and 2014 (65%).

The condition of Lake Ontario Chinook Salmon has been evaluated through four separate LOMU programs: i) Credit River Chinook Salmon Spawning Assessment (Section 1.8), ii) Ganaraska River Salmonid Assessment (Section 1.12), iii) Chinook Salmon Tournament Sampling (Section 2.4) and iv) Western Lake Ontario Angler Survey. Chinook Salmon in the Credit River and Ganaraska River index have lower conditions relative to fish sampled in the lake during mid-summer when condition should be at a maximum. Overall, Chinook Salmon condition, evaluated using data from the Credit River Chinook Spawning Index Program (Section 1.8), has declined since 1995 (Fig. 7.1.6). In 2012, Credit River Chinook Salmon condition was the lowest in the time series, however, Chinook Salmon condition in the Credit River increased from 2012 to 2016, followed by a slight decline in 2017. The condition of Chinook Salmon on the

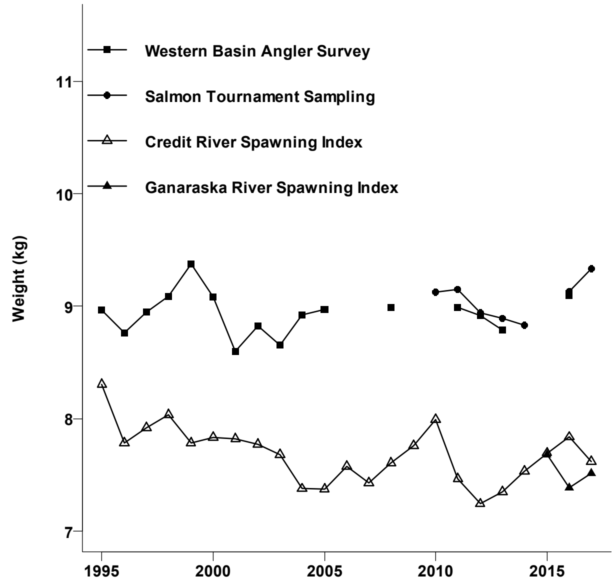

FIG 7.1.6. Condition index of Chinook Salmon from Credit River Spawning Index (triangle), Western Basin Angling Survey (square) and the Salmon Tournament Sampling (circle) from 1995 – 2017. Condition index is the predicted weight (based on a log-log regression) of a 914 mm (36") total length Chinook Salmon.

Ganaraska River has been measured over the past three years (2015 to 2017). On average, the condition of the Ganaraska River Chinook Salmon is lower than the Credit River (Fig. 7.1.6). In contrast, these overall trends were not observed in either the Western Lake Ontario Boat Fishery or the tournament sampling (Fig. 7.1.6). Despite the decline in Chinook Salmon condition from 2011 to 2013 in the Western Lake Ontario Boat Fishery, the 2016 condition index increased and is above the long-term 1995 to 2016 average. A similar decline in condition during 2011 to 2013 was observed in Chinook Salmon sampled in tournaments; however the condition value for Chinook Salmon sampled in 2017 tournaments has been the highest observed in the time series (Fig. 7.1.6).

In 2017, LOMU operated the new Riverwatcher fish counting system in the Ganaraska River Fishway from March 28th to November 8th, 2017. This marks the longest period of continuous monitoring of migratory salmonids on that river and the first visual recordings of fish passage that cover the entire monitoring period. The first Chinook Salmon to migrate upstream through fishway was observed on June 4th, 2017 and a total of 8,646 Chinook Salmon were observed in 2017 (Fig. 7.1.7; Section 1.12). The Ganaraska River Salmonid Assessment will continue into the future allowing

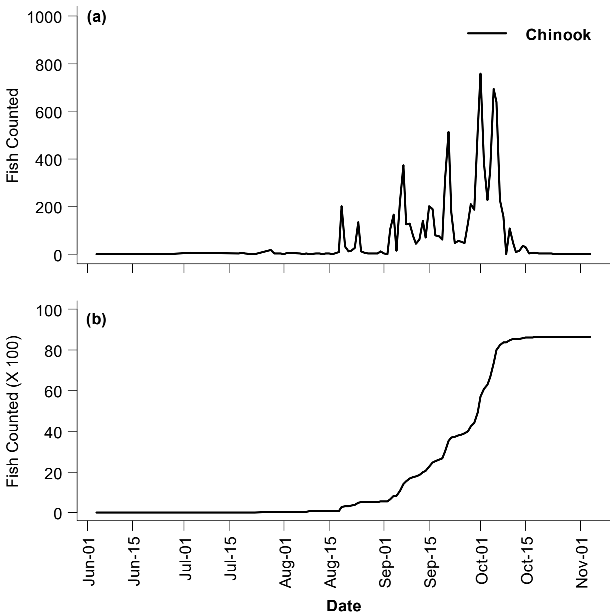

FIG. 7.1.7. (a) Daily and (b) cumulative observed counts of Chinook Salmon at the Ganaraska River fishway at Port Hope, Ontario from June 4th to November 4th, 2017.

for the development of new indices on this recreationally important species. LOMU has purchased a second Riverwatcher fish counting system and it will be installed in the Streetsville Fishway on the Kraft Dam, Credit River, Mississauga, ON. This second system is expected to be in testing phase throughout 2018 and become fully operational in 2019. This fish counting system will augment current Chinook Salmon programs on the Credit River, providing more information on not only the Chinook Salmon spawning run, but also the spring Rainbow Trout run, and fall salmonid runs.

With the exception of age-3 females, average length of adult Chinook Salmon returning to the Credit River increased significantly in 2017 (Section 1.8, Fig. 1.8.1). The condition of returning females increased slightly in 2017, however, condition of returning males declined significantly (Section 1.8, Fig. 1.8.2). Body condition of Chinook Salmon collected on the Credit River and Ganaraska River during the egg collection was comparable in 2017 (Fig. 7.1.6). Monitoring and assessment of both Credit River and Ganaraska River salmon and trout provides comparisons between fish populations that are predominantly of stocked origin (Credit River) and completely naturalized (Ganaraska River). Continued monitoring and assessment of these populations on the Credit and Ganaraska Rivers is critical in understanding the dynamic between stocked and naturalized fish populations as well as the success of the Lake Ontario Management Unit's diverse egg collection strategy with Chinook Salmon.

Mean summer temperatures for Lake Ontario were above the long-term average in 2017; a sharp contrast to the 2014 and 2015 seasons, which marked the coldest mean summer water temperatures recorded since 2002 (Section 11.1). In addition, the winter 2016 was significantly less severe compared to the previous two years (Section 11.1). While, these two factors may not be the only ones behind the observed declines in Chinook Salmon size, they likely have a significant contribution, as cooler temperatures are associated with lower metabolic activity and growth.

7.2 Rainbow Trout

M. J. Yuille , Lake Ontario Management Unit

The Lake Ontario fish community is a mix of non-native and remaining native species. Rainbow Trout, a non-native species, was intentionally introduced to Lake Ontario in 1968 and has since become naturalized (naturally reproducing fish). Rainbow Trout are the primary target for tributary anglers, who take advantage of the seasonal staging and spawning runs of this species and Rainbow Trout are the second most sought-after species in the Ontario waters of the Lake Ontario offshore salmon and trout fishery. In addition, the spring and fall spawning runs attract high numbers of tourists to local tributaries to watch these fish jump at fishways and barriers along their spawning migration. For all of these reasons, Rainbow Trout are not only ecologically important but recreationally and economically important as well.

The OMNRF stocks only Ganaraska River strain Rainbow Trout into Lake Ontario. Stocked numbers of Rainbow Trout were not affected in the 2017 stocking reduction and a total of 158,181 Rainbow Trout were stocked, slightly below the 2008 to 2017 average of 165,280 (Fig. 7.2.1).

The spring spawning run of Rainbow Trout in the Ganaraska River has been estimated at the fishway at Port Hope since 1974 (Section 1.1). In 2017, the Lake Ontario Management Unit (LOMU) operated the new Riverwatcher fish counting system in the Ganaraska River Fishway from March 28th to November 8th, 2017. This marks the longest period of continuous monitoring of migratory salmon and trout on the Ganaraska River and the first visual recordings of fish passage that cover the entire monitoring period. In 2017, the spring Rainbow Trout run in the Ganaraska River increased from 4,987 fish in 2016 to 6,952 fish, but remains below the previous 10 year average (7,392 fish from 2008 – 2017; Fig. 7.2.2). Additionally, Rainbow Trout were observed after the spring monitoring period utilising the fishway. Through the entire monitoring period, a total of 8,897 Rainbow Trout were identified migrating upstream through the Ganaraska Fishway (Fig. 7.2.3). The spring run represents 78% of the total number of Rainbow Trout observed in 2017; the majority of the Rainbow Trout using the fishway in the fall were observed after both Chinook and Coho Salmon runs had subsided (Section 1.12).

The Lake Ontario ecosystem has changed dramatically during this time series (e.g., phosphorus abatement, dreissenid mussel invasion, round goby invasion). During this time period (1974 to 2016), Rainbow Trout condition has declined (Fig. 7.2.4a). With the exceptions of 1994 and 1996, the highest condition values occurred in the 1970’s, prior to invasion of Zebra Mussels, Quagga Mussels and Round Goby. Fish body condition declined through the 1980’s to a low point in 1987. From 1990 to 2017, the long-term trend shows slight decline in relative condition. Data on Rainbow Trout condition over the past 10 years are the most informative for the current population (Fig. 7.2.4b). Rainbow Trout

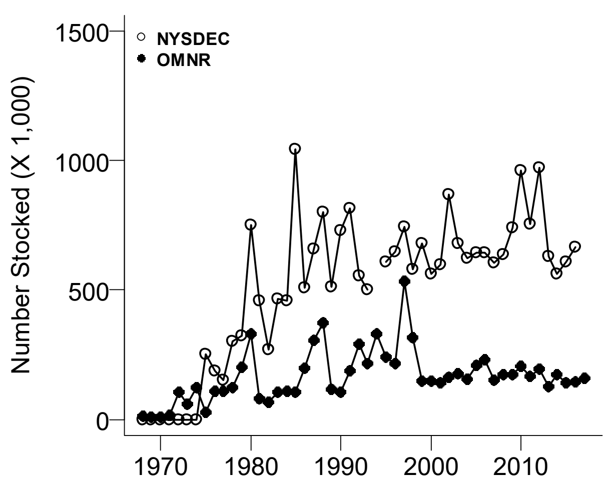

FIG 7.2.1. Number of Rainbow Trout stocked by New York State Department of Environmental Conservation (NYSDEC) and OMNRF from 1968 – 2017 (see Section 6.1).

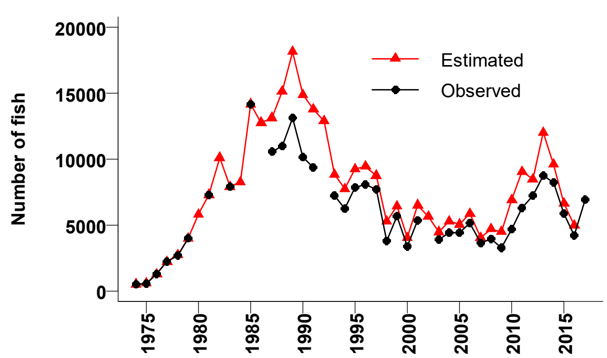

FIG 7.2.2. Estimated and observed spring run of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario from 1974 – 2017.

condition declined to a low in 2008 then has increased up to 2013, the highest in the whole time series since 1997. In 2015, Rainbow Trout condition declined significantly, to the lowest point since 1986. Rainbow Trout condition has increased over the past three years; relative condition in 2017 (96%) is comparable to the previous 10 year average relative condition value (97% from 2008 to 2017; Fig. 7.2.4b).

After a sharp increase in catch per unit effort (CUE) from 1979 to 1984 (the highest in the 34 year time series), the CUE declined until 2004 in the Western Lake Ontario Boat Fishery (Fig. 7.2.5). After 2004 (the lowest CUE since1982), the CUE steadily increased to 2013. The Lake Ontario Management Unit, did not evaluate the Western Lake Ontario Boat Fishery in 2014 or 2015, but Rainbow Trout CUE in 2016 showed a significant decline, falling below the average CUE for both the time series (1977-2016) and the past 10 years (2008 to 2016; Fig. 7.2.5). Effort in this fishery has remained fairly stable since 1994 (Fig. 7.2.5). Total numbers of Rainbow Trout caught and harvested in the Western Lake Ontario Boat Fishery naturally followed the same trends found in CUE with total harvest generally lower than total catch (Fig. 7.2.6).

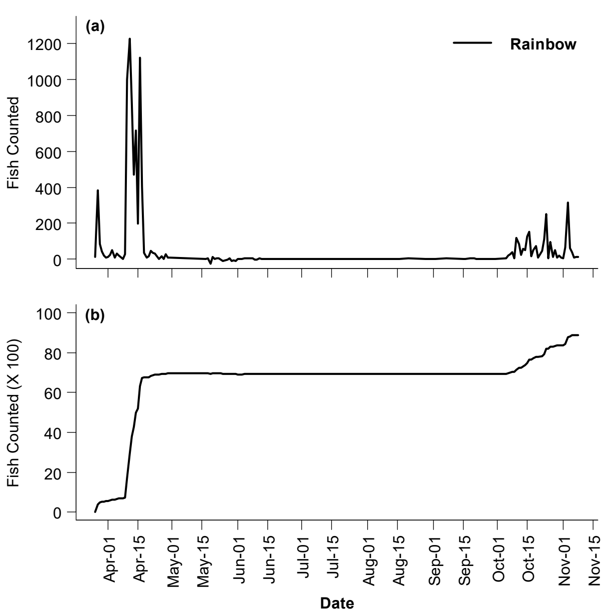

FIG 7.2.3. (a) Daily and (b) cumulative observed counts of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario from March 28th to November 8th, 2017.

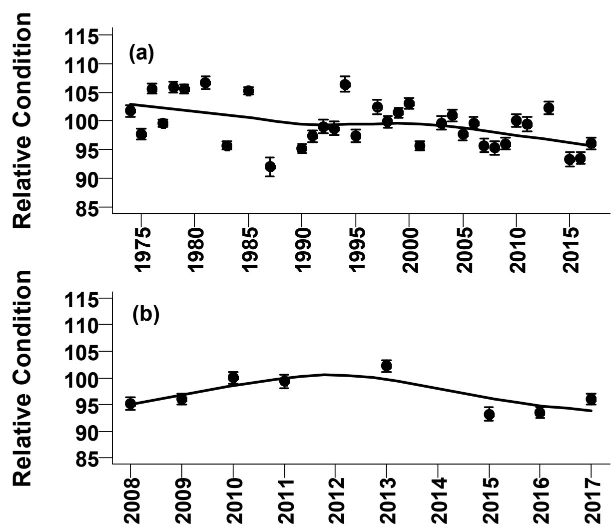

FIG 7.2.4. Relative weight of Rainbow Trout sampled at the Ganaraska River fishway at Port Hope, Ontario for (a) the whole time series 1974 – 2017 and (b) a 10 year average (2008 – 2017; see Section 1.1).

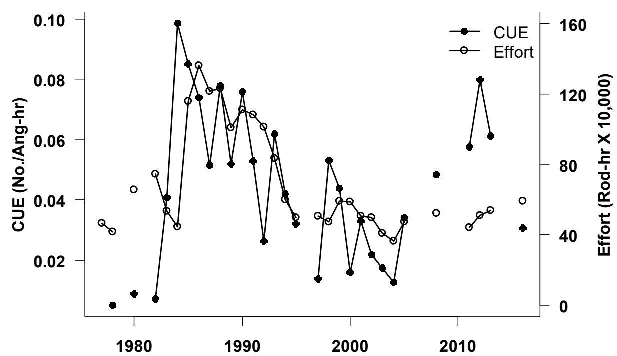

FIG 7.2.5. Catch rate (CUE) of Rainbow Trout and total effort (rod-hrs) in the Ontario waters of Lake Ontario (excluding Kingston Basin), 1977 – 2016.

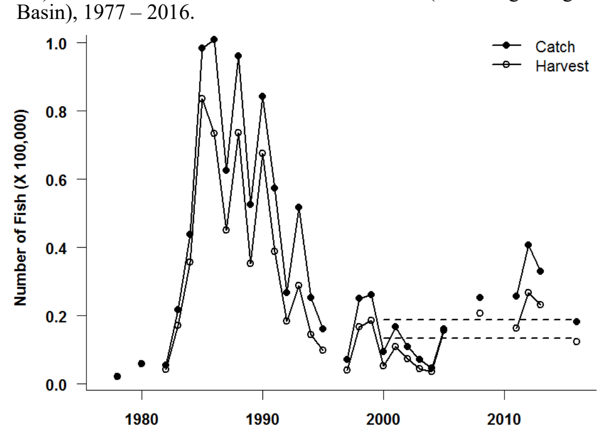

FIG 7.2.6. Number of Rainbow Trout caught (closed circle) and harvested (open circle) annually by the boat fishery in the Ontario waters of Lake Ontario (excluding Kingston Basin), 1978 – 2016. The dashed line represents the mean catch and harvest from 2000 to 2016.

7.3 Lake Whitefish

J. A. Hoyle, Lake Ontario Management Unit

Lake Whitefish is a prominent member of the eastern Lake Ontario cold-water fish community and an important component of the local commercial fishery. Two major spawning stocks are recognized in Canadian waters: one spawning in the Bay of Quinte and the other in Lake Ontario proper along the south shore of Prince Edward County. A third spawning area is Chaumont Bay in New York State waters of eastern Lake Ontario.

Commercial Fishery

Lake Whitefish commercial quota and harvest increased from the mid-1980s through the mid-1990s, declined through to the mid-2000s then stabilized at a relatively low level (Fig. 7.3.1). Quota and harvest averaged 122,000 lb and 80,000 lb respectively, over the 2008-2017 time-period. In 2017, base quota was 134,883 lb, issued quota was 137,455 lb and the harvest was 68,242 lb (Section 3.2). In recent years, most of the harvest occurs in quota zone 1-2, eastern Lake Ontario (Fig. 7.3.2). Here, most of the harvest occurs at spawning time in November and early December (Fig. 7.3.3). Although harvest at other times of the year is less than at spawning time, considerable gill net fishing effort does occur. Highest harvest rates (HUE) occur at spawning time.

The age distribution of Lake Whitefish harvested is comprised of many age-classes (Fig. 7.3.4). Most fish are age-5 to age-14.

Abundance

Lake Whitefish abundance is assessed in a number of programs. Summer gill net sampling is used to assess relative abundance of juvenile and adult fish in eastern Lake Ontario (Fig. 7.3.5, and see Section 1.2). Young-of-the-year (YOY) abundance is assessed in bottom trawls (Section 1.3) at Conway (lower Bay of Quinte) and Timber Island (EB03 in eastern Lake Ontario) (Fig. 7.3.5). Lake Whitefish abundance, like

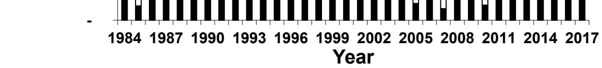

FIG. 7.3.1. Lake Whitefish commercial quota and harvest, 1984-2017.

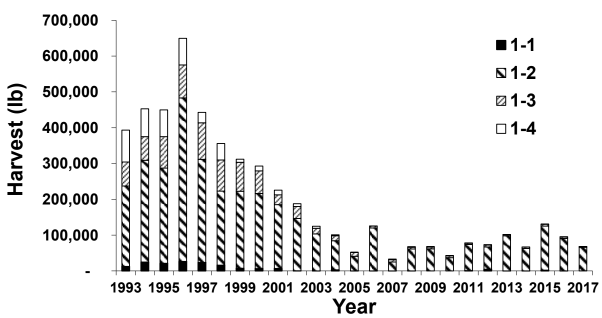

FIG. 7.3.2. Lake Whitefish commercial harvest by quota zone, 1993-2017.

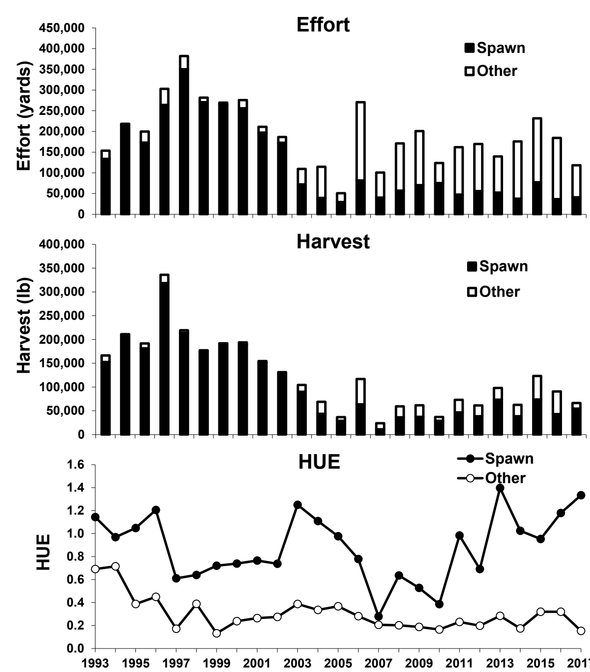

FIG. 7.3.3. Commercial Lake Whitefish gill net fishing effort (top panel), harvest (middle panel), and harvest-per-unit-effort (HUE; bottom panel) in quota zone 1-2, 1993-2016. "Spawn" includes November and December, and "Other" includes January through October.

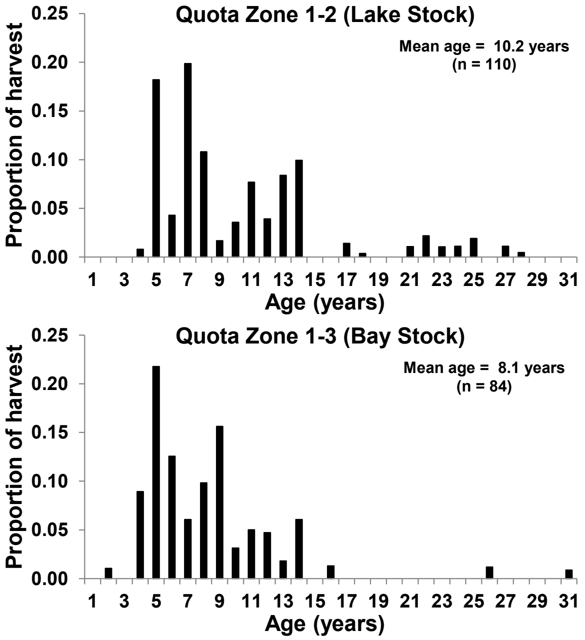

FIG. 7.3.4. Lake Whitefish age distributions (by number) in the 2017 quota zones 1-2 (upper panel) and 1-3 (lower panel) fall commercial fisheries.

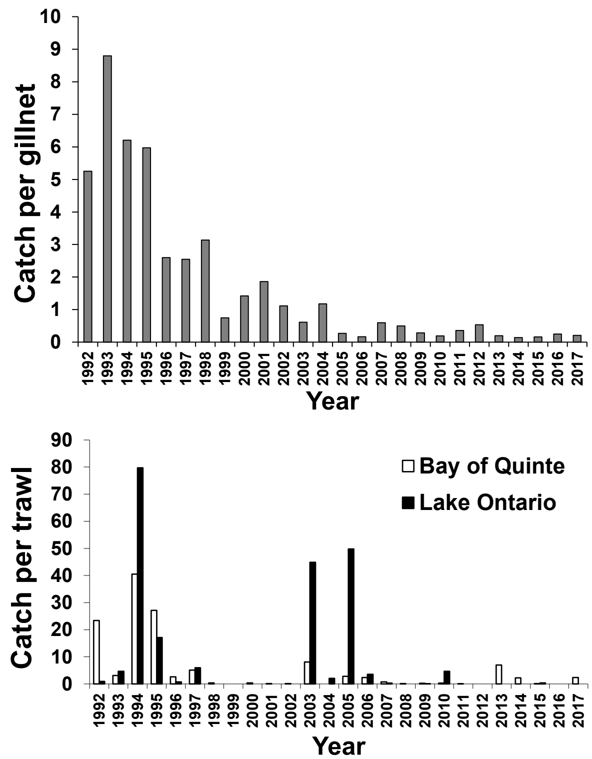

FIG. 7.3.5. Lake Whitefish abundance in eastern Lake Ontario assessment gill nets, 1992-2017 (sub-adult and adult; upper panel) and bottom trawls, 1992-2017(young-of-the-year; lower panel).

commercial harvest, has been stable at a relatively low level for the last decade. Young-of-the-year catches have been highly variable.

Growth

Trends in length-at-age for Lake Whitefish caught during summer assessment gill nets for age -2, age-3, and age-10 (males and females) fish are shown in Fig. 7.3.6. Generally, fork length-at-age declined during the 1990s then stabilized in the early 2000s.

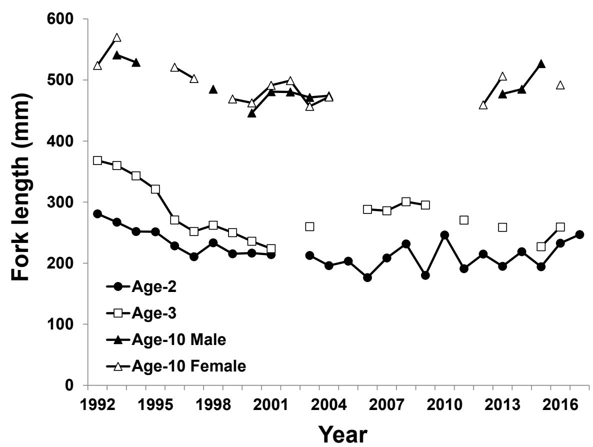

FIG. 7.3.6. Trends in Lake Whitefish fork length-at-age for age-2, age-3, age-10 males and females, caught in summer assessment gill nets, 1992-2016.

Condition

Trends in Lake Whitefish condition during summer and fall are shown in Fig. 7.3.7. Condition was high from 1990-1994, declined through 1996. Condition then increased to intermediate levels for Lake Whitefish sampled during summer but condition remained low for fish sampled during fall.

Overall Status

Following severe decline in abundance, commercial harvest, growth and condition, during the 1990s, the eastern Lake Ontario Lake Whitefish population appears to have stabilized at a much reduced but stable level of abundance, and condition.

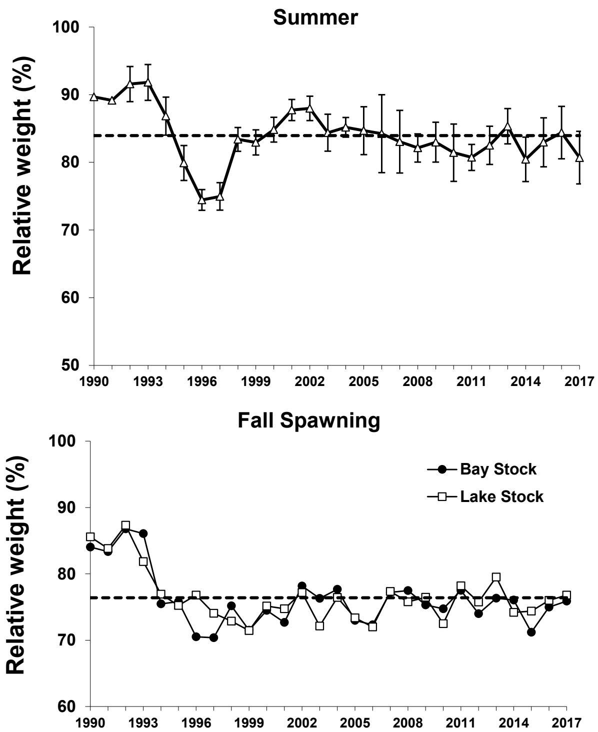

FIG. 7.3.7. Condition (relative weight) of Lake Whitefish sampled during summer assessment gill net surveys in eastern Lake Ontario (upper panel error bars ±2SE) and fall commercial catch sampling (lower panel) in the Bay of Quinte ("Bay Stock") and the south shore Prince Edward County ("Lake Stock"), 1990-2017.

7.4 Walleye

J. A. Hoyle, Lake Ontario Management Unit

Walleye is the Bay of Quinte fish community's primary top piscivore and of major interest to both commercial (Section 3.2) and recreational fisheries (Section 2.2). The Walleye population in the Bay of Quinte and eastern Lake Ontario is managed as a single large stock. The Walleye's life history-specific movement and migration patterns between the bay and the lake determines the seasonal distribution patterns of the fisheries. Understanding Walleye distribution is also crucial to interpret summer assessment netting results (Sections 1.2 and 1.3). After spawning in April, mature Walleye migrate from the Bay of Quinte toward eastern Lake Ontario to spend the summer months. These mature fish return back "up" the bay in the fall to over-winter. Immature Walleye generally remain in the bay year-round. In 2017 a multi-year acoustic telemetry project was initiated to describe Bay of Quinte-eastern Lake Ontario Walleye movement at a finer scale than currently exists (Section 9.9).

Recreational Fishery

The recreational fishery consists of a winter ice-fishery and a three season (spring/summer/ fall) open-water fishery. Most Walleye harvest by the recreational fishery occurs in the upper and middle reaches of the Bay of Quinte during the winter ice-fishery (Fig. 7.4.1) and the spring/early summer open-water fishery. All sizes of fish are caught during winter while mostly juvenile fish (age-2 and age-3) are caught during spring and summer. A popular "trophy" Walleye fishery occurs each fall based on the large, migrating fish in the middle and lower reaches of the Bay of Quinte at that time (see Section 2.3). Increasingly in recent years, there is also a late-summer fishery in eastern Ontario targeted at these large Walleye prior to their return to the Bay of Quinte. Trends in the open-water fishery are shown in Fig. 7.4.2 (see also Section 2.2). Annual Walleye angling effort and catch (ice and open-water fisheries combined) has been relatively stable averaging over 330,000 hours and 63,000 fish caught during the last decade. Walleye catch and harvest spiked in the 2017 open-water fishery (102,351 and 52,651 fish, respectively) as two very strong year-classes (age-2 and 3) recruited to the fishery (see Section 2.2).

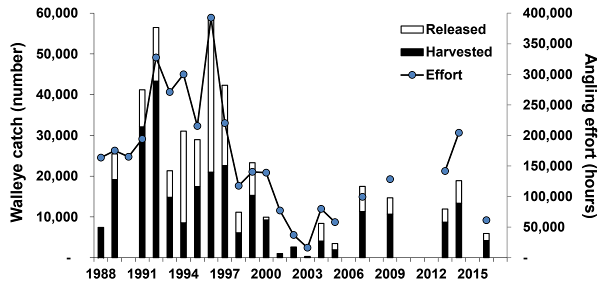

FIG. 7.4.1. Bay of Quinte recreational angling effort and walleye catch (released and harvested) during the winter ice-fishery, 1988-2017. No data for 2006, 2008, 2010-2012, 2015 or 2017.

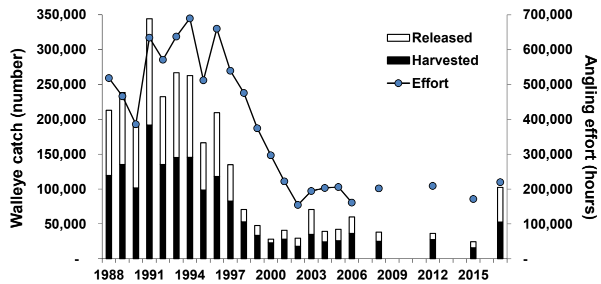

FIG. 7.4.2. Bay of Quinte recreational angling effort and walleye catch (released and harvested) during the open-water fishery, 1988-2017. No data for 2007, 2009-2011, 2013-2014 or 2016.

Commercial Fishery

Walleye harvest by the commercial fishery is highly regulated and restricted. No commercial Walleye harvest is permitted in the upper and middle reaches of the bay (Trenton to Glenora). A relatively modest Walleye commercial quota (48,092 lbs; Fig. 7.4.3) is allocated in the lower Bay of Quinte and Lake Ontario with additional seasonal, gear, and fish-size restrictions. The commercial harvest of Walleye was 31,741 lbs in 2017. Commercial Walleye harvest has shifted location from quota zone 1-2 to 1-4 over the last decade (Fig. 7.4.4). This shift has likely resulted in smaller, younger Walleye being harvested but this has not been measured.

Annual Harvest

Total annual Walleye harvest in the recreational and commercial fisheries (by number and weight) over the last decade (2008-2017) is given in Table 7.4.1. The recreational fishery takes about 80% of the annual harvest with the open-water component of the recreational fishery

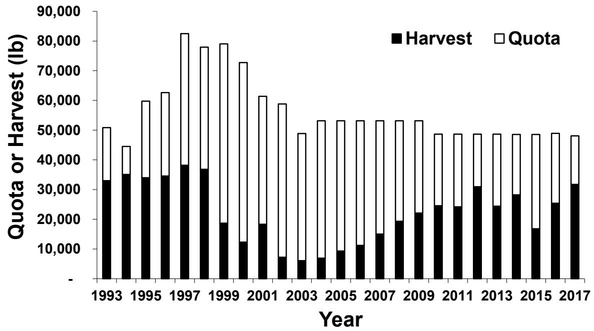

FIG. 7.4.3. Walleye commercial quota and harvest, 1993-2018.

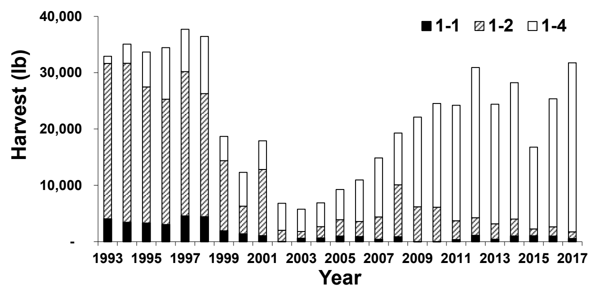

FIG. 7.4.4. Walleye commercial harvest by quota zone, 1993-2017.

making up 61% (by number) of total annual harvest.

Abundance

Walleye abundance is assessed in a number of programs. Summer gill net sampling (Section 1.2) is used to assess relative abundance of juvenile (Bay of Quinte) and adult (eastern Lake Ontario) fish (Fig. 7.4.5). Fig. 7.4.6 shows the 2017 Walleye age distribution in these two geographic areas. Young-of-the-year (YOY) abundance is assessed in Bay of Quinte bottom trawls (Fig. 7.4.7; Section 1.3).

Except for an unusually high catch in 2013, juvenile abundance in the Bay of Quinte has been relatively stable since 2001 (Fig. 7.4.5). The 2017 catch was high with a large contribution of age-2 and 3 fish. In eastern Lake Ontario index gill nets, after an unusually low catch in 2013, Walleye abundance in eastern Lake Ontario increased to a level similar to that observed in the previous few years. The 2017 catch was high (Fig. 7.4.5). The 2014 catch of YOY Walleye in bottom trawls was the highest since 1994 (Fig. 7.4.7) and the 2015 year-class was also very large. The 2016 year-class was of moderate strength, and the 2017 year -class was poor. Nonetheless, these recent year-classes foreshadow continued stability in the Walleye population and fisheries.

TABLE 7.4.1. Mean annual Walleye harvest by major fishery over the last decade (2008-2017).

	Walleye harvest			
	Number of fish	lbs	% by number	% by weight
Recreational				
ice-fishery	9,245	29,724	19%	27%
open-water fishery	30,131	57,572	61%	51%
Commercial	9,902	24,755	20%	22%
Total	49,278	112,050	100%	100%

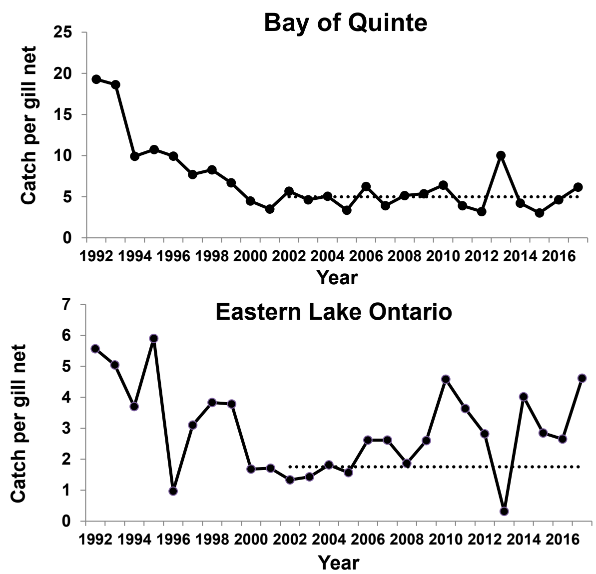

FIG. 7.4.5. Walleye abundance in summer gill nets in the Bay of Quinte, 1992-2017 (upper panel) and eastern Lake Ontario, 1992-2017 (lower panel). Also shown (dotted line) is the Bay of Quinte FMP (Fisheries Management Plan) "target" for these two components of the Walleye population.

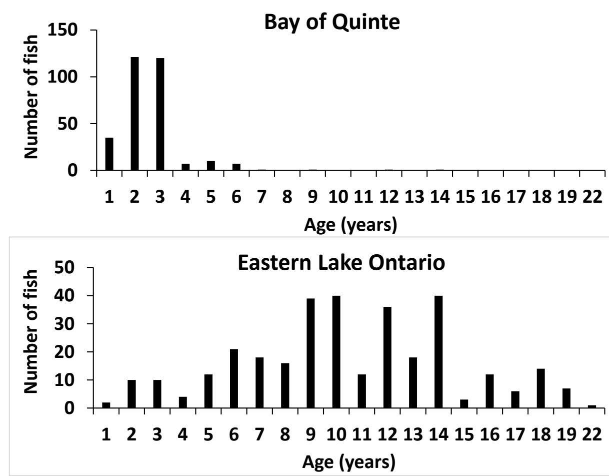

FIG. 7.4.6. Walleye age distribution in **2017** summer gill nets in the Bay of Quinte (upper panel) and Lake Ontario (lower panel).

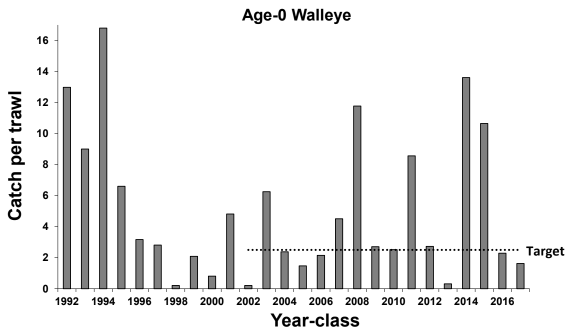

FIG. 7.4.7. Young-of-the-year (Age-0) Walleye catch per trawl in the Bay of Quinte, 1992-2017. Also shown (dotted line) is the Bay of Quinte FMP (Fisheries Management Plan) "target" catch per trawl.

Growth

Walleye length-at-age for age-2 and age-3 juvenile fish and age-10 mature fish (males and females separated) is shown in Fig. 7.4.8. Length -at-age increased for juvenile (age-2 and 3) fish in 2000 and remained stable since. For mature fish (age-10), length-at-age has remained stable with females being larger than males.

Condition

Walleye condition (relative weight) is shown in Fig. 7.4.9. Condition has remained stable in Bay of Quinte fish (immature) and showed an increasing trend in Lake Ontario (mature fish) until 2014 when condition declined sharply; condition increased in 2015 and 2016 and held steady in 2017.

Other Walleye Populations

The Bay of Quinte/eastern Lake Ontario Walleye population is the largest on Lake Ontario; smaller populations exist in other nearshore areas of the Lake Ontario. Walleye in these other areas are regularly assessed with a standard trap net program (Nearshore Community Index Netting; see Section 1.4). Mean Walleye trap net catches (2008-2013 compared to 2014-2017 time-periods) in 8 geographic nearshore areas are shown in Fig. 7.4.10. Highest Walleye abundance occurs in the Bay of Quinte, East Lake, West Lake, Weller's Bay and Hamilton Harbour. Walleye abundance increased in Hamilton Harbour after stocking efforts began in 2012.

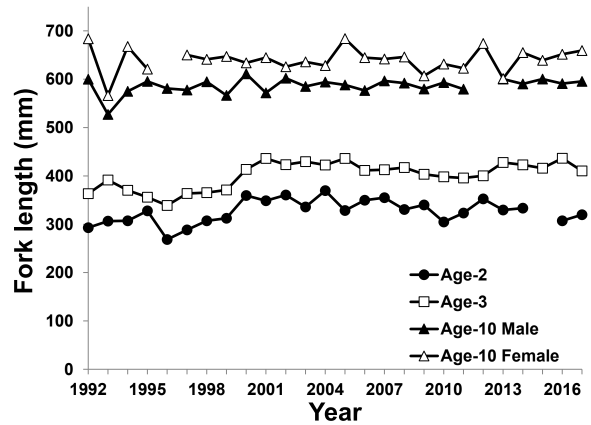

FIG. 7.4.8. Trends in Walleye fork length-at-age for age-2, age-3, age-10 males and females, caught in summer assessment gill nets, 1992-2017.

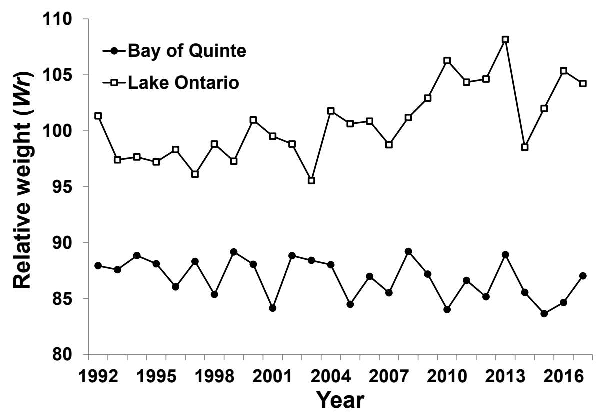

FIG. 7.4.9. Trends in Walleye condition (relative weight), caught in summer assessment gill nets in the Bay of Quinte (fish <500 mm fork length) and Lake Ontario (fish >500 mm fork length), 1992-2017.

Walleye Stocking

Walleye were stocked into Toronto Harbour (see Section 6.1) in an effort to re-establish this native, predatory fish and to promote urban, near-shore angling. Approximately 1 million fry were stocked in the spring of 2017, followed by over 100,000 fingerlings stocked in July. Walleye stocking is planned to alternate annually between Toronto Harbour and Hamilton Harbour (first stocked in 2012).

Overall Status

The overall status of Lake Ontario Walleye is good. The Bay of Quinte/eastern Lake Ontario population did decline during the 1990s but stabilized at levels that still supports a high quality fishery, and recent recruitment levels are positive.

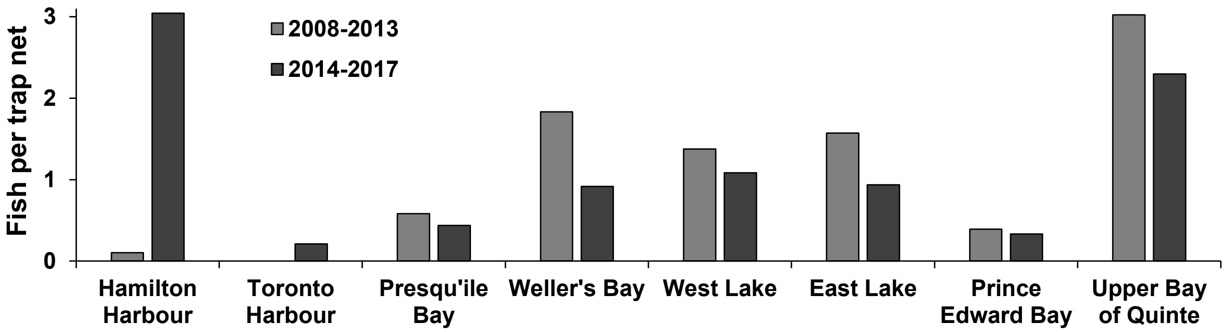

FIG. 7.4.10. Walleye abundance (mean annual number of fish per trap net) in 8 geographic nearshore areas of Lake Ontario arranged from west (Hamilton Harbour) to east (Upper Bay of Quinte). Catches are annual means for all sampling from 2008-2013 and 2014-2017 time-periods with individual areas having been sampled from one to six years within a time-period.

7.5 Yellow Perch

J. A. Hoyle, Lake Ontario Management Unit

Yellow Perch is one of the most ubiquitous and abundant species in the Lake Ontario and St. Lawrence River warm and coolwater fish community (see Sections 1.2, 1.3 and 1.7). The species support important recreational and commercial fisheries (see Sections 2.2 and 3.2), and are prey for nearshore predators.

Recreational Fishery

The most significant Yellow Perch recreational fishery occurs on Lake St. Francis, below the Cornwall dam on the St. Lawrence River. The most recent angling survey of this fishery estimated that anglers caught and harvested 363,217 (9.1 perch per hour by anglers targeting Yellow Perch) and 144,925 perch, respectively from May 10 to Oct 4, 2013. On the Bay of Quinte in northeastern Lake Ontario, large numbers of Yellow Perch are caught by anglers that are otherwise primarily targeting Walleye. In a 2017 open-water angler survey on the Bay of Quinte, an estimated 261,747 perch were caught (2.1 perch per hour for anglers targeting Yellow Perch) but only 16,497 were harvested (see Section 2.2).

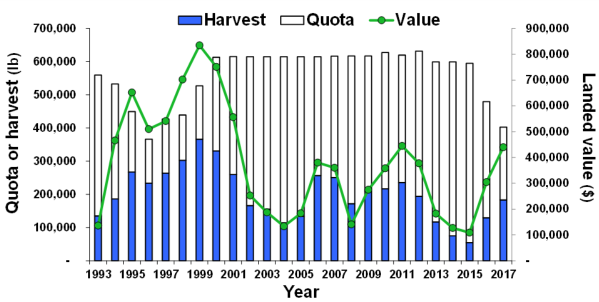

FIG. 7.5.1. Yellow Perch commercial harvest, quota and landed value trends for the Lake Ontario (including East and West Lakes) and the St. Lawrence River, 1993-2017.

Commercial Fishery

Yellow Perch was the most important species, in terms of both total weight (182,974 lb) and landed value ($434,222), in the 2017 Lake Ontario and St. Lawrence River commercial fisheries (see Section 3.2). Most of the harvest was taken in the Bay of Quinte and the St. Lawrence River. Total annual Yellow Perch commercial harvest declined to a low point in 2015 and commercial quota was decreased in 2016 and again in 2017. Harvest and landed value increased in 2016 and 2017 (Fig. 7.5.1).

Abundance

Yellow Perch abundance is assessed in a number of index netting programs (see Sections 1.2, 1.3, 1.4 and 1.7). Long-term trends in Yellow Perch biomass in assessment gillnets (Section 1.2) is shown in Fig. 7.5.2. Overall biomass was low through the 2012 to 2015 time-period and increased in 2016 and again in 2017.

Abundance targets set in the Bay of Quinte FMP (Fisheries Management Plan) for the Bay of Quinte and eastern Lake Ontario are shown in Fig. 7.5.3. Yellow Perch abundance is currently below target values in both areas, particularly in eastern Lake Ontario; abundance appears to be increasing in the Bay of Quinte.

Yellow Perch abundance in the Thousand Islands area of the upper St. Lawrence River increased in 2017 (see Section 1.7, Fig, 1.7.3).

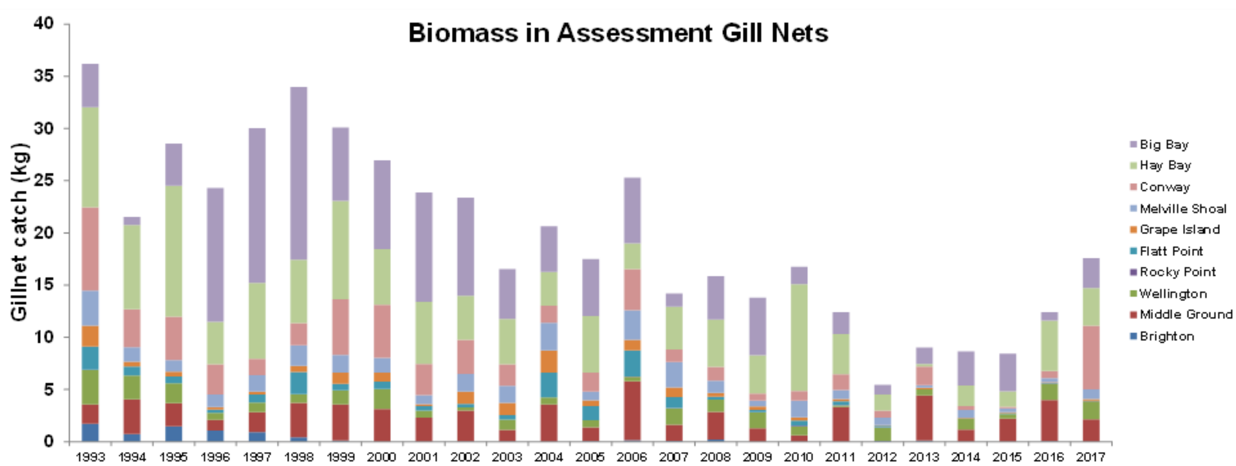

FIG. 7.5.2. Yellow Perch biomass trends at multiple sampling areas in eastern Lake Ontario (from Brighton in central Lake Ontario east to Melville Shoal near the mouth of the St. Lawrence River) and the Bay of Quinte, 1993-2017. See map in Section 1.2 (Fig. 2.1.1).

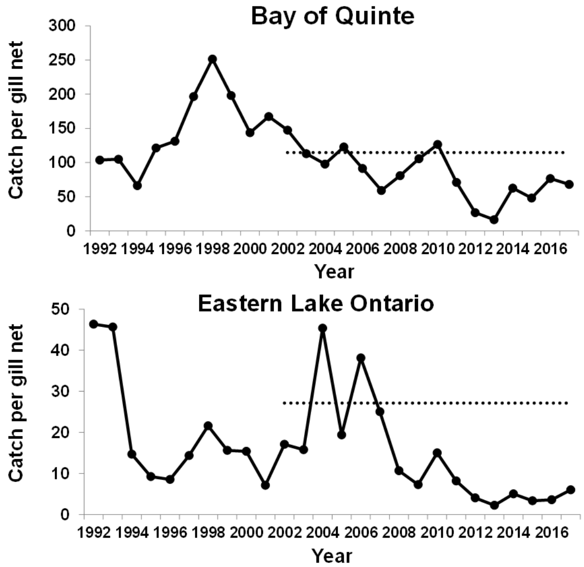

FIG. 7.5.3. Yellow Perch abundance trends in the Bay of Quinte and eastern Lake Ontario, 1992-2017. Also shown (dotted lines, 2002-2017) are target abundance levels established in the Bay of Quinte FMP (Fisheries Management Plan).

7.6 Lake Ontario Prey Fish

B.C. Weidel Lake Ontario Biological Station, USGS
J.P. Holden Lake Ontario Management Unit
M.J. Connerton Cape Vincent Fisheries Station, NYSDEC

Managing Lake Ontario fisheries in an ecosystem-context requires prey fish community and population data. The abundance of current and future prey fish resources provides important context for establishing Salmon and Trout stocking levels and managing for sustainable recreational fisheries.

The historical prey fish community was thought to have been dominated by cisco species (Cisco and deepwater forms such as Bloater). Alewife and to a lesser extent, Rainbow Smelt have been the dominant species throughout the modern era (1900s to present). The off-shore benthic fish community was largely a mix of sculpin species (Deepwater, Spoonhead and Slimy Sculpin) while Spottail Shiner, Johnny Darter, and Trout-perch were abundant closer to shore. The recent establishment of Round Goby and recovery of Deepwater Sculpin populations have further changed the diversity within the benthic prey fish community.

Bottom trawls have been the primary prey fish assessment gear for the majority of the data series. Bottom trawling in the Bay of Quinte and Kingston Basin has been conducted annually (except 1989) since 1963 (Section 1.3 for additional details). In US waters, an extensive, multi-season trawl program began in 1978. These programs operated independently of each other for most of the survey history. In 2015 the US fall trawl program was expanded to a whole-lake survey with the addition of multiple sites in Canadian waters conducted by OMNRF and USGS (Section 1.11). The US spring survey was similarly expanded in 2016 (Section 1.11). The acoustic program has supplemented Alewife and Rainbow Smelt assessment since 1997 with a greater emphasis on conducting mid-water trawling targeting Cisco and Bloater beginning in 2016 (Section 1.6).

Alewife

Alewife are the dominant prey fish in Lake Ontario and are the primary prey item for important pelagic predators (e.g. Chinook Salmon, Rainbow Trout) as well as other recreationally important species such as Walleye and Lake Trout. It is important to monitor Alewife abundance because significant declines in their abundances in Lakes Huron and Michigan lead to concurrent declines in Alewife-dependent species such as Chinook Salmon. However, having Alewife as the principal prey item can lead to a thiamine deficiency in fish that eat Alewife, which has been linked to undesirable outcomes like reproductive failure in Lake Trout as well as Early Mortality Syndrome (EMS).

Adult Alewife (age-2 and older) mean abundance in the spring trawl survey increased in US waters relative to 2016 but declined in Canadian waters (Fig. 7.6.1). The 2016 US adult Alewife abundance index value is likely the lowest ever observed since contemporary surveys began in 1978. A slightly lower value was observed in 2010 but subsequent cohort analyses indicate that value was biased low. The 2016 value resulted from two concurrent years of low reproductive success in 2013 and 2014, which is illustrated in Fig. 7.6.2 as low numbers of Age-1 Alewife captured in 2014 and 2015. The spring survey targets Alewife at a time when their demersal, winter behavior maximizes their susceptibility to bottom trawls. Depth distribution differs throughout the other programs as does the overall catch numbers (Fig. 7.6.3).

Cisco

Cisco were thought to be the historically dominant native fish species in Lake Ontario prior to European colonization. Even throughout the early part of the 20th century Cisco supported important commercial fisheries. Cisco are the only remaining form of a diverse flock that included four other forms. At present Cisco represent only small fraction of the lake-wide pelagic prey fish community. Population dynamics show declining commercial catches from the 1950s. All surveys show an increase in abundance in the late 1980s to early 1990s followed by a period of low abundance. The most recent years indicate a period of higher abundance

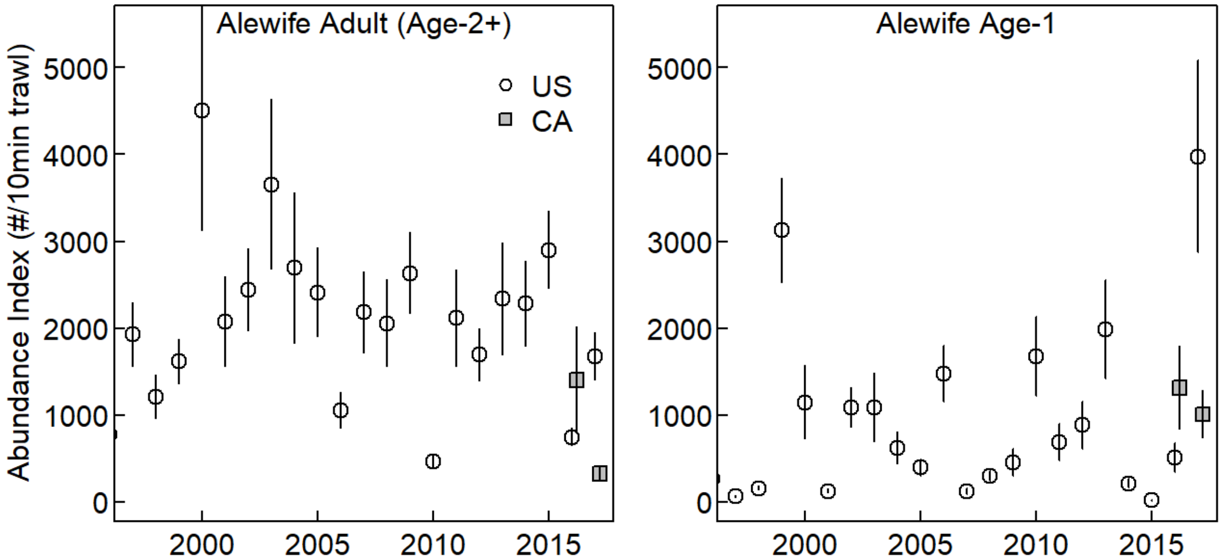

FIG. 7.6.1. Lake Ontario spring bottom trawl-based abundance indices for adult Alewife (age-2 and older, left panel) and age-1 Alewife (right panel). Values represent a stratified, area weighted mean number of Alewife captured in a 10 minute trawl. Error bars represent a standard error of the mean. Trawling in Canadian waters was included in 2016 but to maintain comparisons, separate indices are illustrated for Canadian and US waters which constitute 52% and 48% of lake by area respectively.

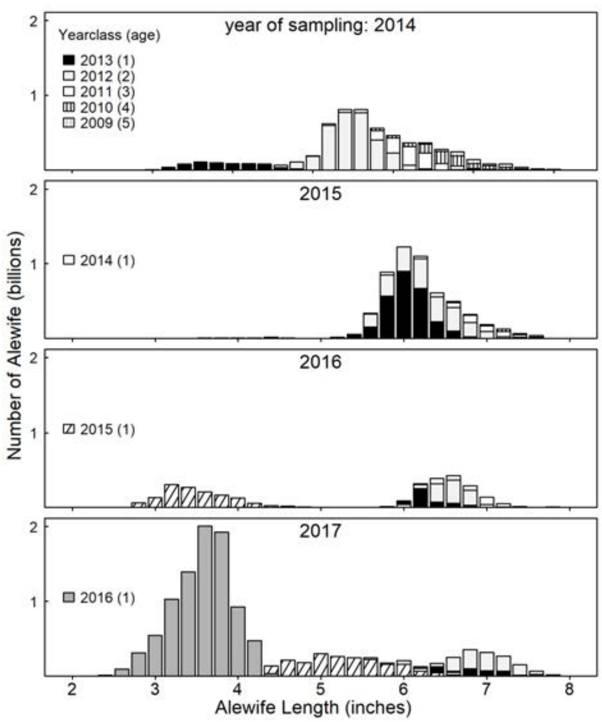

FIG. 7.6.2. Alewife size and distributions from spring bottom trawl surveys conducted in US waters of Lake Ontario, 2014-2017. Each Alewife year class (all the fish born in a given year) are represented by a consistent color or pattern. The low catches of Age-1 fish in 2015 and 2016 (2nd and 3rd panels) contributed to management concerns for Alewife population that resulted in salmonid stocking reductions in 2017 and 2018. The catch of Age-1 fish in 2017 (2016 year class, bottom panel) was the largest ever observed in the survey.

(Fig. 7.6.4).

Fish community changes had already occurred before the establishment of the current assessment programs therefore we lack a historical CUE information from when Cisco dominated the system to provide context to contemporary CUE. Lake Superior, a system where Cisco still dominate the fish community, provides a biological reference point for Lake Ontario. Acoustic estimates (0.5 kg/ha in 2016, 1.2 kg/ha in 2017) (are still well below comparable Lake Superior estimates (5.5 kg/ha).

Other Pelagic Fishes

Rainbow Smelt abundance declined through the 2000s but appears to have established a new lower equilibrium (Fig. 7.6.5). Smelt fishing during the spring spawning period was a popular activity throughout Lake Ontario when populations were at much higher levels. High abundance of Rainbow Smelt however has been thought to negatively impact native species. For example, the decline of the native Cisco population in the 1940s coincided with high abundance of Rainbow Smelt. While still the second most abundant pelagic species, Alewife still contributes the majority of fish biomass in predator diets.

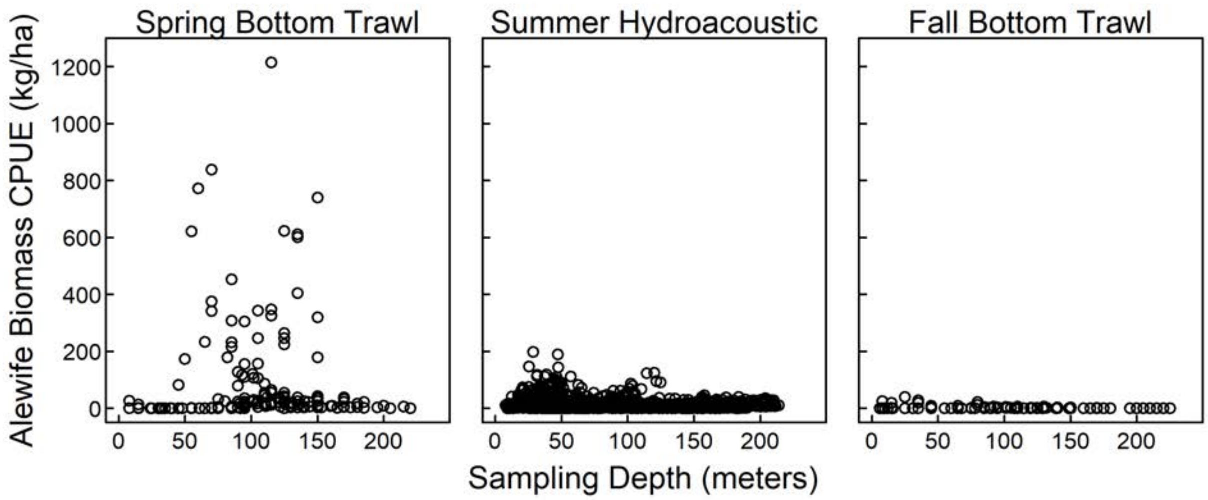

FIG. 7.6.3. Lake Ontario Alewife catch varies substantially across sampling depths across seasons. Individual values represent Alewife weight according to the area of lake bottom swept by the bottom trawls. Note, different trawls are used on the spring (left) and fall (right) survey and the summer index is derived from hydroacoustics (center).

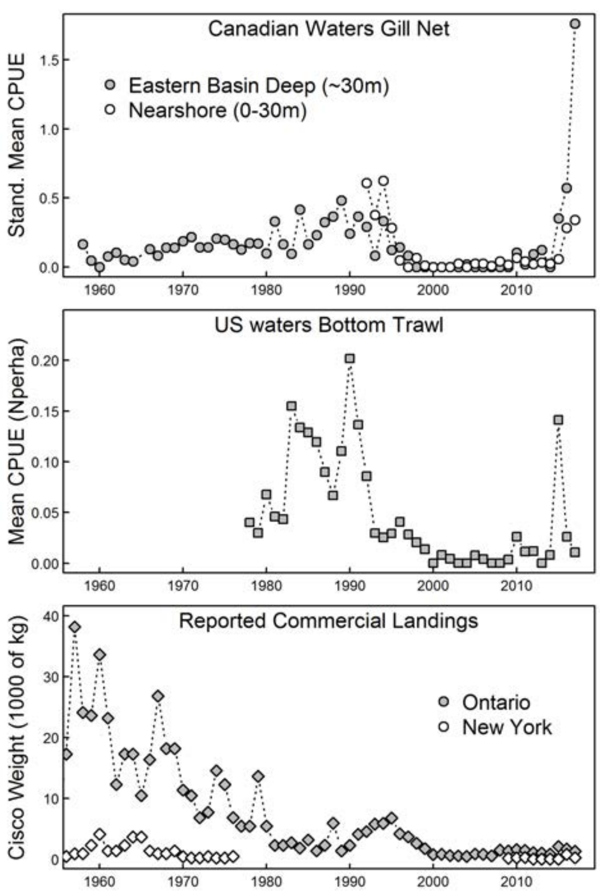

FIG. 7.6.4. Lake Ontario Cisco time series including gillnet catch per unit effort for two surveys, bottom trawl catch per effort from US waters and commercial catch statistics for Ontario and New York.

Threespine Stickleback catches were high for a brief period in the late 1990s but are now caught only infrequently. Emerald Shiner catches are have had brief periods of moderately higher abundance however their catches in the trawl surveys are generally quite low even at peak abundance.

Benthic Fishes

In 2017, Deepwater Sculpin were the most abundant benthic prey fish since Round Goby abundance declined sharply from 2016 (Fig. 7.6.6). Deepwater Sculpin were once thought to be extirpated from Lake Ontario, but their abundance and biomass indices have increased steadily in annual surveys since 2004. Slimy Sculpin density continues to decline as the 2017 biomass index for US waters was the lowest ever observed. Prior to Round Goby proliferation, juvenile Slimy Sculpin comprised ~10% of the catch, but since 2004 the average of that value is less than 0.5%, suggesting Round Goby are limiting Slimy Sculpin reproduction.

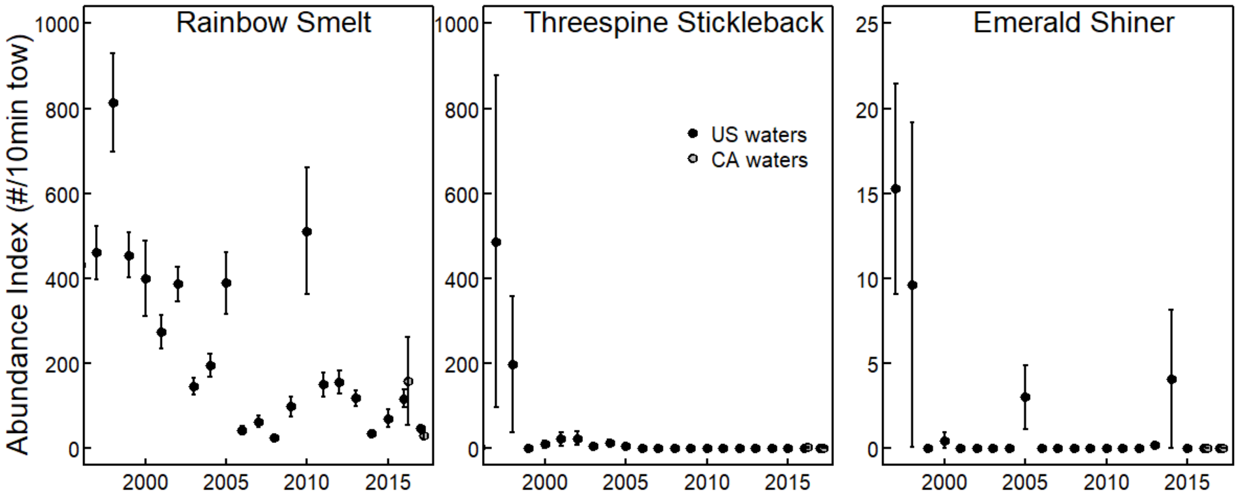

FIG. 7.6.5. Abundance indices for other Lake Ontario pelagic prey fishes based on bottom trawls in U.S. and Canadian waters, 1997-2017. Error bars represent one standard error.

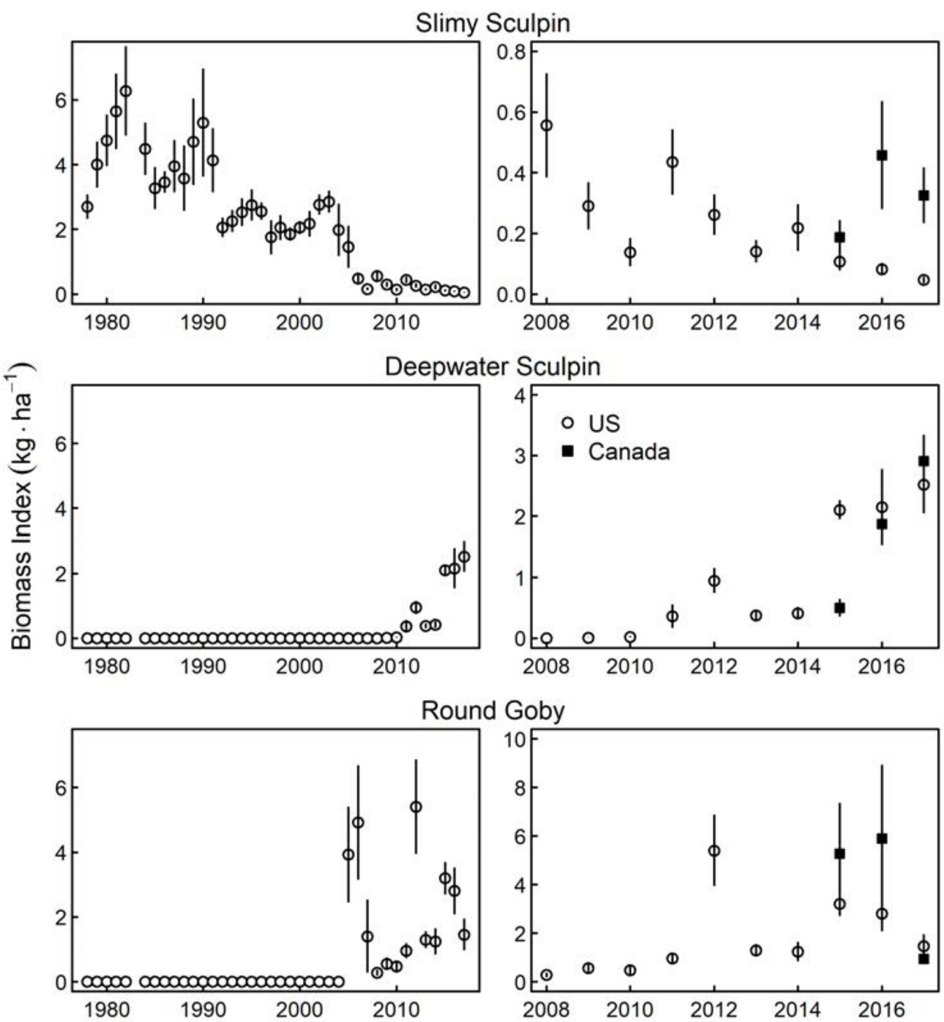

FIG. 7.6.6. . Lake Ontario prey fish trends for demersal or bottom-oriented species from 1978-2017 (left panels) and 2008-2017 (right panels). Survey is conducted in late-September and early-October and error bars represent one standard error. Sampling in Canadian waters began in 2015. Separate 20m stratified, lake area-weighted means are calculated separately for tows in US and Canadian waters to maintain comparability across the US index time series.

8. Species Rehabilitation

8.1 Introduction

A. Mathers, Lake Ontario Management Unit

OMNRF works with many partners—government agencies, non-government organizations and interested individuals at local, provincial and national levels—to monitor, protect and restore the biological diversity of fish species in the Lake Ontario basin (including the lower Niagara River and the St. Lawrence River downstream to the Quebec-Ontario border). Native species restoration is the center piece of LOMU's efforts to restore the biodiversity of Lake Ontario.

The sections following describe the planning and efforts to restore Atlantic Salmon, American Eel, Bloater, Lake Trout, and Lake Sturgeon. Some of these species have been extirpated while others were once common but are now considered rare, at least in some locations in the lake. Successful restoration of these native species would be a significant milestone in improving Ontario's biodiversity and help to address Ontario's commitments under the GLFC's Fish Community Objectives and commitments identified in the Great Lakes Water Quality Agreement.

8.2 Atlantic Salmon Restoration

M.D. Desjardins, Lake Ontario Management Unit

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

Originating as a small stocking program in 1987, the Lake Ontario Atlantic Salmon Restoration Program has developed into a significant partnership combining the efforts of the Ontario Ministry of Natural Resources and Forestry (MNRF), the Ontario Federation of Anglers and Hunters (OFAH), and many corporate and community partners. Since 2006, significant progress has been made through enhancements in fish production, community involvement, research and assessment, and habitat enhancement. However, progress toward some program benchmarks has not kept pace. Specifically, the program has failed to generate sufficient numbers of returning adult fish to achieve program goals.

In 2015, the program steering committee developed a revised five-year plan (2016-2020) with new priorities and performance measures designed to accelerate restoration with emphasis on improving adult returns. One new program objective was to advance the creation of a recreational tributary fishery in hopes of garnering more support for the program. To implement this objective, catch and release Atlantic salmon seasons were implemented in zones 16 and 17 in 2016 and a portion of our current restoration stocking allotment has been diverted toward the Ganaraska River to create an Atlantic Salmon destination fishery. Since 2016, roughly 50 thousand yearling Atlantic salmon have been stocked annually in the Ganaraska River (Section 6.1).

To help monitor progress, a new "state of the art" fish counter /camera has been installed in the fish way on Corbett's Dam. This new technology will also provide valuable information on the migratory patterns for other species running up the Ganaraska River. This past field season served as a trial year to fine tune operational and analytical requirements. Although it is still too premature to see a response from our stocking efforts, results have been encouraging (Section 1.12) and provide confidence in the technology to detect Atlantic Salmon when the begin to show-up in the Ganaraska. Plans are in place to install an additional unit in the Credit River in 2018. This new technology will vastly improve our ability to monitor returning salmon and trout species in Lake Ontario tributaries.

8.3 American Eel Restoration

A. Mathers, Lake Ontario Management Unit

Background

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-SLR). They also functioned as an important component of the LO-SLR commercial fishery during the latter part of the 20th century, and are highly valued by indigenous peoples. American Eel abundance declined in the LO-SLR system as a result of the cumulative effects from a variety of factors including: mortality during downstream migration due to hydro-electric turbines, reduced access to habitat imposed by man-made barriers to upstream migration, commercial harvesting, contaminants, and loss of habitat.

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). In 2012 the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommended that American Eel be identified as Threatened under the Canadian Species at Risk Act. These events led to additional efforts to protect and restore the American Eel. This section describes the current status of American Eel in LO-SLR as well as actions taken by the Lake Ontario Management Unit and its partners to reverse the decline of American Eel populations in Lake Ontario and the St. Lawrence River.

Indices of Eel Abundance

Moses Saunders Eel Ladder Operation

The largest barriers to both upstream and downstream migration of American Eels into the Lake Ontario system are power dams in the St. Lawrence River. One of these dams, the Moses Saunders Power Dam (MSPD), is located on the upper St. Lawrence River between Cornwall, Ontario and Massena, New York. In 1974, an eel ladder (Saunders Ladder) was put in place on the Ontario portion of the dam in order to aid in the upstream passage of American Eel. The maintenance and operation of the ladder has been maintained and upgraded through collaborations between OMNRF and Ontario Power Generation (OPG) in the years since, and OPG took full responsibility of the operation and maintenance of the ladder in 2007.

In 2017, the Saunders eel ladder was in operation 24 hours a day from June 15 to October 15. Over the course of these four months, passive integrated transponder (PIT) tag readers and an electronic fish counter were used to monitor the use of the ladder and quantify the number of eels passing upstream. The PIT tag reader and counter operated uninterrupted throughout the season. In 2017, a total of 77 eels successfully passed through the OPG eel ladder (Fig. 8.3.1) which represents the lowest number of eels passed ever recorded. The majority of eels passed through the ladder during a six week period from early July to late August and all eels exited the ladder during hours of darkness from 22:00 to 06:00.

The number of eels passed through the OPG ladder during 2017 was far lower than the number of eels that passed through a second eels ladder (Moses Ladder) on the New York portion of the MSPD where 6,644 eels successfully exited. The Moses Ladder has been in operation since 2006 and has been maintained by the New York Power Authority (NYPA). During 2012 to 2017, the NYPA ladder passed somewhat more eels than the OPG ladder and made up 53% of the total number that passed.

The combined number of eels that passed through both ladders (6,721 eels) was the lowest since 2003 when only the OPG ladder was in operation. During 2001 to 2011 there was an annual increase in the number exiting the ladder (s) but since 2011 the numbers have been declining annually by approximately 8,000 fish per year. The number of eels ascending the ladders in 2017 is less than 1% of the level of recruitment identified as a long-term indicator in the Lake Ontario Fish Community Objectives for American Eel (FCO 1.3; at least one million eels ascending the ladders annually).

The year 2017 was a year of record high water levels on the Great Lakes due to a great deal of snow melt and rain. To reduce these high water levels, record high flows were passed at both the MSPD and the Long Sault Dam. This passage of water through Long Sault Dam appears to have resulted in upstream migrating juvenile eels following this flow past the west end of the MSPD another 6 km upstream through the South Channel bypass reach to the base of the Long Sault Dam. This movement upstream to Long Sault Dam bypasses the entrance to the OPG ladder, located at the east end of MSPD. The Moses ladder would be more likely encountered by upstream migrating eels at the confluence of the South Channel with the tailrace of MSPD. An analysis of NYPA eel passage data strongly suggests that eel passage at the American facility was inversely related to flows through Long Sault Dam. Both the OPG ladder and the NYPA ladder saw increased in eel passage immediately following the closing of the gates at Long Sault Dam.

Biological characteristics were recorded on 75 eels collected from the OPG ladder during 2017. The average length (419.8 ± 88.2 mm, n=75, range: 274 - 790 mm) and average weight (105.9 ± 75.0g, n=75, range: 30-579g) was similar to what has been observed in recent years with a trend for slightly larger fish since 2012. These values are also similar to the average length (430.6 mm, n=529) and weight (113.3g, n=529) recorded from the NYPA ladder.

Lake Ontario and Upper St. Lawrence River Assessment programs

In 2017, the abundance of larger "yellow" eels in the LO-SLR was measured with several assessment programs. Bottom trawling in the Bay of Quinte has been conducted since 1972 as part of the fish community index program. The average catch of American Eel in 511 trawls conducted (June-September at sites upstream of Glenora) between 1972 and 1996 was 2.0 eels per trawl. No eels were captured in the 360 trawls conducted between 2003 and 2011 and less than 3 eels have been captured during the forty bottom trawls conducted annually between 2012 and 2017.

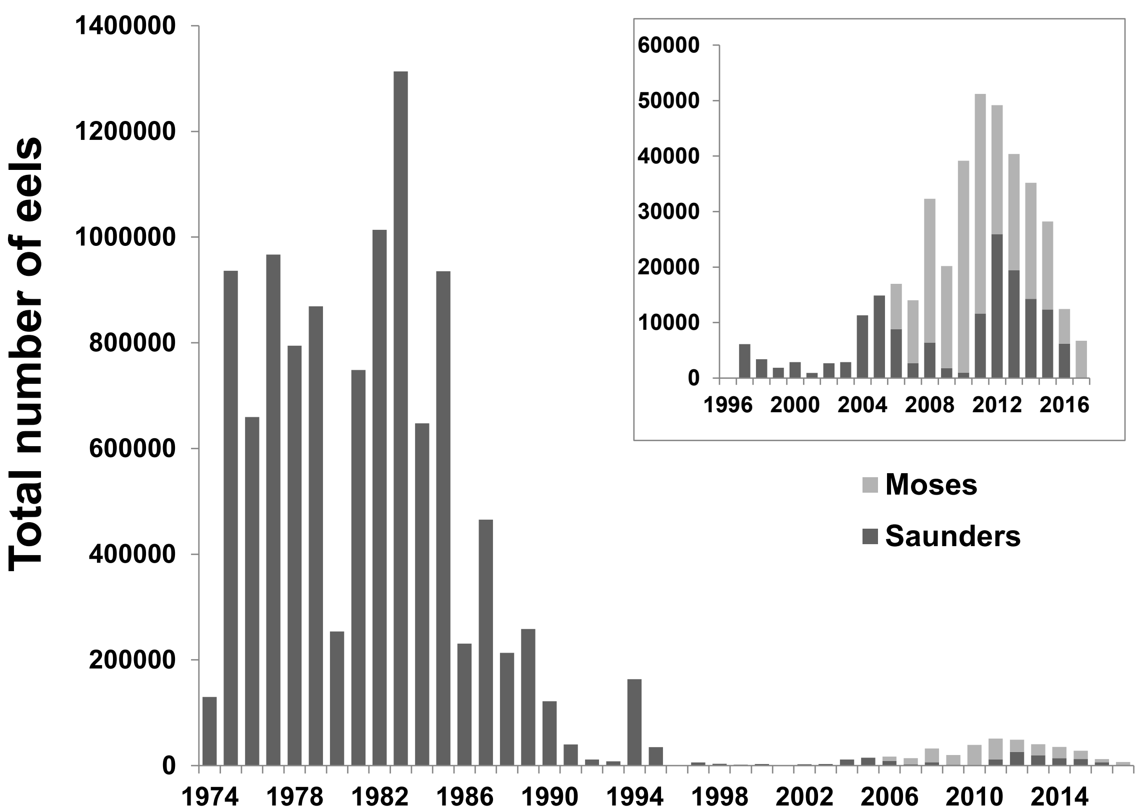

FIG. 8.3.1. Total number of eels ascending the eel ladders at the Moses-Saunders Dam, Cornwall, Ontario from 1974-2017. During 1996, the ladder operated however no counts were made.

Nearshore trap netting was conducted using the NSCIN fish community index protocol (see Section 1.4). During 2017, one eel was captured in 24 nets set in West Lake, one eel was captured in 24 nets set in Prince Edward Bay, no eels were captured in the 24 nets set in East Lake, and five eels were captured in 36 nets set in the Upper Bay of Quinte.

Tail Water Survey

In 2017, surveys were conducted by OPG to collect dead eels in the Canadian water from the tail water of the MSPD. The surveys followed standardized routes which extended approximately 10 km downstream of the dam along the Canadian shoreline. Tail water surveys were conducted from twice weekly on each Tuesday and Friday from June 13 to September 28, 2017. Investigators working in a boat searched the specified area for dead and injured American Eels that were floating or submerged along or near the shoreline. In 2017, OPG observed a total of 35 eels were collected during 32 surveys, an average of 2.0 eels per day while NYPA observed 1.1 eels per day during their survey of US waters below the MSPD (Fig. 8.3.2). The average length of whole eels (n=7) collected by OPG was 910 ± 70 mm (mean ± SD) (Fig. 8.3.3). Abundance of collected eels was highest in September with 12 eels collected. Most eels (91%) were collected when water temperatures were greater than or equal to 20°C. These results are similar to those of previous years, although fewer eels were collected in 2017 as compared to 2016 (n=64).

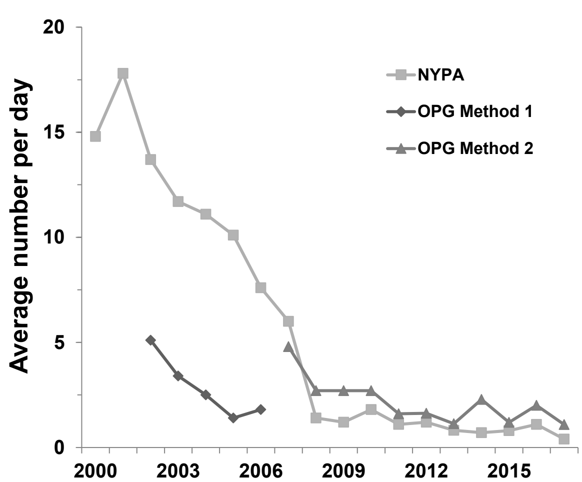

FIG. 8.3.2. Average number of eels observed per day in the tail-waters of the Moses-Saunders Dam 2000-2017. Note that the OPG sampling methodology and route changed in 2007.

Restoration Efforts

Effectiveness Monitoring of Stocked Eels

In one component of the OPG Action Plan for Offsetting Turbine Mortality of American Eel, over 4 million glass eels were stocked into the LO -SLR between 2006 and 2010. All stocked eels were purchased from commercial fisheries in Nova Scotia and were marked with oxytetracycline to distinguish them from eels that migrated naturally. Prior to stocking, health screening for a wide variety of fish pathogens (including Anguillicolodes crassus) was conducted at the Atlantic Veterinary College. As prescribed in the current Action Plan, eels have not been stocked since 2010.

DFO and OPG have collaborated to monitor the effectiveness of American Eel stocking through the night-time electrofishing of pre-established transects in the St. Lawrence River (Jones Creek, Grenadier Island, and Rockport) the Bay of Quinte (Deseronto, Big Bay, and Hay Bay) and Prince Edward Bay. In the spring of 2017, one hundred and sixty 100 m long electrofishing transects were sampled in these areas and a total of 130 eels were enumerated. Of the 130 American Eels observed or netted, 48 were captured, 2 were measured and weighed before being released, and 46 were sacrificed for age, growth, and origin assessment.

Spring density estimates during 2017 were much lower in all three survey areas relative to the peak density in 2013 (Fig. 8.3.4). In 2017, density estimates fell by half in the St. Lawrence River (39.3 ± 7.6 eels/hectare) and by two-thirds in the Bay of Quinte (32.0 ± 5.8 eels/hectare). Density estimates in the control sites in Prince

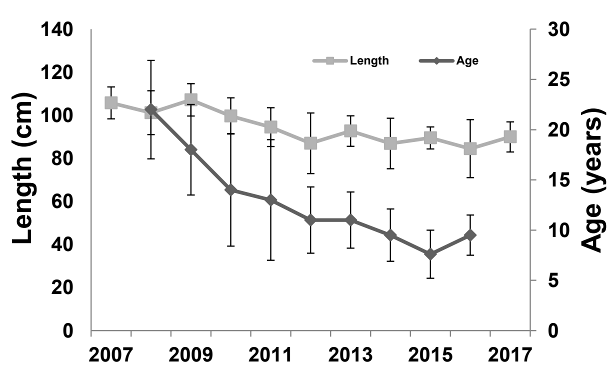

FIG. 8.3.3. Length (mean ± standard deviation) and age (mean ± standard deviation) of eels collected in the tail-waters of the Moses-Saunders Dam 2007-2017.

Edward Bay (14.0 +/- 12.1) fell by half in 2017, after having remained quite stable over the previous 4 years. The decline in overall density is not surprising as natural recruitment remains low, stocking has not occurred since 2010, and the number of eels out-migrating is increasing.

Following the large declines in density estimates, the spring biomass estimates declined in all locations (Fig. 8.3.5). During 2017, biomass estimates were nearly identical in the Bay of Quinte and the upper St. Lawrence River.

Ages were determined for 46 fish (25 from the St. Lawrence River and 20 from the Bay of Quinte and one eel from Prince Edward Bay). For the St. Lawrence River location, included only fish from the 2009 and 2010 stocking years. All of the year-classes stocked in the Bay of Quinte (2008-2010) were present. Given the current growth rates, it is estimated that the majority of stocked eels will out-migrate within the next 4 years.

Trap and Transport

Safe downstream passage past hydro turbines during the eel's spawning migration is an obstacle to restoration of eel that is identified in the OPG Action Plan. "Trap and Transport" (T&T) of large yellow eels was initiated in 2008 as an OPG pilot project to investigate this alternative for mitigating mortality of eels in the turbines at the Saunders Hydroelectric Dam. The project also involved local commercial fishers and the Québec Ministère des Forêts, de la Faune et des Parcs (MFFP). LOMU staff assisted OPG in the collection of eels captured in local commercial fisheries and transport of these fish from LO-SLR to Lac St. Louis (a section of the St. Lawrence River below all barriers to downstream migration). During 2008-2014, 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 in an effort to increase the numbers of eels transported.

A total of 4,970 large yellow eels (912 and 56 from Lake St. Francis (LSF) in the spring and fall respectively, and 1,781 and 2,221 from above the Moses-Saunders Dam during the spring and fall respectively) were released into Lac St. Louis immediately downstream of the Beauharnois Hydroelectric Dam as part of the T&T program (Fig. 8.3.6). During release, all T&T eels were observed to be in good health and swam away from the release site and down towards the substrate. The mortality of large yellow eels during both the spring (5 eels died) and fall (9 eels died) capture phases of the program was low in 2017.

MFFP Silver Eel Fishery Monitoring

To monitor the abundance of stocked eels in the out-migration to the spawning grounds, staff from MFFP monitored the silver eel weir fishery in the St. Lawrence River estuary. MFFP estimated the total commercial landings of the 11 fishermen at 14.8 tons or 9,933 silver eels during the fall of 2017. Harvest was observed between September 29 and November 18 with the peak numbers occurring during the weeks of October 13th and 20th. The CPUE was 3.0 kg/m of tidal weir, which was one of the lowest ever recorded

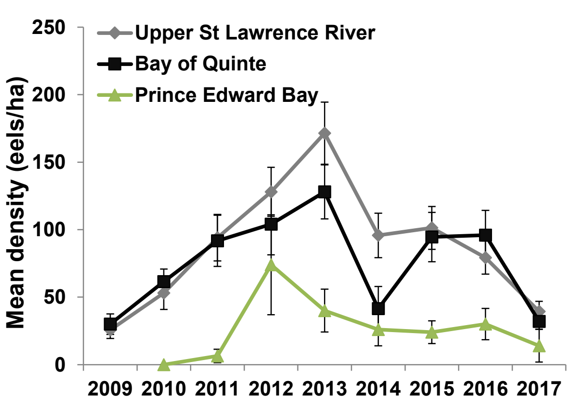

FIG. 8.3.4. Mean eels per hectare ± standard error of stocked American eel enumerated in spring transects, by study area.

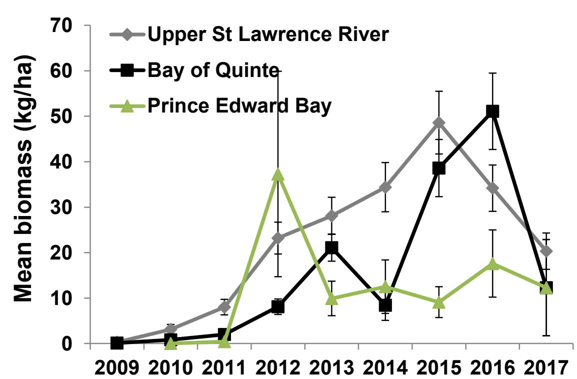

FIG. 8.3.5. Mean biomass (mean kg per hectare ± standard error) of eels captured in the Upper St. Lawrence River and the Bay of Quinte using electrofishing from 2009-2017. Sampling took place in the spring and fall from 2009-2011 and only in the spring from 2012-2017.

for this fishery. Eels originating from stocking are smaller and younger than the natural migrants; however since 2015 stocked fish have increased in size. The largest stocked individual during 2017 was 1,039 mm long. During 2017 the abundance of eels originating from stocking was estimated to be 36,169, which represents 33.5% of the total migration (107,967 fish). These eels originated from elvers stocked in the Richelieu River and LO-SLR between 2005 and 2010. MFFP anticipates that the occurrence of stocked eels will increase further over the next few years due to the large number of stocked individuals in the last three years of the experimental program. The exotic swimbladder parasite *Anguillicoides crassus* was found in six eels for a prevalence rate of 1.6% and an mean intensity of 2.0 (± 0.9) parasites. Three of the six parasitized eels were of natural origin, proving that the parasite now completes its life cycle in this new habitat.

Acoustic Telemetry to Track Movement

Since the fall of 2015, 191eels collected in the T&T program were implanted with acoustic tags and released into the Bay of Quinte (Table 8.3.1). Data from acoustic telemetry receivers in the Bay of Quinte, Lake Ontario, Iroquois Dam (upper SLR) and at various locations in the lower St. Lawrence River provide information that tracks eels movements downstream on the way to their spawning grounds in the North Atlantic Ocean.

To date, all 191 tagged eels have been detected after release, but based on lack of movement of some it is presumed that 5 tags have 'died'. Of the 178 eels tagged since the spring of 2016, 86 (50% after accounting for 'dead' tags) have been detected at the Iroquois Dam array, and 57 (33%) have been detected in Quebec waters of the SLR (Table 8.3.1). In addition, 6 of the released eels have been detected on the Cabot Strait receiver array in the North Atlantic Ocean (between Cape Breton and Newfoundland) which is maintained by the Ocean Tracking Network.

The US Fish and Wildlife Service maintained and monitored the Iroquois Dam array and eels were detected between July 23 and December 3, 2017 (Fig. 8.3.7). Fifty-seven eels from four different tagging sessions were detected. The peak abundance of eels moving through the array occur during the second week of November approximately one month after the peak numbers were observed in the silver eel fishery downstream. Additionally, movement seems to take place predominantly at night where 87% of detections were collected in darkness which is defined as the time between1 hour after sunset and 1 hour before sunrise. The eels generally moved quickly through the array with the duration of detections for 41 eels (72%) lasting less than 30 minutes.

Future work in this area is focused on VEMCO Positioning Information around the Iroquois Dam in order to determine if there is a particular path through the dam that the eels tend to favor (Fig. 8.3.8). If there is an overall similarity in the path that the eels follow, this information could be used to understand their behaviour during migration and potentially lead to methods of guiding eels safely around dams.

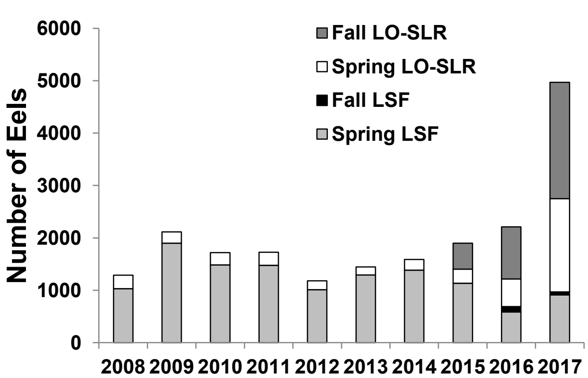

FIG. 8.3.6. Total number of eels collected in the Trap and Transport program from 2008-2017. Each total is divided into the locations at which the eels were captured in commercial fishery nets.

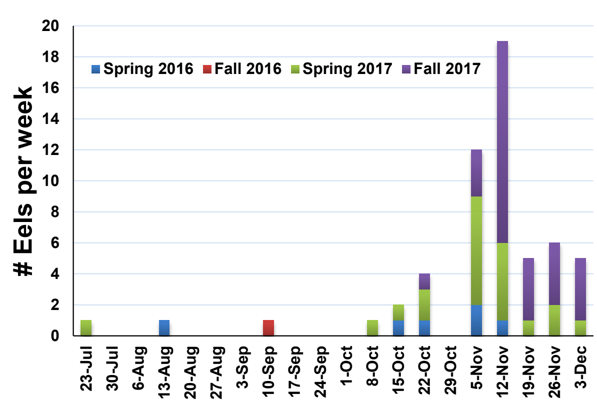

FIG. 8.3.7. Number of eels observed per week during 2017 at the Iroquois Water Control Structure on the upper St. Lawrence River. The session where the eels were tagged (Spring 2016, Fall 2016, Spring 2017 and Fall 2017) are identified in the figure legend. Data were provided by Scott Schlueter (USFWS).

TABLE 8.3.1. Fate of tags implanted in American Eels during the 5 tagging sessions between the fall of 2015 and the fall of 2017.

Fate	Fall 2015	Spring 2016	Fall 2016	Spring 2017	Fall 2017	Total
# Tags	13	39	40	49	50	191
"Dead" tags	0	2	2	1	0	5
Iroquois detection	-	17	20	20	29	86
Quebec detection	7	10	15	16	16	64
Cabot Strait detection	1	0	5	0	0	6

Eel Passage Research Center

Since 2013, the Eel Passage Research Center (EPRC) has conducted research to evaluate potential techniques to concentrate out-migrating eels for downstream transport around turbines at Moses-Saunders and Beauharnois Hydroelectric Dams to mitigate mortality in turbines. EPRC is coordinated by Electric Power Research Institute and primary funders of the research include OPG, Hydro Quebec, and the United States Fish and Wildlife Service (through a funding arrangement from NYPA). EPRC activities during 2017 included:

A White Paper investigation of the use of sound to guide out-migrating American Eels, Anguilla rostrata, near Iroquois Dam and the Beauharnois Power Canal was completed during 2017 and will be published in 2018.

An investigation of the use of electricity to guide out-migrating eels was continued during 2017.

The North American Eel Science Symposium was held at the OPG Visitor Centre and attracted 85 participants (from North America and Europe) with 32 presentations.

Future Work

In 2018, many of the projects described above will continue. The OPG and Quebec MFFP will monitor the presence of stocked eels in the silver eel fishery in the estuary of the St. Lawrence River. The OPG and OMNRF Trap and Transport program is scheduled again for spring and fall 2018. At the Moses-Saunders Dam, the Tail water surveys and the operation of the Eel Ladder will also occur again in 2018.

Restoration of American Eel in Lake Ontario and the St. Lawrence River has been identified as a Fish Community Objective for Lake Ontario. The abundance of eels moving into the system via the ladders at the Moses-Saunders Dam and the number of mature eels leaving the system are much lower than the FCO long-term indicators. However, the mortality rate of eels migrating downstream towards the spawning grounds has decreased as a result of the Trap and Transport project. In addition, a collaborative effort to develop methods of reducing mortality of eels during their downstream migration has been initiated. Although the Fish Community Objective related to American Eels has not been achieved, the activities summarized in this report show that some progress has been made.

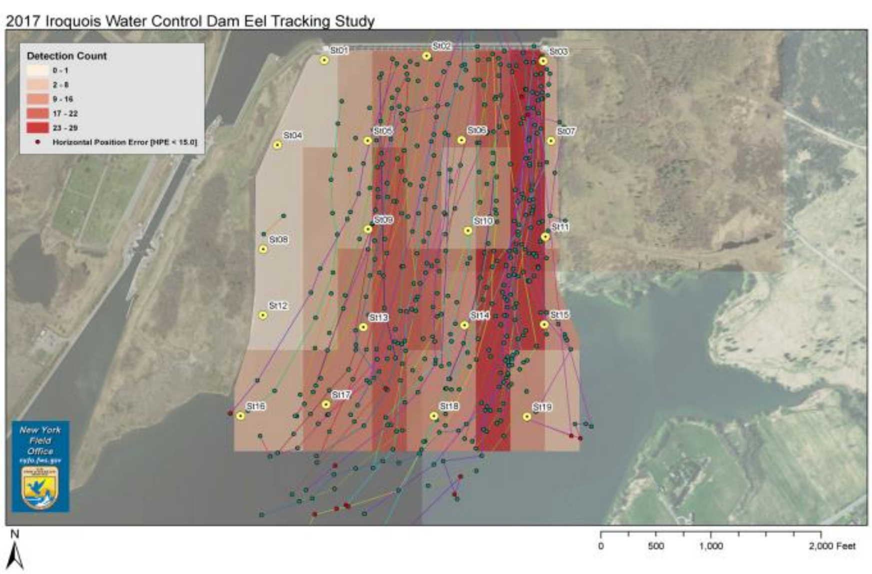

FIG. 8.3.7. Image of Iroquois Water Control Structure (located just above St01 to St03) in the upper St. Lawrence River. St01 to St19 are the locations of the acoustic receivers. Dots are individual positions determined with VPS analysis of the receiver data (https://vemco.com/products/vps/). Lines represent the tracks of tagged eels during September to December 2017. Figure from S. Schuelter and J. Ecret (USFWS).

8.4 Deepwater Cisco Restoration

J. P. Holden and C. Lake, Lake Ontario Management Unit

Prior to the mid-1950s, Lake Ontario was home to a very diverse assemblage of deepwater ciscoes including Bloater (*Coregonus hoyi*), Kiyi (*C. kiyi*), and Shortnose Cisco (*C. reighardi*). Currently, only the Lake Herring (*C. artedi*) remains in Lake Ontario. Re-establishing self-sustaining populations of Bloater in Lake Ontario is the focus of 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 Lake Ontario Committee has set a goal to establish a self-sustaining population of Bloater in Lake Ontario within 25 years. The objectives and strategies for the establishment of Bloater are specified in a draft strategic plan, which is currently under review. 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 supporting a small 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.

In 2017, there were 169,000 fall yearling (age-1) Bloater were stocked by MNRF at two stocking locations. 12,000 were stocked near Main Duck Island (in ‘the trench’) to support ongoing research activities along with an additional 119 older fish (see Section 9.2). The remaining 157,000 were stocked in deep water south of Cobourg. As production numbers increase the stocking strategy will focus on putting these fish in 80m-100m depths south of Cobourg. This area minimizes the delivery time from the hatcheries and the on vessel delivery time due to the close proximity to suitable depths.

Several of the assessment programs have the potential to capture and assess Bloater survival and population levels. Bloater can be easily be misidentified as Cisco so extra care is taken to collect morphometrics and DNA tissue to verify suspected catches of Bloater. On July 5, 2017 a trawl in 90 m south of Rocky Point captured what is believed to be a Bloater. Measurements of fin length ratios are consistent with baseline measurements made on stocked Bloater. Results from the DNA analysis have not yet been conducted. Additionally, the bones analyzed by USGS showed the presence of chemical marks applied while in the hatchery indicating it was a US stocked fish. The fish was 130 mm (TL, 119 mm fork length) long and weighed 14 grams (Fig. 8.4.1).

FIG. 8.4.1. Suspected Bloater caught in a bottom trawl at Rocky Point in 90 m water depth on July 7, 2017. The fish is pinned with the fins stretched out so that the measurements from specific reference points can be conducted to aid in species determination.

8.5 Lake Trout Restoration

J. P. Holden and M. J. Yuille, Lake Ontario Management Unit

Lake Trout were extirpated in Lake Ontario in the 1950s. The loss of this top predator and valued commercial species caused both ecological and economic damage. Rehabilitation of Lake Trout in Lake Ontario began in the 1970s with Sea Lamprey control and stocking of hatchery fish. The first joint Canada/U.S. plan outlining the objectives and strategies for the rehabilitation efforts was formulated in 1983 (referred to henceforth as 'the strategy'), and revisions in 1990, 1998, and most recently in 2014 were made to evaluate the methodology and the progress of rehabilitation. The two objectives of the 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.

Prior to 1996, Lake Trout were monitored with a targeted bi-national Lake Trout netting program. Since 1996, in Canadian waters of Lake Ontario the Lake Trout targets have been evaluated based on catches in a subsample of sites in the Fish Community Index Gill Netting (Section 1.2). Relative abundance is tracked across three areas of the survey: Kingston Basin (Grape Island, Melville Shoal, EB02, EB06, and Flatt Point), Main Lake (Rocky Point, Brighton and Wellington), and Deep Main Lake (Rocky Point deep sites) at sites where the water temperature on lake bottom is below 12°C. Pre-1996 indices back to 1992 from the Fish Community Index Gill Netting program (Section 1.2) have been added to the current status report for context.

Lake Trout abundance experienced a significant period of decline that began in the early 1990s and reached a low point in 2005 (Fig. 8.5.1). Since 2005, there has been a gradual increase in the relative abundance of adult Lake Trout although catches are still well below those seen in the 1990s. The strategy specifically identifies the abundance of female Lake Trout greater than 4000 g as an important indicator of the health of the spawning stock. The current catch per unit effort (CUE, number per 24 hr gill net set) is on an increasing trend since 2005; however, it has been relatively stable since 2013 and decreased in Kingston Basin sites (Lake Deep Excluded Index) (Fig. 8.5.2).

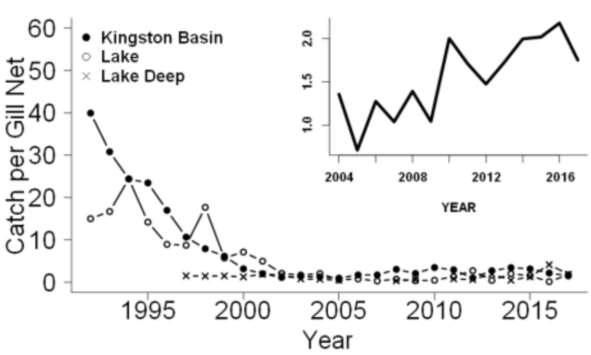

FIG. 8.5.1. Catch per unit effort of mature Lake Trout by area. Inset shows mean trend of the three areas combined since 2005.

Survival of juvenile Lake Trout was identified as one factor contributing to the decline in abundance. Catches of age-3 fish per half million fish stocked is used as an index of juvenile survival. Survival to age-3 of the 2014 cohort (sampled in 2017) is well below the target of 1.5 identified in the strategy (Fig. 8.5.3). This index has become increasingly variable in recent years and evaluation of alternative methods of assessing year-class strength based on catches of adults over multiple years is on-going.

As a measure of improved production of wild offspring and recruitment to the adult life stage, the strategy sets a target of wild fish to levels greater than observed between 1994 and 2011 (Ontario target = 13.6 wild fish per 100 standard gill net sets). The occurrence of wild Lake Trout is measured through catches of fish that do not bear hatchery fin clips (i.e., unclipped). Stable isotope analysis suggested that more than 90% of unclipped fish were of wild origin. Catches of wild Lake Trout remain below target (Fig. 8.5.4).

Catches of small Lake Trout in the Fish Community Index Trawling (Section 1.3) are generally low but can provide some additional insight on wild recruitment. Small numbers of wild young-of-year (YOY) fish have been occurring more frequently in recent years and 2016 is the highest combined catch of

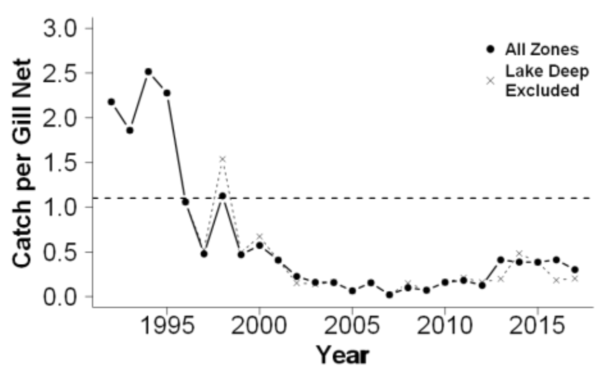

FIG. 8.5.2. Relative abundance of mature female Lake Trout greater than 4000 g. Trend is present with and without Lake Deep sites as they were not conducted in all years.

wild age-0 and age-1 fish in the time series (Fig. 8.5.5).

The effectiveness of Sea Lamprey control is monitored through the number of A1 wounds (fresh with no healing) observed on Lake Trout. The strategy sets a target of less than two A1 wounds per 100 Lake Trout. The target has been consistently met since 1996 with the exception of 2012 (Fig. 8.5.6).

Since 1998, Lake Trout stocked by MNRF have been clipped with multiple fin clips (an adipose clip and one other), and contain no coded wire tags (CWT). US stocked fish have continued to use only adipose clips paired with CWT. This difference in marking allows for an evaluation of fish straying although CWT detection rates and past Ontario stocking of fish with adipose only clips creates a range in expected values. CWT returns alone over the past 3 years suggests 23% (mean, range: 20 to 25%) of the total number of Lake Trout captured in Fish Community Index Gill Netting originated from US stocking while catches of adipose clip only fish suggest a higher immigration rate (mean 32%, range: 30 to 35%). Catch location and stocking sites are mapped in Fig 8.5.7.

The body condition of Lake Trout is reported as the predicted weight, based on a log-log regression, of a 680 mm (fork length) Lake Trout. While below the peak condition index observed in 2011 and 2013, Lake Trout condition (4.64 kg) in remains above the average (4.46 kg) for the time series (Fig. 8.5.8).

Catch and harvest of Lake Trout in the recreational fishery is assessed through the Western Lake Ontario Boat Angling Survey (last conducted in 2016). The estimated recreational catch of Lake Trout in the Ontario waters of Lake Ontario was 6,814 fish in 2016; a significant decline (47%) from the previous 2013 catch estimate (Fig. 8.5.9). Harvest in 2016 (12% of catch) was higher than 2013 (4% of catch), but remains just below the average harvest rate since 2000 (15% of catch; Fig. 8.5.10). Of the salmon and trout species targeted in Lake Ontario, Lake Trout was the third most frequently caught species behind Chinook Salmon and Rainbow Trout, although the majority of the catch in 2016 was isolated in the western end of Lake Ontario (Niagara and Hamilton Areas). Of the Lake Trout sampled by creel technicians, it was determined that the majority of fish were of hatchery origin (89%) and 78% were stocked in U.S. waters (based on clip data). An angler survey was conducted in the Kingston Basin in 1992 and suggested that Lake Trout catches were 3.5 times higher in the Kingston Basin compared to catches

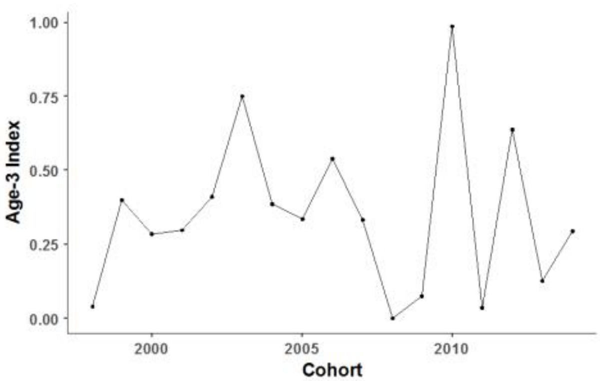

FIG. 8.5.3. Catch per unit effort (CUE) of age-3 Lake Trout standardized to 500,000 stocked. The Lake Trout Management Strategy target has established a target CUE = 1.5.

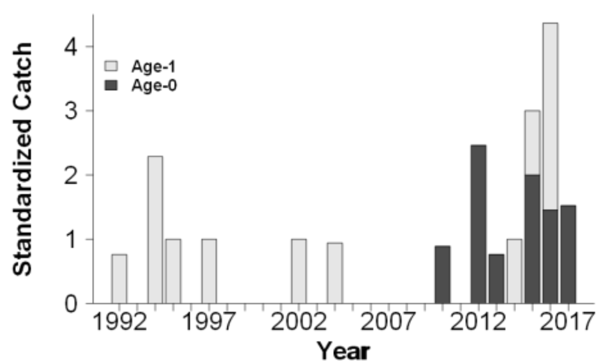

FIG. 8.5.5. Catches of age-0 and age-1 Lake Trout in the Fish Community Index Trawling (Section 1.3). Catches are standardized to a 32 tow trawl program.

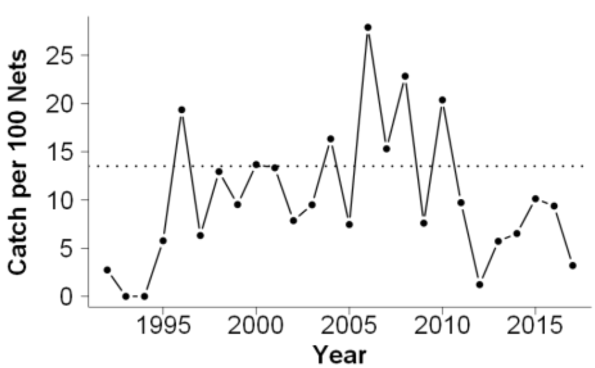

FIG. 8.5.4. Catch of unclipped Lake Trout per 100 standardized nets. Dotted line indicates Lake Trout Management Strategy target of 13.7 fish per 100 standardized nets.

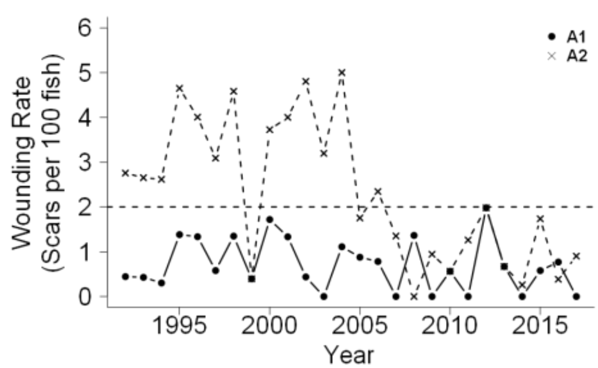

FIG. 8.5.6. Sea Lamprey scarring rate. Dotted line indicates the Lake Trout Management Strategy target of a maximum of two A1 wounds (fresh with no healing) per 100 Lake Trout.

observed in the Western Lake Ontario Boat Angling Survey. Scaling the 2016 western basin harvest to account for Kingston Basin harvest results in 3,667 Lake Trout per year being harvested. Commercial fishers report by-catch of fewer than 1000 Lake Trout annual resulting in a total harvest (recreational and commercial combined) approaching the strategy's maximum recommended harvest of 5,000 fish from Ontario waters.

The expanded transects and depths in the Fish Community Index Gill Netting (Sections 1.2) provide an opportunity to contrast new sites with the established index sites Overall, the size distribution of Lake Trout captured at western gill net sites was similar to the traditional index sites (Fig. 8.5.11). Gill Net catch per standard set (standardized to 24hrs) was variable within zones but the general trend is that Conway and Kingston Basin sites had a slightly higher median catch than the main lake sites (Fig. 8.5.12). Noteworthy, however, is that comparisons of CUE between Zones is complicated by unbalanced sampling, and how CUE is influenced by depth (Fig. 8.5.13) and bottom temperature (Fig. 8.5.14).

FIG. 8.5.7. Catch and generalized origin location of US stocked Lake Trout captured in Fish Community Index Gill Netting (Section 1.2) gill net sets. Black circles indicate the catch location. Open circles indicate the generalized stocking area.

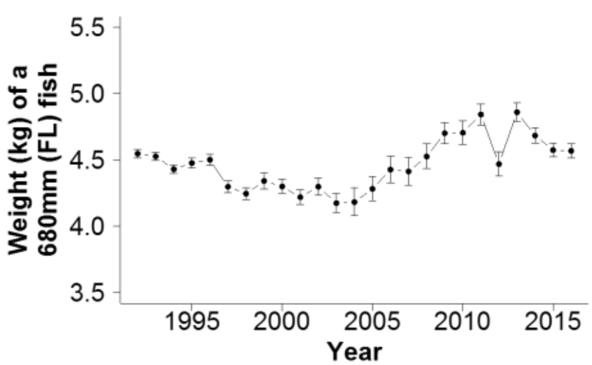

FIG. 8.5.8. Lake Trout Condition Index is the predicted weight of a 680 mm (fork length) Lake Trout. Error bar indicate the 95% confidence intervals.

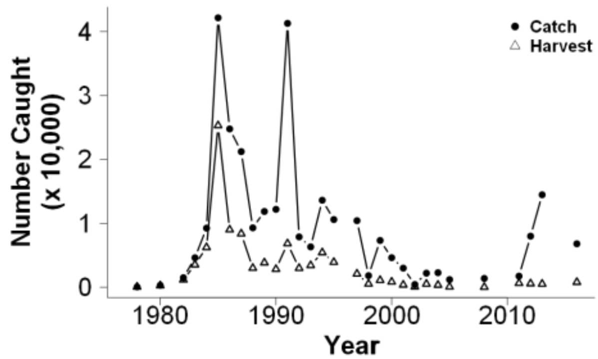

FIG. 8.5.9. Estimated catch and harvest of Lake Trout in the Western Lake Ontario Boat Angling Fishery survey.

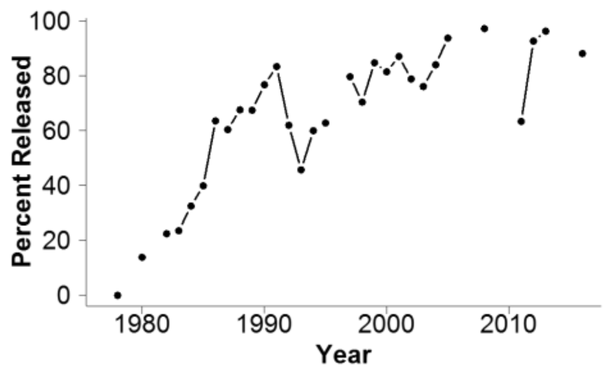

FIG. 8.5.10. Percentage of Lake Trout released in the Western Lake Ontario Boat Angling Fishery.

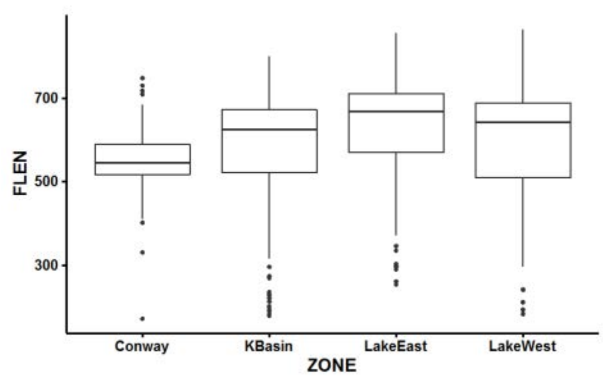

FIG. 8.5.11. Comparison of size distribution across Lake Ontario of Lake Trout captured in Fish Community Index Gill Netting (Section 1.2). Median value is indicated by the solid line. Boxes and whiskers capture 50% and 95%, respectively, of the values. Values beyond the 95% quantile are represented individually as solid circles. Specific transects have been assigned to broader groups (LakeWest = Port Credit, Cobourg, Brighton and Wellington; LakeEast = Rocky Point; KBasin= EB sites, Flatt Point, Grape Island and Melville Shoal; Conway = Conway).

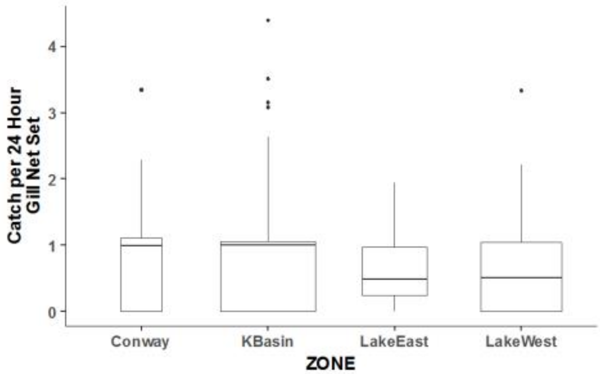

FIG. 8.5.12. Comparison of catches of Lake Trout per standardized 24hr set time Lake Ontario captured in Fish Community Index Gill Netting (Section 1.2) . Median value is indicated by the solid line. Boxes and whiskers capture 50% and 95%, respectively, of the values. Values beyond the 95% quantile are represented individually as solid circles. Specific transects have been assigned to broader groups (LakeWest = Port Credit, Cobourg, Brighton and Wellington; LakeEast = Rocky Point; KBasin= EB sites, Flatt Point, Grape Island and Melville Shoal; Conway = Conway).

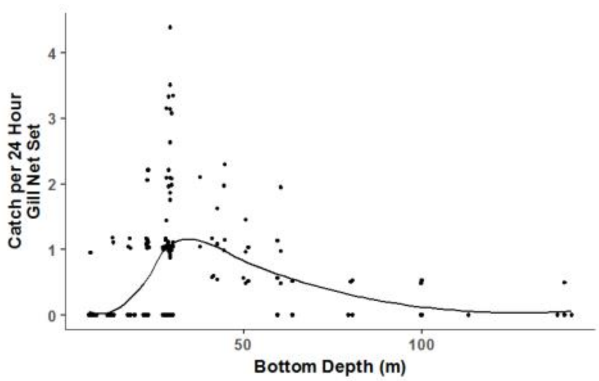

FIG. 8.5.13. Relationship between net depth of bottom set gill nets and Lake Trout catch per standardized 24hr gill net set combined for all sites in Fish Community Index Gill Netting (Section 1.2). The trend line has been fitted with a non-linear loess fit.

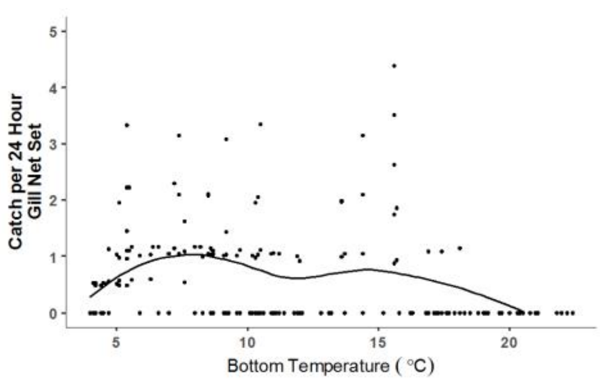

FIG. 8.5.14. Relationship between water temperature at net depth of bottom set gill nets and Lake Trout catch per standardized 24hr gill net set combined for all sites in Fish Community Index Gill Netting (Section 1.2). The trend line has been fitted with a non-linear loess fit.

8.6 Lake Sturgeon

C. Lake and M. Hanley, Lake Ontario Management Unit

Lake Sturgeon (*Acipenser fulvescens*) were a key component of the fish community in Lake Ontario and the Upper St. Lawrence river in the past, but are now listed as threatened under the Endangered Species Act (ESA) in this area. The goal of the Lake Sturgeon Recovery Strategy (RS) is to "maintain existing Lake Sturgeon populations throughout their current range and where feasible, to restore, rehabilitate or re-establish, self-sustaining Lake Sturgeon populations which are viable in the long term within their current habitat and/or within habitats they have historically occupied, in a manner consistent with maintaining ecosystem integrity and function".

In order to achieve the goals set out in the RS for Lake Sturgeon, more information is needed related to their current distribution and abundance. Over two weeks during the spring of 2017, Lake Sturgeon were targeted with various gears in the Lower Trent River. The main goal of the project is to determine presence of Lake Sturgeon in the system, and if possible, implant an acoustic tag into captured Sturgeon to determine range and timing of movement in the Bay of Quinte and Lake Ontario. This information will help to address key knowledge gaps identified in the RS and will contribute to the continued rehabilitation of this species. Acoustic tags deployed in the program take advantage of other large-scale acoustic tracking programs being conducted throughout the Bay of Quinte and Eastern Lake Ontario (see Section 9 of this report for details on these projects).

The 2017 Lake Sturgeon survey took place in the Trent River, downstream of Lock 1 to the mouth of the Bay of Quinte from April 25 to May 4. Various gears were used, including baited hook lines, large-mesh multifilament gill net (20 m x 203mm, 254 mm, 279 mm mesh size) and boat electrofishing (Table 8.6.1). The baited hook lines and large-mesh gill nets caught very few fish (8 fish total; hook lines - 1 Common Carp, gill nets - 5 Walleye, 1 Greater Redhorse, 1 Common Carp). The electrofishing boat resulted in the observation of over 5,000 fish, and for the more numerous species, numbers were only estimated. A detailed summary is given in LOA 17.24 Trent River Lake Sturgeon Survey – 2017. Walleye were extremely abundant during the survey, accounting for roughly a third of the fish observed.

On the last day of the survey (May 4), two Lake Sturgeon were encountered. The first was too large (estimated 1.8 m length) to net into the boat, despite being temporarily immobilized by the electrofishing boat. Shortly after the first Lake Sturgeon was observed, a second was observed and captured. This fish was retained long enough to record length and weight, and a quick surgery was conducted to implant an acoustic tag (Table 8.6.2).

Some preliminary acoustic tracking data were obtained in 2017, prior to the receivers being retrieved for the winter (Fig. 8.6.1). The tagged Lake Sturgeon was first detected at the mouth of the Trent River on October 2 (approximately 3 kilometers from the tagging site, 152 days after tagging). It then moved east past other receivers over the next 10 days (approximately 21 kilometers). The long battery life of the tag will hopefully ensure that this fish continues to provide valuable data for some time to come.

TABLE 8.6.1. Summary effort data (means and SD) for the various gears used from April 25 – May 4, 2017.

Gear	Sets	Mean effort duration	Total effort	Depth (m) Min	Depth (m) Max	Temperature (°C)
Hook lines	18	22.9 ± 0.58 hr	413.9 hr	1.9 ± 0.8	2.4 ± 1.2	10.9 ± 0.5
Gillnet	8	22.5 ± 0.98 hr	202.5 hr	2.4 ± 1.0	3.1 ± 1.2	10.9 ± 0.5
Electrofishing	-	27.7 ± 10.2 min	221.7 min	-	-	10.9 ± 0.5

TABLE 8.6.2. Summary biological and tagging data for Lake Sturgeon captured May 4, 2017 in the Trent River.

Weight:	12.6 kg	External Tag:	Fluorescent green Floy tags (x2)
Total Length:	1.29 m	Internal Tag:	Vemco V16 (10 yr. battery life)
Girth:	48 cm		
Sex:	unknown		

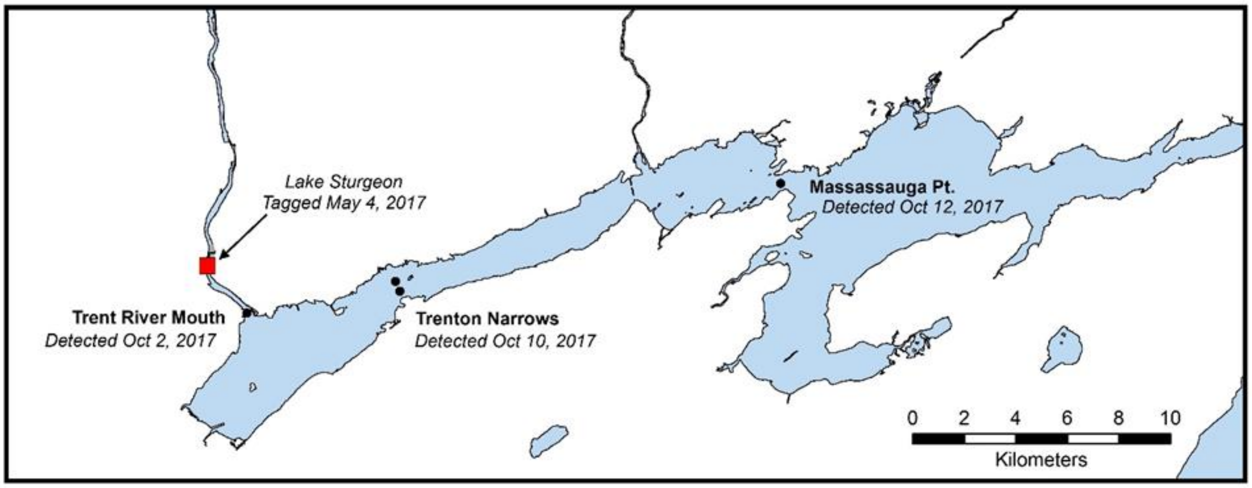

FIG. 8.6.1. Detections of tagged Lake Sturgeon at receivers in the Upper Bay of Quinte during the fall of 2017.

Juvenile Lake Sturgeon Survival Study

The Lake Ontario Management Unit (LOMU), in partnership with the Springside Community Hatchery (operated by the Napanee and District Rod & Gun Club), released 20 juvenile Lake Sturgeon into the Napanee River on August 15, 2017. The fish were 3 years old and approximately 30 cm long. All fish were PIT-tagged; five also had acoustic tags implanted internally. Students from the Mohawks of the Bay of Quinte Community Well Being Day Camp participated, releasing individual fish from small buckets into the Napanee River.

Approximately three weeks after the initial release event, three more juvenile Lake Sturgeon were released. These fish had received internal acoustic tags later than the ones released initially, and required the extra time to recover prior to release. This brought the total number of Lake Sturgeon released to twenty-three (15 PIT-tagged only; 8 PIT-tagged and tagged with an internal acoustic transmitter tag).

The Lake Sturgeon were hatched from eggs collected in the upper St. Lawrence River in 2014 by US Fish and Wildlife Services and raised by the New York State Department of Environmental Conservation Oneida Lake fish culture station. Since that time, approximately 40 sturgeon have been held on the Canadian side at the Glenora Fisheries Station and White Lake Fish Culture Station. One week prior to release, sturgeon were moved to the Springside Community Hatchery to acclimatize to the temperature of the Napanee River.

Data from the acoustically tagged sturgeon have been uploaded to the Great Lakes Acoustic Telemetry Observation System (GLATOS) so that we may track the overwinter movement of these fish in the river, or if they move into the lake. We have confirmed some limited movement of several fish within the Napanee River with the use of a mobile hydrophone. The data collected will inform future management strategies for Lake Sturgeon recovery.

9. Research Activities

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

Project Leads: Mary Hanley, Carolina Taraborelli, Brent Metcalfe, Tim Johnson (OMNRF-ARMS)
Collaborators: Lake Ontario Management Unit, Fisheries and Oceans Canada
Funding: OMNRF Special Purposes Account, Great Lakes Protection Act / Canada-Ontario Agreement

Long-term sampling of lower trophic levels allows for the monitoring of changes in the physical, chemical, and biological aspects of a lake ecosystem. From 1981-1995, Fisheries and Oceans Canada (DFO) collected this information from Station 81 (Fig. 9.1.1) in eastern Lake Ontario. In 2007, the OMNRF Aquatic Research and Monitoring Section (ARMS) resumed sampling at Station 81, and in 2017 added two more sampling sites to the program: T4L and NYSDEC (Fig. 9.1.1). The NYSDEC site is part of a long-term, U.S.-lakewide biomonitoring program conducted by several U.S. agencies & Cornell University; our observations will supplement their efforts. The collection of information on physical, chemical and lower trophic levels was completed at all three sites between May and October, 2017 in collaboration with the Lake Ontario Management Unit (LOMU) and Fisheries and Oceans Canada.

Station 81 is located in the centre of the eastern basin (44° 01.02'N, 76° 40.23'W; 34 m water depth; Fig. 9.1.1), while the other two sites are located farther offshore. These additional sites were chosen to provide more information about the variation in lake conditions to support the Bloater restoration project (Section 9.2). T4L represents a site with greater depth than Station 81 lying just outside of the eastern basin proper (43° 49.67'N, 76° 41.68'W; 57 m water depth; Fig. 9.1.1). NYSDEC is also a deeper site but is situated within the acoustic array used to inform Bloater restoration efforts (43° 55.20'N, 76° 31.00'W; 53 m water depth; Fig. 9.1.1).

In 2017, stratification of the water column was first observed on June 19th at all three of the sites and was still observed during the last visit on October 2nd. Average depth of the thermocline was similar for both Station 81 and T4L, but was

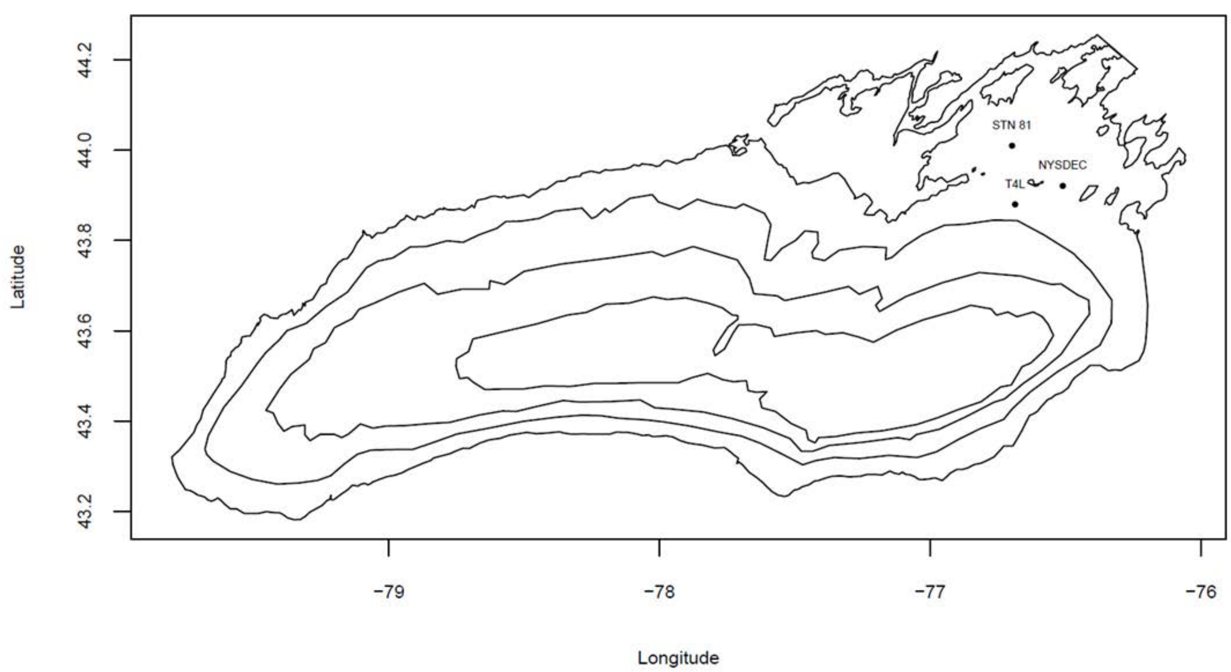

FIG. 9.1.1. Map of Lake Ontario showing the locations of all three sampling sites.

much deeper in the water column at NYSDEC (Table 9.1.1).

At Station 81, Secchi depth varied between 3 m and 15 m. The mean daily water temperature ranged from 5.2° C to 16.3° C with the highest average temperature observed on August 21. At T4L, Secchi depth varied between 4.5 m and 17 m. The mean daily water temperature ranged from 4.1° C to 13.4° C with the highest average temperature observed on September 12. At NYSDEC, the mean daily water temperature ranged from 6.3° C to 16.3° C with the highest average temperature observed on August 10. Nutrient, phytoplankton, and zooplankton samples are currently being analyzed.

Long-term monitoring of lower trophic levels at sites like Station 81 provides information to scientists on the effects of various ecological, physical, and chemical stressors on ecosystem health. In addition, continual monitoring allows for the identification of natural variation and the development of "normal" ranges of values for measured parameters. Adding more sampling locations to this long term monitoring allows scientists to compare new sites to others that have been observed for several years to look for variation among sites and obtain a more complete picture of the lake.

TABLE 9.1.1. Average, maximum, and minimum depths of the thermocline at all three sampling sites in Lake Ontario. All data was collected from May 4 – October 2, 2017.

	STN 81	**T4L**	**NYSDEC**
Mean	16.3	17.8	27.0
Max	22.0	25.0	35.0
Min	11.0	11.0	21.0

9.2 Movement and habitat use of a reintroduced fish species: Bloater (*Coregonus hoyi*) in Lake Ontario

Project Leads: Natalie Klinard, Scott Colborne, Aaron Fisk (Great Lakes Institute for Environmental Research, University of Windsor); Tim Johnson, Brent Metcalfe (OMNRF-ARMS)
Collaborators: Lake Ontario Management Unit, Fisheries and Oceans Canada, New York State Department of Environmental Conservation
Funding: Great Lakes Fishery Commission, Great Lakes Protection Act / Canada-Ontario Agreement

Deepwater ciscoes (*Coregonus spp.*) are a diverse group of fish that were an integral part of the native fish community of the Great Lakes. A total of seven deepwater cisco species (*C. hoyi, C. reighardi, C. alpenae, C. zenithicus, C. johannae, C. kiyi, C. nigrippinis*) were once present in the Great Lakes basin, four of which occurred in Lake Ontario. Currently, most deepwater ciscoes are extinct or have suffered local extirpations that restrict them to Lake Superior, while the shallow-water form of cisco (*C. artedi*) persists throughout the Great Lakes. An exception to this is Bloater (*C. hoyi*), a deepwater cisco that remains in Lakes Huron, Michigan, and Superior. Until the mid-1950s, Bloater were an abundant forage fish in Lake Ontario but became scarce in the 1960s as a result of a dramatic population decline associated with competition with invasive Rainbow Smelt (*Osmerus mordax*) and Alewife (*Alosa pseudoharengus*), overharvesting, and Sea Lamprey (*Petromyzon marinus*) induced mortality. Although Bloater persisted in Lake Ontario longer than the other three deepwater ciscoes (*C. reighardi, C. kiyi, C. nigripinnis*), the last documented catch was in 1983.

OMNRF and New York State Department of Environmental Conservation have developed an initiative to re-establish a self-sustaining population of deepwater ciscoes in Lake Ontario by stocking juvenile hatchery-reared Bloater (see Section 8.4). However, as with most stocked fishes, we have little knowledge of their behaviour and survival following stocking. Questions include: Where do fish go after they're stocked? What habitats do they use and how does this change over time? How many of them survive after stocking? Do they school together and move in groups? All of these questions can be answered through the use of acoustic telemetry, which involves surgically implanting Bloater with acoustic transmitters and releasing them as part of a normal stocking event. This update provides further analyses of data obtained between November 2015 and May 2017; the next scheduled download of the receivers is in May 2018.

In November of 2015, we tagged 70 yearling Bloater (mean length 174 mm) with either Vemco V7- or V9-69kHz tags, and released those fish with ~40,000 fingerlings and yearlings into the centre of an acoustic array in eastern Lake Ontario (Fig. 9.2.1a). The receiver array (n = 80 Vemco 69 kHz receivers) detected 68 of the 70 tagged Bloater, amounting to 577,361 detections over 6.5 months. The Bloater were released in November and showed variation in residence patterns during the first week after release (Fig.

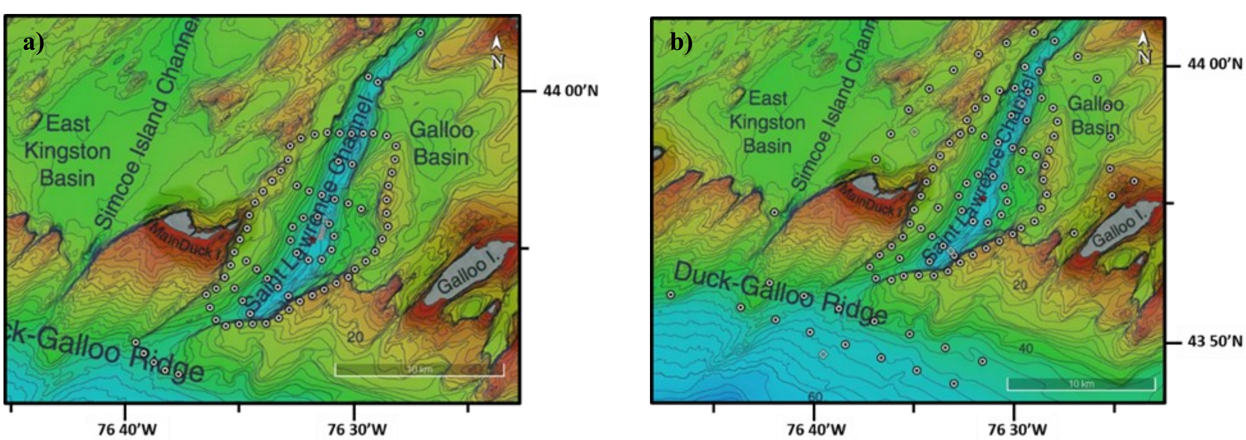

FIG. 9.2.1. Bathymetric maps of eastern Lake Ontario featuring the acoustic receiver array for (a) 2015-16 and (b) 2016-17 where white dots represent individual receivers, white triangles indicate range test receivers, white diamonds represent thermistor strings, and red stars show the release site.

9.2.2). Residence time of Bloater in the array ranged from less than a day to 57 days with an average of 8.8 days, indicating relatively quick dispersal. However, individuals were detected beyond the main receiver array with one tagged Bloater being detected in the Bay of Quinte (~74 km from release location) and another at the mouth of the Niagara River (~220 km from release location). Preliminary analyses of fate indicated the majority (51%) of Bloater emigrated from the array shortly after release, moving either towards the main basin or further into the St. Lawrence Channel. The 200-day survival of Bloater was estimated to be about 5%. Predation by salmon and trout is likely the primary source of mortality, and this is being investigated using specialised predation tags and by tracking the behaviour and movements of the dominant predators (see Section 9.4).

Receivers downloaded in May 2016 were redeployed, along with 23 additional receivers to continue to track the behaviour and survival of tagged Bloater (Fig. 9.2.1b). In November 2016, 161,680 Bloater were stocked by MNRF including 24 tagged fish. Half of these tagged Bloater contained V9 detection tags, while the other half contained V9-pt tags that record the depth and temperature of the fish when it is detected. An additional 27 Bloater were tagged with V9 and V9-pt tags in March 2017 and released in April 2017 as part of a smaller stocking event. The array was downloaded in May 2017 and expanded to include a total of 105 receivers (Fig. 9.2.3). However, the November 2016 and April 2017 stocking events were each associated with technical issues which generated concerns about the reliability of these data to represent true Bloater behaviours. In November 2017, 109 Bloater were tagged with V9 and V9-pt tags and released with 12,560 untagged Bloater in the array (an additional 156,930 Bloater were stocked near Cobourg, see Section 8.4). The receiver array will next be downloaded in May 2018, and those detections, in combination with in situ environmental and biological data being collected throughout eastern Lake Ontario will help to inform our knowledge of Bloater ecology and their potential to re-establish in Lake Ontario.

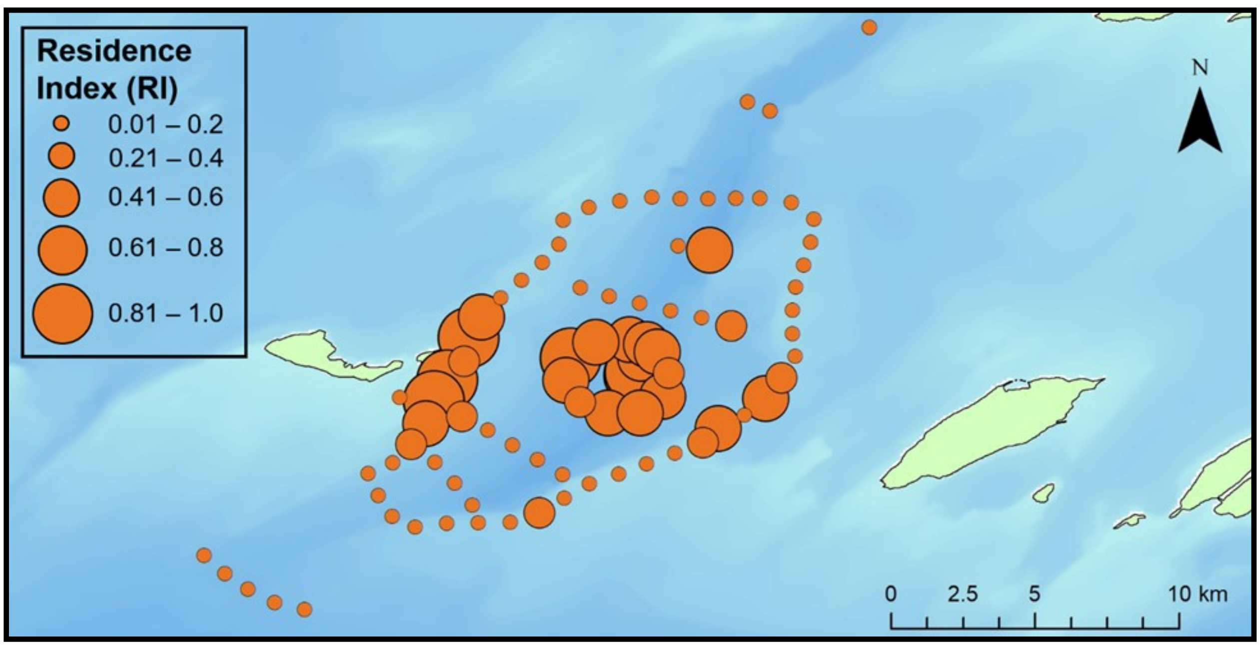

FIG. 9.2.2. Residence Index (RI) by acoustic receiver station across the first receiver deployment of the study period (9 November 2015 – 1 June 2016). Orange circles represent the mean RI for all tagged Bloater (n = 70).

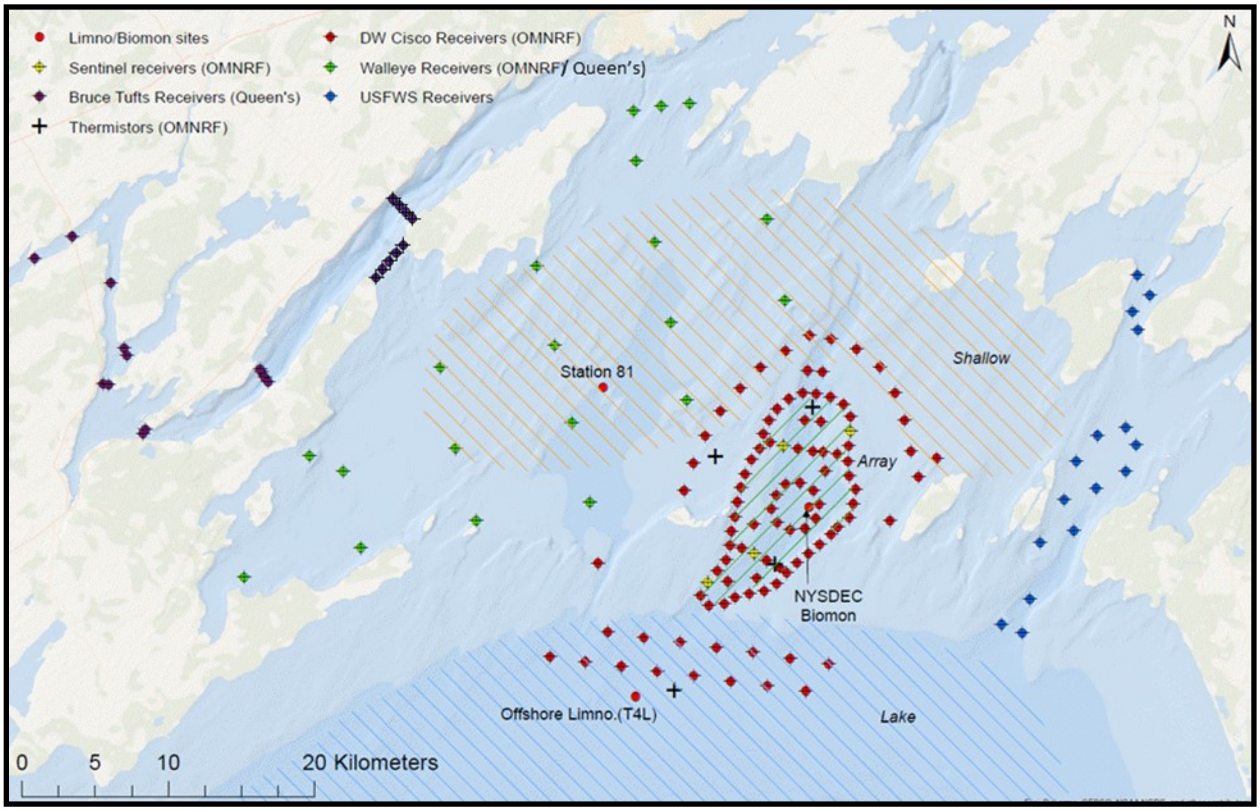

FIG. 9.2.3. Acoustic receiver arrays in the St. Lawrence Channel of eastern Lake Ontario in May 2017. The deepwater cisco array (shown in red) consists of 105 69-kHz receivers used to assess the post-stocking behaviour and survival of Bloater, *Coregonus hoyi*. Other receiver arrays shown in green, blue and purple assist in gathering detection data for tagged Bloater.

9.3 Using acoustic telemetry to investigate smolt survival and adult salmonid spatial habitat use with a focus on Atlantic Salmon

Project leads: Sarah Larocque, Aaron Fisk (Great Lakes Institute for Environmental Research, University of Windsor), Tim Johnson (OMNRF-ARMS)
Collaborators: Fisheries and Oceans Canada, OMNRF- Fish Culture Section, U.S. Fish and Wildlife Service, Great Lakes Acoustic Telemetry Observation System (GLATOS)
Funding: NSERC Strategic Partnership Grant, Great Lakes Protection Act / Canada-Ontario Agreement

Atlantic Salmon (*Salmo salar*) once abundant in Lake Ontario were extirpated in the 1890s. The Lake Ontario Atlantic Salmon Restoration Program was developed in 2006 and significant efforts have been made to reintroduce Atlantic Salmon into Lake Ontario. However, there have been limited adult returns to date which is presenting challenges to the restoration effort. For instance, it is uncertain if the smolts are successfully reaching Lake Ontario, and once in the lake, as adults, whether there is inter-species competition for space and food resources with the five other salmonids present. It is particularly important to know whether the life stage at which Atlantic Salmon are stocked (e.g. as yearlings ready to smolt or as fingerlings that remain in the river prior to smolting) affects their ability to successfully migrate from the lake tributaries. An improved understanding of the movements and habitat preferences of adult salmonids in the lake would help discern whether competition in the lake environment is limiting Atlantic Salmon performance and ultimately the number of adults returning to the rivers to spawn.

Smolts

Atlantic Salmon smolt migration success was assessed in the Credit River (a river that is stocked with both Atlantic Salmon fingerlings and yearlings) using acoustic telemetry. Using small acoustic transmitters (hereafter called tags; Vemco – V5 - 180 kHz), both "wild" (stocked as fingerlings the year prior in the river; n = 8) and hatchery yearlings (n = 32) were tagged on the West Credit River (a tributary of the Credit River near the headwaters) in April 2017. The migration to Lake Ontario is approximately 75 river km and involves passing two dams. Acoustic receivers (n = 27) were deployed throughout the river from the tagging location to Lake Ontario, and into Lake Ontario around the river mouth. Overall, 50% of the fish reached Lake Ontario. Of those fish, the migration started at the beginning of May and reached the lake by mid-late May. However, some differences were seen between the "wild" and hatchery yearlings. The "wild" yearlings were 100% (n = 8) successful in reaching the lake, compared to 37.5% (n = 12) of hatchery yearlings. Also, of those that were successful, "wild" yearlings began migrating sooner and faster than the hatchery yearlings (Table 9.3.1). Although this is a preliminary analysis of the Atlantic Salmon smolt migration, it appears that hatchery yearlings are not as successful as those that were initially stocked as fingerlings and spent a year in the river before migrating. We will continue to assess migration success with increased sample sizes and continued monitoring of environmental variables in 2018 as the high flows in the spring of 2017 may have influenced the success rates.

Adults

Understanding fish migrations and movements in a lake as large as Lake Ontario can be challenging. However, with acoustic telemetry becoming more prevalent amongst researchers, the receiver coverage in the eastern and western basins increased in 2017 making it possible to begin to understand large-scale movements and habitat use of fish. By the end of 2017, there were approximately 120 and 50 acoustic receivers in the eastern and western basins, respectively, with none in the central basin. With such coverage in the lake, efforts have begun to tag all six salmonid species in Lake Ontario and look at large-scale movements and habitat use. Four salmonid species were captured, tagged (Vemco – V13 – 69 kHz), and released in the western basin near Port Credit in June 2017 (Lake Trout: n = 5; Rainbow

TABLE 9.3.1. Atlantic Salmon smolt migratory details based on acoustic telemetry movements of "wild" (stocked as fingerlings in the river) and hatchery yearlings from the Credit River to Lake Ontario in 2017.

	"Wild"			Hatchery		
	Mean	Min	Max	Mean	Min	Max
Start Date	02-May	28-Apr	14-May	07-May	23-Apr	23-May
End Date	09-May	05-May	22-May	18-May	01-May	28-May
Duration	6.6	2	11	8.8	2	20

Trout: n = 5; Coho Salmon: n = 5; Chinook Salmon: n = 7; Fig. 9.3.1). Atlantic Salmon are difficult to catch in the lake, so 2-year-old brood stock hatchery Atlantic Salmon were tagged (n = 19) and subsequently released near Port Dalhousie in late December, 2017. Currently, no Brown Trout have been tagged. Also of note, from a previous study with pDST tags in 2016 (see section 9.2 in the 2016 Annual Report), hatchery Atlantic Salmon (N = 20) were simultaneously tagged and released near Glenora (Bay of Quinte area) in April 2016 (Fig. 9.3.1).

Although relatively few fish have been tagged, and the number of acoustic receivers remains limited to the eastern and western basins, some interesting movements have been seen. Three of the seven Chinook Salmon captured and tagged in the western basin were detected in the eastern basin – with one being captured by an angler (Fig. 9.3.1). Lake Trout (3 of 5) tagged in the western basin appear to be moving towards the Niagara River in the fall of 2017 (Fig. 9.3.1). And three of the Atlantic Salmon released from Glenora, moved out of the Bay of Quinte, into the eastern basin and were then detected in the western basin (Fig. 9.3.1). Although these are preliminary results based on a partial download of receivers in the lake, we are beginning to see evidence of large forays made by some of the salmonids including potential seasonal spawning movements of Lake Trout. Next year, we anticipate increasing the number of tagged fish (including Brown Trout), using tags with sensors to discern depth and temperature use, and downloading all the receivers (many fish were tagged after receivers were downloaded in 2017) with the potential to further expand the acoustic receiver array. Over the next few years, we will obtain important new information on lakewide and seasonal movements and behaviours of co-existing salmonids, including an improved understanding of potential overlap in distribution and of their over-wintering habitat.

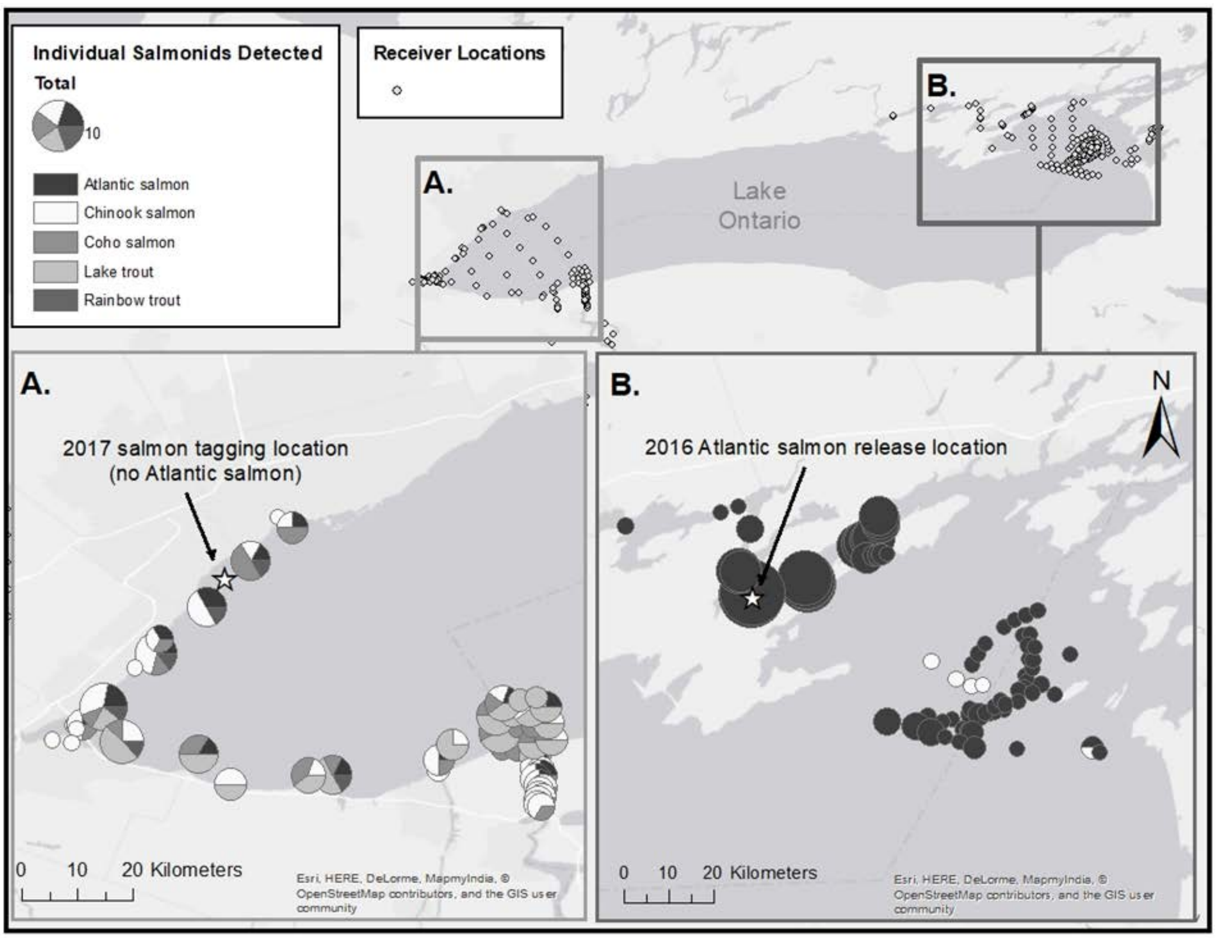

FIG. 9.3.1. Overview of acoustic receiver locations and detections in Lake Ontario, 2017. Panels A. and B. show the western and eastern basin detections of individual salmonids, respectively.

9.4 Combining traditional ecological knowledge with cutting edge technology to inform Lake Trout restoration in Lake Ontario

Project Leads: Silviya Ivanova, Aaron Fisk (Great Lakes Institute for Environmental Research, University of Windsor); Tim Johnson, Brent Metcalfe (OMNRF-ARMS)
Collaborators: New York State Department of Environmental Conservation
Funding: Great Lakes Protection Act / Canada-Ontario Agreement

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

Little is known of Lake Trout and Chinook Salmon seasonal movements and preferred depth and temperature in Lake Ontario. However, acoustic telemetry provides a means to begin to understand these behaviours. We are using both a fixed-station receiver array in the east and west ends of Lake Ontario, and an autonomous underwater vehicle (self-propelled mini-sub) to track the movements and behaviour of Lake Trout and Chinook Salmon that have been surgically implanted with acoustic tags. Both Lake Trout and Chinook Salmon will be tagged each year starting in 2016 and ending in 2019. The first set of data will become available for analysis in May 2018.

This work contributes directly to Lake Trout, Atlantic Salmon and Bloater restoration, and thus, to maintaining biodiversity in Lake Ontario. The results may aid management in optimising the numbers and mix of species' stocked into the Great Lakes. Furthermore, the proposed research will contribute new insights on the spatial interactions of top predator fish in large lake ecosystems helping us develop more adaptive stocking strategies and management plans.

9.5 Post-surgical performance of acoustically tagged salmonids

Project Leads: Andrew Darcy, Aaron Fisk (Great Lakes Institute for Environmental Research, University of Windsor); Tim Johnson (OMNRF-ARMS)
Collaborators: OMNRF Fish Culture Section; Graham Raby, Trevor Pitcher (Great Lakes Institute for Environmental Research, University of Windsor),
Funding: Canada Research Chairs Program, Great Lakes Protection Act / Canada-Ontario Agreement, Alex S. Davidson Great Lakes Stewardship Award

Acoustic telemetry is changing our understanding of fish ecology in the Great Lakes, but there are a lack of tagging studies on smaller fish and younger life stages such as juvenile salmonids commonly stocked by resource management agencies. It is assumed that tagged fish will provide accurate estimates of movement, growth, and survival. However, the act of tagging may impair functions (e.g. survival, growth, swimming performance) depending on the size of tags relative to the fish. Larger tags increase the detection range and have a longer battery life, thus allowing for greater scope to studies. A tag burden of less than 2% body mass is the generally accepted standard which, given available tag sizes, limits the application for smaller fish. Additionally, there may be species-specific variation in burden limits. Technological advances continue to see further miniaturization of tags and users continue to push the limits of tag burden with smaller fish. It is therefore important to identify whether this 2% rule is still applicable, and to identify "ideal" tag burden ratios for juvenile fishes that are staples of the provincial fish culture program. To this end, we have initiated laboratory experiments using a variety of salmonid species (e.g. Rainbow Trout, Lake Trout, Chinook Salmon, and Atlantic Salmon) to measure tag burden effects in sizes typically stocked by OMNRF. Preliminary results with juvenile Rainbow Trout (13-36 g) revealed subtle, but not statistically different, reductions in growth rate (Fig. 9.5.1) and statistically lower critical swimming speed (Fig. 9.5.2) in tagged vs untagged fish. Additional results on metabolic performance have yet to be analysed. The other fish species will be similarly evaluated over the next several months allowing comparison in performance among species.

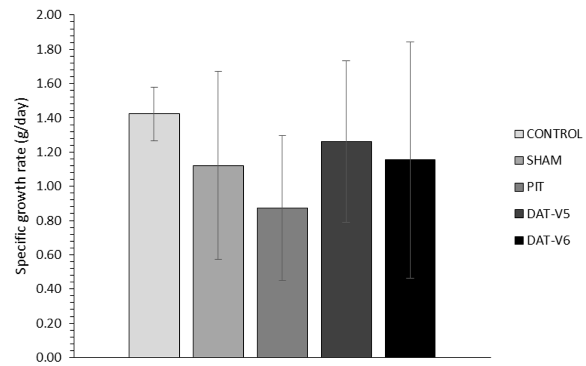

FIG. 9.5.1. Average % increase in weight (grams) per day for juvenile Rainbow Trout over the eight-week study period, based on treatment group (i.e. CONTROL (n=3), SHAM (n=26), PIT (n=24), and DAT (dead acoustic tag) [VEMCO V5 (n=5) and V6 (n=16)]). Rainbow Trout were 13-36 grams and 105-150 millimetres in fork length at the initial weigh-in, and 24-70 grams and 120-178 millimetres at the final weigh-in. CONTROL = untagged fish, SHAM = surgery but no tag, PIT = 0.032 g [pit tag only], DAT-V5 = 0.67 gram tag (2.3-3.8% tag burden at final weigh-in), DAT-V6 = 0.97 gram tag (2.8-6.0% tag burden at final weigh-in).

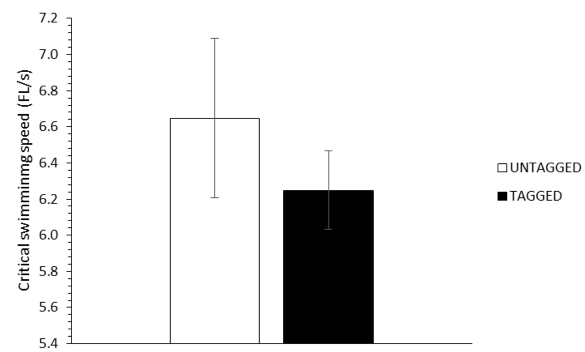

FIG. 9.5.2. Critical swimming speed (Ucrit) in fork lengths per second (FL/s) of juvenile Rainbow Trout (~118-138 millimetres) from UNTAGGED (n=9) and TAGGED (n=10) (DAT) (V5 and V6 tags pooled together) treatment groups 4 to 8 weeks after surgery. The untagged group experienced no tag burden, and the tagged treatment group represented a range of tag burden (DAT-V5 = 0.67 gram tag (2.9-3.6% tag burden), DAT-V6 = 0.97 gram tag (2.8-4.6% tag burden)).

The results will provide novel insights into the interplay between surgically implanted acoustic tag burden with fish performance and physiology (i.e. metabolism and behaviour). These insights have important implications for future tagging studies and our understanding of how tag burden affects different sizes and species of fish. Acoustic telemetry is increasingly being used to understand post-stocking behaviour and survival of economically important fishes (e.g. walleye, salmon, trout) and restoration initiatives (e.g. Atlantic Salmon, American Eel, and Bloater) described in sections 8.2, 8.3, 8.4, and 9.3 of this report.

9.6 Vulnerability assessment of aquatic invasive species

Project Leads: Jeff Buckley, Tim Johnson (OMNRF-ARMS)
Collaborators: Len Hunt (OMNRF-CNFER); Andrew Drake (Fisheries and Oceans Canada)
Funding: Great Lakes Protection Act / Canada-Ontario Agreement, OMNRF Natural Heritage Policy Section

Invasive species pose a threat to the function and diversity of native aquatic communities. Over 200 species of fish, plants, and invertebrates are currently listed as potential aquatic invaders to Ontario and neighbouring jurisdictions in Canada and the U.S. In collaboration with researchers at the Centre for Northern Forest Ecosystem Research and the Department of Fisheries and Oceans Canada, we are developing a vulnerability assessment of Ontario and the Great Lakes to the spread and establishment of aquatic invasive species. Recent work in this project has focused on developing measures of habitat suitability for invasive fish.

Suitable habitat was defined by relating species-specific measures of thermal tolerance to important stages of invasion: survival and establishment. Metrics were chosen to represent the ability of an invader to survive, grow, and reproduce in a particular thermal environment. These metrics included upper incipient lethal temperature, optimal growth temperature, and optimal spawning temperature. Both volume of thermal habitat and its duration through the year were considered when calculating suitability. Using detailed water temperature data, the suitability of lakes in the Broad-scale Monitoring database (n = 782) were calculated for a number fish species.

Known distributions of native species based on Broad-scale Monitoring data were used as an initial evaluation of the suitability model. For example, Brown Bullhead, a native warm water species, was found to have more suitable habitat concentrated in the southern end of the province (Fig. 9.6.1).

Following this preliminary validation of the habitat suitability models with the Broad-scale Monitoring data, we estimated suitability for invasive species. Suitability values were calculated with water temperature data based on current climate conditions (Fig. 9.6.2a, Fig. 9.6.2e). To assess potential changes in suitability given the warming effects of climate change, suitability was also calculated from temperatures derived from climate projections over three future time periods (2011-2040, 2041-2070, 2071-2100) and three potential climate change scenarios (Fig. 9.6.2b-d, Fig. 9.6.2f-h).

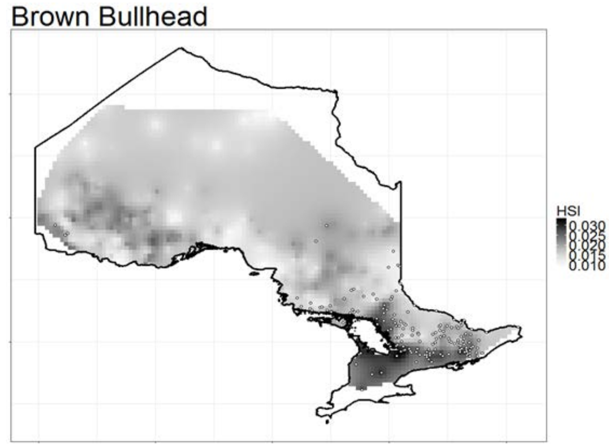

FIG. 9.6.1. Suitability of habitat for brown bullhead (*Ameiurus nebulosus*) in Ontario. Darker colours indicate greater suitability. Points show lakes sampled through the Broad-Scale Monitoring program in which brown bullhead were present.

Changes in suitable habitat differ among species; however, the effects of climate change generally will lead to a decrease in suitable habitat for cool water invaders in the northern regions of the province, while suitable habitat for warm water invaders is likely to increase throughout the province. These changes are particularly noticeable in scenarios in which little is done to mitigate climate change.

In the coming year we expect to complete the habitat suitability modelling for the Great Lakes and to begin to explore habitat suitability for invasive plants and invertebrates. We will also begin to incorporate the human dimensions pathway analyses with the habitat suitability work to provide a more complete perspective on the risk of establishment and spread of aquatic invasive species in Ontario.

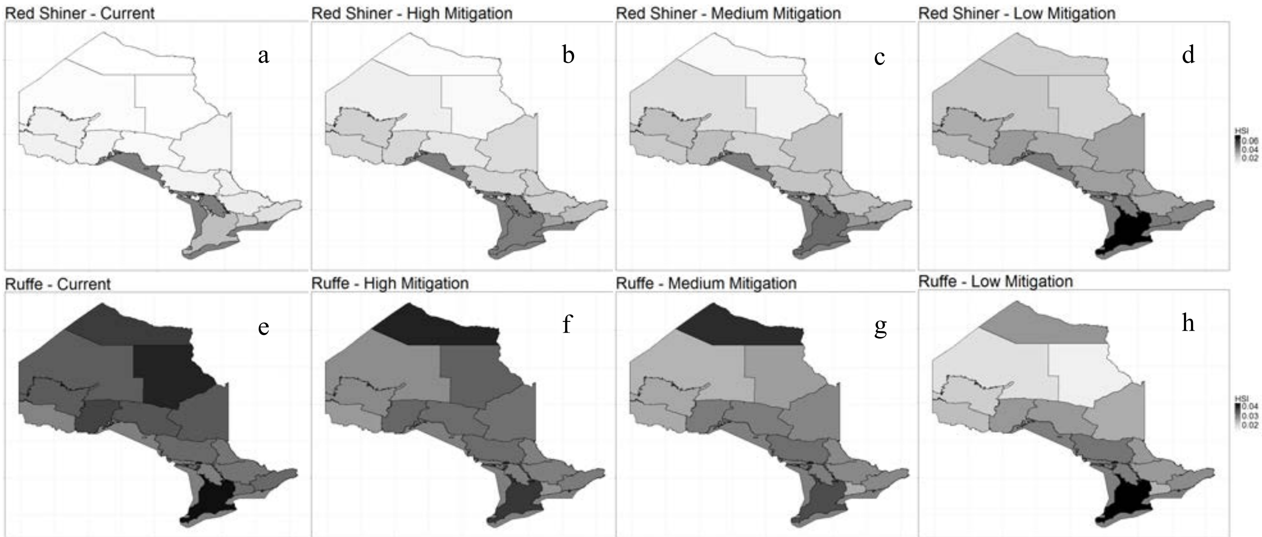

FIG. 9.6.2. Suitability of habitat for a warm water (Red Shiner (*Cyprinella lutrensis*)) and a cool water (Ruffe (*Gymnocephalus cernua*)) invasive species. Darker colours indicate greater suitability. Figures a & e are based on current climate conditions (1981 – 2010). Figures b-d and f-h are based on future protections of climate conditions (1971 – 2100). Mitigation level indicates the amount of worldwide action taken to lessen the effects of climate change (e.g. reduction of carbon emissions).

9.7 Selecting optimal models for predicting habitat suitability of invasive freshwater fishes

Project Leads: Caleb Yee, Shelley Arnott (Queen's University); Tim Johnson (OMNRF-ARMS)
Funding: Great Lakes Protection Act / Canada-Ontario Agreement; Queen's University

Invasive species are a significant threat to ecosystem function and health. Understanding where invaders are likely to occur can help direct proactive measures for invasive species control. Areas with suitable habitat for an invader are more vulnerable to invasion. Habitat suitability is often determined using species distribution models (SDM). SDMs are a group of analytical procedures that describe habitat suitability by comparing habitat characteristics (e.g. water temperature, rainfall, etc.) where the species is known to occur, to the available habitat conditions in the target area. The more similar the habitat conditions between regions of known occurrences and the target region the more suitable the habitat. Habitat suitability predictions are most useful prior to species invasion. This requires a spatial transfer of model predictions to areas where they were not trained.

How well an SDM performs is assessed by its ability to assign species occurrences to areas of high habitat suitability and non-occurrences to areas of low habitat suitability. Since predictions of habitat suitability are most desirable prior to a species invasion, when there are no occurrences to evaluate the model in the target range, models are often assessed using cross-validation. In cross-validation, occurrence points from the native range are divided into groups and all but one group are used to train the model with the remaining group being used to test the model performance. Confidence in a models performance is based on these cross-validated results, however, little work has been done comparing cross-validated model performance to target area performance.

This project assesses 1) how well three different SDM techniques (MaxEnt, Domain, and Bioclim) predict habitat suitability in North America for freshwater fishes, when fish occurrences from North America are not used to train the models and, 2) evaluates the relationship between cross-validated and North American performance assessments. Five species of fish (Brown Trout *Salmo trutta*, Lake Trout *Salvelinus namaycush*, Burbot *Lota lota*, Common Carp *Cyprinus carpio*, and Northern Pike *Esox lucius*) were selected because they have a trans-Atlantic distribution and a long introduction history in both the eastern and western hemispheres. Potential invasive fish were not used for this project because many lack species occurrences in North America to assess model predictions and most invaders are currently undergoing range expansion which makes model assessment difficult.

The predictions for the trained models were assessed by comparing how well they predicted North American occurrences. True Skill Statistic (TSS), a measure of how well a model can discriminate between suitable (occurrence) and unsuitable habitat (non-occurrence), was the metric used to evaluate model performance. SDMs create continuous predictions of habitat suitability ranging from 0 (low suitability) to 1 (high suitability) but TSS requires a binary prediction of either suitable or unsuitable habitat. To transform model predictions to suitable or unsuitable, the lowest suitability score in training that had a species occurrence was used as the boundary between suitable (the lowest suitability score and higher) and unsuitable (less than the lowest suitability score).

The performance of modelling techniques varied by species with no single technique consistently outperforming the others (Fig. 9.7.1). Burbot was best modeled by Bioclim, Brown Trout by Domain, and Lake Trout by MaxEnt. All SDM techniques used showed a poor ability to discriminate between suitable and unsuitable habitat for Common Carp and Northern Pike. When TSS in North America is compared to cross -validated TSS (Fig. 9.7.2) a positive relationship is seen, and cross-validation tends to under estimate model performance in North America. However, many models that show some ability to discriminate between suitable and unsuitable habitat (cross-validated TSS≥0) in cross-validated assessments show no ability to discriminate in North America (North American TSS≤0).

Preliminary results for this project indicate the best performing models may be species specific. Cross-validated TSS can provide some indication of model performance in North America but there is substantial variation. These results suggest that no single model should be applied to all species for habitat suitability assessments; instead models should be selected based on their performance in training. TSS in training shows some ability to select the best performing models but is not always accurate. Using multiple assessment metrics together may increase our ability to differentiate between well and poorly performing models in training. Further work selecting the best performing models using multiple assessment metrics is currently being undertaken.

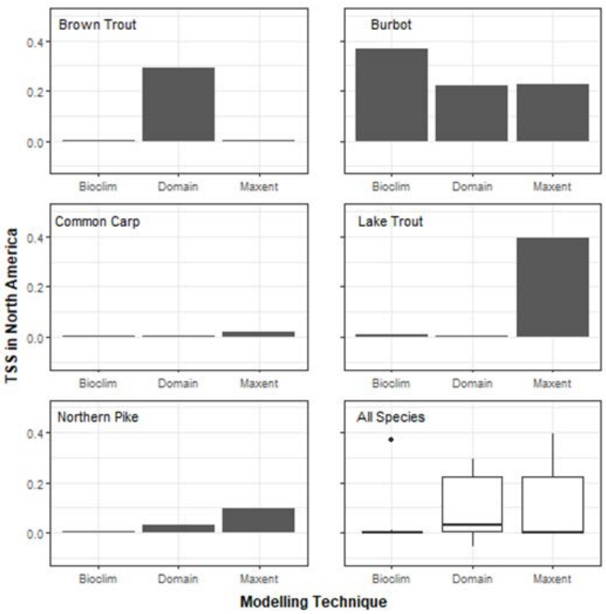

FIG. 9.7.1. Comparison of True Skill Statistic Scores (TSS) by modelling techniques and species identity calculated at the lowest suitability score in training. Species bar plots show the highest TSS for a modelling technique. The all species plot shows the median (black line), 25th and 75th percentiles (bottom and top of the box) TSS of all models. 16 models using the three modelling techniques were created for each species. Models using the same techniques differed in how sampling bias was corrected and how model coefficients were selected.

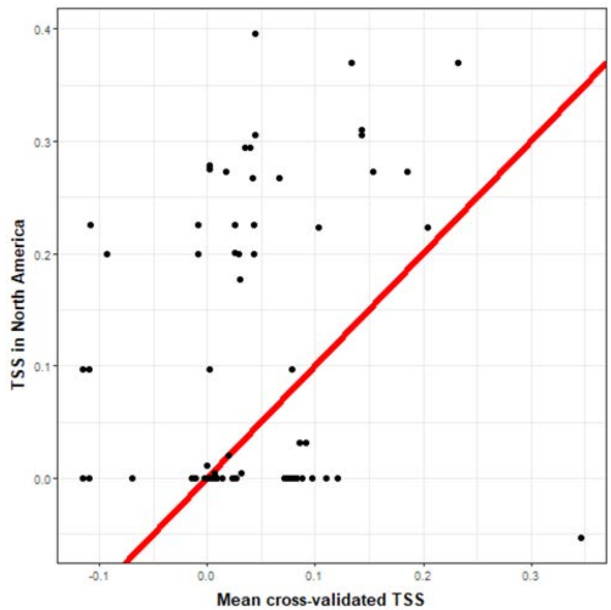

FIG. 9.7.2. Mean TSS in North America compared to cross-validated TSS for all models (n=80). As mean cross-validated TSS increases TSS in North America generally increases. Many models (n=42) show a TSS<0 in North America. The outlier model in the bottom right of the plot is a Domain model for Lake Trout. The red line equates to perfect agreement between cross-validated and North American assessment. Points below the line are over estimating model performance, points above the line are under estimating model performance.

9.8 Community level response to Zequanox® molluscicide - a biocontrol for invasive mussels

Project Leads: Michele Nicholson, Shelley Arnott (Queen's University), Tim Johnson (OMNRF-ARMS)
Partners: Marrone Bio Innovations
Funding: Invasive Species Centre, Great Lakes Protection Act / Canada-Ontario Agreement, Queen's University, NSERC

Zebra and quagga mussels (*Dreissena spp.*) are European freshwater clams that have invaded most major inland water systems across North America. Their invasion has resulted in billions of dollars in damages and losses to fisheries, recreational water use, infrastructure, and industry each year. Zequanox® molluscicide, a biopesticide made from soil bacteria, has been advertised as dreissenid-selective and environmentally safe. Health Canada has approved the use of Zequanox® in hydroelectric facilities, which may lead to open-water use in Canada, as has occurred in the United States and Ireland. Data from single-species assays indicate that exposure to Zequanox® concentrations near those recommended for open-water applications may cause mortality in fish and invertebrates. In some cases, these assays were conducted with exposure times exceeding those in the field. Further, little is known about the non-target impacts of applying Zequanox® in an open-water setting, given that toxicants can behave differently in natural versus laboratory environments and because single-species tests are unable to characterize indirect effects such as pesticide-mediated changes to inter-species interactions like competition and predation.

Using a six-week-long replicated aquatic mesocosm experiment, we simulated open-water applications of Zequanox® (100 mg/L of the active ingredient) to determine the responses of primary producers, zooplankton, and macroinvertebrates to Zequanox® exposure in a complex aquatic environment. Short-term increases occurred in algal (phytoplankton and periphyton) biomass (250–350% of controls), abundance of large zooplankton (cladoceran grazers) (700% of controls), and insect emergence (490% of controls). Large declines initially occurred among small cladoceran zooplankton (88–94% reductions in *Chydorus sphaericus*, *Ceriodaphnia lacustris*, and *Scapheloberis mucronata*), but abundances recovered within three weeks. Declines also occurred in scuds *Hyalella azteca* (mean abundance 77% less than controls) and snails *Viviparus georgianus* (survival 73 ±16%), which did not recover during the experiment. Short-term impacts to water quality included a decrease in dissolved oxygen (minimum 1.2 mg/L), despite aeration of the mesocosms.

This research may assist regulators and managers in assessing the ecological risks of using Zequanox® in open-water systems and support informed decision-making about dreissenid control, including for established infestations, rapid response to new invasions, and efforts under the Species at Risk Act to protect and restore native mussel habitats that have been threatened and damaged by dreissenid invasion.

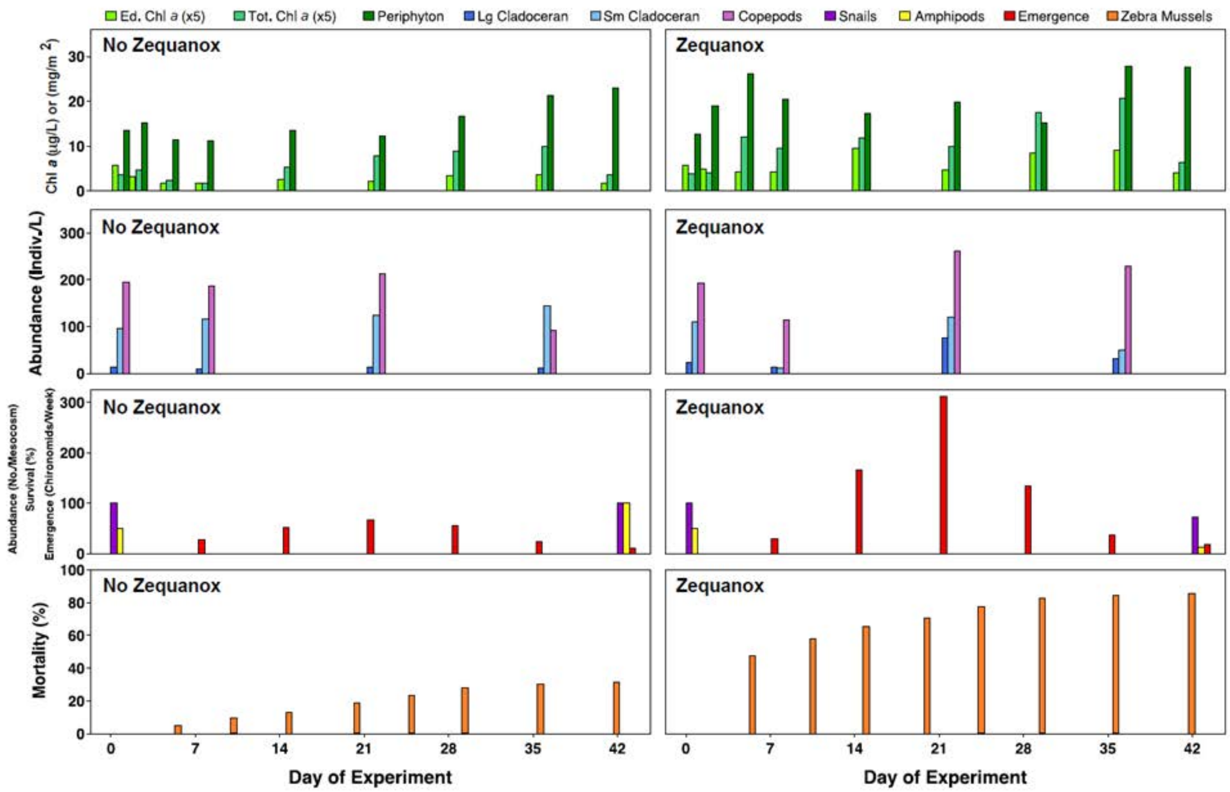

FIG. 9.8.1. Comparison of mean responses of the biological community and zebra mussels (*Dreissena polymorpha*) in 587 L mesocosms, over the course of 43 days after Zequanox® treatment (100 mg a.i./L at time=0) versus no-Zequanox® controls. Top row: algal community, total and edible chlorophyll a (µg/L) and periphyton total chlorophyll a (mg/m^2). Concentrations of total and edible chl a have been multiplied by 5 to improve visibility of the data. Second row: crustacean zooplankton community, cladoceran and copepod abundances. Third row: abundance of *Hyalella azteca* amphipods, survival (%) of *Viviparus georgianus* snails, and emergence rates of midges. Bottom row: percent mortality of zebra mussels. All bars represent the geometric mean (as response data were log transformed to increase normality of residuals and reduce unequal variances among treatment groups), except for large cladoceran abundance and zebra mussel mortality, which represent the arithmetic mean. n=24 for each bar except in the bottom row where n=12 for each bar.

9.9 Migration and Spatial Ecology of Bay of Quinte-Eastern Lake Ontario Walleye

E.N. Brown[1], B. Tufts[2] and J.A. Hoyle[1]
Lake Ontario Management Unit[1]; Queens University[2]

Walleye (*Sander vitreum*) are the dominant piscivorous fish in the Bay of Quinte-eastern Lake Ontario nearshore waters and are known to be highly migratory. Historical mark-recapture studies and age-specific geographical and seasonal distributions suggest that movements are related to spawning habitat, temperature regimes, and foraging opportunities. This population supports important recreational, commercial, and First Nations fisheries. In 2017, 79% of Bay of Quinte anglers were targeting Walleye during the recreational open-water season, with effort varying over season and space. In recent years, an increase in anglers targeting “trophy” Walleye during August and September has been observed in eastern Lake Ontario (Section 2.2 and Section 2.3).

The goal of this multi-year acoustic telemetry project is to describe Bay of Quinte-eastern Lake Ontario Walleye movement at a finer scale than currently exists, and subsequently, to better understand the mechanisms which influence aspects of Walleye life history. We hypothesise that after spawning, mature Bay of Quinte Walleye migrate to the Lake to improve fitness associated with foraging opportunities, and that once individuals leave the Bay, variation in distribution over time will be observed to reflect this. Within the first year of this project, we present early insight into seasonal distribution and movement patterns of mature Walleye in Bay of Quinte-eastern Lake Ontario, highlight areas of Walleye seasonal aggregation, and discuss areas of future work.

Twenty six mature Walleye (>2½ lbs) were captured in the spring of 2017 at the time of spawning. Fish were captured from three locations within the Bay of Quinte (Trent River, Big Bay, and Glenora) using trap netting or boat electrofishing. External identification tags were applied and surgical techniques were used to equip fish with Vemco V16 69 kHz internal acoustic transmitters (5 year life span) (Fig. 9.9.1). In the summer of 2017, ten additional mature Walleye were capture by angling in eastern Lake Ontario, east of Long Point, and tagged in a similar manner as was done in the spring. All Walleye were released near the area which they were captured, with no apparent mortality at the time of release. OMNRF, Queens University and USFWS have established arrays of Vemco 69 kHz acoustic receivers in the Bay of Quinte-eastern Lake Ontario (Fig. 9.9.2). Together, these arrays provided information on individual detection events and frequency, which were then used to describe Walleye movement.

Data from receivers downloaded in 2017 were retrieved from the Great Lakes Acoustic Telemetry Observation System (GLATOS). Individual detection histories and frequency of detections were examined over space and time. Of the 26 Walleye tagged in the spring, one individual was never detected and two were removed from the tagged population by the recreational fishery. The distribution of tagged fish by month is shown in Figure 9.9.3. After spawning in the Bay of Quinte, tagged Walleye

FIG. 9.9.1. OMNRF Lake Ontario Management Unit staff used boat electrofishing to capture mature Bay of Quinte Walleye during the spawn (left) and surgical techniques to implant Vemco acoustic transmitters (middle; right). Fish were marked with external tag, displaying individual fish numbers and OMNRF contact information (middle; right).

migrated towards eastern Lake Ontario (April-May). The majority of Walleye left the Bay within one month of being tagged, passing through the gap between Prince Edward County and Amherst Island. Several individuals migrated to New York waters within 1-2 weeks of leaving the bay (May-June). Tagged Walleye were detected throughout eastern Lake Ontario during the late-spring and summer, with some areas of aggregation noted (June-July). Aggregation near Timber and False Duck Islands was observed in August and September, with signs of movement back towards the Bay in October. Detections of Walleye tagged during the summer are not reported here.

LOMU, in partnership with Queens University, will continue acoustic tagging efforts and receiver retrievals in 2018. Spring efforts will be focused on the Trent and Napanee River, with additional mature walleye tagged in eastern Lake Ontario during June and August. Additional years of detection information paired with information collected from LOMU's assessment program is expected to provide a compressive look at Walleye migration and spatial ecology in the Bay of Quinte-eastern Lake Ontario.

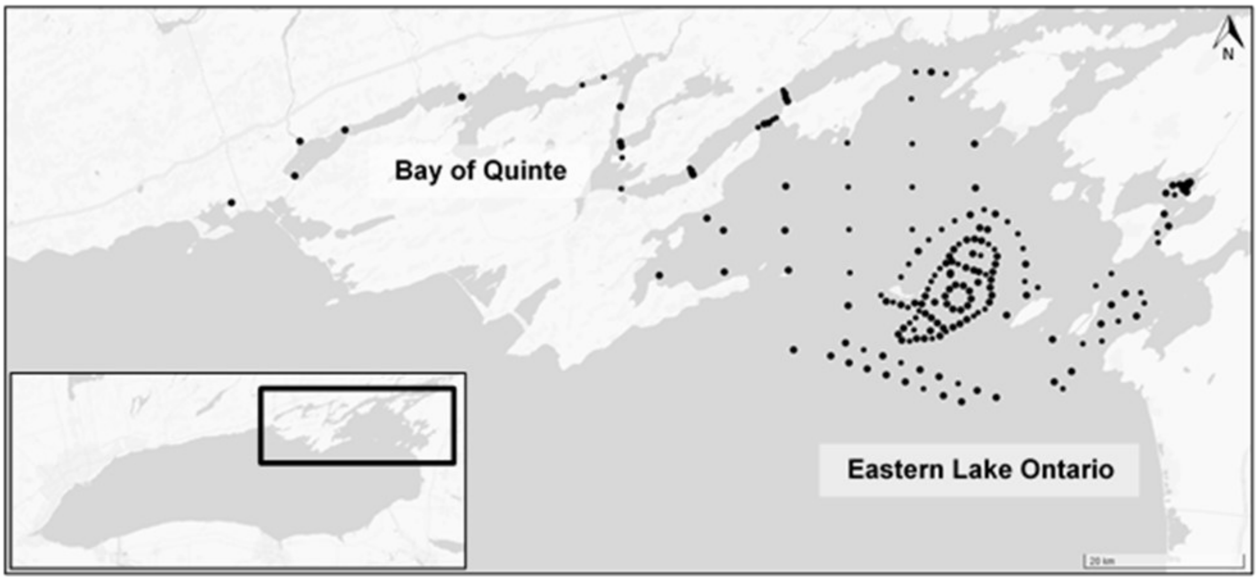

FIG. 9.9.2. Active acoustic receiver arrays in the Bay of Quinte-eastern Lake Ontario during 2017 (OMNRF, Queens University and USFWS). See Fig. 9.2.3 for a more detailed depiction of the eastern Lake Ontario acoustic receiver array.

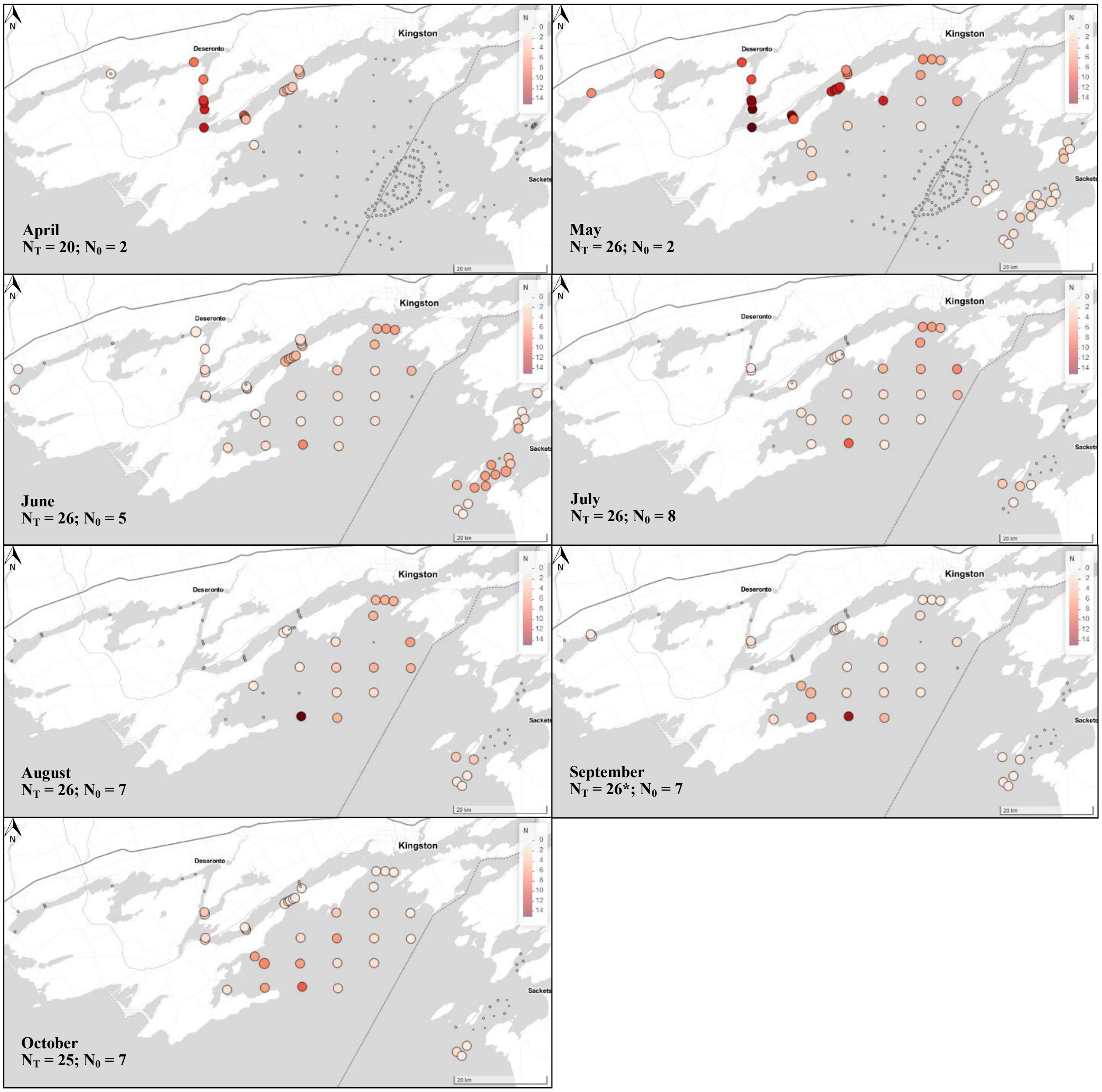

FIG. 9.9.3. Overview of acoustic receiver locations and detections in the Bay of Quinte-eastern Lake Ontario, separated by month, in 2017. The number of tagged fish detected (N) at each receiver is visualized by colour saturation. Smaller circles with no colour indicates receivers which were active and were downloaded at the time of this report, but for which no fish were detected. The number of fish in the tagged population during each month is denoted as N_T; this excludes the 10 fish tagged during the summer sampling period. One fish was removed from the tagged population in September by way of the recreational fishery. The number of fish that were part of the defined tagged population (N_T) but which were not detected by any receiver during each time period is also displayed (N_0).

10. Partnerships

10.1 Walleye Spawn Collection

J.A. Hoyle, Lake Ontario Management Unit

In April 2017 the Lake Ontario Management Unit (LOMU) worked in conjunction with MNRF's White Lake Fish Culture Station (FCS) to collect Bay of Quinte Walleye gametes. Similar projects were conducted in spring 2013-2016. In 2017, trap nets were set at four sites (Fig. 10.1.1, Table 10.1.1): Trumpour Point, "Highshore", Big Bay, and Glenn Island. The trap nets were set beginning on April 3 in shoreline areas thought to be inhabited by Walleye that were staging to spawn. Netting took place from April 3-13. Water temperature ranged from 3.3-6.4 ^{o}C over this time period. Catches of Walleye captured in trap nets were supplemented with boat electrofishing efforts but electrofishing sampling information and fish catches were not recorded. Walleye, in spawning condition, were brought by boat to the Glenora Fisheries Station. Approximately 7.6 million eggs were collected from 33 families and transferred to the White Lake FCS.

Walleye gametes collected in 2017 will be used to supply walleye fingerlings for stocking in inland lakes. The 2017 spawn collection will also provide wild gametes for restoration Walleye stocking of Walleye summer fingerlings in Toronto Harbour (see Section 7.4).

Twenty species and a total of 1,609 fish including 488 Walleye were caught in trap nets in 2017 (Table 10.1.2). Other commonly caught species included: Yellow Perch (280), White Perch (207), Black Crappie (137), Cisco (131), Brown Bullhead (80), Pumpkinseed (48), and Bluegill (42). Catches in 2017 are compared with those in 2014 to 2106 in Table 10.1.3. A total of 23 species was caught in trap nets during the last four years.

The size distribution of 489 Walleye

FIG. 10.1.1. Bay of Quinte Walleye egg collection trap net site locations, 2017. Also shown is the location of the water temperature recording station.

TABLE 10.1.1. Trap net location and sampling information for the Bay of Quinte Walleye egg collection program, 2017.

Attribute	Trumpour Point	Highshore	Big Bay	Glenn Island
Latitude (deg decmin)	44 03.97	44 02.54	44 07.74	44 03.44
Longitude (deg decmin)	77 04.32	77 06.71	77 15.52	77 03.47
Site depth (m)	3.0	3.1	3.9	3.8
Trap net size (ft)	12	6	10	6
First set date	03-Apr-16	10-Apr-16	03-Apr-16	10-Apr-16
Final lift date	13-Apr-16	13-Apr-16	13-Apr-16	12-Apr-16
Number of days fished	10	10	3	10
Number of lifts	5	3	5	2
Water temperature range (^{o}C)	3.3 to 6.4	4.7 to 6.4	4.1 to 6.2	5.0 to 6.3
Number of Walleye caught	33	2	451	2

TABLE 10.1.2. Summary of fish captured (20 species) at six trap net locations during the Bay of Quinte Walleye egg collection program, 2017.

Species	Trumpour Point	Highshore	Big Bay	Glenn Island	Total
Longnose Gar	1	-	14	-	15
Bowfin	6	2	17	-	25
Gizzard Shad	-	-	1	-	1
Rainbow Trout	-	-	1	-	1
Lake Whitefish	3	-	2	-	5
Cisco	51	6	74	-	131
Northern Pike	19	3	16	2	40
White Sucker	6	-	22	1	29
Common Carp	-	-	10	-	10
Brown Bullhead	1	-	76	3	80
White Perch	9	-	197	1	207
Rock Bass	18	4	13	-	35
Pumpkinseed	42	-	6	-	48
Bluegill	22	-	20	-	42
Smallmouth Bass	1	-	2	-	3
Largemouth Bass	4	-	24	-	28
Black Crappie	107	-	30	-	137
Yellow Perch	169	1	75	35	280
Walleye	33	2	451	2	488
Freshwater Drum	2	-	1	1	4
Total	494	18	1,052	45	1,609

measured for fork length is shown in Fig. 10.1.2. Walleye sex (male, female, immature) and state of maturity information is shown in Table 10.1.4. Walleye catch in 2017 included a large number of small, immature fish.

Water temperature was recorded continuously at a Long Reach shoreline site near Sherman's Point (Fig. 10.1.1). Water temperature increased steadily from late-March through the month of April. Water temperature reached 8 °C about mid-April (Fig. 10.1.3).

Acoustic Telemetry Studies

Twenty mature Walleye, captured during the spawn collection activities, were equipped with acoustic telemetry transmitters. These fish will be tracked for several years by acoustic receivers in place in the Bay of Quinte and eastern Lake Ontario. Note that six additional Walleye were tagged in the Trent River in early May during the Sturgeon electrofishing project (see Section 9.9).

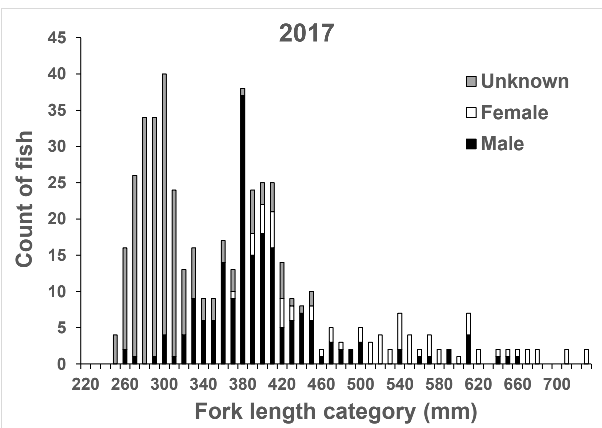

FIG. 10.1.2. Size distribution of (10 mm fork length categories) of 479 Walleye caught in trap nets and measured during the egg collection program, April 2017. Totals: 191 males, 68 females and 220 unknown sex.

TABLE 10.1.4. Sex and gonad classification (based on external characteristics) for 479 Walleye caught in trap nets and sampled during the 2017 Walleye egg collection program.

	Sex			
Gonad condition	Male	Female	Unknown	Total
Green	7	53	0	60
Ripe	184	12	0	196
Spent	0	3	0	3
Unknown	0	0	220	220
Total	191	68	220	479

Six Lake Whitefish were also caught and equipped with acoustic transmitters by Queen's University.

TABLE 10.1.3. Summary of fish captured in trap nets (23 species) during the Walleye egg collection program, April 2014 to 2017.

Species	2014	2015	2016	2017
Longnose Gar	6	-	1	15
Bowfin	8	4	9	25
Gizzard Shad	-	-	2	1
Rainbow Trout	1	2	5	1
Lake Whitefish	24	14	5	5
Lake Herring	36	26	223	131
Northern Pike	26	52	52	40
White Sucker	183	53	107	29
Common Carp	-	-	2	10
Golden Shiner	-	-	3	-
Brown Bullhead	22	29	33	80
Channel Catfish	19	2	1	-
American Eel	1	1	1	-
White Perch	48	-	-	207
Rock Bass	7	17	14	35
Pumpkinseed	3	2	43	48
Bluegill	-	1	39	42
Smallmouth Bass	-	2	-	3
Largemouth Bass	6	2	51	28
Black Crappie	8	70	45	137
Yellow Perch	93	4	122	280
Walleye	601	464	78	488
Freshwater Drum	35	21	3	4
Total catch	1,127	766	839	1,609

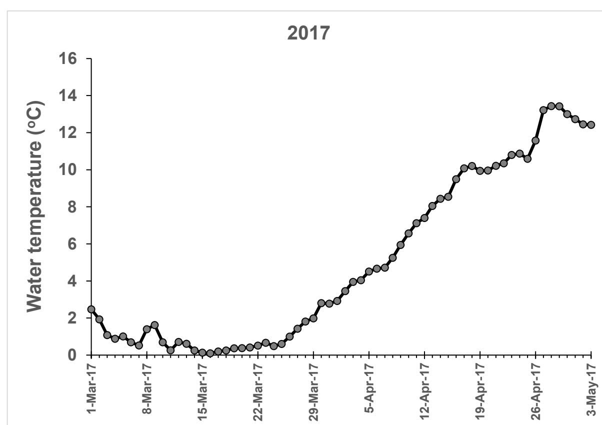

FIG. 10.1.3. Mean daily water temperature (recorded at 1 hr intervals) at 1 m depth, east side of Long Reach near Sherman's Point (44° 06.514, 77° 04.021), March 17-May 3, 2017.

11. Environmental Indicators

11.1 Water Temperature

J.P. Holden and J.A. Hoyle, Lake Ontario Management Unit

Winter Severity Index

Winter severity is often correlated with year-class strength in temperate fish species. A long-term (1944-2017) winter severity index is presented in Fig. 11.1.1. The winter of 2017 was less severe than the long-term average. Fourteen of the last 20 years have been less severe than the long term average.

Mid-summer Water Temperature

Summer water temperatures can impact fish distribution and influence growth and survival of young of the year fish.

Bay of Quinte

A long-term (1944-2017) mid-summer water temperature index is presented in Fig. 11.1.2. Water temperature in the summer of 2017 was very similar to the long term average. Sixteen of last 20 years were above the long term average.

Lake Ontario

Main lake surface water temperatures have been collected by the National Oceanic and Atmospheric Administration's National Data Buoy Center (www.ndbc.noaa.gov) at Station 45012 (East Lake Ontario – 20 nautical miles north of Rochester, NY, 43.621 N 77.406 W). Mean summer water temperatures in 2017 were above the average for the time series (2002 to 2017; Fig. 11.1.3).

Coldwater Habitat

Native coldwater species such as Lake Trout, Lake Whitefish and Cisco depend on access to suitable temperatures. Temperature profiles are collected at each Fish Community Index Gill Net and Trawl site (Section 1.2 and 1.3). Gill net site EB06 is an offshore site in the Kingston Basin (for a map, see map 1.2.1) that can provide a representative index of available thermal habitat in summer months within the Kingston Basin through time. Profiles collected in July and August at EB06 (Fig. 11.1.4) show the seasonal warming (warmer water deeper) of the

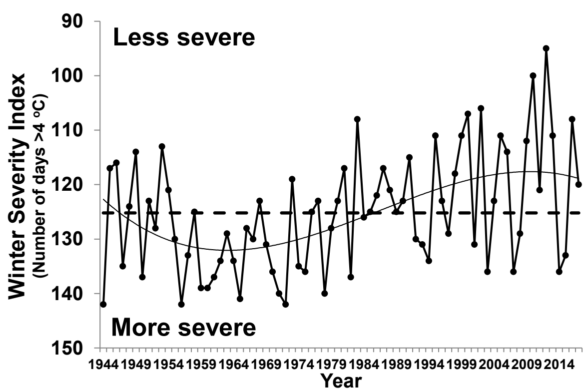

FIG. 11.1.1. Winter severity index, 1944-2017. Winter severity is measured as the number of days in December through April with a mean water temperature less than 4°C. By way of example, the 2017 data point includes the mean daily surface water temperature from Dec 1, 2016 to April 30, 2017. The long-term average index is depicted with a dashed line, and a third order polynomial fit to the data is shown as a thin solid line. Mean daily surface water temperature data was obtained from the Belleville (Bay of Quinte) Water Treatment Facility.

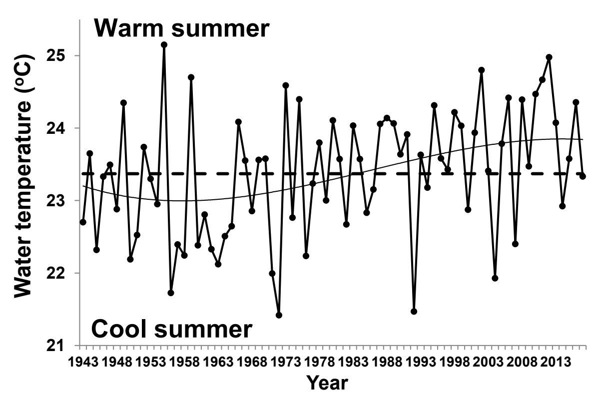

FIG. 11.1.2. Mean mid-summer water temperature (July and August; mean of 62 days) at the Belleville Water Treatment Facility, 1943-2017. The long-term average index is depicted with a dashed line, and a third order polynomial fit to the data is shown as a thin solid line. Mean daily surface water temperature data was obtained from the Belleville (Bay of Quinte) Water Treatment Facility.

Kingston Basin but do not capture the daily variability influenced by thermal mixing due to wind events. The water depth at which water temperature is below 15°C provides an index of the amount of coldwater habitat available between years which may influence catches of coldwater species such as Lake Trout and Lake Whitefish. A shallower depth of 15°C would indicate more coldwater habitat available.

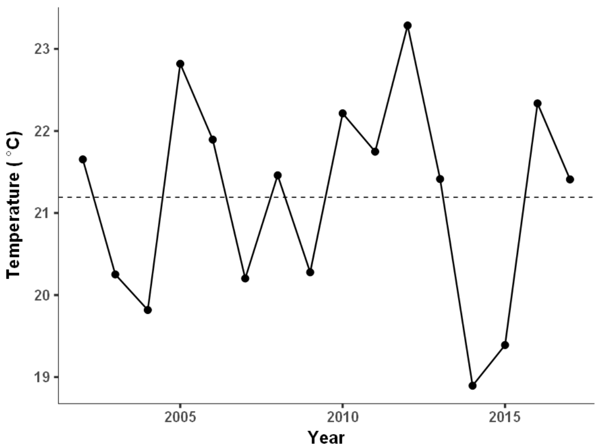

FIG. 11.1.3. Mean annual water temperatures in July and August collected at the National Oceanic and Atmospheric Administration's Station 45012 (East Lake Ontario – 20 nautical miles north of Rochester, NY). Data provided by National Data Buoy Center, NOAA (http://www.ndbc.noaa.gov/).

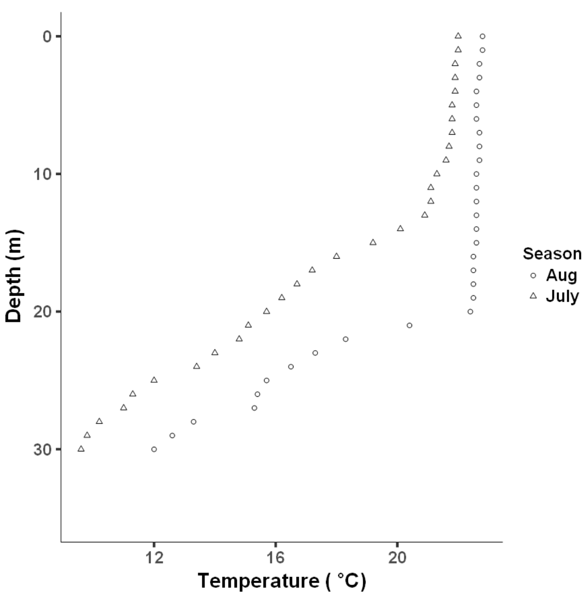

FIG. 11.1.4. Temperature profiles collected in July and August at Fish Community Index Gill Net (Section 1.2) site EB06.

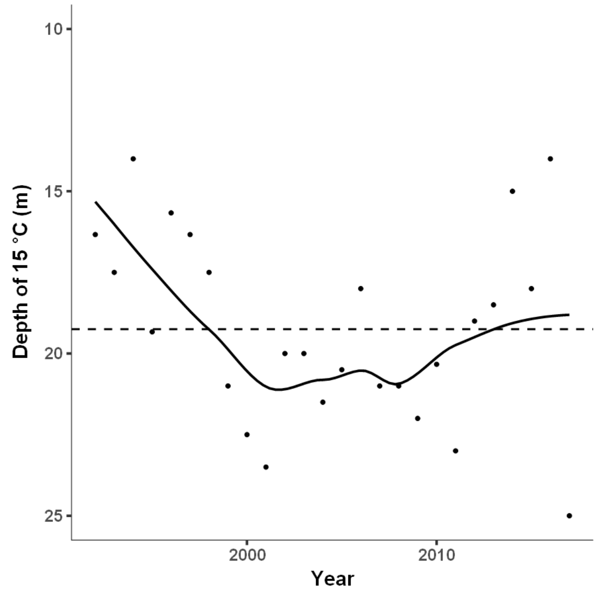

FIG. 11.1.5. Index of coldwater habitat in the Kingston Basin determined by July and August temperature profiles collected at Fish Community Index Gill Net (Section 1.2) site EB06. The solid line is the trend through time (loess fit) and the dotted line is the average depth of 15°C throughout the time-series (1992-2017).

11.2 Wind

M.J. Yuille and J.P. Holden, 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 – 2017 (Fig. 11.2.1). 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 since 2007, the years 2010, 2011, 2014 and 2017 had higher than average small craft warnings and 2017 had the second most number of warnings within July and August (Fig. 11.2.1a). The number of small craft warning hours increased from 2015 to 2017, where it was well above the long-term average number of warning for July and August (Fig. 11.2.1a). A second index, the East Wind Index, was calculated to determine the total number of hours between July 1st and August 31st, each year, that an eastern wind predominated (Fig. 11.2.1b). This index shows a decline in from 2016 to 2017, where the number of east wind hours was comparable to the long-term average (Fig. 11.2.1b).

Lastly, wind direction and velocity have been summarized for the months of July and August from 2015 – 2017 (Fig. 11.2.2). These analyses show the seasonal and annual variability in wind patterns on Lake Ontario. While, southwestern winds generally predominate through July and August (Fig. 11.2.2), the variability that exists may impact the Lake Ontario ecosystem as well as the recreational fishery.

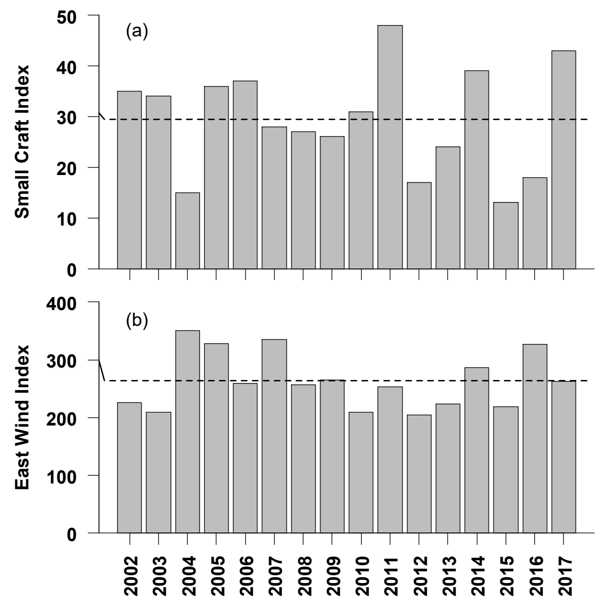

FIG. 11.2.1. Lake Ontario wind as characterized by the Small Craft Index (a) and East Wind Index (b). The Small Craft Index represents the total number of hours from July 1st to August 31st each year (2002 – 2017), where the wind velocity was ≥ 20 knots. The East Wind Index represents the number of hours from July 1st to August 31st each year (2002 – 2017) that an eastern wind predominated. Data provided by National Data Buoy Center, NOAA (http://www.ndbc.noaa.gov/).

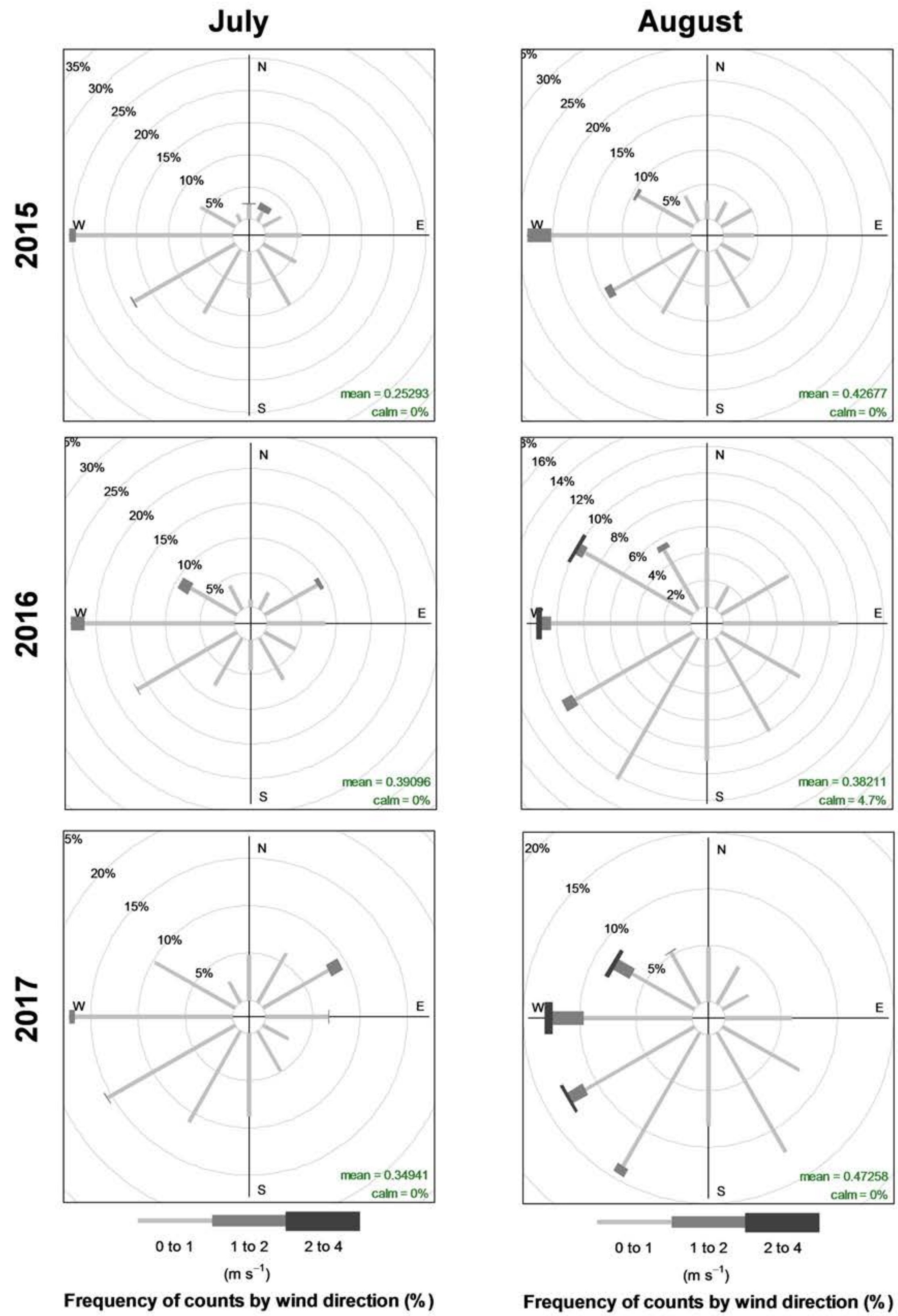

FIG. 11.2.2. Wind direction and velocity represented as a proportional frequency of occurrence for July and August in 2015 – 2017. Wind velocities of 0 – 1 knots are light grey, 1 – 2 knots are medium grey and > 2 knots are dark grey. Data provided by National Data Buoy Center, NOAA (http://www.ndbc.noaa.gov/).

11.3 Water Clarity

J.P. Holden, Lake Ontario Management Unit

Summer Water Transparency

Water clarity is measured using a Secchi disk at each Fish Community Index Gill Netting site (Section 1.2). The maximum depth the Secchi disk can be observed is an index of water clarity. Mean annual water clarity—as measured during June, July and August—varies between the Bay of Quinte, Kingston Basin and the Eastern Portion of Lake Ontario (measured at Rocky Point gill net sites; Fig. 11.3.1). Bay of Quinte Secchi depths are generally lower (less clear) than main lake sites and have been stable since the early 2000s. Similarly, Rocky Point is marginally clearer than the Kingston Basin but neither show a trend through time series (1994 to present). Year to year variation in Kingston Basin and Rocky Point are highly correlated throughout the time series.

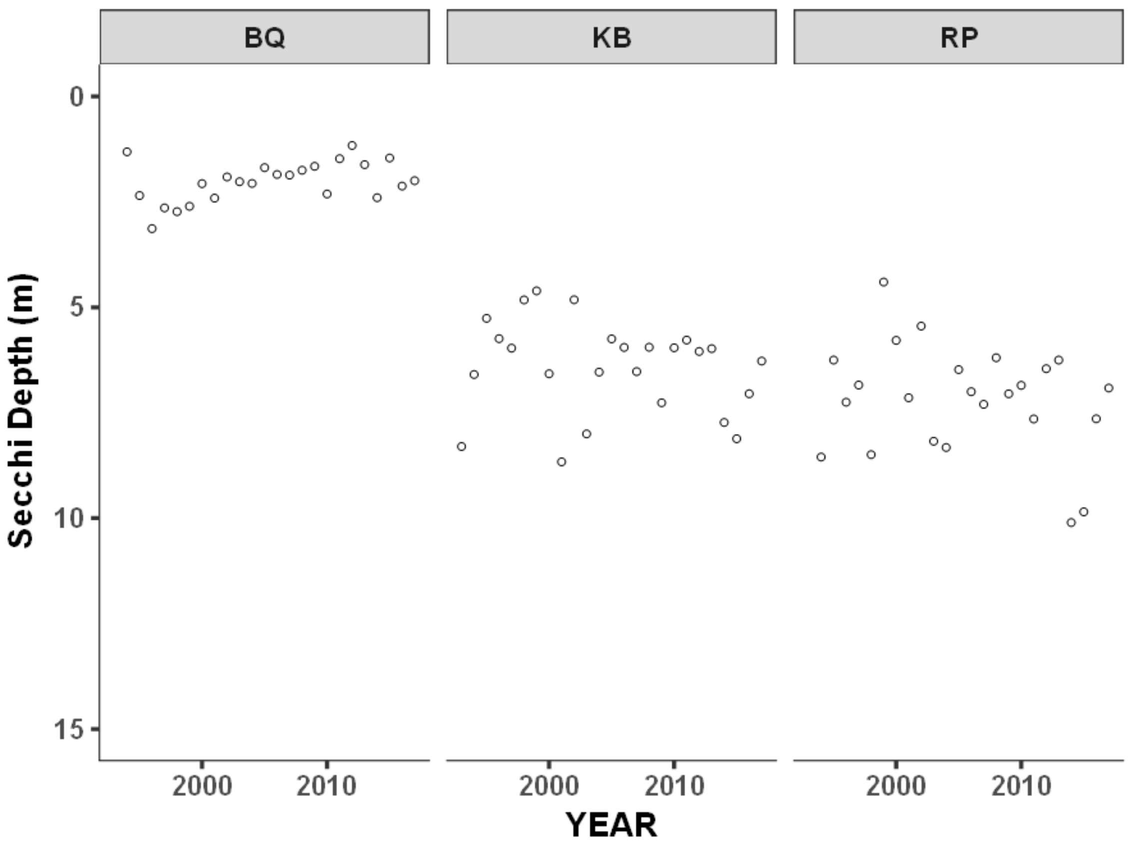

FIG. 11.3.1. Mean annual water clarity determined by Secchi disk readings collected at Fish Community Index Gill Net sites in June, July and August (Section 1.2).

11.4 Tributary Water Flow

E. N. Brown, Lake Ontario Management Unit

Tributary water flow regimes can impact fish species that use Lake Ontario's tributaries for spawning and rearing grounds. For example, migratory salmonid species such as Rainbow Trout and Chinook Salmon rely on cold water tributaries during the spring and fall in areas where natural reproduction occurs. Native cool water species such as Walleye, Northern Pike, and Lake Sturgeon may also use tributary areas for spawning during the spring. Though flow regimes can be described using several metrics, in this report, annual discharge data ($m^3{\bullet}s^{-1}$) and central flow timing (i.e. date at which half the annual discharge has been exceeded) are used. Average annual discharge is used to describe large-scale comparison in flow among years, whereas central flow timing is used to indicate whether the annual discharge occurred early or late in the season relative to the long-term average.

Water Surveys of Canada (WSC) collects hydrometric data from gauges across Canada, which are available through the Environment Canada webpage (http://wateroffice.ec.gc.ca/index_e.html). Discharge data from three stations (listed and described Table 11.4.1) were retrieved in January 2018 and summarised to characterise tributary water flow regimes. At the time of this report, 2017 daily discharge data are considered provisional by the Environment and Climate Change Canada and subject to change.

The Credit River drains into the western end of Lake Ontario and provides fishing opportunity for migratory salmonids within the river and lake basin. In 2017, the average annual discharge at the Credit River (Station ID: 02HB029) was 10.64 $m^3{\bullet}s^{-1}$. This was above the long-term average and represents the highest discharge rate since 2013 (Fig. 11.4.1). The central flow Julian day date was 131, indicating that flows occurred later relative to the 5-year average (123).

The Ganaraska River receives annual runs of naturalized Chinook Salmon and Rainbow Trout and both of these species reproduce naturally within this river system. In 2017, the average annual discharge at the Ganaraska River (Station ID: 02HD012) was 3.78 $m^3{\bullet}s^{-1}$. This was above the long-term average and represents the highest discharge rate since 2011 (Fig. 11.4.2). The central flow Julian day date was 152, indicating that flows occurred later relative to the 5-year average (124).

The Salmon River drains into the Bay of Quinte near Shannonville, Ontario. The lower reaches of this system provide spawning and rearing habitat for warm and coolwater species that inhabit the Bay of Quinte and Lake Ontario (e.g. Walleye). In 2017, the average annual discharge at the Salmon River (Station ID: 02HM003) was 18.47 $m^3{\bullet}s^{-1}$. Well above the long -term average, 2017 represents the highest discharge rate since observed since this reporting time series (Fig. 11.4.3). The central flow Julian day date was 126, indicating that flows occurred later relative to the 5-year average (105).

TABLE 11.4.1. Information of three Lake Ontario tributaries used in the stream flow analysis including river name, station ID, latitude and longitudes (Degrees Decimal Minutes), gross drainage area (km^2), and the Daily Discharge Time Series for each tributary.

River	Station ID	Latitude	Longitude	Gross Drainage Area (km^2)	Daily Discharge Time Series
Credit	02HB029	44° 34.933 N	79° 42.517 W	774.24	2005-2017
Ganaraska	02HD012	43° 59.450 N	78° 16.683 W	241.87	1976-2017
Salmon	02HM003	44° 12.433 N	77° 12.550 W	906.73	1958-2017

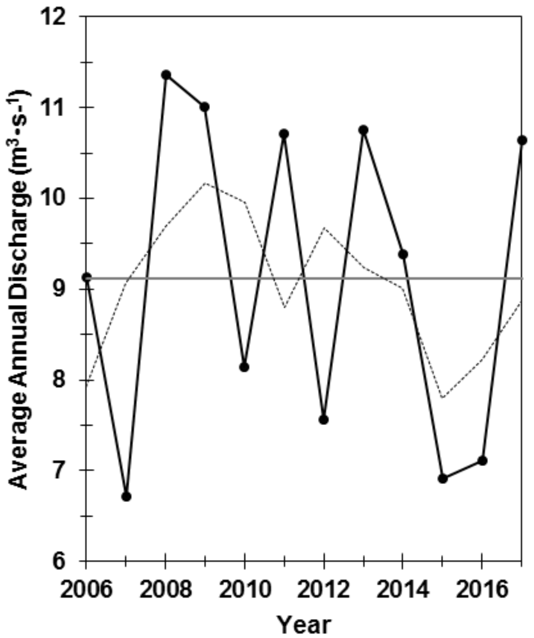

FIG. 11.4.1. Average annual discharge (m^3s^{-1}) for the Credit River, Ontario (Station ID: 02HB029) from 2006 to 2017. The horizontal line is the historical average discharge and the dotted line represents the 3-year running mean.

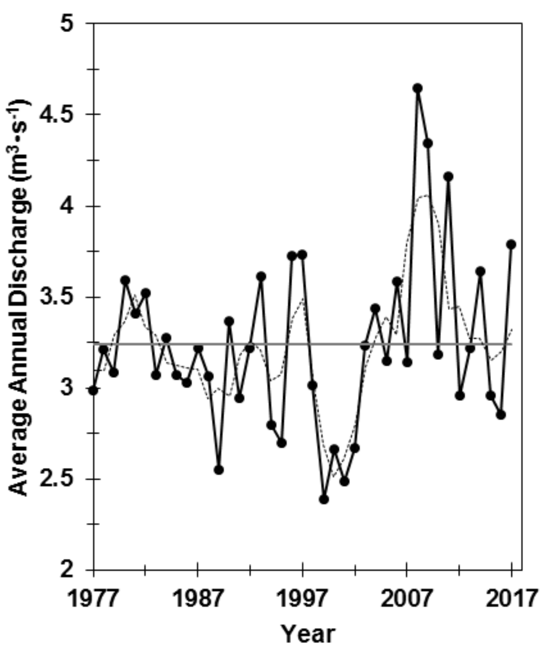

FIG. 11.4.2. Average annual discharge (m^3s^{-1}) for the Ganaraska River, Ontario (Station ID: 02HD012) from 1977 to 2017. The horizontal line is the historical average discharge and the dotted line represents the 3-year running mean.

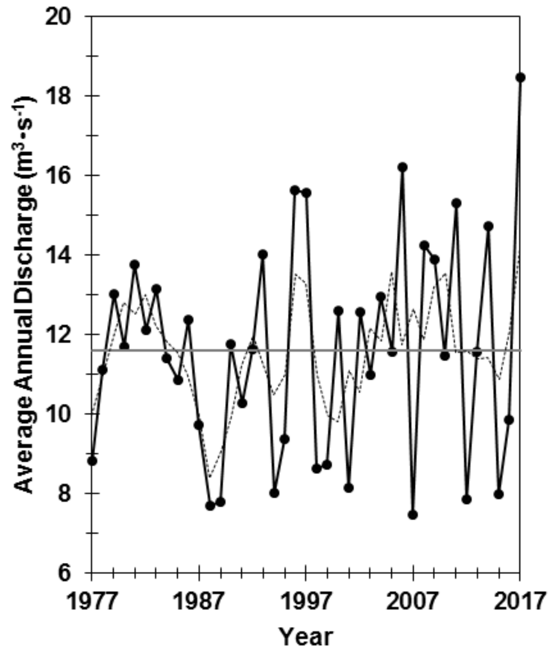

FIG. 11.4.3. Average annual discharge (m^3s^{-1}) for the Salmon River, Ontario (Station ID: 02HM003) from 1977 to 2017. The horizontal line is the historical average discharge and the dotted line represents the 3-year running mean.

12. Staff 2017

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13. Operational Field and Lab Schedule, 2017

(SPA = Special Purpose Account; COA = Canada Ontario Agreement; TRCA = Toronto and Region Conservation Authority; OPG = Ontario Power Generation; GLFC = Great Lakes Fisheries Commission).

Field and Lab Projects	Dates	Species Assessed, Monitored or Stocked	Project Lead	Operational Lead	Funding Source
Public Outreach - Toronto Sportsmen's Show	Mar	Public Outreach/Education	McNevin	Kranzl	SPA
Ganaraska River Chinook Salmon Marking Program	Mar	Chinook Salmon	Lake	Chicoine	SPA
Atlantic Salmon Marking Program	Mar	Atlantic Salmon	Lake	Chicoine	SPA
Atlantic Salmon Classroom Hatchery Program	Jan-May	Atlantic Salmon	Robinson	Wingrove	OFAH
Ganaraska River Fish Counter Salmon and Trout Assessment	Mar-Nov	Migratory Trout & Salmon	Yuille	Brown	COA/SPA/CRF
Ganaraska Fishway Rainbow Trout Assessment	Mar-Apr	Rainbow Trout	Yuille	Maynard	SPA
Public Outreach - Cottage Life Show	Apr	Public Outreach/Education	McNevin	Kranzl	SPA
Walleye Egg Collection	Mar-Apr	Walleye	Kranzl	Wingrove	SPA
Walleye Acoustic Tagging	Apr-Aug	Walleye	Hoyle	Wingrove	SPA
Chinook Salmon Tournament Sampling	Apr-Sept	Chinook Salmon	Yuille	Kranzl	SPA
Asian Grass Carp Emergency Response	Apr-Nov	Grass Carp	McNevin	Kranzl	SPA
Chinook Salmon Net Pens	Apr	Chinook Salmon	Lake	Jakobi	SPA
Lake Trout Tug Stocking	Apr	Juvenile Lake Trout	Lake	Chicoine	SPA
Lake Ontario Spring Prey fish Trawling Survey	Apr	Alewife/Smelt	Holden	Dale	CRF
Fish Contaminant Sampling	Apr-Dec	Sport Fish	McNevin	Kranzl	SPA
Bay of Quinte Open Water Angling Survey	May-Dec	Walleye, Bass and Perch	Hoyle	Kranzl	SPA
St 81- Offshore Benthos and Zooplankton Survey	May-Oct	Lower Food Web	Dr. Johnson	Metcalfe	SPA
Spring American Eel Trap and Transfer	Apr-Jun	American Eel	Mathers	Gardner Costa	OPG
Deepwater Cisco Acoustic Telemetry Research Program	Jun	Deepwater Cisco	Johnson	Chicoine	COA/SPA
Juvenile Chinook Salmon Assessment (Electrofishing)	May	Juvenile Chinook Salmon	Yuille	Jakobi	SPA
Trent River Lake Sturgeon Survey / Acoustic Tagging	May	Lake Sturgeon	Lake	Wingrove	COA
Queens University - Bay of Quinte/Eastern L.Ont Acoustic Receiver Program	Jun-Oct	Bass / Walleye	Tufts	McIntosh	SPA
Eastern Lake Ontario and Bay of Quinte Community Index Netting	Jun-Nov	Fish Community	Hoyle	Kranzl	SPA
Western Lake Ontario Community Index Netting	July	Fish Community	Hoyle	Kranzl	SPA
Eastern Lake Ontario and Bay of Quinte Index Trawling	Jun-Sep	Fish Community	Hoyle	Kranzl	SPA
Lake-wide Hydroacoustic Assessment of Prey fish	July	Prey Fish Community	Holden	Chicoine	COA
Public Outreach - Hamiton Harbour Kids Fishing Day	Aug	Public Outreach/Education	Todd	Jakobi	SPA
West and East Lake Nearshore Community Index Netting	Aug	Nearshore Fish Community	Hoyle	Peat	COA
Prince Edward Bay Nearshore Community Index Netting	Sept	Nearshore Fish Community	Hoyle	Murphy	COA
Upper Bay Nearshore Community Index Netting	Sept	Nearshore Fish Community	Hoyle	Perry	COA
Boat Electrofishing - Bay of Quinte	Sept	Nearshore Fish Community	Hoyle	Wingrove	SPA
Thousand Islands Community Index Netting	Sept	Fish Community	Yuille	Scholz	COA

Continued on next page

13. Operational Field and Lab Schedule, 2017 *(continued from previous page)*

Ganaraska Chinook Salmon Assessment and Egg Collection	Sept	Chinook Salmon	Yuille	Brown	SPA
Public Outreach - Belleville Cops for Kids Fishing Day	Jun	Public Outreach/Education	McNevin	Jakobi	SPA
Fall American Eel Trap and Transfer	Sept-Oct	American Eel	Mathers	Gardner Costa	OPG
Lake Ontario Fall Benthic Prey Fish Trawling Survey	Sept-Oct	Round Goby/Slimy and Deepwater Sculpin	Holden	Chicoine	COA
Credit River Chinook Salmon Assessment and Egg Collection	Oct	Chinook Salmon	Yuille	Jang	SPA
Commercial Catch Sampling	Oct-Nov	Lake Whitefish	Hoyle	Moore	SPA
Age and Growth (Lab)	Year-Round	Multiple Species	Multiple	Kranzl	SPA
Deepwater Cisco Restoration Stocking	Nov	Deepwater Cisco	Lake	Chicoine	SPA
Deepwater Cisco Research Acoustic Telemetry Stocking	Nov	Deepwater Cisco	Johnson	Chicoine	COA/SPA

14. Primary Publications of Glenora Fisheries Station Staff[1] in 2017

Bowlby, J.N., Hoyle, J.A. 2017. Predicting restored nearshore fish populations in two Areas of Concern in Lake Ontario using a comparative approach. Aquatic Ecosystem Health & Management, 20:242-251, http://dx.doi.org/10.1080/14634988.2017.1295760.

Colborne, S.F., Fisk, A.T., **Johnson, T.B.** 2017. Tissue-specific turnover and diet-tissue discrimination factors of carbon and nitrogen isotopes of a common forage fish held at two temperatures. Rapid Comm. Mass Spectro. 31:1405-1414, doi: 10.1002/rcm.7922.

Feiner, Z.S, Chong, S.C., Fielder, D.G., **Hoyle, J.A.**, Knight, C., Lauer, T.E., Thomas, M.V., Tyson, J.T., Höök, T.O. 2017. Sex-based tradeoffs between growth, mortality, and maturation in Great Lakes yellow perch stocks. Canadian Journal of Fisheries and Aquatic Sciences, 74:2059-2072, http://dx.doi.org/10.1139/cjfas-2016-0173.

Hoyle, J.A., Holden, J.P, Yuille, M.J. 2017. Diet and relative weight in migratory walleye (*Sander vitreus*) of the Bay of Quinte and eastern Lake Ontario, 1992–2015. Journal of Great Lakes Research, 43:846-853, https://doi.org/10.1016/j.jglr.2017.01.013.

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

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