Ontario

LAKE ONTARIO FISH COMMUNITIES AND FISHERIES:

2015 ANNUAL REPORT OF THE LAKE ONTARIO MANAGEMENT UNIT

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Lake Ontario Fish Communities and Fisheries: 2015 Annual Report of the Lake Ontario Management Unit

Foreword

The Lake Ontario Management Unit (LOMU) and the Lake Ontario research staff from the Applied Research and Monitoring Section are pleased to provide the Annual Report of monitoring, assessment, research and management activities carried out during 2015.

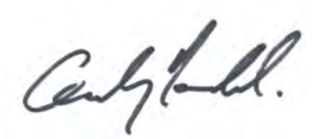
Lake Ontario fisheries are managed by the Ontario Ministry of Natural Resources and Forestry (MNRF) in partnership with New York State within the Lake Ontario Committee under the Great Lakes Fishery Commission. Lake Ontario Fish Community Objectives 2013 provide bi-national fisheries management direction 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.

Management highlights from 2015 include the release of the final Lake Ontario Stocking Strategy for Canadian Waters and the development of an Atlantic Salmon Restoration Program - Five Year Implementation Strategy. Assessment program highlights include the acquisition of a new electro-fishing vessel, completion of the first ever lake-wide tributary angler creel, initiation of a bi-national lake-wide fall benthic trawling program and the development of acoustic telemetry capability through Queens University and other partners. New for the 2015 Annual Report is a section on environmental factors that influence the fishery.

Ongoing MNRF assessment programs delivered in 2015 include the Ganaraska River Rainbow Trout assessment, angler diary programs, St. Lawrence River index netting, Atlantic Salmon assessment, and the ongoing delivery of the LOMU fisheries nearshore and offshore assessment programs. The MNRF fish culture program produced and stocked more than 2 million fish into Lake Ontario including the third stocking of Deepwater Cisco.

We express our sincere appreciation to the many partners and volunteers who contributed to the successful delivery of LOMU initiatives. Special thanks to the Aurora MNRF District, Credit Valley Conservation and the Toronto Region Conservation Authority for their leadership and operational excellence in the delivery of the Atlantic Salmon program on the Credit River and Duffins Creek and to the Ontario Federation of Anglers and Hunters and the many other partners committed to the Lake Ontario Atlantic Salmon restoration program. Work with University of Windsor and Queen's University is ongoing and should provide unique insight into Lake Ontario fisheries. LOMU gratefully acknowledges the important contribution of the commercial fish Lake Ontario Liaison Committee, the Fisheries Management Zone 20 Council (FMZ20) members, the Ringwood hatchery partnership with the Metro East Anglers, Credit River Anglers Association, Napanee Rod and Gun Club, Chinook Net Pen Committee, Muskies Canada and the participants in the angler diary and assessment programs. Local Port Hope volunteers have dedicated many hours of support to the Ganaraska Fishway operation for spring Rainbow Trout assessment and fall Chinook Salmon egg collection.

Our team of skilled and committed staff and partners delivered an exemplary program of field, laboratory and analytical work that will provide 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 2015.



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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. Since 1987, fish counts were made with a Pulsar Model 550 electronic fish counter. Based on visual counts, the electronic counter is about 85.5% efficient, and the complete size of the run has been 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 2015, the fish counter was installed on April 3rd, 2015 and ran until May 16th, 2015.

In 2015, the Rainbow Trout run in the Ganaraska River was estimated at 6,669 fish (Table 1.1.1), below the average for the previous 10 years (7,030 fish on average from 2005-2014). From 2009-2013, the Rainbow Trout run in the Ganaraska River increased. In 2014 and again in 2015, the Rainbow Trout run in the Ganaraska River declined (Fig. 1.1.1).

Rainbow Trout were measured and weighed during the spawning run in most years since 1974. Rainbow Trout body condition was determined as the estimated weight of a 635 mm (25 inch) fish at the Ganaraska River. In 2015, the condition of male (2,792 g) and female (2,963 g) Rainbow Trout were significantly lower ($p < 0.05$) than in 2013, and were the lowest in the time series (Fig 1.1.2 and Table 1.1.2).

Lamprey marks on Rainbow Trout in the Ganaraska River in 2015 were comparable to 2013 with 0.296 marks/fish (Table 1.1.3). The marking rate is still higher than any value during 1990-2003 (Fig. 1.1.3). Marking rates from 2004-2013 are similar to levels in the 1970s (Fig. 1.1.3).

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, 1974-2015. Estimates for 1980, 1982, 1984, 1986, 1992, and 2002 were interpolated from adjacent years with virtual population analysis.

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

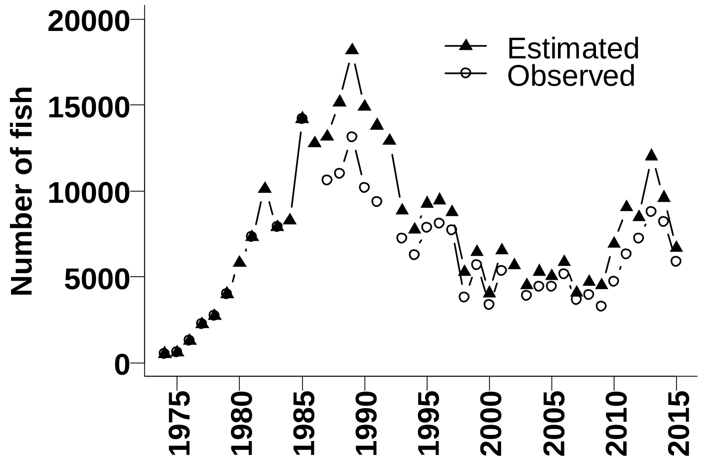

FIG. 1.1.1. Estimated and observed run of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario during spring 1974-2015.

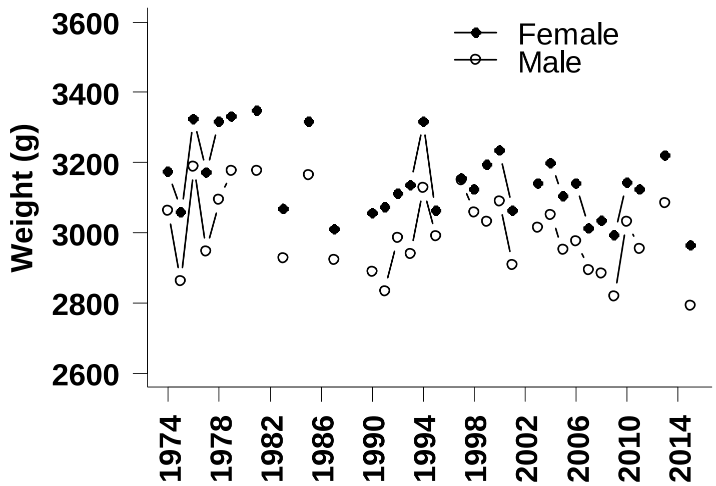

FIG. 1.1.2. Body condition (estimated weight at 635 mm fork length) of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario during spring 1974-2015. Open and closed circles represent male and female Rainbow Trout (respectively).

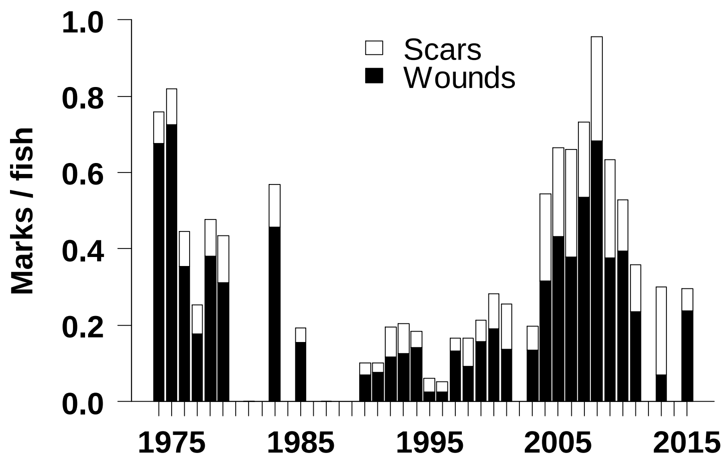

FIG. 1.1.3. Trend in lamprey marks on Rainbow Trout during the spring 1974-2015, at the Ganaraska River fishway at Port Hope, Ontario. Since 1990, A1 and A2 marks (King and Edsall 1979) were called wounds and the remainder of marks were called scars to fit with historical classification.

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.

The Lake Ontario Management Unit would like to thank the all of the volunteers at the Ganaraska Fishway for their hard work and dedication throughout the 2015 field season

TABLE 1.1.2. Body condition (estimated weight at 635 mm) of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario during spring, 1974-2015.

Year	Male		Female	
	Weight (g)	Sample Size	Weight (g)	Sample Size
1974	3,064	183	3,175	242
1975	2,863	202	3,058	292
1976	3,188	447	3,325	624
1977	2,947	698	3,171	1038
1978	3,094	275	3,317	538
1979	3,177	372	3,332	646
1981	3,176	282	3,348	493
1983	2,928	327	3,069	481
1985	3,164	446	3,318	760
1987	2,923	84	3,010	110
1990	2,890	261	3,057	198
1991	2,834	127	3,073	289
1992	2,986	142	3,112	167
1993	2,941	89	3,136	172
1994	3,128	116	3,317	181
1995	2,990	147	3,062	155
1997	3,149	157	3,156	148
1998	3,058	131	3,123	262
1999	3,033	182	3,193	293
2000	3,090	125	3,235	234
2001	2,909	308	3,063	299
2003	3,015	93	3,140	144
2004	3,050	143	3,198	248
2005	2,952	145	3,103	176
2006	2,976	102	3,141	217
2007	2,893	75	3,011	131
2008	2,885	125	3,034	148
2009	2,820	78	2,994	211
2010	3,031	74	3,143	156
2011	2,954	94	3,123	204
2013	3,085	163	3,221	217
2015	2,792	86	2,963	119
Average	3,000		3,148	

TABLE 1.1.3. Lamprey marks on Rainbow Trout in spring 1974-2015, 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

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

J. A. Hoyle, Lake Ontario Management Unit

This gill netting program is used to monitor the abundance of a variety of warm, cool and cold -water fish species in Lake Ontario and Bay of Quinte. Data from the program are used to help manage local commercial and recreational fisheries as well as for detecting 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. Each site or area is visited from one to three times within a specified time-frame and using 2, 3 or 8 replicate gill net gangs.

Annual index gill netting field work occurs during 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.

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 at 13 mm (½ in) intervals, arranged in sequence. However, a standard gill net gang may consist of

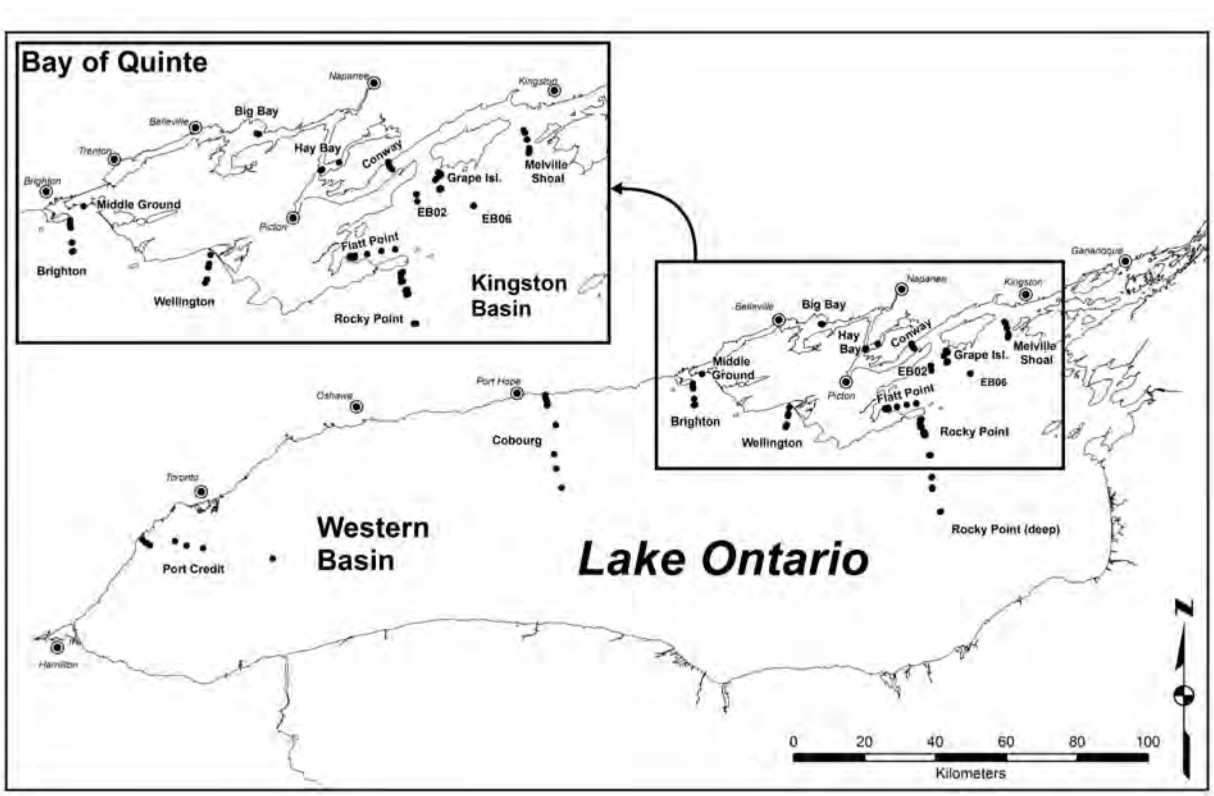

FIG. 1.2.1. Map of north eastern Lake Ontario. Shown are eastern Lake Ontario and Bay of Quinte fish community index gill netting sites.

TABLE. 1.2.1. Sampling design (2015) of the Lake Ontario and Bay of Quinte fish community index gill netting program including geographic and depth stratification, number of visits, number of replicate gill net gangs set during each visit, and the time-frame for completion of visits.

						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	Depth stratified area	PC08	7.5	1	2		433230	793476	2	Jul 1-Jul 31	2014	2
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC13	12.5		2		433182	793403	2			
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC18	17.5		2		433164	793355	2			
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC23	22.5		2		433156	793335	2			
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC28	27.5		2		433143	793308	2			
Northwestern Lake Ontario	Port Credit	Depth stratified area	0060	60	1		3	433213	792808	3	Jul 1-Jul 31	2014	2
Northwestern Lake Ontario	Port Credit	Depth stratified area	0080	80			3	433190	792515	3			
Northwestern Lake Ontario	Port Credit	Depth stratified area	0100	100			3	433162	792161	3			
Northwestern Lake Ontario	Port Credit	Depth stratified area	0140	140			3	433065	790735	3			
Northeastern Lake Ontario	Cobourg (CB)	Depth stratified area	CB08	7.5	2	2		435701	781167	4	Jul 1-Jul 31	2010	6
Northeastern Lake Ontario	Cobourg	Depth stratified area	CB13	12.5		2		435661	781157	4	Aug 1-Sep 15		
Northeastern Lake Ontario	Cobourg	Depth stratified area	CB18	17.5		2		435622	781136	4			
Northeastern Lake Ontario	Cobourg	Depth stratified area	CB23	22.5		2		435584	781109	4			
Northeastern Lake Ontario	Cobourg	Depth stratified area	CB28	27.5		2		435549	781110	4			
Northeastern Lake Ontario	Cobourg	Depth stratified area	0060	60	1		3	435257	780916	3	Jul 1-Jul 31	2014	2
Northeastern Lake Ontario	Cobourg	Depth stratified area	0080	80			3	434813	780919	3			
Northeastern Lake Ontario	Cobourg	Depth stratified area	0100	100			3	434589	780857	3			
Northeastern Lake Ontario	Cobourg	Depth stratified area	0140	140			3	434310	780728	3			
Northeastern Lake Ontario	Brighton (BR)	Depth stratified area	BR08	7.5	2	2		435955	774058	4	Aug 1-Sep 15	1988	28
Northeastern Lake Ontario	Brighton	Depth stratified area	BR13	12.5		2		435911	774071	4			
Northeastern Lake Ontario	Brighton	Depth stratified area	BR18	17.5		2		435878	774053	4			
Northeastern Lake Ontario	Brighton	Depth stratified area	BR23	22.5		2		435777	774034	4			
Northeastern Lake Ontario	Brighton	Depth stratified area	BR28	27.5		2		435624	774004	4			
Northeastern Lake Ontario	Middle Ground (MG)	Fixed site	MG05	5	2	2		440054	773906	4	Aug 1-Sep 15	1979	37
Northeastern Lake Ontario	Wellington (WE)	Depth stratified area	WE08	7.5	2	2		435622	772011	4	Aug 1-Sep 15	1988	28
Northeastern Lake Ontario	Wellington	Depth stratified area	WE13	12.5		2		435544	772027	4			
Northeastern Lake Ontario	Wellington	Depth stratified area	WE18	17.5		2		435515	772025	4			
Northeastern Lake Ontario	Wellington	Depth stratified area	WE23	22.5		2		435378	772050	4			
Northeastern Lake Ontario	Wellington	Depth stratified area	WE28	27.5		2		435348	772066	4			
Northeastern Lake Ontario	Rocky Point (RP)	Depth stratified area	RP08	7.5	2	2		435510	765220	4	Jul 21-Sep 15	1988	28
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP13	12.5		2		435460	765230	4			
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP18	17.5		2		435415	765222	4			
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP23	22.5		2		435328	765150	4			
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP28	27.5		2		435285	765135	4			
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0060	60	2		3	434950	765029	6	Jul 1-Jul 31	1997	19
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0080	80			3	434633	765006	6			
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0100	100			3	434477	764998	6			
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0140	140			3	434122	764808	6			
Kingston Basin (nearshore)	Flatt Point (FP)	Depth stratified area	FP08	7.5	2	2		435665	765993	4	Jul 1-Jul 31	1986	30
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP13	12.5		2		435659	765927	4			
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP18	17.5		2		435688	765751	4			
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP23	22.5		2		435726	765541	4			
Kingston Basin (nearshore)	Flatt Point	Depth stratified area	FP28	27.5		2		435754	765314	4			
Kingston Basin (nearshore)	Grape Island (GI)	Depth stratified area	GI08	7.5	2	2		440537	764712	4	Jul 1-Jul 31	1986	30
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI13	12.5		2		440523	764747	4			
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI18	17.5		2		440476	764710	4			
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI23	22.5		2		440405	764718	4			
Kingston Basin (nearshore)	Grape Island	Depth stratified area	GI28	27.5		2		440470	764796	4			
Kingston Basin (nearshore)	Melville Shoal (MS)	Depth stratified area	MS08	7.5	2	2		441030	763500	4	Jul 1-Jul 31	1986	30
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS13	12.5		2		441004	763470	4			
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS18	17.5		2		440940	763460	4			
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS23	22.5		2		440835	763424	4			
Kingston Basin (nearshore)	Melville Shoal	Depth stratified area	MS28	27.5		2		440792	763424	4			
Kinston Basin (offshore)	Eastern Basin (EB)	Fixed site	EB02	30	3		8	440330	765050	24	Last week Jun-Sep 15	1968	48
Kinston Basin (offshore)	Eastern Basin (EB)	Fixed site	EB06	30	3		8	440220	764210	24	Last week Jun-Sep 15	1968	48
Bay of Quinte	Conway (CO)[1]	Depth stratified area	CO08	7.5	2		2	440664	765463	4	Jul 21-Aug 21	1972	44
Bay of Quinte	Conway	Depth stratified area	CO13	12.5			2	440649	765452	4			
Bay of Quinte	Conway	Depth stratified area	CO20	20			2	440643	765453	4			
Bay of Quinte	Conway	Depth stratified area	CO30	30			2	440707	765458	4			
Bay of Quinte	Conway	Depth stratified area	CO45	45			2	440601	765402	4			
Bay of Quinte	Hay Bay (HB)[2]	Depth stratified area	HB08	7.5	2		2	440656	770156	4	Jul 21-Aug 21	1959	57
Bay of Quinte	Hay Bay	Depth stratified area	HB13	12.5			2	440575	770400	4			
Bay of Quinte	Big Bay (BB)	Fixed site	BB05	5	3		2	440920	771360	6	Jul 21-Aug 21	1972	44

[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.

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 deep Lake Ontario sites (60-140 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 2015, gill netting occurred from 8-Jun to 1-Sep. Twenty-eight different species and nearly twenty thousand individual fish were caught. About 88% of the observed catch was alewife (Table 1.2.2). Species-specific gill net catch summaries are shown by geographic area/site in Tables 1.2.3-1.2.15.

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

Lake Ontario

Cobourg (Tables 1.2.3 and 1.2.4)

Nearshore sites: Alewife dominate the catch at the Cobourg nearshore sites but the salmonid fish community is also well represented (Table 1.2.3). Seven species were caught in 2015. Alewife catch declined significantly from 2010-2014 but increased in 2015.

Deep sites: The deep sites at Cobourg were sampled again in 2015 and three species were caught: Alewife, Lake Trout and Deepwater Sculpin. Alewife abundance was higher in 2015 (Table 1.2.4).

TABLE 1.2.2. Species-specific catch per gill net set in 2015. "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.

Species	Observed Catch	Standard Catch	Mean Weight (g)
Longnose Gar	10	10	2207
Alewife	17,489	41,721	76
Gizzard Shad	19	19	222
Chinook Salmon	17	17	1317
Atlantic Salmon	1	1	3494
Brown Trout	22	22	2930
Lake Trout	492	497	3531
Lake Whitefish	20	22	581
Cisco (Lake Herring)	32	34	250
Coregonus sp.	1	1	229
Rainbow Smelt	7	7	43
Northern Pike	25	25	3836
Longnose Sucker	2	2	1237
White Sucker	92	92	756
Common Carp	1	1	6846
Golden Shiner	4	4	36
Brown Bullhead	5	5	364
Burbot	1	1	579
White Perch	220	220	66
White Bass	3	3	588
Rock Bass	36	68	91
Pumpkinseed	3	3	85
Bluegill	71	71	64
Smallmouth Bass	14	14	574
Yellow Perch	900	1,239	66
Walleye	245	252	2339
Round Goby	55	175	120
Freshwater Drum	64	64	874
Deepwater Sculpin	21	21	38

TABLE 1.2.3. Species-specific catch per gill net set at **Cobourg (nearshore sites only) in Northeastern Lake Ontario**, 2010-2015. 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
Alewife	351.96	196.13	56.77	23.78	7.48	136.71
Coho Salmon	-	-	0.10	-	0.05	-
Chinook Salmon	0.68	2.05	1.82	0.44	0.40	0.20
Rainbow Trout	0.51	0.25	0.80	0.05	-	-
Brown Trout	0.13	0.65	0.50	0.42	0.25	0.40
Lake Trout	0.37	0.05	-	1.26	0.70	0.37
Lake Whitefish	-	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
Greater redhorse	-	-	0.10	-	-	-
Burbot	-	-	-	-	0.05	-
Smallmouth Bass	-	0.05	-	-	-	-
Yellow Perch	0.33	-	0.10	-	-	-
Walleye	0.03	-	0.40	-	0.05	0.10
Round Goby	2.20	9.91	3.30	0.40	0.17	1.65
Freshwater Drum	-	0.05	0.10	-	-	-
Total catch	356	210	65	27	9	140
Number of species	10	12	11	7	9	7
Number of sets	30	20	10	19	20	20

TABLE 1.2.4. Species-specific catch per gill net set at **Cobourg (deep sites only) in Northeastern Lake Ontario**, 1997, 1998, 2014. and 2015 Annual catches are averages for 2 or 3 gill net gangs set at each of 4 depths (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
Alewife	67.16	42.75	29.75	171.50
Brown Trout	-	-	0.08	-
Lake Trout	0.50	0.88	0.17	0.42
Cisco (Lake Herring)	-	0.13	-	-
Rainbow Smelt	2.88	0.50	-	-
Slimy Sculpin	0.06	-	-	-
Deepwater Sculpin	-	-	3.67	0.25
Total catch	71	44	30	172
Number of species	4	4	4	3
Number of sets	16	16	12	12

Middle Ground (Table 1.2.5)

Five species were caught at Middle Ground in 2015. Alewife and Yellow Perch dominated the catch.

Northeast (Brighton, Wellington and Rocky Point) and Kingston Basin (Melville Shoal, Grape Island and Flatt Point) Nearshore Areas (Tables 1.2.6-1.2.11 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 are used here to provided a broad picture of the warm, cool and coldwater fish community inhabiting open-coastal waters out to about 30 m water depth. 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 the last few years until 2014 when abundance declined precipitously. Alewife abundance increased in 2015. Yellow Perch remained at a very low level of abundance in 2015. Lake Trout appear to be increasing slowly but steadily over the last few years. In 2014, Round Goby abundance declined to its lowest level since 2004, and remained low in 2015. Walleye catch rebounded in 2014 after an unusually low catch in 2013, and remained high in 2015. Lake Whitefish remain at a very low abundance level. Rock Bass and Smallmouth Bass abundance levels have been generally stable for over a decade.

Rocky Point—Deep Sites (Table 1.2.12)

Nine species have been captured at the Rocky Point deep sampling sites since 1997. Alewife and Lake Trout are the two most abundant species. Lake Trout abundance was relatively stable from 1997-2002, declined

TABLE 1.2.5. Species-specific catch per gill net set at **Middle Ground in Northeastern Lake Ontario**, 1992-2015 (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
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
Gizzard Shad	**0.39**	-	-	-	-	0.50	-	0.25	-	-	0.25	**0.10**	-		-	-	-
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
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
Common Carp	**0.41**	0.50	-	0.75	0.50	-	-	-	-	-	-	**0.18**	-		-	-	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		-	-	-
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	-	-
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
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	-
Freshwater Drum	**0.57**	-	0.25	-	3.00	0.25	-	0.50	-	0.50	-	**0.45**	-		-	-	-
Total catch	**70**	50	66	31	75	34	110	41	50	35	24	**52**	264		123	54	101
Number of species	**8**	7	7	7	8	8	7	9	7	7	8	**8**	8		6	4	5
Number of sets		4	4	4	4	4	4	4	4	4	4		4	-	4	4	4

TABLE 1.2.6. Species-specific catch per gill net set at **Brighton in northeastern Lake Ontario**, 1992-2015. Annual catches are averages for 1-3 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. 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
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
Gizzard Shad	**0.44**	-	-	-	-	-	-	-	-	-	0.15	**0.02**	-	-	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	-
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
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
Lake Whitefish	**0.42**	0.05	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-
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
Round Whitefish	**1.19**	-	0.25	0.05	0.05	-	-	-	-	-	-	**0.04**	-	-	-	-	-
Rainbow Smelt	**0.11**	-	-	-	-	-	-	-	-	-	0.10	**0.01**	0.22	-	0.05	-	-
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	-
Lake Chub	**-**	-	-	-	-	-	-	-	0.17	-	-	**0.02**	-	-	-	-	-
Common Carp	**0.12**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-
Brown Bullhead	**0.10**	0.52	0.20	0.85	0.27	0.35	-	0.25	0.22	0.05	-	**0.27**	-	-	-	0.17	-
Channel Catfish	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-
American Eel	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-
Burbot	**0.05**	0.05	-	-	-	-	0.05	0.05	-	-	-	**0.02**	-	-	-	0.05	0.05
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
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	-
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
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
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
Number of species	**13**	6	9	15	12	12	12	14	11	10	12	**11**	9	8	10	13	9
Number of sets		20	20	20	20	20	20	20	20	20	20		20	10	20	20	20

TABLE 1.2.7. Species-specific catch per gill net set at **Wellington in northeastern Lake Ontario**, 1992-2015. Annual catches are averages for 1-3 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. 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
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
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
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
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	-
Lake Whitefish	**0.61**	0.10	0.05	-	-	-	-	-	-	-	-	**0.02**	0.35	-	-	0.20	-
Cisco (Lake Herring)	**0.11**	-	-	-	-	-	0.05	-	-	0.05	0.05	**0.02**	0.05	-	-	-	-
Round Whitefish	**0.06**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-
Rainbow Smelt	**0.07**	-	-	-	-	-	-	-	0.05	0.10	0.17	**0.03**	0.05	0.10	-	0.05	-
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	-
White Perch	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-
Rock Bass	**0.35**	0.17	-	0.52	0.10	0.05	-	-	0.58	-	-	**0.14**	-	-	0.05	-	-
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
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	-
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
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
Number of species	**11**	9	10	11	12	11	8	8	9	7	11	**10**	12	8	9	10	5
Number of sets		20	20	20	20	20	20	20	20	20	20		20	10	20	20	20

TABLE 1.2.8. Species-specific catch per gill net set at **Rocky Point (nearshore sites only) in northeastern Lake Ontario**, 1992-2015. Annual catches are averages for 1-3 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. 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
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
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
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
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
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 (Lake Herring)	**0.07**	-	-	-	-	-	-	-	-	-	-	**-**	0.05	-	-	-	-
Chub	**-**	0.17	-	-	-	-	-	-	-	-	-	**0.02**	-	-	-	-	-
Rainbow Smelt	**0.03**	-	-	-	-	-	-	-	0.17	-	-	**0.02**	-	-	-	-	-
White Sucker	**0.04**	0.05	-	-	-	-	-	0.05	-	-	-	**0.01**	-	-	-	-	-
Lake Chub	**0.11**	-	0.17	-	-	-	-	0.05	-	-	-	**0.02**	-	-	-	-	-
Common Carp	**0.01**	-	-	-	0.10	0.05	-	-	-	-	-	**0.02**	-	-	-	-	-
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	-
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
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
Yellow Perch	**0.06**	-	-	-	-	0.17	0.81	0.88	0.22	0.33	1.75	**0.42**	0.60	0.66	-	-	-
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
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
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
Number of species	**10**	10	11	11	12	12	13	13	12	10	11	**12**	11	9	11	10	8
Number of sets		20	20	20	20	20	20	20	20	20	20		20	10	20	20	20

TABLE 1.2.9. Species-specific catch per gill net set at **Flatt Point in the Kingston Basin of Lake Ontario**, 1992-2015. Annual catches are averages for 1-3 gill net 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 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
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
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	-
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
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
Cisco (Lake Herring)	**0.83**	-	-	0.10	-	0.05	-	-	-	-	-	**0.02**	-	0.05	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
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
Smallmouth Bass	**0.06**	-	0.10	0.05	-	-	-	-	-	-	-	**0.02**	-	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
Walleye	**0.10**	-	-	-	-	0.05	0.05	0.05	0.10	0.15	0.25	**0.07**	0.10	0.10	-	-	0.15
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
Freshwater Drum	**0.08**	-	-	-	-	-	-	-	-	-	-	**-**	0.05	-	-	-	-
Total catch	**119**	60	14	19	149	179	269	172	308	314	638	**212**	923	828	341	15	298
Number of species	**10**	11	9	11	10	11	11	11	11	10	11	**11**	12	14	8	6	9
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20

TABLE 1.2.10. Species-specific catch per gill net set at **Grape Island in the Kingston Basin of Lake Ontario**, 1992-2015. Annual catches are averages for 1-3 gill net 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 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
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
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
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	-	-
Cisco (Lake Herring)	**0.08**	-	-	-	-	-	-	-	-	-	0.15	**0.02**	0.05	-	0.10	0.05	-
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
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
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
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
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
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
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
Number of species	**11**	9	9	16	11	11	11	11	10	8	11	**11**	11	10	10	9	8
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20

TABLE 1.2.11. Species-specific catch per gill net set at **Melville Shoal in the Kingston Basin of Lake Ontario**, 1992-2014. Annual catches are averages for 1-3 gill net 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 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
Lake Sturgeon	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-
Alewife	**71.63**	40.83	39.19	14.14	82.41	177.38	195.64	83.04	134.66	496.46	620.85	**188.46**	666.70	223.18	553.63	93.28	170.89
Gizzard Shad	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-
Chinook Salmon	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-
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
Lake Whitefish	**1.59**	0.10	0.20	0.30	-	-	-	0.05	-	-	-	**0.07**	-	-	-	-	-
Cisco (Lake Herring)	**0.04**	-	-	-	-	-	-	-	-	-	0.20	**0.02**	0.05	0.05	-	0.05	0.27
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
White Sucker	**0.03**	0.05	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-
Greater Redhorse	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-
Moxostoma sp.	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-
Common Carp	**0.02**	-	-	0.05	0.10	-	-	-	0.05	-	-	**0.02**	-	-	-	-	-
Channel Catfish	**0.15**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-
Stonecat	**0.03**	0.33	0.43	-	-	0.50	-	-	-	-	-	**0.13**	-	-	-	-	-
Burbot	**0.10**	-	-	-	0.05	-	-	-	-	-	-	**0.01**	-	-	-	-	-
White Perch	**0.20**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-
Rock Bass	**1.88**	1.99	0.98	1.33	2.25	1.84	1.82	1.72	3.16	0.80	1.28	**1.72**	1.20	1.89	0.42	1.99	1.51
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
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
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
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
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
Number of species	**12**	12	9	12	9	7	8	10	10	8	12	**10**	10	9	6	8	10
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20

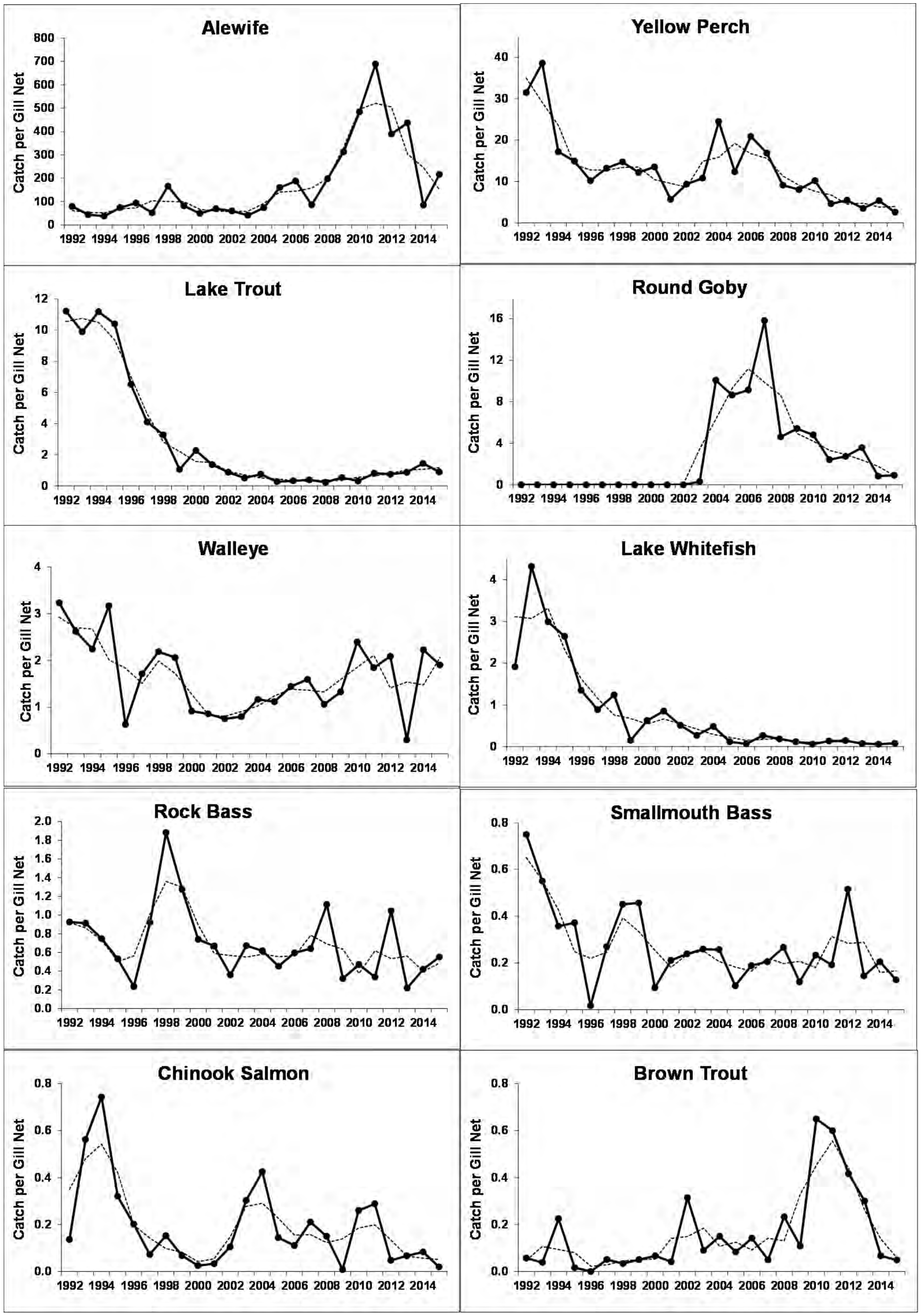

FIG. 1.2.2. Abundance trends for the most common species caught in gill nets at six depth-stratified transects (nearshore out to 30 m) in northeastern Lake Ontario (Melville Shoal, Grape Island, Flatt Point, Rocky Point, Wellington and Brighton; see Fig. 1.2.1). Annual catch per gill net values were corrected (covariate) for the overall mean observed water temperature (14.3 °C). Dotted lines show 3-yr running averages (two years for first and last years graphed).

TABLE 1.2.12. Species-specific catch per gill net set at **Rocky Point (deep sites only) in northeastern Lake Ontario**, 1997-2015 (no sampling in 2006, 2007 or 2010). Annual catches are averages for 2 or 3 gill net gangs set at each of 4 depths (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 gill nets set each year are indicated.

	1997-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
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	-	-	-	-	-
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	-	-	-	-	-
Lake Whitefish	**0.50**	0.13	-	0.08	-	0.08			0.25	0.50		**0.15**	0.13	-	0.67	0.67	0.29	-	-	-	-	-
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**	-	-	-	-	-	-	-	-	-	-
Round Goby	**-**	-	-	-	-	-			-	-		**-**	-	0.08	-	-	0.04	-	-	-	-	-
Slimy Sculpin	**0.08**	0.06	-	0.04	0.04	-			0.08	-		**0.03**	-	-	-	-	-	-	-	-	-	-
Deepwater Sculpin	**-**	-	-	-	-	-			-	-		**-**	-	-	-	-	0.04	-	-	-	-	-
Total catch	**11**	19	7	14	17	4			26	43		**18**	38	5	20	44	67	-	-	-	-	-
Number of species	**6**	4	4	5	5	3			5	4		**4**	4	3	4	5	6	-	-	-	-	-
Number of sets		16	16	24	24	24	-	-	24	24	-		24	12	12	24	24	-	-	-	-	-

significantly through 2004 and recovered somewhat in the years following. Round Goby appeared for the first time in 2012 (at the 60 m site) and were captured again in 2015. Unlike Cobourg and Port Credit deep gill net sites (see below), Deepwater sculpin had never been caught in the Rocky Point gill net sites until 2015.

Kingston Basin—Deep Sites (EB02 and EB06; Table 1.2.13 and 1.2.14)

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, Rainbow Smelt, Cisco, Burbot, Chinook Salmon and Round Goby). Alewife catches were variable with high catches in some years, 1998-1999, 2010 and 2012. Lake Trout, Lake Whitefish, Rainbow Smelt, and Cisco abundance declined throughout the 1990s and remained low during the years that followed except that Lake Trout appears to be increasing gradually in recent years and Cisco abundance increased during 2010-2015. Burbot catches peaked in the late-1990s then declined to zero for the last nine years.

Port Credit (Tables 1.2.15 and 1.2.16)

Port Credit was sampled for the first time in 2014 and sampling occurred again in 2015.

Nearshore sites: Catches were much higher in 2015 at the Port Credit nearshore sites. Eight species were caught in 2015 compared to only four in 2014. Alewife dominated the catch. Other species caught included Chinook Salmon, Atlantic Salmon, Brown Trout, Lake Trout, Longnose Sucker, White Sucker and Round Goby (Table 1.2.15).

Deep sites: Three species were caught at the Port Credit deep sites: Alewife, Lake Trout and Deepwater Sculpin (Table 1.2.16)

Lakewide Depth Stratified Transects (Rocky Point, Cobourg, Port Credit; Table 1.2.17)

For the first time in 2014, and now again in 2015, three lakewide depth stratified gill net transects, spanning a wide depth range (7.5 to 140 m), were sampled (Table 1.2.17). Fourteen species were caught. Alewife and Lake Trout showed broad geographic and depth distributions. Lake Whitefish, Cisco, Rock Bass, Smallmouth Bass and Walleye were caught only in the east. Longnose Sucker was caught only in the west.

Bay of Quinte *(Conway, Hay Bay and Big Bay; Tables 1.2.18-1.2.20 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 catch for the three sites are summarized graphically in Fig. 1.2.4 to illustrate abundance trends of the most abundant species from 1992-2015. Yellow Perch abundance peaked in 1998 then gradually declined. White Perch catches were high in 1992, declined through 2001, increased to a peak in 2006, then declined through 2011, increased in 2012 and again in 2013. In 2014, White Perch abundance declined to its lowest level since 2001, and in 2015 it recovered only very slightly. Alewife abundance increased from 2007-2010, declined from 2010-2014, and increased in 2015. 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 gradually since 1992, gradually levelling off in recent years. 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 Pumpkinseed catches did not. Cisco catches increased in the late-1990s then declined.

TABLE 1.2.13. Species-specific catch per gill net set at **EB02 in the Kingston Basin of Lake Ontario**, 1992-2015. Annual catches are averages for 4-8 gill net 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 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
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
Chinook Salmon	**0.05**	0.25	-	0.04	0.04	-	-	0.04	-	0.13	0.08	**0.06**	-	0.13	0.04	-	0.17
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
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
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 (Lake Herring)	**0.20**	-	-	-	0.04	-	-	-	-	-	0.21	**0.03**	0.04	-	0.08	-	0.21
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
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
Number of species	**7**	6	4	5	9	5	6	7	7	7	10	**7**	7	4	7	4	8
Number of sets		12	12	24	24	24	24	24	24	24	24		24	16	24	24	24

TABLE 1.2.14. Species-specific catch per gill net set at **EB06 in the Kingston Basin of Lake Ontario**, 1992-2015. Annual catches are averages for 4-8 gill net gangs set during each of 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
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
Chinook Salmon	**0.02**	-	-	-	-	0.08	-	-	0.04	-	-	**0.01**	0.08	0.19	0.08	-	-
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
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
Cisco (Lake Herring)	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.19	0.17	-	0.50
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	-	-	-	-
Total catch	**57**	18	4	3	8	4	5	10	17	5	82	**16**	23	19	19	6	7
Number of species	**6**	4	5	6	5	6	6	6	6	5	5	**5**	7	7	7	3	5
Number of sets		12	12	24	24	24	24	24	24	24	24		24	16	24	24	24

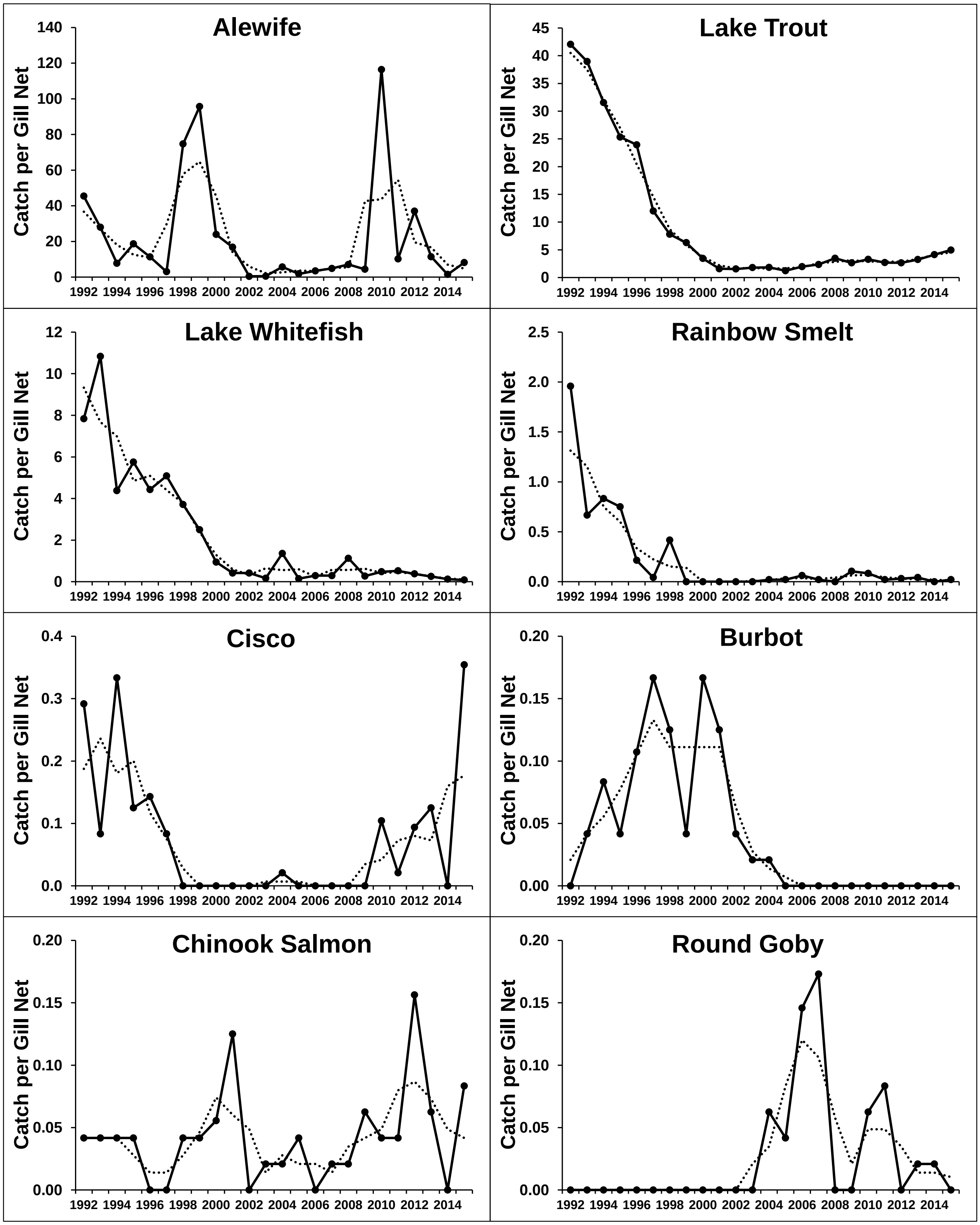

FIG. 1.2.3. Abundance trends (annual means) for the most common species caught in gill nets at the Kingston Basin deep sites, in eastern Lake Ontario (EB02 and EB06; see Fig. 1.2.1). Dotted lines show 3-yr running averages (two years for first and last years graphed).

TABLE 1.2.15. Species-specific catch per gill net set at **Port Credit (nearshore sites only) in Northwestern Lake Ontario**, 2014 and 2015. 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 summer. The total number of species caught and gill nets set each year are indicated.

	2014	2015
Alewife	24.12	358.58
Chinook Salmon	0.10	0.20
Atlantic Salmon	-	0.10
Brown Trout	-	0.10
Lake Trout	1.20	0.80
Longnose Sucker	-	0.20
White Sucker	0.20	1.50
Round Goby	-	1.32
Total catch	26	361
Number of species	4	8
Number of sets	10	10

TABLE 1.2.16. Species-specific catch per gill net set at **Port Credit (deep sites only) in Northwestern Lake Ontario**, 2014 and 2015. Annual catches are averages for 3 gill net gangs set at each of 4 depths (60, 80, 100, and 140 m) during summer. The total number of species caught and gill nets set each year are indicated.

	2014	2015
Alewife	79.92	7.33
Lake Trout	1.17	1.42
Deepwater Sculpin	2.00	1.42
Total catch	83	10
Number of species	3	3
Number of sets	10	10

TABLE 1.2.17. Species-specific catch per gill net set at **Rocky Point, Cobourg and Port Credit by site depth, Lake Ontario**, 2015. 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)									North Central (Cobourg)									Northwest (Port Credit)								
Site depth (m)	7.5	12.5	17.5	22.5	27.5	60	80	100	140	7.5	12.5	17.5	22.5	27.5	60	80	100	140	7.5	12.5	17.5	22.5	27.5	60	80	100	140
Alewife	286.00	74.85	50.07	95.00	171.25	43.33	97.83	54.50	55.17	46.26	123.91	265.99	162.21	85.18	206.67	185.30	195.37	98.67	478.98	648.08	495.65	163.57	6.61	8.33	5.00	8.00	8.00
Chinook Salmon	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.25	0.50	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Atlantic Salmon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brown Trout	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.75	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake Trout	0.00	0.25	0.25	1.00	4.00	12.00	3.17	0.83	0.00	0.00	0.00	0.00	0.00	1.83	0.67	0.33	0.67	0.00	0.00	0.00	1.00	1.00	2.00	2.67	1.67	1.33	0.00
Lake Whitefish	0.00	0.00	0.00	0.00	0.00	0.67	0.33	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cisco (Lake Herring)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coregonus sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Longnose Sucker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
White Sucker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Bass	3.55	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Smallmouth Bass	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Walleye	4.75	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Round Goby	0.00	0.00	0.83	3.30	0.00	0.17	0.00	0.00	0.00	0.83	0.00	0.83	2.48	4.13	0.00	0.00	0.00	0.00	0.00	3.30	0.00	3.30	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	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.67
Total catch	295	78	51	99	175	56	101	56	56	49	125	267	165	92	207	186	196	100	482	659	497	168	9	11	7	9	14
Number of species	5	7	3	3	2	4	3	3	3	5	4	3	3	4	2	2	2	2	3	6	2	3	2	2	2	2	2
Number of sets	4	4	4	4	4	6	6	6	6	4	4	4	4	4	3	3	3	3	2	2	2	2	2	3	3	3	3

TABLE 1.2.18. Species-specific catch per gill net set at **Conway in the Bay of Quinte**, 1993-2015. Annual catches are averages for 2-3 gill net 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 gill nets 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
Sea Lamprey	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	0.05	-
Lake Sturgeon	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-
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
Gizzard Shad	**0.01**	-	-	-	0.05	-	-	0.20	0.10	-	-	**0.04**	0.10	-	-	-	-
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
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
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
Cisco (Lake Herring)	**0.19**	0.20	-	-	-	-	0.05	-	0.10	0.05	0.15	**0.06**	-	0.15	-	-	0.45
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
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
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
White Bass	**-**	-	-	-	-	-	-	-	-	-	-	**-**	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
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	-	-
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
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
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	-
Total catch	**150**	81	89	75	89	105	77	51	106	90	196	**96**	211	128	119	66	144
Number of species	**14**	19	14	15	16	15	15	18	17	13	16	**16**	16	12	12	12	11
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20	20

TABLE 1.2.19. Species-specific catch per gill net set at **Hay Bay in the Bay of Quinte**, 1992-2015. Annual catches are averages for 1-3 gill net gangs set at each of 2 depths (7.5 and 12.5) 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
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
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
Brown Trout	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-
Lake Trout	**0.12**	-	-	0.25	-	-	-	-	-	-	-	**0.03**	-	-	-	-	-
Lake Whitefish	**0.06**	0.13	-	-	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-
Cisco (Lake Herring)	**3.79**	1.00	0.13	-	0.13	-	-	0.13	-	0.13	10.25	**1.18**	0.38	0.25	-	-	-
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
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
River Redhorse	**-**	-	-	-	-	-	-	0.13	-	-	-	**0.01**	-	-	-	-	-
Common Carp	**0.23**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	0.13	-	-
Golden Shiner	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.25	0.13	-	0.50
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
White bass	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.13	-	-	-
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	-
Bluegill	**-**	-	-	-	-	-	-	-	-	-	-	**-**	0.13	-	-	-	-
Smallmouth Bass	**0.10**	0.13	0.13	-	-	-	-	-	-	-	-	**0.03**	-	-	-	-	-
Black Crappie	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	0.13	-	-
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
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
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
Total catch	**193**	176	138	127	120	149	116	130	127	111	266	**146**	116	55	79	71	58
Number of species	**14**	12	14	11	11	10	11	14	13	10	9	**12**	10	11	8	9	11
Number of sets		8	8	8	8	8	8	8	8	8	4		8	8	8	8	8

TABLE 1.2.20. Species-specific catch per gill net set at **Big Bay in the Bay of Quinte**, 1992-2015. Annual catches are averages for 2 gill net 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 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
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
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
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
Lake Whitefish	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.17	-	-	-
Northern Pike	**0.68**	0.13	0.13	-	0.17	0.17	0.50	0.17	-	-	-	**0.13**	-	-	-	-	-
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
Silver Redhorse	**-**	-	-	-	-	-	-	-	-	-	0.17	**0.02**	-	-	-	-	-
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
Channel Catfish	**0.37**	-	0.13	-	0.17	-	0.25	-	-	0.17	-	**0.07**	-	-	0.17	0.17	-
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
White Bass	**0.08**	-	0.13	-	-	-	-	0.17	0.17	-	-	**0.05**	-	0.17	-	0.33	0.50
Rock Bass	**0.26**	-	-	-	-	0.17	-	-	-	-	-	**0.02**	-	-	0.17	-	0.83
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
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
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
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
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
Total catch	**292**	277	270	199	273	249	371	164	223	286	173	**248**	254	189	227	112	137
Number of species	**14**	14	15	15	16	14	16	13	13	12	12	**14**	11	12	12	12	13
Number of sets		8	8	6	6	6	4	6	6	6	6		6	6	6	6	6

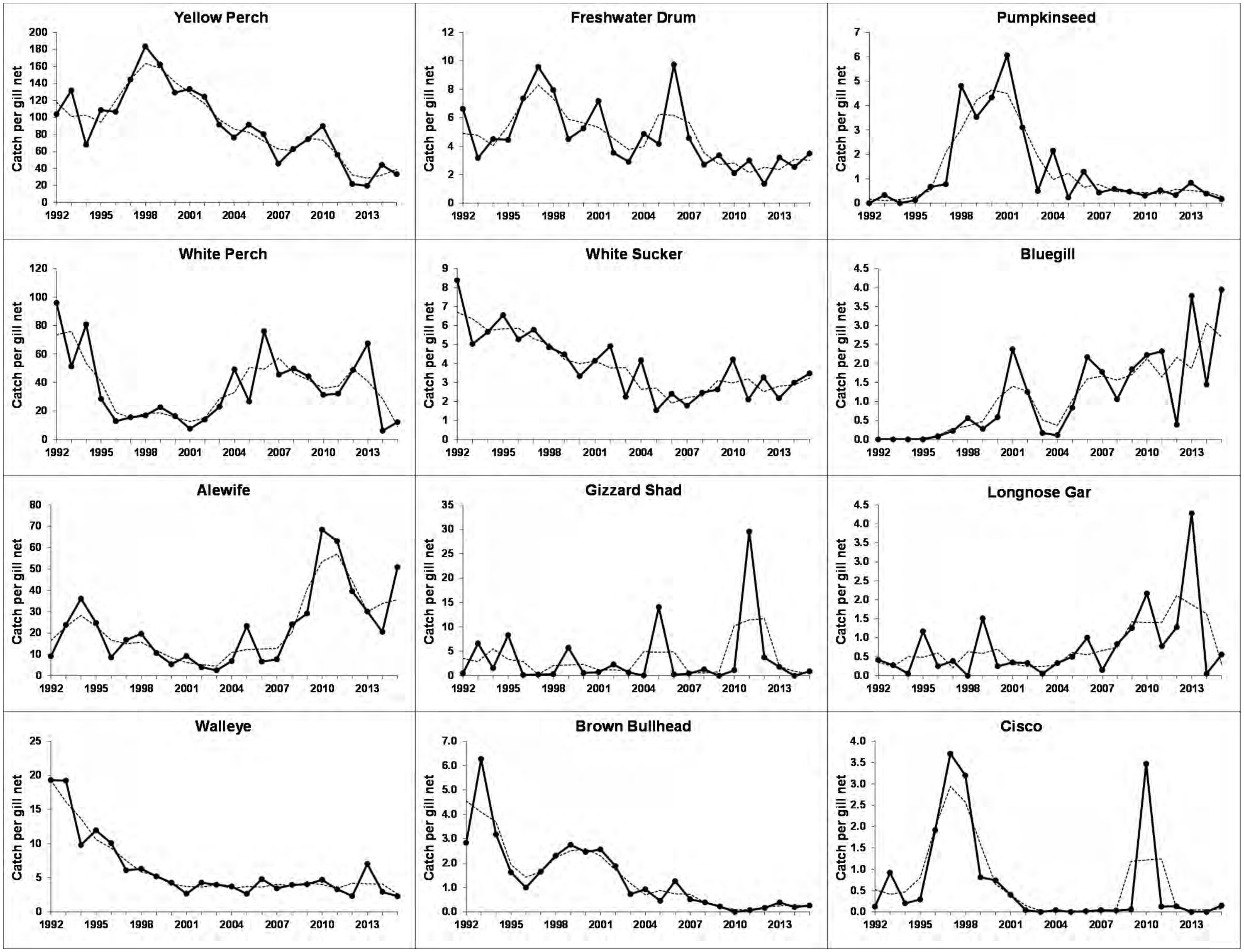

FIG. 1.2.4. Abundance trends (annual means) for the most common species caught in gill nets at three areas in the Bay of Quinte (Conway, Hay Bay and Big Bay; see Fig. 1.2.1). Dotted lines show 3-yr running averages (two years for first and last years graphed).

Species Highlights

Lake Whitefish

Twenty Lake Whitefish were caught and 17 were interpreted for age in the 2015 index gill nets (Table 1.2.21). Seven (41%) whitefish were from the 2012 year-class and 4 (24%) were from the 2013 year-class.

Walleye

Two hundred and forty-five Walleye were caught and 240 were interpreted for age in the 2015 index gill nets (Table 1.2.22). Forty-seven (87%) of 54 Walleye caught in the Bay of Quinte gill nets were age 1-4 years. In the Kingston Basin nearshore gill nets, nearly all (150) of the 159 Walleye (94%) were age-5 or greater.

TABLE 1.2.21. Age distribution of **17 Lake Whitefish** sampled from summer index gill nets, by region, during 2015. Also shown are mean fork length and mean weight.

	Age / Year-class								
	2	3	4	6	10	23	24	25	
Region	2013	2012	2011	2009	2005	1992	1991	1990	Total
Northeast	3	3		1					7
Kingston Basin (deep)					1	1		1	3
Kingston Basin (nearshore)	1	1	1				1		4
Bay of Quinte		3							3
Total aged	4	7	1	1	1	1	1	1	17
Mean fork length (mm)	194	227	341	367	527	431	530	551	
Mean weight (g)	75	122	480	573	1965	933	1671	2088	

TABLE 1.2.22. Age distribution of **240 Walleye** sampled from summer index gill nets, by region, 2015. 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	14	15	16	17	19	21	22	23	
Region	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2001	2000	1999	1998	1996	1994	1993	1992	Total
Central													2								2
Northeast				1	2		3	1	5	2	1	7			2	1					25
Kingston Basin	3		2	4	1	3	30	26	6	21	6	23	10	2	10	5	1	2	2	2	159
Bay of Quinte	32	2	7	6	2		4						1								54
Total aged	35	2	9	11	5	3	37	27	11	23	7	30	13	2	12	6	1	2	2	2	240
Mean fork length (mm)	199	259	416	478	540	564	578	584	593	624	592	634	607	684	651	611	643	567	611	626	
Mean weight (g)	79	208	841	1397	1934	2296	2507	2632	2755	3058	2814	3409	2993	3750	3708	3107	3494	2445	3053	3246	
Mean GSI (females)	0.05		0.19	0.34	0.37	0.30	0.37	0.39	0.33	0.43	0.28	0.43	0.33	0.48	0.46	0.37		0.25	0.55		
% mature	0		20	100	100	100	88	100	100	100	100	100	100	100	86	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. Currently, three visits are 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 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 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.

Thirty-two species and over 48,000 fish were caught in 110 bottom trawls in 2015 (June 10-September 1,Table 1.3.2). Yellow Perch (42%) Round Goby (28%), and Alewife (20%), collectively made up 90% of the catch by number. Species-specific catches in the 2015 trawling program are shown in Tables 1.3.3-1.3.13.

Lake Ontario

EB02 (Table 1.3.3)

Six species: Round Goby, Alewife,

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

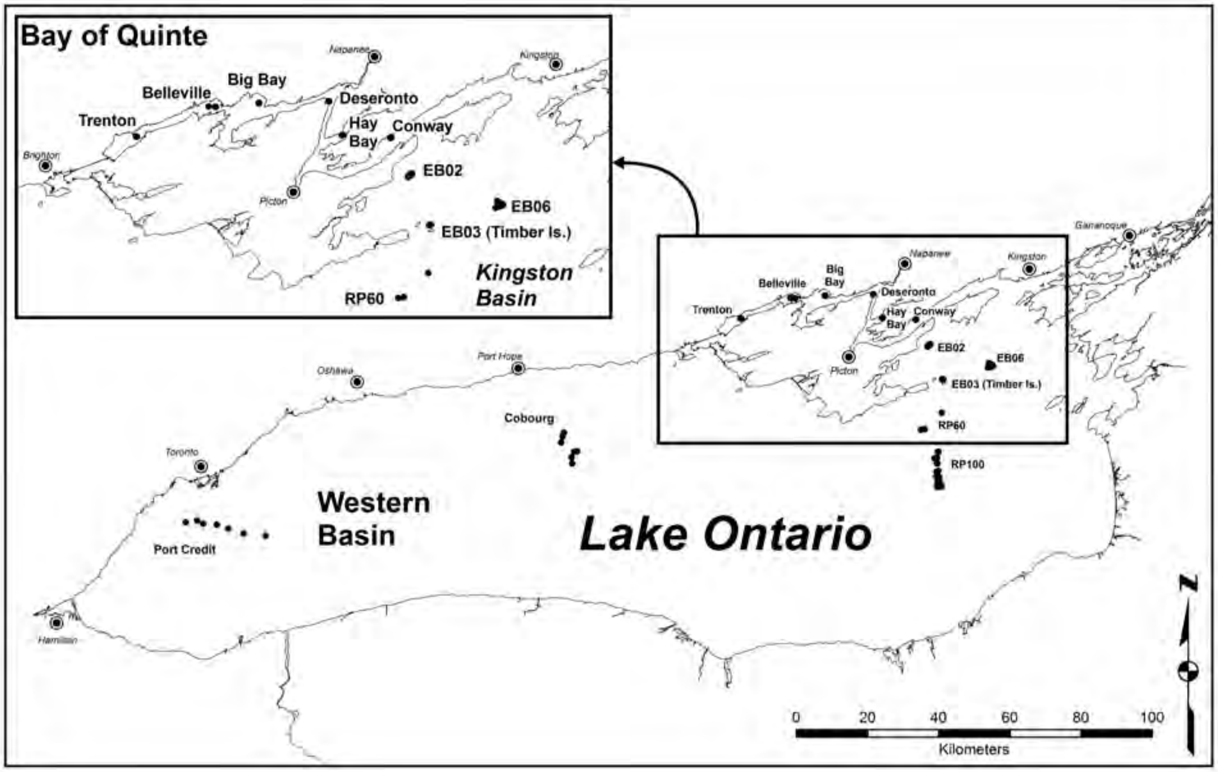

FIG. 1.3.1. Map of north eastern Lake Ontario. Shown are eastern Lake Ontario and Bay of Quinte fish community index bottom trawling site locations.

Rainbow Smelt, Lake Trout, Deepwater Sculpin and Cisco were caught at EB02 in 2015. A single wild Lake Trout was caught (fork length 207 mm; weight 99 g). A single Cisco was caught that was 112 mm fork length and weighed 14 g. 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 the last nine years. Slimy Sculpin, another formerly abundant species has also been absent for nine years. In a very unusual event, a number of young-of-the-year Deepwater Sculpin were caught that ranged in total length from 32-36 mm.

EB03 (Table 1.3.4)

Eight species: Round Goby, Alewife, Rainbow Smelt, Cisco, Freshwater Drum, Lake Whitefish, Chinook Salmon and Yellow Perch were caught at EB03 in 2015. Round Goby, having first appeared in the EB03 catches in 2004, now dominate the total catch. Rainbow Smelt abundance was higher than it has been for many years. As was the case for EB02, Threespine Stickleback have been absent from the EB03 catches for nine years. A number of Cisco were caught, ranging in fork length from 202-233 mm, and weight from 82-164 g. Three young-of-the-year Lake Whitefish were caught. A single small Chinook Salmon (108 fork length, 15 g in weight) was caught.

EB06 (Table 1.3.5)

Four species: Deepwater Sculpin, Lake Trout, Lake Whitefish and Round Goby were caught at EB06 in 2015. Two young-of-the-year wild Lake Trout were caught (fork lengths 41 and 47 mm; weights 0.40 and 0.58 g). In very unusual event, as was observed at EB02, a number of young-of-the-year Deepwater Sculpin were caught that ranged in total length from 26-50 mm.

Rocky Point (Table 1.3.6)

Four species: Alewife, Deepwater Sculpin, Slimy Sculpin, and Rainbow Smelt were caught at

Rocky Point in 2014.

Deep Trawl Sites 2015 (Rocky Point, Cobourg and Port Credit; Table 1.3.7)

Five species were caught at the deep trawl sites at Rocky Point, Cobourg and Port Credit in 2015: Alewife, Deepwater Sculpin, Slimy Sculpin, Rainbow Smelt and Yellow Perch.

Bay of Quinte

Conway (Table 1.3.8)

Eleven species were caught at Conway in 2015. The most abundant species were Round Goby, Yellow Perch, Alewife, Rainbow Smelt and Trout-perch.

Hay Bay (Table 1.3.9)

Sixteen species were caught at Hay Bay in 2015. The most abundant species were Alewife, Yellow Perch, Trout-perch, Gizzard Shad, Black Crappie and Walleye.

Deseronto (Table 1.3.10)

Twenty species were caught at Deseronto in 2015. The most abundant species were Yellow Perch, Trout-perch, Alewife, Gizzard Shad and Spottail Shiner.

Big Bay (Table 1.3.11)

Sixteen species were caught at Big Bay in 2015. The most abundant species were Yellow Perch, Gizzard Shad, Trout-perch, White Perch, and Spottail Shiner .

Belleville (Table 1.3.12)

Sixteen species were caught at Belleville in 2015. Gizzard Shad, Yellow Perch, Alewife, White Perch and Round Goby were the most abundant species in the catch. A single American Eel was caught for the first time in many years.

TABLE 1.3.2. Species-specific total catches in bottom trawls in 2015. Frequency of occurrence (FO) is the number of trawls out of a possible 110 in which each species was caught.

Species	FO	Catch	Biomass (kg)	Mean weight (g)
Alewife	76	9,773	118.56	12
Gizzard Shad	31	3,663	27.62	8
Chinook Salmon	1	1	0.02	15
Lake Trout	10	14	6.58	470
Lake Whitefish	4	5	1.82	365
Cisco (Lake Herring)	9	27	1.64	61
Rainbow Smelt	28	2,940	20.71	7
Northern Pike	1	1	1.37	1370
White Sucker	26	113	20.41	181
Shorthead Redhorse	1	1	0.09	94
Golden Shiner	1	1	0.02	20
Spottail Shiner	40	1,971	9.74	5
Brown Bullhead	34	106	32.14	303
Channel Catfish	1	1	0.33	329
American Eel	1	1	0.94	938
Trout-perch	40	2,310	6.32	3
White Perch	37	1,124	7.76	7
White Bass	28	338	2.22	7
Rock Bass	7	17	0.48	28
Pumpkinseed	28	793	21.16	27
Bluegill	14	124	5.76	46
Largemouth Bass	8	45	0.21	5
Black Crappie	14	156	1.56	10
Lepomis sp.	24	642	0.21	0
Yellow Perch	48	20,364	165.01	8
Walleye	41	631	26.18	41
Johnny Darter	6	7	0.01	1
Logperch	19	121	0.47	4
Brook Silverside	2	2	0.00	1
Round Goby	56	13,528	47.35	4
Freshwater Drum	33	345	53.29	154
Slimy Sculpin	25	191	1.89	10
Deepwater Sculpin	32	2,571	71.24	28
Totals		48,491	507	10

TABLE 1.3.3. 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																
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	**1685**	253	64	115	365	56	70	135	34	357	623	**207**	11	112	321	43	125
Number of species	**9**	6	5	8	8	7	7	5	4	4	6	**6**	3	6	4	4	6
Number of trawls		12	12	12	10	12	12	12	12	12	12		12	12	12	12	12

TABLE 1.3.4. 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															
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015
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
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
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
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
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
Cisco (Lake Herring)	**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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	**2004**	320	1502	695	3254	943	902	968	1257	2565	1303	**1371**	2354	998	598	2033	1658
Number of species	**10**	4	5	10	10	9	9	9	5	6	7	**7**	8	5	4	4	8
Number of trawls		8	8	16	12	12	8	12	8	12	12		8	7	8	8	8

TABLE 1.3.5. 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
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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	**843**	30	55	16	434	173	38	85	3	24	954	**181**	22	314	218	1	2
Number of species	**6**	5	5	6	7	4	5	4	3	5	6	**5**	3	5	4	2	4
Number of trawls		12	12	12	12	12	12	12	12	12	12		12	8	12	12	12

TABLE 1.3.6. 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**, 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 2006, 2010.

	Year															
	1997-2000										**2001-2010**					
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013	2014	2015
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
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
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
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
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
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
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
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
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
Total catch	**208**	95	38	8	113	20		35	18	12		**42**	16	7	114	29	229
Number of species	**3**	4	4	3	5	5		4	5	4		**4**	5	2	4	6	4
Number of trawls		4	4	4	4	4	0	4	4	4	0		4	1	2	6	4

TABLE 1.3.7. 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, Cobourg and Port Credit (multiple water depths)**, Lake Ontario, 2015. Catches are the mean number of fish caught per trawl. Total catch, number of species caught, and number of trawls are indicated.

		Site depth (m)							
Area	Site depth (m)	60	80	90	100	110	120	130	140
Rocky Point									
	Alewife	34.00	776.39	222.00	114.50	31.00	30.00	23.00	45.00
	Rainbow Smelt	40.00	2.50	2.50	2.00	1.50	0.00	0.50	0.00
	Yellow Perch	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Slimy Sculpin	19.50	3.00	2.50	7.50	0.50	8.00	3.50	2.00
	Deepwater Sculpin	0.50	45.00	72.50	105.00	19.00	11.00	10.00	23.50
Cobourg									
	Alewife		12.00	143.00	30.00	160.00	275.80	113.00	230.00
	Rainbow Smelt		0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Yellow Perch		0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Slimy Sculpin		0.00	12.00	29.00	28.00	14.00	4.00	3.00
	Deepwater Sculpin		14.00	37.00	7.00	12.00	65.00	250.00	683.31
Port Credit									
	Alewife		0.00	5.00	2.00	6.00	8.00	3.00	1.00
	Rainbow Smelt		0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Yellow Perch		0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Slimy Sculpin		0.00	1.00	4.00	2.00	1.00	0.00	0.00
	Deepwater Sculpin		2.00	1.00	5.00	9.00	198.00	413.00	270.00
	Total catch	94.50	854.89	498.50	306.00	269.00	610.80	820.00	1257.81
	Number of species	5	4	4	4	4	3	4	3
	Number of trawls	2	4	4	4	4	4	4	4

Trenton (Table 1.3.13)

Eighteen species were caught at Trenton in 2015. The most abundant species were Yellow Perch, Spottail Shiner, Pumpkinseed, Gizzard Shad and Alewife.

Species Trends (Fig. 1.3.2)

Bottom trawl results were summarized across the six Bay of Quinte sites and presented graphically to illustrate abundance trends for major species in Fig. 1.3.2. All species show significant abundance changes over the long-term. The most abundant species remain White Perch, Yellow Perch and Alewife. White Perch abundance declined significantly in 2014 and remained low in 2015. Yellow Perch remain abundant. Alewife abundance declined in 2015. Most centrarchid species are currently at moderate to high levels of abundance as are Gizzard Shad, Spottail Shiner, Round Goby, Logperch, and Cisco. Species currently at low abundance levels relative to past levels include Brown Bullhead, Rainbow Smelt, White Sucker, Lake Whitefish, Johnny Darter and American Eel.

Species Highlights

Catches of age-0 fish in 2015 for selected species and locations are shown in Tables 1.3.14-1.3.17 for Lake Whitefish, Cisco, Yellow Perch and Walleye respectively.

Age-0 Lake Whitefish were present in low abundance at both Conway and Timber Island in 2015 (Table 1.3.14). Except for the 2003 and 2005 year-classes, age-0 Lake Whitefish catches have been low for more than a decade. By way of contrast, Lake Whitefish abundance measured at older ages suggests less variation in year-class strength over the same time-period. For example, the 2004 year-class figures prominently, relative to the 2003 and 2005 year-classes, in both index

TABLE 1.3.8. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Conway** (24 m depth), Bay of Quinte. Catches are the mean number of fish observed at each site for the number of trawls indicated. Total catch and number of species caught are indicated.

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

TABLE 1.3.9. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Hay Bay** (7 m depth), Bay of Quinte. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated.

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

TABLE 1.3.10. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Deseronto** (5 m depth), Bay of Quinte. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated.

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

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 **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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	**891**	721	1511	442	2301	2017	1700	661	1586	1543	1109	**1359**	2310	827	1077	1498	568
Number of species	**17**	17	22	15	17	17	20	18	19	16	17	**18**	17	17	19	15	16
Number of trawls		8	8	8	8	8	8	8	8	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 **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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	**1042**	453	724	365	2691	1318	1161	1421	1571	2213	1385	**1330**	2193	893	3897	832	641
Number of species	**18**	19	21	19	16	18	17	18	17	16	19	**18**	18	16	16	15	16
Number of trawls		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 **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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	**1155**	781	547	1203	353	1381	781	751	1145	2186	688	**982**	1849	1081	1421	703	1382
Number of species	**20**	20	18	19	15	18	19	15	18	18	20	**18**	21	19	13	17	18
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8	8

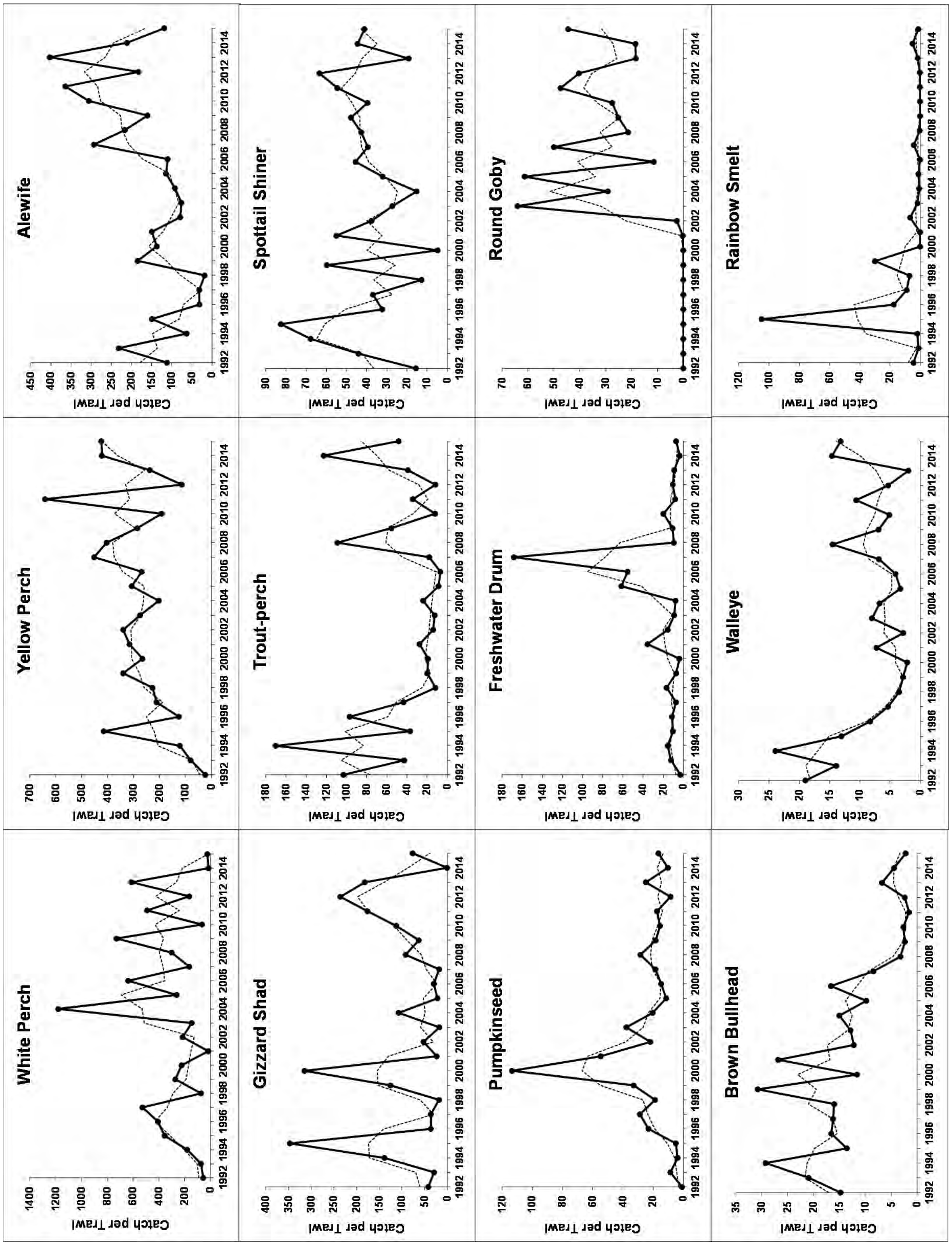

FIG. 1.3.2. Abundance trends (annual means) for the most common species caught in bottom trawls at six sites in the Bay of Quinte (Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton; see Fig. 1.3.1). Values shown here are 3-yr running averages (two years for first and last years graphed).

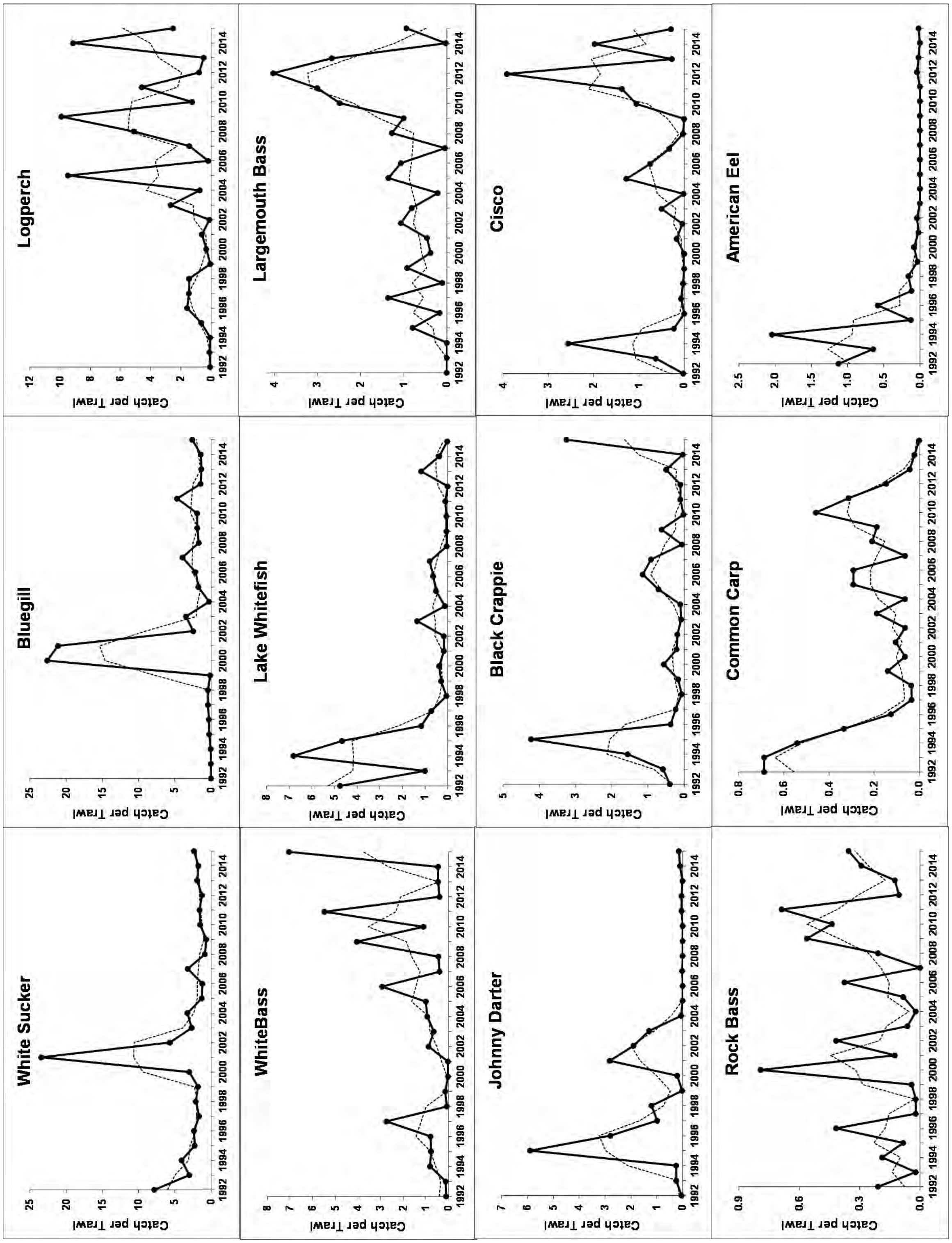

FIG. 1.3.2 (continued). Abundance trends for the most common species caught in bottom trawls at six sites in the Bay of Quinte (Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton; see Fig. 1.3.1). Values shown here are 3-yr running averages (two years for first and last years graphed).

TABLE 1.3.14. Mean catch-per-trawl of **age-0 Lake Whitefish** at two sites, Conway in the lower Bay of Quinte and EB03 near Timber Island in eastern Lake Ontario, 1992-2015. 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

TABLE 1.3.15. Mean catch-per-trawl of **age-0 Cisco** at Conway in the lower Bay of Quinte, 1992-2015. 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	0.0	8
1993	1.5	8
1994	7.7	8
1995	1.3	8
1996	0.0	8
1997	0.0	8
1998	0.1	8
1999	0.0	8
2000	0.0	8
2001	0.0	8
2002	0.1	8
2003	2.8	12
2004	0.1	12
2005	7.2	12
2006	4.5	12
2007	2.0	12
2008	0.2	12
2009	0.0	12
2010	6.3	12
2011	8.3	8
2012	23.3	8
2013	1.5	8
2014	11.6	8
2015	1.8	8

gill net surveys (Section 1.2) and the commercial harvest (Section 3.2).

Age-0 Cisco catches at Conway were relatively low in 2015 compared to recent years (Table 1.3.15).

Age-0 catches of Yellow Perch were high in 2015 (Table 1.3.16).

Age-0 Walleye catches were high again in 2015 (Tables 1.3.17 and 1.3.18).

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 2015.

TABLE 1.3.16. Mean catch-per-trawl of **age-0 Yellow Perch** at six Bay of Quinte sites, 1992-2015. 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

TABLE 1.3.17. Mean catch-per-trawl of **age-0 Walleye** at six Bay of Quinte sites, 1992-2015. 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	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

TABLE 1.3.18. Age distribution of 232 **Walleye** sampled from summer bottom trawls, Bay of Quinte, 2015. Also shown are mean fork length and mean weight. Fish of less than 150 mm fork length (n = 122) were assigned an age of 0, fish between 150 and 290 mm (n = 99) were aged using scales; and those over 290 mm fork length (n = 11) were aged using otoliths.

Age (years)	0	1	2	3	4	Total
Year-class	2015	2014	2013	2012	2011	
Number	130	90	9	0	3	232
Mean Fork Length (mm)	119	216	347		431	
Mean Weight (g)	17	103	446		926	

1.4 Lake Ontario Nearshore Community Index Netting

J. A. Hoyle, Lake Ontario Management Unit

The nearshore community index netting program (NSCIN) was 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 (Table 1.4.1). In 2015, four areas were completed: Hamilton Harbour, Presqu'ile Bay, Weller's Bay, and the upper Bay of Quinte (Fig. 1.4.1).

TABLE. 1.4.1. Annual NSCIN trap net schedule for Lake Ontario nearshore areas, 2001-2015. The numbers of trap net samples at each area in each year are indicated.

Annual NSCIN Trap Net Schedule											
Year	Lake Ontario										
2015	24		16	24				36			
2014	24	24						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									
2005								36	29	7	
2004								36	29	7	
2003								36	29	7	
2002								36	29	7	
2001				6	6			36			
Area	Hamilton Harbour	Toronto Harbour	Presqu'ile Bay	Weller's Bay	West Lake	East Lake	Prince Edward Bay	Bay of Quinte (upper)	Bay of Quinte (middle)	Bay of Quinte (lower)	North Channel

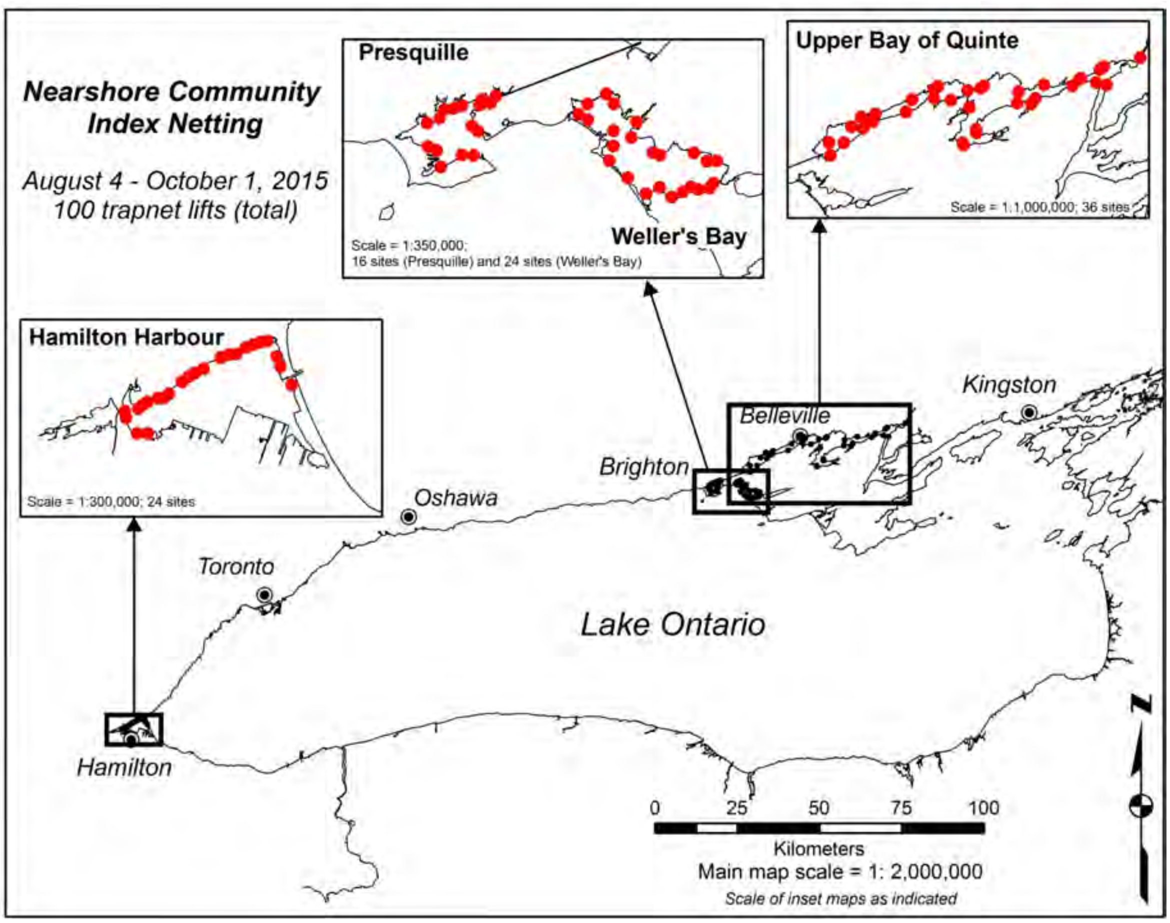

FIG. 1.4.1. Map of Lake Ontario indicating NSCIN trap net locations in Hamilton Harbour, Presqu'ile Bay, Weller's Bay, and the upper Bay of Quinte, 2015 .

The NSCIN program utilized 6-foot trap nets and was designed to evaluate the abundance and other biological attributes of fish species that inhabit the littoral area. Suitable trap net sites were chosen from randomly selected UTM grids that contained shoreline in the area netted.

Hamilton Harbour *(partnership program with Fisheries and Oceans Canada)*

Twenty-four trap net sites were sampled on Hamilton Harbour from Aug 4-13 with water temperatures ranging from 19.2-21.2°C (Table 1.4.2). More than 22,000 fish comprising 23 species were captured (Table 1.4.3). The most abundant species by number were Brown Bullhead (18,091), White Perch (3,169), Alewife (33) and Channel Catfish (270). Three American Eel were captured; total lengths of two eel were 880 and 895 mm.

The age distribution and mean length by age-class of selected species are shown 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. Of particular note was the strong showing of age-3 Walleye from the 2012 Walleye stocking event (see Section 8.7) and the absence of Walleye from subsequent stocking events.

Presqu'ile Bay

Sixteen trap net sites were sampled on Presqu'ile Bay from Sep 28-Oct 2 with water temperatures ranging from 12.4-18.1 °C (Table 1.4.2). Nearly 1,000 fish comprising 16 species were captured (Table 1.4.3). The most abundant species by number were Brown Bullhead (335), Bluegill (291), Rock Bass (94) and Pumpkinseed (92).

Weller's Bay

Twenty-four trap net sites were sampled on Weller's Bay from Sep 14-25 with water temperatures ranging from 18.1-21.0 °C (Table 1.4.2). Over 1,500 fish comprising 16 species were captured (Table 1.4.3). The most abundant species by number were Bluegill (1,093), Rock Bass (155), Pumpkinseed (94), Brown Bullhead (48), and Largemouth Bass (45).

TABLE 1.4.2. Survey information for the 2015 NSCIN trap net program on Hamilton Harbour, Presqu'ile Bay, Weller's 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.

		Hamilton Harbour	Presqu'ile Bay	Weller's Bay	Upper Bay of Quinte
Survey dates		Aug 4-13	Sep 28-Oct 2	Sep 14-Sep 25	Sep 8-Sep 25
Water temperature range (°C)		19.2-21.2	12.4-18.1	18.1-21.0	18.5-24.0
No. of trap net lifts		24	16	24	36
No. of lifts by depth:					
	Target (2-2.5 m)	10	7	9	5
	> Target	5		2	31
	< Target	9	9	13	
No. of lifts by substrate type:					
	Hard	5	4	8	10
	Soft	19	12	16	26
No. of lifts by cover type:					
	None			2	2
	1-25%	19	5	16	14
	26-75%	5	11	6	14
	76-100%				6

TABLE 1.4.3. Species-specific catch in the 2015 NSCIN trap net program in Hamilton Harbour, Presqu'ile Bay, Weller's Bay, and the upper Bay of Quinte. Statistics shown 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.

	Hamilton Harbour				Presqu'ile Bay				Weller's 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	0.542	0.397	26	854	0.063	0.044	100	750	1.167	0.591	31	770	2.222	0.669	32	756
Bowfin	0.833	0.658	19	621	2.813	1.985	15	556	0.333	0.200	45	569	0.528	0.318	30	574
Alewife	13.750	0.706	54	155												
Gizzard Shad	0.333	0.260	29	326	0.125	0.091	68	240	0.375	0.183	54	189	0.583	0.262	39	151
Northern Pike	0.542	0.388	28	641	0.313	0.220	46	584	0.250	0.189	36	607	0.278	0.203	30	593
Quillback													0.028	0.019	100	440
White Sucker	0.625	0.325	40	292	0.313	0.220	46	418	0.917	0.549	28	405	0.250	0.180	32	507
Bigmouth Buffalo	0.042	0.029	100	440												
Silver Redhorse													0.111	0.080	48	438
Shorthead Redhorse													0.111	0.063	70	410
Greater Redhorse	0.042	0.029	100	600									0.139	0.101	42	528
River Redhorse					0.250	0.106	100	583					0.028	0.019	100	640
Black Buffalo	0.042	0.029	100	430												
Goldfish	1.083	0.705	24	342												
Common Carp	2.375	1.549	16	565	0.188	0.139	54	657	0.125	0.091	55	713	0.111	0.080	48	785
Rudd	0.375	0.221	44	348												
Brown Bullhead	753.792	116.391	9	257	20.938	14.841	7	241	2.000	1.314	17	278	5.750	3.655	10	269
Channel Catfish	11.250	5.374	12	558									0.194	0.135	39	570
American Eel	0.125	0.091	55	910									0.028	0.019	100	810
White Perch	132.042	46.894	10	192					0.042	0.029	100	220	0.306	0.164	45	175
White Bass	0.583	0.387	30	289	0.063	0.044	100	130					0.083	0.051	72	130
Rock Bass	1.042	0.552	30	177	5.875	2.993	19	158	6.458	4.024	12	157	2.500	1.229	19	171
Pumpkinseed					5.750	4.341	12	127	3.917	2.072	17	140	50.333	19.825	8	150
Bluegill	3.417	1.767	20	159	18.188	10.345	12	141	45.542	33.176	5	138	62.889	43.143	4	153
Smallmouth Bass									0.958	0.504	34	279	0.056	0.039	70	235
Largemouth Bass	0.083	0.059	69	420	1.750	0.984	29	244	1.875	0.879	27	256	3.333	2.036	13	279
Black Crappie					0.750	0.565	27	178	0.083	0.059	69	190	4.222	2.477	12	237
Yellow Perch	0.708	0.321	43	184	1.813	0.664	42	181	0.083	0.059	69	170	3.750	1.671	17	195
Walleye	2.042	1.351	18	492	0.438	0.306	40	357	0.917	0.678	21	360	0.944	0.616	20	434
Freshwater Drum	1.875	1.059	22	539									0.972	0.584	22	470
Total catch per net	928				60				65				140			
Number of species	23				16				16				25			
Number of nets	24				16				24				36			
Total catch	22,261				954				1,561				5,031			

Table 1.4.4. Age distribution of selected species caught in Hamilton Harbour, Presqu'ile Bay, Weller's Bay, and the upper Bay of Quinte, 2015.

		Year-class / Age (years)										
		2015	2014	2013	2012	2011	2010	2009	2008	2007	2005	2003
Location	Species	0	1	2	3	4	5	6	7	8	10	12
Hamilton Harbour												
	Northern Pike			5	3	2		1				
	White Bass		3	1	7	2	1					
	Bluegill			6	13	8	2					
	Largemouth Bass						1					
	Yellow Perch			12	5							
	Walleye			1	29							1
Presqu'ile Bay												
	Northern Pike			1		2		1		1		
	Pumpkinseed			3	15	9	3					
	Bluegill			4	15	5	3					
	Largemouth Bass	3	8	7	3	1	1	1		1		
	Black Crappie		9	1	1							
	Yellow Perch			4	4	4						
	Walleye			5							1	
Weller's Bay												
	Northern Pike		2		1	2			1			
	Pumpkinseed				11	6	8	3	2			
	Bluegill				6	8	11	2	3			
	Smallmouth Bass		5	7	3	1						
	Largemouth Bass		2	4	7	2	1	1	1			
	Black Crappie		1	1								
	Yellow Perch			1	1							
	Walleye		8	1	5	5		1	1	1		
Upper Bay of Quinte												
	Northern Pike		5			1		1				
	Pumpkinseed				8	11	9	1				
	Bluegill			2	11	14	4	2				
	Smallmouth Bass		1	1								
	Largemouth Bass		7	13	8	1	1		1			
	Black Crappie		8	10	2	4	5	2				
	Yellow Perch			2	8	11	8		2			
	Walleye			4	9	9	5	2	3	2		

Table 1.4.5. Mean fork length (mm) of selected species caught in Hamilton Harbour, Presqu'ile Bay, Weller's Bay, and the upper Bay of Quinte, 2015.

		Year-class / Age (years)										
		2015	2014	2013	2012	2011	2010	2009	2008	2007	2005	2003
Location	Species	0	1	2	3	4	5	6	7	8	10	12
Hamilton Harbour												
	Northern Pike			588	624	645		623				
	White Bass		216	258	271	339	328					
	Bluegill			142	153	165	169					
	Largemouth Bass						370					
	Yellow Perch			178	189							
	Walleye			385	473							631
Presqu'ile Bay												
	Northern Pike			507		628		528		598		
	Pumpkinseed			105	129	129	138					
	Bluegill			120	170	148	164					
	Largemouth Bass	155	187	232	301	355	382	406		387		
	Black Crappie		164	233	231							
	Yellow Perch			180	180	221						
	Walleye			278							640	
Weller's Bay												
	Northern Pike		472		688	645			600			
	Pumpkinseed				115	135	149	159	176			
	Bluegill				117	140	152	161	155			
	Smallmouth Bass		212	273	322	382						
	Largemouth Bass		164	225	291	345	364	370	363			
	Black Crappie		149	213								
	Yellow Perch			191	143							
	Walleye		237	344	412	385		456	555	485		
Upper Bay of Quinte												
	Northern Pike		467			540		558				
	Pumpkinseed				128	137	147	162				
	Bluegill			104	130	141	146	170				
	Smallmouth Bass		213	245								
	Largemouth Bass		200	259	293	327	364		364			
	Black Crappie		154	213	270	292	281	306				
	Yellow Perch			144	175	186	205		245			
	Walleye			260	386	450	468	479	547	499		

TABLE 1.4.6. Species-specific abundance trends (mean catch per trap net) in Hamilton Harbour, Presqu'ile Bay, Weller's Bay, and the upper Bay of Quinte. Annual total catch per net lift, number of net sets, and number of species are also indicated.

	Hamilton Harbour						Presquille Bay		Weller's Bay			Upper Bay of Quinte													
Species	2006	2008	2010	2012	2014	2015	2008	2015	2001	2008	2015	2001	2002	2003	2004	2005	2007	2008	2009	2010	2011	2012	2013	2014	2015
Longnose Gar	0.47	0.71	0.28	0.67	0.17	0.54	0.33	0.06	0.40	1.54	1.17	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
Spotted Gar			0.04																						
Bowfin	0.58	1.17	2.42	1.17	1.54	0.83	1.08	2.81	0.20	0.58	0.33	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
Alewife				0.04	0.71	13.75																			
Gizzard Shad	3.42	0.50	2.38	2.13	1.21	0.33	0.92	0.13			0.38	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
Rainbow Trout	0.05	0.04																							
Brown Trout					0.04																				
Lake Trout	0.05														0.03										
Lake Whitefish																0.03									
Coregonus sp.				0.25																					
Northern Pike	1.11	1.08	1.08	0.29	0.25	0.54	0.67	0.31	0.60	0.50	0.25	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
Muskellunge		0.04																						0.03	
Mooneye												0.03													
Suckers	0.05																								
Quillback		0.04			0.08														0.03						0.03
White Sucker	0.11	0.21	0.46	0.29	2.17	0.63	0.25	0.31	0.80	0.63	0.92	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
Bigmouth Buffalo	0.05				0.04	0.04																			
Silver Redhorse		0.04					0.08							0.69	0.81	0.28	0.64	0.50	1.44	0.44	0.17	0.47	0.83	0.47	0.11
Shorthead Redhorse	0.11	0.04	0.25											0.08	0.47	0.25	0.19	0.33	0.36	0.06	0.19	0.08	0.31	0.17	0.11
Greater Redhorse					0.08	0.04								0.22	0.06			0.08	0.06		0.44	0.28	0.83	0.11	0.14
River Redhorse								0.25				0.06		0.14	0.17	0.14	0.11	0.44	0.03		0.14	0.08	0.14		0.03
Black Buffalo						0.04																			
Moxostoma sp.												0.78	0.42	0.08											
Minnow		0.04																							
Goldfish	0.32	0.92	2.71	0.88	0.58	1.08																			
Common Carp	4.47	3.92	2.20	1.21	2.25	2.38	0.25	0.19		0.42	0.13	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
Golden Shiner							0.17					0.03		0.03		0.03		0.22		0.06	0.14	0.03	0.06		
Rudd				0.04		0.38																			
Black Bullhead	0.05																								
Brown Bullhead	380.79	189.33	482.67	76.25	251.71	753.79	27.67	20.94	17.80	2.63	2.00	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
Channel Catfish	34.84	15.92	8.00	14.17	49.58	11.25						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
American Eel					0.08	0.13			0.20			0.44	0.14		0.03	0.06					0.11	0.03	0.44	0.28	0.03
White Perch	48.42	34.88	84.38	69.92	169.29	132.04	0.17		1.20	0.29	0.04	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
White Bass	2.00	1.75	1.46	0.29	0.75	0.58		0.06		0.04		0.06	0.14	0.11	0.11	0.19	0.03	0.14			0.17	0.08			0.08
Rock Bass	0.58	1.08	1.48	1.17	2.00	1.04	4.67	5.88	3.80	6.50	6.46	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
Green Sunfish	0.05																								
Pumpkinseed	0.68	1.13	3.33	2.04	1.00		5.25	5.75	29.20	3.25	3.92	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
Bluegill	4.05	3.21	9.08	14.42	14.96	3.42	12.25	18.19	129.60	34.79	45.54	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
Smallmouth Bass	0.11		0.13						1.20	2.00	0.96	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
Largemouth Bass	0.26	0.17	0.33	0.25	0.13	0.08	4.17	1.75	3.60	2.21	1.88	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
Black Crappie	2.32	0.17	0.42	0.58	0.08		0.25	0.75	0.20	0.21	0.08	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
Yellow Perch	0.11	0.63	4.16	0.25	1.08	0.71	1.42	1.81	0.20	0.08	0.08	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
Walleye	1.05	0.17	0.04		2.46	2.04	0.58	0.44	2.80	1.83	0.92	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
Round Goby	0.05																								
Freshwater Drum	1.37	1.71	1.24	0.33	1.08	1.88	0.33		0.20			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
Total catch	488	259	609	187	503	928	61	60	192	58	65	464	354	175	153	127	131	233	131	134	230	133	144	124	140
Number of net lifts	19	24	25	24	24	24	12	16	5	24	24	36	36	36	36	36	36	36	36	36	36	36	36	36	36
Number of species	28	25	22	21	25	23	18	16	16	16	16	24	21	25	25	25	22	24	23	21	25	25	24	23	25

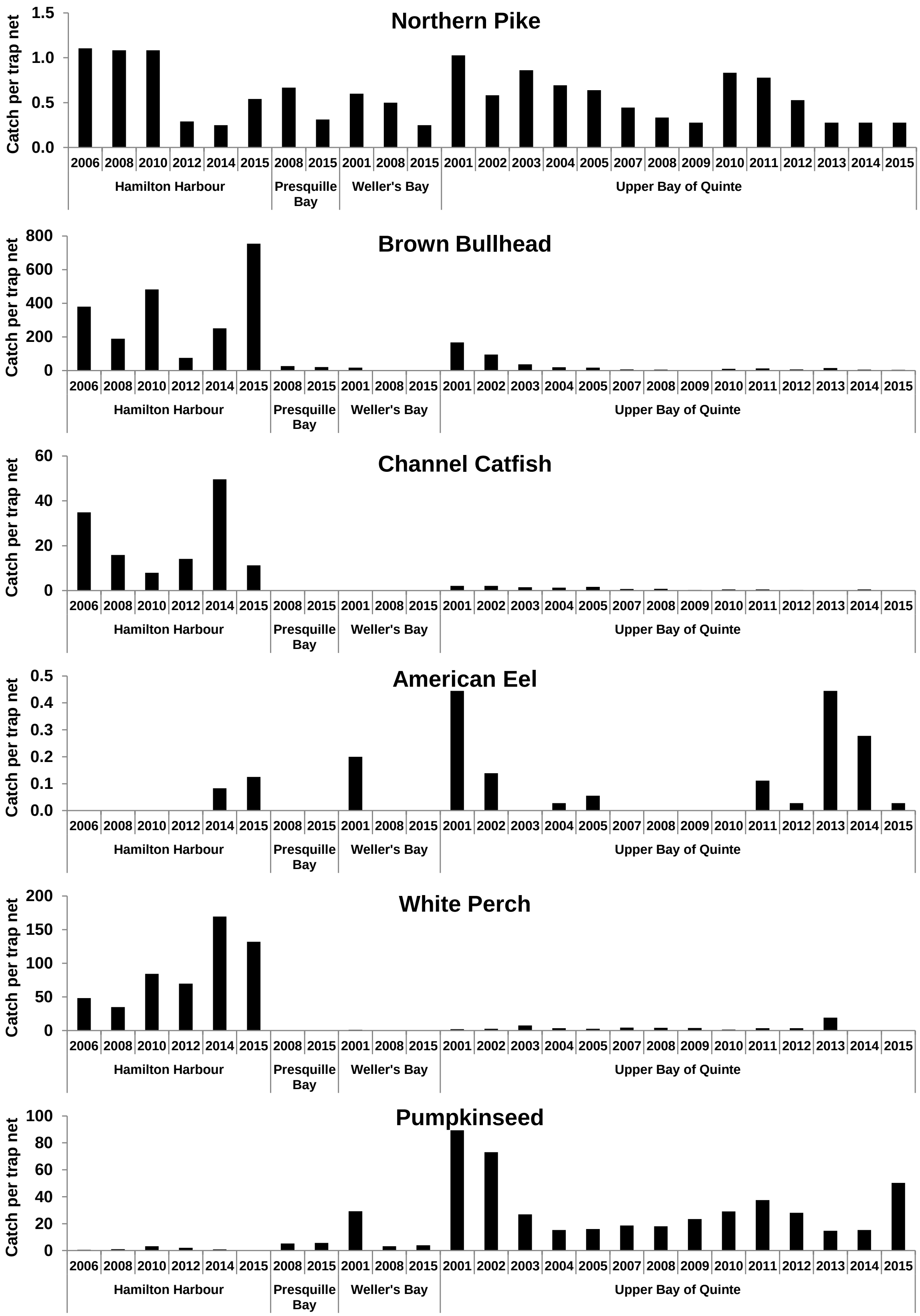

FIG. 1.4.2. Abundance trends for selected species caught in nearshore trap nets in Hamilton Harbour, Presqu'ile Bay, Weller's Bay, and the upper Bay of Quinte. Values shown are annual arithmetic means.

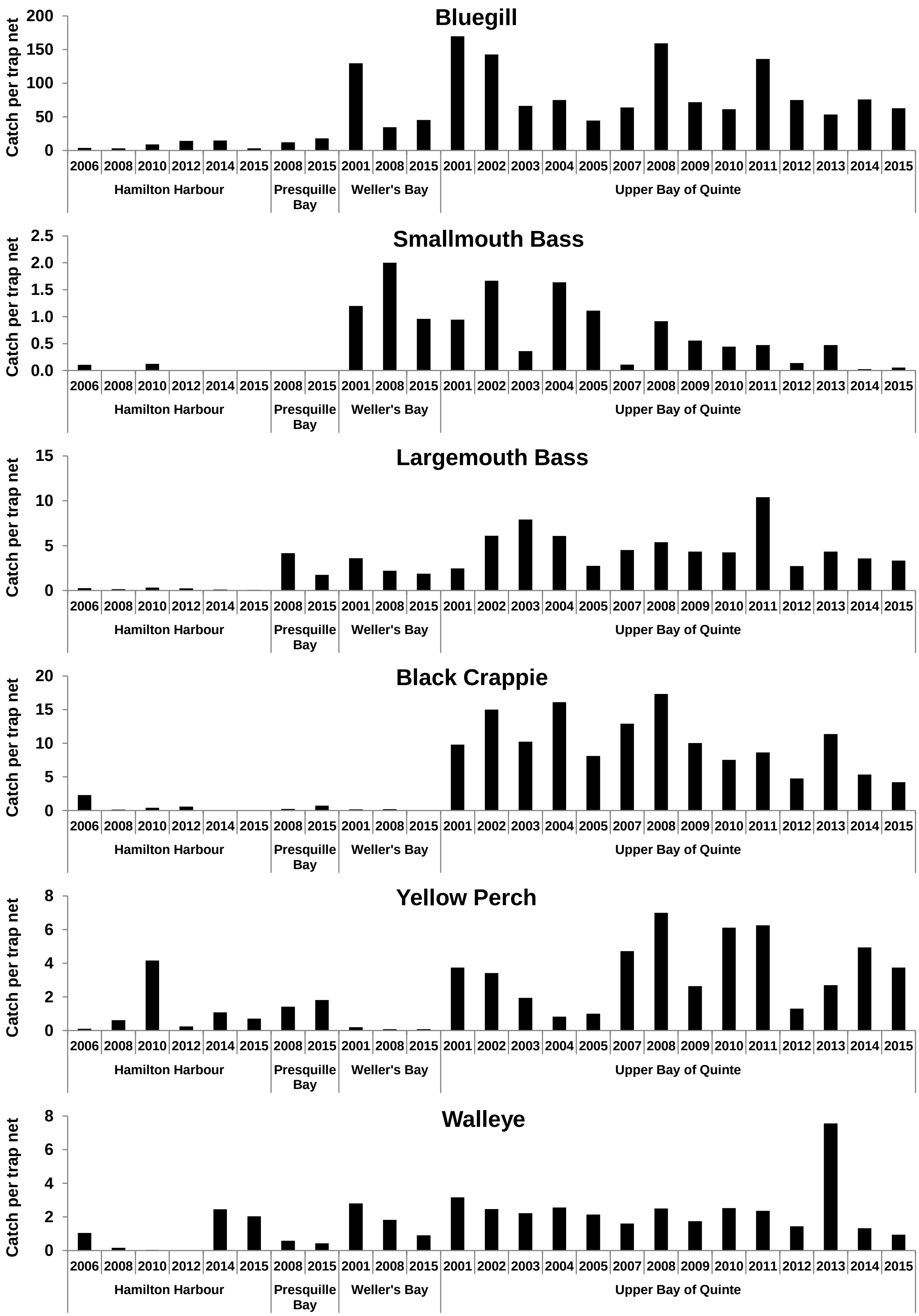

FIG. 1.4.2. (continued) Abundance trends for selected species caught in nearshore trap nets in Hamilton Harbour, Presqu'ile Bay, Weller's Bay, and the upper Bay of Quinte. Values shown are annual arithmetic means.

Upper Bay of Quinte

Thirty-six trap net sites were sampled on the upper Bay of Quinte from Sep 8-25 with water temperatures ranging from 18.5-24.0 °C (Table 1.4.2). Over 5,000 fish comprising 25 species were captured (Table 1.4.3). The most abundant species by number were Bluegill (2,264), Pumpkinseed (1,812), Brown Bullhead (207), Black Crappie (152), Yellow Perch (135), and Largemouth Bass (120). One American Eel was caught. This eel was 809 mm total length and 1,322 g in weight.

Northern Pike abundance declined from 2001-2009, increased significantly in 2010, then declined. Pike abundance was similar in 2015 as in 2013 and 2014. Brown Bullhead and Channel Catfish remained at low abundance. American Eel abundance has declined in 2015 compared to the previous two years. White Perch abundance was unusually high in 2013 but very few were caught in 2014 (7) and 2015 (11). Pumpkinseed abundance increased in 2015. Bluegill and Largemouth Bass abundance was similar to recent years. Smallmouth Bass were very low in 2015. Black Crappie abundance declined in 2014 and again in 2015 compared to 2013. Yellow Perch abundance declined slightly from the previous year. Walleye abundance, having been unusually high in 2013, declined in 2014 and 2015 (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 2015 were 0.08, 0.44, 0.39, and 0.25 in Hamilton Harbour, Presqu'ile Bay, Weller's Bay, and the upper Bay of Quinte, respectively. The PPB at Hamilton Harbour remained significantly below 0.2 and that of other sheltered Lake Ontario embayments (Fig. 1.4.3). The PPBs at Weller's Bay and the upper Bay of Quinte were well above the target PPB. Among exposed embayments, Presqu'ile Bay PPB was similar to the Prince Edward Bay and well above that of Toronto Harbour (Fig. 1.4.4).

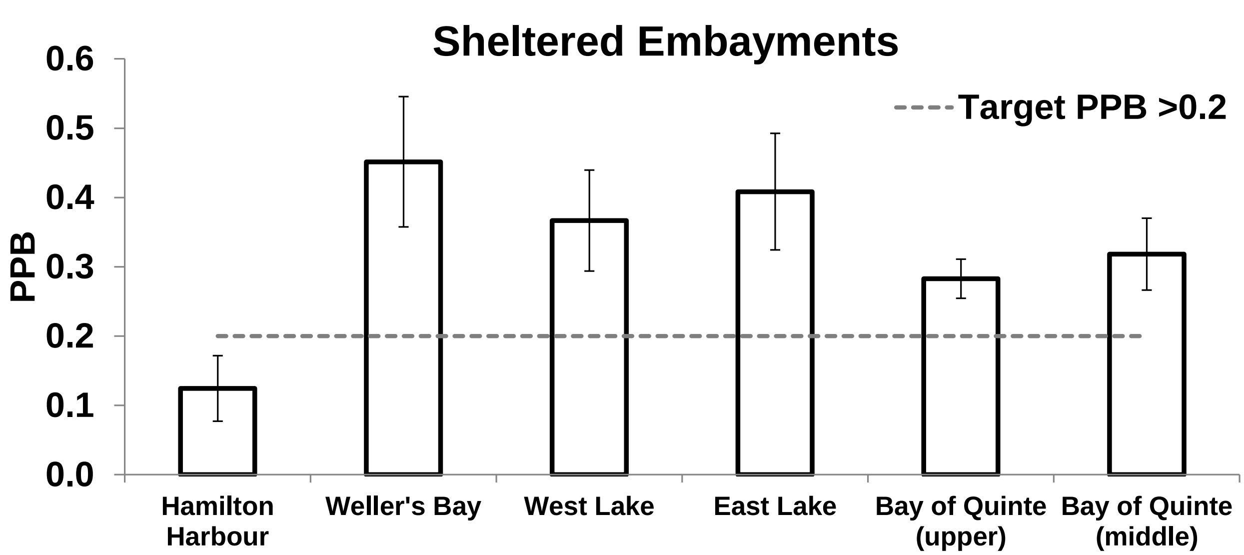

FIG. 1.4.3. Proportion of total fish community biomass represented by piscivore species (PPB) in the nearshore trap net surveys in five sheltered Lake Ontario embayments. A PPB>0.2 is indicative of a balanced trophic structure (depicted by a dashed line). Piscivore species included Longnose Gar, Bowfin,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

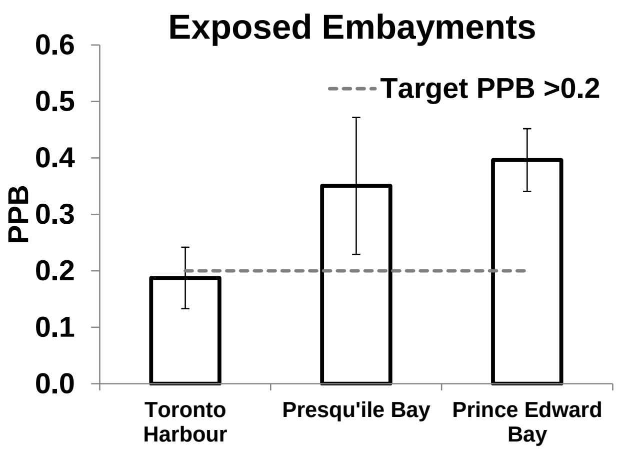

FIG. 1.4.4. Proportion of total fish community biomass represented by piscivore species (PPB) in the nearshore trap net surveys in three exposed Lake Ontario embayments. A PPB>0.2 is indicative of a balanced trophic structure (depicted by a dashed line). Piscivore species included Longnose Gar, Bowfin,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

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 45 (fair), 65 (good), 68 (good), and 71 (good) in Hamilton Harbour, Presqu'ile Bay, Weller's Bay, and the upper Bay of Quinte, respectively. The IBI at Hamilton Harbour remained significantly below those of other sheltered Lake Ontario embayments (Fig. 1.4.5). The IBIs at Weller's Bay and the upper Bay of Quinte were similar to IBI values at other Lake Ontario sheltered nearshore areas. Among exposed embayments, Presqu'ile Bay IBI was similar to the Prince Edward Bay and well above that of Toronto Harbour (Fig. 1.4.6).

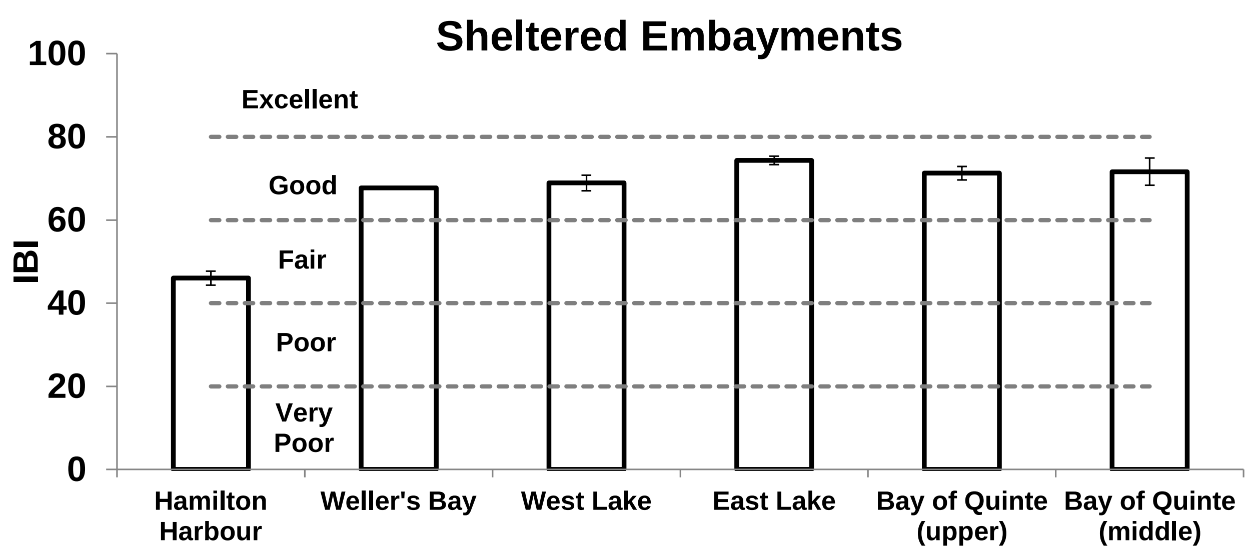

FIG. 1.4.5. Index of biotic integrity (IBI), as a measure of ecosystem health, in the nearshore trap net surveys in five sheltered Lake Ontario embayments. IBI classes can be described as follows: 0-20 very poor, 20-40 poor, 40-60 fair, 60-80 good, and 80-100 excellent ecosystem health. Error bars are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

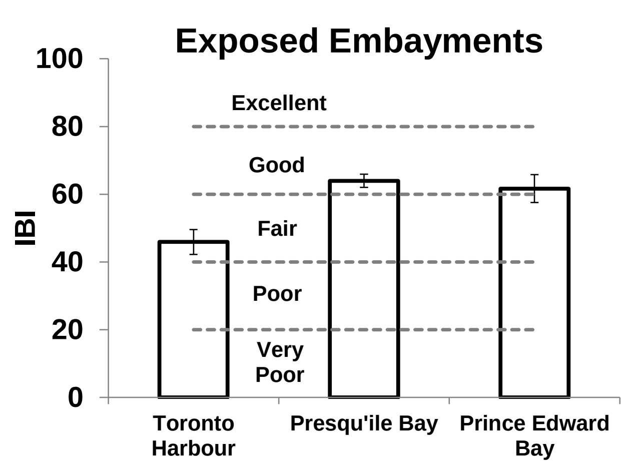

FIG. 1.4.6. Index of biotic integrity (IBI), as a measure of ecosystem health, in the nearshore trap net surveys in three exposed Lake Ontario embayments. IBI classes can be described as follows: 0-20 very poor, 20-40 poor, 40-60 fair, 60-80 good, and 80-100 excellent ecosystem health. Error bars are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

1.5 Lake-wide Hydroacoustic Assessment of Prey Fish

J. P. Holden, Lake Ontario Management Unit
M. J. Connerton, Cape Vincent Fisheries Station, New York State Department of Environmental Conservation

Hydroacoustic assessments of Lake Ontario prey fish have been conducted since 1991 with a standardized mid-summer hydroacoustic survey implemented in 1997. The survey is conducted jointly by the Ontario Ministry of Natural Resources and Forestry (OMNRF) and the New York State Department of Environmental Conservation (NYSDEC). Results from the hydroacoustic survey complement information obtained in spring bottom trawling surveys of prey fish conducted in the U.S. waters of the lake, provides whole-lake indices of prey fish abundance and describes midsummer distribution of pelagic prey fish species.

The survey consists of five, north-south, shore-to-shore transects in the main lake, and one transect in the Kingston Basin (Fig. 1.5.1). 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 annually 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 and mysis hauls were conducted at multiple intervals along each transect.

Since 1997, annual hydroacoustic survey index values have been calculated with slightly different methods (e.g., varying target strength thresholds, and species partitioning methods) and

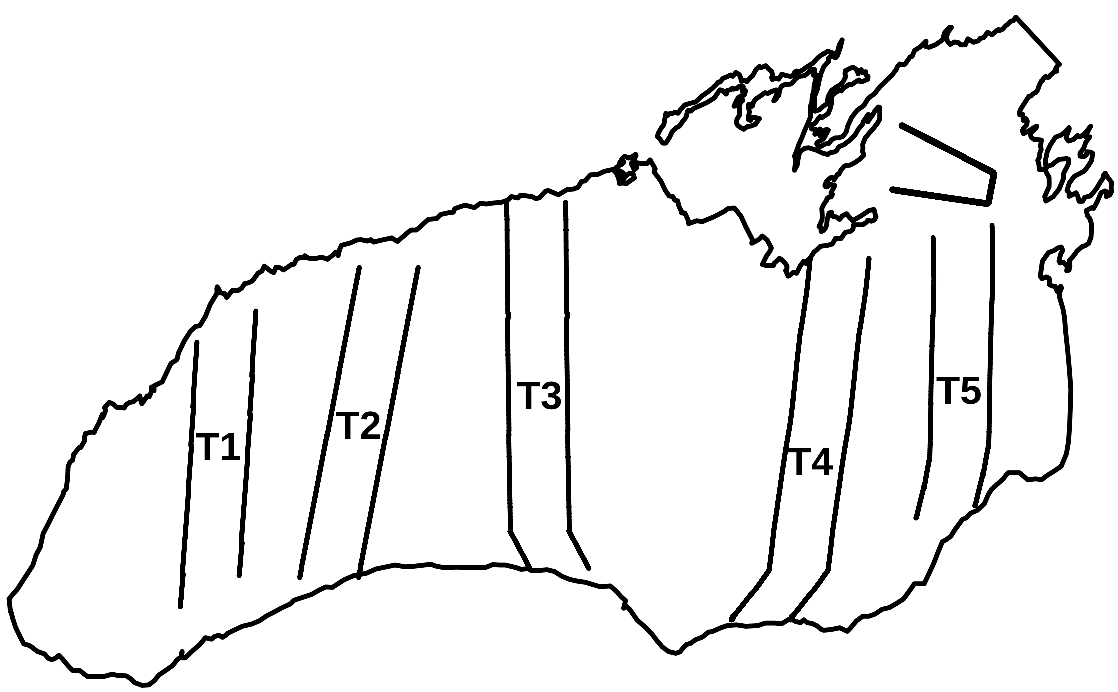

FIG. 1.5.1. The Lake Ontario Lake-wide prey fish survey uses cross-lake hydroacoustic transects. Transect corridors are logistically constrained but utilize a random starting point within the corridor for each annual survey.

different analytical software, which has also evolved to enable more sophisticated approaches (e.g., noise filtering). For this 2015 report, historical data were re-analyzed using a standardized approach to target strength thresholds for Alewife and Rainbow Smelt, noise filtering and species partitioning. Acoustic data can distinguish between sizes of targets but not species. However, historical midwater trawling data (2000-2004) shows 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%). The current analytical approach to species partitioning uses this thermal separation and target strength thresholds to define indices of abundance for both Alewife and Rainbow Smelt (Table 1.5.1).

Comparisons of Alewife biomass estimates between acoustics and spring bottom trawls show that surveys are correlated but that acoustic estimates of Alewife are lower. Vertical gill nets 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. The values for Alewife reported here do not include a conversion factor to account for this unmeasured biomass and thus should be treated as an index of abundance between years and not as a whole lake population estimate.

Alewife abundance in 2015 declined by 45% down to an index of 447 million fish (95% confidence interval = 401-498 million fish) which is 35% below the 10-year average abundance (Fig. 1.5.2). Alewife densities during the survey were greater toward the north shore in 2015 (Fig. 1.5.3). Distribution of Alewife during the survey, however varies from year to year and no consistent spatial trend has been found. We are currently exploring factors which may explain their distribution. The highest concentrations of Alewife were found over bottom depths between 30 and 70 m (Fig. 1.5.4).

Rainbow Smelt abundance increased by 127% to an index of 30.0 million fish (95% confidence interval = 20.8-43.0 million fish) which is 23% below the 10-year average abundance (Fig. 1.5.5). Rainbow Smelt distribution tends to be highest in the eastern portion of the lake (Fig. 1.5.6). The highest concentrations of Rainbow Smelt were found over bottom depths between 60 and 100 m (Fig. 1.5.7).

TABLE 1.5.1. Acoustic parameter settings and target strength thresholds used for the 2015 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 6.1)
Alewife target threshold range	-50 to -35dB
Rainbow Smelt target threshold range	-52 to -35dB

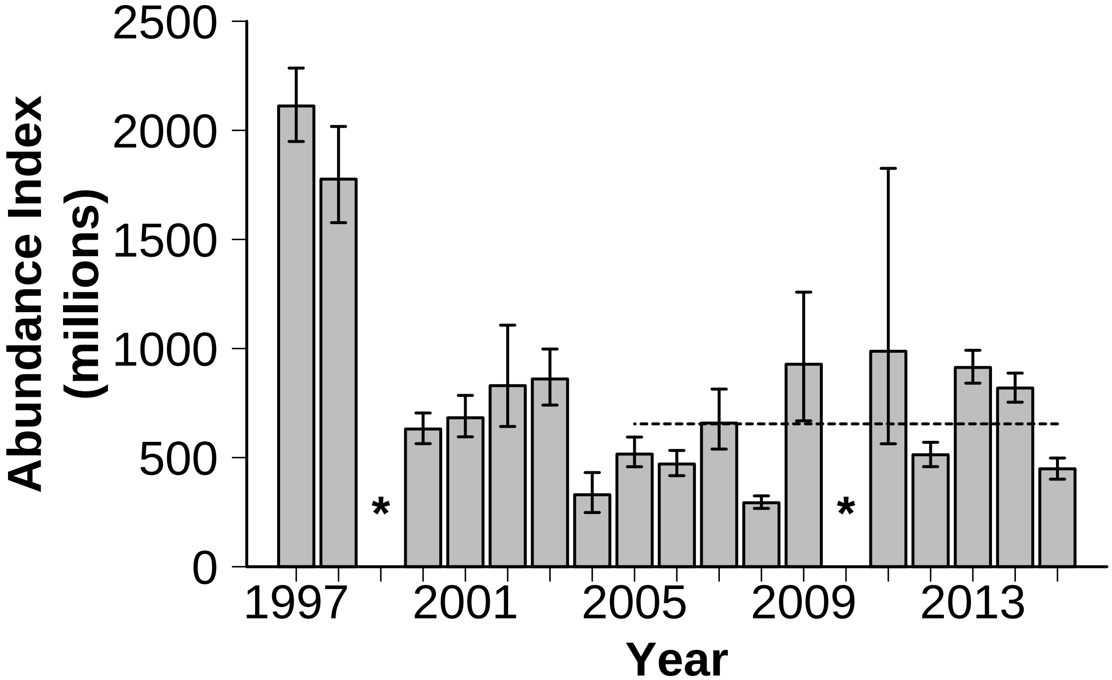

FIG. 1.5.2. Abundance index (in millions of fish) of yearling-and-older Alewife from 1997-2015. Summer acoustic estimates were not conducted in 1999 and 2010(*).

FIG. 1.5.3. Relative distribution of Alewife (fish/ha) observed during the hydroacoustic survey in July 2015. Points are scaled to reflect observed density (fish/ha).

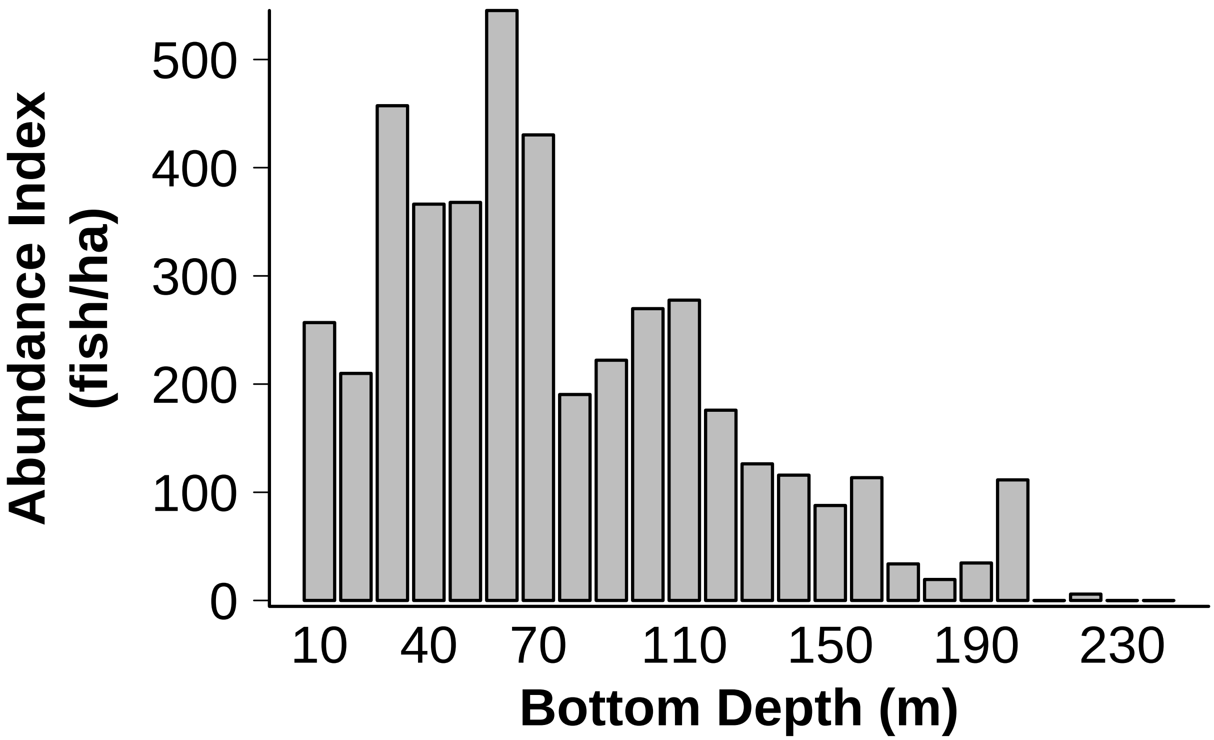

FIG. 1.5.4. Relative distribution of Alewife (fish/ha) in proportion to Lake bottom depth of the 500m portion of the transect.

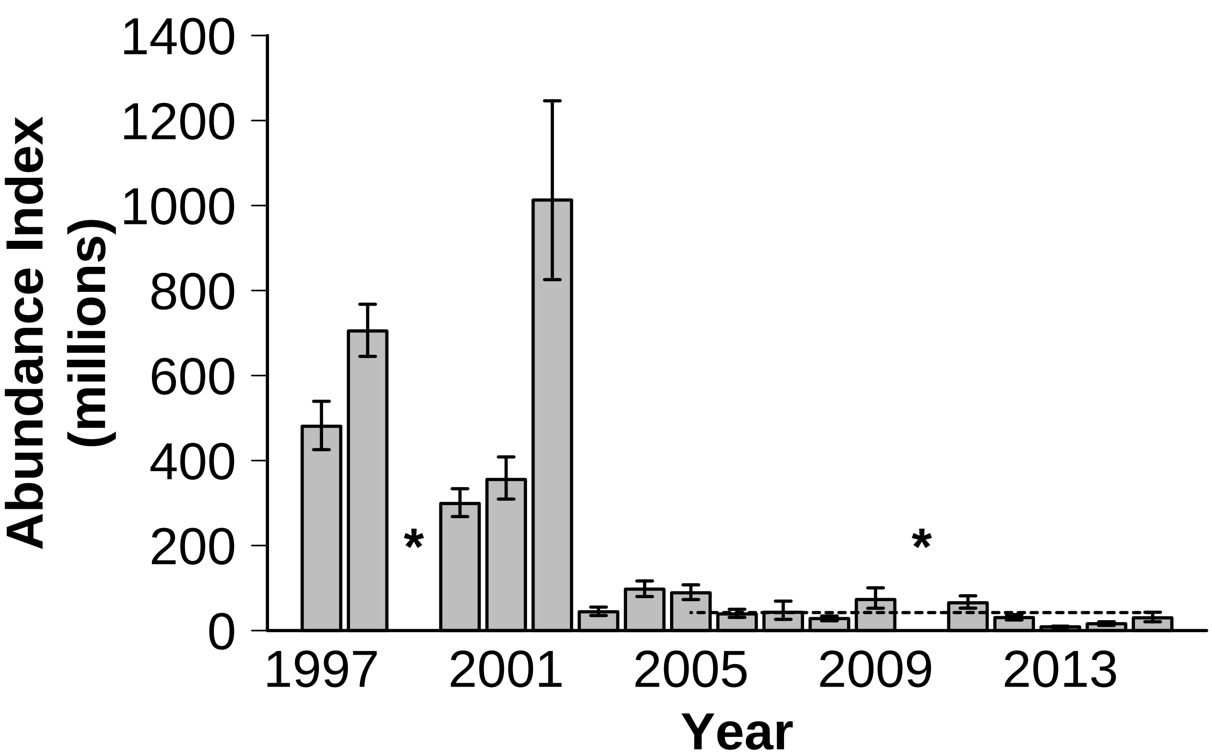

FIG. 1.5.5. Abundance (in millions of fish) of yearling-and-older Rainbow Smelt from 1997-2015. Summer acoustic estimates were not conducted in 1999 and 2010(*).

FIG 1.5.6. Relative distribution of Rainbow Smelt (fish/ha) observed during the hydroacoustic survey in July 2015. Points are scaled to reflect observed density (fish/ha).

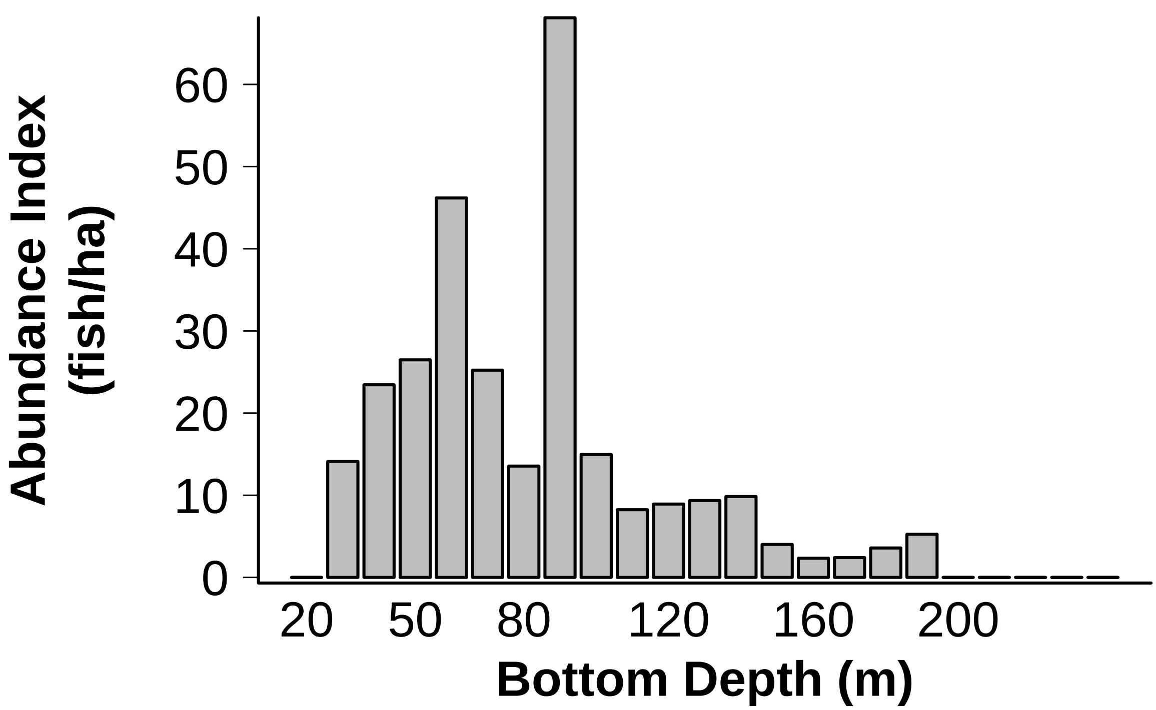

FIG 1.5.7. Relative distribution of Rainbow Smelt (fish/ha) in proportion to Lake bottom depth of the 500 m portion of the transect.

1.6 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 gill net 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 are also collected. 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 2015, the survey was conducted between September 8th and September 24th. Forty-eight sets were made, using standard gill nets consisting of 25-foot panels of monofilament meshes ranging from 1.5-6 inches in half-inch increments. The average set duration was 21 hours (range 17.3 -24.2). The overall catch was 1,069 fish comprising 20 species (summary in Table 1.6.1). The average number of fish per set was 40.6,

TABLE 1.6.1. Catches per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2015. 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
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
Alewife	0.49	--	0.11	0.04	0.04	--	--	--	--	0.02	0.14	0.07	--	0.12	0.27
Gizzard Shad	--	0.38	0.52	--	--	--	0.04	0.11	--	0.05	0.02	--	0.09	0.14	0.12
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	--	--	--	--	--	--	--	--	--
Lake Herring	--	0.04	--	--	0.07	--	--	--	--	--	--	--	--	--	--
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
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
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
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
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
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
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
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
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
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
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
Round Goby	--	--	--	--	--	--	--	--	--	0.86	0.22	0.21	0.02	0.02	0.05
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
Total catch	50.54	53.34	46.90	40.52	42.62	41.71	50.82	55.99	44.91	43.60	56.90	44.61	59.65	26.33	25.69

which is lower than the previous survey in 2013 and comparable to the lowest catches per set in the history of the survey (Fig. 1.6.1). Yellow Perch remained the dominant species caught in the nets followed by: Rock Bass and Smallmouth Bass (Fig. 1.6.2). Less common species included Walleye, Northern Pike and Brown Bullhead. The remaining species comprised 8% of the total catch.

Species Highlights

In 2015, Yellow Perch catches increased slightly from 21.68 fish per gill net to 22.79 fish per gill net and represented 56% of the total catch by number (Table 1.6.1; Fig. 1.6.2 and 1.6.3). In the 2015 Thousand Islands survey, average Yellow Perch catch per net (22.79) were below the average catch from the previous five netting surveys (average of 38.06 from 2005-2013).

The centrarchids were represented by six species in the upper St. Lawrence: Rock Bass, Pumpkinseed, Bluegill, Smallmouth Bass, Largemouth Bass and Black Crappie (Fig. 1.6.4 and 1.6.5). While Rock Bass remain the most abundant of the centrarchids, catches in 2015 were 55% of those observed in the previous decade. We observed a small increase in the catch of Smallmouth Bass during 2015, the first increase in catch since 2005 (Fig. 1.6.4). Growth, as determined by mean length of age-1 Smallmouth Bass (136 mm in 2015), declined 6% below the long-term average (151 mm, 1997-2015), however age-3 and age-5 mean length (289 mm and 385 mm, respectively) continue to remain above the long-term average (265 mm and 351 mm, respectively; Fig. 1.6.6, Tables 1.6.2 and 1.6.3). Pumpkinseed abundance continued to decline in 2015 and remain at the lowest level observed in this survey (Fig. 1.6.4). Bluegill,

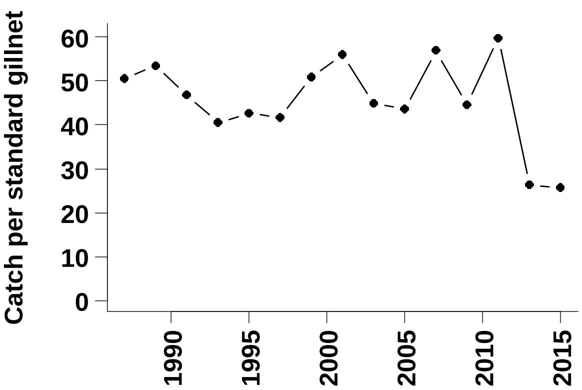

FIG. 1.6.1. Total number of fish (all species) per standard gill net set in the Thousand Islands area of the St. Lawrence River, 1987-2015.

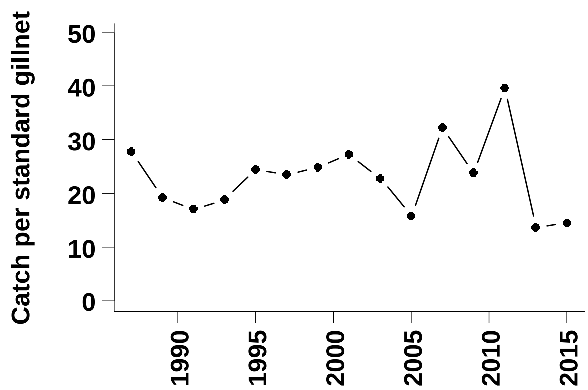

FIG. 1.6.3. Yellow Perch catch per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2015.

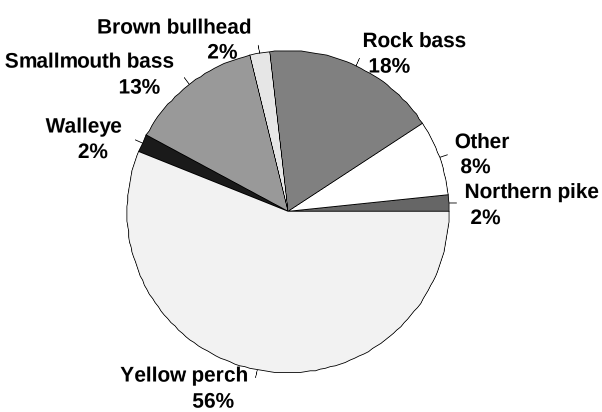

FIG. 1.6.2. Species composition in the 2015 gill net survey in the Thousand Island area of the St. Lawrence River.

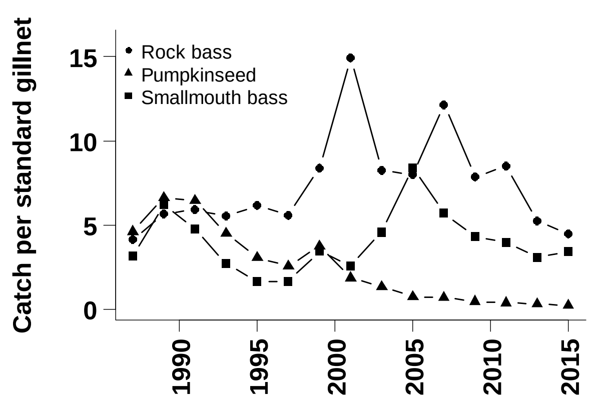

FIG. 1.6.4. Centrarchid catches per standard gill net set in the Thousand Islands area of the St. Lawrence River, 1987-2015.

Largemouth Bass and Black Crappie were historically at much lower levels than the former three species, and remain so. While catches of Largemouth Bass had a moderate increase over the last decade, the abundance has declined since 2011 (Fig. 1.6.5).

Northern Pike remain at very low levels, reached after a slow, steady decline spanning almost the entire history of the Thousand Islands survey (Fig. 1.6.7). Currently, Northern Pike abundance is at the lowest observed in this survey; roughly 6% of its peak, observed in 1989. Growth as determined by mean length of age-4 Northern Pike has remained stable since 1997; however mean length of age-5 and age-6 Northern Pike have declined 9% and 7% (respectively) below the long term average (Fig. 1.6.8 and Tables 1.6.2 and 1.6.3)).

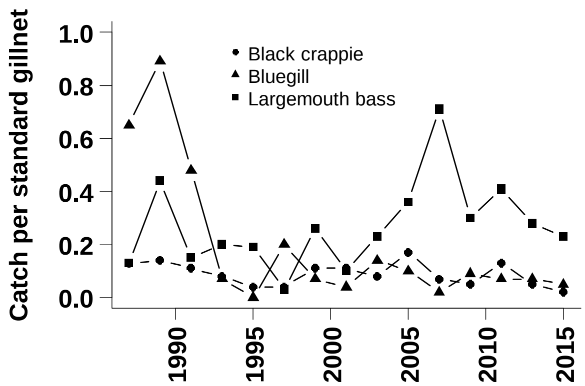

FIG. 1.6.5. Centrarchid catches per standard gill net set in the Thousand Islands area of the St. Lawrence River, 1987-2015.

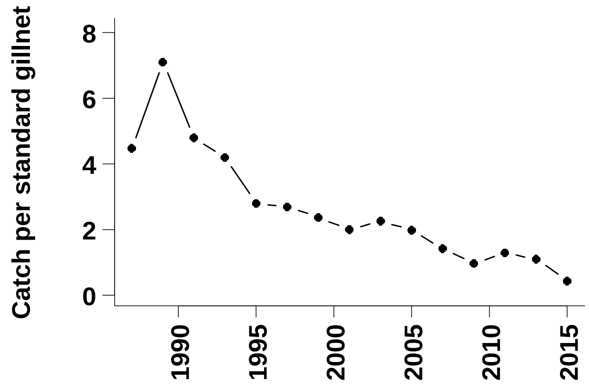

FIG. 1.6.7. Northern Pike catch per standard gill net set in the Thousand Islands area of the St. Lawrence River, 1987-2015.

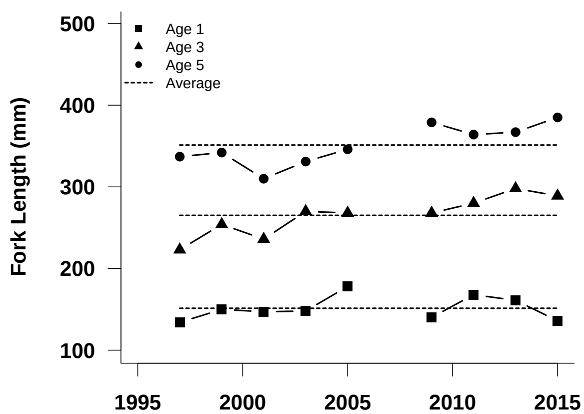

FIG. 1.6.6. Mean fork length (mm) of age-1 (square), age-3 (triangle) and age-5 (circle) Smallmouth Bass from 1997-2015. Dashed lines represent the average fork length from 1997-2015 for the aforementioned ages.

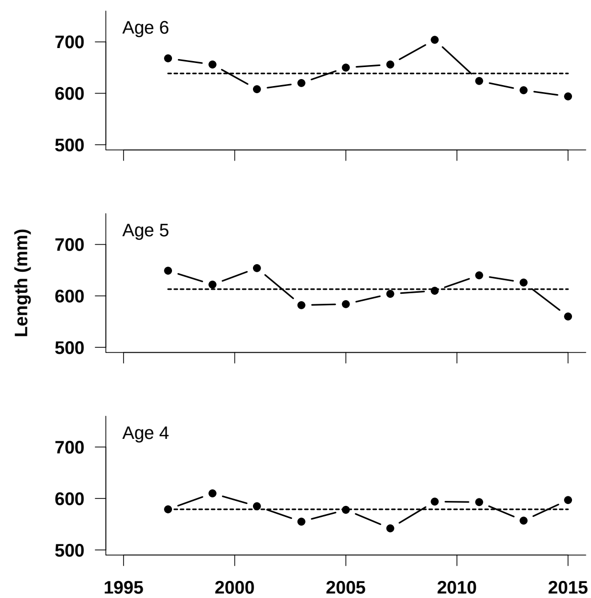

FIG. 1.6.8. Mean fork length (mm) of age-4, age-5 and age-6 Northern Pike from 1997-2015. Dashed lines represent the average fork length from 1997-2015 for the aforementioned ages.

TABLE 1.6.2. Age distribution of selected species caught in the Thousand Islands, 2015.

	Year-class/Age															
	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Yellow Perch	2	33	44	46	8	4	3	2	1		1					
Walleye		1	1	3	2	1	1	3			3			1	1	2
Northern Pike		1	2	3	7	3	1				1					
Smallmouth Bass	29	33	25	23	1	7	4	7	6	3	1					

TABLE 1.6.3. Mean fork length (mm) by year-class/age of selected species caught in the Thousand Islands, 2015.

	Year-class/Age															
	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Yellow Perch		140	152	181	202	225	213	261	290	293		313				
Walleye		297	403	450	539	522	586	595			702			634	600	666
Northern Pike		508	520	597	560	594	672				668					
Smallmouth Bass	136	196	289	320	385	414	437	427	451	447	461					

1.7 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 spawn 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 2015 Chinook Salmon index were taken on September 29th, October 1st, 5th-7th, and 13th-15th. Detailed sampling occurred on 350 Chinook Salmon, 103 fish were sampled for the representative length sample, and one Chinook Salmon with an adipose fin clip was checked for CWTs.

In 2015, mean size of Chinook Salmon decreased in all sex and age-classes (Fig. 1.7.1). The mean length of age-3 females (825 mm) and males (832 mm) continue to decline from 2013 and are 7% and 8% below the long term average of 883 mm and 906 mm, respectively. Length of age-2 females (768 mm) declined from 2014 to 3% below the long term mean of 793 mm. Age-2 males (756 mm) also declined from 2014 and are now 10% below the peak length observed in 2013 (841 mm); however age-2 males are just marginally (5%) below the mean of 800 mm for the time series (1989-2015).

The estimated weight (based on a log-log regression) of a 900 mm (fork length) Chinook Salmon is used as an index of condition. In 2015, condition of females decreased, while the condition of males increased (Fig. 1.7.2). Female condition declined in 2015 (8,690 g) but is only 2% below the average condition from 2003-2015. Male condition (8,716 g) increased and is currently 3% above the average condition between 2003 and 2015. It should be noted that the absolute difference between maximum and minimum condition for female (1995 and 2007) and male (1995 and 2005) Chinook Salmon in this time series is 1,433g and 1,149 g (respectively).

Lamprey scarring rates are highly variable throughout the time series. A1 (fresh wound with no healing) wounding rates were comparable to

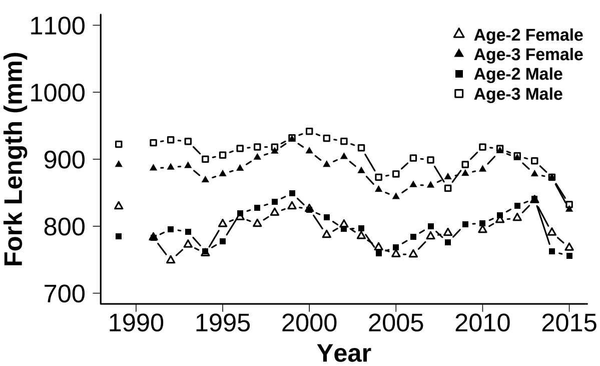

FIG. 1.7.1. Mean fork length of age-2 and age-3 Chinook Salmon by sex, caught for spawn collection in the Credit River during the fall spawning run (approximately first week of October), 1989-2015.

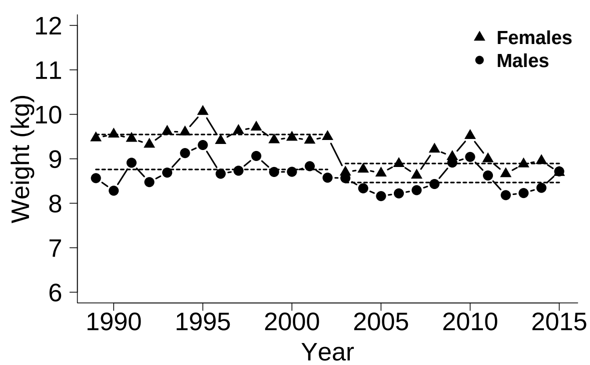

FIG. 1.7.2. Condition index as the mean weight of a 900 mm (fork length) Chinook Salmon in the Credit River during the spawning run (approximately first week of October), 1989-2015.

observation in 2014 and remained low. A2 (wound with limited healing) wounding rates in 2015 increased from observed rates in 2014 but still remain well below levels observed in 2013 (Fig. 1.7.3). As the clipped cohorts of Chinook Salmon (2008-2011) exit the system, clip rates and CWT recoveries continue to decline. Only one fish was observed with an adipose clip in 2015 and this fish did not have a CWT.

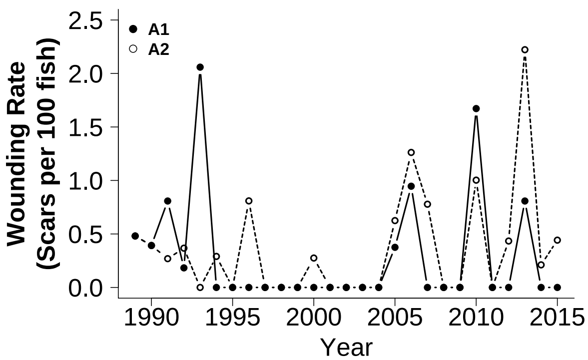

FIG. 1.7.3. Lamprey scarring index (number of scars per 100 fish) observed during the Chinook Salmon spawning run at the Credit River (approximately the first week of October), 1989-2015. A1 (fresh wound with no healing) and A2 (fresh wound with limited healing) refer to different classes of Sea Lamprey scars observed on Chinook Salmon.

1.8 Juvenile Atlantic Salmon Parr Survey

M.D. Desjardins, Lake Ontario Management Unit

In 2015, Atlantic Salmon spring fingerlings (average 3.39 g) were stocked in the Credit River and its tributaries (Section 6.1) to restore self-sustaining populations (Section 8.2). The purpose of this survey was to evaluate growth and survival of Atlantic Salmon parr stocked as spring fingerlings, and in conjunction with smolt surveys (Section 1.9), to evaluate the relative contribution of each reach to the smolt migration.

Atlantic Salmon parr were surveyed at 5 reaches in the Credit River and Black Creek (Table 1.8.1) during October 2015, after most of the year's growth was complete, and when fish size is greater than 98 mm which indicates potential smolting the following spring. Atlantic Salmon were captured by electrofishing. Largely, other species were released upon capture, and were not generally recorded. Biological information (length, weight) was collected for all Atlantic Salmon captured and fish were tagged with half-duplex passive integrated transponder (PIT) tags at all sites. Three thousand and sixty-six (3,066) PIT tags were implanted into the body cavity of Atlantic Salmon parr (Table 1.8.2). Larger PIT tags (23 mm) were used on fish >108 mm. Smaller PIT tags (12 mm) were used on fish <108 and >68 mm. A piece of caudal or adipose fin was clipped from all Atlantic salmon for genetic determination of strain, and provided a secondary mark. The smallest fish (<67 mm) were not PIT-tagged but these fish could be recognized on recapture by the fin clip used for a genetic sample. Repeat sampling occurred at three reaches to obtain population and density estimates. One hundred and fifty (150) tagged/ marked Atlantic Salmon were recaptured generally at the same location (Table 1.8.2) as originally tagged. Seven additional fish were recaptured from 2014 tagging efforts.

First year growth of age-0 spring fingerling stocked Atlantic Salmon (Table 1.8.3) declined during 2015. In fact, the average weight of age-0

TABLE 1.8.1. Geo-coordinates (downstream end) and dimensions of population sampling sites in the Credit River, 2015.

Reach	Latitude	Longitude	Sample length (m)	Stream width (m)	Days sampled
Meadow (Forks Prov. Park)	43° 48.75'	80° 00.87'	462	8.4	2
Stuck truck (Forks Prov. Park)	43° 48.61'	80° 00.29'	460	10.8	1
Brimstone (Forks Prov. Park)	43° 48.17'	79° 59.71'	405	13.1	2
Ellies (Forks o' Credit Rd.)	43° 48.28'	79° 59.51'	136	14.0	1
Black Creek 6th Line	43° 37.91'	79° 57.03'	330	5.5	2

TABLE 1.8.2. Number of applied and recaptured PIT tags by location and Atlantic Salmon age group in 2015.

Reach	Age 0			Age 1 and older			Total number
	Number of PIT tags	Not tagged	Recaptured	Number of PIT tags	Not tagged	Recaptured	
Meadow (Forks Prov. Park)	998	39	43	42		3	1125
Stuck truck (Forks Prov. Park)	435	15		36			486
Brimstone (Forks Prov. Park)	737	10	43	44	1	1	836
Ellies (Forks o' Credit Rd.)	257	11		13			281
Black Creek 6th Line	488	9	58	16		2	573
Total	2,915	84	144	151	1	6	3,301

* Does not include recaptured fish tagged in previous years

Atlantic Salmon has declined since 2012 at all of the main Credit River stocking locations with average weight equaling 19.4 g in 2012, 15.2 g in 2014 and 9.5 g in 2015. This decline in the size of fish in the fall has occurred despite the stocking of larger spring fingerlings beginning in the spring of 2013. The size of stocked spring fingerlings averaged 1.5 g in 2012, 2.07g in 2013, 3.12 g in 2014, and 3.25 g in 2015. The percentage of fish expected to emigrate as age-1 smolts has also declined across the same sites from 83% in 2013 to 55% in 2014, and 42% in 2015. At the Black Creek stocking location the average weight of age -0 Atlantic Salmon declined in 2015 as well as did the percentage of juveniles expected to smolt (87% in 2014 to 48% in 2015). Despite this decline, the average size and the likelihood of smolting at age-1 was higher at Black Creek in 2015 than during most of the previous sampling years. Black Creek has continually produced smaller juveniles than the main Credit sites but in 2015 this location produced the largest juveniles and will likely produce relatively more smolts in 2016 (Table 1.8.3).

The density of age-0 Atlantic Salmon was assessed at a subset of sampling locations and fall densities continue to meet or exceed the restoration target (0.05-0.5 m^{-2})[1] at all sites (Table 1.8.4). The fall juvenile density estimate of 0.70 m^{-2} at the Black Creek stocking location was similar to the 2014 estimate. On average, fall density at stocking locations upstream of the forks have increased since 2013 with average densities equaling 0.43 m^{-2} in 2013, 1.22 m^{-2} in 2014, and 1.10 m^{-2} in 2015. High fall densities coupled with smaller juvenile size may indicate density dependent growth constraints. A negative correlation was detected when average fall weight and annually stocked biomass ($p = 0.06$, $r = 0.79$) was examined at upper Credit stocking locations between 2012 and 2015. This may indicate that the stocked density of large fish (higher biomass) is suppressing growth and reducing the number of smolts produced annually. Conversely, reduction in the carrying capacity of these repeatedly stocked habitats cannot be ruled out. Further analysis is required to determine how to adjust stocking rates of fingerling Atlantic Salmon to optimize growth and smolt production.

[1] Miller-Dodd, L., and S. Orsatti. 1995. An Atlantic Salmon Restoration Plan for Lake Ontario. Ontario Ministry of Natural Resources. Lake Ontario Assessment Internal Report LOA 95.08. Napanee.

TABLE 1.8.3. Mean fork length and weight of Atlantic Salmon by location and age group in 2015.

Reach	Age 0		% expected to smolt in 2015	Age 1 and older	
	Length (mm)	Weight (g)		Length (mm)	Weight (g)
Meadow (Forks Prov. Park)	98.1	10.8	47%	141.9	30.1
Stuck truck (Forks Prov. Park)	95.0	9.5	41%	141.6	30.7
Brimstone (Forks Prov. Park)	94.6	9.7	37%	146.8	34.8
Ellies (Forks o' Credit Rd.)	89.9	8.2	21%	153.0	39.4
Black Creek 6th Line	99.8	11.1	48%	133.9	25.8

TABLE 2.8.4. Population estimates, density, and biomass of Age-0 Atlantic Salmon in the Credit River and Black Creek, 2015.

Reach	Age/size (mm)	Number	Lower 95% CI	Upper 95% CI	Density (No. m^{-2})	Biomass (g m^{-2})
Meadow (Forks Prov. Park)	Age 0 <98	3,173	2,046	4,871	0.82	5.86
	Age 0 $\geq$98	2,924	2,005	4,242	0.76	10.66
Brimstone (Forks Prov. Park)	Age 0 <98	2,022	1,413	2,879	0.38	2.71
	Age 0 $\geq$98	1,265	785	2,008	0.24	3.39
Black Creek 6th Line	Age 0 <98	658	447	961	0.36	2.71
	Age 0 >98	604	435	835	0.33	4.78

1.9 Credit River Atlantic Salmon Smolt Survey

M.D. Desjardins, Lake Ontario Management Unit

Monitoring Atlantic Salmon throughout their life cycle is critical to the success of the Lake Ontario Atlantic Salmon Restoration Program. This information is necessary to choose the 'best' management strategies in the future. Collecting information while salmon are "out-migrating" to Lake Ontario is a critical fisheries reference point, because it represents the outcome of stream-life and allows biologists to compare stream and lake survival. This is particularly important for the restoration program as it is implementing a stocking strategy that is exploring the use of three stocked life stages (spring fingerlings, fall fingerlings, and spring yearlings), and three strains (LeHave, Sebago, and Lac St. Jean). Assessing the relative contribution/survival of the strains and life stages will allow for the optimization of the stocking program in the future and in turn improve the chances for restoration.

In 2015, the Lake Ontario Management Unit and Credit Valley Conservation conducted the fifth year of out-migrant sampling on the Credit River using a Rotary Screw Trap. The trap was deployed on time in 2015 and fishing commenced on April 7. Daily trap sampling occurred for the next 71 days until the trap was removed on June 17. This represents roughly a 30% increase in sampling effort compared to the 2014 field season, which was plagued with high spring flows that delayed sampling. In 2015, 3,030 fish representing 27 species were collected (Table 1.9.1.). This represents about a 50% decline in total catch. Conversely, Atlantic Salmon catches in 2015 were the highest since the beginning of the program with approximately a 60% increase in catch.

Tissues from 798 Atlantic Salmon were submitted to Trent University for genetic analysis to determine strain assignment and parentage (life -stage stocked). The catch contained mainly Sebago strain (50%) and LaHave strain (45%) Atlantic Salmon (Table 1.9.2.). The Lac St. Jean strain was poorly represented at just over one percent of the catch. Interestingly, about three percent of the samples were classified as having an "ambiguous" ancestry. These fish are interesting as they could not be classified as belonging solely to any one of the three stocked strains and therefore potentially represent a mixed ancestry with some fish potentially resulting from wild matings.

TABLE 1.9.1. List of species and total catch using the Rotary Screw Trap, 2015.

Species	Sum of Catch
Chinook Salmon	1,540
Atlantic Salmon	798
Common Shiner	299
Rainbow Trout	129
Longnose Dace	62
Blacknose Dace	37
Rainbow Darter	33
Coho Salmon	30
Golden Shiner	19
Fathead Minnow	16
Hornyhead Chub	14
Salmonid	11
White Sucker	11
Fathead Minnow	6
Brook Stickleback	5
Pumpkinseed	3
Minnow sp.	3
Stonecat	2
Black Crappie	2
Sea Lamprey	2
Creek Chub	2
Brown Trout	1
Johnny Darter	1
Fantail Darter	1
Northern Hog Sucker	1
Common Carp	1
River Chub	1
Total catch	3,070

Stocked life- stage was confirmed for 502 (63%) of the submitted samples (Table 1.9.2.). In 2015, the majority of the catch was from the spring yearling stocked life-stage (53%) with the spring fingerling life-stage making up only five percent of the catch. This catch composition differs significantly from that of past years when spring yearlings comprised a smaller portion of the catch (9% in 2011-2013 and 20% in 2014) and the spring fingerling life-stage represented the bulk of the catch (85% in 2011-2013, 34 % 2015). Also of note is the relatively large percentage (31%) of life-stage designations classified as being "unassigned". These fish could be identified to strain but matched poorly against stocked family genotypes. The number of fish designated as being "unassigned" has increased in recent years. Prior to 2014 they comprised only about 5% of the catch. The high frequency of this designation requires further analysis.

Changes in the 2015 Atlantic Salmon out-migrant catch are best examined on a daily basis for added insight. In previous years the catch of Atlantic salmon would increase slowly following trap deployment in early April peak at about 20-30 fish per day in early May and then decline slowly to zero in June (Fig. 1.9.1A). This catch pattern represents the "typical" out-migration pattern encountered in most years. In 2015 the catches were high within days following trap deployment, daily catches were significantly higher with the peak catch occurring on April 16 only nine days after deployment (Fig. 1.9.1.A). When the catch is partitioned into stocked life-stages, we find that these high early catches are made up largely by spring yearling fish (Fig. 1.9.1.B). The early timing of these large yearling catches likely reflects a close alignment between the dates of yearling stocking and the date of trap deployment. In previous years, yearling stocking occurred in early to mid-March well before the onset of sampling. In these years yearling catches were low. In 2015, yearling stocking began on April 2 and concluded April 17 which overlaps our sampling window. High catches soon after stocking times may indicate that these fish out-migrate soon after stocking and that lower catches in previous years indicating relatively poor performance of the spring yearling life-stage may in fact be artificial.

The small catches in 2015 during the "typical" peak out-migration window (late April to mid-May) are composed mostly of the poorly represented fall and spring fingerling life-stages. Low catch during this period may be due to lower trap efficiencies resulting from relatively low water conditions and slower flow rates encountered during this time frame (Section 11.4). Low catches may also indicate a true shift in the timing of out-migration of these life-stages resulting from low river discharge. If outmigration was significantly delayed a large fraction of the out-migrants may have been missed.

Also of interest is the catch timing of the "unassigned" individuals (Fig. 1.9.1B). These

TABLE 1.9.2. Composition of the 2015 Atlantic Salmon catch by stocked life-stage, strain, and smolt age.

		Life-stage					
Strain / Smolt Age		Eyed egg	Spring fingerling	Fall fingerling	Spring yearling	Unassigned	Total
Ambiguous	20						20
LaHave							
1		28	10	22	244		
2		1	13	8	2	15	343
Sebago							
1			10	1	158		
2			1			214	384
Lac St. Jean							
1			3				
2				1		6	10
Total		29	37	32	404	235	757

fish were encountered early (early to mid-April) in the sampling season and dominate the catch along with the spring yearlings. Similarities between these two categories continue when fish size is examined. The distribution of catch fork length across all stocked life stages (Age-1 fish only) reveals a high degree of overlap between the size of the "unassigned" and the spring yearling catch (Table 1.9.3.). Similarities in abundance, catch timing, and size of the "unassigned" and spring yearling fish may indicate that a significant portion of the "unassigned" fish are in fact misclassified spring yearlings. Misclassification is but one potential explanation for the recent increase (2014-2015) in the "unassigned" designations. Work will continue to determine the significance of this classification and the reason for its recent prominence.

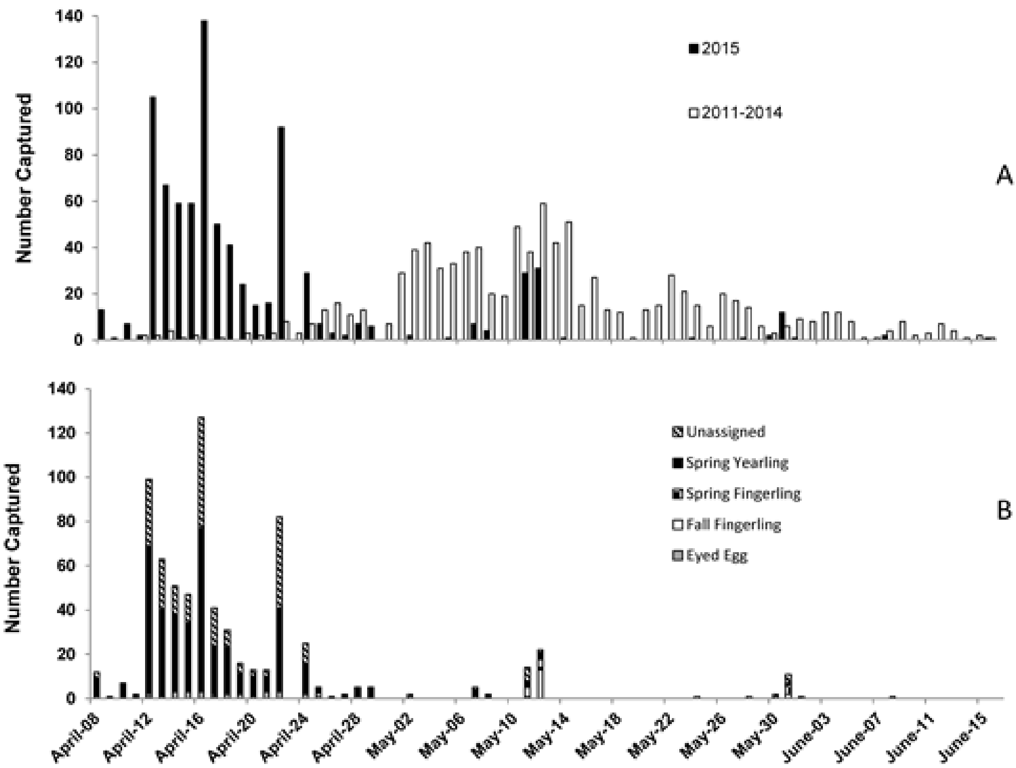

FIG. 1.9.1. Timing and composition of the 2015 Atlantic Salmon catch at the Rotary Screw Trap. A) Timing of the total 2015 catch (all life-stages combined) relative to the combined catch (all life-stages combined) of the 2011-2014 seasons. B) The composition of the 2015 catch showing the relative catch for each of life-stage (ambiguous fish not represented).

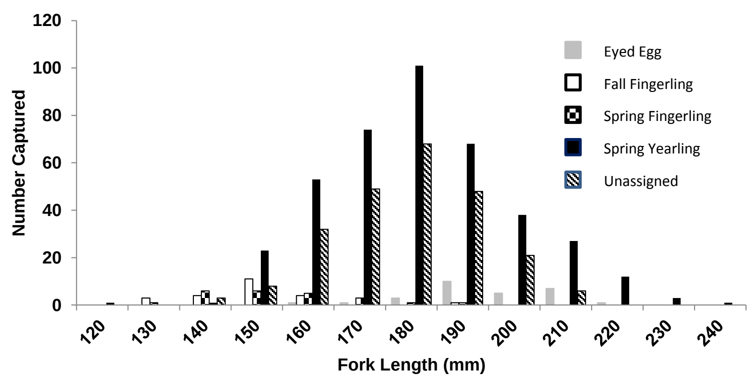

FIG. 1.9.2. Distribution of fork lengths for each of the stocked life-stages captured in 2015. To remove the influence of fish age on size, only age-1 fish are represented. All unassigned fish are represented as their age is unknown.

1.10 Credit River Fishway

M.D. Desjardins Lake Ontario Management Unit and *M. Heaton,* Aurora District

Management efforts to restore Atlantic Salmon to Lake Ontario continued in 2015 (Section 8.2). As in previous years, effort has focused on three high quality streams (Credit River, Duffins Creek, and Cobourg Brook). Fish of three different strains are stocked at multiple life-stages to determine the best performing strain and stocked life-stage. Juvenile Atlantic Salmon remain in stream habitats for 1 - 2 years before smolting and out-migrating to Lake Ontario where they will reside for at least one year until they mature and return to spawn in the stocked streams.

Fishways on two Credit River dams located at Streetsville and Norval (Fig. 1.10.1) allow for passage of mature salmon enabling access to upstream spawning habitat. These fishways also provide opportunities to count and sample returning Atlantic Salmon and enable program evaluation. The first fishway encountered by returning adult salmon is located at the Streetsville dam located roughly 15 km from Lake Ontario. This step- pool design fishway provides selective passage for jumping fish species including mature salmonids. The next fishway encountered is a Denil fishway located on the Norval dam roughly 40 kilometers upstream from Lake Ontario. The fishway at Streetsville is left on swim-through year round and is closed with screens to allow trapping when adult collections are needed. The Norval fishway is operated as a trap and transfer facility. It remains closed year round and is checked as needed (seasonally) to allow for the transfer of target migratory species.

Monitoring was more targeted in 2015 than in previous years (Table 1.10.1) with trapping not beginning until mid-August and ending in mid-September. Previous years of sampling have indicated that this timing window yields the majority of Atlantic Salmon. This truncated sampling approach was used to optimize effort focusing more on the collection of genetic information rather than on run enumeration. Previous years of sampling have shown that small runs of Atlantic Salmon are difficult to quantify amidst a significantly larger run of Pacific Salmon.

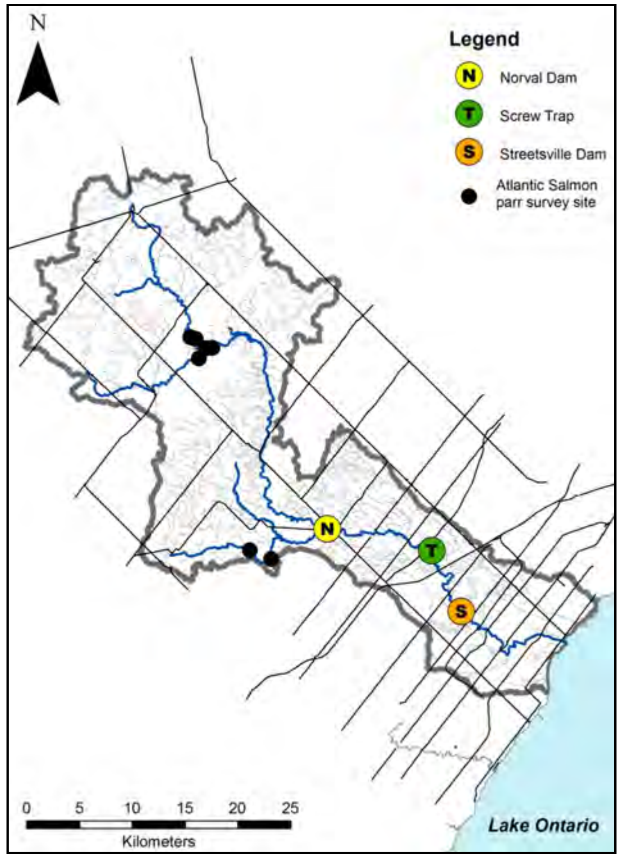

FIG. 1.10.1. Map of the Credit River, Lake Ontario showing locations of the fishways at Norval (N) and Streetsville (S) dams, the smolt screw trap (T) site (Section 1.9), and Atlantic Salmon parr assessment survey (●) sites (Section 1.8).

The number of adult Atlantic Salmon captured on the Credit River and other streams continues to be low. During the 47 days of combined fishway operation only 7 Atlantic Salmon were captured at Credit River fishways (Table 1.10.1). Lower catches in 2015 likely reflect the reduced sampling effort (targeted approach) expended toward adult enumeration. Additional fish were collected later in the season during several non-targeted sampling programs (e.g. Chinook egg collections). Peak run timing may also have shifted in 2015 due to warmer fall weather. Anecdotal reports of late running

Pacific Salmon were received from many tributaries in 2015. Lower stream discharge and warm water temperatures were recorded in many Lake Ontario tributaries and perhaps these conditions were not sufficient to trigger the onset of migration in 2015.

This survey highlights the difficulties of monitoring small runs of fish in variable stream environments. Furthermore, the use of multiple strains of salmon with potential run timing differences may necessitate a broader surveillance period rather than the more focused approach. Regardless, manual enumeration is proving to be a demanding, labour intensive and costly enterprise. If continued run monitoring is needed for the many species of anadromous sport fish using Lake Ontario tributaries, then cost effective technologies should be explored that will enable a more thorough assessment.

We would like to recognize our colleagues at the Aurora District, Ministry of Natural Resources and Forestry for their continued dedication and hard work in operating the fishways and data collection.

TABLE 1.10.1. Operational details of the Streetsville and Norval fishways 2011-2015.

Year	Fishway	Operational duration	Days operated	Adult Atlantic Salmon captured (recaptures)
2011	Streetsville	Sep 8 - Nov 30	48	21
	Norval	August 23 - Nov 25	58	8(2)
	Total		106	29
2012	Streetsville	Sep 10 - Nov 3	30	2
	Norval	June 20 - Nov 21	87	18(1)
	Total		117	20
2013	Streetsville	Sep 12 - Nov 4	35	9
	Norval	Jun 25 - Nov 8	88	11(1)
	Total		123	20
2014	Streetsville	Sep 12 - Oct 31	29	15
	Norval	Jun 3 - Oct 31	94	10(5)
	Total		123	25
2015	Streetsville	Sep 18- Sept 25	7	5
	Norval	August 19 - Sep 25	40	2
	Total		47	7

1.11 Duffins Creek Resistance Board Weir

M.D. Desjardins, Lake Ontario Management Unit

Since 2006, the Atlantic Salmon restoration program has used an experimental stocking strategy where the performance of multiple strains and stocked life-stages is being evaluated. Collecting information on adult salmon is a vital component of this evaluation as these individuals have survived both stream and lake environments and likely represent the most successful strain and life-stage. An effective opportunity for sampling adults presents itself annually as mature fish return to their natal streams to spawn. Fishing spawning runs with fixed structures (e.g. fishways) has proven to be very effective as actively migrating fish readily interact with gear as they endeavor to access upstream spawning habitats. Of the targeted restoration tributaries, only the Credit River has fishways that allow for the capture of returning adults. In 2013, with the support of the Great Lakes Fishery Commission (GLFC), the Ontario Ministry of Natural Resources and Forestry and the Toronto and Region Conservation Authority installed a Resistance Board Weir (RBW) in Duffins Creek to capture migrating adult Atlantic Salmon. RBW's are proven technology pioneered on the west coast of North America to capture returning salmon in rivers. The weirs are site adaptable, temporary, portable, safe, and inexpensive. Here we report on the 2015 weir operation.

As with the sampling at the Credit River fishways, monitoring was more targeted in 2015 with sampling commencing on August 9 and ending on Sep 22 representing 34 days of fishing. This period coincides with historic times of high catches. The weir was not operated in early summer in 2015 as it has been in the previous two years of sampling. A total of 462 fish representing five species of salmonids were captured during 7 weeks of weir operation (Table 1.11.1). This represents a significant decline in the number of fish handled at the weir and reflects the decreased effort expended in Duffins Creek in 2015. As with the previous sampling years, Chinook Salmon comprised the majority of the catch. Catches began soon after weir deployment with both Chinook and Atlantic salmon being intercepted on August 14. Overall, catches were sporadic during the first four weeks of sampling with only 20 fish being captured. Catches did not appreciably increase until the latter half of the sampling frame with the last week containing the highest daily and weekly catch totals. Catches of Atlantic Salmon were comparable compared to other years despite the reduced fishing effort with most of the fish being captured during the last week of sampling. All Atlantic Salmon tissues were sent to Trent University for parentage assessments (strain /life-stage). This information will be available following genetic processing.

Mortality rates of captured fish declined as the program progressed. The occurrence of the gill parasite *Salmincola californiesis* was also monitored on all fish handled at the weir in 2015. The frequency of parasitic infestation on fish was similar to that seen during last year's sampling with about a third of all fish carrying a parasite load and with Chinook salmon having the highest rates of infection at 64% (Table 1.11.1).

We would like to recognize our colleagues at the Toronto and Region Conservation Authority for their continued dedication and hard work in operating the weir and data collection.

TABLE 1.11.1. Summary of sampling effort and catch by species including mortalities and the occurrence of gill parasites during the 2015 field season.

Week	New fish caught (adjusted for recaps)					Mortalities*					Fish with gill parasite				
	Chinook Salmon	Coho Salmon	Rainbow Trout	Brown Trout	Atlantic Salmon	Chinook Salmon	Coho Salmon	Rainbow Trout	Brown Trout	Atlantic Salmon	Chinook Salmon	Coho Salmon	Rainbow Trout	Brown Trout	Atlantic Salmon
Aug-09	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Aug-16	0	0	0	0	1	2	0	0	0	1	0	0	0	0	0
Aug-23	4	0	0	0	1	0	0	0	0	0	3	0	0	0	0
Aug-30	4	1	0	0	0	4	0	0	0	0	0	0	0	0	0
Sep-06	38	0	0	1	0	9	0	0	0	0	29	0	0	1	0
Sep-13	93	6	0	5	1	5	0	0	0	1	68	2	0	0	0
Sep-20	261	37	0	3	4	4	0	0	0	0	156	3	0	1	0
Species totals	401	44	0	9	8	24	0	0	0	2	256	5	0	2	0
Bulk totals			462					26					263		

* sum of mortalities in the cage and on the panels; does not include carcasses that have washed downstream

1.12 Juvenile Chinook 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 were of wild origin. Past electrofishing surveys determined that many wild Chinook Salmon were produced in Ontario tributaries. In 2014, a program was initiated to assess wild production of juvenile Chinook Salmon in Lake Ontario streams. This program was based on previous surveys conducted during the springs of 1997-2000. From a broader list of streams, Wilmot Creek and Shelter Valley were surveyed starting in 2014. Past surveys indicated Wilmot Creek had the highest abundance of wild Chinook Salmon and Shelter Valley Creek had moderate abundance. Both Wilmot Creek and Shelter Valley were not stocked with Chinook or Coho Salmon, or Rainbow Trout.

During 2015, juvenile Chinook Salmon were surveyed by electrofishing in Shelter Valley Creek and Wilmot Creek, following the same methods and generally at the same randomly selected sites as surveyed in 1997-2007. In Shelter Valley Creek, eight sites were surveyed during May 12-15, 2015, completely covering the length of stream where Chinook Salmon spawned (Table 1.12.1). In Wilmot Creek, seven sites in downstream reaches were sampled during May 19 -25, 2015 (Table 1.12.1).

In Shelter Valley Creek Age-0 Chinook Salmon were the most abundant fish caught (155.75 fish/site) (Table 1.12.2). The second most abundant fish in that tributary was juvenile Rainbow Trout (age 1 and older), averaging 26.75 fish/site. In Wilmot Creek, age-0 Chinook Salmon catches (502.86 fish/site) were an order of magnitude higher than juvenile Rainbow Trout (44.14 fish/site), and higher than Chinook Salmon in Shelter Valley Creek. The abundance of age-0 Chinook Salmon in Shelter Valley Creek was about an order of magnitude higher in 2015 than during 2014 and about double Wilmot Creek. (Figs. 1.12.1 and 1.12.2, Tables 1.12.1 and 1.12.2)

Year to year variability in abundance of Chinook Salmon in Lake Ontario streams is still not well understood, but appears to be greater than for Rainbow Trout. 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 wild Chinook Salmon production in streams should provide additional insights into wild fish production.

TABLE 1.12.1. Location, sampling date, site dimensions, abundance estimates (number, linear density (fish/m) and biomass (g/m^2)) of age-0 salmon and trout in Shelter Valley Creek and Wilmot Creek in 2015. The abundance was estimated for each species at each site using: N = catch + (catch / (1/(1-0.2617)*mean weight*0.27116)-1). The spatial coordinates are at the downstream end of each site. Sites are ordered in the table from downstream to upstream.

Site	Latitude	Longitude	Date	Site width (m)	Site length (m)	Coho Salmon			Chinook Salmon			Rainbow Trout			Brown Trout		
						Estimated No.	No./m	g/m^2	Estimated No.	No./m	g/m^2	Estimated No.	No./m	g/m^2	Estimated No.	No./m	g/m^2
	Shelter Valley Cr.																
SE03	43° 58.50'	78° 00.23'	May 12	6.88	42.30	0.00	0.00	0.000	1,767.87	41.79	42.300	0.00	0.00	0.000	5.24	0.12	0.020
SE07	43° 59.12'	78° 00.10'	May 13	7.80	40.90	0.00	0.00	0.000	1,378.35	33.70	40.900	0.00	0.00	0.000	0.00	0.00	0.000
SE08	43° 59.83'	77° 59.93'	May 15	5.43	36.50	0.00	0.00	0.000	626.81	17.17	36.500	0.00	0.00	0.000	5.24	0.14	0.030
SE09	44° 00.04'	77° 59.70'	May 13	7.00	45.00	0.00	0.00	0.000	929.26	20.65	45.000	0.00	0.00	0.000	0.00	0.00	0.000
SE10	44° 00.59'	77° 59.15'	May 14	8.43	53.50	3.95	0.07	0.010	503.08	9.40	53.500	0.00	0.00	0.000	0.00	0.00	0.000
SE05	44° 01.03'	77° 59.37'	May 14	8.30	54.50	0.00	0.00	0.000	306.03	5.62	54.500	0.00	0.00	0.000	0.00	0.00	0.000
SE11	44° 01.99'	77° 59.73'	May 15	6.53	49.50	18.78	0.38	0.060	186.89	3.78	49.500	0.00	0.00	0.000	0.00	0.00	0.000
SE06	44° 02.57'	78° 00.07'	May 15	5.55	42.20	78.14	1.85	0.330	3.58	0.08	42.200	0.00	0.00	0.000	0.00	0.00	0.000
	Wilmot Creek																
WMA2	43° 54.17'	78° 36.04'	May 19	8.73	64.00	6.98	0.11	0.010	2,575.47	40.24	4.610	0.00	0.00	0.000	0.00	0.00	0.000
WMA8	43° 54.64'	78° 36.49'	May 19	7.15	66.00	38.92	0.59	0.080	938.31	14.22	1.990	0.00	0.00	0.000	0.00	0.00	0.000
WMA10	43° 54.81'	78° 36.60'	May 20	7.32	56.00	22.95	0.41	0.060	2,823.53	50.42	6.890	0.00	0.00	0.000	0.00	0.00	0.000
WMA11	43° 55.02'	78° 36.74'	May 20	6.78	50.00	14.97	0.30	0.040	1,530.33	30.61	4.510	0.00	0.00	0.000	0.00	0.00	0.000
WMA15	43° 55.68'	78° 37.10'	May 21	8.56	38.50	78.84	2.05	0.240	1,487.34	38.63	4.510	1.13	0.03	0.000	0.00	0.00	0.000
WMB1	43° 55.87'	78° 37.17'	May 25	7.92	55.00	46.90	0.85	0.110	971.38	17.66	2.230	0.00	0.00	0.000	0.00	0.00	0.000
WMB3	43° 56.22'	78° 36.96'	May 25	7.23	62.00	118.76	1.92	0.260	1,308.74	21.11	2.920	0.00	0.00	0.000	19.15	0.31	0.040

TABLE 1.12.2. Catch by species of fish in Lake Ontario tributaries during electrofishing surveys in 2015. Sites are ordered in the table from downstream to upstream.

Site	Date	Lamprey sp.	American Brook Lamprey	Sea Lamprey	Coho Salmon		Chinook Salmon		Rainbow Trout			Brown Trout		Brook Trout	Central Mudminnow	White Sucker	Northern Redbelly Dace	Brassy Minnow	Blacknose Shiner	Fathead Minnow	Blacknose Dace	Longnose Dace	Creek Chub	Brook Stickleback	Rainbow Darter	Round Goby	Mottled Sculpin
					Age-0	1+	Age-0	1+	Age-0	1+	Adult	Age-0	1+	1+													
Shelter Valley Cr.																											
SE03	May 12	0	3	0	0	0	386	0	0	0	0	1	0	0	1	1	0	0	1	0	11	0	0	0	0	0	17
SE07	May 13	0	2	0	0	0	301	0	0	5	1	0	0	1	0	1	0	1	0	2	29	2	1	1	0	0	37
SE08	May 15	0	0	0	0	0	137	0	0	13	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	27
SE09	May 13	0	6	0	0	0	203	0	0	29	2	0	0	2	0	0	1	0	0	3	2	1	1	0	0	0	29
SE10	May 14	0	1	0	1	0	110	0	0	53	2	0	1	0	0	0	0	0	0	0	0	0	5	0	0	0	16
SE05	May 14	0	2	0	0	0	67	0	0	31	2	0	1	0	0	0	0	0	0	0	5	4	0	0	0	0	21
SE11	May 15	0	4	0	4	0	41	0	0	46	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	15
SE06	May 15	0	1	0	16	0	1	0	0	37	0	0	0	0	0	1	0	0	0	9	0	4	2	0	0	0	11
	Mean	0.00	2.38	0.00	2.63	0.00	155.75	0.00	0.00	26.75	0.88	0.25	0.63	0.50	0.13	0.38	0.13	0.13	0.13	1.75	6.00	1.50	1.13	0.13	0.00	0.00	21.63
Wilmot Creek																											
WMA2	May 19	5	0	0	2	0	779	0	0	31	3	0	6	0	0	9	0	0	0	0	10	0	0	0	2	18	8
WMA8	May 19	2	0	0	10	0	284	0	0	63	3	0	7	0	0	0	0	0	0	0	0	23	0	0	0	2	57
WM10	May 20	0	2	0	6	0	854	0	0	40	1	0	3	0	0	2	0	0	0	0	6	0	1	2	0	0	32
WM11	May 20	2	0	1	4	0	463	1	0	41	2	0	4	0	0	12	0	0	0	0	24	0	0	0	0	0	38
WM15	May 21	1	0	0	20	0	450	1	1	31	2	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	22
WMB1	May 25	1	0	0	12	0	294	0	0	55	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	31
WMB3	May 25	5	0	0	30	2	396	0	0	48	0	2	5	0	0	0	1	0	0	0	0	0	1	0	0	0	23
	Mean	2.29	0.29	0.14	12.00	0.29	502.86	0.29	0.14	44.14	1.57	0.29	4.86	0.00	0.00	3.29	0.14	0.00	0.00	0.00	5.71	3.29	0.29	0.43	0.29	2.86	30.14

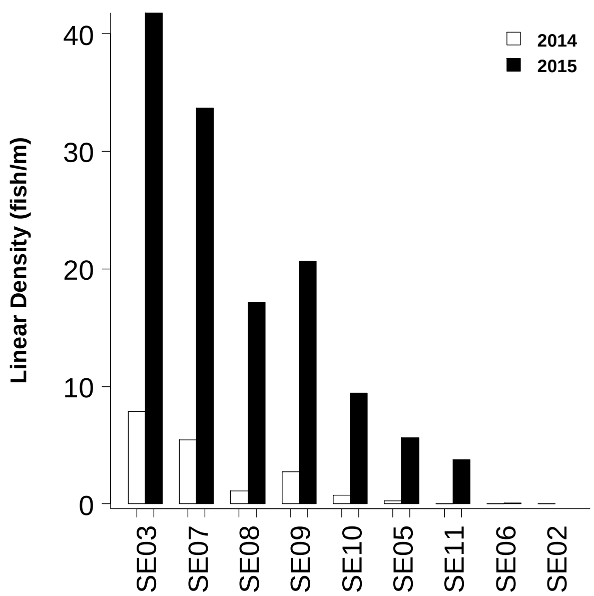

FIG. 1.12.1. Linear density (fish/m) of Chinook Salmon at sites in Shelter Valley Creek. White bars represent data collected in 2014 and black bars represent data collected in 2015.

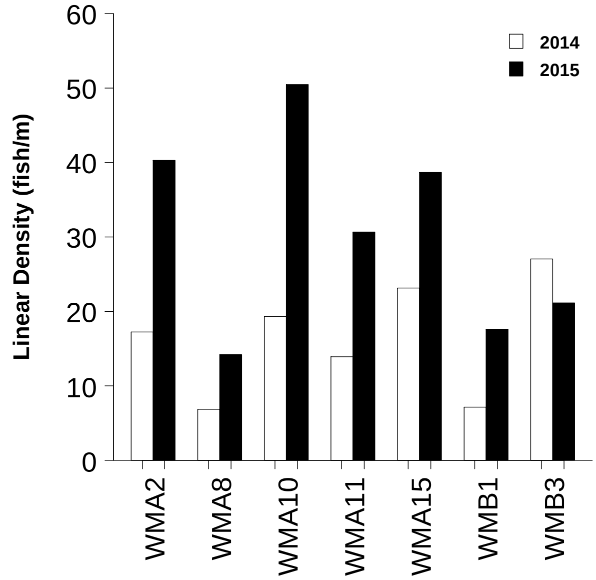

FIG. 1.12.2. Linear density (fish/m) of Chinook Salmon at sites in Wilmot Creek. White bars represent data collected in 2014 and black bars represent data collected in 2015.

1.13 Lake Ontario Fall Benthic Prey Fish Assessment

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A main basin assessment of benthic prey fish has typically only been conducted by the US Geological Survey. The historical survey assessed prey fish along six southern-shore, US-water transects in depths from 8-150 m. The restricted geographic and depth coverage prevented this survey from adequately informing important benthic prey fish dynamics at a whole-lake scale, including monitoring the reappearance of Deepwater Sculpin. In 2015, this program was expanded to include additional trawl sites conducted by OMNRF and New York Department of Environmental Conservation (NYSDEC). This section will emphasize lake wide results and species specific results are reported in the Status of Stocks section of this report (Section 7).

The survey consisted of 135 trawls conducted between September 25th and October 21st. All vessels used a similar trawl (3/4 Yankee Standard, see Table 1.3.1 for specifications) however doors and warp ratios varied between vessels. Depth loggers were used on USGS and OMNRF trawls to provide estimates of true bottom time in order to standardize catches to area swept. Despite the availability of suitable trawl sites on the north shore in depths of less than 80 m and ports for large vessels in portions of the lake, the survey encompassed a broad geographical range (Fig. 1.13.1) and bottom depth coverage (Fig. 1.13.2).

Species diversity varied between sites (Fig. 1.13.3) and overall, 26 different fish species were captured in the survey. However 13 species were encountered in five or fewer trawls. Alewife was the most common species encountered in catches (81% of trawls) followed by Round Goby (67%), Rainbow Smelt (55%), Deepwater Sculpin (46%) and Slimy

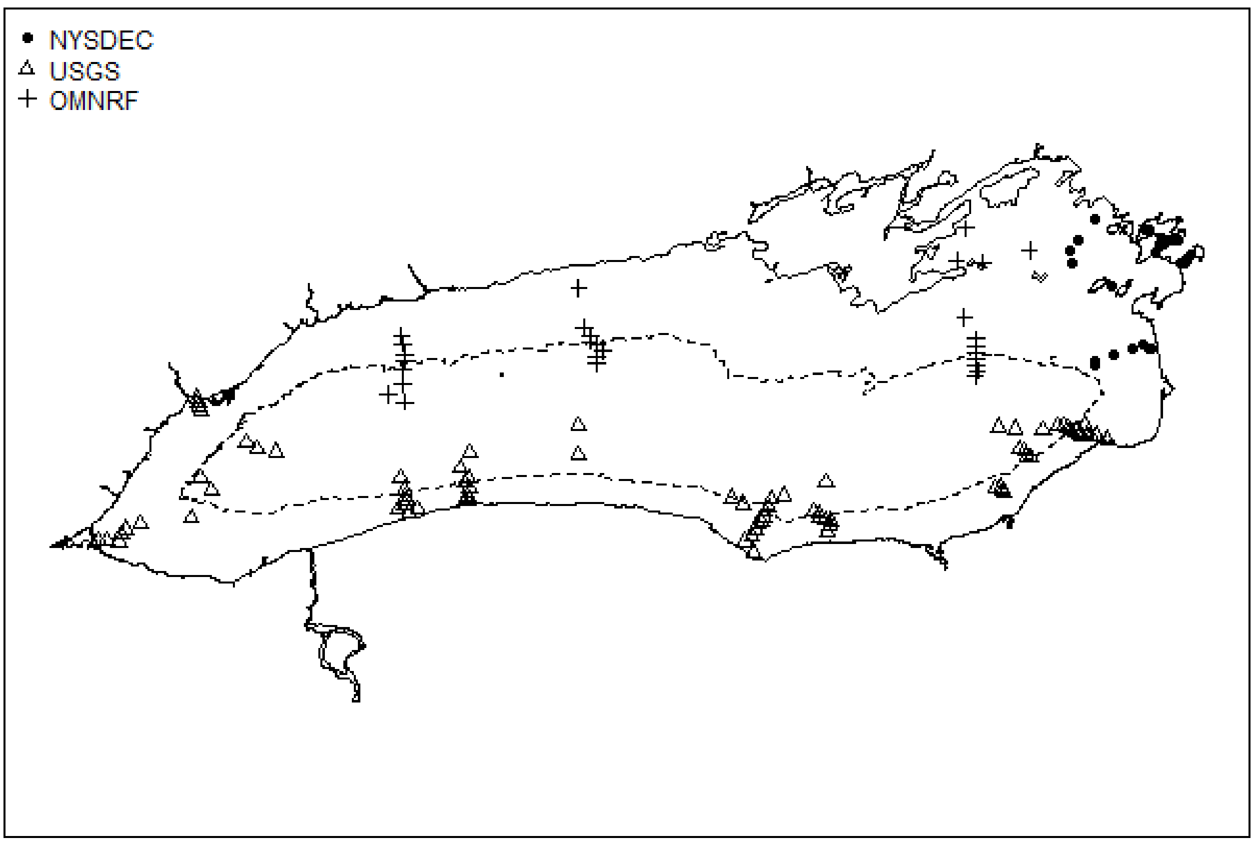

FIG. 1.13.1. Geographic distribution of trawl sites conducted by MNRF, USGS and NYSDEC.

Sculpin (43%) (Table 1.13.1).

Spatial distribution of abundance is presented in Fig. 1.13.4. Alewife and Rainbow Smelt catches were highest along the south shore with some additional higher catches of smelt near the Niagara River. Both Alewife and Rainbow Smelt are thought to be mostly pelagic (suspended) at this time of the year. As a result, this benthic survey may not accurately reflect their distribution. Round Goby and sculpin species distribution seems to be determined by availability of suitable depth, with Round Goby occupying depths shallower than Slimy Sculpin which are shallower than Deepwater Sculpin (Fig. 1.13.5).

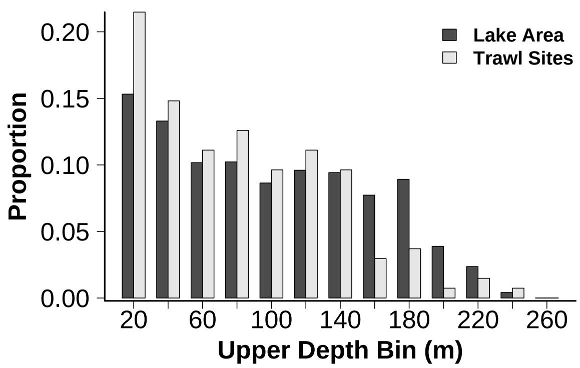

FIG. 1.13.2. Depth distribution of trawl sites relative to the lake area at depth.

TABLE 1.13.1. Percentage of trawls in which the ten most common species occurred.

Species	% Trawl Sites
Alewife	81
Round Goby	67
Rainbow Smelt	56
Deepwater Sculpin	46
Slimy Sculpin	43
Lake Trout	27
Yellow Perch	16
White Perch	13
Spottail Shiner	11
Brown Bullhead	7

FIG. 1.13.3. Species diversity per trawl site. Points are scaled to number of species caught ranging from one to ten species at the most diverse site.

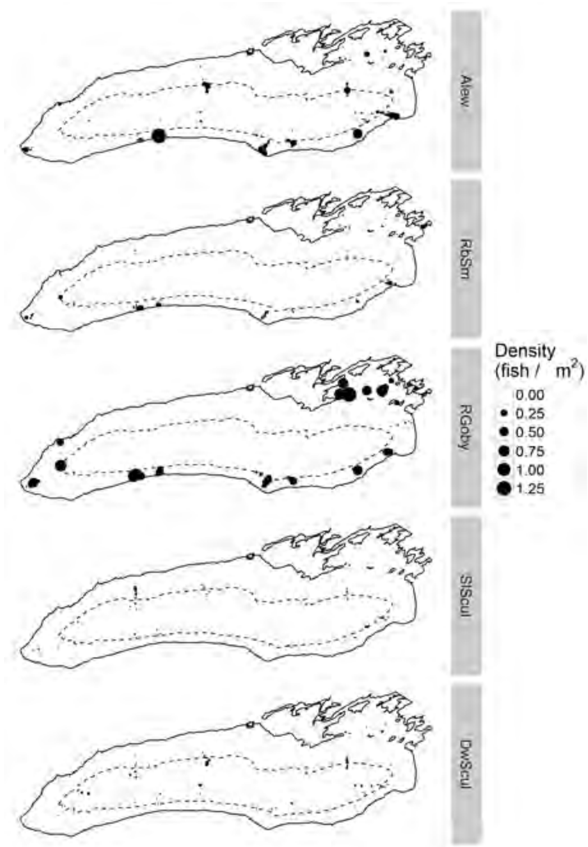

FIG. 1.13.4. Relative density (fish/m²) of species catches throughout the survey area. Alew=Alewife; RbSm=Rainbow Smelt; RGoby=Round Goby; SlScul=Slimy Sculpin; DwScul=Deepwater Sculpin.

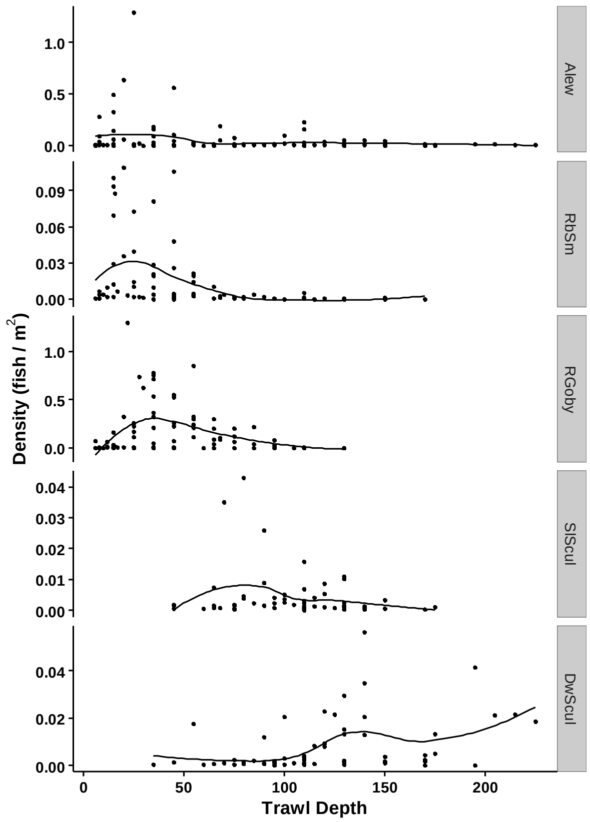

FIG. 1.13.5. Relative density (fish/m²) of important prey species by trawl depth. Trend line is a loess fit of the depth. Alew=Alewife; RbSm=Rainbow Smelt; RGoby=Round Goby; SlScul=Slimy Sculpin; DwScul=Deepwater Sculpin.

2. Recreational Fishery

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

M. D. Desjardins and 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. In 2015, the council helped finalize the Stocking Plan for the Canadian waters of Lake Ontario following a public comment period on the provincial Environmental Registry. Completion of the stocking plan is an important milestone as it documents a decision making framework and rationalizes all stocking activities against approved lake-wide management objectives. Other council activities of note include a review of the Bay of Quinte Fisheries Management Plan and the revision of the Fish Community Objectives for the St. Lawrence River.

Many of our volunteer clubs (council affiliated and non-affiliated) also help with the physical delivery of several management programs. Multiple clubs help with planning and implementation of Lake Ontario's pen rearing initiatives for Chinook Salmon. Others help with the annual delivery of our stocking program through the operation of community based hatcheries. The Nappanee Rod and Gun Club helps MNRF meet its stocking targets by rearing Brown Trout. The Credit River Anglers help with the delivery of Atlantic Salmon, Rainbow Trout, and Coho Salmon stocking targets. 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 spend many hours ensuring the fishway is operating properly, installing and maintaining the fish counter, helping to assess the spring Rainbow Trout population, and helping with fall Chinook Salmon egg collection. Numerous anglers / clubs also participate regularly by supplying catch and harvest information in our volunteer angler diary programs.

The Lake Ontario Management Unit would like to thank and acknowledge the dedication of all the clubs and anglers alike for the generous donation of their time and effort.

2.2 Chinook Salmon Mark and Tag Monitoring

M. J. Yuille, Lake Ontario Management Unit

NYSDEC and OMNRF are conducting a study of the origin (stocked or wild), distribution, and movement of Chinook Salmon in Lake Ontario using fin clips and coded wire tags (CWTs). In 2008, NYSDEC acquired an AutoFish System from Northwest Marine Technology to apply fin clips and CWTs to fish stocked in Lake Ontario. NYSDEC and OMNRF used this system to mark all Chinook Salmon stocked into Lake Ontario from 2008-2011 with an adipose fin clip. Some of these fish were tagged internally with a CWT in the nose to designate the agency and stocking location. Accordingly, all stocked Chinook Salmon that are four years old observed in Lake Ontario in 2015 should be marked. Detailed results from OMNRF surveys are reported here. NYSDEC and OMNRF will be reporting jointly when this study is complete.

Returns of Chinook Salmon fin clips and CWTs are reported from five OMNRF surveys: i) Western Lake Ontario Boat Angling Survey (not conducted in 2015), ii) Chinook Salmon Angling Tournament and Derby Sampling (not conducted in 2015), iii) Lake Ontario Volunteer Angler Diary Program (Section 2.3), iv) Eastern Lake Ontario and Bay of Quinte Fish Community Index Gillnetting (Section 1.2) and v) Credit River Chinook Assessment (Section 1.7). Methods and detailed results from these surveys can be found in this Annual Report as well as the 2013 and 2014 Annual Reports. The gill nets effectively caught small Chinook Salmon, and complemented the angler programs that caught larger fish. The gill nets and angling programs targeted a mixed population of Chinook Salmon originating from widespread stocking and tributary spawning locations. The Credit River survey targeted fish returning to spawn.

In the Lake Ontario Volunteer Angler Diary Program, anglers were asked to record whether any fin clips were present on these caught salmon (see Section 2.3). In 2015, 3% (26 of 746) of Chinook Salmon reported caught by volunteer anglers had fin clips. These fish would be a combination of age-4 Chinook Salmon stocked as part of the original 2008-2011 Mark and Tag Monitoring Program, as well as younger pen stocked Chinook Salmon, that NYSDEC adipose clipped after 2011 to examine the effects of pen stocking compared to direct stocking techniques.

Catch summary for fin clip by year-class of Chinook Salmon from community index gillnetting, angler surveys and angler diaries can be found in Table 2.2.1. For mark and tag results on the Credit River Chinook Assessment Program, see Section 1.7.

TABLE 2.2.1. Catch of Chinook Salmon in Fish Community Index Gillnets and angler surveys by fin clip and year-class during 2008-2015, showing percent stocked origin. Angler Survey for 2014 consists of results from Angler Tournament and Derby sampling only (no angler surveys in 2015). Data from 2015 volunteer angler diaries is not included to determine percent stocked as there was not enough information to determine whether adipose clipped Chinook Salmon reported in this program were from the 2011 year-class.

		Gill nets								Angler Surveys						Angler Diaries						
Year class	Fin Clip	2008	2009	2010	2011	2012	2013	2014	2015	2010	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015	Total	Percent stocked
2008	No clip	0	1	1	0	0	-	-	-	42	35	0	-	-	-	124	0	-	-	-	203	67
	Adipose	3	2	1	1	0	-	-	-	53	76	0	-	-	-	281	0	-	-	-	417	
2009	No clip	-	2	12	1	1	0	-	-	56	106	147	8	-	-	315	355	3	-	-	1006	53
	Adipose	-	0	18	3	0	0	-	-	102	142	114	2	-	-	430	328	1	-	-	1140	
2010	No clip	-	-	7	43	1	1	1	-	3	72	263	288	1	-	465	515	149	-	-	1809	40
	Adipose	-	-	3	14	0	0	0	-	0	48	176	118	4	-	326	412	83	-	-	1184	
2011	No clip	-	-	-	3	4	4	2	0	-	3	61	104	24	-	-	195	47	-	-	447	57
	Adipose	-	-	-	11	4	1	0	0	-	0	116	79	19	-	-	315	57	-	-	602	
Total		3	5	42	76	10	6	3	0	256	482	877	599	48	0	1941	2120	340	0	0	6808	

2.3 Lake Ontario Volunteer Angler Diary Program

M. J. Yuille, Lake Ontario Management Unit

A mass-marking and tag monitoring study was initiated in 2008 by NYSDEC and OMNRF to determine the origin (stocked or wild), distribution, and movement of Chinook Salmon in Lake Ontario (see Section 2.2). All Chinook Salmon stocked into Lake Ontario from 2008-2011 were marked with an adipose fin clip and a portion were also tagged with a coded-wire tag. Lake Ontario anglers have been contributing to the collection of data on Lake Ontario salmonids, including these marked Chinook Salmon, through a volunteer diary program. Since 2011, anglers have participated in a volunteer diary program reporting catch, biological and fin clip information on Chinook Salmon from their annual fishing trips. In 2014, the angler diary program expanded to collect catch and effort information as well as biological information on all Lake Ontario salmonid species (Coho Salmon, Chinook Salmon, Rainbow Trout, Atlantic Salmon, Brown Trout and Lake Trout) caught. This information was collected again in 2015.

In 2015, 19 boats (anglers originating from Ontario and Québec, Fig. 2.3.1) participated in the program; a decrease of six participants from 2014. Anglers participating in the diary program fished from April to September out of ports spanning from the Niagara River to Wellington, providing good temporal and spatial distribution of fishery information (Fig. 2.3.2). Of all participants, 68% were affiliated with an angling club and 26% were charter boat operators. In 2015, anglers made 435 angling trips and recorded data on 1,654 Lake Ontario salmonids (Tables 2.3.1 and 2.3.2). Anglers were asked to record location (nearest port), disposition (kept or released), fish lengths and weights as well as examine every salmonid landed for fin clips.

Of the five salmonid species, Chinook Salmon were targeted most frequently and represented the highest catch in 2015 (Fig. 2.3.3 and Tables 2.3.1, 2.3.2 and 2.3.3). Similar to 2014, Rainbow Trout were the second most frequently targeted species in 2015; however Lake Trout represented the second highest catches (Fig. 2.3.3, Tables 2.3.1 and 2.3.2). Forty-six percent of trips targeted more than one species simultaneously. Approximately 43% of trips targeted solely Chinook Salmon, 8% targeted all species and 9% targeted both Chinook Salmon and Rainbow Trout at the same time (Fig. 2.3.4).

In 2015, Rainbow Trout had the highest percent harvest (76% of catch) followed by Coho Salmon

FIG. 2.3.1. Geographical distribution of participants in the 2015 Lake Ontario Volunteer Angler Diary program, ranging from Sarnia, ON (south western most point) to Pont-Rouge, QC (north eastern most point). Image courtesy of Google Earth.

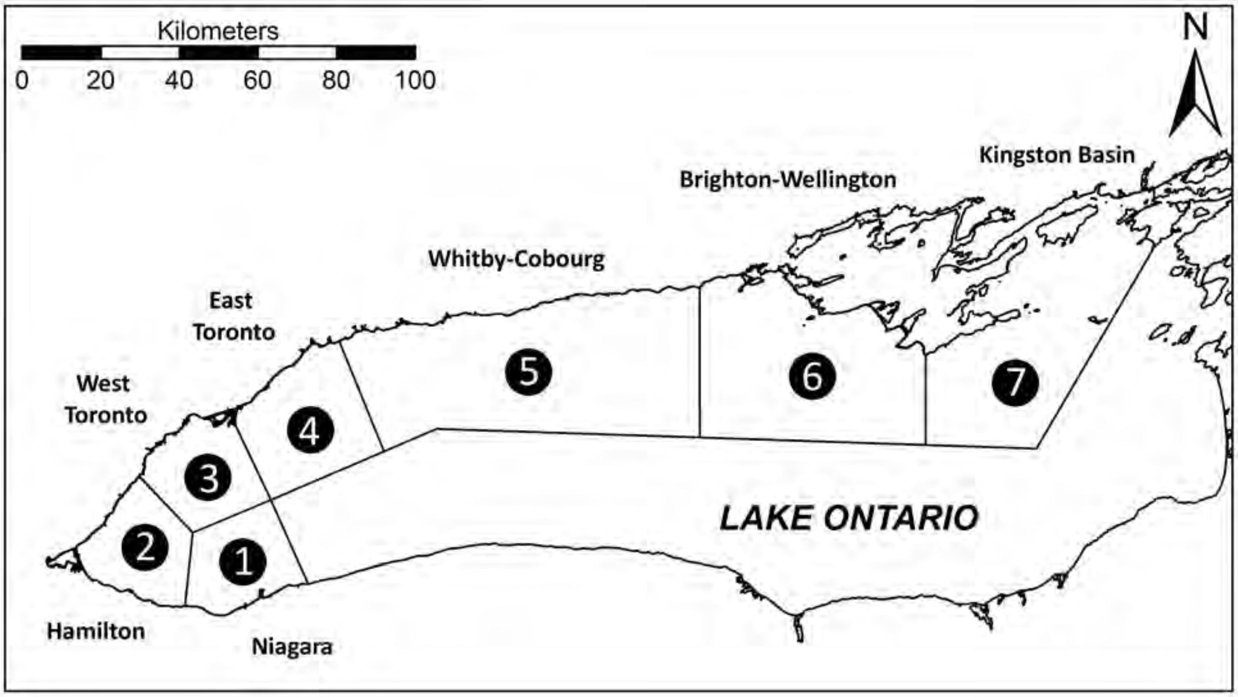

FIG. 2.3.2. Spatial stratification of OMNRF recreational boat angler surveys in Lake Ontario.

TABLE 2.3.1. Distribution of angler catches and targets (in brackets) for the six Lake Ontario salmonid species across seven months (April-September 2015) as reported in the 2015 Lake Ontario Angler Diary Program.

2015 Lake Ontario Angler Diary								
Month	Number of trips	Coho Salmon	Chinook Salmon	Rainbow Trout	Atlantic Salmon	Brown Trout	Lake Trout	Total
April	14	32 (11)	37 (12)	7 (7)	4 (0)	24 (10)	50 (8)	154 (48)
May	135	8 (6)	158 (35)	3 (7)	3 (2)	6 (6)	128 (22)	308 (80)
June	181	15 (13)	55 (41)	6 (12)	0 (0)	6 (22)	37 (13)	115 (84)
July	42	30 (65)	301 (165)	78 (86)	--	6 (32)	82 (13)	497 (377)
August	43	39 (54)	348 (121)	99 (60)	1 (0)	2 (19)	12 (13)	502 (267)
September	20	0 (7)	58 (19)	15 (8)	--	0 (2)	7 (5)	80 (41)
Total	435	124 (156)	957 (393)	208 (180)	10 (2)	39 (74)	316 (90)	1,656 (897)

TABLE. 2.3.2. Distribution of angler catch and targets (in brackets) for the six Lake Ontario salmonid species across six sector locations as reported in the 2015 Lake Ontario Angler Diary Program. See Fig. 2.3.2 for a map of the six defined areas.

2015 Lake Ontario Angler Diary								
Sector	Number of trips	Coho Salmon	Chinook Salmon	Rainbow Trout	Atlantic Salmon	Brown Trout	Lake Trout	Total
Brighton-Wellington	93	0 (21)	130 (84)	2 (22)	--	12 (29)	49 (14)	193 (189)
Whitby-Cobourg	108	47 (43)	222 (80)	113 (69)	4 (1)	21 (18)	18 (10)	425 (247)
East Toronto	10	0 (1)	48 (10)	0 (1)	--	0 (1)	0 (1)	48 (14)
West Toronto	13	7 (2)	51 (13)	2 (2)	1 (0)	--	9 (2)	70 (19)
Hamilton	149	40 (59)	331 (145)	50 (55)	4 (0)	1 (17)	130 (50)	556 (326)
Niagara	43	28 (13)	116 (42)	11 (12)	1 (1)	5 (7)	110 (11)	271 (86)
Other	19	2 (17)	59 (19)	30 (19)	--	0 (2)	0 (2)	91 (59)
Total	435	124 (156)	957 (393)	208 (180)	10 (2)	39 (74)	316 (90)	1,654 (940)

TABLE 2.3.3. Annual angler participation and spatial distribution of Chinook Salmon captured in the Lake Ontario Volunteer Angler Diary Program, 2011-2015. See Fig. 2.3.2 for a map of the six defined areas.

			Chinook Salmon Caught							
Survey year	Number of volunteer anglers	Number of trips	Niagara	Hamilton	West Toronto	East Toronto	Whitby-Cobourg	Brighton-Wellington	Undefined	Total catch
2011	26	626	757	19	370	120	309	635	47	2,257
2012	31	645	676	195	367	39	324	488	147	2,236
2013	21	424	246	145	84	24	105	331	10	945
2014	26	474	376	183	32	4	38	193	3	829
2015	19	435	116	331	51	48	222	130	59	957
Total	123	2,604	2,171	873	904	235	998	1,777	266	6,267

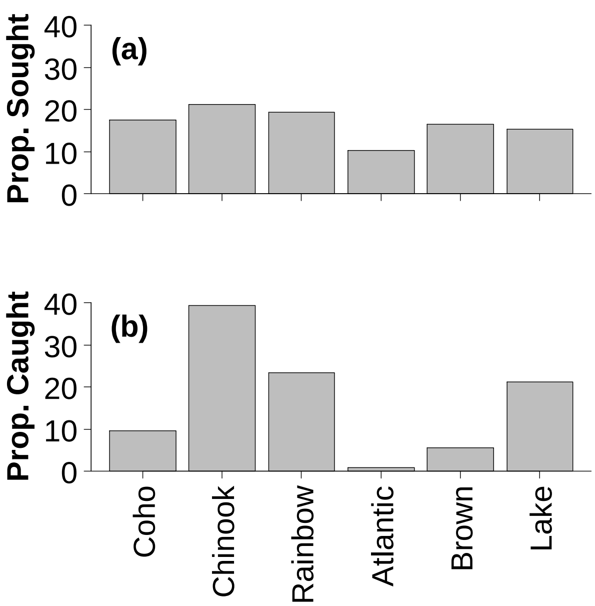

FIG. 2.3.3. Proportion of species sought (a) and caught (b) from all 435 trips recorded in the 19 Lake Ontario Volunteer angler diaries submitted to the Lake Ontario Management Unit. Species labels include Coho Salmon (Coho), Chinook Salmon (Chinook), Rainbow Trout (Rainbow), Atlantic Salmon (Atlantic), Brown Trout (Brown) and Lake Trout (Lake).

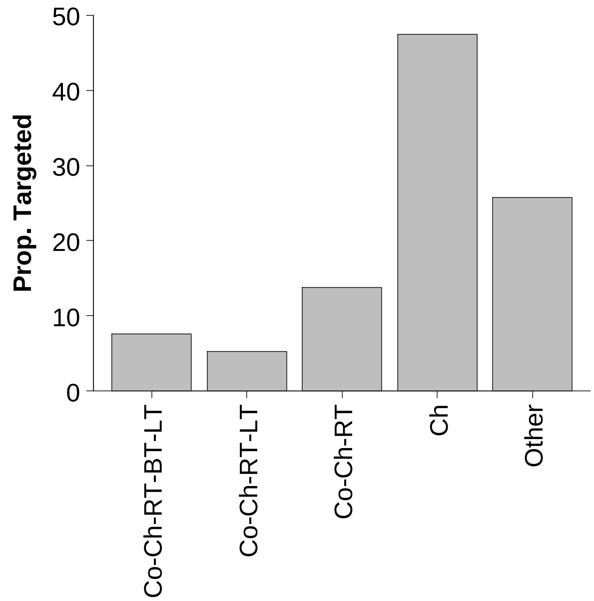

FIG. 2.3.4. Proportion of species combinations that were targeted by anglers in the 2015 Lake Ontario Angler Diary Program. Targeted species include: Coho Salmon (Co), Chinook Salmon (Ch), Rainbow Trout (RT), Atlantic Salmon (AS), Brown Trout (BT) and Lake Trout (LT). Other represents the cumulative sum of proportions for targeted species combinations that were less than 5% frequency of occurrence.

(62%), Chinook Salmon (32%), Brown Trout (31%), Lake Trout (16%) and Atlantic Salmon (10%) (Fig. 2.3.5). No clips were observed on any Coho or Atlantic Salmon caught. Twenty-three percent of Lake Trout, 3% of Chinook Salmon and 7% of Rainbow Trout caught had fin clips (Fig. 2.3.6).

Seasonal and geographical catch summaries are provided in Tables 2.3.1 and 2.3.2 (respectively). Most angling trips were recorded in May and June (73% combined) and originated predominantly from Hamilton, Whitby-Cobourg and Brighton-Wellington sectors (80% of trips). Chinook Salmon were predominantly caught in July and August (68% of catch) and in the Hamilton and Whitby-Cobourg sectors (58% combined). Most Rainbow Trout were caught in July and August (85% combined) and in the Whitby-Cobourg and Hamilton sectors (78% combined). Lastly, Lake Trout were predominantly caught from May to July (94% combined) and predominantly from the Hamilton and Niagara sectors (76% of catch).

We would like to thank all Lake Ontario Volunteer Angler Diary participants who generously volunteered their time to collect marking and biological information for this program. Participants that gave permission for their names to appear in this report include: Herman Baughman, Dan Brown, Bill Cuthill, Blair Cyr, Richard Dew, Al van Dusen , Kevin Gibson, Doug Harasymiw, Ken Herrington, Jean-Marie LaFleche, Jack Laki, Andrew Lalonde, Pierre Leblanc, Jean Morneau, Al Oleksuik, Paul Paulin, Christian Quiron, Stan Smaggas, Shane Thombs, Ken Trumble and Glen Wagner.

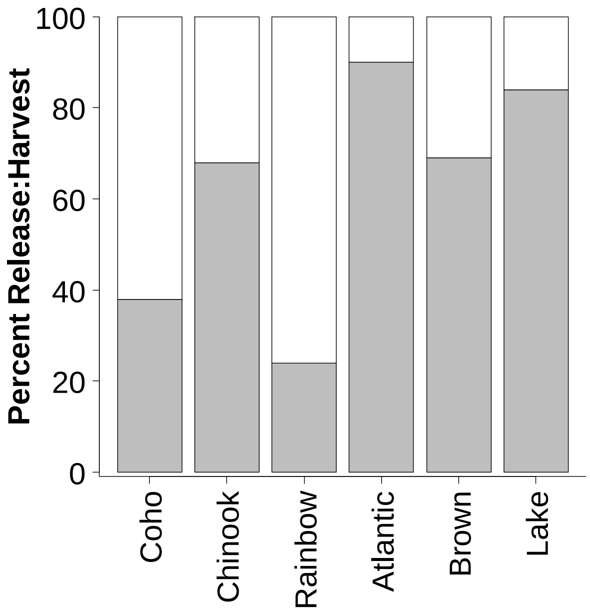

FIG. 2.3.5. Percent released (grey) and harvested (white) for each salmonid species (Coho Salmon (Coho), Chinook Salmon (Chinook), Rainbow Trout (Rainbow) Atlantic Salmon (Atlantic), Brown Trout (Brown) and Lake Trout (Lake)) reported in the 2015 Lake Ontario Angler Diary Program.

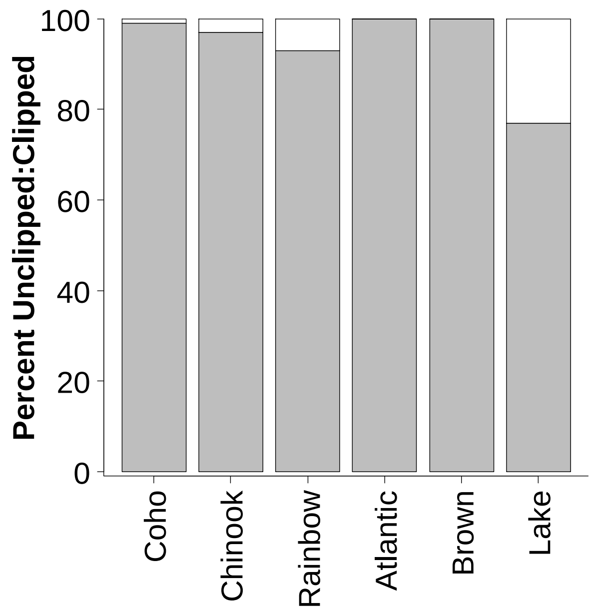

FIG. 2.3.6. Percent composition of unclipped (grey) vs clipped (white) for each salmonid species (Coho Salmon (Coho), Chinook Salmon (Chinook), Rainbow Trout (Rainbow) Atlantic Salmon (Atlantic), Brown Trout (Brown) and Lake Trout (Lake)) reported in the 2015 Lake Ontario Angler Diary Program.

2.4 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—for the first time since 2012—from May 2 (Walleye angling "opening-weekend") until December 20, 2015. Typically the angling survey ends on November 30 or sooner but warm late-fall conditions allowed angling and the angling survey to continue well into December. A roving survey design was employed from Trenton to Lake Ontario ("upper gap"; Fig. 2.4.1). 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 (14 areas; Fig. 2.4.1), season (seven seasons: (1) May 2-3, (2) May 4-24, (3) May 25-Jun 19, (4) Jun 20-Jul 31, (5) Aug 1-31, (6) Sep 1-Oct 11, and (7) Oct 12-Dec 20), and day-type (weekdays and weekend days). A total of 3,857 anglers in 1,732 boats were interviewed by field crews during the survey (Table 2.4.1). Thirty percent of anglers interviewed were local, 60% were from Ontario

TABLE 2.4.1. 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, 2015. Note that the use of 2-lines is only permitted east of Glenora (survey areas 90 and 89; Fig. 2.4.1).

Total angling effort (hours)	204,632
Number of boats checked	1,732
Number of anglers interviewed	3,857
Anglers per boat	2.23
Rods per angler	1.12

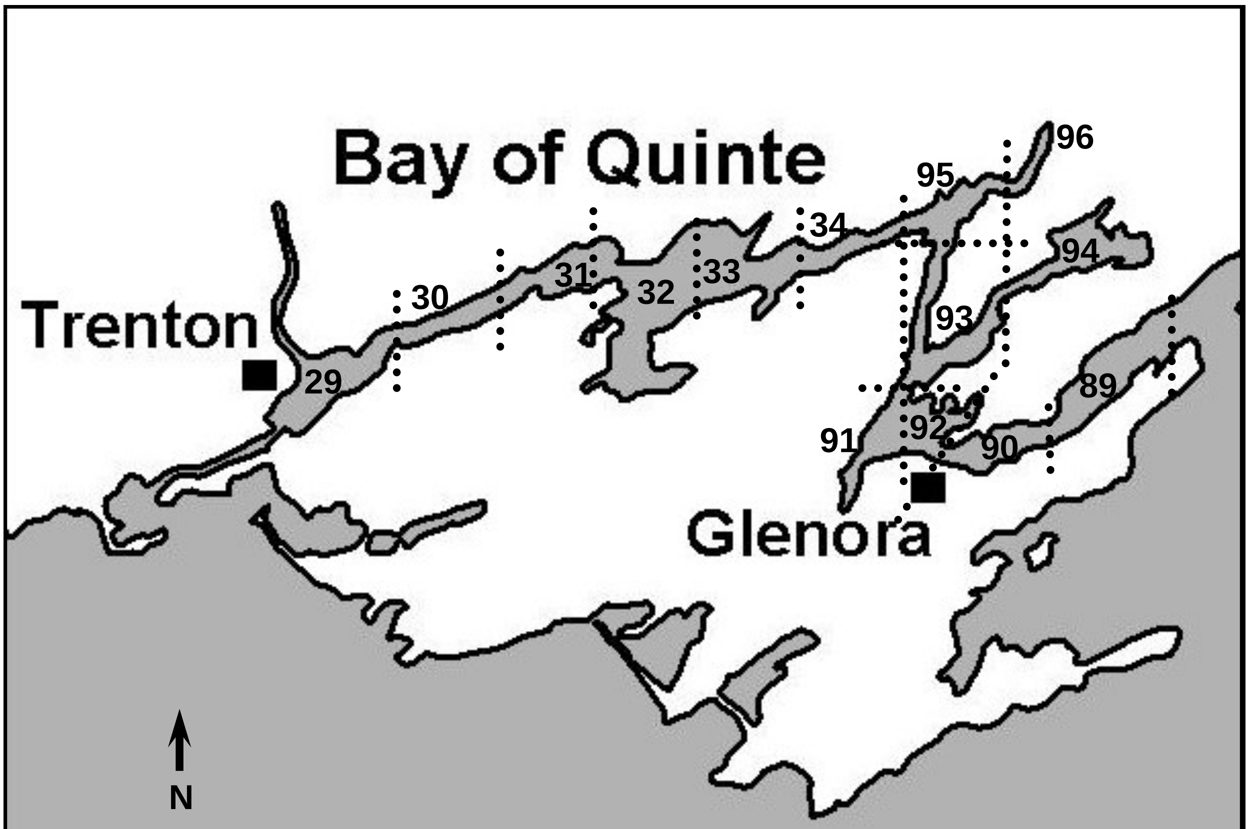

FIG. 2.4.1. Bay of Quinte angling survey areas.

(outside the local area), 6% were from the US, and 4% were from elsewhere in Canada. Total angling effort was estimated to be 204,632 angler hours for all anglers. Anglers caught 21 different species (Table 2.4.2). Eighty-four percent of anglers indicated that they were targeting Walleye and 16% were targeting Largemouth Bass. Fishing effort was 171,337 hours for anglers targeting Walleye, and 32,696 hours for anglers targeting Largemouth Bass (Table 2.4.2 and Table 2.4.3). Numbers of Walleye caught and harvested were 24,446 and 15,667, respectively. Numbers of Walleye caught and harvested per hour by anglers targeting Walleye were 0.142 and 0.091, respectively. Numbers of Largemouth Bass caught and harvested were 17,499 and 4,255 respectively. Numbers of Largemouth Bass caught and harvested per hour by anglers targeting Largemouth Bass were 0.501 and 0.115 respectively. Anglers also caught 45,933 Yellow Perch, 6,252 Northern Pike and 5,627 Freshwater Drum (Table 2.4.2).

The seasonal and regional patterns of Walleye and Largemouth Bass angling effort are depicted in Fig. 2.4.2 and Fig. 2.4.3. Targeted Walleye angling is highest in May and June, generally lowest in September and early October. Most Walleye angling effort occurs in the upper and middle regions of the Bay of Quinte but a

TABLE 2.4.2. Species-specific statistics for the open-water recreational fishery on the Bay of Quinte, 2015. Statistics shown are: targeted angling effort (angler hours), percent of anglers targetting each species, catch and harvest by all anglers, percent of catch caught by anglers targeting that species, percent of fish kept, and the number of fish caught per angler hour (CUE) by anglers targeting that species.

	Angler effort		Catch		Harvest		
Species	Hours	% Targeted	Catch	% Targeted	Harvest	% kept	CUE
Longnose Gar	-	-	230	-	-	0%	-
Bowfin	-	-	39	-	-	0%	-
Chinook Salmon	-	-	8	-	-	0%	-
Brown Trout	75	-		-			-
Lake Trout	284	-	52	-	6	12%	-
Northern Pike	10,084	5	6,252	15	747	12%	0.091
Muskellunge	116	-		-			-
Redhorse	-	-	22	-	-	0%	-
Common Carp	-	-	10	-	-	0%	-
Golden Shiner	145	-		-			-
Brown Bullhead	-	-	217	-	-	0%	-
Channel Catfish	-	-	109	-	-	0%	-
White Perch	-	-	323	-	-	0%	-
White Bass	-	-	594	-	84	14%	-
Rock Bass	133	-	1,079	7	72	7%	0.542
Pumpkinseed	91	-	635	29	297	47%	2.000
Bluegill	625	-	2,130	20	397	19%	0.680
Smallmouth Bass	433	-	680	45	-	0%	0.700
Largemouth Bass	32,696	16	17,499	94	4,255	24%	0.501
Black Crappie	-	-	357	-	328	92%	-
Yellow Perch	2,733	1	45,933	3	1,344	3%	0.523
Walleye	171,337	84	24,446	100	15,667	64%	0.142
Round Goby	-	-	88	-	-	0%	-
Freshwater Drum	1,264	1	5,627	4	166	3%	0.170

TABLE 2.4.3. Angling statistics for Walleye and Largemouth Bass by season surveyed during the open-water recreational fishery on the Bay of Quinte, 2015. "Targeted" statistics refer to anglers targeting the indicated species (Walleye or Largemouth Bass).

	Season							
Angling Statistic	May 2-3	May 4-24	May 25-Jun 19	Jun 20-Jul 31	Aug 1-31	Sep 1-Oct 11	Oct 12-Dec 20	Total
Walleye:								
Catch by All Anglers	1,286	8,854	4,804	1,600	2,953	1,461	3,487	24,446
Catch by Targeted Anglers	1,286	8,854	4,795	1,534	2,953	1,461	3,487	24,370
Harvest by All Anglers	1,196	5,647	3,470	1,173	2,023	1,055	1,103	15,667
Harvest by Targeted Anglers	1,196	5,647	3,470	1,138	2,023	1,055	1,103	15,632
Targeted Effort (angler hours)	19,758	42,055	31,643	16,395	17,439	9,088	34,958	171,337
Targeted Effort (rod hours)	19,987	42,180	31,695	16,579	17,439	9,088	49,113	186,081
All Effort (angler hours)	20,379	42,124	32,060	32,555	26,388	14,744	36,382	204,632
Targeted CUE	0.065	0.211	0.152	0.094	0.169	0.161	0.100	0.142
All Anglers CUE	0.063	0.210	0.150	0.049	0.112	0.099	0.096	0.119
Targeted HUE	0.061	0.134	0.110	0.069	0.116	0.116	0.032	0.091
All Anglers HUE	0.059	0.134	0.108	0.036	0.077	0.072	0.030	0.077
Largemouth Bass:								
Catch by All Anglers	73	366	35	8,510	3,333	3,526	1,656	17,499
Catch by Targeted Anglers				8,350	3,078	3,289	1,656	16,373
Harvest by All Anglers				2,714	420	292	828	4,255
Harvest by Targeted Anglers				2,621	364	292	828	4,106
Targeted Effort (angler hours)				17,372	7,726	6,189	1,409	32,696
Targeted Effort (rod hours)				17,339	7,726	6,189	1,409	32,663
All Effort (angler hours)	20,379	42,124	32,060	32,555	26,388	14,744	36,382	204,632
Targeted CUE				0.481	0.398	0.531	1.175	0.501
All Anglers CUE	0.004	0.009	0.001	0.261	0.126	0.239	0.046	0.086
Targeted HUE				0.151	0.047	0.047	0.588	0.126
All Anglers HUE				0.083	0.016	0.020	0.023	0.021

spike in effort also occurs in the lower Bay in late October through December (Fig. 2.4.2). Targeted Largemouth Bass angling is highest in June and July in the upper Bay of Quinte (Fig. 2.4.3).

Thirteen percent of anglers interviewed after mid-October reported that they were participants in the Bay of Quinte Volunteer Angler Diary Program (see Section 2.5).

Open-water angling fishery trend statistics from 1988-2015 are shown graphically in Fig. 2.4.4 and from 1957-2015 in Table 2.4.4.

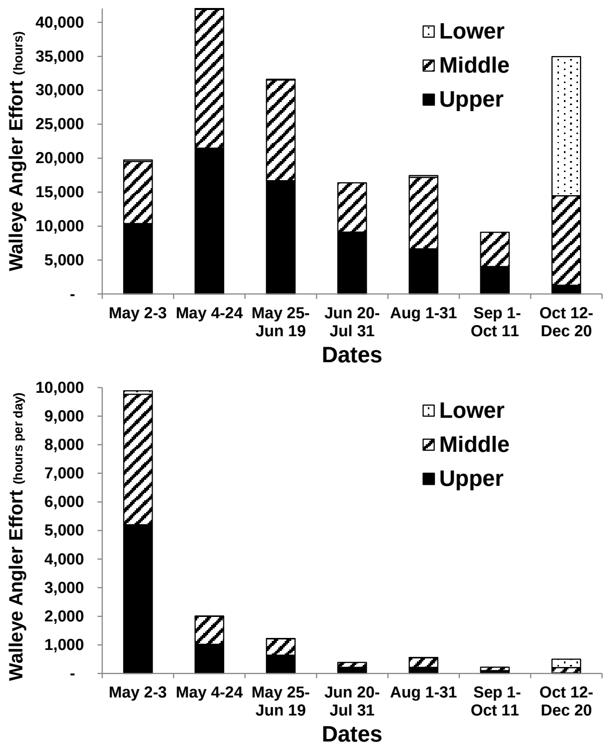

FIG. 2.4.2. Targeted Walleye angling effort (hours, upper panel; hours per day, lower panel) by season and region surveyed in the open-water recreational fishery on the Bay of Quinte, 2015 (regions include the survey areas indicated in Fig. 2.4.1 as follows: upper = 29, 30, 31, 32, 33, 34, 95, 96; middle = 91, 92, 93, 94; lower = 89, 90).

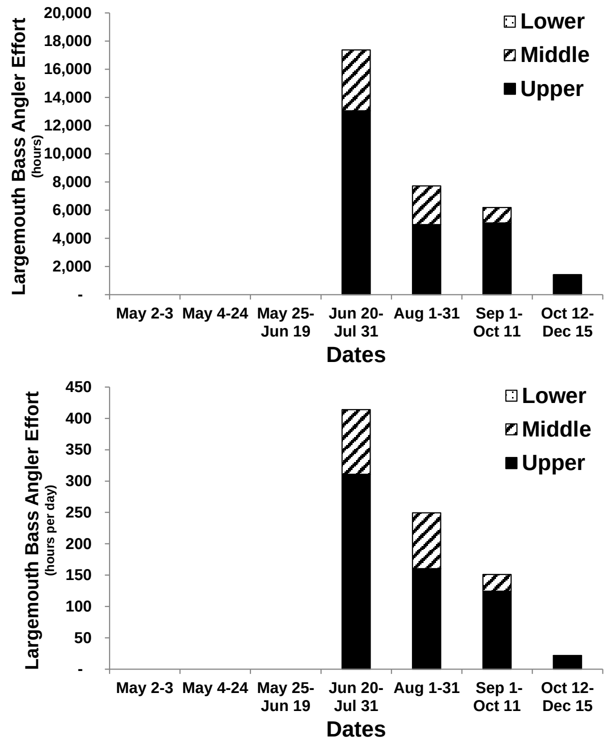

FIG. 2.4.3. Targeted Largemouth Bass angling effort (hours, upper panel; hours per day, lower panel) by season and region surveyed in the open-water recreational fishery on the Bay of Quinte, 2015 (regions include the survey areas indicated in Fig. 2.4.1 as follows: upper = 29, 30, 31, 32, 33, 34, 95, 96; middle = 91, 92, 93, 94; lower = 89, 90).

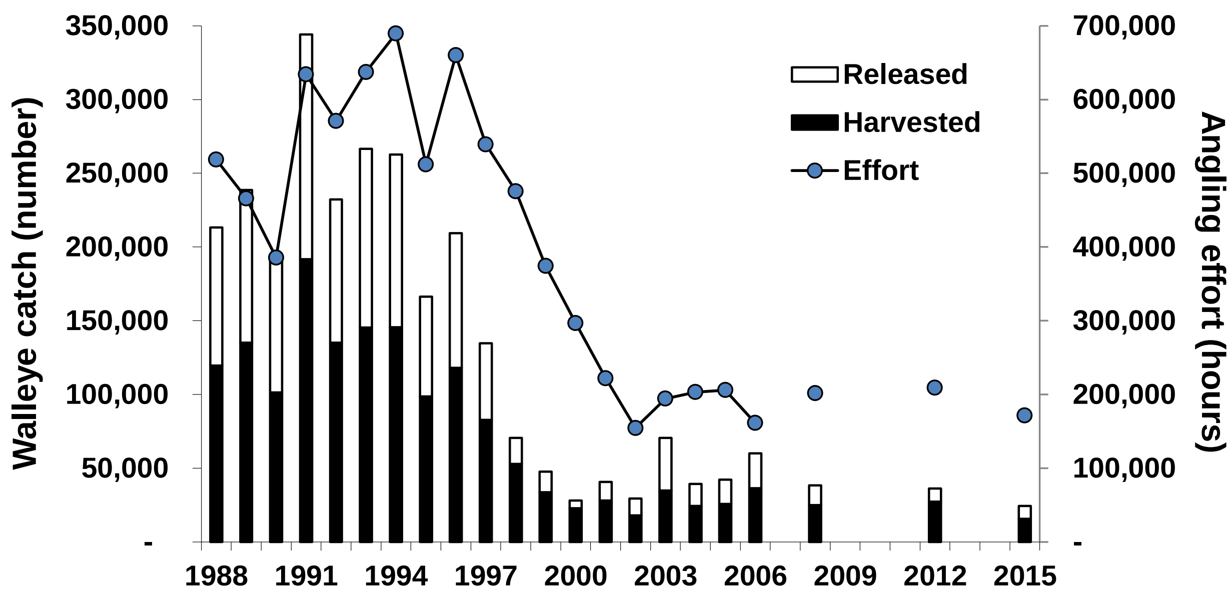

FIG. 2.4.4. Trends in Walleye angling effort and catch (released and harvested), 1988-2015 for the open-water recreational fishery on the Bay of Quinte.

TABLE 2.4.4. Bay of Quinte open-water angling fishery statistics, 1957-2015, 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

2.5 Bay of Quinte Volunteer Walleye Angler Diary Program

J. A. Hoyle, Lake Ontario Management Unit

A volunteer angler diary program was conducted during fall 2015 on the Bay of Quinte. The diary program focused on the popular fall recreational fishery for "trophy" Walleye, primarily on the middle and lower reaches of Bay of Quinte. This was the forth 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. 2.5.1). A total of 26 diaries were returned as of February 2016. We thank all volunteer anglers for participating in the program. A map showing the distribution of volunteer addresses of origin is shown in Fig. 2.5.2.

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.

Four of the 26 returned diaries reported zero fishing trips. The number of fishing trips reported in each of the remaining 22 diaries

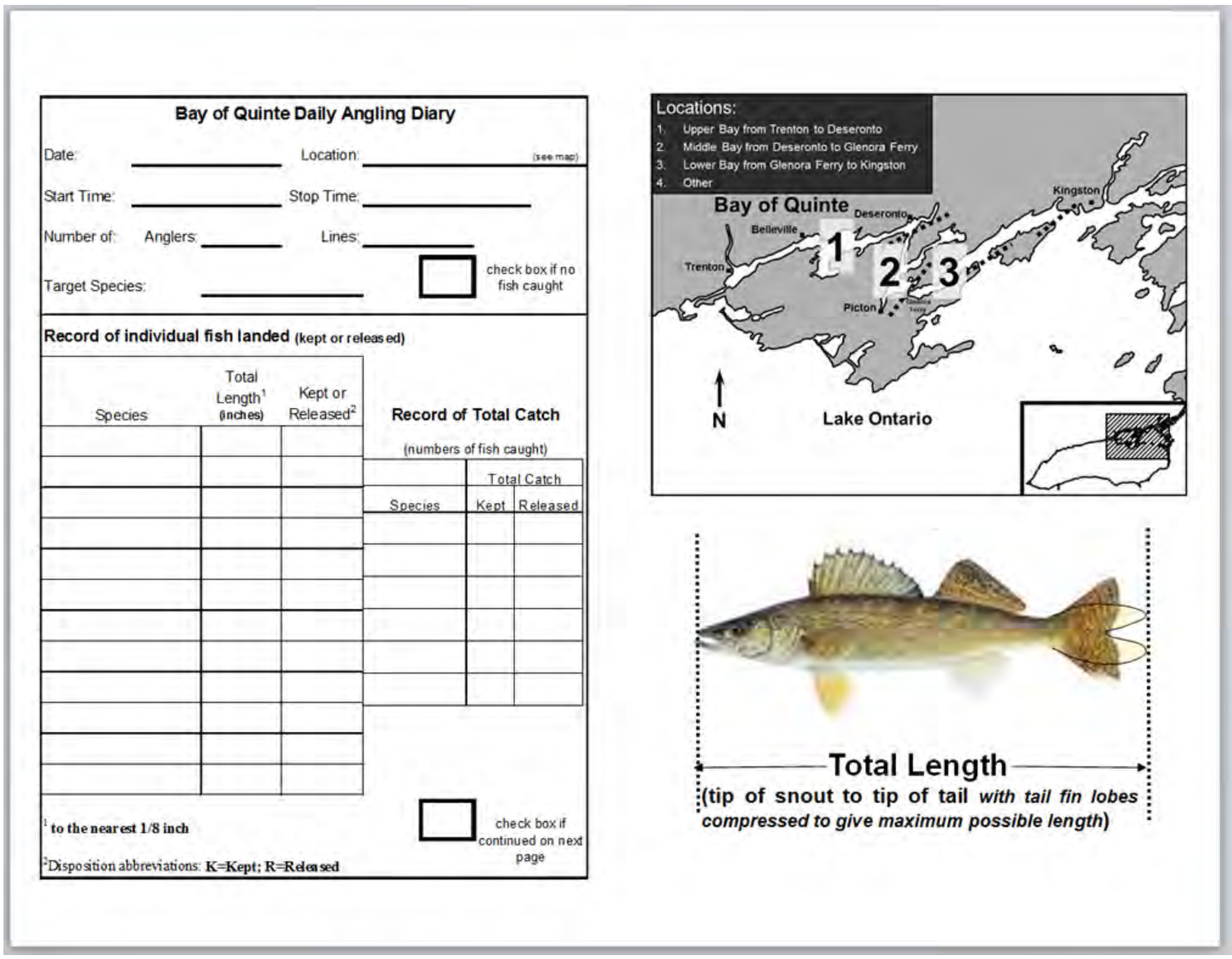

FIG. 2.5.1. Volunteer angler diary used to record information about daily fishing trips and catch.

FIG. 2.5.2. Map showing the distribution of volunteer addresses of origin. Image courtesy of Google Earth.

ranged from two to 23 trips. Fishing trips were reported for 86 out of a possible 121 calendar days from Sep 10, 2015-Jan 8, 2016. There were from one to seven volunteer angler boats fishing on each of the 86 days, and a total of 235 trip reports targeted at Walleye; 118 charter boat trips and 117 non-charter boat trips (Table 2.5.1). Of the 235 trips, 209 (89%) were made on Locations 2 and 3, the middle and lower reaches of the Bay of Quinte (see Fig. 2.5.1). The overall average fishing trip duration was 7.5 hours for charter boats and 5.3 hours for non-charter boats, and the average numbers of anglers per boat trip were 4.3 and 2.0 for charter and non-charter boats, respectively (Table 2.5.1). In Location 3, where two lines are permitted, most anglers used two lines (1.9 rods per angler on average).

Table 2.5.1. 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 2012-2015 on the Bay of Quinte.

		Total number of boat trips	Average trip duration (hours)	Average number of anglers per trip
2012	Charter	121	7.7	4.4
	Non-charter	137	5.6	2.3
2013	Charter	72	7.4	4.0
	Non-charter	84	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	117	5.3	2.0

Fishing Effort

A total of 5,266 angler hours of fishing effort was reported by volunteer anglers (Table 2.5.2). Reported fishing effort increased from September until November and then declined (Fig. 2.5.3). Most (47%) fishing effort occurred in November followed by October (32%). Most fishing effort occurred in Locations 3 (52%; middle Bay) or 2 (39%; lower Bay) (Fig. 2.5.4).

Catch

Ten species and a total of 574 fish were reported caught by volunteer anglers. The number of Walleye caught was 436; 285 (65%) kept and 151 (35%) released (Table 2.5.3). The next most abundant species caught was

Table 2.5.2. 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 2012-2015 on the Bay of Quinte.

Year	2012	2013	2014	2015
Number of diaries	22	19	20	22
Number of boat trips	258	155	210	235
Boat effort (hours)	1,694	941	1,375	1,506
Angler effort (hours)	5,915	3,093	5,164	5,266
Catch	542	574	682	436
Harvest	291	307	336	285
Released	251	267	346	151
Fish per boat trip	2.1	3.7	3.2	1.9
Fish per boat hour	0.320	0.610	0.496	0.289
Fish per angler hour	0.092	0.186	0.132	0.083
"Skunk" rate	36%	19%	27%	34%

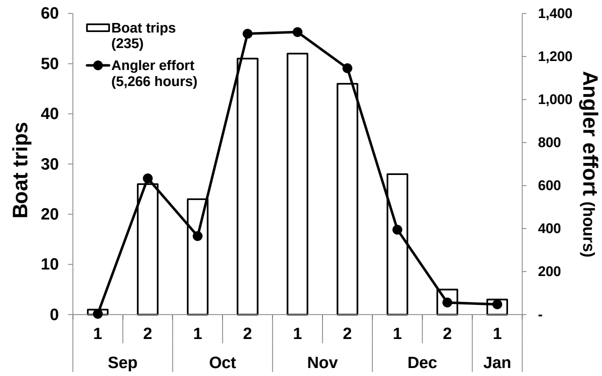

FIG. 2.5.3. Seasonal breakdown (summarized by first and second half of each month from the first half of Sep to the first half of Jan) of fishing effort (boat trips and angler hours) reported by volunteer Walleye anglers during fall 2015/winter 2016 on the Bay of Quinte.

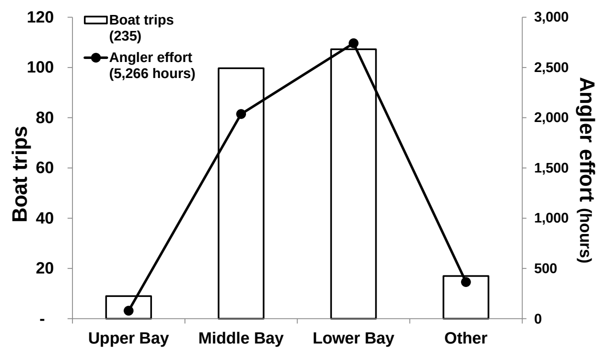

FIG. 2.5.4. Geographic breakdown of fishing effort (boat trips and angler hours) reported by volunteer Walleye anglers during fall 2015/winter 2016 on the Bay of Quinte.

TABLE 2.5.3. Number of fish, by species, reported caught (kept and released) by volunteer anglers during the fall Walleye diary program, 2012 -2015.

	2012			2013			2014			2015		
Species	Kept	Released	Total	Kept	Released	Total	Kept	Released	Total	Kept	Released	Total
Brown Trout	1	0	1	0	0	0	0	1	1	1	0	1
Chinook Salmon	0	1	1	0	0	0	0	2	2	0	0	0
Freshwater Drum	1	43	44	0	25	25	1	53	54	8	81	89
Lake Trout	0	1	1	0	0	0	0	4	4	3	10	13
Lake Whitefish	0	1	1	0	0	0	0	0	0	0	0	0
Morone sp.	1	15	16	0	0	0	0	0	0	0	0	0
Northern Pike	1	47	48	4	20	24	2	36	38	2	14	16
Rainbow Trout	0	0	0	0	0	0	0	3	3	0	0	0
Smallmouth Bass	0	0	0	0	3	3	1	2	3	0	1	1
Sunfish	0	0	0	0	0	0	0	0	0	0	2	2
Walleye	292	252	544	307	267	574	338	350	688	285	151	436
White Bass	0	0	0	0	3	3	0	7	7	9	5	14
White Perch	0	0	0	0	12	12	0	0	0	1	0	1
Yellow Perch	4	32	36	2	6	8	0	0	0	1	0	1
Total	300	392	692	313	336	649	342	458	800	310	264	574

Freshwater Drum (89) followed by Northern Pike (16), White Bass (14), and Lake Trout (13).

Fishing Success

The overall fishing success for Walleye in fall 2015 was 1.9 Walleye per boat trip or 0.083 fish per angler hour of fishing (Table 2.5.2). Fishing success in 2015 was the lowest since the diary program began in 2012. Sixty-six percent of all boat trips reported catching at least one Walleye ("skunk" rate 34%). Seasonal fishing success, for geographic Locations 2 and 3 combined, is shown in Fig. 2.5.5. Success was high in September and low thereafter. Fishing success was higher in location 2 (middle Bay; 2.2 Walleye per boat trip or 0.240 fish per angler hour) than in Location 3 (lower Bay; 1.5 Walleye per boat trip or 0.062 fish per angler hour).

Length Distribution of Walleye Caught

Seventy percent of Walleye caught by volunteer anglers were between 20 and 28 inches in total length (Fig. 2.5.6). The proportion of Walleye released was highest for smallest and largest fish and lowest for fish of intermediate size. Less than 20% of fish caught that were between 20 and 25 inches were released. The mean total length of Walleye caught (harvested and released fish) is shown in Fig. 2.5.7.

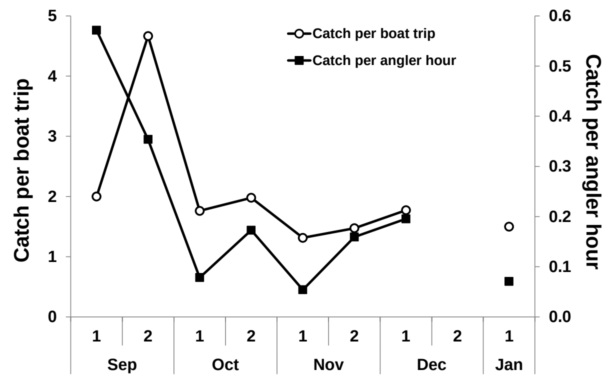

FIG. 2.5.5. Walleye fishing success (catch per boat trip and per angler hour) reported by volunteer Walleye anglers in areas 2 and 3 during fall 2015 on the Bay of Quinte ((summarized by first and second half of each month from the first half of Sep to the first half of Jan).

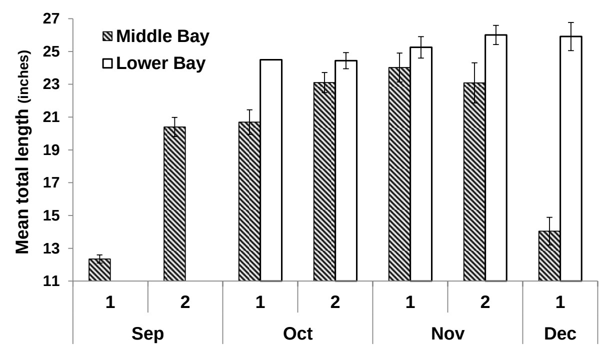

FIG. 2.5.7. Mean total length (inches) of Walleye caught by volunteer Walleye anglers during fall 2015 on the Bay of Quinte by location (summarized by first and second half of each month from the first half of Sep to the first half of Dec). Error bars are +- 1SE.

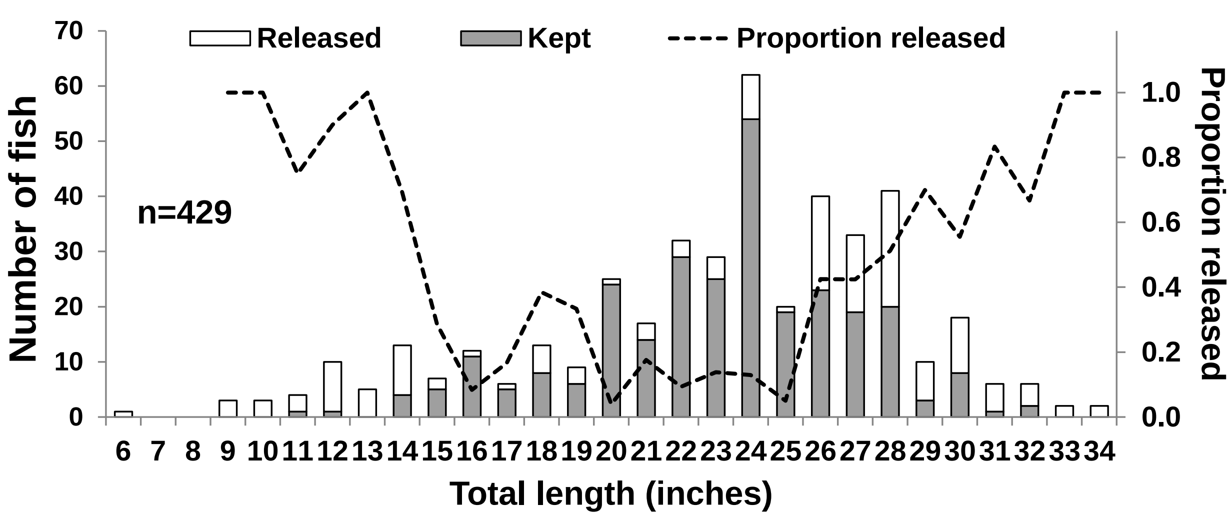

FIG. 2.5.6. Length distribution of 429 Walleye caught (kept and released) by volunteer Walleye anglers during fall 2015 on the Bay of Quinte.

2.6 Lake Ontario Tributary Angling Survey

M. J. Yuille, Lake Ontario Management Unit

Lake Ontario tributaries provide an important recreational fishery for migratory trout and salmon. In addition, these tributaries provide essential spawning habitat for stocked and wild salmon and trout species (i.e., Chinook Salmon, Atlantic Salmon and Rainbow Trout). Currently, the Ontario Ministry of Natural Resources and Forestry (OMNRF) and partners stock over 1.1 million migratory salmon and trout into Lake Ontario tributaries and Lake Ontario proper for the put-grow-take recreational fishery (Section 6). Prior to the implementation of the Lake Ontario Tributary Angling Survey, information about the Lake Ontario tributary fishery along the Canadian shoreline has been limited.

The New York State Department of Environmental Conservation (NYSDEC) conducts a comprehensive tributary angling survey along the south shore of Lake Ontario on a three year cycle (2015-2016 survey currently ongoing) covering the fall, winter and spring tributary fishery (New York State Department of Environmental Conservation 2013). NYSDEC has reported an increase in tributary effort (angler hours spent fishing) from 2005-2012; current estimates suggest angler effort in the U.S. Lake Ontario tributary fishery (approximately 1.6 million hours) represents twice the effort reported in the U.S. Lake Ontario recreational boat fishery (approximately 900,000 hours) (New York State Department of Environmental Conservation 2013). Based on these results, the Lake Ontario tributary fishery (Ontario and U.S.) could have ecological effects on the lake fish community.

Until 2014, the OMNRF had not conducted comprehensive angling survey on Canadian tributaries to Lake Ontario, which has resulted in data gaps for the tributary fishery including (but not limited to):

- Ecological effects of the tributary fishery on the Lake Ontario fisheries and ecosystem
- Current and future economic value of the Lake Ontario tributary fishery
- Seasonal, spatial and species distribution for the tributary fishery including angler effort, catch, harvest practices and behaviors

The Lake Ontario Management Unit implemented the first comprehensive landscape

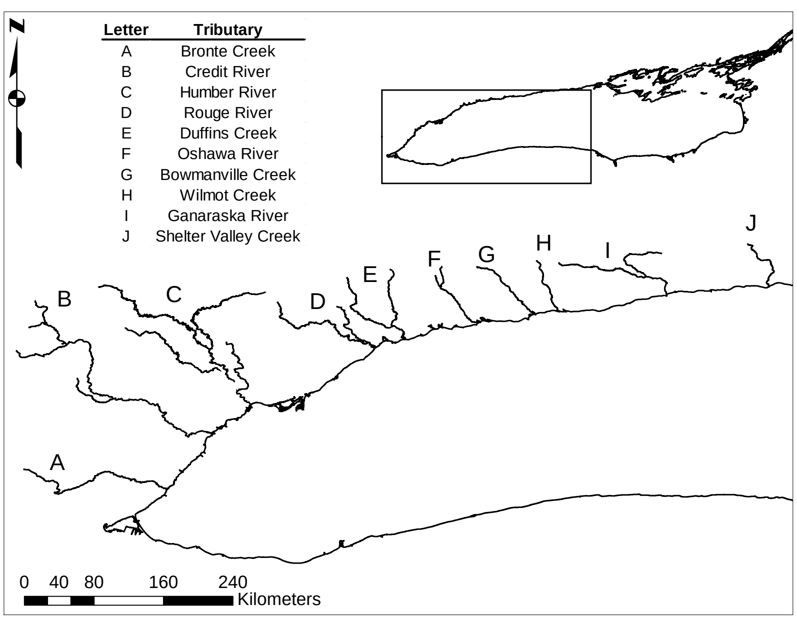

FIG. 2.6.1. Map of the 10 tributaries surveyed in the 2014-2015 Lake Ontario Tributary Angling Survey.

scale Lake Ontario tributary survey from September 5, 2014-May 31, 2015. This survey included 10 Lake Ontario tributaries across the north shore of Lake Ontario (Fig. 2.6.1). The value of this program is multi-facetted, providing critical information on angler effort, catch and harvest as well as characterising some of the behaviours and practices of tributary anglers. This program contributes to the understanding and management of Lake Ontario fisheries as a whole ecosystem as outlined in the 2013 Fish Community Objectives for Lake Ontario.

Questions asked during this survey provide information on angling effort, catch and harvest as well as describe angler preferences (e.g., what fishing method was used?), behaviours (e.g., do anglers always fish the same tributary?) and the economic value of the fishery (e.g., how long does it take to get to your fishing location?).

A total of 2,774 anglers were interviewed out of 11,229 anglers counted in 283 survey days from September 5th, 2014-May 31st, 2015 (Table 2.6.1). During this time, survey staff biologically sampled 117 fish harvested by tributary anglers (6 Coho Salmon, 45 Chinook Salmon, 58 Rainbow Trout, 7 Brown Trout and 1 unidentified salmonid).

Angler Effort

Total estimated effort for all tributaries surveyed in 2014-2015 was 239, 716 angler hours

TABLE 2.6.1. Number of survey days, anglers counted fishing (excluding car counts), number of anglers interviewed (Interviews) and harvested fish biologically sampled (Fish sampled) from September 5, 2014 to May 31, 2015 during the Lake Ontario Tributary Angling Survey.

Year - Month	Survey days	Anglers	Interviews	Fish sampled
2014 – Sept.	30	1,818	505	39
2014 – Oct.	32	1,602	520	29
2014 – Nov.	36	1,064	482	12
2014 – Dec.	36	841	355	3
2015 – Jan.	17	245	15	0
2015 – Feb.	17	138	2	0
2015 – Mar.	17	313	87	2
2015 – Apr.	26	3,329	467	19
2015 – May	72	1,974	341	13
Total	283	11,324	2,774	117

(Table 2.6.2). The Ganaraska River had the highest total angler effort from September 2014-May 2015, followed by the Credit River and Duffins Creek (Table 2.6.2 and Fig. 2.6.2). Seasonally, 55% of the total effort in the tributary fishery occurred in the 2014 fall season (September 1st – November 30th, 2014) followed by spring and winter fishing seasons (23% and 22%, respectively; Fig. 2.6.3). Opening weekend alone (April 25th and 26th, 2015) accounted for 8% of the total estimated effort from 2014-2015. September, 2014 had the highest amount of effort (73,848 angler hours) representing 31% of the estimated 2014-2015 total angler effort followed by April, 2015, October, 2014 and May, 2015 (38,894, 33,948 and 33,241 angler hours, respectively). The middle of the winter season (January and February, 2015) consisted of the lowest monthly angler counts and effort. Lower counts in these months were expected as this time period coincides with the most geographically restrictive fishing regulations. Ontario fishing regulations change in the tributaries through the year, opening and restricting access from the mouth to headwaters of each tributary within Ontario's Fisheries Management Zones. As a result, we would expect angler counts to decline after December 31st, 2014 just due to declines in available fishing areas.

Catch and Harvest

Across all tributaries surveyed, catch per unit effort (CUE) for salmon and trout was

TABLE 2.6.2. Estimated total effort (angler hours) by season: Fall (September 1 to November 30, 2014), Winter (December 1, 2014 to April 24, 2015) and Spring (April 25 to May 31, 2015) for each tributary surveyed in the 2014-2015 Lake Ontario Tributary Angling Survey.

Tributary	Total Effort (angler hours) Fall	Winter	Spring	Total
Bronte Creek	16,823	2,393	4,124	23,340
Credit River	29,114	13,880	6,169	49,163
Humber River	1,208	982	2,143	4,333
Rouge River	3,470	2,449	2,298	8,217
Duffins Creek	18,633	13,970	5,728	38,331
Oshawa River	12,241	8,942	3,225	24,408
Bowmanville Creek	18,776	2,321	7,383	28,480
Wilmot Creek	5,649	2,214	1,981	9,844
Ganaraska River	24,289	5,205	20,226	49,720
Shelter Valley Creek	625	705	2,550	3,880
Total	130,828	53,061	55,827	239,716

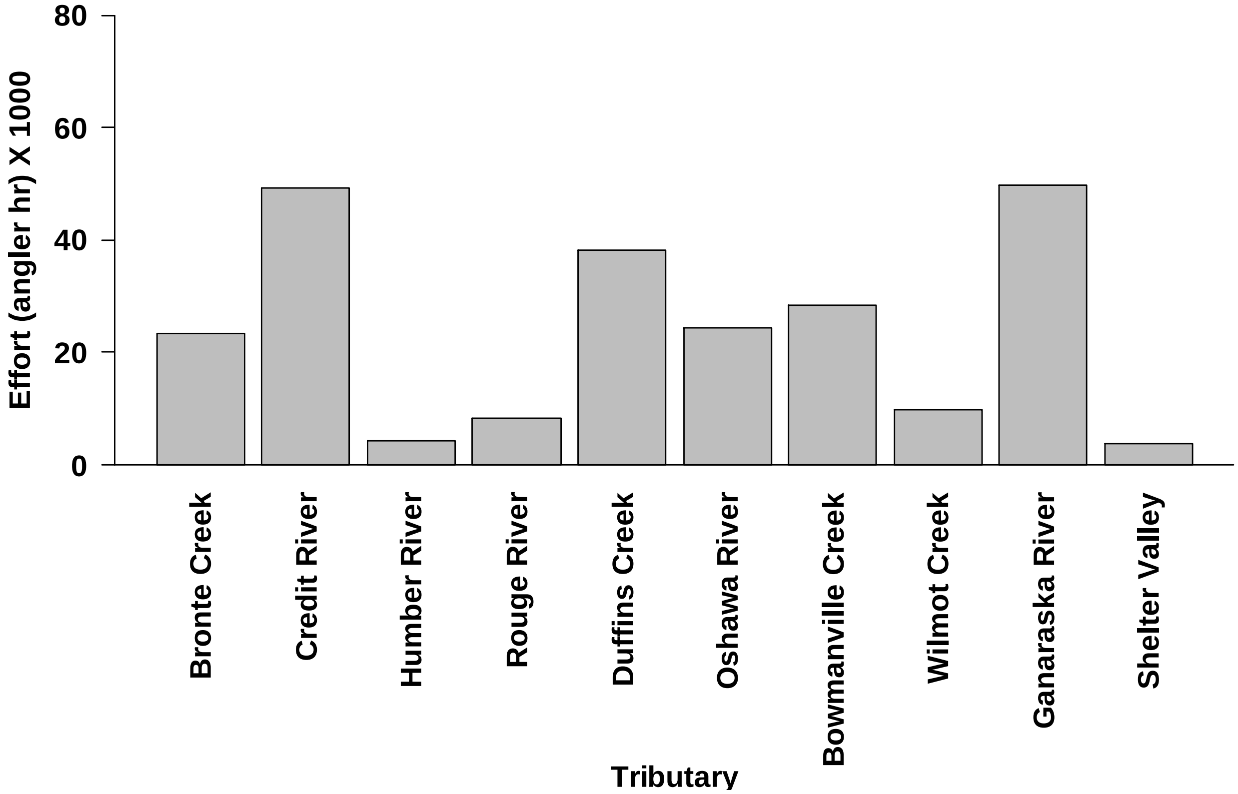

FIG. 2.6.2. Estimated total angling effort from September 1st, 2014 to May 31st, 2015 for each tributary surveyed in the 2014-2015 Lake Ontario Tributary Angling Survey.

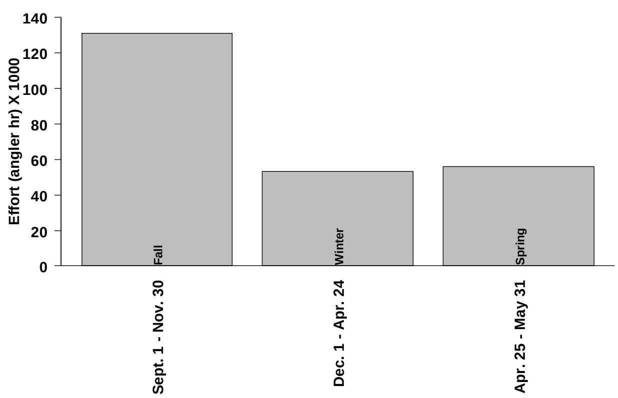

FIG. 2.6.3. Estimated total angling effort in each season (Fall 2014, Winter 2014 and Spring 2015) for all tributaries surveyed in the 2014-2015 Lake Ontario Tributary Angling Survey combined.

highest over spring opening weekend (April 25th and 26th, 2015) and lowest in the fall (September 1st-November 30th, 2014; Table 2.6.3). Across all seasons, CUE for salmon and trout was highest in Shelter Valley Creek, followed by Oshawa River, Ganaraska River and Duffins Creek (Fig. 2.6.4). Species specific CUE and HUE for each migratory salmonine can be found in Tables 2.6.4-2.6.7. Harvest per unit effort (HUE) tended to be low relative to CUE for all seasons surveyed (Tables 2.6.3-2.6.7). Percent released for Coho Salmon in the fall varied between tributaries and ranged from 25-100% (Table 2.6.4). Chinook Salmon release percentages were consistent around 80%, with the exception of Wilmot Creek, where the percent released was 31% (Table 2.6.5). Rainbow Trout release percentages varied between seasons and among tributaries surveyed (Table 2.6.6). Release percentages were highest in the fall followed by winter and spring seasons (92%, 92% and 87%, respectively; Table 2.6.6). Brown Trout release percentages were variable in the fall (39-100%) and were consistent at 100% across all tributaries in the winter and spring seasons (Table 2.6.7).

Angling Method

During the survey, staff recorded the angling method used by the interviewed angler (Fig. 2.6.5). Shoreline drift fishing was the most common fishing method in all tributaries through

TABLE 2.6.3. Average number of fish caught for all anglers (CUE) and harvested (HUE) per angler hour for all migratory salmon and trout across the 10 tributaries surveyed in the 2014-2015 Lake Ontario Tributary Angling Survey.

Season	Date	CUE (fish/hr)	HUE (fish/hr)	% Released
Fall	09/01/2014 to 11/30/2014	0.042	0.006	86
Winter	12/01/2014 to 04/24/2015	0.043	0.003	93
Opener	04/25/2015 to 04/26/2015	0.065	0.007	89
Mid-Opener	04/27/2015 to 05/10/2015	0.040	0.006	85
May	05/11/2015 to 05/31/2015	0.024	0.001	96

each season. Next most common angling methods were: still fishing (8%), spin casting (7%) and fly fishing (8%). The Credit River, Duffins Creek, Oshawa River and Ganaraska River had the highest number of angling methods recorded through the 2014-2015 fishing season, while Shelter Valley Creek had the least number of angling methods employed.

Angler Residency

Tributary anglers were mainly comprised of local (reside less than 30 minutes away from fishing location) and Ontario residents (anglers that reside more than 30 minutes away from their fishing location; Fig. 2.6.6). Western tributaries (Bronte Creek, Credit River, Rouge River, Humber River and Duffins Creek) had higher proportions of local resident anglers (55%) relative to eastern tributaries (Oshawa River, Bowmanville Creek, Wilmot Creek, Ganaraska River and Shelter Valley Creek; 21%), which may be due to higher urbanization/development, leading to easier access across a greater proportion of the tributary as well as higher population densities surrounding western tributaries relative to eastern tributaries. For the whole survey, out of province Canadian anglers made up 1% of the angling community on eastern and western tributaries, while U.S. and international anglers combined represented 1% of the angling community (Fig. 2.6.6). Humber River, Oshawa River and Bowmanville Creek anglers were strictly local and Ontario residents. Four of the 10 tributaries surveyed (Duffins Creek, Wilmot Creek, Ganaraska River and Shelter Valley Creek) had Canadian (non-Ontario) resident anglers. Four of the 10 tributaries surveyed (Bronte Creek, Credit River, Rouge River and Ganaraska River) had U.S.

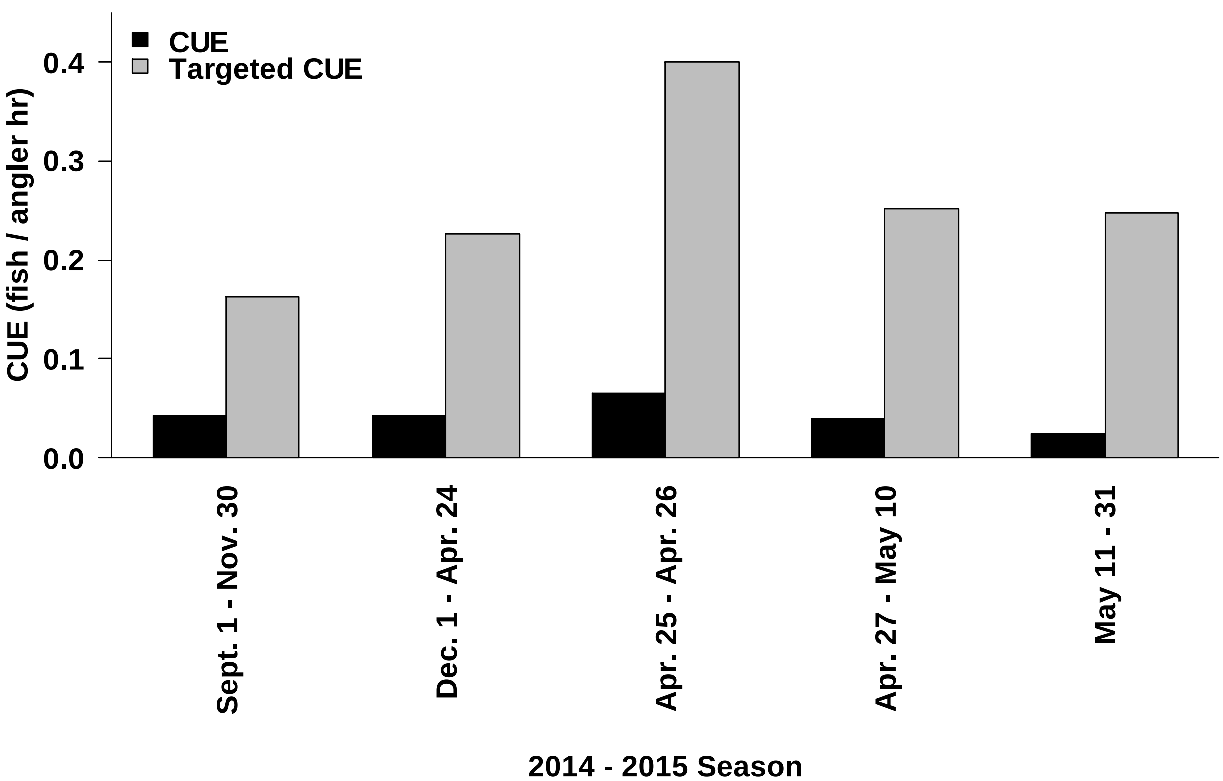

FIG. 2.6.4. Catch per unit effort (black) and targeted catch per unit effort (grey) for all migratory salmon and trout species in each tributary from September 1st, 2014 to May 31st, 2015.

TABLE 2.6.4.Estimated catch for all anglers (rate), anglers specifically targeting Coho Salmon (targeted), and harvest and their respective rates (fish/angler hour) for Coho Salmon by tributary in the fall (September 1 to November 30, 2014). No Coho Salmon were reported caught after the Fall timeframe.

		Catch		Harvest		%
Tributary	Rate	Targeted	Number	Rate	Number	Released
Bronte Creek	0.002	0.007	34	0.000	0	100
Credit River	0.002	0.009	58	0.000	0	100
Humber River	0.000	0.000	0	--	--	--
Rouge River	0.000	0.000	0	--	--	--
Duffins Creek	0.002	0.118	37	0.000	0	100
Oshawa River	0.000	0.000	0	--	--	--
Bowmanville Creek	0.008	0.287	150	0.006	113	25
Wilmot Creek	0.059	0.285	333	0.007	40	88
Ganaraska River	0.033	0.190	802	0.009	219	73
Shelter Valley Creek	0.000	0.000	0	--	--	--
Total			1,414		371	

TABLE 2.6.5. Estimated catch for all anglers (Rate), anglers specifically targeting Chinook Salmon (Targeted) and harvest and their respective rates (fish/angler hour) for Chinook Salmon by tributary in the fall (September 1 to November 30, 2014). No Chinook Salmon were reported caught after the Fall timeframe.

		Catch		Harvest		%
Tributary	Rate	Targeted	Number	Rate	Number	Released
Bronte Creek	0.090	0.152	1,514	0.016	269	82
Credit River	0.032	0.089	932	0.005	146	84
Humber River	0.106	0.790	128	0.035	42	67
Rouge River	0.000	0.000	0	--	--	--
Duffins Creek	0.120	0.431	2,236	0.020	373	83
Oshawa River	0.078	0.207	955	0.017	208	78
Bowmanville Creek	0.143	0.617	2,685	0.027	507	81
Wilmot Creek	0.044	0.334	249	0.030	169	32
Ganaraska River	0.272	0.771	6,607	0.050	1,214	82
Shelter Valley Creek	0.000	0.000	0	--	--	--
Total			15,305		2,929	

TABLE 2.6.6. Estimated catch for all anglers (rate), anglers specifically targeting Rainbow Trout (targeted) and harvest and their respective rates (fish/angler hour) for Rainbow Trout by tributary and for the fall (September 1 to November 30, 2014) and winter (December 1, 2014 to April 24, 2015) and spring (April 25 to May 31, 2015) fishing seasons.

	Fall						Winter						Spring					
		Catch		Harvest		%		Catch		Harvest		%		Catch		Harvest		%
Tributary	Rate	Targeted	Num.	Rate	Num.	Released	Rate	Targeted	Num.	Rate	Num.	Released	Rate	Targeted	Num.	Rate	Num.	Released
Bronte Creek	0.080	0.125	1,346	0.004	67	95	0.111	0.112	266	0.007	17	94	0.396	0.448	1,633	0.024	99	94
Credit River	0.092	0.148	2,678	0.008	233	91	0.142	0.149	1,971	0.007	97	95	0.111	0.171	685	0.012	74	89
Humber River	0.000	0.000	0	--	--	--	0.029	0.029	28	0.000	0	100	0.032	0.079	69	0.000	0	100
Rouge River	0.057	0.092	198	0.011	38	81	0.414	0.414	1,014	0.000	0	100	0.000	0.000	--	--	--	--
Duffins Creek	0.162	0.236	3,019	0.027	503	83	0.355	0.362	4,959	0.018	251	95	0.484	0.495	2,772	0.026	149	95
Oshawa River	0.101	0.273	1,236	0.000	0	100	0.505	0.505	4,516	0.019	170	96	0.781	0.781	2,519	0.000	0	100
Bowmanville Creek	0.111	0.175	2,084	0.013	244	88	0.254	0.265	590	0.063	146	75	0.226	0.226	1,669	0.042	310	81
Wilmot Creek	0.177	0.403	1,000	0.015	85	92	0.270	0.270	598	0.101	224	63	0.247	0.247	489	0.114	226	54
Ganaraska River	0.157	0.271	3,813	0.005	121	97	0.173	0.176	900	0.011	57	94	0.284	0.283	5,744	0.062	1,254	78
Shelter Valley Creek	0.405	0.909	253	0.000	0	100	1.144	1.144	807	0.000	0	100	0.373	0.373	951	0.032	82	91
Total			15,628		1,292				15,648		962				16,531		2,193	

TABLE 2.6.7. Estimated catch for all anglers (Rate), anglers specifically targeting Brown Trout (Targeted) and harvest and their respective rates (fish/angler hour) for Brown Trout by tributary and for the fall (September 1 to November 30, 2014) and winter (December 1, 2014 to April 24, 2015) and spring (April 25 to May 31, 2015) fishing seasons.

	Fall						Winter						Spring					
		Catch		Harvest		%		Catch		Harvest		%		Catch		Harvest		%
Tributary	Rate	Targeted	Num.	Rate	Num.	Released	Rate	Targeted	Num.	Rate	Num.	Released	Rate	Targeted	Num.	Rate	Num.	Released
Bronte Creek	0.040	0.086	673	0.002	34	95	0.026	0.051	62	0.000	0	100	0.000	0.000	0	--	--	--
Credit River	0.002	0.020	58	0.000	0	100	0.009	0.051	125	0.000	0	100	0.000	0.000	0	--	--	--
Humber River	0.000	0.000	0	--	--	--	0.000	0.000	0	--	--	--	0.000	--	--	--	--	--
Rouge River	0.000	0.000	0	--	--	--	0.000	0.000	0	--	--	--	0.000	--	--	--	--	--
Duffins Creek	0.018	0.138	335	0.011	205	39	0.014	0.076	196	0.000	0	100	0.000	--	--	--	--	--
Oshawa River	0.034	0.140	416	0.000	0	100	0.005	0.096	45	0.000	0	100	0.000	0.000	0	--	--	--
Bowmanville Creek	0.023	0.068	432	0.006	113	74	0.013	0.072	30	0.000	0	100	0.009	--	66	0.000	0	100
Wilmot Creek	0.022	0.102	124	0.007	40	68	0.000	--	0	--	--	--	0.000	0.000	0	--	--	--
Ganaraska River	0.009	0.105	219	0.002	49	78	0.000	0.000	0	--	--	--	0.004	0.415	81	0.000	0	100
Shelter Valley Creek	0.000	0.000	0	--	--	--	0.000	--	0	--	--	--	0.000	--	0	--	--	--
Total			2,257		439				458		0				147		0	

resident anglers. The Ganaraska River was the only tributary that had all five angler resident categories participating in the river fishery.

Number of Anglers per Car

Across all seasons and tributaries surveyed the average number of anglers per car was 2.7 (range of 2.4 in Oshawa River to 2.9 in the Ganaraska River and Wilmot Creek). The distribution and average number of anglers per car was fairly consistent between tributaries.

Of the anglers that did not use a vehicle to get to their fishing location (83 of 1,317 respondents): 51 walked, 16 biked and 16 took

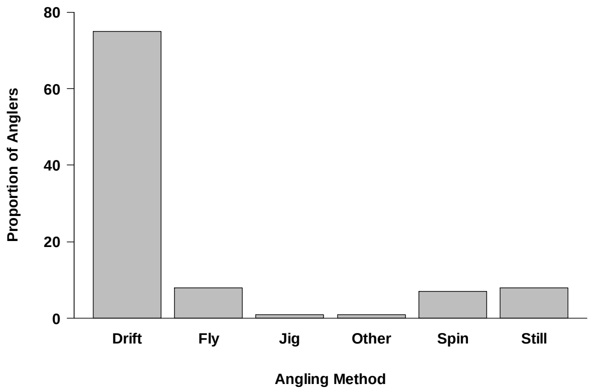

FIG. 2.6.5. Distribution of angling methods employed by tributary anglers interviewed in the 2014-2015 Lake Ontario Tributary Angling Survey. Proportions represent data pooled across tributaries

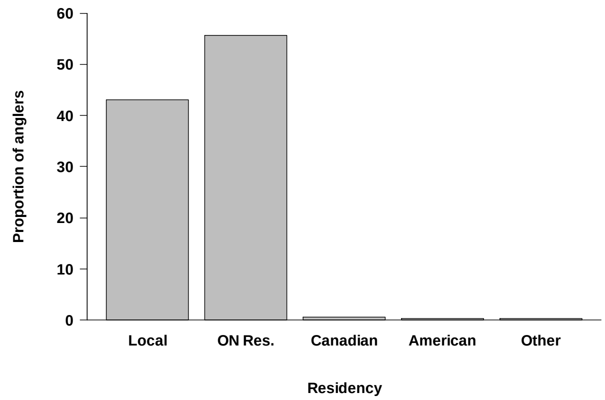

FIG. 2.6.6. Distribution of angler residency for tributary anglers interviewed in the 2014-2015 Lake Ontario Tributary Angling Survey. Proportions represent data pooled across tributaries and seasons.

public transportation to their fishing location.

Comparison of angler effort on the Ganaraska River in 1998 and 2015

In the spring of 1998, the Lake Ontario Management Unit conducted an angling survey on the Ganaraska River to determine the level of exploitation of Rainbow Trout by stream anglers (Ontario Ministry of Natural Resources 1999). In the current survey, the same locations and design were used on the Ganaraska River to compare current levels of effort to this previous survey in 1998. Total angler effort on the Ganaraska River from spring opening weekend to the end of May was lower in 2015 compared to estimates from the 1998 survey (20,226 in 2015 to 24,400 in 1998 total angler hours; Table 2.6.8). During the opening weekend, angler effort in 2015 (9,180 angler hours) was lower than 1998 estimates (10,770; Table 2.6.8). In the two weeks following opening weekend (mid-opening season), angler effort in 2015 (8,636 angler hours) was lower than estimates from 1998 (12,306 angler hours; Table 2.6.8). Lastly, angler effort during the remainder of May in 2015 (2,410 angler hours) was higher than estimates from the 1998 survey (1,324 angler hours; Table 2.6.8). In each seasonal strata (Opening weekend, Mid-Opener and May) CUE was lower in 2015 compared to 1998; HUE was lower in 2015 on Opening weekend, but higher during Mid-Opener and May in 2015 compared to 1998 (Table 2.6.8). For full details on the 1998 Ganaraska River Angling Survey please refer to the Ontario Ministry of Natural Resources (1999).

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Ontario Ministry of Natural Resources. 1999. Lake Ontario Fish Communities and Fisheries: 1998 Annual Report of the Lake Ontario Management Unit. Ontario Ministry of Natural Resources, Picton, Ontario, Canada. Available at: http://www.glfc.org/lakecom/loc/mgmt_unit/index.html

TABLE 2.6.8. Comparison of angler survey results from the 1998 Rainbow Trout Angler Survey and the 2015 Lake Ontario Tributary Angling Survey on the Ganaraska River, Port Hope, Ontario.

Season	1998 Spring Angler Effort (angler-hr)	CUE	HUE	2015 Spring Angler Effort (angler-hr)	CUE	HUE
Opening Weekend	10,770	0.4	0.1	9,180	0.31	0.07
Mid-Opener	12,306	0.47	0.05	8,636	0.27	0.06
May	1,324	0.4	0.01	2,410	0.29	0.04
Total	24,400	0.44	0.07	20,226	0.29	0.06

3. Commercial Fishery

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

A. Mathers, 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 (OCFA), 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. During 2015, Quota Zone representatives were elected to the LOLC (3-year term) and the Terms of Reference for the committee was reviewed.

The committee met three times during 2015. One of the topics of discussion was the expansion of the American Eel trap and transport program (Section 8.3) to include a fall season. Other notable topics of discussion at the LOLC meetings included status of fish stocks, licence restrictions, quota and harvest levels for Yellow Perch, Lake Whitefish and Walleye, observation of Grass Carp in Lake Ontario (Section 10.3), Lake Ontario commercial fish program review, and Double-Crested Cormorant management policy.

3.2 Quota and Harvest Summary

J. A. Hoyle, Lake Ontario Management Unit

Lake Ontario supports a commercial fish industry; the commercial harvest comes primarily 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). Commercial harvest statistics for 2015 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 2014, 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 366,705 lb ($493,364) in 2015, up 7,699 lb (2%) from 2014. The harvest (landed value) for Lake Ontario, the St. Lawrence River, and East and West Lakes was 279,670 lb ($391,869), 57,770 lb ($66,138), and 29,265 lb ($36,708), respectively (Fig. 3.2.2 and Fig. 3.2.3). Lake Whitefish, Yellow Perch and Sunfish 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.

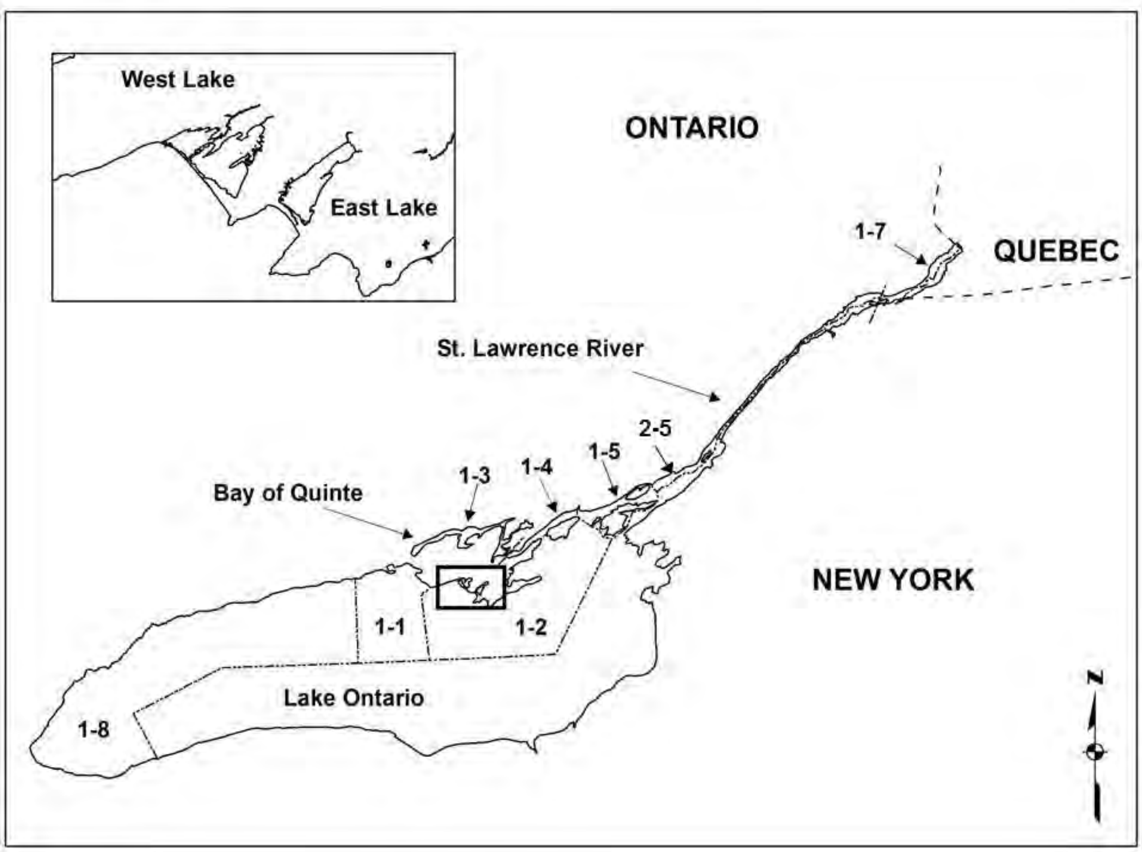


FIG. 3.2.1. Map of Lake Ontario and the St. Lawrence River showing commercial fishing quota zones in Canadian waters.

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), 2015.

	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	2,800	14,170	17,590	4,840	3,100	9,850	26,264	36,600	75,814
Bowfin	0	0	0	0	500	0	0	0	0	0	500	0	500
Brown Bullhead	36,200	0	0	0	0	0	0	0	14,350	27,220	36,200	0	77,770
Lake Whitefish	7,275	76,023	13,675	20,313	208	0	0	0	0	0	117,494	0	117,494
Sunfish	28,130	0	0	0	0	0	0	0	14,600	18,080	28,130	0	60,810
Walleye	4,255	33,808	0	9,683	800	0	0	0	0	0	48,546	0	48,546
Yellow Perch	35,590	143,473	100,928	126,170	13,000	68,976	82,814	18,048	1,400	4,420	419,161	169,838	594,819
Total	115,990	256,304	129,427	157,266	17,308	83,146	100,404	22,888	33,450	59,570	676,295	206,438	975,753

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), 2015.

	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	12,712	650	1,400	7,635	8,795	4,840	3,100	9,850	18,532	21,270	52,752
Bowfin	0	0	0	0	500	0	0	0	0	0	500	0	500
Brown Bullhead	36,200	0	0	0	0	0	0	0	14,350	27,220	36,200	0	77,770
Lake Whitefish	2,230	139,169	9,051	4,692	104	0	0	0	0	0	155,246	0	155,246
Sunfish	28,130	0	0	0	0	0	0	0	14,600	18,080	28,130	0	60,810
Walleye	1,335	11,882	0	22,864	400	0	0	0	0	0	36,481	0	36,481
Yellow Perch	17,795	74,140	58,387	67,069	6,500	34,488	41,407	18,048	1,400	4,420	223,891	93,943	323,654
Total	87,960	226,691	80,150	95,275	8,904	42,123	50,202	22,888	33,450	59,570	498,980	115,213	707,213

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), 2015.

	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	86	0	6,601	29	0	1,904	573	198	6	3,206	6,716	2,675	12,603
Bowfin	644	0	2,367	0	0	640	1,694	138	219	464	3,011	2,472	6,166
Brown Bullhead	21	7	6,021	123	0	0	3,037	17,442	107	145	6,172	20,479	26,903
Common Carp	0	117	2,357	5,463	0	138	67	0	0	260	7,937	205	8,402
Freshwater Drum	6	156	9,188	9,708	0	0	0	0	0	0	19,058	0	19,058
Cisco	116	101	3,664	709	0	0	0	0	0	46	4,590	0	4,636
Lake Whitefish	2,155	123,046	5,149	735	0	0	0	0	0	0	131,085	0	131,085
Northern Pike	2,739	470	12,890	2,422	0	3,420	0	0	226	1,907	18,521	3,420	24,074
Rock Bass	1,681	596	3,297	512	0	231	250	155	1,438	1,062	6,086	636	9,222
Sunfish	3,106	0	19,315	138	0	1,560	766	558	9,758	7,894	22,559	2,884	43,095
Walleye	1,038	1,224	0	14,509	0	0	0	0	0	0	16,771	0	16,771
White Bass	0	23	154	512	0	0	0	0	0	0	689	0	689
White Perch	10	8	624	139	0	31	0	0	194	1,352	781	31	2,358
White Sucker	44	347	3,986	2,044	0	363	186	0	33	251	6,421	549	7,254
Yellow Perch	537	4,795	16,715	7,226	0	2,900	5,499	16,020	255	442	29,273	24,419	54,389
Total	12,183	130,890	92,328	44,269	0	11,187	12,072	34,511	12,236	17,029	279,670	57,770	366,705

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, 2015.

	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	6,716	$3.44	$23,119	2,675	$2.72	$7,284	12,603	$3.17	$39,940
Bowfin	3,011	$0.39	$1,179	2,472	$0.81	$2,012	6,166	$0.59	$3,656
Brown Bullhead	6,172	$0.21	$1,304	20,479	$0.42	$8,677	26,903	$0.39	$10,503
Common Carp	7,937	$0.14	$1,109	205	$0.35	$71	8,402	$0.15	$1,277
Freshwater Drum	19,058	$0.09	$1,772	0		$0	19,058	$0.09	$1,772
Cisco	4,590	$0.24	$1,080	0		$0	4,636	$0.23	$1,081
Lake Whitefish	131,085	$1.65	$216,679	0		$0	131,085	$1.65	$216,679
Northern Pike	18,521	$0.31	$5,689	3,420	$0.32	$1,091	24,074	$0.30	$7,291
Rock Bass	6,086	$0.62	$3,793	636	$0.75	$480	9,222	$0.65	$5,998
Sunfish	22,559	$1.26	$28,321	2,884	$1.14	$3,276	43,095	$1.22	$52,457
Walleye	16,771	$2.49	$41,837	0		$0	16,771	$2.49	$41,837
White Bass	689	$0.55	$376	0		$0	689	$0.55	$376
White Perch	781	$0.48	$377	31	$0.51	$16	2,358	$0.51	$1,214
White Sucker	6,421	$0.10	$665	549	$0.10	$55	7,254	$0.10	$759
Yellow Perch	29,273	$2.21	$64,569	24,419	$1.77	$43,177	54,389	$2.00	$108,523
Total	279,670		$391,869	57,770		$66,138	366,705		$493,364

3.2.5) respectively. In 2014, harvest declined again in both major geographic areas. In 2015, harvest declined in the St. Lawrence River and increased slightly in Lake Ontario.

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 2015 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, only 7% (54,389 lb) of the Yellow Perch base quota was harvested in 2015. The highest Yellow Perch harvest came from quota zones 1-3 and 1-7. A very small proportion of base quota was harvested in most quota zones.

Trends in Yellow Perch quota (base), harvest and price-per-lb are shown Fig. 3.2.7. Quota has remained more or less constant since 2000 except in quota zone 1-7 where quota increased significantly after 2009 and allowed for increased harvest. In quota zone 1-7, all base quota was issued and, in recent years, most quota was harvested until 2014 when harvest declined. As a result, base quota was deceased for 2015; harvest increased slightly in 2015. In quota zone 1-2, harvest has declined significantly since the early 2000s . Harvest decreased in all the major quota zones in 2015, except in zone 1-7 (Fig. 3.2.7).

Lake Whitefish

Lake Whitefish 2015 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, 112% (131,085 lb) of the Lake Whitefish base quota was harvested in 2015. Most of the Lake Whitefish harvest came from quota zone 1-2. Lake Whitefish is managed as

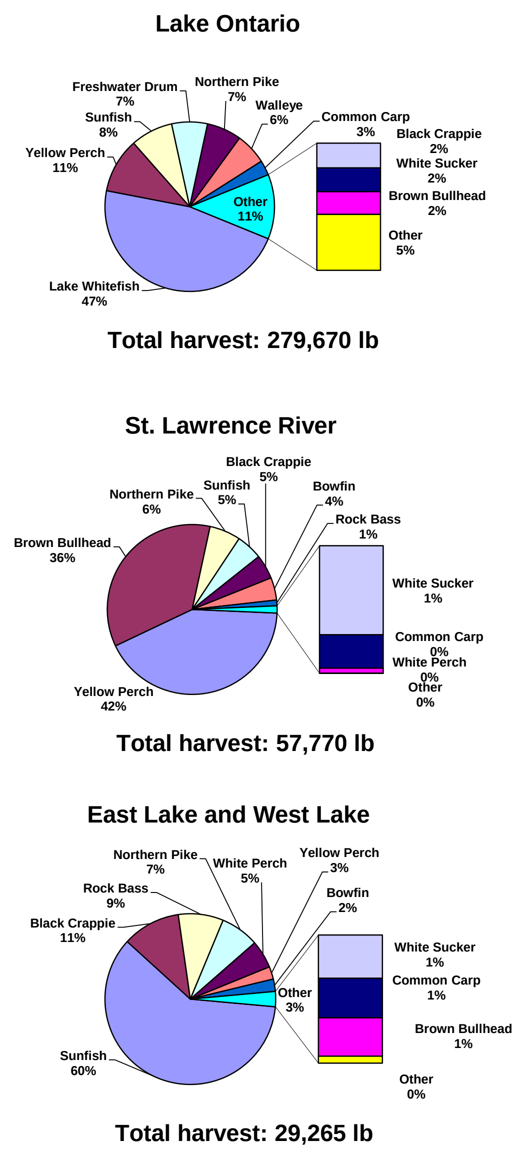


FIG. 3.2.2. Pie-charts showing breakdown of 2015 commercial harvest by species **(% by weight)** for Lake Ontario (quota zones 1-1, 1-2, 1-3, 1-4 and 1-8), the St. Lawrence River (quota zones 1-5, 2-5 and 1-7), and for East and West Lakes combined.

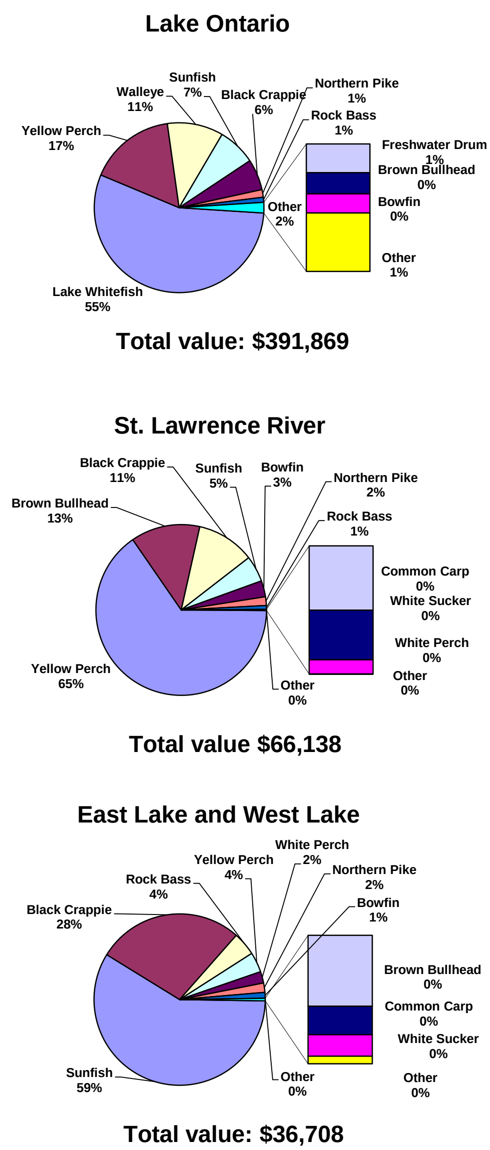


FIG. 3.2.3. Pie-charts showing breakdown of 2015 commercial harvest by species **(% by landed value)** for Lake Ontario (quota zones 1-1, 1-2, 1-3, 1-4 and 1-8), the St. Lawrence River (quota zones 1-5, 2-5 and 1-7), and for East and West Lakes combined.

one fish 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 constant for the last five years (just under 120,000 lb for all quota zones combined). In 2015, an additional 10% of base quota was issued in September after the fishery had harvested 40% of the base quota, and another 10% was issued in November after the fishery had harvested 70% of base quota.

Seasonal whitefish harvest and biological attributes (e.g., size and age structure) information are reported in Section 3.3. Lake Whitefish price-per-lb was high again in 2015.

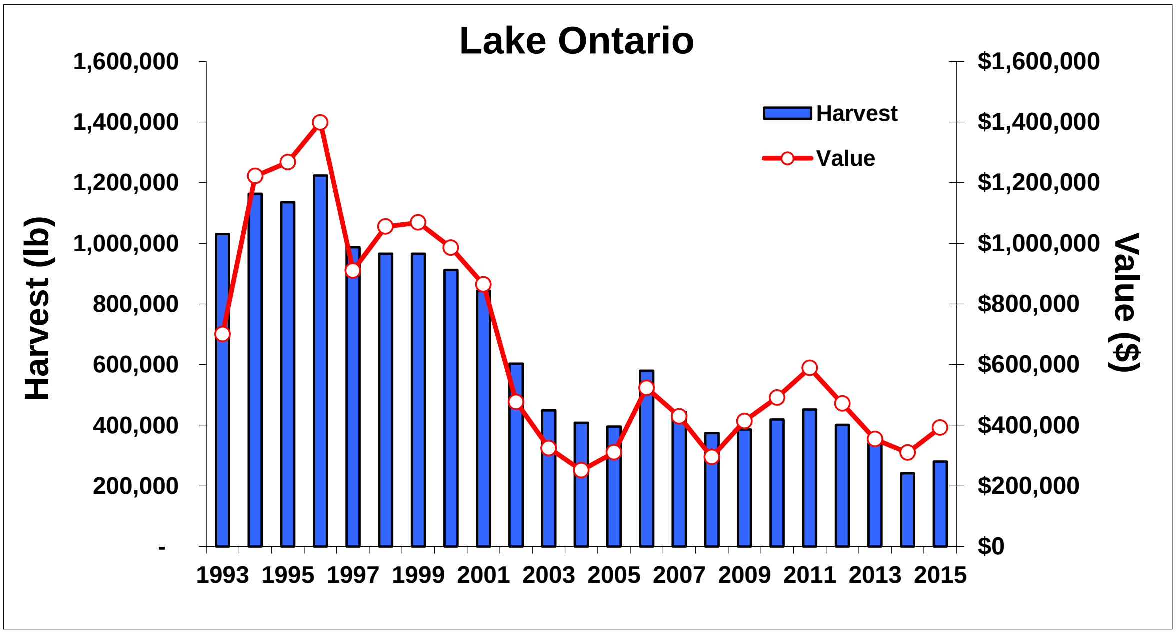


FIG. 3.2.4. Total commercial fishery harvest and value for **Lake Ontario** (Quota Zones 1-1, 1-2, 1-3 ,1-4 and 1-8) 1993-2015.

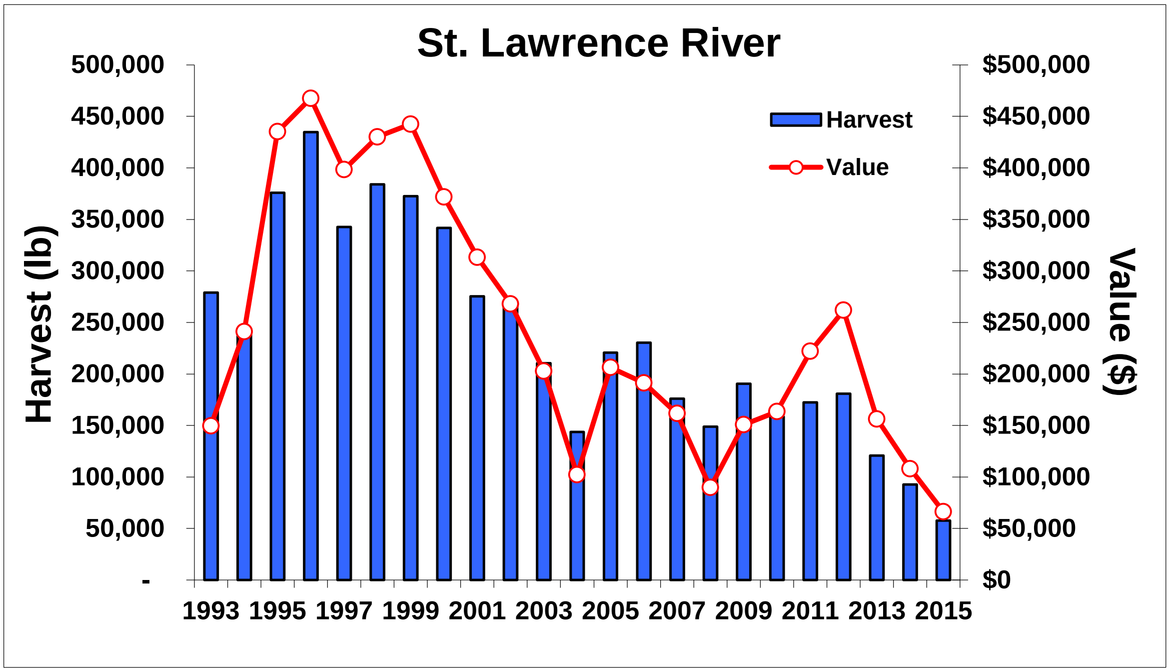


FIG. 3.2.5. Total commercial fishery harvest and value for the **St. Lawrence River** (Quota Zones 1-5, 2-5 and 1-7), 1993-2015.

Walleye

Walleye 2015 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 declined in 2015. Overall, 35% (16,771 lb) of the Walleye base quota 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 2015, 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

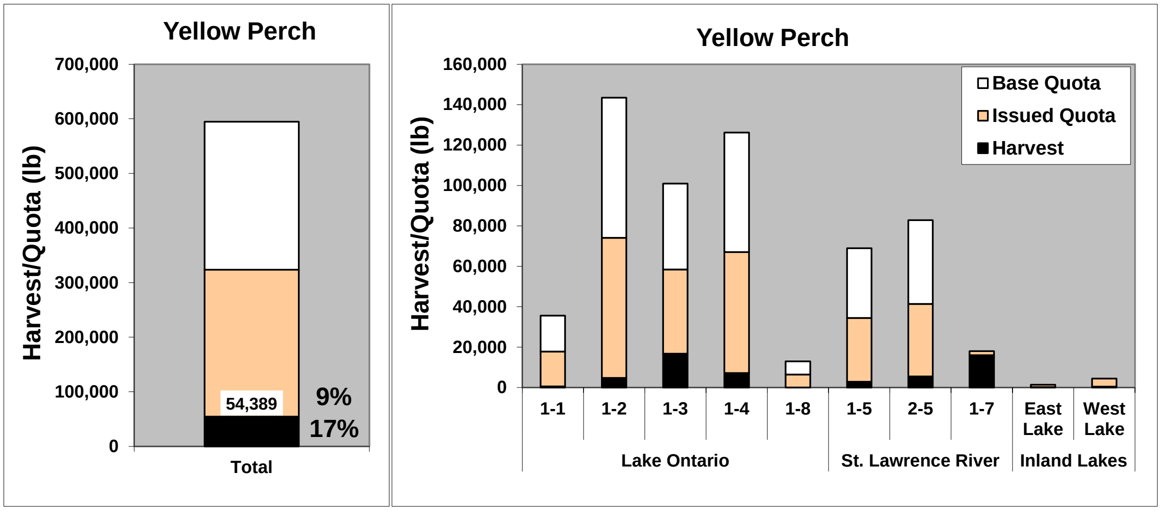


FIG. 3.2.6. **Yellow Perch** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2015.

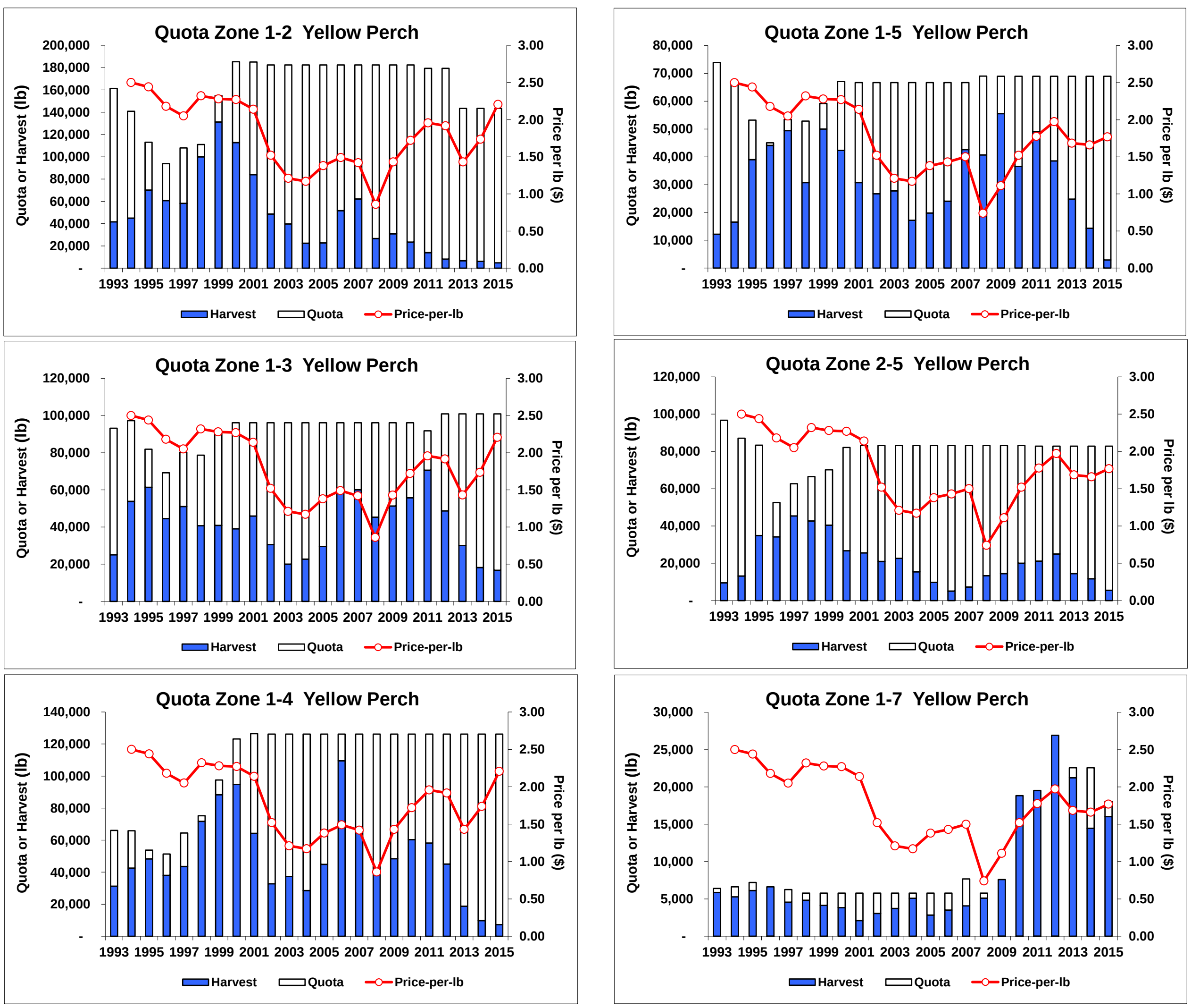


FIG. 3.2.7. Commercial base quota, harvest and price-per-lb for **Yellow Perch** in Quota Zones 1-2, 1-3, 1-4, 1-5, 2-5 and 1-7, 1993-2015.

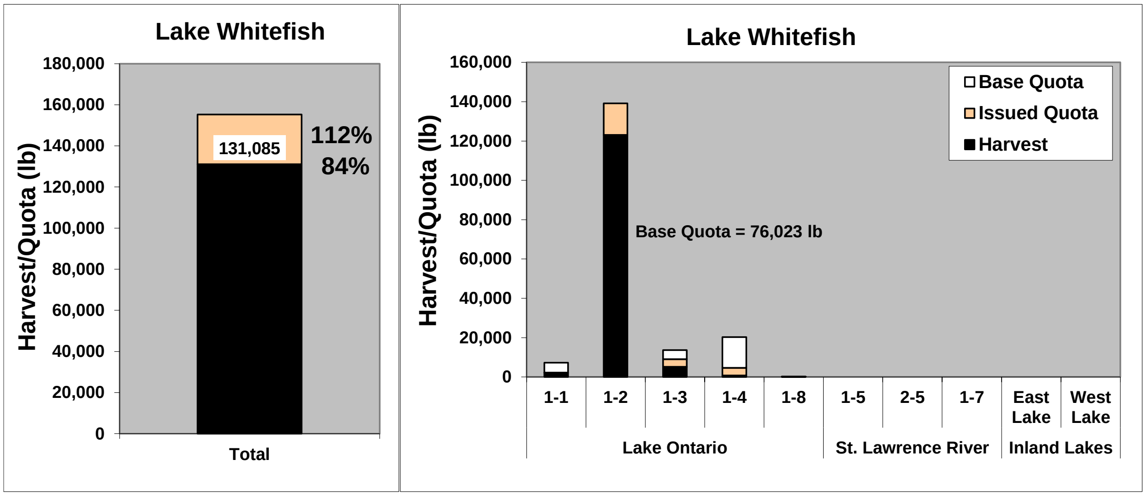


FIG. 3.2.8. **Lake Whitefish** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2015.

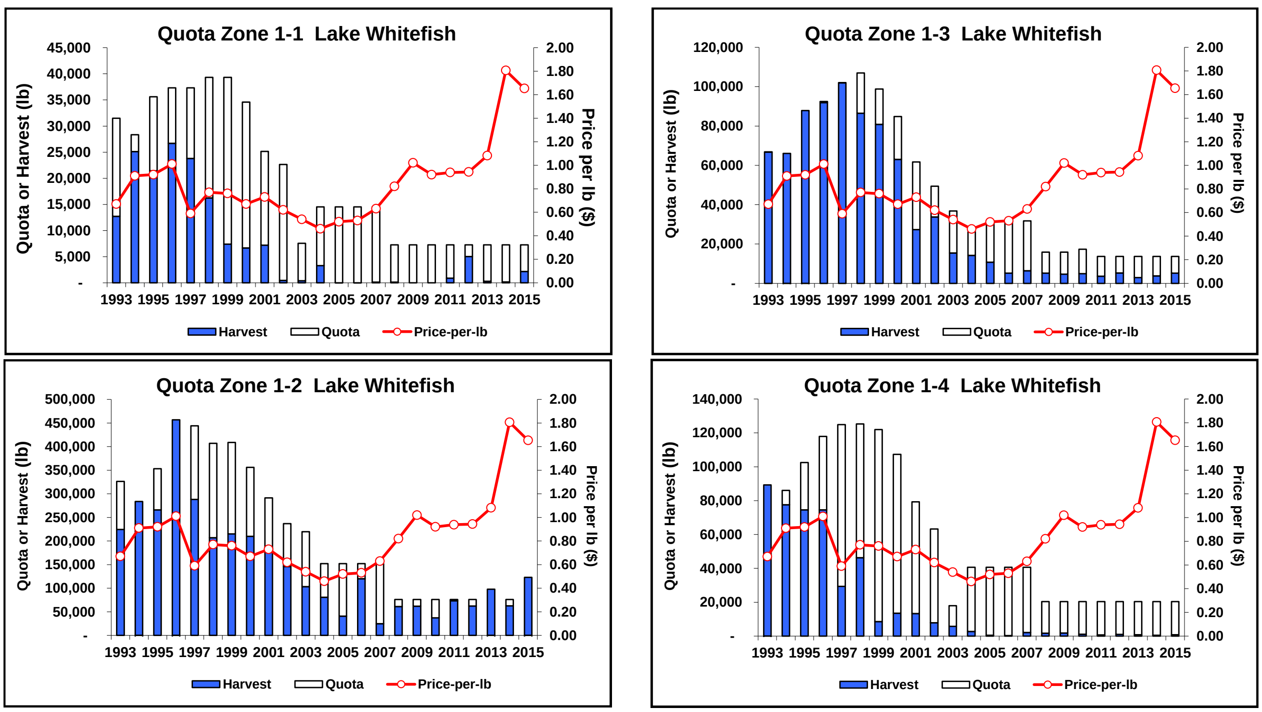


FIG. 3.2.9. Commercial base quota, harvest and price-per-lb for **Lake Whitefish** in Quota Zones 1-1, 1-2, 1-3 and 1-4, 1993-2015.

has remained constant since the early 2000s (just under 50,000 lb for all quota zones combined). Walleye price-per-lb is currently relatively high.

Black Crappie

Black Crappie 2015 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 17% (12,603 lb) of the Black Crappie base quota was harvested in 2015. The highest Black Crappie harvest came from quota zones 1-3, West Lake, and 1-5. 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. Harvest declined in most quota zones. Black Crappie price-per-lb is currently high.

Sunfish

Sunfish 2015 commercial harvest relative

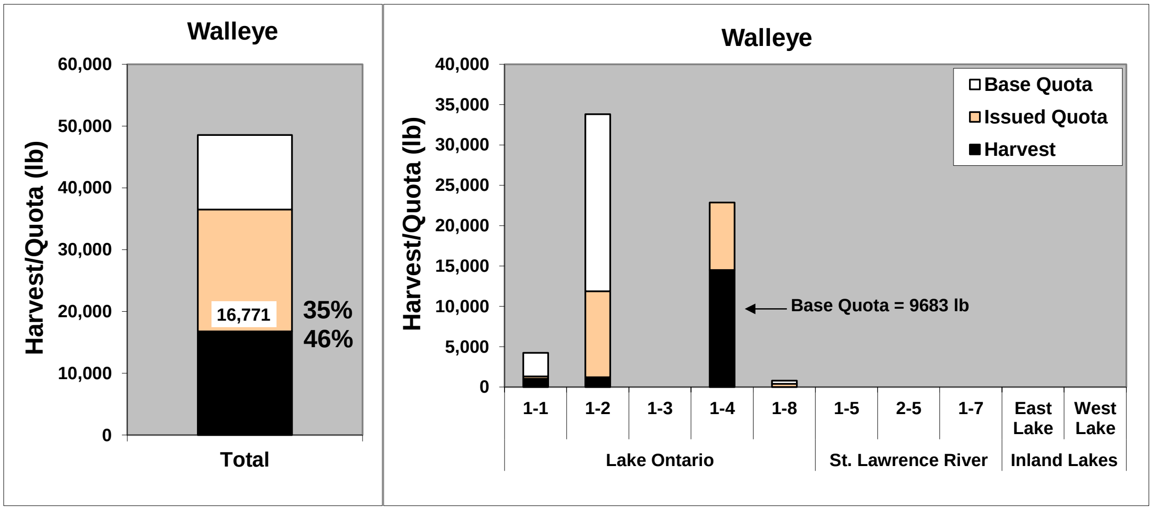
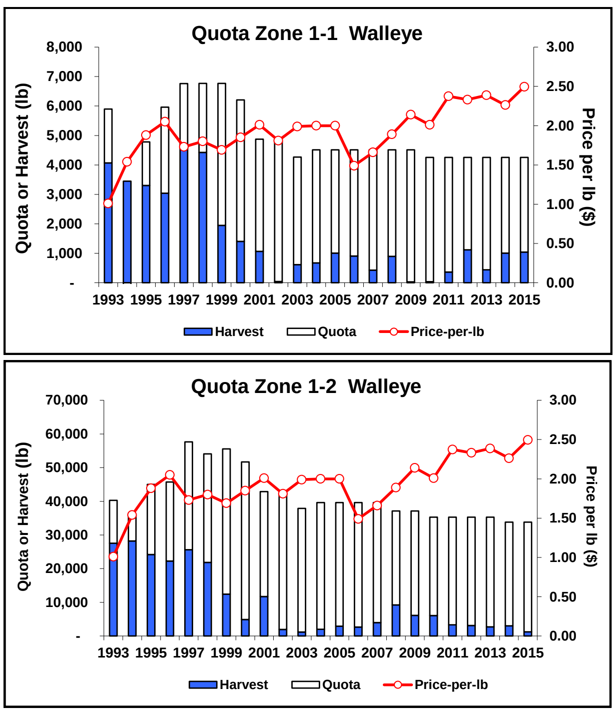


FIG. 3.2.10. **Walleye** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2015.



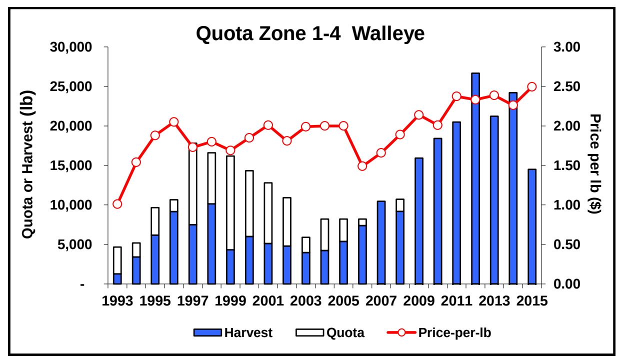


FIG. 3.2.11. Commercial base quota, harvest and price-per-lb for **Walleye** in Quota Zones 1-1, 1-2 and 1-4, 1993-2015.

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 2015, harvest declined in quota zones 1-4, 1-5, 2-5, 1-7 and East Lake and increased in zones 1-1, 1-3 and West Lake. Sunfish price-per-lb is currently high.

Brown Bullhead

Brown Bullhead 2015 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.16. Only quota zones 1-1 (embayments areas only), East Lake and West Lake have quotas for Brown Bullhead; quota is unlimited in the other zones. In the quota zones with quota restrictions, almost none of the quota was actually harvested. Highest Brown Bullhead harvest came from quota zone 1-7.

Trends in Brown Bullhead quota (base), harvest and price-per-lb are shown in Fig. 3.2.17. With the exception of quota zone 1-7, current harvest levels are extremely low relative to past levels.

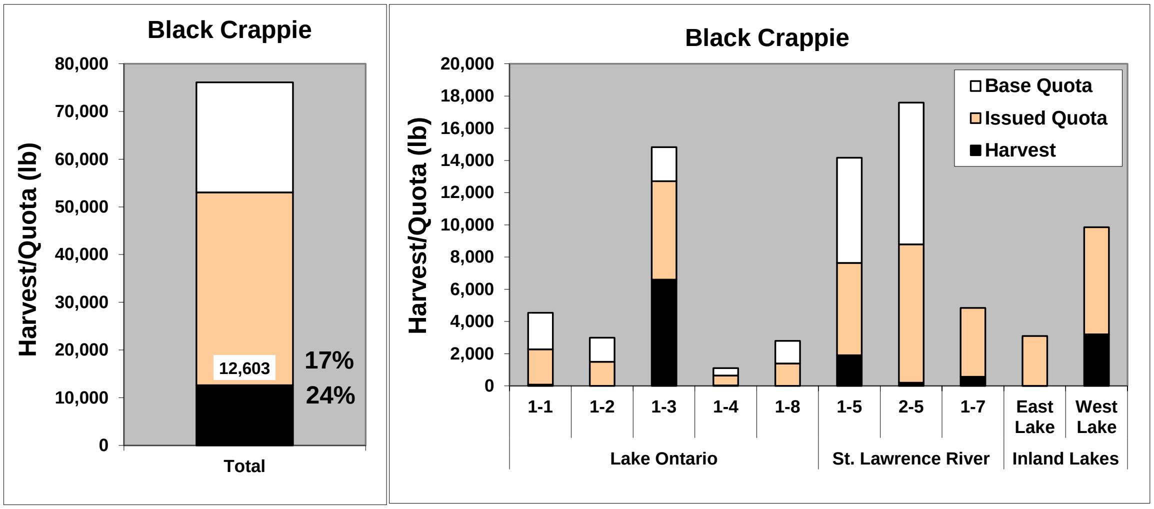


FIG. 3.2.12. **Black Crappie** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2015.

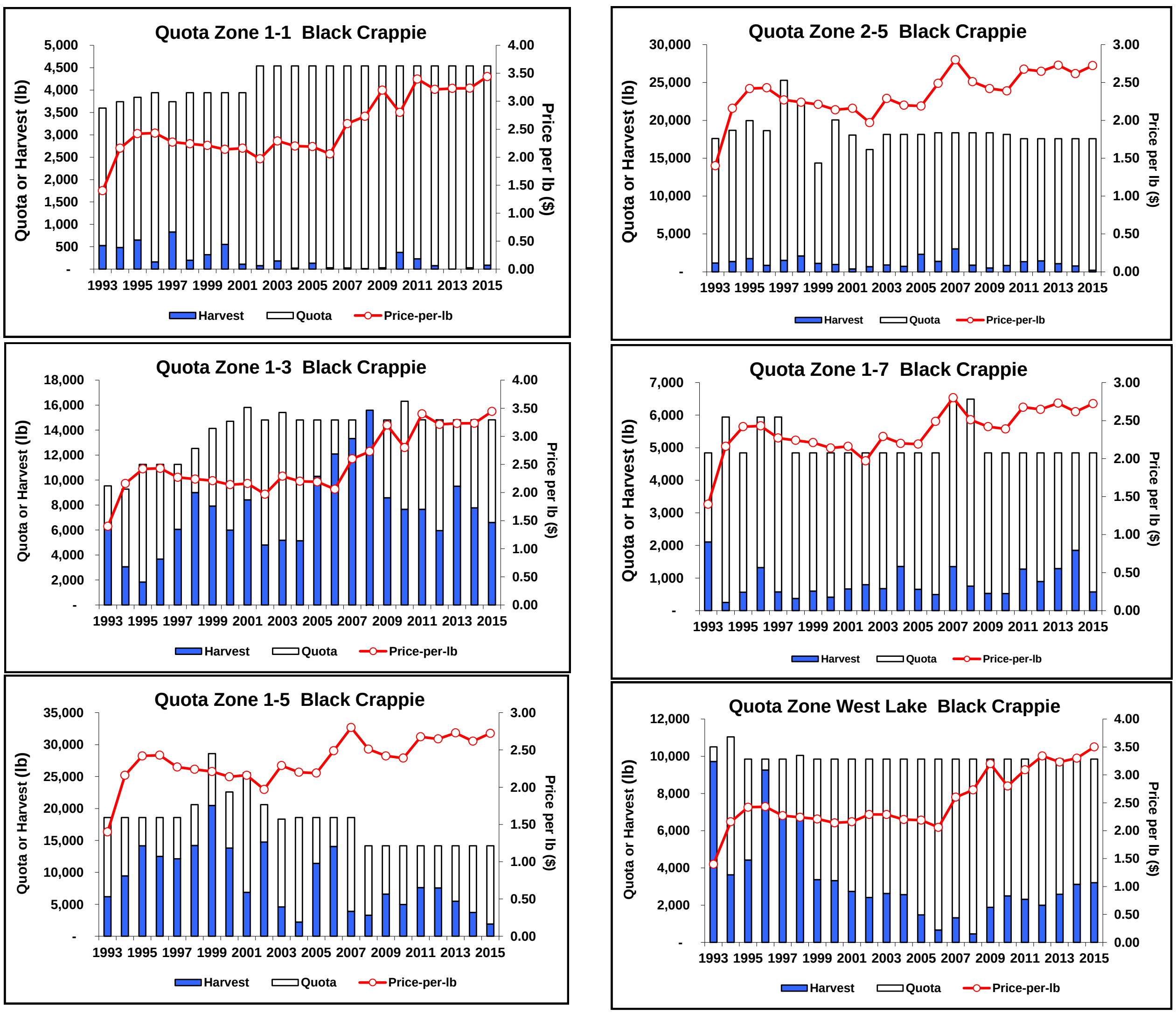


FIG. 3.2.13. Commercial base quota, harvest and price-per-lb for **Black Crappie** in Quota Zones 1-1, 1-3, 1-5, 2-5, 1-7 and West Lake, 1993-2015.

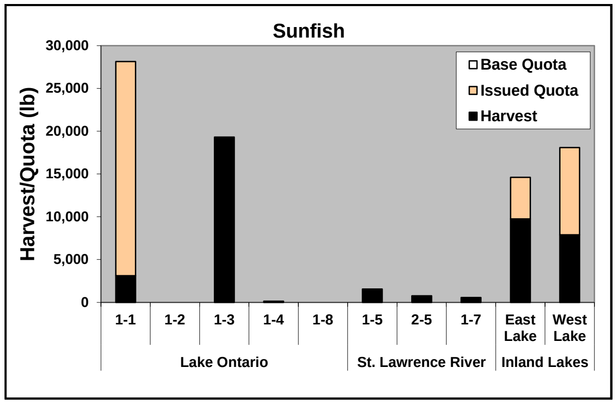


FIG. 3.2.14. **Sunfish** commercial harvest relative to issued and base quota for quota zones 1-1, East Lake and West Lake, 2015. The remaining quota zones have unlimited quota.

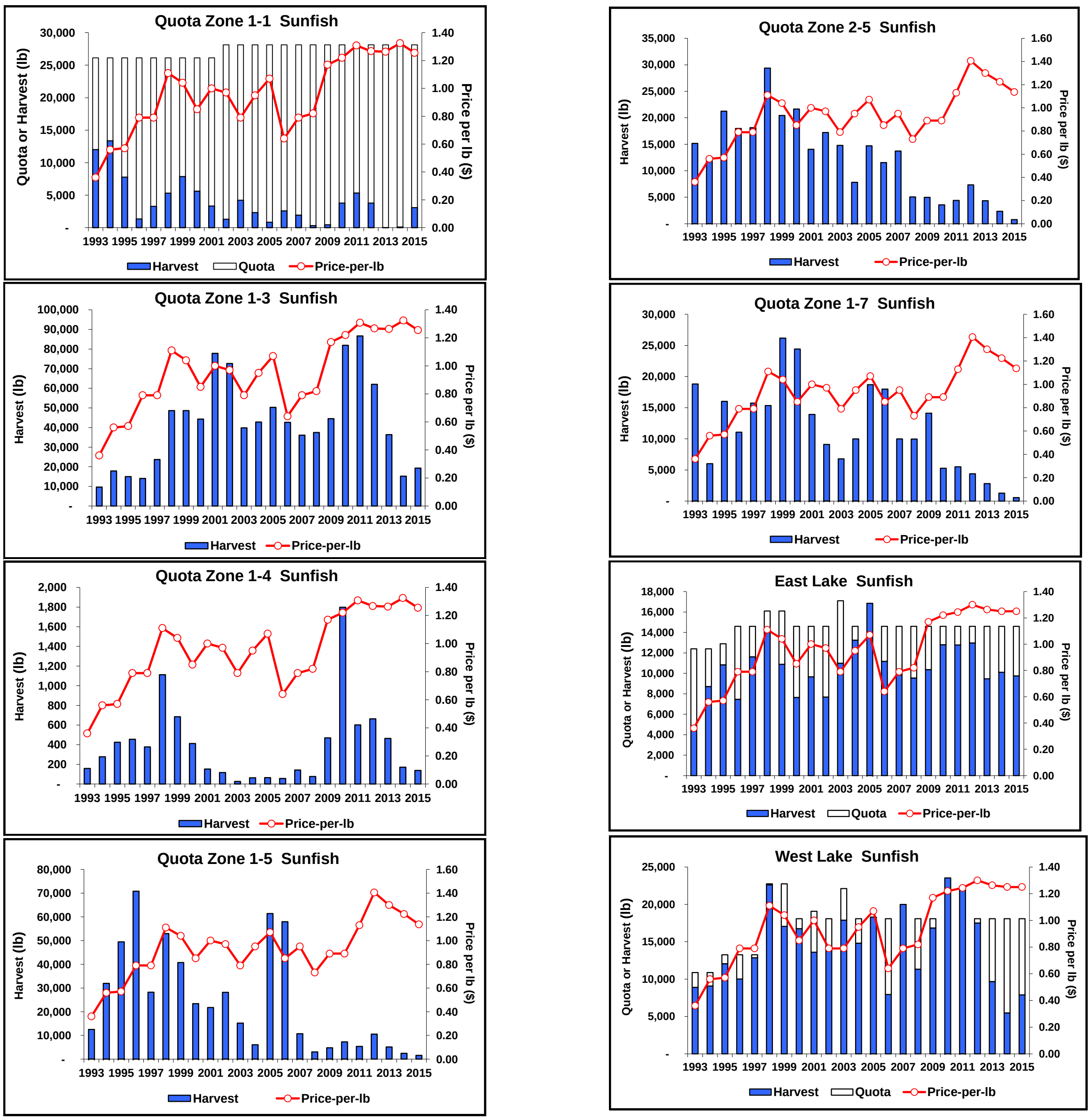


FIG. 3.2.15. Commercial base quota, harvest and price-per-lb for **Sunfish** in Quota Zones 1-1, 1-3, 1-4, 1-5, 2-5 and 1-7, East Lake and West Lake, 1993-2015.

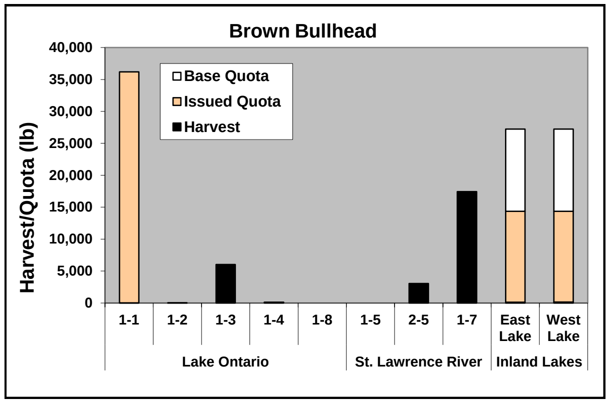


FIG. 3.2.16. **Brown Bullhead** commercial harvest relative to issued and base quota for quota zones 1-1, East Lake and West Lake, 2015. The remaining quota zones have unlimited quota.

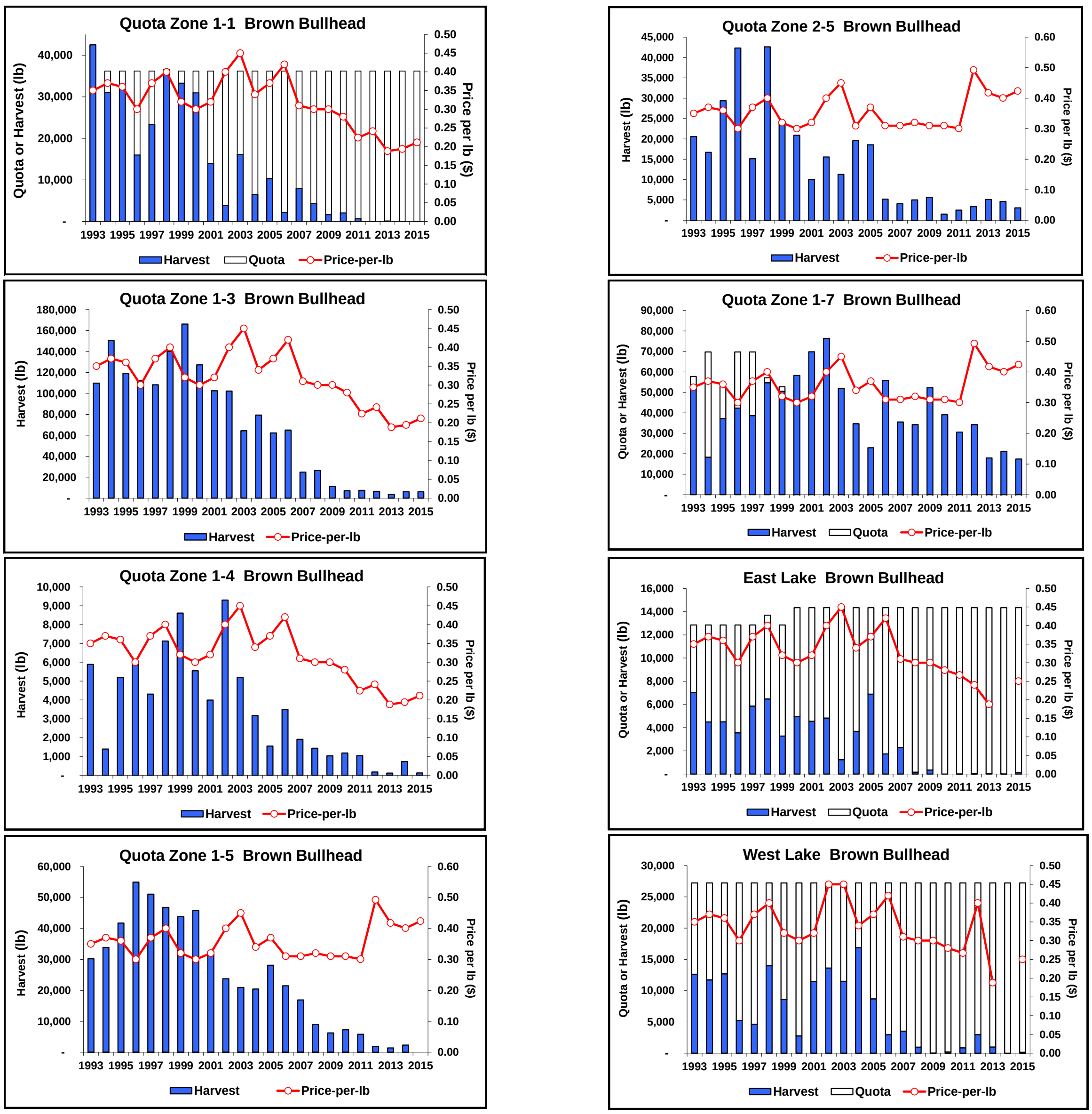


FIG. 3.2.17. Commercial base quota, harvest and price-per-lb for **Brown Bullhead** in Quota Zones 1-1, 1-3, 1-4, 1-5, 2-5 and 1-7, East Lake and West Lake, 1993-2015.

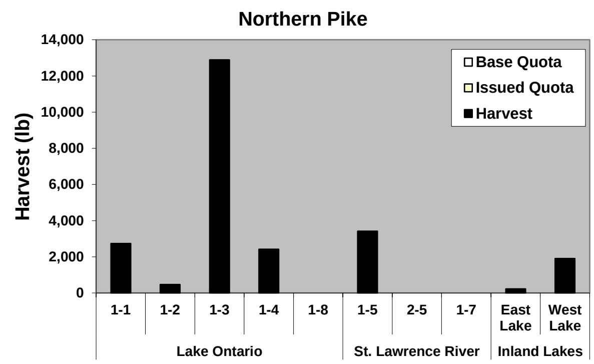
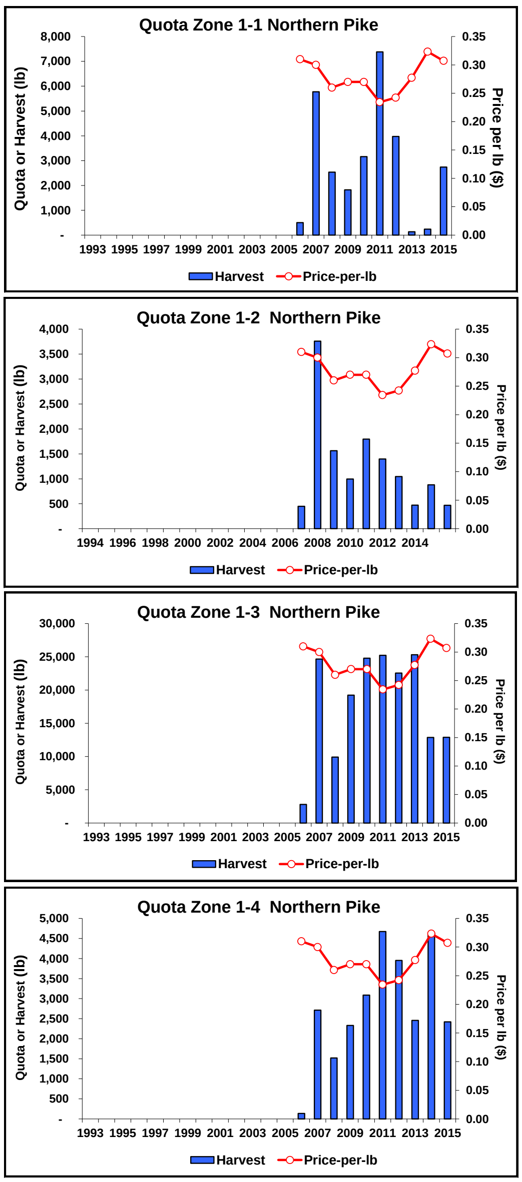


FIG. 3.2.18. **Northern Pike** commercial harvest by quota zone, 2015. In quota zones 2-5 and 1-7 no harvest is permitted; all other zones have unlimited quota.



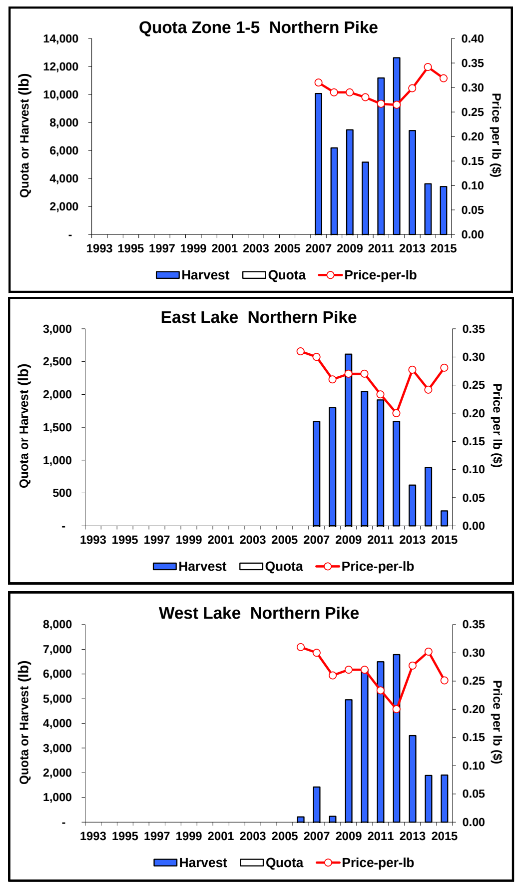


FIG. 3.2.19. Commercial base quota, harvest and price-per-lb for **Northern Pike** in Quota Zones 1-1, 1-2, 1-3, 1-4, and 1-5, East Lake and West Lake, 1993-2015.

Northern Pike

Northern Pike 2015 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 2015, harvest increased in quota zone 1-1 but decreased or remained similar to 2014 in all other quota zones.

3.3 Lake Whitefish Commercial Catch Sampling

J. A. Hoyle, Lake Ontario Management Unit

Sampling of commercially harvested Lake Whitefish for biological attribute 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. Age-specific harvest data can then be used in catch-age modeling to estimate population size and mortality schedule.

Commercial Lake Whitefish harvest and fishing effort by gear type, month and quota zone for 2015 is reported in Table 3.3.1. Most of the harvest was taken in gill nets, 96% by weight; 4% of the harvest was taken in impoundment gear. Ninety-four percent of the gill net harvest occurred in quota zone 1-2. Fifty-six 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 October and November (Table 3.3.1).

Cumulative daily commercial Lake Whitefish harvest relative to quota ‘milestones’ is shown in Fig. 3.3.1. Forty percent of base quota was harvested by Oct 6 and 70% by Nov 25.

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 6,152 fish and age was interpreted using otoliths for 293 fish (Table 3.3.2, Fig. 3.3.2 and 3.3.3).

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

		Harvest (lbs)				Effort (number of yards or nets)			
Gear type	Month	1-1	1-2	1-3	1-4	1-1	1-2	1-3	1-4
Gill net	Jan				10				1,200
	Feb								
	Mar				9				960
	Apr		179				8,400		
	May		247				19,770		
	Jun		311				34,900		
	Jul		540				33,530		
	Aug		234				24,240		
	Sep		555		129		27,200		2,000
	Oct		385				12,100		
	Nov	308	***1,206***		11	7,500	***61,040***		200
	Dec		***733***		37		***16,300***		2,600
Impoundment	Jan			9				9	
	Apr			4	4			49	3
	May	4			3	4			12
	Oct			***102***	2			***149***	5
	Nov			***150***				***132***	

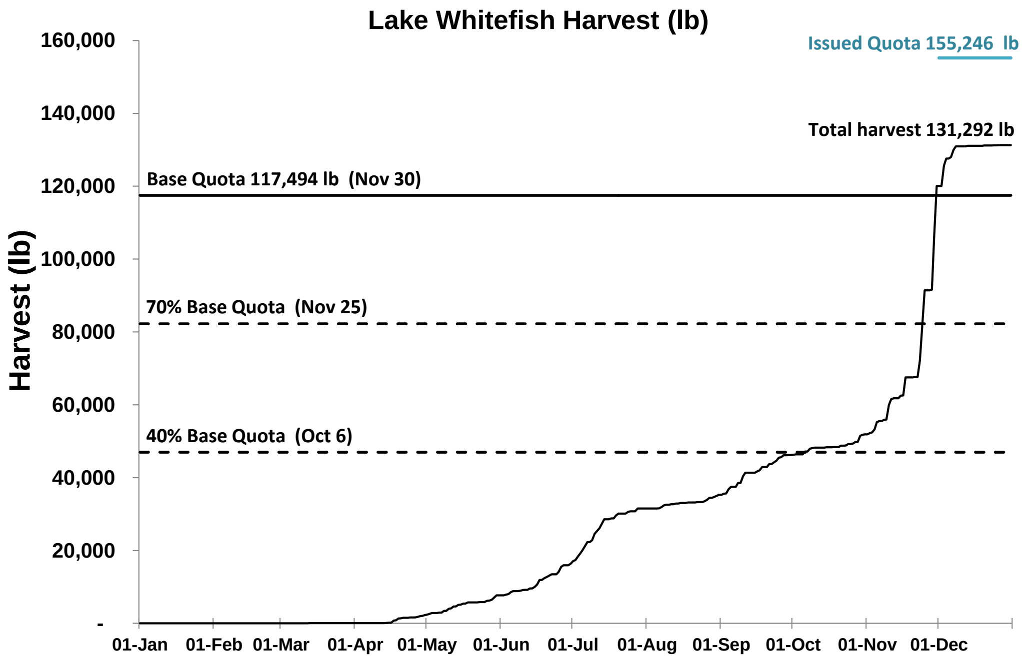


FIG. 3.3.1. Cumulative daily commercial Lake Whitefish harvest (2015) relative to quota 'milestones'.

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, 2015.

Quota zone 1-2 (Lake stock)							
	Sampled			Harvested			
Age (years)	Number aged	Number lengthed	Proportion	Number	Weight (kg)	Mean weight (kg)	Mean length (mm)
1	-	-	0.000	-	-		
2	-	-	0.000	-	-		
3	-	-	0.000	-	-		
4	1	1	0.000	7	5	0.749	390
5	8	235	0.044	2,113	1,942	0.919	435
6	38	813	0.152	7,292	6,521	0.894	432
7	29	803	0.150	7,203	6,712	0.932	442
8	10	331	0.062	2,971	3,028	1.019	450
9	22	718	0.134	6,441	7,570	1.175	481
10	33	1,122	0.210	10,070	12,551	1.246	480
11	12	456	0.085	4,089	5,415	1.324	491
12	18	535	0.100	4,803	7,114	1.481	502
13	-	-	0.000	-	-		
14	1	23	0.004	203	303	1.491	543
15	-	-	0.000	-	-		
16	2	44	0.008	396	553	1.395	507
17	3	56	0.010	504	877	1.740	516
18	-	-	0.000	-	-		
19	-	-	0.000	-	-		
20	-	-	0.000	-	-		
21	2	30	0.006	272	465	1.710	519
22	2	26	0.005	238	385	1.622	535
23	4	74	0.014	668	953	1.427	517
24	4	71	0.013	634	1,165	1.837	537
25	1	17	0.003	153	254	1.667	571
26	-	-	0.000	-	-		
27	-	-	0.000	-	-		
28	-	-	0.000	-	-		
29	-	-	0.000	-	-		
30	-	-	0.000	-	-		
Total	190	5,355	1	48,056	55,814		
Weighted mean						**1.161**	

Quota zone 1-3 (Bay stock)							
	Sampled			Harvested			
Age (years)	Number aged	Number lengthed	Proportion	Number	Weight (kg)	Mean weight (kg)	Mean length (mm)
1	-	-	0.000	-	-		
2	-	-	0.000	-	-		
3	-	-	0.000	-	-		
4	-	-	0.000	-	-		
5	2	31	0.039	84	80	0.943	438
6	9	99	0.124	267	246	0.920	437
7	20	212	0.266	573	536	0.934	445
8	20	169	0.212	457	439	0.961	447
9	14	101	0.127	273	305	1.118	470
10	9	55	0.069	148	182	1.235	483
11	8	41	0.052	111	145	1.304	486
12	9	38	0.048	103	154	1.489	519
13	2	5	0.006	13	21	1.679	542
14	1	3	0.004	8	17	2.107	617
15	-	-	0.000	-	-		
16	-	-	0.000	-	-		
17	1	4	0.005	11	18	1.686	538
18	-	-	0.000	-	-		
19	-	-	0.000	-	-		
20	-	-	0.000	-	-		
21	1	6	0.008	16	27	1.689	569
22	-	-	0.000	-	-		
23	1	4	0.004	9	22	2.300	556
24	4	25	0.032	68	123	1.809	564
25	1	3	0.003	7	10	1.430	527
26	-	-	0.000	-	-		
27	1	2	0.003	6	11	1.858	554
28	-	-	0.000	-	-		
29	-	-	0.000	-	-		
30	-	-	0.000	-	-		
Total	103	797	1	2,155	2,336		
Weighted mean						**1.084**	

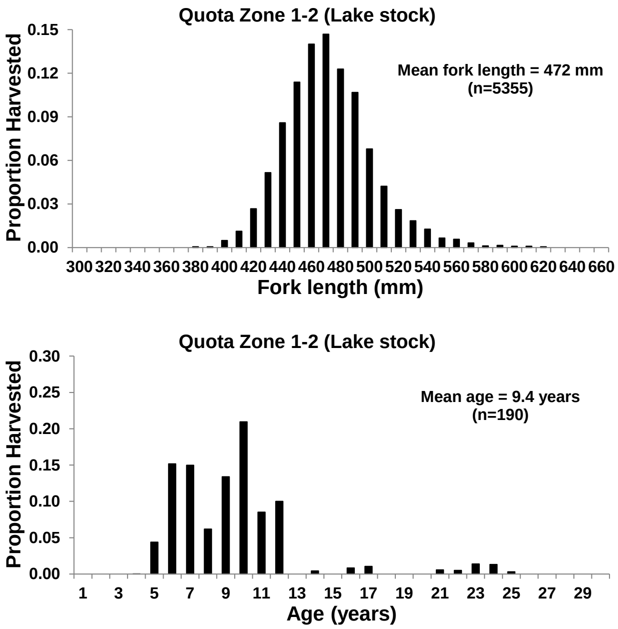


FIG. 3.3.2. Size and age distribution (by number) of **Lake Whitefish** sampled in quota zone 1-2 during the 2015 commercial catch sampling program.

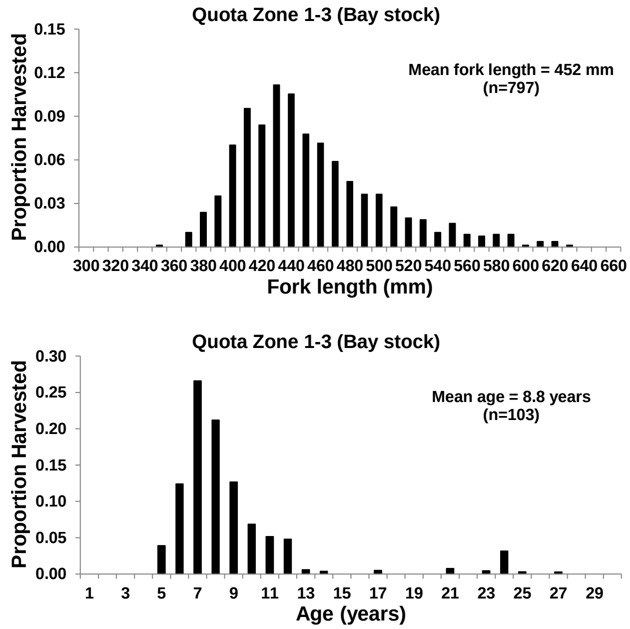


FIG. 3.3.3. Size and age distribution (by number) of **Lake Whitefish** sampled in quota zone 1-3 during the 2015 commercial catch sampling program.

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 472 mm and 9.4 years respectively (Fig. 3.3.2). Fish ranged from ages 4 -25 years. The most abundant age-classes in the fishery were aged 6-12 years which together comprised 89% of the harvest by number (88% by weight).

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

Mean fork length and age were 452 mm and 8.8 years, respectively (Fig. 3.3.3). Fish ranged from ages 5-24 years. The most abundant age-classes in the fishery were aged 6-12 years which together comprised 90% of the harvest by number (86% by weight).

Condition

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

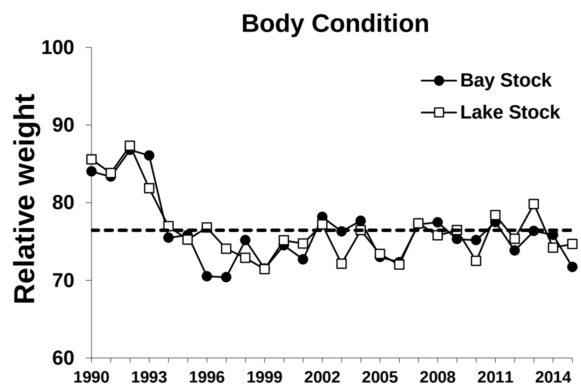


FIG. 3.3.4. **Lake Whitefish** (Lake Ontario and Bay of Quinte spawning stocks and sexes combined) relative weight (see [1]Rennie et al. 2008), 1990-2015.

[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 Assessment of Bycatch in Lake Ontario Commercial Fishery

R. Green, Lake Ontario Management Unit

This summary was compiled to examine the levels of "bycatch" by the commercial fishery as reported on Daily Catch Reports (DCRs) for the gill net fishery in Quota Zones 1-2 and 1-4 (see Fig. 3.2.1) during 2015. Commercial fishers are required, as a condition of their licence, to report bycatch, as fish that are released or discarded, on DCRs.

The amount of bycatch encountered can depend on gear type, fish community structure, season and the location and habitat fished. Monitoring levels of bycatch is important to evaluate the level of risk that bycatch is putting on non-target fish species particularly for species that are being restored to Lake Ontario such as Lake Trout as well as species such as Walleye, Smallmouth Bass and Northern Pike that are important to the recreational and/or commercial fisheries. Bycatch can also provide information on the presence of rarely encountered species such as Lake Sturgeon.

In quota zone 1-2, Lake Whitefish comprised the vast majority of commercial harvest followed by Yellow Perch and Walleye (Fig. 3.4.1). Lake Trout, which are often found in similar habitats as Lake Whitefish, were the most frequently encountered species in the bycatch in quota zone 1-2 (Fig. 3.4.2). Lake Trout bycatch in quota zone 1-2 occurred from April-November, peaking in May (Fig. 3.4.3). Walleye and Smallmouth Bass were encountered in small numbers at various times of the year and Lake Sturgeon was also encountered and released alive in April of 2015 (Fig. 3.4.3).

In quota zone 1-4, the two main commercially harvested species were Yellow Perch and Walleye followed by Freshwater Drum and Northern Pike (Fig. 3.4.1). The total bycatch of all species combined in quota zone 1-4 (2,007 lb) was less than quota zone 1-2 (7,268 lb) and the bycatch is more widely distributed among species. Bycatch in 1-4 was comprised mainly of Lake Trout, White Sucker and Walleye with lower levels of Northern Pike, Smallmouth Bass and Lake Whitefish (Fig. 3.4.1). The bycatch of these species occurred mainly during spring and fall with Lake Trout, Northern Pike and Smallmouth Bass bycatch peaking in the fall and bycatch of Walleye and Lake Whitefish peaking in the spring during 2015 (Fig. 3.4.4).

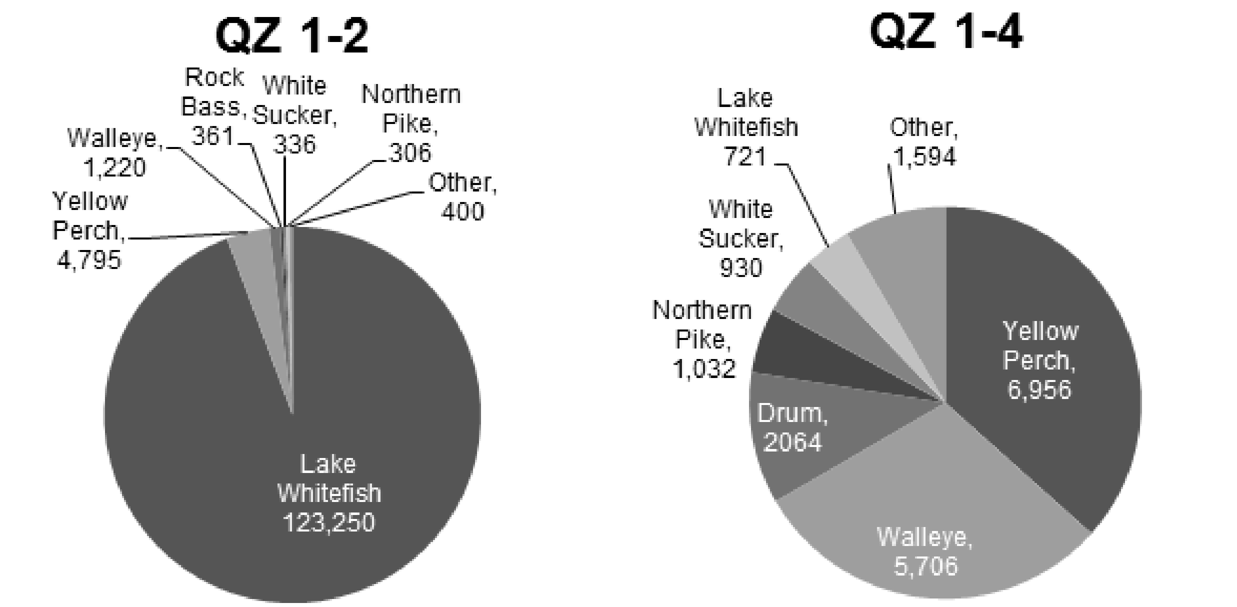


FIG. 3.4.1. Weight (lb) of harvestable species catch in quota zones (QZ) 1-2 and 1-4 gill net fisheries reported in 2015. For a complete summary of commercial harvest by quota zone see section 3.2.

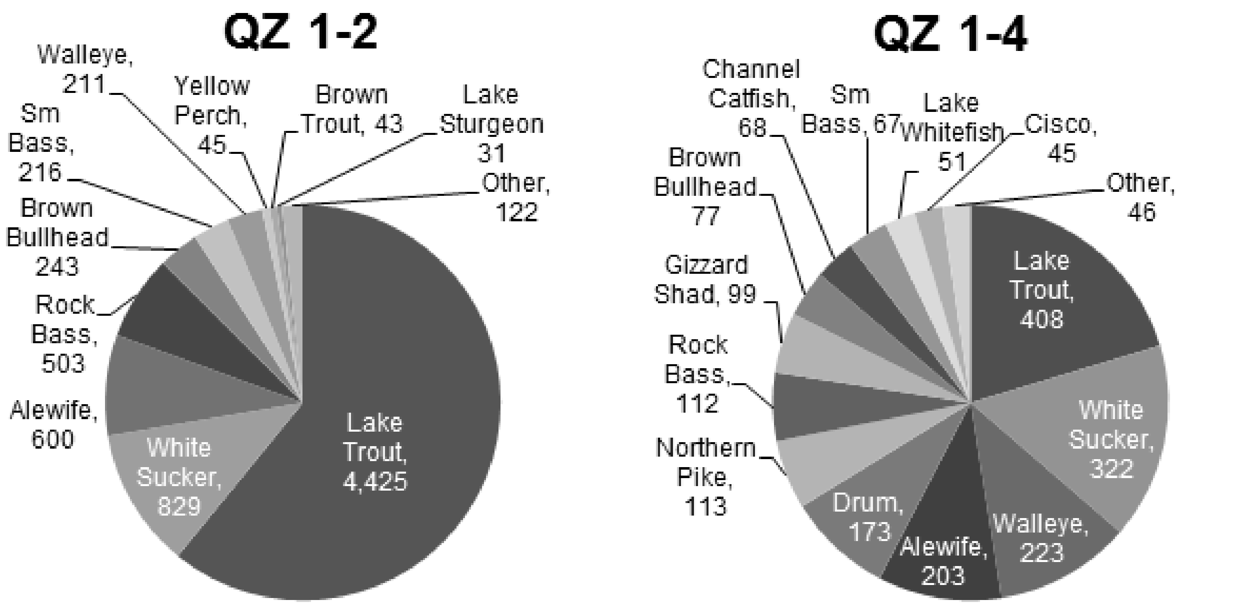


FIG. 3.4.2. Weight (lb) of bycatch in quota zones 1-2 and 1-4 reported as released and discarded in 2015. Note that for quota zone 1-2 ‘Other’ includes (order by weight): Bowfin, Longnose Gar, Channel Catfish, *Oncorhynchus spp*., *Lepomis spp*., Rainbow Smelt, Largemouth Bass, Rainbow Trout, White Perch, Suckers, White Bass, Atlantic Salmon, Common Carp, Freshwater Drum and Northern Pike. For quota zone 1-4 ‘Other’ includes (order by weight): Sucker spp., White Perch, Longnose Gar, Lake Sturgeon, Burbot and Sea Lamprey.

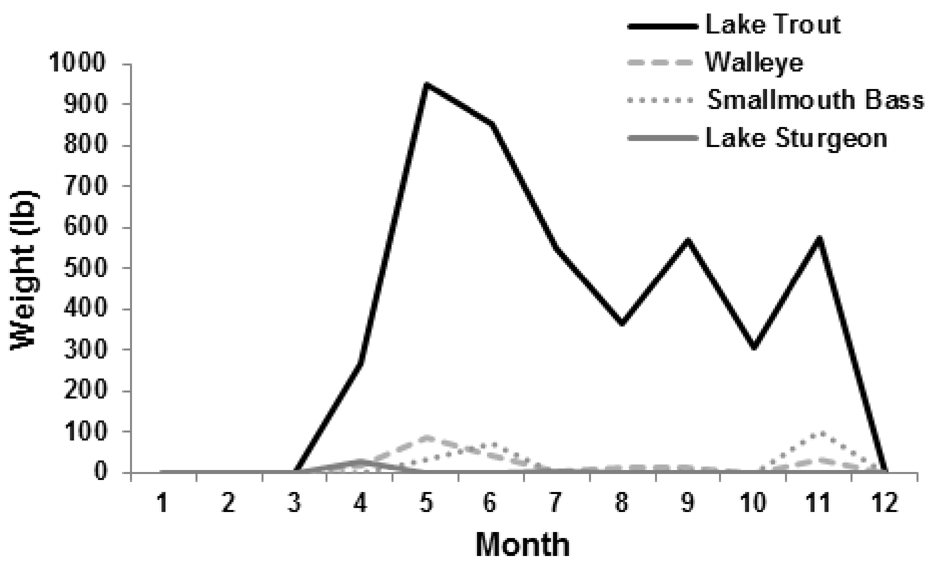


FIG. 3.4.3. Quota zone 1-2 Commercial bycatch (released and discarded) by month for recreational and restoration species in 2015.

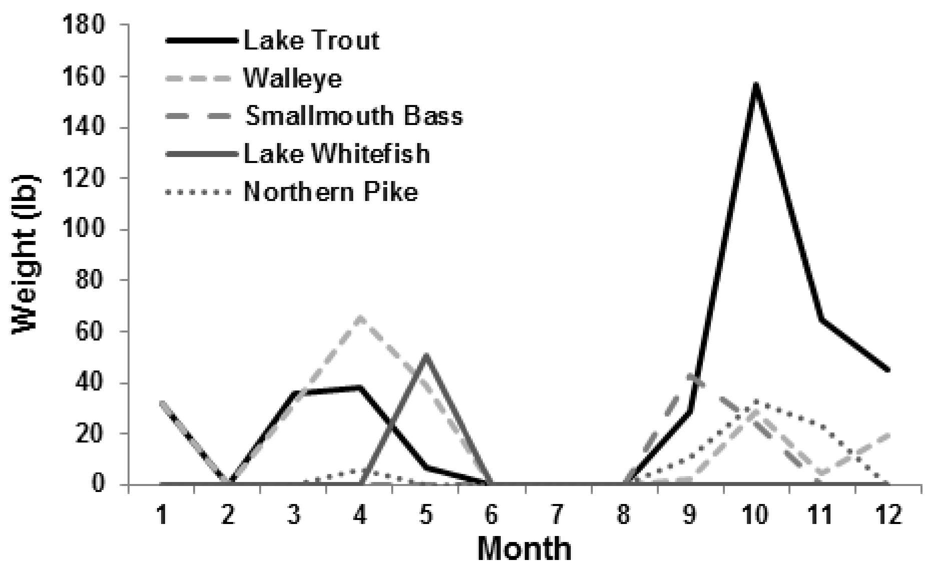


FIG. 3.4.4. Quota zone 1-4 commercial bycatch (released and discarded) by month for recreational and restoration species in 2015.

4. Age and Growth Summary

N. J. Jakobi 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 2015, a total of 2131 structures were processed from 12 different field projects (Table 4.1) and interpreted from 14 different fish species (Table 4.2)

TABLE 4.1. Project-specific summary of age and growth structures interpreted for age (n=2,131) in support of 12 different Lake Ontario Management Unit field projects, 2015 (CWT, Code Wire Tags).

Project	Species	Structure	n
Ganaraska Rainbow Trout Assessment			
	Rainbow Trout	Scales	105
Lake Ontario and Bay of Quinte Community Index Gillnetting			
	Northern Pike	Cleithra	25
	Smallmouth Bass	Scales	14
	Walleye	Otoliths	240
	Lake Trout	CWT	128
	Lake Whitefish	Otoliths	20
Lake Ontario and Bay of Quinte Community Index Trawling			
	Deepwater Sculpin	Otoliths	101
	Walleye	Otoliths	10
	Walleye	Scales	99
Bay of Quinte on Water Creel			
	Walleye	Scales	51
Hamilton Harbour Nearshore Community Index Netting			
	Northern Pike	Cleithra	11
	White Bass	Scales	14
	Bluegill	Scales	29
	Largemouth Bass	Scales	1
	Yellow Perch	Scales	17
	Walleye	Otoliths	31
Upper Bay of Quinte Nearshore Community Index Netting			
	Northern Pike	Cleithra	7
	Pumpkinseed	Scales	29
	Bluegill	Scales	33
	Smallmouth Bass	Scales	2
	Largemouth Bass	Scales	31
	Black Crappie	Scales	32
	Yellow Perch	Scales	31
	Walleye	Otoliths	34
Weller's Bay Nearshore Community Index Netting			
	Northern Pike	Cleithra	6
	Pumpkinseed	Scales	30
	Bluegill	Scales	30
	Smallmouth Bass	Scales	16
	Largemouth Bass	Scales	18
	Black Crappie	Scales	2
	Yellow Perch	Scales	2
	Walleye	Scales	9
	Walleye	Otoliths	13
Presqu'ile Bay Nearshore Community Index Netting			
	Northern Pike	Cleithra	5
	Pumpkinseed	Scales	50
	Bluegill	Scales	27
	Largemouth Bass	Scales	25
	Black Crappie	Scales	11
	Yellow Perch	Scales	12
	Walleye	Otoliths	7
St. Lawrence River Fish Community Index Netting - Thousand Islands			
	Northern Pike	Cleithra	18
	Smallmouth Bass	Scales	144
	Largemouth Bass	Scales	10
	Yellow Perch	Scales	145
	Walleye	Otoliths	19
Credit River Chinook Assessment and Egg Collection			
	Chinook Salmon	Otoliths	85
Ganaraska Chinook Assessment and Egg Collection			
	Chinook Salmon	Otoliths	59
Commercial Catch Sampling			
	Lake Whitefish	Otoliths	293
Total			2131

Archived otoliths from adult Lake Trout caught in the Community Index Gillnetting program from 2004-2013 were examined this year (Table 4.3). These otoliths had not previously been age interpreted. A total of 1,231 Lake Trout otoliths were interpreted allowing for better assessment of Lake Trout year-class strength and survival.

TABLE 4.3. Year-specific summary (n=1,231) of archived Lake Trout otoliths interpreted in 2015.

Sampling year	Number of adult Lake Trout aged
2004	111
2005	73
2006	86
2007	103
2008	112
2009	107
2010	141
2011	175
2012	118
2013	205
Total	1231

TABLE 4.2. Species-specific summary of age and growth structures interpreted for age (n=2,131) in 2015.

	Structure				
Species	Scales	Otoliths	Cleithra	Code Wire Tags	Total
Black Crappie	45				45
Bluegill	119				119
Chinook Salmon		144			144
Deepwater Sculpin		101			101
Lake Trout				128	128
Lake Whitefish		313			313
Largemouth Bass	85				85
Northern Pike			72		72
Pumpkinseed	109				109
Rainbow Trout	105				105
Smallmouth Bass	176				176
Walleye	159	354			513
White Bass	14				14
Yellow Perch	207				207
Total	1010	926	72	128	2,131

5. Contaminant Monitoring

N. J. Jakobi 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 2015, 310 contaminant samples were collected for Ontario's Ministry of the Environment and Climate Change (MOECC) Sport Fish Monitoring program (Table 5.1). Samples were primarily collected using existing fisheries assessment programs on Lake Ontario, Bay of Quinte and the St. Lawrence.

A summary of the number of fish samples collected by species, for contaminant analysis by the MOECC from 2000 to 2015 is shown in Table 5.2.

TABLE 5.1. Number of fish samples provided to MOECC for contaminant analysis, by region and species, 2015.

Region	Block	Species	Total
Hamilton Harbour	3	Walleye	31
Ganaraska	7	Rainbow Trout	20
Upper Bay of Quinte	9	Black Crappie	10
		Bluegill	9
		Brown Bullhead	10
		Lake Herring	10
		Lake Whitefish	10
		Largemouth Bass	10
		Walleye	10
		White Perch	10
Middle Bay of Quinte	10	Black Crappie	4
		Bluegill	1
		Brown Bullhead	2
		Lake Herring	7
		Lake Whitefish	4
		Walleye	1
Lower Bay of Quinte/	11	Brown Trout	1
Eastern Lake Ontario		Chinook Salmon	2
		Lake Herring	1
		Lake Trout	10
		Lake Whitefish	5
		Rainbow Smelt	3
		Walleye	10
		White Perch	1
Thousand Islands	12	Brown Bullhead	20
		Largemouth Bass	8
		Northern Pike	18
		Smallmouth Bass	20
		Walleye	15
		White Sucker	7
		Yellow Perch	20
Lake St. Francis	15	Brown Bullhead	20
Total			310

TABLE 5.2. Summary of the number of fish samples collected, by species, for contaminant analysis by the Ministry of Environment, 2000-2015.

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

6. Stocking Program

6.1 Stocking Summary

C. Lake , Lake Ontario Management Unit

In 2015, OMNRF stocked approximately 2.1 million salmon and trout into Lake Ontario (Table 6.1.1; Fig. 6.1.1). This number of fish equaled nearly 38,000 kilograms of biomass added to the Lake (Fig. 6.1.1.b). Figure 6.2.1 shows stocking trends in Ontario waters from 1968 to 2015. The New York State Department of Environmental Conservation (NYSDEC) also stocked 4.26 million salmon and trout into the lake in 2015.

Approximately 615,000 Chinook Salmon spring fingerlings were stocked at various locations to provide put-grow-and-take fishing opportunities. All Chinook Salmon for the Lake Ontario program were produced at Normandale Fish Culture Station. About 175,000 (28% of total stocking) Chinook Salmon were held in pens at eight sites in Lake Ontario for a short period of time prior to stocking. This ongoing project is being done in partnership with local community groups. It is hoped that pen-imprinting will help improve returns of mature adults to these areas in the fall, thereby enhancing local nearshore and shore fishing opportunities.

Atlantic Salmon were stocked in support of an ongoing program to restore self-sustaining

TABLE 6.1.1. Fish stocked into the Ontario waters of Lake Ontario for 2015, and targets for 2016.

Species	Life Stage	2015*	2016
Atlantic Salmon	Spring Fingerlings	304,611	400,000
	Fall Fingerlings	74,750	150,000
	Spring Yearlings	64,564	75,000
	Adult		-
		443,925	625,000
Brown Trout	Fall Fingerlings	50,861	40,000
	Spring Yearlings	177,169	140,000
		228,030	180,000
Chinook Salmon	Spring Fingerlings	615,679	600,000
Coho Salmon	Spring Fingerlings	44,264	80,000
Rainbow Trout	Fall Fingerlings	25,562	15,000
	Spring Yearlings	173,871	140,000
		199,433	155,000
Lake Trout	Fall Fingerlings	7,781	
	Spring Yearlings	549,800	500,000
	Adult	399	
		557,980	500,000
Walleye	Fry	**1,017,625	-
	Summer Fingerlings	52,963	100,000
		52,963	100,000
Bloater	Fall Fingerlings	31,845	50,000
	Fall Yearlings	1,652	
	Sub-Adult	2,100	
		35,597	50,000
Grand total		2,177,871	2,290,000

* includes fish reared by MNRF and partners
** 2015 total does not include Walleye fry

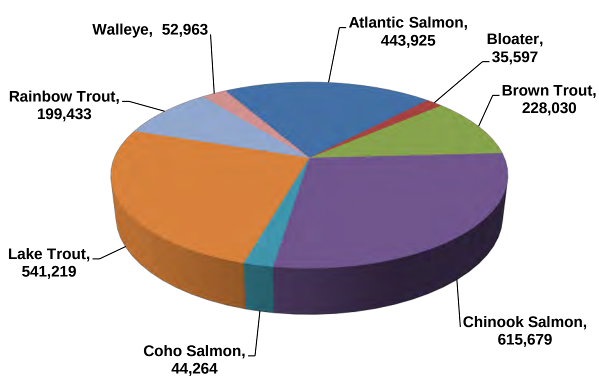


FIG. 6.1.1(a). Number of fish stocked into Ontario waters of Lake Ontario (excluding Walleye fry) in 2015. Total = 2,177,871.

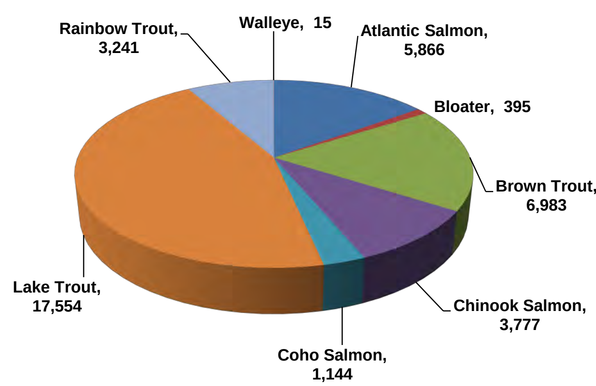


FIG. 6.1.1(b). Weight (in kilograms) of fish stocked into Ontario waters of Lake Ontario (excluding Walleye fry) in 2015. For a small number of stocking events, total weight was not recorded, so the total weight should be considered an estimate only. Total = 37,982 kilograms.

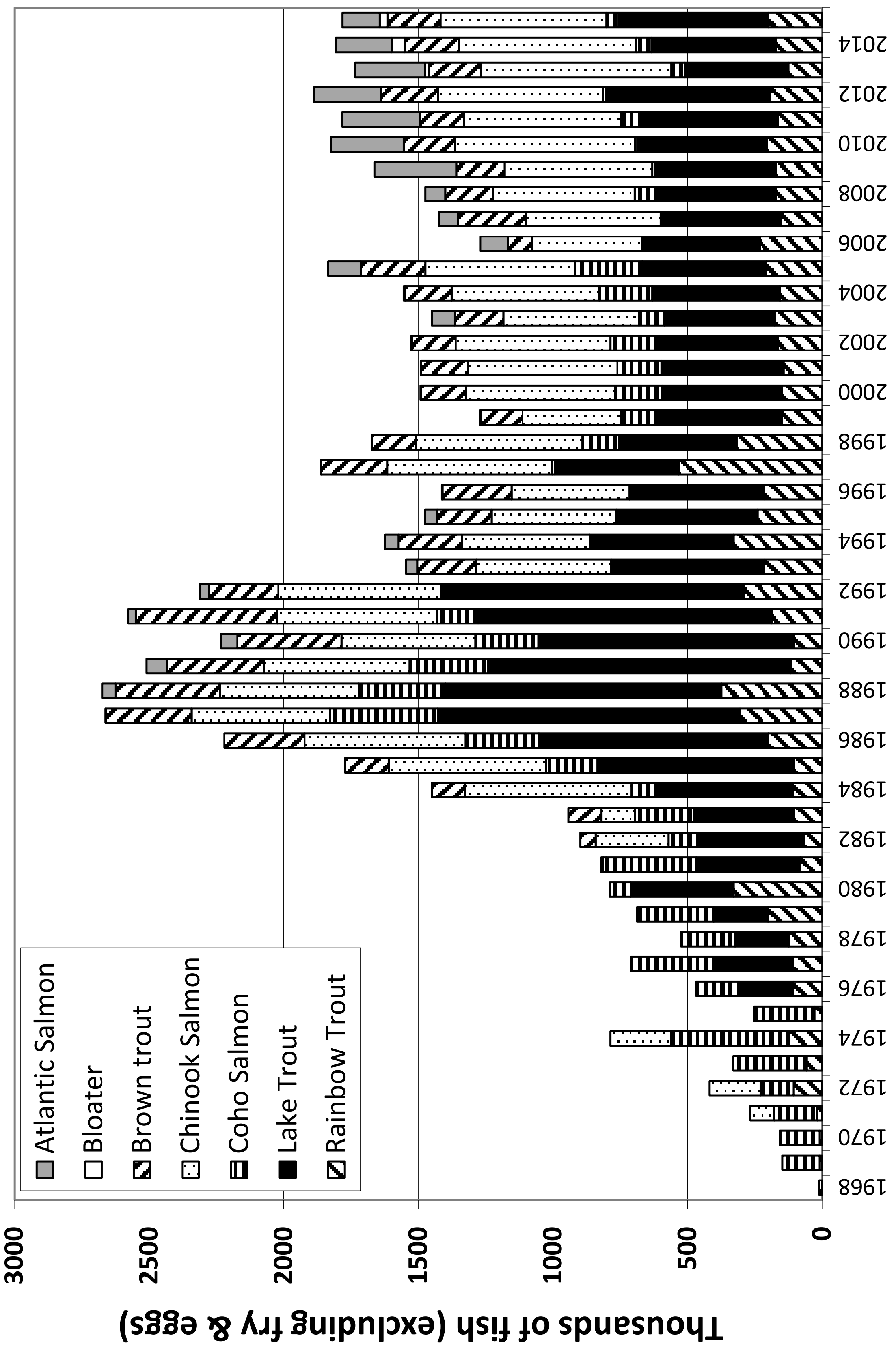


FIG. 6.1.2. Trends in salmon and trout stocking in Ontario waters of Lake Ontario, 1968-2015.

populations of this native species to the Lake Ontario basin (Section 8.2). Approximately 440,000 Atlantic Salmon of various life stages were released into current restoration streams in 2015: Credit River, Duffins Creek and Cobourg Brook. New for 2015, Shelter Valley Creek was also stocked during a single event. OMNRF 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 OMNRF and partner facilities. Three Atlantic Salmon brood stocks from different source populations in Nova Scotia, Quebec and Maine are currently housed at OMNRF'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 540,000 Lake Trout yearlings were stocked as part of an established, long-term rehabilitation program, and in support 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. A small number of 'retired' adult brood stock Lake Trout were stocked into the Bay of Quinte in the fall of 2015. These fish were identified with an external tag. Through the winter of 2015-16 approximately a half-dozen have been reported captured by anglers.

Approximately 35,500 Deepwater Cisco, or Bloater were stocked in 2015. 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 being stocked in 2013. Dedicated work by our US partners and MNRF Fish Culture Section staff have resulted in great advances each year in the complicated process of rearing Bloater. See section 8.4 for a detailed description of this restoration effort.

Rainbow Trout (140,000) and Brown Trout (230,000) were stocked at various locations to provide shore and boat fishing opportunities. Over 55,000 Coho Salmon were produced by stocking partner Metro East Anglers (approximately 44,000 fall fingerlings) and Credit River Anglers (460 spring fingerlings).

Walleye were once again stocked into Hamilton Harbour in an effort to 'jump-start' recovery of the fish community, which is currently dominated by Channel Catfish and Brown Bullhead. Just over a million Walleye fry were stocked in the spring of 2015, followed by over 50,000 summer fingerlings stocked in July.

OMNR remains committed to providing diverse fisheries in Lake Ontario and its tributaries, based on wild and stocked fish, as appropriate. Detailed information about OMNRF's 2015 stocking activities is found in Tables 6.1.3 to 6.1.10.

TABLE 6.1.3 . Atlantic Salmon stocked in the Province of Ontario waters of Lake Ontario, 2015.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
ATLANTIC SALMON - EGG									
Cobourg Brook									
Danforth Rd.	2	2014	Harwood FCS	LaHave River	0			-	161,940
									161,940
ATLANTIC SALMON - SPRING FINGERLING									
Cobourg Brook									
Dale Rd.	5	2014	Normandale FCS	LaHave River (NMC)	6	1.88	18.8	-	9,978
Division St.	5	2014	Sir Sandford Fleming College	LaHave River				-	4,100
Hie - McNichol Properties	5	2014	Normandale FCS	LaHave River (NMC)	6	1.88	16.0	-	8,498
Hie - McNichol Properties	5	2014	Normandale FCS	Sebago Lake (HWC)	6	1.8	4.5	-	2,493
McDougal Rd. Balls Mill	5	2014	Normandale FCS	Sebago Lake (HWC)	6	2.17	23.8	-	10,990
McDougal Rd. Balls Mill	5	2014	Normandale FCS	LaHave River (NMC)	6	2.26	24.8	-	10,989
									47,048
Credit River									
Black Cr. - 15th Sideroad	5	2014	Normandale FCS	LaHave River (NMC)	6	2.05	38.8	-	18,950
Black Cr. - 6th Line	5	2014	Normandale FCS	LaHave River (NMC)	6	2.51	62.6	-	24,938
Ellies Ice Cream Parlour	5	2014	Normandale FCS	LaHave River (NMC)	6	2.04	30.6	-	15,023
Forks of the Credit	5	2014	Normandale FCS	LaHave River (NMC)	6	2.29	34.4	-	15,027
Forks of the Credit - Meadow	5	2014	Normandale FCS	LaHave River (NMC)	6	2.42	24.2	-	9,999
Forks of the Credit - Meadow	5	2014	Normandale FCS	Sebago Lake (HWC)	6	4.15	41.5	-	9,998
Forks of the Credit - Meadow	5	2014	Normandale FCS	Lac St. Jean (HWC)	6	2.92	29.2	-	9,999
Forks of the Credit - Stuck Truck	5	2014	Normandale FCS	LaHave River (NMC)	6	2.21	22.0	-	9,975
Forks of the Credit - Stuck Truck	5	2014	Normandale FCS	Lac St. Jean (HWC)	6	4.05	14.1	-	3,478
Forks of the Credit - Stuck Truck	5	2014	Normandale FCS	Sebago Lake (HWC)	6	4.72	49.9	-	10,563
Forks of the Credit Provincial Park	5	2014	Belfountain	LaHave River	5	0.21	2.1	-	10,172
Shaws Creek Rd.	5	2014	Belfountain	LaHave River	5	0.21	1.0	-	4,853
Terra Cotta	5	2014	Belfountain	LaHave River	5	0.21	0.5	-	2,286
West Credit - Winston Churchill Blvd.	5	2014	Belfountain	LaHave River	5	0.21	0.6	-	2,660
West Credit - Winston Churchill Blvd.	5	2014	Belfountain	LaHave River	5	0.21	0.2	-	723
West Credit Belfountain	5	2014	Normandale FCS	LaHave River (NMC)	6	2.07	31.1	-	15,002
									163,646
Duffins Creek									
Claremont	5	2014	Normandale FCS	LaHave River (NMC)	6	2.43	48.5	-	19,972
Duffins Crk. - Sideline 32	5	2014	Normandale FCS	Sebago Lake (HWC)	6	6.14	92.1	-	14,999
Duffins Crk. - Sideline 32	5	2014	Normandale FCS	LaHave River (NMC)	6	2	30.0	-	14,988
E. Duffins Crk. - Durham Outdoor Centre	5	2014	Normandale FCS	LaHave River (NMC)	6	2.38	54.7	-	22,963
Greenwood	5	2014	Normandale FCS	LaHave River (NMC)	6	2.38	50.0	-	20,995
									93,917
						Spring Fingerling Total:	746.0		**304,611**
ATLANTIC SALMON - FALL FINGERLING									
Cobourg Br.									
Danforth Rd.	11	2014	Normandale FCS	LaHave River (NMC)	11	15.1	91.5	-	**6,061**
Shelter Valley									
Skyview Rd.	12	2014	Normandale FCS	LaHave River (NMC)	11	12.03	180	-	**14,996**

Continued on next page

TABLE 6.1.3 (continued) Atlantic Salmon stocked in the Province of Ontario waters of Lake Ontario, 2015.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
ATLANTIC SALMON - FALL FINGERLING (continued from previous page)									
Credit River									
Inglewood	11	2014	Normandale FCS	LaHave River (NMC)	11	12.24	110.4	None	9,023
McLaren Rd.	11	2014	Normandale FCS	Lac St. Jean (HWC)	11	14.39	47.5	None	3,302
McLaren Rd.	11	2014	Normandale FCS	LaHave River (NMC)	11	21.68	86.9	None	4,008
McLaren Rd.	11	2014	Normandale FCS	Sebago Lake (HWC)	11	24.48	81.8	None	3,342
McLaughlin Road Bridge	11	2014	Normandale FCS	LaHave River (NMC)	11	12.49	124.9	None	10,004
Norval Nashville North	11	2014	Normandale FCS	LaHave River (NMC)	11	21.64	86.7	None	4,008
Norval Nashville North	11	2014	Normandale FCS	Sebago Lake (HWC)	11	20.53	82.1	None	3,999
Norval Nashville North	11	2014	Normandale FCS	Lac St. Jean (HWC)	11	16.97	67.9	None	4,001
5th Concession	11	2014	Normandale FCS	LaHave River (NMC)	11	13.35	80.4	None	6,021
Paulynn Park	11	2014	Normandale FCS	LaHave River (NMC)	11	16.62	99.5	None	5,985
									53,693
						Fall Fingerling Total:	1,140		**74,750**
ATLANTIC SALMON - SPRING YEARLING									
Cobourg Br.									
Danforth Rd.	4	2013	Normandale FCS	LaHave River (NMC)	16	70.4	211.0	None	2,999
Danforth Rd.	4	2013	Normandale FCS	Sebago Lake (HWC)	16	58.9	179.5	None	3,048
Danforth Rd.	4	2013	Normandale FCS	LaHave River (NMC)	16	64.0	206.0	None	3,217
Division St.	4	2013	Normandale FCS	Sebago Lake (HWC)	16	46.5	248.2	None	5,334
									14,598
Credit R.									
Norval Nashville North	6	2015	CRAA	LaHave River			-	None	170
Norval Nashville North	4	2013	Normandale FCS	LaHave River (NMC)	16	70.0	777.6	None	11,108
Norval Nashville North	4	2013	Normandale FCS	Sebago Lake (HWC)	16	62.0	85.1	None	1,372
Norval Nashville North	4	2013	Normandale FCS	Sebago Lake (HWC)	16	61.8	225.0	None	3,641
Norval Nashville North	4	2013	Normandale FCS	Sebago Lake (HWC)	16	53.9	125.5	None	2,330
Norval Nashville North	4	2013	Normandale FCS	Sebago Lake (HWC)	16	55.2	62.3	None	1,129
Norval Nashville North	4	2013	Normandale FCS	LaHave River (NMC)	16	64.4	85.1	None	1,322
Terra Cotta	4	2013	Normandale FCS	Lac St. Jean (HWC)	16	46.0	220.9	None	4,803
Terra Cotta	4	2013	Normandale FCS	Sebago Lake (HWC)	16	62.3	201.4	None	3,233
Terra Cotta	2	2013	Normandale FCS	Sebago Lake (HWC)	16	62.0	109.7	None	1,770
Terra Cotta	4	2013	Normandale FCS	LaHave River (NMC)	16	72.1	169.4	None	2,350
Terra Cotta	4	2013	Normandale FCS	LaHave River (NMC)	16	71.3	189.0	None	2,652
									35,880
Duffins Crk.									
5th Concession	4	2013	Normandale FCS	LaHave River (NMC)	16	66.25	469.0	-	7,079
Paulynn Park	4	2013	Normandale FCS	LaHave River (NMC)	16	66.8	67.0	-	1,003
Paulynn Park	4	2013	Normandale FCS	Sebago Lake (HWC)	16	58	348.2	-	6,004
									14,086
						Spring Yearling Total:	3,980		**64,564**
						Spring Fingerling Total:	746.0		**304,611**
						Fall Fingerling Total:	1,140.0		**74,750**
						Spring Yearling Total:	3,979.9		**64,564**
						Atlantic Salmon Total (not including eggs):	**5,866**		**443,925**

Continued on next page

TABLE 6.1.4. Brown Trout stocked in the Province of Ontario waters of Lake Ontario, 2015.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
			BROWN TROUT - FALL FINGERLINGS						
Lake Ontario									
Amherst Island	9	2014	Springside Park - Napanee	Ganaraska River (TTC)	7			None	10,000
Finkle's Shore Ramp	9	2014	Springside Park - Napanee	Ganaraska River (TTC)	7			None	10,000
Frenchmans Bay	10	2014	Ringwood (OFAH 2006)	Ganaraska River (TTC)	10	15	462.9	None	30,861
									50,861
					Fall Fingerling Total:		462.9		**50,861**
			BROWN TROUT - SPRING YEARLINGS						
Bowmanville Cr.									
CLOCA Ramp	4	2013	Chatsworth FCS	Ganaraska River (TTC)	16	38.42	960.0	None	**24,987**
Credit R.									
Norval Nashville North	6	2013	Credit River Angers Assoc. Hatchery	Ganaraska River (TTC)			-	None	**255**
Lake Ontario									
Athol Bay	4	2013	Chatsworth FCS	Ganaraska River (TTC)	16	38.42	970.0	None	25,246
Burlington Canal	4	2013	Chatsworth FCS	Ganaraska River (TTC)	16	37.31	979.9	None	26,264
Fifty Point CA	3	2013	Chatsworth FCS	Ganaraska River (TTC)	15	35.89	900.0	None	25,076
Humber Bay Park	4	2013	Chatsworth FCS	Ganaraska River (TTC)	16	37.06	930.0	None	25,094
Lakefront Promenade	4	2013	Chatsworth FCS	Ganaraska River (TTC)	16	36.4	910.0	None	25,000
Port Dalhousie East	3	2013	Chatsworth FCS	Ganaraska River (TTC)	15	34.46	870.0	None	25,247
									151,927
					Spring Yearling Total:		6519.9		**177,169**
					Fall Fingerling Total:		462.9		**50,861**
					Spring Yearling Total:		6,519.9		**177,169**
					Brown Trout Total:		**6,983**		**228,030**

TABLE 6.1.5. Rainbow Trout stocked in the Province of Ontario waters of Lake Ontario, 2015.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
RAINBOW TROUT - FALL FINGERLINGS									
Credit River									
Norval Nashville North	11	2015	Credit River Angers Assoc. Hatchery	Ganaraska River (NMC)	7	-	-	None	**5,562**
Lake Ontario									
Wellington Channel	10	2015	Springside Park Hatchery	Ganaraska River (NMC)	6	-	-	None	**20,000**
						Fall Fingerling Total:	-		**25,562**
RAINBOW TROUT - SPRING YEARLINGS									
Bronte Creek									
2nd Side Road Bridge	4	2014	Harwood FCS	Ganaraska River (TTC)	13	18.11	216.3	None	11,945
5th Side Road Bridge	4	2014	Harwood FCS	Ganaraska River (TTC)	13	22.5	269.4	None	11,975
Lowville Park	5	2014	Harwood FCS	Ganaraska River (TTC)	13	21.93	263.2	None	12,000
Credit River									
Norval	5	2014	Harwood FCS	Ganaraska River (TTC)	13	21.93	372.8	None	17,000
Norval Nashville North	6	2014	Credit River Angers Assoc. Hatchery	Wild Egg Collection		-	-	None	395
Norval	4	2014	Harwood FCS	Ganaraska River (TTC)	13	24.4		None	16980
Humber River									
East Branch, Islington	4	2014	Harwood FCS	Ganaraska River (TTC)	13	26.3		None	16,970
King Vaughan Line	4	2014	Harwood FCS	Ganaraska River (TTC)	13	20.62	350.3	None	16,990
Little Rouge R. Steeles Ave.	4	2014	Ringwood (OFAH 2006)	Wild Egg Collection	12	36	298.8	None	8,300
Milne Reservoir	4	2014	Ringwood (OFAH 2006)	Wild Egg Collection	12	37	307.1	None	8,300
Lake Ontario									
Beacon Inn	5	2014	Harwood FCS	Ganaraska River (TTC)	13	19.65	235.8	None	12,000
Jordan Harbour	5	2014	Harwood FCS	Ganaraska River (TTC)	13	24.94	299.3	None	12,000
Port Dalhousie East	5	2014	Harwood FCS	Ganaraska River (TTC)	13	22.07	527.5	None	23,901
Port Dalhousie East	5	2014	Harwood FCS	Ganaraska River (TTC)	13	19.65	100.5	None	5,115
						Spring Yearling Total:	315.1		**173,871**
						Fall Fingerling Total:	-		**25,562**
						Spring Yearling Total:	315.1		**173,871**
						Rainbow Trout Total:	315		**199,433**

TABLE 6.1.6. Chinook Salmon stocked in the Province of Ontario waters of Lake Ontario, 2015.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
CHINOOK SALMON - SPRING FINGERLINGS									
Bronte Cr.									
2nd Side Road Bridge	5	2014	Normandale FCS	Lake Ontario (Wild)	6	5.96	149.0	None	24,999
4th Side Road Bridge	5	2014	Normandale FCS	Lake Ontario (Wild)	6	5.84	146.0	None	24,994
									49,993
Credit R.									
Eldorado Park	5	2014	Normandale FCS	Lake Ontario (Wild)	6	5.48	164.2	None	29,968
Norval Nashville North	5	2014	Normandale FCS	Lake Ontario (Wild)	6	5.04	277.1	None	54,977
									84,945
Don R.									
East Don R Donalda Golf Club	5	2014	Normandale FCS	Lake Ontario (Wild)	6	5.53	221.2	None	**40,001**
Humber R.									
East Branch Islington	5	2014	Normandale FCS	Lake Ontario (Wild)	6	5.47	273.3	None	**49,965**
Lake Ontario									
Ashbridge's Bay	5	2014	Normandale FCS	Lake Ontario (Wild)	6	4.86	72.8	None	14,976
Bluffer's Park	5	2014	Normandale FCS	Lake Ontario (Wild)	6	4.86	72.8	None	14,982
Burlington Canal	5	2014	Normandale FCS	Lake Ontario (Wild)	6	5.77	173.3	None	30,041
Consecon Robinson Point	5	2014	Normandale FCS	Lake Ontario (Wild)	6	5.16	77.5	None	15,010
Lakeport	5	2014	Normandale FCS	Lake Ontario (Wild)	6	4.65	70.0	None	15,062
Oshawa Harbour	5	2014	Normandale FCS	Lake Ontario (Wild)	6	5.25	78.9	None	15,022
Port Dalhousie East	5	2014	Normandale FCS	Lake Ontario (Wild)	6	5.44	224.6	None	41,286
Port Dalhousie East	5	2014	Normandale FCS	Lake Ontario (Wild)	6	5.44	131.4	None	24,149
Port Darlington	5	2014	Normandale FCS	Lake Ontario (Wild)	6	5.25	78.9	None	15,028
Wellington Channel	5	2014	Normandale FCS	Lake Ontario (Wild)	6	4.65	70.1	None	15,075
Whitby Harbour	5	2014	Normandale FCS	Lake Ontario (Wild)	6	4.99	74.9	None	15,014
									215,645
Lake Ontario - Net Pens									
Bluffer's Park	5	2014	Net Pen - MEA	Lake Ontario (Wild)	6	9.6	240.0	None	25,000
Bronte Harbour	5	2014	Net Pen - HRSTA	Lake Ontario (Wild)	6	7.09	70.9	None	9,995
Oshawa Harbour	5	2014	Net Pen - MEA	Lake Ontario (Wild)	6	8.21	123.0	None	14,984
Port Dalhousie East	5	2014	Net Pen - SCFGC	Lake Ontario (Wild)	6	8.19	409.6	None	50,015
Port Darlington	5	2014	Net Pen - MEA	Lake Ontario (Wild)	6	8.11	162.2	None	20,005
Pt. Credit Harbour	5	2014	Net Pen - SCFGC	Lake Ontario (Wild)	6	8.2	82.8	None	10,092
Wellington Channel	5	2014	Net Pen - CLOSA	Lake Ontario (Wild)	6	7.21	216.6	None	30,042
Whitby Harbour	5	2014	Net Pen - MEA	Lake Ontario (Wild)	6	7.7	115.5	None	14,997
									175,130
						Chinook Salmon Total:	3,777		**615,679**

TABLE 6.1.7. Coho Salmon stocked in the Province of Ontario waters of Lake Ontario, 2015.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
			COHO SALMON - SPRING FINGERLINGS						
Credit R.									
Norval Nashville North	6	2014	CRAA	Lake Ontario (Wild)	-	-	-	None	**460**
			COHO SALMON - FALL FINGERLINGS						
Credit R.									
Norval	10	2014	Ringwood (OFAH 2006)	Lake Ontario (Wild)	-	26.00	1,138.9	None	**43,804**
						Coho Salmon Total:	1,138.9		**44,264**

TABLE 6.1.8. Lake Trout stocked in the Province of Ontario waters of Lake Ontario, 2015.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
				LAKE TROUT - FALL FINGERLINGS					
Lake Ontario									
Fifty Point CA	12	2013	Chatsworth FCS	Slate Islands (TTC)	13	17.35	135.0	1	**7,781**
				LAKE TROUT - SPRING YEARLINGS					
Lake Ontario									
Amherst Island - Pig Pt.	4	2013	North Bay FCS	Slate Islands (DNC)	13	28.77	450.7	RVAD	15,664
Amherst Island - Kerr Point	4	2013	North Bay FCS	Seneca Lake (TTC)	13	28.77	449.4	RVAD	15,619
Amherst Island	4	2013	Harwood FCS	Seneca Lake (TTC)	17	32.6	942.3	RVAD	28,904
Amherst Island - K10 Buoy	4	2013	White Lake FCS	Seneca Lake (TTC)	15	30	987.6	RVAD	32,920
Athol Bay	4	2013	Harwood FCS	Seneca Lake (TTC)	17	37.43	168.5	RVAD	4,503
Athol Bay	4	2013	Harwood FCS	Michipicoten Island (DNC)	18	28.53	134.2	RVAD	4,703
Brighton - Offshore	4	2013	Harwood FCS	Seneca Lake (TTC)	17	33.91	1110	RVAD	31,990
Brighton - Offshore	4	2013	Harwood FCS	Michipicoten Island (DNC)	18	35.03	249.5	RVAD	7,122
Brighton - Offshore	4	2013	Harwood FCS	Slate Islands (DNC)	18	29.6	551.5	RVAD	18,633
Cobourg Harbour Pier	4	2013	North Bay FCS	Slate Islands (DNC)	13	28.77	1666.8	RVAD	57,936
Cobourg Harbour Pier	4	2013	White Lake FCS	Slate Islands (DNC)	16	23.7	265	RVAD	11,181
Cobourg Harbour Pier	4	2013	North Bay FCS	Seneca Lake (TTC)	13	29.78	1602.6	RVAD	53,876
Cobourg Harbour Pier	5	2013	Harwood FCS	Michipicoten Island (DNC)	18	38.54	646.0	RVAD	16,761
Fifty Point CA	3	2013	Chatsworth FCS	Seneca Lake (TTC)	15	21.9	789.9	RVAD	36,068
Fifty Point CA	3	2013	Chatsworth FCS	Seneca Lake (TTC)	15	22.59	729.9	RVAD	32,310
Long Point	4	2013	North Bay FCS	Slate Islands (DNC)	13	28.77	448.8	RVAD	15,599
North of Main Duck Sill	4	2013	White Lake FCS	Seneca Lake (TTC)	15	30	1014.1	RVAD	33,803
North of Main Duck Sill	4	2013	White Lake FCS	Slate Islands (DNC)	16	23.7	1040.6	RVAD	43,907
North of Main Duck Sill	4	2013	White Lake FCS	Slate Islands (DNC)	16	23.7	1040.2	RVAD	43,892
Pt. Petre	4	2013	Harwood FCS	Michipicoten Island (DNC)	18	25.45	474.1	RVAD	18,629
Pt. Petre	4	2013	Harwood FCS	Michipicoten Island (DNC)	18	28.53	324.6	RVAD	11,376
Scotch Bonnet Shoal	4	2013	Harwood FCS	Michipicoten Island (DNC)	18	35.03	415.2	RVAD	11,852
Scotch Bonnet Shoal	4	2013	Harwood FCS	Michipicoten Island (DNC)	18	28.53	72.8	RVAD	2,552
									549,800
				LAKE TROUT - ADULTS					
Lake Ontario									
Glenora	10	2009	Chatsworth FCS	Michipicoten Island (Wild)	70	4,167	375.0	AD	90
Glenora	11	2008	Chatsworth FCS	Michipicoten Island (Wild)	71	4,301	615.0	AD	143
Glenora	10	2007	Chatsworth FCS	Michipicoten Island (Wild)	82	5,125	615.0	AD	120
Glenora	11	2007	Chatsworth FCS	Michipicoten Island (Wild)	83	5,217	240.0	AD	46
									399
						Fall Fingerling Total:	135.0		**7,781**
						Spring Yearling Total:	15,574.3		**549,800**
						Adult Total:	1,845.1		**399**
						Lake Trout Total:	17,554		**557,980**

TABLE 6.1.9. Walleye stocked in Hamilton Harbour, 2015.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
				WALLEYE - FRY					
Lake Ontario									
Hamilton Harbour	5	2015	White Lake FCS	Bay of Quinte (Wild)		-	-	None	**1,017,625**
				WALLEYE - SUMMER FINGERLINGS					
Lake Ontario									
Hamilton Harbour	7	2015	White Lake FCS	Bay of Quinte (Wild)	3	0.26	10.2	None	39,315
Hamilton Harbour	7	2015	White Lake FCS	Bay of Quinte (Wild)	3	0.35	4.8	None	13,648
									52,963
						Fry Total:	-		**1,017,625**
						Summer Fingerling Total:	15.0		**52,963**
						Walleye Total:			**1,070,588**

TABLE 6.1.10. Bloater stocked in the Province of Ontario waters of Lake Ontario, 2015.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
				BLOATER - FALL FINGERLING					
Lake Ontario									
Main Duck Isl.	11	2015	White Lake FCS	Lake Michigan (Wild)	8	3.6	104.1	None	28,904
Main Duck Isl.	11	2015	White Lake FCS	Lake Michigan (Wild)	8	3.6	10.6	None	2,941
									31,845
				BLOATER - FALL YEARLING					
Lake Ontario									
Main Duck Isl.	11	2015	Chatsworth FCS	Lake Michigan (Wild)	19	49.07	50.4	None	1,027
Main Duck Isl.	11	2014	White Lake FCS	Lake Michigan (Wild)	19	58.1	36.3	None	625
									1,652
				BLOATER - SUB-ADULT					
Lake Ontario									
Main Duck Isl.	11	2013	White Lake FCS	Lake Michigan (Wild)	31	92	193.2	None	2,100
						Fall Fingerling Total:	114.6		31,845
						Fall Yearling Total:	86.7		1,652
						Sub-Adult Total:	193.2		2,100
						Bloater Total:	394.5		**35,597**

6.2 Net Pens

C. Lake, Lake Ontario Management Unit

Net pens have been used in Lake Ontario since 1998 in New York State, and more recently (since 2003) in Ontario. The net pen is a floating enclosure that is tied to a pier or other nearshore structure, and is used to temporarily house young salmonids (Chinook Salmon in Ontario, Chinook and Rainbow Trout in New York) prior to their release into the lake. The net pens are managed by local angler groups, who monitor the health of the fish and feed them multiple times per day. The fish are reared in the net pens for approximately four weeks prior to release. 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 previous marking experiments. Once mature, these fish may return to the net pen site, providing for a near shore fall fishery for migrating fish.

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, with some sites dropped while other sites have added net pens. A thorough review of the history of the program was described in the 2014 Annual Report. Fig. 6.2.1 illustrates the number and location of net pens used in Lake Ontario during 2015.

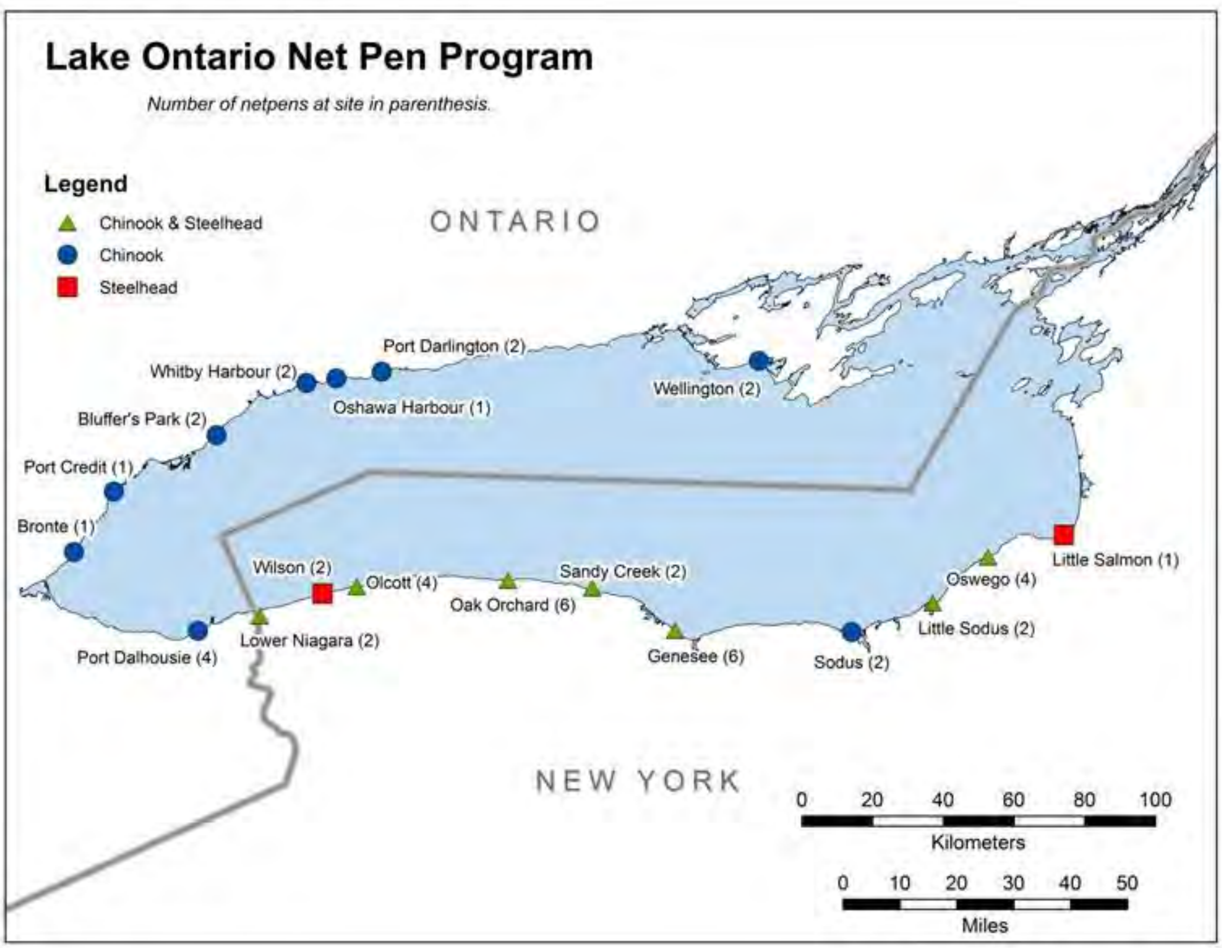


FIG. 6.2.1. Location of net pens used in Lake Ontario in 2015 (Ontario and New York jurisdictions).

2015 Net Pen Program

A total of 15 net pens were used at 8 sites in 2015 (Table 6.2.1). Changes from previous years included: an additional pen located at Whitby, movement of the Brighton pen to Wellington (for a total of two pens at that site) and the addition of a new site – Bronte Harbour. Some operational changes were introduced to the program in 2015, including the deployment of temperature/dissolved oxygen data loggers at all of the sites, and standardized methods of weighing fish. These data have been used to compare the variation in net pen site growing conditions and the evaluation of feed conversion rates.

A total of 175,130 Chinook Salmon were held in net pens in 2015. This represents 28% of the total number stocked (615,679). Overall, fish growth and health was reported as good, with few mortalities. Fish were delivered to the pens at 3.6g and weighed 8.04g when released 25 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.

Over the course of the program, the numbers of Chinook Salmon allocated to the net pens has increased (Fig. 6.2.2a). At the same time, there has been an increase of net pens to a total of 15 in 2015. In order to ensure fish health, a maximum density of 32 g/l 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. The average weight of Chinook at time of release from the net pens (Ontario only; 2003-2015) is 7.73 g.

The Ontario program has taken a conservative approach, generally stocking a maximum of 15,000 fish in a pen. Figure 6.2.2b shows the average density of fish held 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. There have been only a few instances of exceptional fish growth where the guideline has been briefly exceeded prior to release.

Several clubs coordinated outreach events associated with the arrival and subsequent release of the fish, and report that public interest was very high. The net pen program continues to be very popular with the participating clubs, and we look forward to another successful year in 2016.

TABLE. 6.2.1. Summary data of the 2015 Chinook Salmon net pen program.

Net pen location	Volunteer Group	# stocked (in pens)	Number of pens	Date stocked	Size at stocking (g)	Date released	Days held	Size at release (g)	Mortalities (# fish)	Mortality (%)	Number released
Bluffer's Park	MEA	25,005	2	14-Apr	3.57	13-May	29	9.6	5	0.00%	25,000
Bronte Harbour	HRSTA	10,002	1	11-Apr	3.57	09-May	28	7.09	7	0.10%	9,995
Oshawa Harbour	MEA	15,000	1	12-Apr	3.57	03-May	21	8.21	16	0.10%	14,984
Port Credit	PCSTA	10,092	1	11-Apr	3.57	06-May	25	8.2	0	0.00%	10,092
Port Dalhousie	SCFGC	50,022	4	16-Apr	3.78	17-May	31	8.19	7	0.00%	50,015
Port Darlington	MEA	20,020	2	14-Apr	3.62	03-May	19	8.11	15	0.10%	20,005
Wellington	CLOSA	30,058	2	15-Apr	3.63	07-May	22	7.21	16	0.10%	30,042
Whitby Harbour	MEA	15,003	2	12-Apr	3.57	05-May	23	7.7	6	0.00%	14,997
Average		21,900	-	-	3.6	-	25	8.04	9	0.05%	21,891
Total		175,202	15	-	-	-	-	-	72	-	175,130

* 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. Catherines Fish & Game Club).

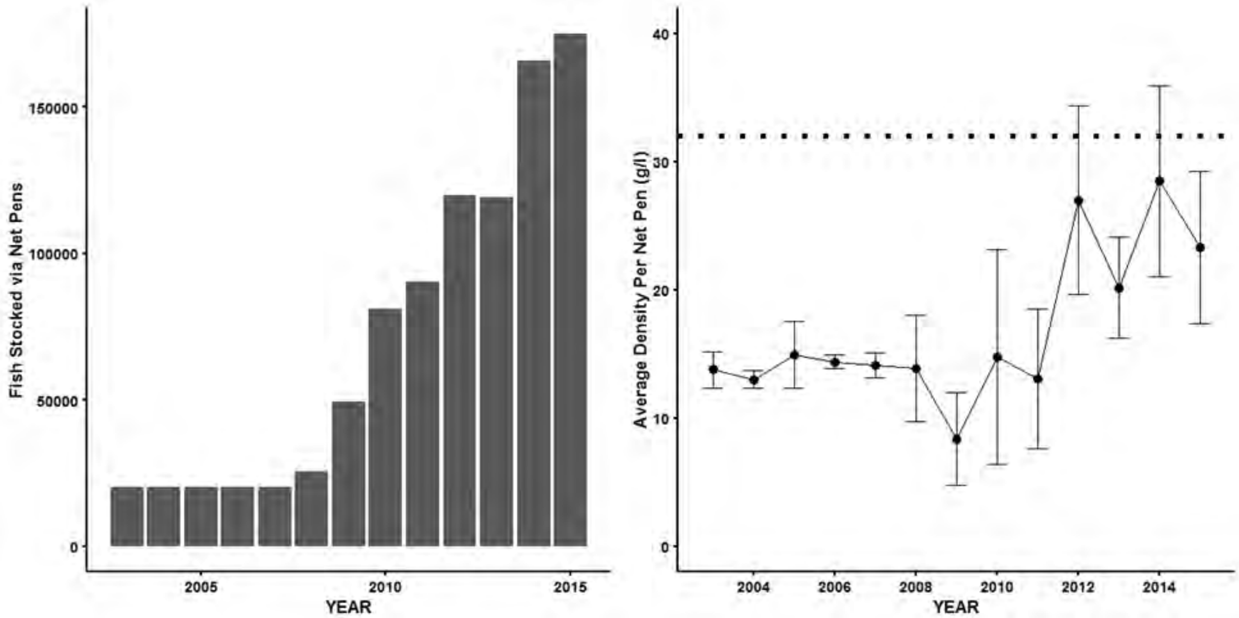


FIG. 6.2.2. a) (left panel) number of Chinook Salmon released into Lake Ontario from net pens (Ontario waters only; 2003-2015); b) (right panel) average density (g/l) of Chinook Salmon held in each net pen. The guideline of 32 g/l is represented by the dashed line.

6.3 Lake Ontario Stocking Plan

C. Lake , Lake Ontario Management Unit

Lake Ontario is stocked annually by New York State and the Province of Ontario with over 6 million fish. The Province of Ontario stocks more than 2.4 million fish into Lake Ontario and its tributaries. Stocking supports a world-class non-native trout and salmon fishery, assists in maintaining the predator-prey balance in the lake, and is a key management tool for the restoration of native species. Fisheries managers strive to balance the social and economic benefits provided by introduced species and the need to restore native species while maintaining overall ecosystem health.

The Stocking Strategy for the Ontario Waters of Lake Ontario was developed by the Ontario Ministry of Natural Resources and Forestry's (OMNRF) Lake Ontario Management Unit with the support of the New York State Department of Environmental Conservation and the advice of the Fisheries Management Zone 20 Advisory Council.

The Stocking Plan was posted to the Environmental Registry in early 2015 for public review and comment. Comments were reviewed and responded to, and edits to the plan (where necessary) were made. The Stocking Strategy is now finalized (early 2016), and will guide stocking decisions for the next ten years (2016-2025).

The Stocking Plan attempts to balance the short-term social, economic, and cultural needs of fishery stakeholders with the long-term goals of restoring native species while maintaining a balanced Lake Ontario fish community. The lake-wide OMNRF approved Fish Community Objectives 2013 guide the overall stocking program.

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 wild fish. Salmon returning to rivers to spawn also support an important shore and tributary fisheries.

In 2015, Chinook Salmon represented 29% of the total number of fish stocked and 10% of total biomass stocked into Lake Ontario by MNRF (Section 6.1). 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. Despite recent stable stocking levels, Chinook Salmon CUE in the Fish Community Index Gill Netting has been variable (Fig.7.1.2). Chinook Salmon CUE moved from the lowest in the time series (2009) to the second highest in just two years (2011, Fig. 7.1.2). Since 2011, Chinook Salmon CUE in gill nets has declined.

Chinook Salmon mark and tag monitoring data (Section 2.2) are reported from five Lake Ontario Management Unit (LOMU) surveys: i) Western Lake Ontario Boat Angling Survey (not conducted in 2015), ii) Chinook Salmon Angling Tournament and Derby Sampling (not conducted in 2015), iii) Lake Ontario Volunteer Angler Diary Program (Section 2.3), 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 1.7). Gill nets caught small Chinook Salmon and complement the angler programs that caught larger fish (Fig. 7.1.3). No coded wire tags (CWTs) were recovered from gill nets or angling programs in 2015, however CWTs collected from these programs in previous years have shown a mixed population of Chinook Salmon 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.

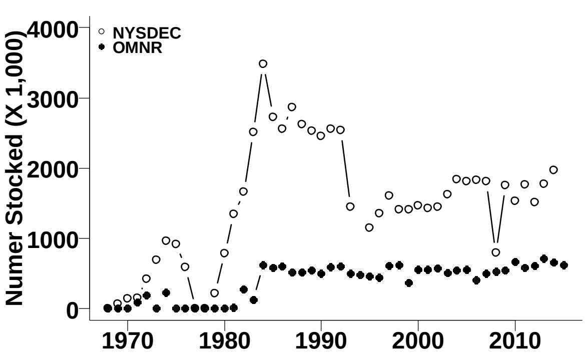


FIG 7.1.1. Number of Chinook Salmon stocked by New York State Department of Environmental Conservation (NYSDEC) and MNRF from 1968-2015 (Section 6.1).

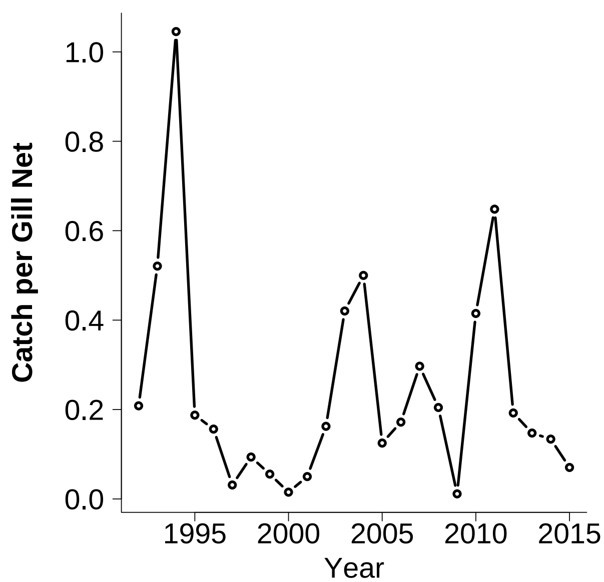


FIG. 7.1.2. Number of Chinook Salmon caught per gill net (CUE) from the Fish Community Index Gill Netting Program (see Section 1.2) from 1992-2015.

Catch per unit effort (CUE), total catch and total harvest is assessed by the Western Lake Ontario Boat Fishery, however this survey was not conducted in 2015. In 2013, total effort increased (Fig. 7.1.4) but total catch and harvest were 11% and 18% lower than the mean through 1997-2013 (Fig. 7.1.5). Release rates in both the Western Lake Ontario Boat Fishery and the Lake Ontario Volunteer Angler Program (Section 2.3) have generally increased through time (Fig. 7.1.6). However, in 2013, the release rates in the Western Lake Ontario Boat Fishery declined to 57% from the 2004-2013 average of 60%. Chinook Salmon release rates reported in the Lake Ontario Volunteer Angler Program were lower in 2015 (55%) compared to 2014 (61%) from the 2004-2015 average of 48%. From 2004-2008, release rates in the Western Lake Ontario Boat Fishery were higher relative to the Volunteer Angler Program (63% vs 32%, respectively); however from 2008-2013, Chinook Salmon release rates from both programs have been comparable (58% in Boat Fishery; 59% in the Volunteer Angler Program).

The condition of Lake Ontario Chinook Salmon was evaluated through three separate LOMU programs: i) Credit River Chinook Salmon Spawning Assessment (Section 1.7), ii) Data collected for Chinook Salmon Mark and Tag Monitoring (Section 2.2) and iii) Western Lake Ontario Boat Fishery. Chinook Salmon in the

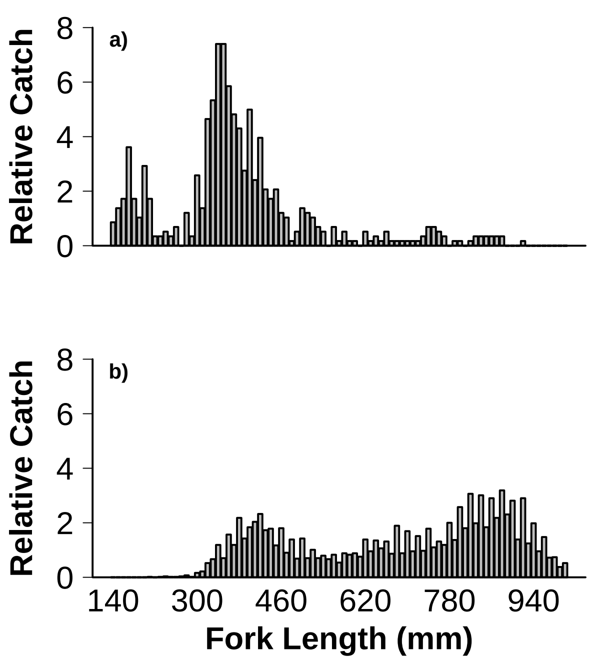


FIG 7.1.3. Size distribution (fork length in mm) of Chinook Salmon caught (a) in the Fish Community Index Gill Netting Program from 1992-2015 (Section 1.2), and (b) by anglers in the Western Lake Ontario Angler Survey from 1995-2013.

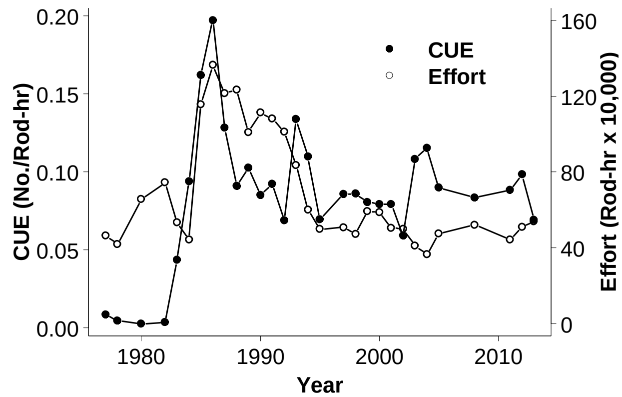


FIG 7.1.4. Catch rate (CUE) of Chinook Salmon and annual total effort (rod-hrs) in the Ontario waters of Lake Ontario (excluding the Eastern Basin), 1977-2013.

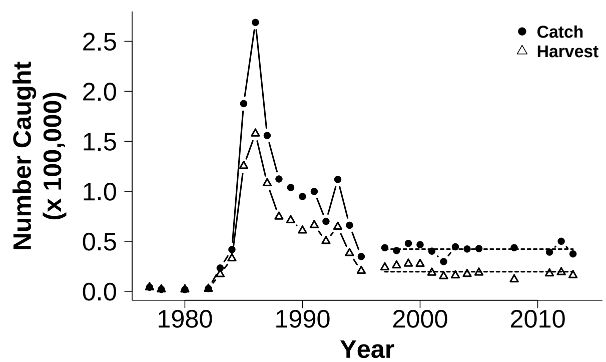


FIG 7.1.5. Number of Chinook Salmon caught (circle) and harvested (triangle) annually in the Ontario waters of Lake Ontario (excluding he Eastern Basin), 1977 to 2013. Dashed line represents the mean catch and harvest from 1997-2013.

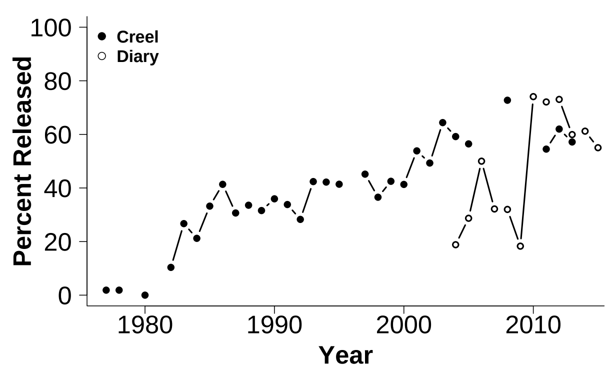


FIG 7.1.6. Annual average of the proportion of Chinook Salmon released per trip from Lake Ontario Volunteer Angler Diary Program (open circle) and the Western Lake Ontario Angler Survey (closed circle). Data from the Western Lake Ontario Angler Survey are from 1977 to 2013 and do not include the Kingston Basin. Lake Ontario Volunteer Angler Diary data are from 2004-2015.

Credit River index have a lower condition relative to fish sampled in the lake during mid-summer when condition should be at a maximum. Chinook Salmon condition, evaluated using data from the Credit River Chinook Spawning Index Program (Section 1.7) has declined since 1989 (Fig. 7.1.7). In 2012, Credit River Chinook Salmon condition was the lowest in the time series. Since 2012, Chinook Salmon condition in the Credit River has increased. In contrast, these overall trends were not observed in either the Western Lake Ontario Boat Fishery or the tournament sampling (Fig. 7.1.7). Despite the recent decline in Chinook Salmon condition from 2011-2013 in the Western Lake Ontario Boat Fishery, the 2013 condition index still remains above the long-term 1996-2013 average. A similar decline in condition was observed in Chinook Salmon sampled in tournaments; however this decline in condition is subtle relative to observations in the Credit River condition index (Fig. 7.1.7).

In 2015, the Lake Ontario Management Unit also sampled Chinook Salmon on the Ganaraska River. The focus of the project was to collect gametes for fish culture; the LOMU collected additional biological information on 122 fish. The age of 59 of these fish was interpreted. In contrast to the Credit River, where adult returns are predominantly stocked fish, adult Chinook Salmon returning to the Ganaraska River to spawn are thought to be predominantly of wild origin. Adults returning to the Ganaraska River were larger on average than those returning to the Credit River, however, condition of the Chinook Salmon returning to the Ganaraska River was slightly lower than the Credit River.

Using Chinook Salmon otoliths, in-year growth was calculated by measuring the distance from the last annuli to the outer edge of the otolith. Chinook Salmon experienced exceptional in-year growth from 2010-2012, followed by a sharp decline in 2013 (Fig. 7.1.8). In 2014, Chinook Salmon growth was the second lowest in the time series, increasing from 2013 levels (lowest in the 2006-2014 time series), however it remains below the average growth from 2008 (Fig. 7.1.8). In-year growth was determined to be correlated with summer water temperatures.

In 2015, average weight and length of adult Chinook Salmon returning to the Credit River declined for the second year in a row (see Section 1.7, Fig. 1.7.1). Despite this decline in overall size, the condition of these returning fish has either remained stable (females) or increased (males) since 2012 (see Section 1.7, Fig. 1.7.2). Mean summer temperatures for Lake Ontario were significantly below average in both 2014 and 2015 (see Section 11.1, Fig. 11.1.3). In addition, 2014 and 2015 were associated with above average winter severity (see Section 11.1, Fig. 11.1.1). While, these two factors may not be the driving force behind the observed declines in Chinook Salmon size (Fig. 7.1.8, Fig. 1.7.1), they likely have a significant contribution, as cooler temperatures are associated with lower metabolic activity and growth.

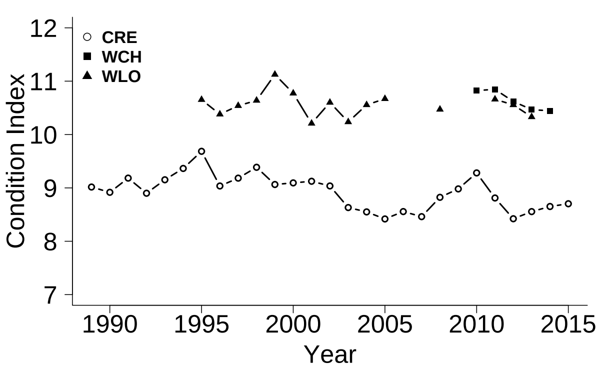


FIG. 7.1.7. Condition index of Chinook Salmon from Credit River Spawning Index (CRE), Tournament sampling (WCH) and the Western Lake Ontario Boat Angling Survey (WLO) from 1989-2015. Condition index is the predicted weight (based on a log-log regression) of a 900 mm Chinook Salmon.

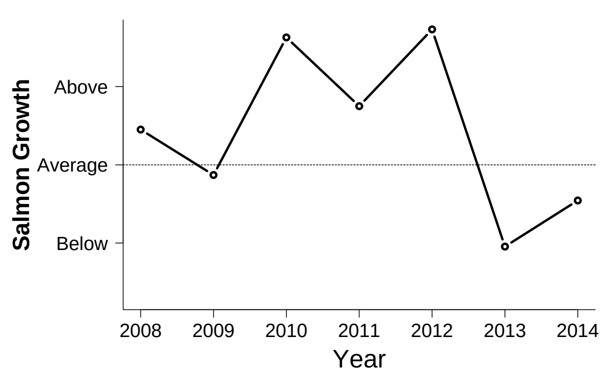


FIG. 7.1.8. Mean in-year growth determined by otolith measurements of age-2 and age-3 Chinook Salmon collected during the Credit River Spawning Index (Section 1.7).

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 producing young, wild fish). Rainbow Trout are the primary target for tributary anglers, who take advantage of the seasonal staging and spawning runs of this species. In addition, Rainbow Trout are the second most sought-after species the offshore salmonid fishery, making them not only ecologically important but recreationally and economically important as well.

The OMNRF stocks only Ganaraska River strain Rainbow Trout into Lake Ontario. Rainbow Trout represent 7.3% of all fish stocked by number and 6.7% biomass into Lake Ontario by the OMNRF. The stocking target for Rainbow Trout is 155,000 fish (Section 6). In 2015, approximately 142,000 fish were stocked, slightly below the 2006-2015 average of 173,000 (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 (see Section 1.1). In 2015, the Rainbow Trout run in the Ganaraska River declined from 9,611 fish in 2014 to 6,669 fish; below the previous 10-year average (7,192 fish from 2006-2015; Fig. 7.2.2). From 2011-2014, the Ganaraska River Rainbow Trout run was higher than the long-term average; 2015 marked a significant decline in run size (Fig. 7.2.2).

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 (1974-2015), Rainbow Trout condition has declined (Fig. 7.2.3a). 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. Condition declined through the 1980’s to a low point in 1987. From 1990-2015, the long-term trend shows slight decline in relative weight. Data on Rainbow Trout condition since the latest significant ecosystem disruption (i.e., Round Goby invasion in 2003—see Section 1.3), are the most informative for current stocks (Fig. 7.2.3b). Rainbow Trout 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 (Fig. 7.2.3b).

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

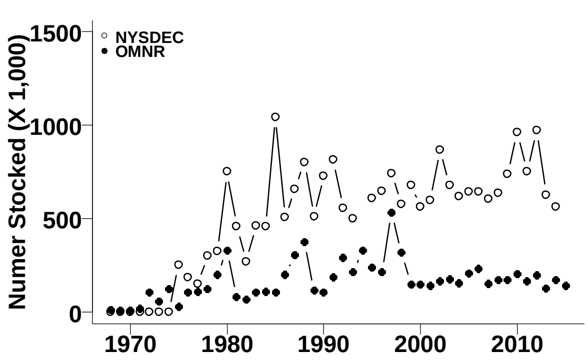


FIG 7.2.1. Number of Rainbow Trout stocked by New York State Department of Environmental Conservation (NYSDEC) and OMNRF from 1968-2015 (see Section 6.1).

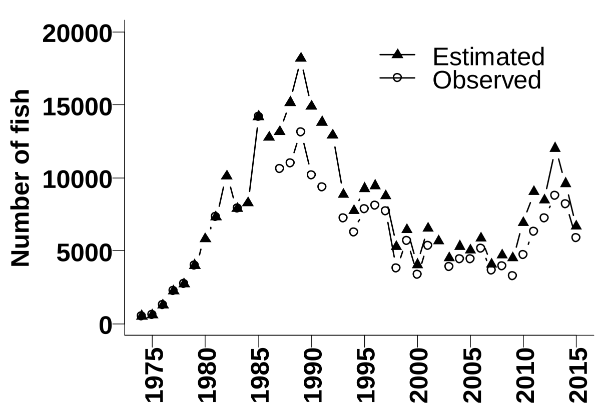


FIG 7.2.2. Estimated run of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario from 1974-2015.

(Fig. 7.2.4). After 2004 (the lowest CUE since 1982), the CUE steadily increased to 2013. Effort in this fishery has remained fairly stable since 1994 (Fig. 7.2.4). Total numbers of Rainbow Trout caught and harvested in the Western Lake Ontario Boat Fishery followed the same trends found in CUE with total harvest generally lower than total catch (Fig. 7.2.5).

Annual release rates (mean percent of total catch released per trip) for Rainbow Trout have remain fairly stable since the mid-1980s (Fig 7.2.6). The lowest release rates were observed in 1978 and 1980 (0.6% and 0.2%, respectively). Release rates were variable from year to year, but slowly climbed over a 21 year period from 1982 (24.1%) to 2003 (38.1%; Fig 7.2.6). They declined to 3.0% in 2005 (Western Lake Ontario Boat Fishery) and 0% in 2006 (Lake Ontario Volunteer Angler Diary; see Section 2.3). Since this time, release rates in the Western Lake Ontario Boat Fishery increased to 30.0% in 2013, similar to the long-term average from 1978 to 2014 of 27.6%. In the Lake Ontario Volunteer Angler Program, release rates increased from 2006 to 2014 (Fig. 7.2.6, see Section 2.3). In 2015, Rainbow Trout release rates dropped to 27%; a significant decline from 2014 (Fig. 7.2.6).

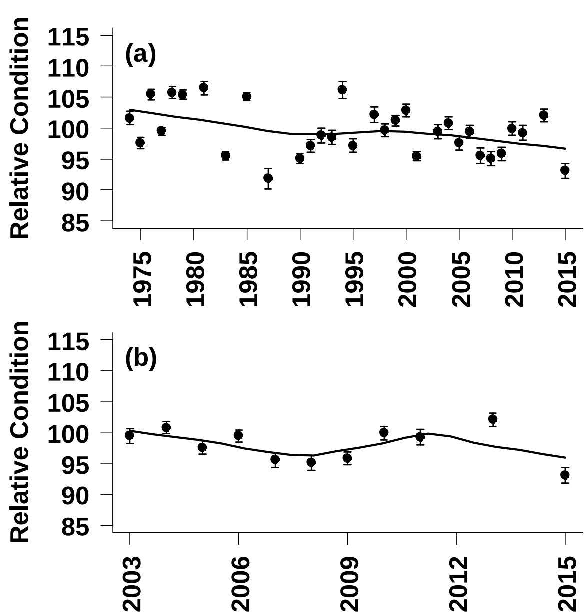


FIG 7.2.3. Relative weight of Rainbow Trout sampled at the Ganaraska River fishway at Port Hope, Ontario for (a) the whole time series 1974-2015 and (b) since the first observation of Round Goby Lake Ontario Trawls (2003-2015; see Section 1.1).

In the fall of 2014, anglers reported and New York State Department of Environmental Conservation (NYSDEC) observed disoriented Rainbow Trout in the Salmon River, New York. After hearing reports of distressed fish in the Salmon River, NY, the Lake Ontario Management Unit actively searched for distressed and disoriented Rainbow Trout in Lake Ontario tributaries. No distressed or disoriented fish were observed by LOMU. Tissues from distressed Rainbow Trout collected by NYSDEC contained low levels of Thiamine (Vitamin B1). Despite not observing distressed Rainbow Trout in Ontario, the impact of low Thiamine levels on the Lake Ontario Rainbow Trout population is uncertain. 2015 marked significant declines in both the run size and condition of Rainbow Trout on the Ganaraska River (Figs. 7.2.2 and 7.2.3). It is unknown whether these declines are related the Thiamine issues observed in New York, a result

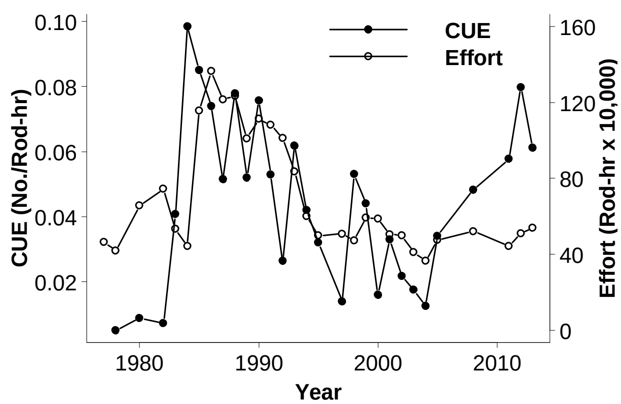


FIG 7.2.4. Catch rate (CUE) of Rainbow Trout and annual total effort (rod-hrs) in the Ontario waters of Lake Ontario (excluding Kingston Basin), 1977-2013.

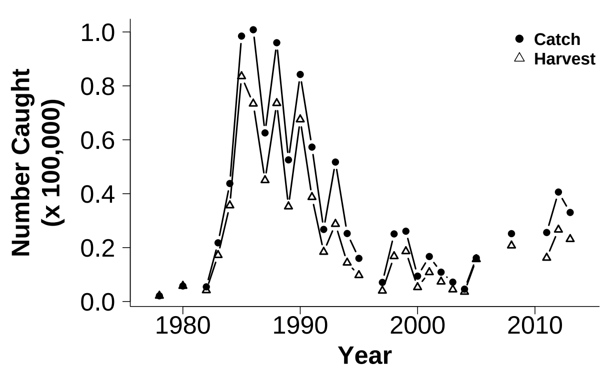


FIG 7.2.5. Number of Rainbow Trout caught (circle) and harvested (triangle) annually by the boat fishery in the Ontario waters of Lake Ontario (excluding Kingston Basin), 1978-2013.

of lower than average seasonal summer temperatures in 2014 and 2015 (see Section 11), or more severe winters in 2013-2014 and 2014-2015 (see Section 11.1), but it is likely the combination of multiple factors.

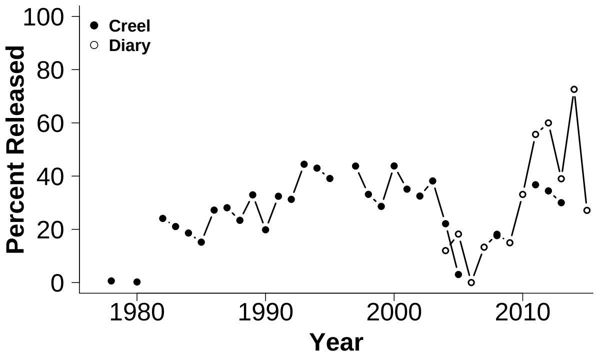


FIG 7.2.6. Annual average of the proportion of Rainbow Trout released per trip from Lake Ontario Volunteer Angler Diary Program (open circle) and the Western Lake Ontario Angler Survey (closed circle). Data from the Western Lake Ontario Angler Survey are from 1977-2013 and do not include the Kingston Basin. Lake Ontario Volunteer Angler Diary data are from 2004-2015.

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 118,000 lb and 78,000 respectively, over the 2008-2015 time -period. In 2015, base quota was 117,494 lb, issued quota was 155,246 lb and the harvest was 135,085 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-12 but very old fish remain in the harvest

Abundance

Lake Whitefish abundance is assessed in a number of programs. Summer gill net sampling is

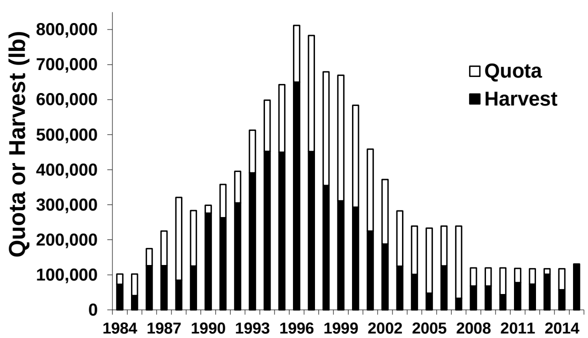


FIG. 7.3.1. Lake Whitefish commercial quota and harvest, 1984-2015.

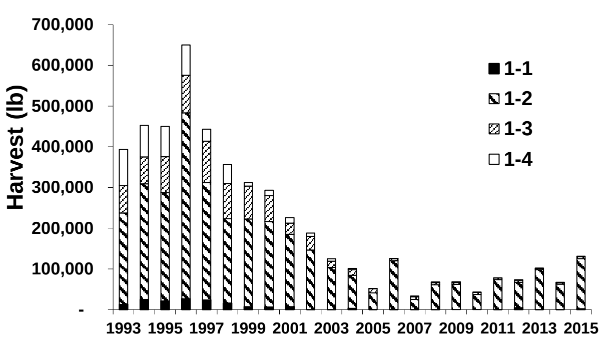


FIG. 7.3.2. Lake Whitefish commercial harvest by quota zone, 1993-2015.

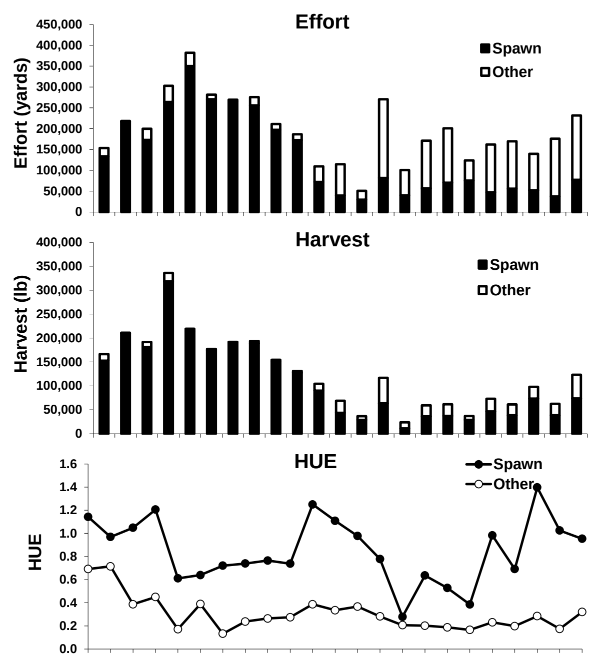


FIG. 7.3.3. Commercial Lake Whitefish gill net fishing effort (top panel), harvest (middle panel), and harvest-per-unit-effort (HUE; bottom panel) in quota zone 1-2, 1993-2015. "Spawn" includes November and December, and "Other" includes January through October.

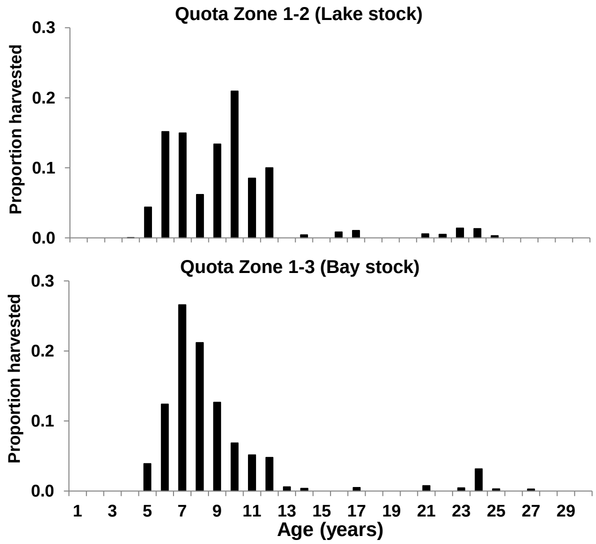


FIG. 7.3.4. Lake Whitefish age distributions (by number) in the 2015 quota zones 1-2 (upper panel) and 1-3 (lower panel) fall commercial fisheries.

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

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.

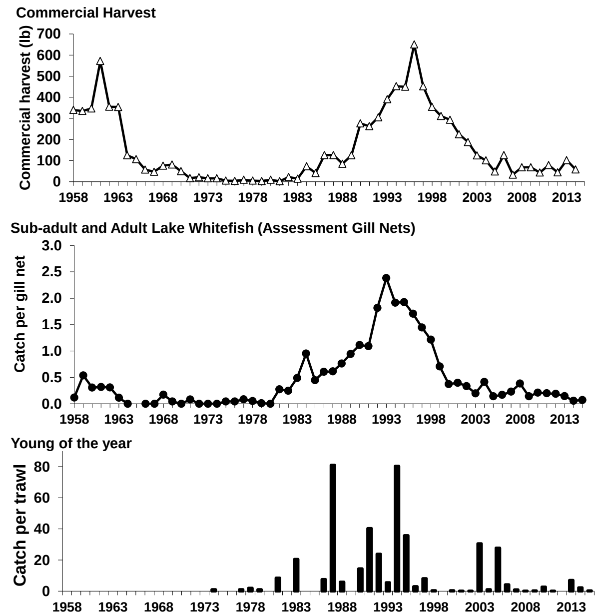


FIG. 7.3.5. Lake Whitefish commercial harvest (upper panel). Lake Whitefish abundance in eastern Lake Ontario assessment gill nets, 1958-2015 (sub-adult and adult; middle panel) and bottom trawls, 1972-2015 (young-of-the-year; lower panel).

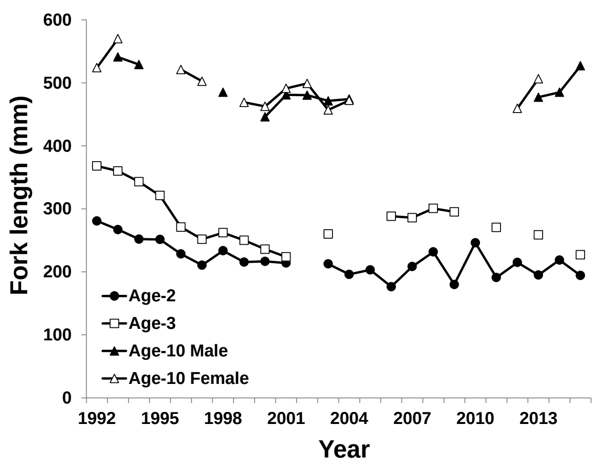


FIG. 7.3.6. Trends in Lake Whitefish fork length-at-age for age-2, age-3, age-10 males and females, caught in summer assessment gill nets, 1992-2015.

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.

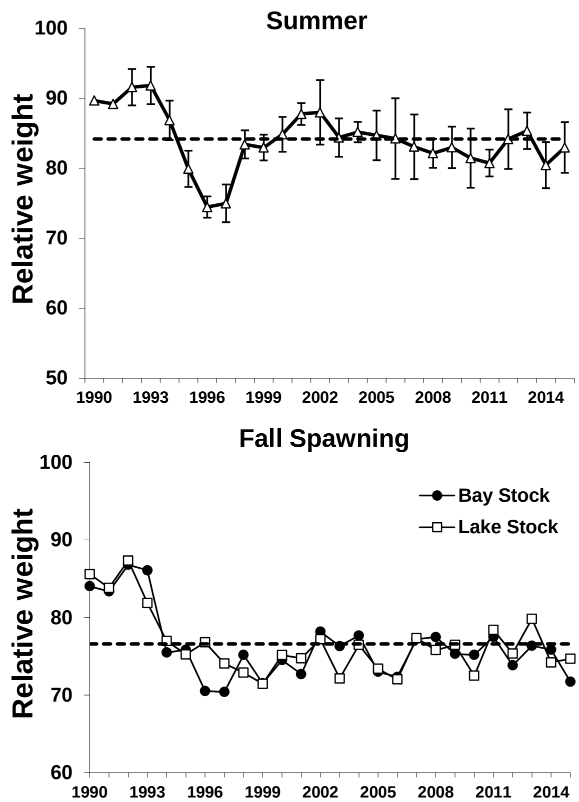


FIG. 7.3.7. Condition (relative weight) of Lake Whitefish sampled during summer assessment gill net surveys in eastern Lake Ontario (upper panel' error bars ±2SE) and fall commercial catch sampling in the Bay of Quinte ("Bay Stock") and the south shore Prince Edward County ("Lake Stock"), 1990-2015.

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 2.4). 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.

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 2.5). Trends in the open-water fishery are shown in Fig. 7.4.2 (see also Section 2.4). Annual Walleye angling effort and catch (ice and open-water fisheries combined) has been relatively stable averaging about 330,000 hours and 55,000 fish during the last decade.

Commercial Fishery

Walleye harvest by the commercial fishery is highly regulated and restricted. No commercial Walleye harvest is permitted in the upper and

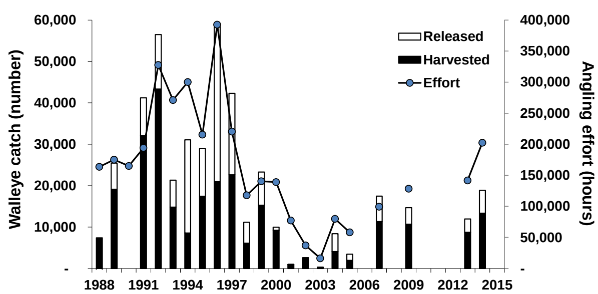


FIG. 7.4.1. Bay of Quinte recreational angling effort and walleye catch (released and harvested) during the winter ice-fishery, 1988-2015. No data for 2006, 2008, 2010-2012 or 2015.

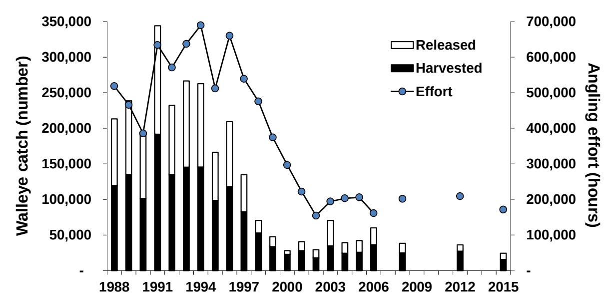


FIG. 7.4.2. Bay of Quinte recreational angling effort and walleye catch (released and harvested) during the open-water fishery, 1988-2014. No data for 2007, 2009-2011, or 2013-2015.

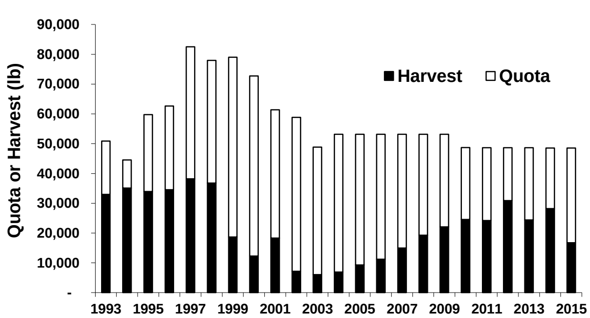


FIG. 7.4.3. Walleye commercial quota and harvest, 1993-2015.

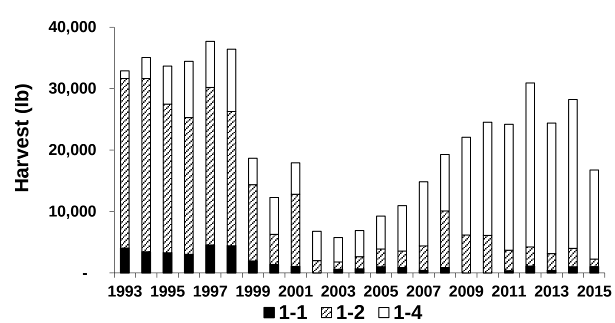


FIG. 7.4.4. Walleye commercial harvest by quota zone, 1993-2015.

middle reaches of the bay (Trenton to Glenora). A relatively modest Walleye commercial quota (48,546 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 16,771 lbs in 2015. Commercial Walleye harvest has shifted 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 (2006-2015) 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 making up 57% (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 2015 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). 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 (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. These two strong 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 (2006-2015).

	Annual Walleye Harvest			
	Pounds of fish	Number of fish	% by weight	% by number
Commercial	21,663	8,665	20%	19%
Recreational				
Open-water Angling	52,548	26,051	49%	57%
Ice Angling	33,485	11,211	31%	24%
Total	107,695	45,927	100%	100%

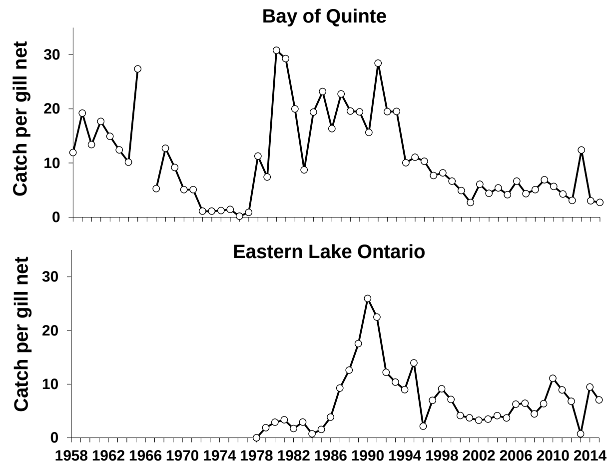


FIG. 7.4.5. Walleye abundance in summer gill nets in the Bay of Quinte, 1958-2015 (upper panel) and eastern Lake Ontario, 1978-2015 (lower panel).

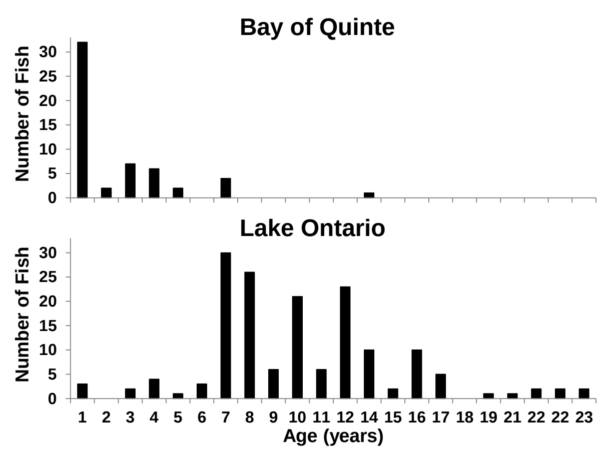


FIG. 7.4.6. Walleye age distribution in 2015 summer gill nets in the Bay of Quinte (upper panel) and eastern Lake Ontario (lower panel).

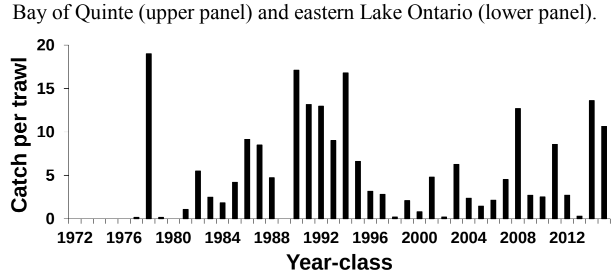


FIG. 7.4.7. Young-of-the-year Walleye catch per trawl in the Bay of Quinte, 1972-2015.

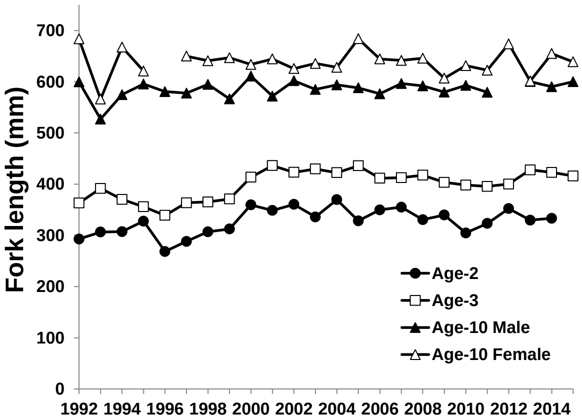


FIG. 7.4.8. Trends in Walleye fork length-at-age for age-2, age-3, age-10 males and females, caught in summer assessment gill nets, 1992-2015.

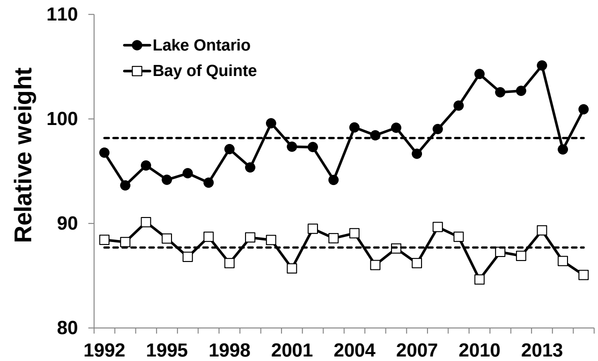


FIG. 7.4.9. Trends in Walleye condition (relative weight), caught in summer assessment gill nets, 1992-2015.

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 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.

Other Walleye Populations

The Bay of Quinte/eastern Lake Ontario Walleye population is the largest on Lake Ontario while smaller populations exist in other nearshore areas of the lake and St. Lawrence River. Walleye in these other areas are regularly assessed with a standard trap net program (Nearshore Community Index Netting; see Section 1.4). Mean (2006-2015) Walleye trap net catches in 13 geographic nearshore areas are shown in Fig. 7.4.10. Highest Walleye abundance occurs in the Bay of Quinte, East Lake, West Lake and Weller's Bay. Walleye abundance increased in Hamilton Harbour following 2012 Walleye stocking efforts (see Section 8.7).

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.

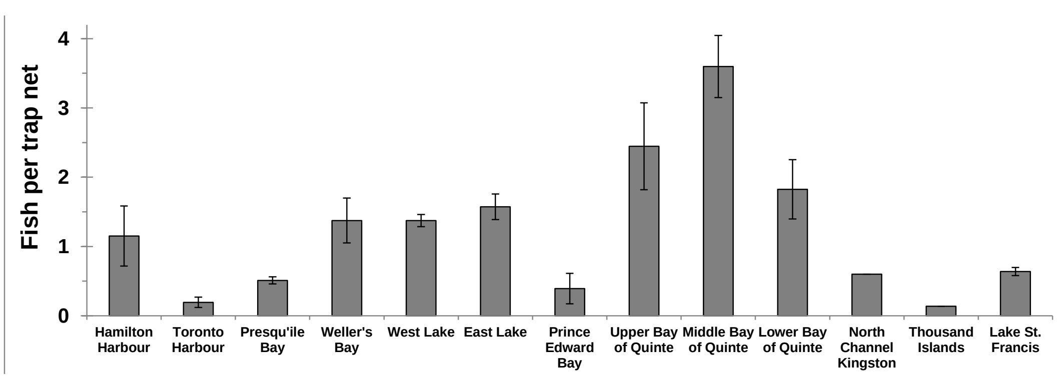


FIG. 7.4.10. Walleye abundance (mean annual number of fish per trap net) in 13 geographic nearshore areas of Lake Ontario and the St. Lawrence River arranged from west (Hamilton Harbour) to east (Lake St. Francis). Catches are means for all sampling from 2006-2015 with individual areas having been sampled from one to nine years over the nine year time-period. Error bars are ± 1 SE.

7.5 Northern Pike

R. Green, Lake Ontario Management Unit

Northern Pike are a native coolwater species that inhabit the embayment areas and near-shore coasts of Lake Ontario and the St. Lawrence River. Northern Pike are an important top-predator in these ecosystems providing recreational angling opportunities from Toronto in the west to Kingston in the east. More recently, commercial fishers in the Bay of Quinte and eastern Lake Ontario region have been permitted to harvest Northern Pike beginning in the fall of 2006 (see Section 3.2).

Northern Pike are most commonly encountered during the Nearshore Community Index Netting (NSCIN) program that began in 2001 and is performed annually on the Upper Bay of Quinte. A target catch rate in the NSCIN program was set in the Bay of Quinte Fisheries Management Plan (BQFMP) to provide an index to identify changes in abundance because of the importance of this species to the fish community. NSCIN is also implemented on Toronto Harbor and Hamilton Harbor. These locations are not sampled annually and generally have a higher catch per unit effort (CUE) of Northern Pike in comparison to the Upper Bay of Quinte.

Catch per unit effort in the past three years (0.27 fish/net) have remained at half that of the long-term average (0.56 fish/net) and below the BQFMP target (0.69 fish/net) for the Upper Bay of Quinte (Fig. 7.5.1). The average age of NSCIN catch has declined slightly over the entire time series (Fig. 7.5.2). Catch per unit effort increased in Hamilton Harbor (0.54 fish/net) in 2015 and decreased in Toronto Harbor (0.96 fish/net) in 2014 (Fig. 7.5.3) but remain above that observed in the Upper Bay of Quinte. Average age of Northern Pike caught in Toronto Harbor was similar to that observed in the Upper Bay of Quinte while the average age of catch in Hamilton Harbor was slightly

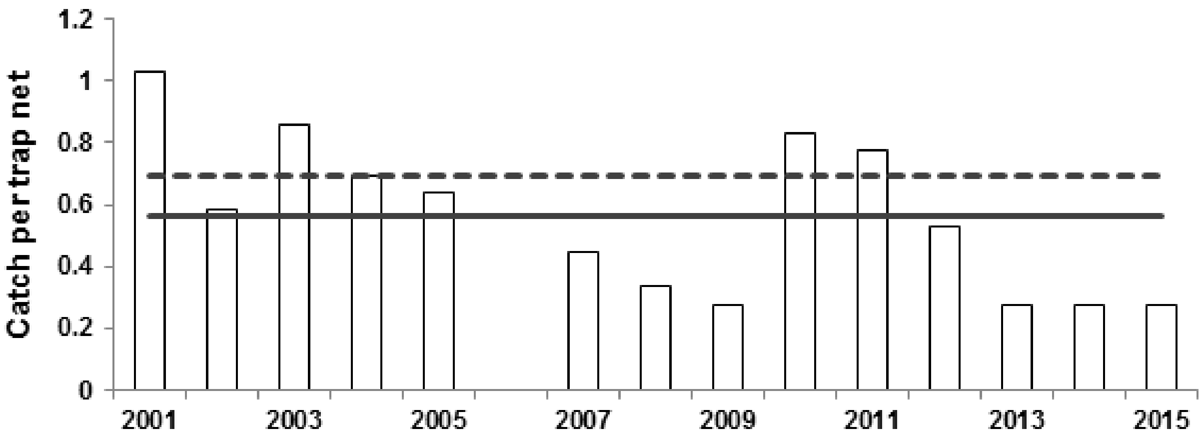


FIG. 7.5.1. Northern Pike abundance in Upper Bay of Quinte Nearshore Community Index Netting, 2001-2015. The solid line shows the long term average, and the dashed line shows the BQFMP target.

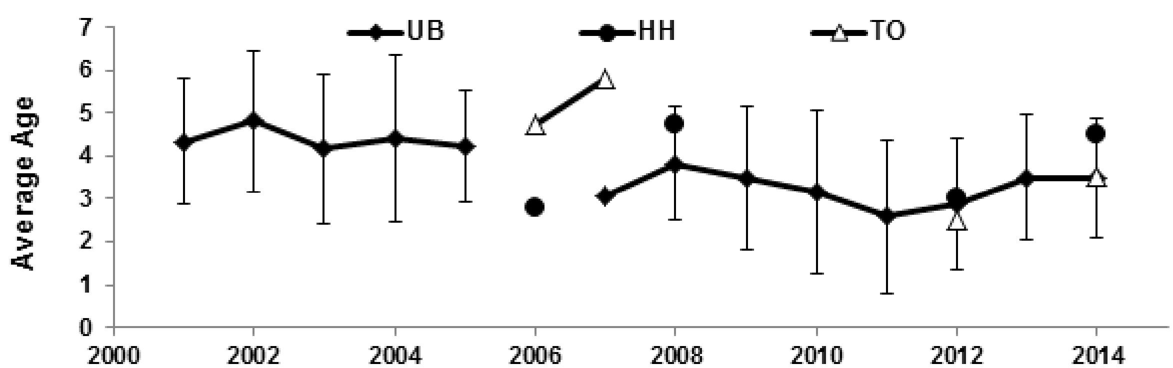


FIG. 7.5.2. Average age of Northern Pike in NSCIN netting – Upper Bay of Quinte (UB), Hamilton Harbor (HH) and Toronto Harbor (TO) 2002-2014. Error bars show the standard deviation for average age of Upper Bay catches.

greater than that observed in the Upper Bay of Quinte and Toronto Harbor in 2014 (Fig. 7.5.2).

Northern Pike abundance is also monitored in the St. Lawrence River through index gill netting that occurs in Lake St. Francis and the Thousand Islands on alternate years. The Thousand Islands area was sampled in 2015 and catches of Northern Pike (Fig. 7.5.4) were the lowest observed to date (see Section 1.6 of this report for complete Thousand Islands netting summary).

OMNRF allowed incidental commercial harvest of Northern Pike as a pilot fishery beginning in the fall 2006. Northern Pike are commercially harvested within quota zones (QZ) 1-2, 1-3 and 1-4 in Lake Ontario as well as East Lake and West Lake in Prince Edward County (See Section 3.2). The majority of commercial harvest of Northern Pike occurs within the Upper Bay of Quinte (QZ 1-3) (Fig. 7.5.5) and has been stable the past two years following a slight decline from the peak harvest in 2011. Commercial harvest of Northern Pike in East Lake and West Lake (QZ 1-1) was permitted by OMNRF starting in 2007. Harvest in East Lake peaked in 2009 with a gradual decline to the lowest point of the time series in 2015 (Fig. 7.5.6). Harvest in West Lake peaked later at much higher total harvest in 2012 and declined to a lower level observed in 2014 and 2015.

Northern Pike compose a small percentage (5%) of recreational fishing effort throughout the open-water season on the Bay of Quinte. The targeted catch per unit effort of Northern Pike (0.09 fish/hour) during the 2015 open-water season was low. Fishing effort and harvest is monitored through Angler Surveys (see Section 2.4 of this report for the open water fishing survey and Section 2.4 of the 2014 Annual Report for the ice fishing survey).

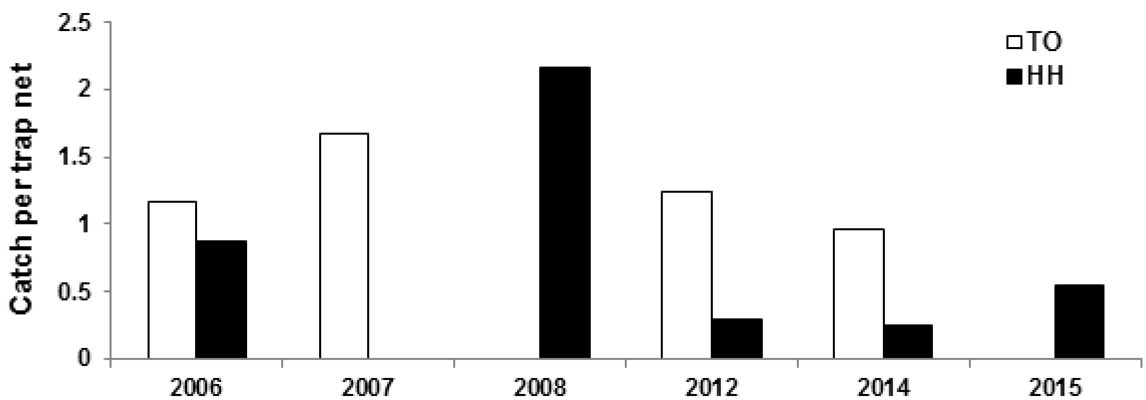


FIG. 7.5.3. Northern Pike abundance in Toronto Harbor & Hamilton Harbor Nearshore Community Index Netting, 2001-2015.

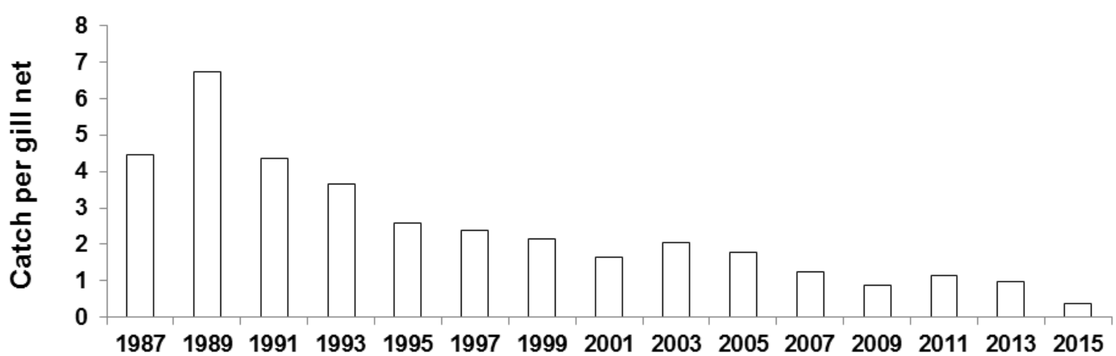


FIG. 7.5.4. Northern Pike abundance in Thousand Islands Community Index Netting, 1987-2015.

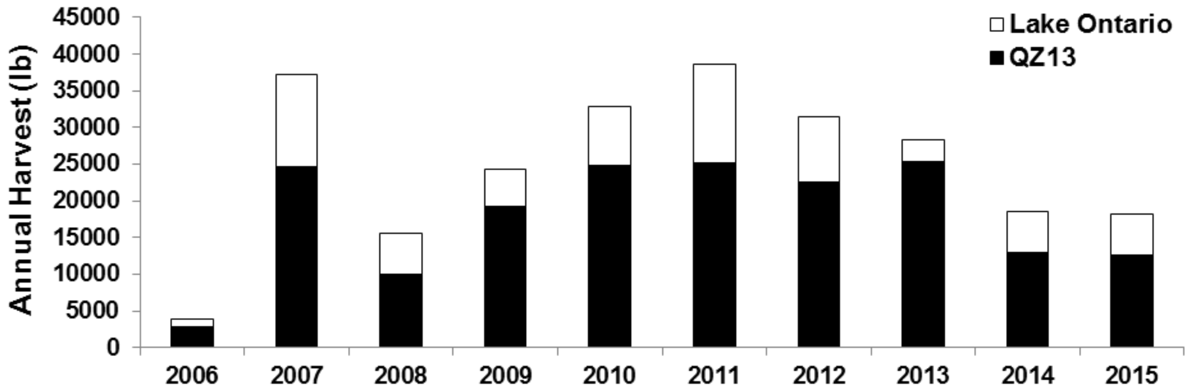


FIG. 7.5.5. Commercial harvest of Northern Pike in Lake Ontario and the Upper Bay of Quinte (QZ 1-3), 2006- 2015.

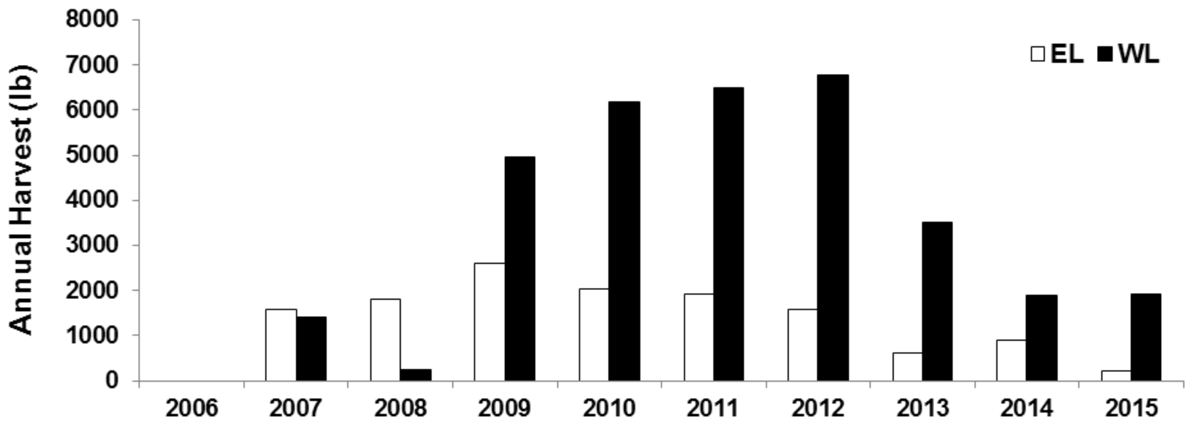


FIG. 7.5.6. Commercial harvest of Northern Pike in East Lake and West Lake, Prince Edward County, 2006-2015.

7.6 Pelagic Prey Fish

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M.G. Walsh, B.C. Weidel Lake Ontario Biological Station, USGS
M.J. Connerton Cape Vincent Fisheries Station, NYSDEC

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 led 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).

The stock status of Alewife as it relates to predator-prey balance in Lake Ontario requires a whole-lake assessment. Acoustic estimates (Section 1.7) are used in conjunction with estimates derived from the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Geological Survey (USGS) spring bottom trawl program (US Spring Trawls) conducted in the U.S. portion of Lake Ontario to track Alewife abundance (Fig. 7.6.1). Acoustic estimates of yearling and older Alewife for 2015 suggest a 45% decline in abundance dropping below the 10-year average index. US Spring Trawls indicate a 34% increase in adult (age 2 and older) numbers compared to 2014 which is slightly above the 10-year average. US Spring Trawls indicated very low numbers of age 1 Alewife in both 2014 and 2015 (Fig. 7.6.2) so the adult index number is expected to decline in 2016 similar to the trend identified in the 2015 acoustic survey. Research into the catchability and selectivity of both gear types (trawl and

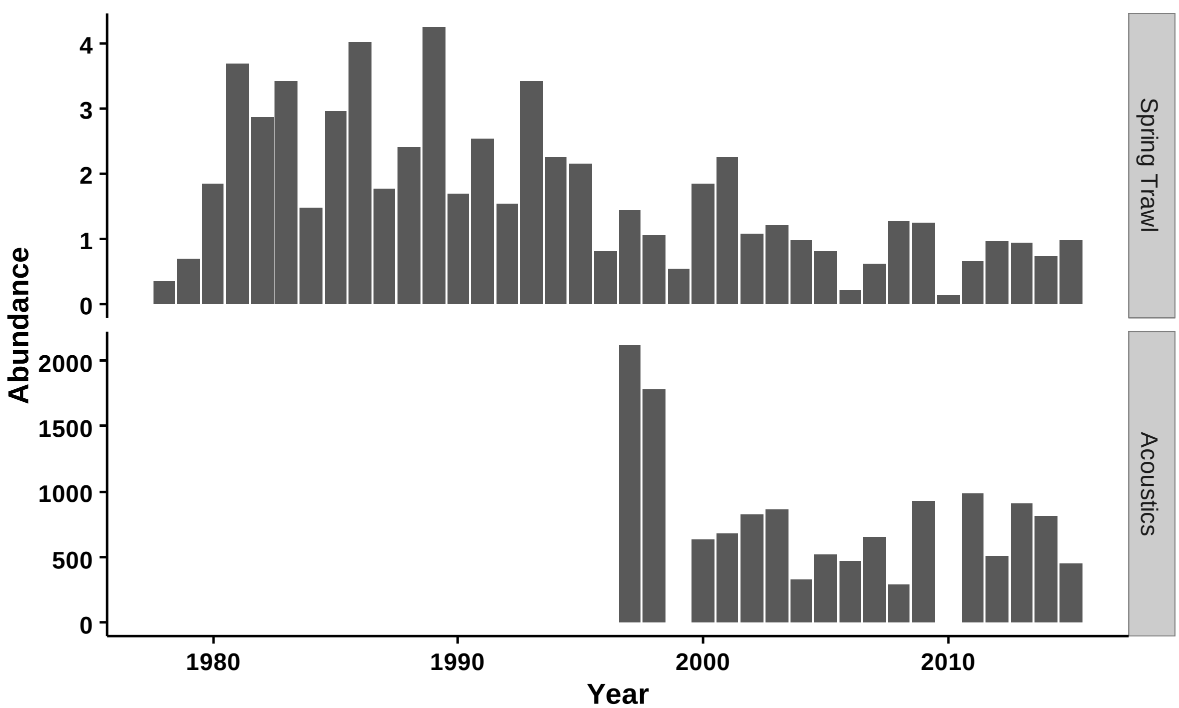

FIG. 7.6.1. Alewife abundance through time in the USGS/NYSDEC Spring Trawling (1000s fish/trawl) and the MNRF/NYSDEC Acoustic survey (whole lake index of fish, in millions). Acoustic estimates were not conducted in 1999 and 2010.

acoustics) is ongoing in order to understand year-to-year trend differences between index programs.

The Fish Community Index Gill Netting (Section 1.2) and Trawling programs (Section 1.3) provide localized trends but may not reflect whole lake abundance trends due to the relatively restricted geographical area of these surveys. A comparison of Acoustics, Trawling and Gill Netting shows little synchrony in abundance trends (Fig. 7.6.3) however neither Fish Community Index Gill Netting nor Trawling are specifically designed to index Alewife. Index gill nets are limited in mesh sizes that effectively target small fish and Index trawls are conducted at a time when Alewife may not be fully vulnerable to the gear. It is also possible that Alewife populations in the Bay of Quinte and Kingston Basin Alewife are independent from the main lake population and may have different trends in abundance.

Fish Community Index Trawls in the Bay of Quinte tend to catch a higher proportion of small Alewife compared to the Kingston Basin Trawls (Fig. 7.6.4). Trawls in the Bay of Quinte capture significant numbers of age-0 Alewife (Fig 7.6.5) however there is no relationship (r=0.15, p=0.4) with spring catches of age-1 Alewife in the US Spring Trawls (Fig. 7.6.2). The utility of this survey to predict cohort success to age-1 requires further investigation to understand over-wintering success and the relationship between catches in the Bay of Quinte/Eastern Basin to the main basin of Lake Ontario catches. Lake catches of Alewife in Index Trawling provide an index of size distribution through time (Fig. 7.6.6). The size distribution of Alewife in 2015 shows very few small fish relative to Alewife greater than 120 mm (FL) which is consistent with low catches of age 1 Alewife in 2014 and 2015 US Spring Trawls.

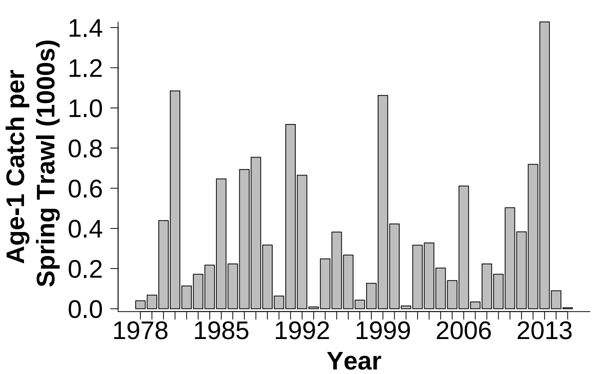

FIG. 7.6.2. Age-1 Alewife Index from the USGS/NYSDEC Spring Trawling (1000s fish/trawl).

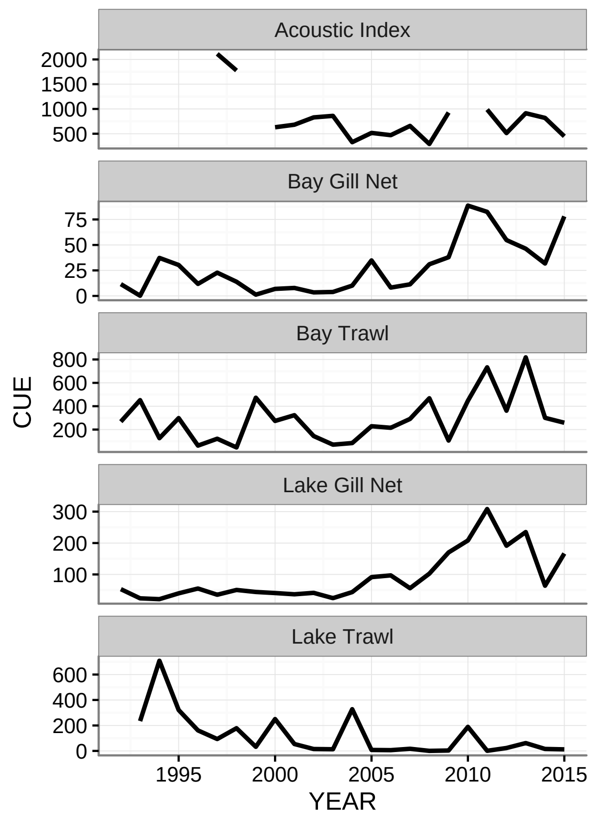

FIG. 7.6.3. Alewife abundance through time in the Bay of Quinte, Kingston Basin and as a whole lake index. Whole lake assessments are conducted with hydroacoustics (Acoustic Index). Bay of Quinte sites were assessed using bottom trawls (Bay Trawl) and gill nets (Bay Gill Net). The Kingston Basin was assessed using bottom trawls (Lake Trawl) and gill nets (Lake Gill Net). Acoustic estimates were not conducted in 1999 and 2010.

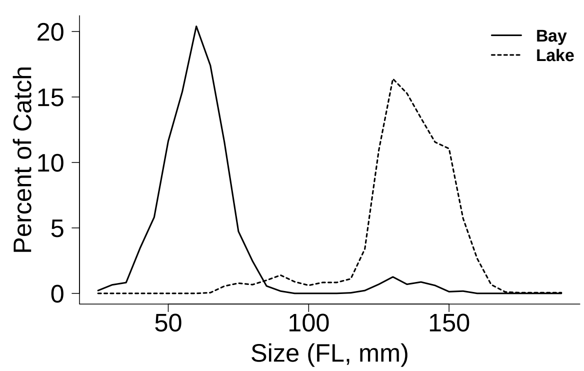

FIG. 7.6.4. Fish Community Index trawls in Bay of Quinte (Bay) and in the Kingston Basin (Lake) size distributions of Alewife catches in 2015.

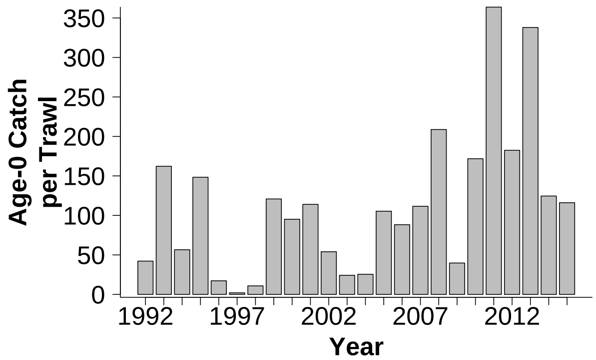

Fig. 7.6.5. Mean age-0 Alewife catch per trawl in the Fish Community Index Trawling Bay of Quinte Sites (1992-2015).

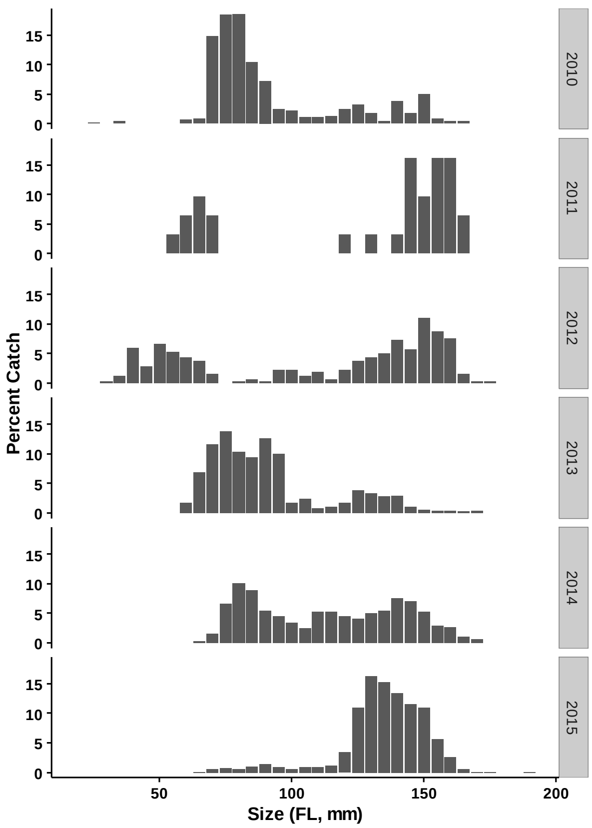

FIG. 7.6.6. Changes in size (fork length, mm) distribution of Alewife caught in Fish Community Index Trawls sites in the main basin and the Kingston Basin between 2010 and 2015.

Acoustic estimates of Alewife have been conducted since 1997 using a standard survey methodology and analytical procedure. In addition to an index of abundance the acoustic survey provides midsummer Alewife distribution (horizontal and vertical). Distribution across Lake Ontario is variable between years (Fig. 7.6.7). Investigation into how factors such as wind patterns, prey availability and thermal conditions affect Alewife distribution is on-going.

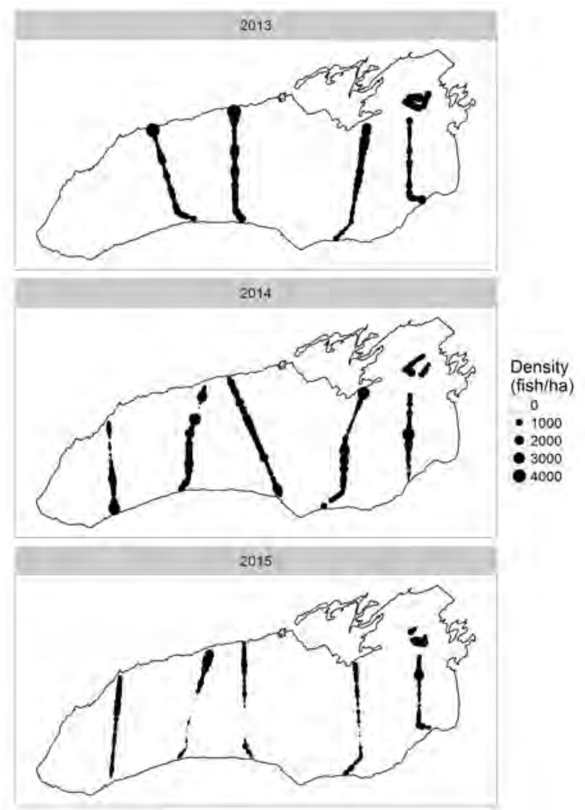

FIG. 7.6.7. Variability of Alewife density (fish/ha) measured through acoustic transects from 2013-2015.

Alewife condition is indexed as the predicted weight (based on a log-log regression) of a 165 mm (TL) fish. US Spring Trawls provide an early spring assessment of lake wide Alewife condition, Fish Community Index Trawling (Section 1.3) provides a mid-summer regional index and Fall Benthic Trawls (Section 1.13) provides a pre-winter index of condition. While the Fish Community Index trawl estimates are generally lower and more variable, all three indices are correlated (R^2>0.5, p<0.05 for all pairwise comparisons). All three indices show an increase in condition (Fig. 7.6.8) in 2015. Spring condition is marginally below the average condition level for the time series (1992-2015) while summer and fall indices are above average for the same time period.

Rainbow Smelt

Rainbow Smelt are the second most

abundant pelagic prey species in Lake Ontario. Alewife however, contributes the majority of fish biomass in predator diets even during high periods of Rainbow Smelt abundance. High abundance of Rainbow Smelt 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.

Since 2005, Rainbow Smelt populations have been variable at a low level (Fig. 7.6.9) following a dramatic decline of Rainbow Smelt since the 1990s (Fig. 7.6.9 inset). Fish Community Index Trawling (Section 1.3) based estimates of Kingston Basin Rainbow Smelt density peaked at 1982 fish/ha with an average density of 861 fish/ha between 1992 to 1997. The whole lake acoustic estimate of Rainbow Smelt from 1997 to present show a similar trend to the Kingston Basin trawls suggesting a lake wide decline, not simply a decline isolated to the Kingston Basin. Acoustic estimates of Rainbow Smelt density was estimated to be 870 fish/ha in 1997, declined to a low of 8 fish/ha in 2014. All three population indices showed an increase in population in 2015. Trawl estimates increased from 9-90 smelt per hectare while Kingston basin acoustic estimates showed significant; but more modest increases; from 23-57 fish/ha. Whole lake estimates increased from 8-16 fish/ha. The spatial distribution through time based on summer acoustic estimates (Section 1.7) suggests a trend of a slightly higher summer density within the eastern portion of the lake and Kingston Basin (Fig. 7.6.10).

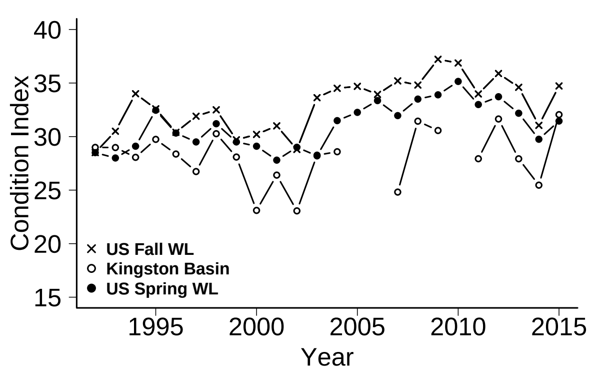

FIG. 7.6.8. Alewife condition, represented as the predicted weight (g, based on a log-log regression) of a 165 mm (total length) Alewife from the Fish Community Index trawls (open circles, Kingston Basin only) conducted in mid-summer and through USGS/NYSDEC Spring Trawling (filled circles, whole lake) and the USGS lead fall trawling (x, whole lake).

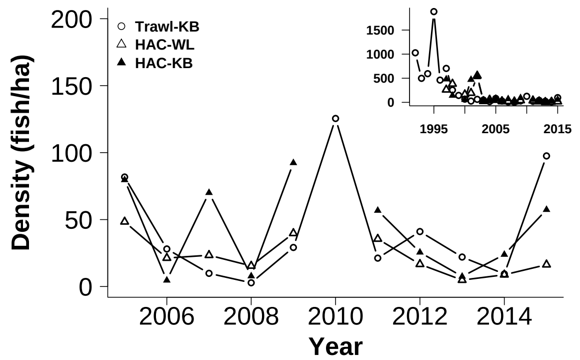

FIG. 7.6.9. Density (fish/ha) of yearling-and-older Rainbow Smelt from 1997-2015 from Fish Community Index trawls in the Kingston Basin (open circle, Trawl-KB), whole lake acoustic estimate (open triangle, HAC-WL), Kingston Basin only acoustic estimates (filled triangles, HAC-KB).

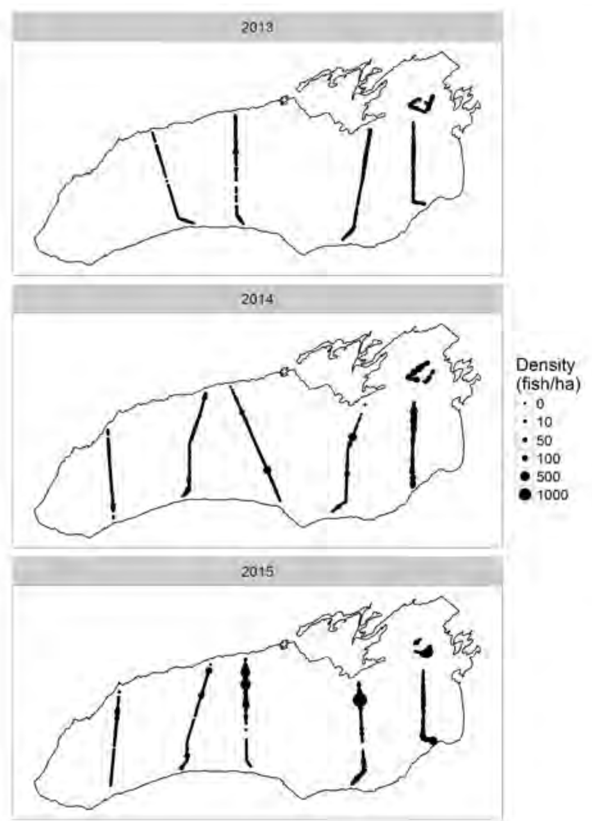

FIG. 7.6.10. Variability of Rainbow Smelt density (fish/ha) measure through acoustic transects from 2013-2015.

Catches of Rainbow Smelt in the Fish Community Index Trawling (Section 1.3) provide an index of size structure of the population. Catches in the Bay of Quinte and Lake sites catch a similar size distribution of Rainbow Smelt with

Bay catches having small numbers of young-of-year not generally seen in Lake catches (Fig. 7.6.11). Lake catches tend to have a higher proportion of larger Rainbow Smelt than Bay catches. Size distribution over the last five years (Fig. 7.6.12) shows some year class effects but appears to have a relatively stable size distribution.

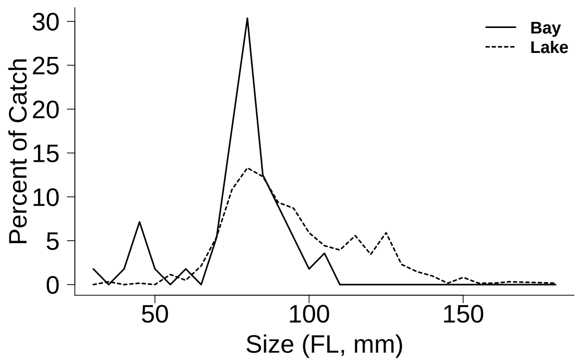

FIG. 7.6.11. Fish Community Index trawls in Bay of Quinte (Bay) and in the Kingston Basin (Lake) size distributions of Rainbow Smelt catches in 2015.

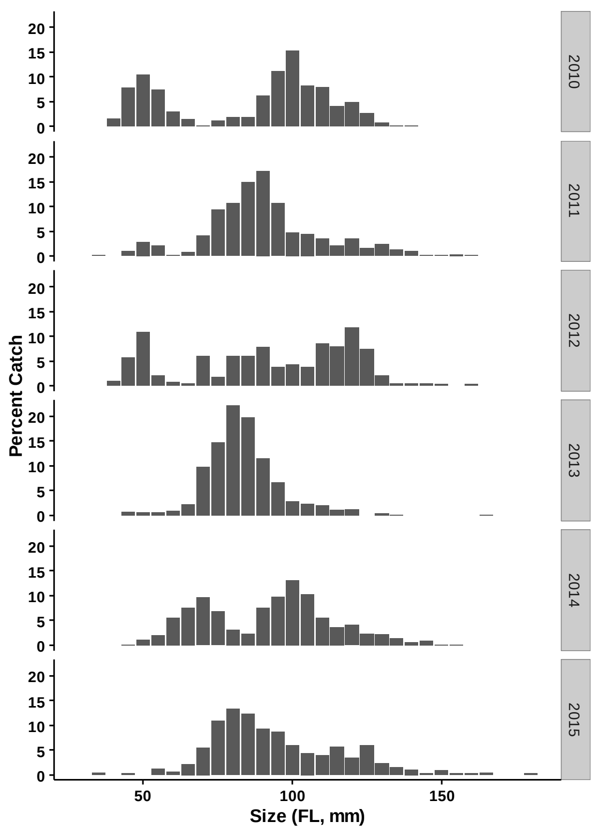

FIG. 7.6.12. Changes in size (fork length, mm) distribution of Rainbow Smelt caught in Fish Community Index Trawls sites in the main basin and the Kingston Basin between 2010 and 2015.

7.7 Benthic Prey Fish

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Round Goby

Round Goby (a non-native fish) is important as a predator and prey in the nearshore and offshore fish communities of Lake Ontario. Round Goby were first documented in Lake Ontario in 1998, first reported in angler catches in 2001, and first collected in the Bay of Quinte and Lake Ontario by the Fish Community Index Trawling program in 2001 and 2003 (respectively, Section 1.3, Fig. 7.7.1). Round Goby are nearshore residents during summer, but migrate to depths up to 150 m during winter, where for half of the year, it also fills a major component of the offshore benthic fish community. Round Goby eat dreissenid mussels extensively, but their prey in offshore waters also includes freshwater shrimp (Mysis diluviana) and other invertebrates.

Round Goby have become important in the diet of many fish in both nearshore and offshore habitats. Increased abundance and biomass of Round Goby and their occurrence in diets may have contributed to the much improved condition and/or growth of recreationally important species like Smallmouth Bass and Walleye. In addition, Round Goby have been integrated into the diets of many salmon and trout species (e.g., Lake Trout and Brown Trout), making them one of the few species linking both nearshore and offshore foodwebs in Lake Ontario.

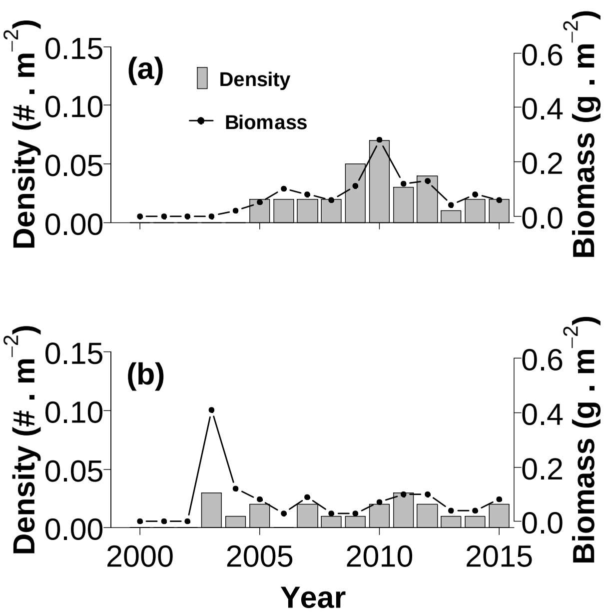

FIG. 7.7.1. Round Goby density and biomass based on bottom trawls conducted by the OMNRF in the Ontario waters of Lake Ontario shoreward of the 90 m bottom contour (a) and the Bay of Quinte (b), 2000-2015. No Round Goby were caught in Lake Ontario (a) prior to 2003 and in the Bay of Quinte (b) prior to 2001. All trawls were conducted during July and August and data have been standardized to a 12-min (½ mi) trawl (see Section 1.3).

In Fish Community Index Trawls, Round Goby density in 2015 was comparable to 2014, but biomass declined slightly in the lake (Fig. 7.7.1a; Section 1.3). Round Goby density and biomass peaked in 2010, followed by steep decline to 2015 (67% and 79% decline in density and biomass from 2010, respectively). Despite the sharp increase in average Round Goby length for Lake Ontario in 2014, Round Goby lengths declined to 63 mm; just below the long-term average of 64 mm (Fig. 7.7.2). In general, Round Goby caught in the Lake Ontario trawls were larger than Round Goby caught in the Bay of Quinte trawls (average of 64 mm vs. 58 mm, respectively for the time series; Fig. 7.7.2).

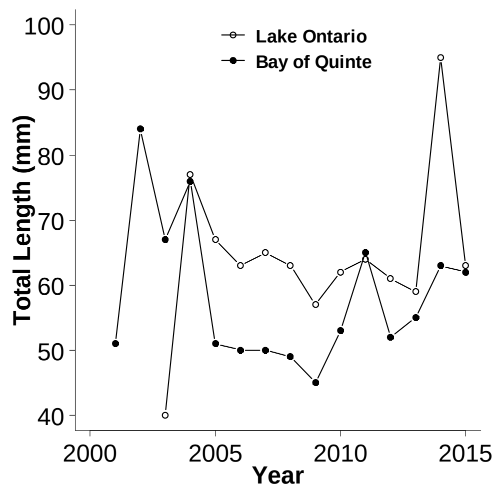

FIG. 7.7.2. Average total length (mm) of all Round Goby caught in Lake Ontario and Bay of Quinte (open and closed circles, respectively) Fish Community Index Trawling from 2001-2015.

In the Bay of Quinte, Round Goby density and biomass peaked in 2003 (Fig. 7.7.1b). After 2003, Round Goby biomass sharply declined to 2005 levels where it has remained stable for the remainder of the time series. In 2015, density and biomass in the Bay of Quinte increased relative to 2014 (Fig. 7.7.1b; Section 1.3). Average total length of Round Goby in the Bay of Quinte trawls has been variable through the time series (Fig. 7.7.2). Total length peaked in 2002 and then declined to the lowest point in 2009 (Fig. 7.7.2). Average total length increased from 2009-2011, declined in 2012, and increased to 2015.

Both summer (Fish Community Index Trawling, Section 1.3) and fall trawling (Lake Ontario Benthic Prey Fish Trawling, Section 1.13) are limited in the availability of shallow (i.e., < 30m) trawl sites in Ontario waters where goby catches are expected to be greatest. Round Goby catches occurred in depths shallower than 50 m in both surveys; fall trawling had higher catches at depths slightly deeper than summer trawling (Fig. 7.7.3, top panel).

Slimy Sculpin

Slimy Sculpin are a native benthic fish and historically would have been important in the diet of Lake Trout. Slimy Sculpin however occupy depths not well represented in the Community Index Trawling program so little historical information is available. In 2015, a depth stratified approach (10 m depth increments between 80-140 m) to main lake sites has helped fill in knowledge gaps for this species. The lack of suitable trawl sites shallower than 80 m along the north shore of the main lake limits a full understanding of their depth distribution.

Slimy Sculpin density and biomass peaked in 1996 and have subsequently declined (Fig. 7.7.4). Slimy Sculpin residing in the Main Lake tend to be larger than those found in the Kingston Basin (Fig. 7.7.5).

Comparison between summer (Fish Community Index Trawling, Section 1.3) and fall trawling (Lake Ontario Benthic Prey Fish Trawling, Section 1.13) both show a preferred depth range for Slimy Sculpin between 45 and 130 m (Fig. 7.7.3, middle panel). Higher densities were observed during the fall, particularly in the 70-120 m catches.

Deepwater Sculpin

Deepwater Sculpin were once abundant in the main basin of Lake Ontario. By the 1970s, Lake Ontario's native fish stocks, including Deepwater Sculpin, had been pushed to near extinction. After 1972, Deepwater Sculpin had

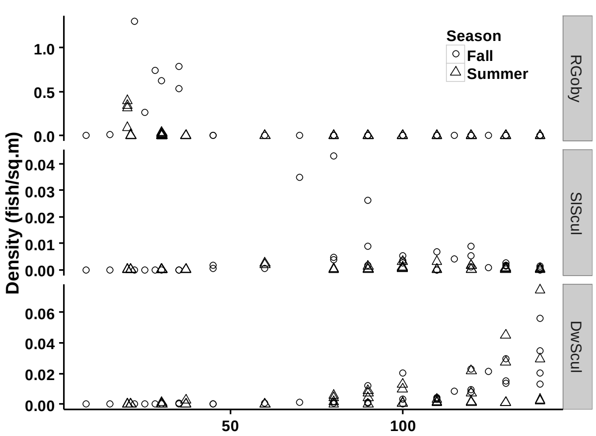

FIG. 7.7.3. Density of Round Goby (top panel), Slimy Sculpin (middle panel) and Deepwater Sculpin (bottom panel) by depth across all sites in the summer Fish Community Index Trawling (triangle; Section 1.3) and fall Lake Ontario Benthic Prey Fish Trawling (circle; Section 1.13).

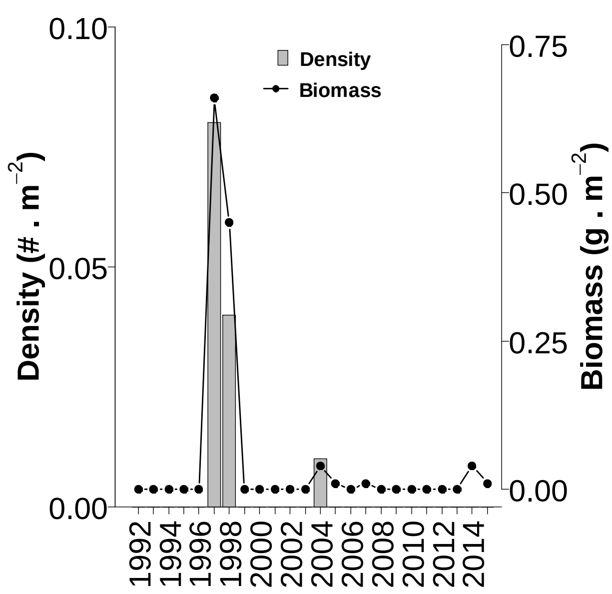

FIG. 7.7.4. Slimy Sculpin density and biomass based on bottom trawls from Fish Community Index Trawling in Lake Ontario from 1992-2015. All trawls were conducted during July and August and data have been standardized to a 12-min (½ mi) trawl.

not been detected in Lake Ontario until 1996, when one was caught in Fish Community Index Trawling (Fig. 7.7.6; Section 1.3).

Since 1996, no Deepwater Sculpin were collected in Fish Community Index programs until 2005, when they were collected in the trawls at Rocky Point (Fig. 7.7.6; Sections 1.2 and 1.3). In the trawls, Deepwater Sculpin were most abundant at Rocky Point, until 2015 when abundances at Cobourg and Port Credit exceeded values at Rocky Point (Fig. 7.7.6a). In 2015, the Fish Community Index Trawling program expanded to include deeper sites, which led to increased abundances at all sites (Fig. 7.7.6a). For a second year in a row, gill nets were fished at Cobourg and Port Credit as part of the Fish Community Index Gill Netting program (Section 1.2). In both 2014 and 2015, Deepwater Sculpin were caught at these sites in the gill nets (Fig. 7.7.6b). In 2015, Deepwater Sculpin were caught in Kingston Basin trawls; Deepwater Sculpin have not been observed in the Kingston Basin since 1996 (Fig. 7.7.6a; Section 1.3).

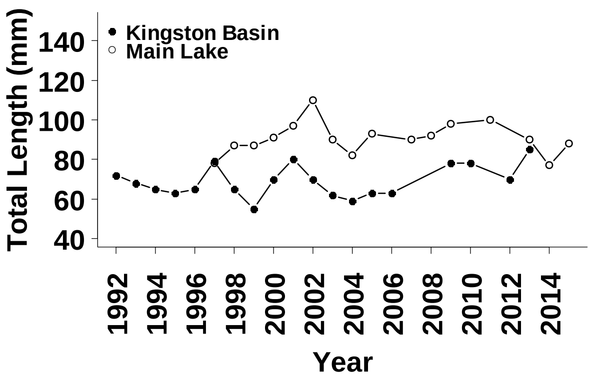

FIG. 7.7.5. Average total length (mm) of all Slimy Sculpin caught in the Kingston Basin and Main Lake (closed and open circles, respectively) in 2015. Main Lake is comprised of Rocky Point, Cobourg and Port Credit trawling sites.

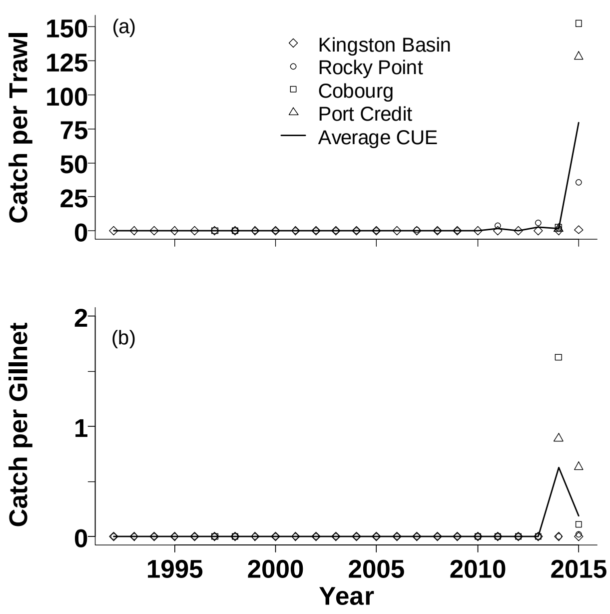

FIG. 7.7.6. Catch per unit effort of Deepwater Sculpin in Fish Community Index Trawling (a) and Fish Community Index Gill Netting (b) at Eastern Basin (diamond), Rocky Point (circle), Cobourg (square) and Port Credit (triangle) sites, 1992-2015. The solid line represents the average catch per unit effort from all sites sampled per year. Not all locations were sampled every year (see Sections 1.2 and 1.3).

A total length by round weight plot of all Deepwater Sculpin caught at Rocky Point, Cobourg, Port Credit and Kingston Basin in 2015 illustrates the size distribution of these fish at each site, but also showcases the size selectivity of the two gear types (Fig. 7.7.7). In general, the Fish Community Index Trawls caught mainly small fish and some large fish, while the gill nets captured mainly larger fish (Fig. 7.7.7). Cobourg and Rocky Point shared the largest distribution of Deepwater Sculpin sizes and ages (Figs. 7.7.7, 7.7.8 and 7.7.9). Deepwater Sculpin from Kingston Basin were caught at 30 m depth, shallow for this species, and represent the

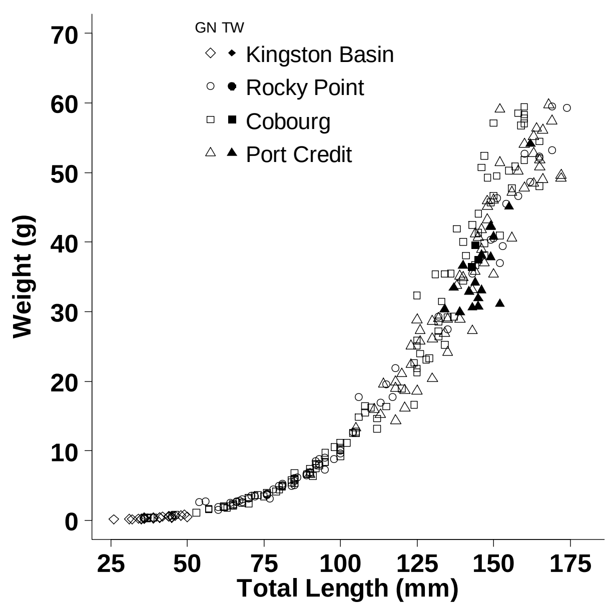

FIG. 7.7.7. Total length (mm) and weight (g) of all Deepwater Sculpin caught in the 2015 Fish Community Index Gill Netting Program (filled shapes, see Section 1.2) and the 2015 Fish Community Index Trawling Program (open shapes, see Section 1.3) for three sites: Rocky Point (circle), Cobourg (square) and Port Credit (triangle).

smallest Deepwater Sculpins caught in Community Index Trawling (Figs. 7.7.7, 7.7.8 and 7.7.9). For the second year in a row, Deepwater Sculpin from Port Credit were larger and older (on average) relative to Kingston Basin, Rocky Point and Cobourg (Fig. 7.7.7, 7.7.8 and 7.7.9). In 2014, Deepwater Sculpin ages ranged from 0 to 9, with age-0 being caught in Kingston Basin, Rocky Point and Cobourg and oldest fish coming from Cobourg (Fig. 7.7.8 and 7.7.9).

Comparisons between summer (Fish Community Index Trawling, Section 1.3) and fall trawling (Lake Ontario Benthic Prey Fish Trawling, Section 1.13) show a relationship between bottom depth and Deepwater Sculpin density (Fig. 7.7.3, bottom panel). Deepwater Sculpin start to become abundant in trawls at depths deeper than 80 m, with the highest densities observed at 140 m depths, which are the deepest depths in the Ontario portion of Lake Ontario. Observed density across depths shows little difference between summer and fall surveys (Fig. 7.7.3, bottom panel).

Considering catches from both the trawling and gill netting gears, there appears to be an east to west gradient of Deepwater Sculpin captured, with small/young fish caught in the east (Rocky Point), large/older fish caught in the west (Port Credit) and a combination caught centrally (Cobourg). The presence of age-0 Deepwater Sculpin in the Kingston Basin, after a 19-year absence, may be evidence that Deepwater Sculpin abundances are truly increasing in Lake Ontario; continued sampling in 2016 will help to corroborate this. Both Fish Community Index trawling and gill netting will continue in the Kingston Basin and at Rocky Point, Cobourg and Port Credit sites in 2016. The increased frequency of occurrence of Deepwater Sculpin in both index trawling and gill netting programs is promising for this once rare species.

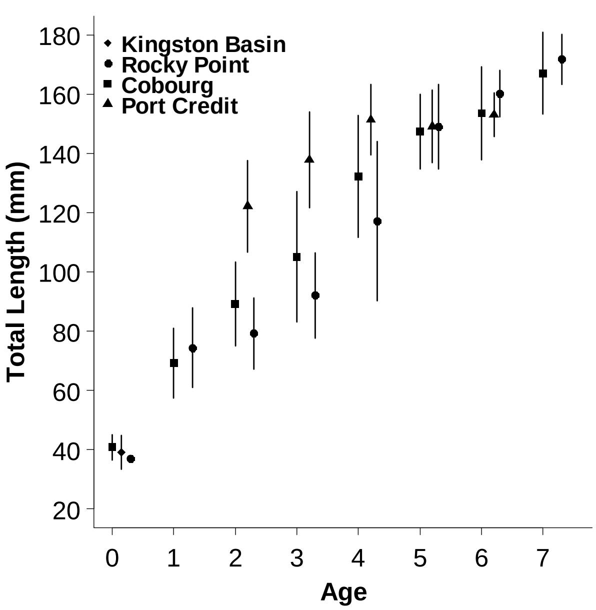

FIG. 7.7.8. Length at age for Deepwater Sculpin caught in the Fish Community Index Gill Netting and Trawling Programs at Rocky Point (circle), Cobourg (square) and Port Credit (triangle). Error bars represent one standard deviation.

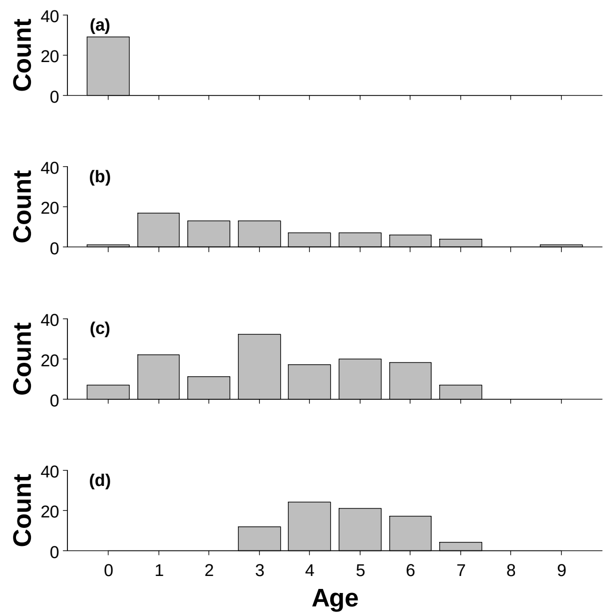

FIG. 7.7.9. Age distribution for Deepwater Sculpin caught at (a) Kingston Basin, (b) Rocky Point, (c) Cobourg and (d) Port Credit in the 2015 Fish Community Index Gill Netting and Trawling Program.

8. Species Rehabilitation

8.1 Introduction

A. Mathers, Lake Ontario Management Unit

OMNR 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 boarder). Native species restoration is the center piece of LOMU's efforts to restore the biodiversity of Lake Ontario.

The sections below describe the planning and efforts to restore Atlantic Salmon, Bloater, Lake Trout, American Eel, Walleye and Round Whitefish. 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.

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 loss of spawning and nursery habitat in streams. As a top predator, they played a key ecological role in the offshore fish community. They were also a valued resource for aboriginal communities and early Ontario settlers. As such, Atlantic Salmon are recognized as an important part Ontario's natural and cultural heritage. A unique partnership has been established to help bring back wild, self-sustaining populations of Atlantic Salmon to Lake Ontario. This partnership, launched in 2006, brings together the Ontario Ministry of Natural Resources and Forestry (OMNRF) and the Ontario Federation of Anglers and Hunters (OFAH) and a strong network of partners and sponsors. Program partners recognize the generous support of Phase I lead sponsor, Australia's Banrock Station Wines, and welcome Phase II lead sponsor, Ontario Power Generation. Many other sponsors, conservation organizations, corporations, community groups and individuals are contributing to the success of this program. Funding and in-kind support from all partners have contributed to enhanced fish production, habitat rehabilitation and stewardship initiatives, research and assessment program and public education and outreach activities.

Restoration efforts have been focused on three "best-bet" streams – the Credit River, Duffins Creek and Cobourg Brook. These systems were chosen due to good quality spawning and nursery habitat, strong community support and accessibility for fish community assessment. In addition to evaluating multiple tributaries, three Atlantic Salmon stocked life-stages and strains are also being evaluated.

Multiple life stages (spring fingerling, fall fingerling, and spring yearlings) are being stocked and monitored to evaluate their relative performance (e.g. growth, survival) and their relative contribution to spawning runs of adult fish. Three strains of Atlantic Salmon are also being investigated to see if one is more suited to Lake Ontario and its tributaries. Strains were selected on the basis of one or more of the following: 1) habitat / ecological requirements which match the characteristics of Lake Ontario and its tributaries; 2) any remnant of the native Lake Ontario population, or a genetic closeness based on geographical proximity to Lake Ontario or suspected common ancestral link with the historic Lake Ontario population; 3) potential to create a good sports fishery (i.e. large fish); and 4) availability of eggs. Ultimately, three strains were chosen: LaHave, Sebago and Lac St. Jean. The LaHave strain provided the initial source for stocked fish, as it was already present in the Ontario fish culture system and it continues to be the strain stocked in the greatest numbers. LaHave are an anadromous strain from the LaHave River in Nova Scotia. The Sebago strain is from a land-locked population from Sebago Lake, Maine which has been used successfully in stocking throughout Maine and in other Great Lake Jurisdictions (New York, Michigan). The third strain being evaluated is Lac St. Jean – a land-locked strain from Lac St. Jean, Québec. Production of this strain is still being refined in the hatchery system. This strain was chosen due to a suspected ancestral link between it and the extirpated Lake Ontario population. The evaluation of the effects of both age at stocking (life-stage) and strain will be used to optimize the stocking program.

The performances of all three strains are being evaluated in the Lake Ontario environment. Genetic profiles have been developed for each individual brood fish in the hatchery to help us track their progeny in the streams and in the lake. Monitoring of juveniles in the streams has been done to assess growth and survival of stocked fish, estimate smolt production (by life stage stocked), document timing of downstream migration, and describe the environmental cues which trigger this downstream movement (Sections 1.8 and 1.9). These projects use conventional electro-fishing assessment, as well as a rotary screw trap, the only example of this technology currently being used on the Great Lakes. Upstream migration is monitored at the Norval fishway, allowing us to enumerate adult Atlantic Salmon (and other species) as they migrate, as well as collect important biological data on individual fish (Section 1.10). In 2013, we implemented another innovative program designed to monitor upstream migration. A resistance board weir was installed on Duffins Creek made possible through a grant from the Great Lakes Fishery Commission. This is a highly specialized piece of fisheries assessment gear, originally developed to assess West Coast salmonid migration. Never used on the Great Lakes before, it has allowed us to monitor the upstream migration of adult Atlantic Salmon and other migrating species (Section 1.11).

The Lake Ontario Atlantic Salmon Restoration Program recently reached an important milestone - as part of the program's adaptive management cycle, a major science review was conducted in the winter of 2014. The science report "Proceedings of the Lake Ontario Atlantic Salmon Restoration Science Workshop" synthesized results from several studies including expert perspectives from scientists in Ontario, other Provinces and several US States. The Steering Committee reviewed the findings and advice in the report and considered a broader suite of management issues related to achieving the long-term goals of the program, including funding, communications, governance, logistics and short-term priorities vs. long-term outcomes. The Steering Committee agreed that a new five-year implementation strategy was required to incorporate the recently synthesized information and to guide the program and coordinate efforts towards the ultimate goal of a restored wild population of Atlantic Salmon in Lake Ontario.

In 2015, a five-year strategy (2016-2020) was developed containing revised restoration priorities and targets to guide specific management actions that will result in measurable progress. The strategy also serves to help coordinate and integrate restoration efforts and improve communication with the public and between partners. The new strategy is intended to be responsive to change and will be reviewed and adjusted as needed.

8.3 American Eel Restoration

A. Mathers, Lake Ontario Management Unit
T. Pratt, Fisheries and Ocean Canada

Historically, the American Eel was an important predator in the nearshore fish community of Lake Ontario and the upper St. Lawrence River (LO-SLR), were 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 of eel 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, eel abundance had declined to levels that warranted closure of all commercial and recreational fisheries for American Eel in Ontario to protect those that remained. In 2007, American Eel was identified as Endangered under Ontario's Endangered Species Act. These events led to additional efforts to protect 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.

Indices of Eel Abundance

The Moses-Saunders Dam, located on the upper St. Lawrence River between Cornwall, Ontario and Massena, New York, is an impediment to both upstream and downstream migration of eels in the LO-SLR system. Since 1974 an eel ladder (Saunders ladder) has been operated to facilitate upstream migration. Since 2007, Ontario Power Generation (OPG) has assumed full responsibility for ladder operation. In 2015, the Saunders eel ladder was opened June 15 and closed October 15 (122 days). During this time, a total of 12,380 eels successfully exited the eel ladder (Fig. 8.3.1). A second ladder (Moses ladder) located on the New York portion of the dam, has been operated since 2006 by the New York Power Authority (NYPA). In 2015, 15,835

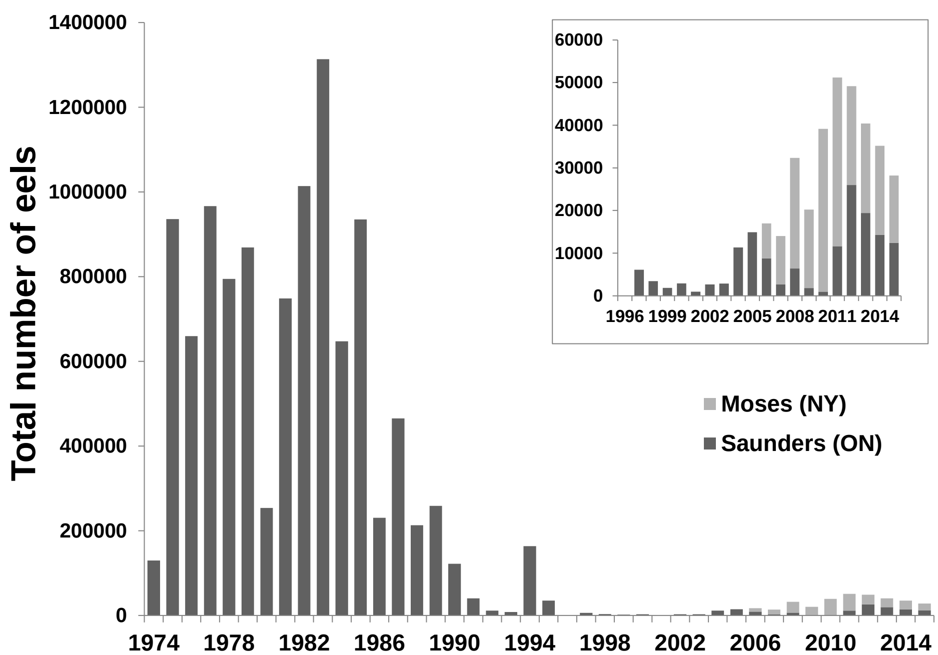

FIG. 8.3.1. Total number of eels ascending the eel ladders at the Moses-Saunders Dam, Cornwall, Ontario from 1974-2015. During 1996, the ladder operated however no counts were made.

eels exited the Moses ladder. The combined number (28,215 eels) is higher than numbers observed during the late 1990's but was the lowest since 2009 and is less than 3% 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).

Sub-samples of eels were collected from the OPG ladder and biological characteristics were measured during 2015. The average length (393.0 ± 67.9 mm, n=1,039, range 208-691 mm) was similar to what has been observed in recent years with a trend for slightly larger fish over the past 3-years. Age distribution of the eels sampled ranged from 3-9 years (mean 5.32±1.19, n=101). All eels from the sub-sample were determined to be female.

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 (Fig. 1.3.1 and Tables 1.3.8 to 1.3.13). The average catch of American Eel in 511 trawls conducted (June-September at sites upstream of Glenora) between 1972 and 1996 was 2.00 eels per trawl. No eels were captured in the 360 trawls conducted between 2003 and 2011 and either zero or one eel was captured during the 40 trawls conducted annually between 2012 and 2015 (1 eel during 40 trawls during 2015). Nearshore trap netting was conducted using the NSCIN fish community index protocol (see Section 1.4). During 2015, one eel was captured in 36 net sets in the upper Bay of Quinte, three eels were captured in 24 nets set in Hamilton Harbour, no eels were captured in 16 nets set in Presqu'ile Bay and no eels were captured in 24 nets set in Weller's Bay (Fig. 1.4.2 and Table 1.4.6).

Systematic surveys to collect and examine eels were conducted by both NYPA and OPG in the tail-waters of the Moses-Saunders Dam. In these studies, investigators travelled approximately 10 km by boat along a standardized survey route searching for dead and injured American Eel along the shoreline from the Moses-Saunders Dam downstream to the end of Cornwall Island. Surveys were conducted on Tuesdays and Fridays each week from May 29-October 2, 2015. During 2015, OPG observed an average of 1.2 eels per day, while NYPA observed 0.8 per day (Fig. 8.3.2). The average length of whole eels (n=24) collected by OPG was 895 ± 51 mm (mean ± SD) and their average age was 7.5 ± 2.1 years (mean ± SD) (Fig. 8.3.3). Seven of the 24 (29%) were identified as stocked eels with an average age of 7 years. The remaining 17 eels were wild migrants and had an average age of 7.9. Eel abundance was greatest in September and most eels (89%) were collected when water temperatures were greater than or equal to 17.5˚C. The numbers of eels collected in recent years is much lower than those observed in earlier years of the survey and the size and age of eels observed have declined considerably since

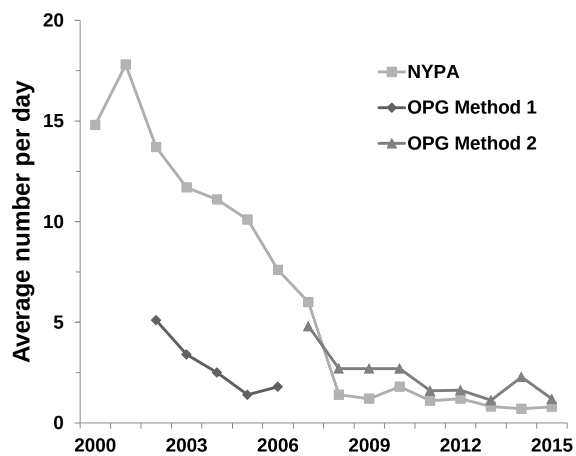

FIG. 8.3.2. Average number of eels observed per day in the tail-waters of the Moses-Saunders Dam 2000-2015. Note that the OPG sampling methodology and route changed in 2007.

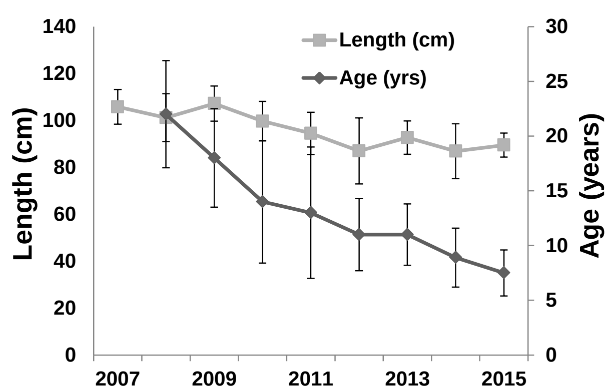

FIG. 8.3.3. Length (mean ± standard deviation) and age (mean ± standard deviation) of eels collected in the tail-waters of the Moses-Saunders Dam 2007-2015.

2008. These data suggest that the numbers of eels leaving the LO-SLR is well below the FCO 1.3 long term escapement target of at least 100,000 silver phase eels leaving annually.

Restoration Efforts

In 2006, Fisheries and Oceans Canada (DFO), Ontario Ministry of Natural Resources and Forestry (OMNRF) and OPG developed an ‘Action Plan for Offsetting Turbine Mortality of American Eel for the Saunders Generating Station’. A second five year American Eel Action Plan took effect in 2014 and includes conducting trap and transport activities, monitoring stocked eels, operation of the eel ladder, tail-water surveys and research into downstream passage options using behavioural guidance. The Action Plan is being implemented using an adaptive management strategy, which will allow modifications to be made based upon findings that emerge.

In one component of the OPG plan, over 4 million glass eel 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 naturally migrating eels. Prior to stocking, health screening for a wide variety of fish pathogens (including *Anguillicoloides 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 evaluate the effectiveness of American Eel stocking using spring boat electrofishing surveys. The monitoring of eel density continues through pre-established electrofishing transects on the St. Lawrence River (Jones Creek, Grenadier Island, and Rockport) and Bay of Quinte (Deseronto, Big Bay, and Hay Bay). In addition, to examine for dispersal outside of the Bay of Quinte, transects in Prince Edward Bay were sampled.

This monitoring program has shown that stocked eels have survived over a 9-year period; however the survival rate remains unknown. There is an overall declining trend in abundance since densities peaked in 2013 (Fig. 8.3.4). This is not surprising as no stocking has occurred since 2010, natural recruitment remains low, and some proportion of the stocked eels are maturing and out-migrating. As eels have increased in size, biomass estimates continue to increase despite decreasing abundance (Fig. 8.3.4). All eels evaluated were females during recent surveys. A large increase in the prevalence of the exotic swim bladder parasite, *A. crassus*, was observed, increasing from no detections in 2014 to 13.3% of individuals infected in 2015.

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 Quebec Ministère des Forêts, de la Faune et des Parcs

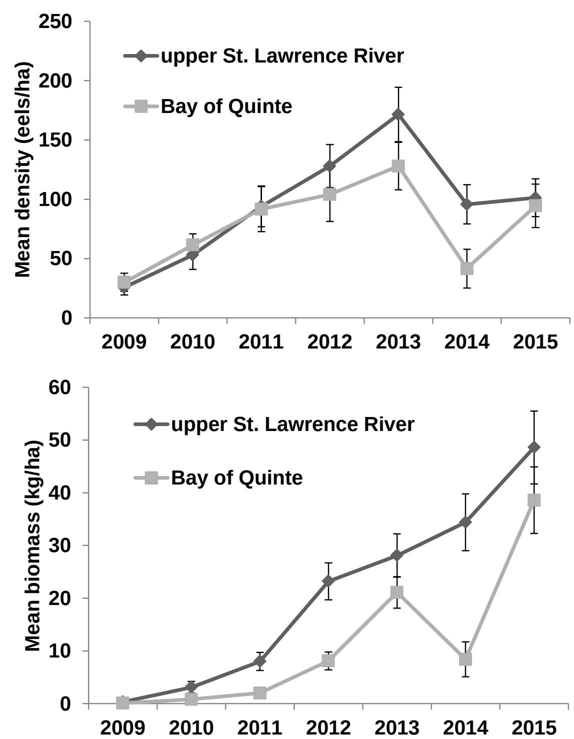

FIG. 8.3.4. The relative abundance (upper panel, mean eels per hectare ± standard error) and biomass (lower panel, mean kg per hectare ± standard error) of stocked American Eel enumerated in spring transects, by study area.

(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 the T&T. During 2015, eels collected during the fall commercial fishery in areas upstream of the dam were also included in the T&T project in an effort to increase the numbers of eels transported.

A total of 1,899 large yellow eels (1,133 from Lake St. Francis during the spring, 270 from above the Moses-Saunders Dam during the spring and 496 from above the dam during the fall (Fig. 8.3.5) were released in Lac St. Louis immediately downstream of the Beauharnois Hydroelectric Dam as part of the T&T program. The mortality of large yellow eels during the spring capture phase of the program has been low with only one eel mortality during 2015. During the fall T&T, the mortality was high with 35 eels dying during the first week prior to transport. This mortality was attributed to the high water temperatures at that time (>20C). Once water temperatures cooled during the second and third weeks of September only 4 eels died.

MFFP staff sampled 9,157 eels (80.7% of the total catch) from the silver eel fishery in the St. Lawrence River estuary during the fall of 2015. Results of this survey suggest that after four years, 75% of the transported eels have migrated towards the spawning grounds. The T&T project continued to demonstrate that, where abundant, large yellow eels can be caught, held for brief periods, and transported successfully with limited mortality and no behavioural or physiological consequences

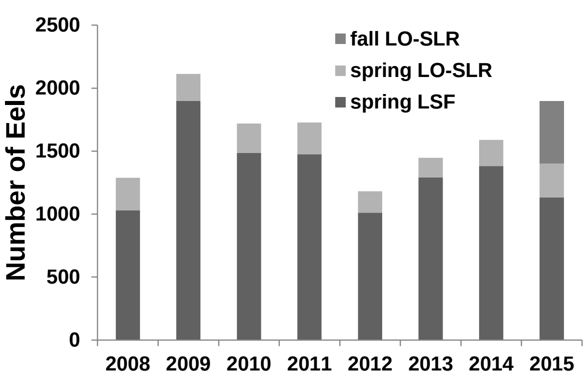

FIG. 8.3.5. Numbers of eels transported from upstream of the Moses -Saunders Dam (LO-SLR) and Lake St. Francis (LSF) to downstream of barriers to migration in the St. Lawrence River by the OPG Trap and Transport project 2008-2015.

Thirteen eels, collected as part of the T&T program, had Vemco V13 transmitters surgically implanted and released off the docks at the Glenora Fisheries Station on October 9 and 14. All of the tagged fish were detected by at least 3 of the acoustic arrays previously established in the Bay of Quinte area suggesting that initial survival was good (Fig. 8.3.6). Three of the fish moved upstream in the Bay of Quinte and were still in this area when the acoustic receivers were downloaded on November 3 and 4. Ten of the eels moved downstream in the Bay of Quinte and only two of these fish were still detected in the Quinte arrays when the data was downloaded. One eel was detected on November 10 in an acoustic array established near Main Duck Island for tracking Bloater (Section 9.2). Three of the

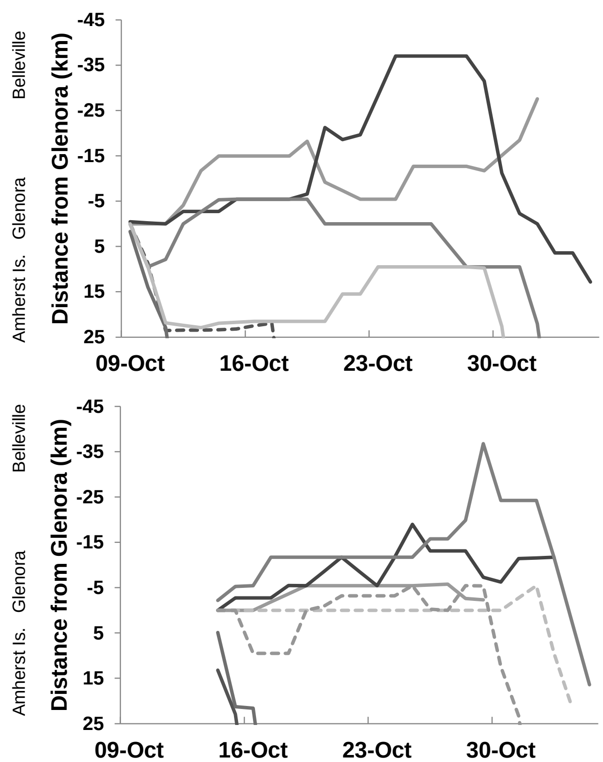

FIG. 8.3.6. Movement of tagged American Eel after release from Glenora on October 9 (upper panel) and October 14 (lower panel). Distances are travelled upstream (negative values) or downstream (positive values) from Glenora. Dashed lines indicate fish that were observed in Lac St. Louis (part of the St. Lawrence River near Montreal) between November 9 and 17, 2015.

eels were detected in Lac St. Louis arrays (operated by MFFP in the St. Lawrence River near Montreal) between November 9 and 17, 2015. These eels moved from the Bay of Quinte to Lac St. Louis (~300 km) in between 9 and 30 days. Additional information on these eels will likely be obtained when acoustic receivers are downloaded in the future.

Since 2013, the eel Passage Research Center (EPRC) has conducted a 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 Québec and the United States Fish and Wildlife Service (through a funding arrangement from NYPA). Four research projects were undertaken or completed during 2015:

- Assessment of downstream migrating American Eel behavior in response to various behavioral cues (electricity, sound and vibration, electromagnetic fields and water velocity gradients) in a laboratory setting.
- Assessment of technologies to study the behavior of American Eel migrating downstream at Iroquois Dam in the upper St. Lawrence River.
- CFD Model development for Iroquois Control Dam and Beauharnois Dam approach channel to evaluate current patterns in the vicinity of potential eel collection points.
- Review of recent research on the effect of light on out-migrating eels and recent advancements in lighting technology: 2007 to 2014.

Restoration of American Eel in LO-SLR 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.

8.4 Deepwater Cisco Restoration

R. Green, 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*), Shortnose Cisco (*C. reighardi*) and possibly Blackfin Cisco (*C. nigripinnis*). Currently, only the Lake Cisco (*C. artedi*) remains in Lake Ontario. Re-establishing self-sustaining populations of deepwater cisco 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 deepwater cisco in Lake Ontario within 25 years. The objectives and strategies for the establishment of deepwater cisco 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 deepwater cisco 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 deepwater cisco 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 deepwater cisco in Lake Ontario.

During January and February of 2015, fertilized Bloater eggs were obtained from Lake Michigan with the help of local commercial fisherman and personnel from the USFWS. Eggs were transferred to quarantined facilities at the OMNRF (White Lake and Normandale Fish Culture Stations) and the USGS Tunison Laboratory of Aquatic Science at Cortland, New York.

In November of 2015, the OMNRF successfully released over 35,000 Bloater (31,845 fall fingerlings 3.6 g mean wt, 1652 fall yearlings 52.5 g mean wt and 2,100 sub-adult 92 g mean wt). The Bloater were released offshore of Main Duck Island. The St. Lawrence Channel near Main Duck Island was chosen as a stocking location because of the suitability of the habitat for this species. Aquatic Research and Monitoring Section has assembled an acoustic telemetry array in this area to track movements of 70 yearling adults within this area (Section 9.2 of this report for the Boater acoustic telemetry summary).

OMNRF staff sampled 256 individual fish from the 2015 stocking events. Length, weight and sex were recorded for all individuals. Of the 256 individuals retained, 105 were male, 133 were female, and 18 fish were of undetermined sex (these latter fish were relatively small). There was not a statistically significant difference in the length-weight relationship based on sex, so all fish were pooled for analysis. The resultant length-weight relationship is illustrated in Fig 8.4.1. The average length and weight of the sampled fish was 160.6 mm and 41.2 g.

The re-introduction of Bloater to Lake Ontario is consistent with bi-national commitments to diversify the offshore prey fish community, increase and restore native fish biodiversity and restore historical ecosystems structures and functions. Continued collection of eggs from the wild and development of a cultured brood stock will result in more fish being stocked in future years. A key restoration goal with this program is to be able to stock 500,000 fish per year starting in 2015. Impediments during rearing prevented reaching the 500,000 fish target this year. To help achieve this goal, broodstock development continues at White Lake FCS and gametes were successfully collected from broodstock at White Lake FCS in 2015.

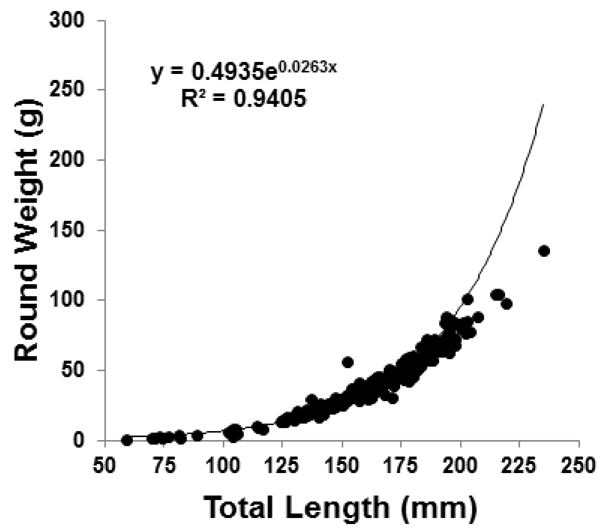

FIG. 8.4.1. Length-weight relationship of retained Bloater, all sexes pooled (n=156, mean total length = 126.2 mm; mean weight = 21.2 g).

8.5 Lake Trout Restoration

J. P. Holden, C. Zhu, 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 Lake Trout netting program. Since 1996, in Canadian waters the Lake Trout targets have been evaluated based on a catches in a subsample of sites in the Fish Community Index Gill Netting project (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) sites and only based on sites where the water temperature on bottom is below 12°C. Pre-1996 indices back to 1992 from the Fish Community Index Gill Netting project (Section 1.2) have been added to the current status report.

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. During 2015, abundance marginally decreased in the Kingston Basin and Lake while the abundance in the Deep Main Lake increased from 2014 catches. The strategy specifically identifies female Lake Trout greater than 4000 g as an important indicator of a spawning stock that has historically been a reference point for a detectable level of wild recruits. The current catch per unit effort (CUE, number per 24 hr gill net set) is on an increasing trend since 2005, however the CUE in 2015 (0.38 fish/net) was lower than in 2014 (0.48 fish/net) and overall catches remain well below the target of 1.1 fish per standard assessment gill net (Fig. 8.5.2).

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 2012 cohort (sampled in 2015) increased above mean survival levels however the current survival index

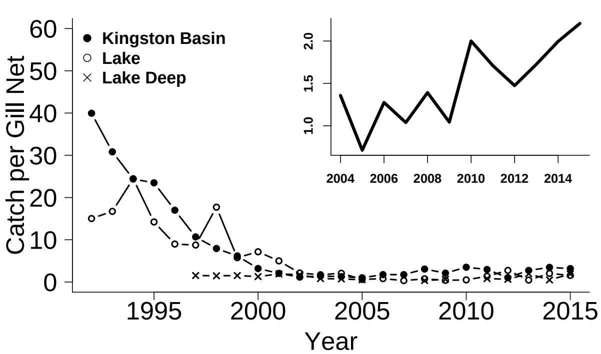

FIG. 8.5.1. Catch per unit effort of mature Lake Trout by area. Inset shows mean trend of the three areas combined since 2005.

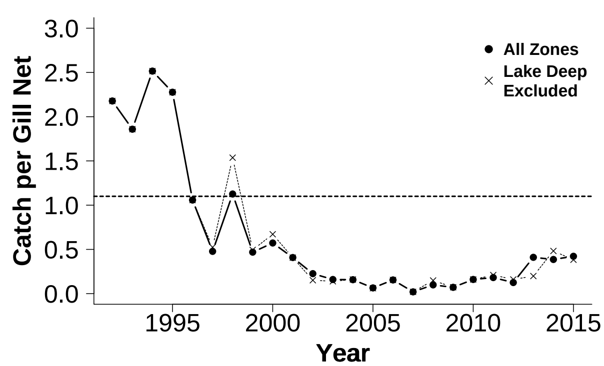

FIG. 8.5.2. Relative abundance of mature female Lake Trout greater than 4000 g. Trend is present with and without Lake Deep sites as they were not conducted in all years.

(0.55) is well below the target of 1.5 identified in the strategy (Fig. 8.5.3).

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 has shown that more than 90% of unclipped fish are of wild origin. Catches of wild Lake Trout increased in 2015 over 2014 (12.3 and 6.5, respectively) to a level slightly below target (Fig. 8.5.4). Ages of unclipped Lake Trout captured between 2005 and 2014 were determined through examination of otoliths and determined that several cohorts were present (Fig. 8.5.5).

Catches of small Lake Trout in the Fish Community Index Trawling project (Section 1.3) are generally low but can provide some additional insight on wild recruitment. Small numbers of wild young-of-year (YOY) fish were caught in 2010, 2012 and 2013 (Fig. 8.5.6). Two wild YOY and one wild yearling were captured in 2015.

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. 8.5.7). Wounding rates were below target again in 2015 (0.6 wounds/100 Lake Trout) and 1.3 A2 wounds (wound with limited healing)/100 Lake Trout.

The strategy calls for Ontario to continue stocking 500,000 Lake Trout yearlings annually to increase adult biomass to levels that would facilitate natural reproduction. Ontario stocks three strains of Lake Trout to maximize genetic

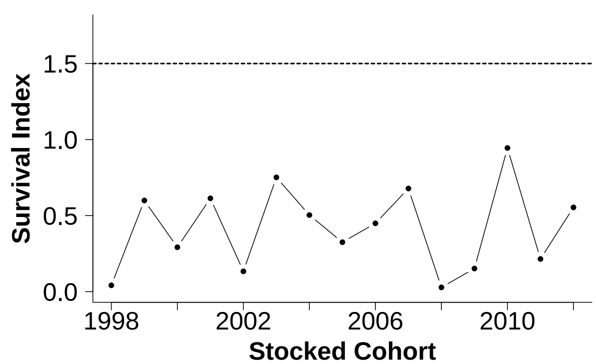

FIG. 8.5.3. Catch per unit effort (CUE) of age-3 Lake Trout standardized to 500,000 stocked. Dotted line indicates the Lake Trout Management Strategy target (CUE = 1.5).

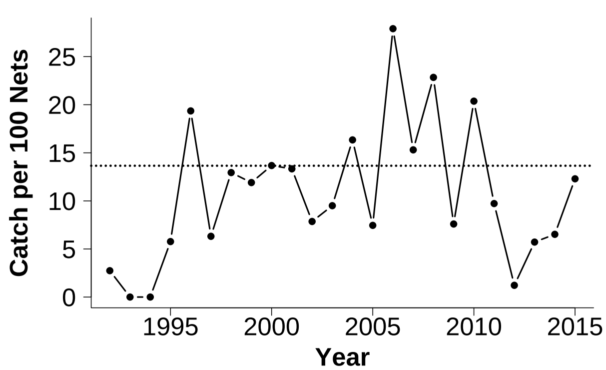

FIG. 8.5.4. Catch of unclipped Lake Trout per 100 standardized nets. Dotted line indicates Lake Trout Management Strategy target of 13.7 fish per 100 standardized nets.

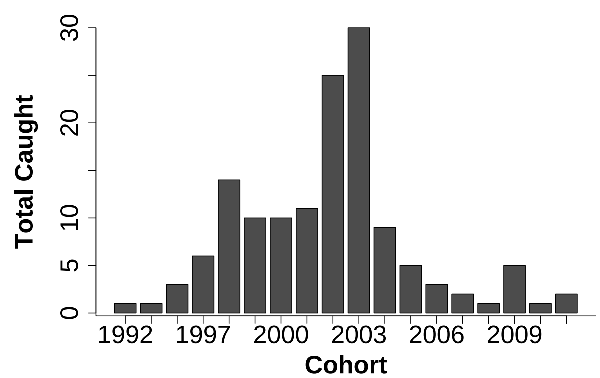

FIG. 8.5.5. Cohort distribution of unclipped Lake Trout captured in the Fish Community Index Gill Netting program (Section 1.2) caught between 2005 and 2014.

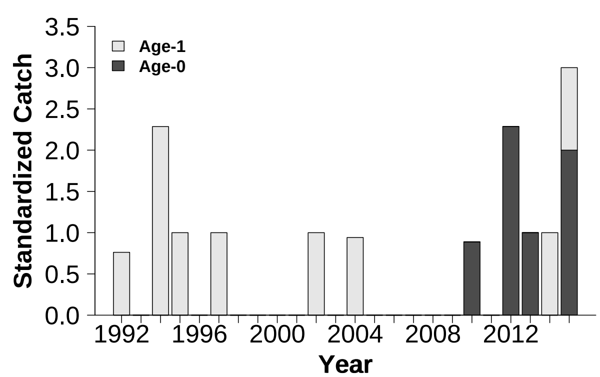

FIG. 8.5.6. Catches of age-0 and age-1 Lake Trout in the Fish Community Index Trawling program (Section 1.3). Catches standardized to a 100 trawl program.

diversity and develop a strain that is well adapted to present conditions in Lake Ontario. In 2015, a total of 533,039 Lake Trout yearlings were stocked at five different areas across the lake. A breakdown of Lake Trout stocking numbers, locations and strains is included in Section 6.1.7.

Since 1998, Lake Trout stocked by OMNRF have been clipped with multiple fin clips (an adipose clip and one other), and contain no coded wire tags (CWT) whereas US stocked fish have continued to use only adipose clips paired with CWT. This difference in marking allows for an evaluation of fish straying. Of the 3,381 Lake Trout sampled in the Fish Community Index Gill Netting project (Section 1.2); 665 Lake Trout were caught with only an adipose clip and of these, 352 had a CWT detected. This suggests that at least 10%; but as much as 20% of Lake Trout caught in the Kingston Basin originated from American stocking programs.

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. The condition index (4,578 g) remains above average for the time series (1992-2015) (Fig. 8.5.8). Analysis of stomach contents from Lake Trout sampled in 2015 determine that Alewife was the most common identifiable fish species (Table 8.5.1) although a large proportion of the stomachs (46%) contained unidentifiable fish remains. Round Goby and Rainbow Smelt were the only two other identifiable fish species and they were found in less than 2% of the stomachs.

Catch and harvest of Lake Trout in the recreational fishery is assessed through the Western Lake Ontario Boat Angling Survey. When last conducted in 2013, the total catch of Lake Trout had increased to levels observed in the 1980s and 1990s (Fig. 8.5.9), however harvest

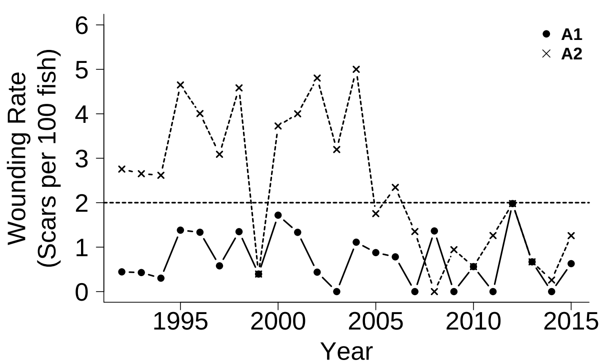

FIG. 8.5.7. Sea Lamprey scarring rate. Dotted line indicates the Lake Trout Management Strategy target of a maximum of two A1 wounds (fresh with no healing) per 100 Lake Trout.

TABLE 8.5.1. Diet composition of Lake Trout sample in the Fish Community Index Gill Netting (Section 1.2)

Content	Number of Lake Trout with these items	Number of items in all Lake Trout stomachs
Unknown Fish	228 (46%)	583 (48%)
Alewife	210 (43%)	593 (49%)
Round Goby	7 (1%)	11 (<1%)
Mysis	1 (<1%)	17 (1%)
Rainbow Smelt	1 (<1%)	1 (<0.1%)
Unknown Molluscs	1 (<1%)	1 (<0.1%)
Empty	167 (34%)	NA
Total	492	1206

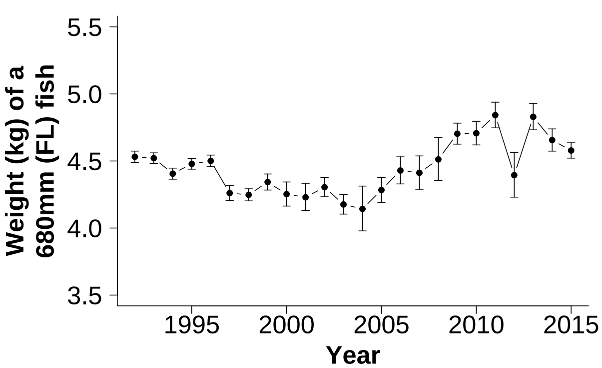

FIG. 8.5.8. . Lake Trout Condition Index is the predicted weight of a 680 mm (fork length) Lake Trout. Error bar indicate the 95% confidence intervals.

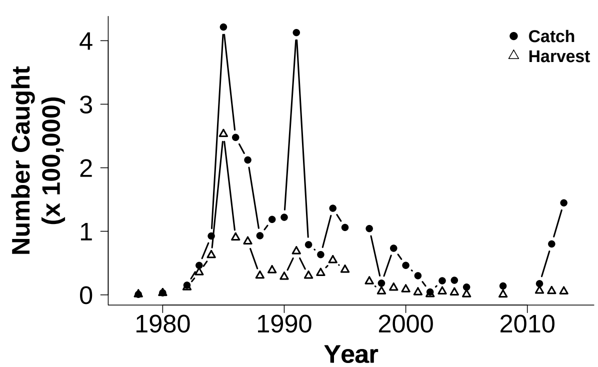

FIG. 8.5.9. . Estimated catch and harvest of Lake Trout in the Western Lake Ontario Boat Angling Fishery survey. The survey was last conducted in 2013.

remains low as anglers chose to release most (96% in 2013) of the Lake Trout caught (Fig. 8.5.10). From direct interviews, Lake Trout was the fourth most caught species behind Chinook Salmon, Rainbow Trout and Largemouth Bass although the majority of the catch in 2013 (95%) was isolated in the western end of Lake Ontario (Niagara and Hamilton Areas, Fig. 2.3.2). Of the Lake Trout sampled by creel technicians, it was determined that the majority of fish were of hatchery origin (93%) and 78% were stocked in U.S. waters (based on coded-wire tag data). However, an angler survey was last conducted in the Kingston Basin in 2008 and suggested that Lake Trout catches were 3.5 times higher in the Kingston Basin compared to catches observed in the Western Lake Ontario Boat Angling Survey. Scaling the 2013 western basin harvest to account for Kingston Basin harvest results in 1,862 Lake Trout per year being harvested which is below the maximum recommended harvest of 5,000 fish from Ontario waters.

The Lake Ontario Volunteer Angler Diary Program (Section 2.3) provides additional information on the recreational fishery for Lake Trout. Diaries were submitted from 19 anglers in 2015. A total of 435 trips were recorded and 90 (21%) were reported as targeting Lake Trout. Trips that targeted Lake Trout occurred in all Sectors but 50 (56%) of the trips occurred in the Hamilton Sector. Brighton (11) and Niagara (10) made up an additional 23% of the targeted Lake Trout trips. Anglers reported catching 316 Lake Trout, which was the second most abundant species after Chinook Salmon in the 2015 catch. Consistent with the Western Lake Ontario Boat Angling Survey, diary anglers reported releasing a large proportion (84%) of the Lake Trout caught.

There is currently no quota for the commercial harvest of Lake Trout; however some fisheries (primarily the gill net fishery) do capture Lake Trout as by-catch (non-target captures). Commercial fishers are required to report by-catch on their Daily Catch Record. A total of 5,123 lbs (2,328 kg) of Lake Trout were reported as by-catch in 2015 (Fig. 8.5.11) and is the highest within time series (2004-2015). Quota Zone 1-2 (see Section 3.2 for description of Quota Zones) makes up the largest proportion (86%) of the reported by-catch. Data on the size of the Lake Trout caught as by-catch is not available however using the mean weight of Lake Trout in the Fish Community Index Gill Netting project (Section 1.2), by-catch in the commercial fishery was estimated at approximately 660 Lake Trout in 2015.

The expanded transects in the Fish Community Index Gill Netting and Trawling projects (Sections 1.2 and 1.3) provide an opportunity to contrast new sites with the established index sites. Comparisons between bottom trawls were not possible as no Lake Trout were captured in western bottom trawl sites. Overall, the size distribution of Lake Trout captured at western gillnet sites was similar to the traditional index sites (Fig. 8.5.12). Gill net CUE of Lake Trout in the western sites were low compared to Kingston Basin, Conway and Deep

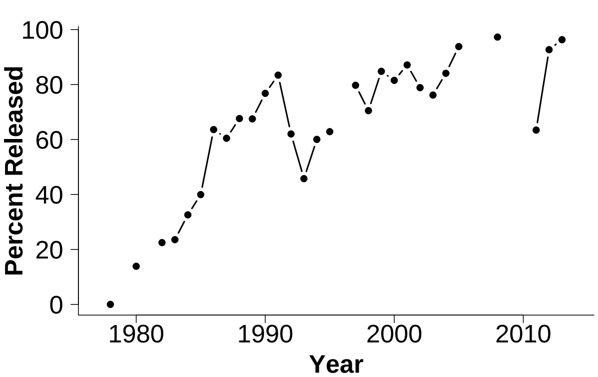

FIG. 8.5.10. Percentage of Lake Trout released in the Western Lake Ontario Boat Angling Fishery. The survey was last conducted in 2013.

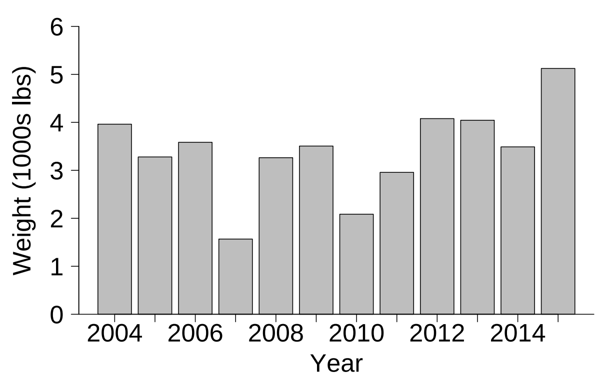

FIG. 8.5.11. By-catch of Lake Trout in the gillnet fishery reported by commercial fishers on Daily Catch Records.

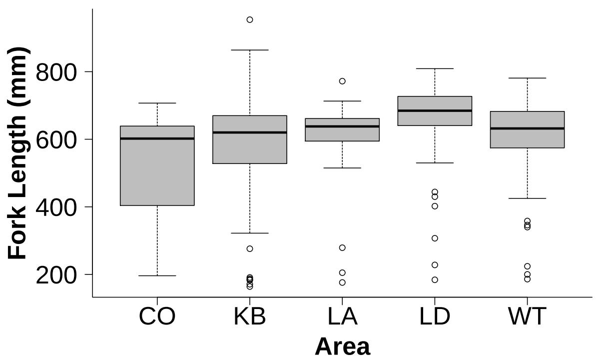

FIG. 8.5.12. Comparison of size distribution of Lake Trout between traditional eastern areas (CO = Conway, KB = Kingston Basin, LA = Lake, LD = Lake Deep) and the 2015 western areas combined (WT). Median value is indicated by the solid line. Boxes and whiskers capture 50% and 95%, respectively, of the values. Values beyond the 95% quantile are represented individually as open circles.

Lake sites (Table 8.5.2). Three unmarked Lake Trout were caught in the western transect sites (specifically, Port Credit sites) and while catch numbers are low, this area had the highest proportion of unmarked fish (Table 8.5.3).

TABLE 8.5.2. Comparison of 2015 Fish Community Index Gill Netting (Section 1.2) catches (CUE) between areas within the five areas sampled based on sex and maturity.

Zone	CUE	Immature	Mature females <4000g	Mature females >= 4000g	Mature males
Conway	1.65	0.20	0.30	0.25	0.90
Kingston Basin	2.70	0.46	0.54	0.44	1.26
Lake	0.48	0.02	0.06	0.11	0.28
Deep Lake	3.96	0.21	0.21	1.17	2.38
West	0.65	0.13	0.10	0.19	0.24

TABLE 8.5.3. Clipped to unclipped ratio of Lake Trout captured in the 2015 Fish Community Index Gill Netting project (Section 1.2) across five geographic areas. Isotope studies have shown that more than 90% of unclipped fish are of wild origin.

Zone	Unclipped	Clipped	% Unclipped
Conway	0	33	0.0
Kingston Basin	14	283	4.9
Lake	2	23	8.7
Deep Lake	1	95	1.1
West	3	32	9.4

8.6 Round Whitefish Spawning Population Study

J. Wood, C. Wilson, Aquatic Research and Monitoring Section
J. A. Hoyle, Lake Ontario Management Unit

The genetic stock structure of Round Whitefish (*Prosopium cylindraceum*) in Lake Ontario was assessed to test for the potential presence of cryptic stocks in Ontario waters. Historical and contemporary samples collected from Round Whitefish from three locations in Lake Ontario (Darlington, Pickering, and Peter Rock, Fig. 8.6.1) during fall spawning were analyzed using microsatellite DNA markers. Individual-based analyses of multilocus genotypes failed to identify significant genetic differences or discrete genetic populations among Round Whitefish from the different sampling locations.

Results of this study will help inform ongoing management of this native coregonid species.

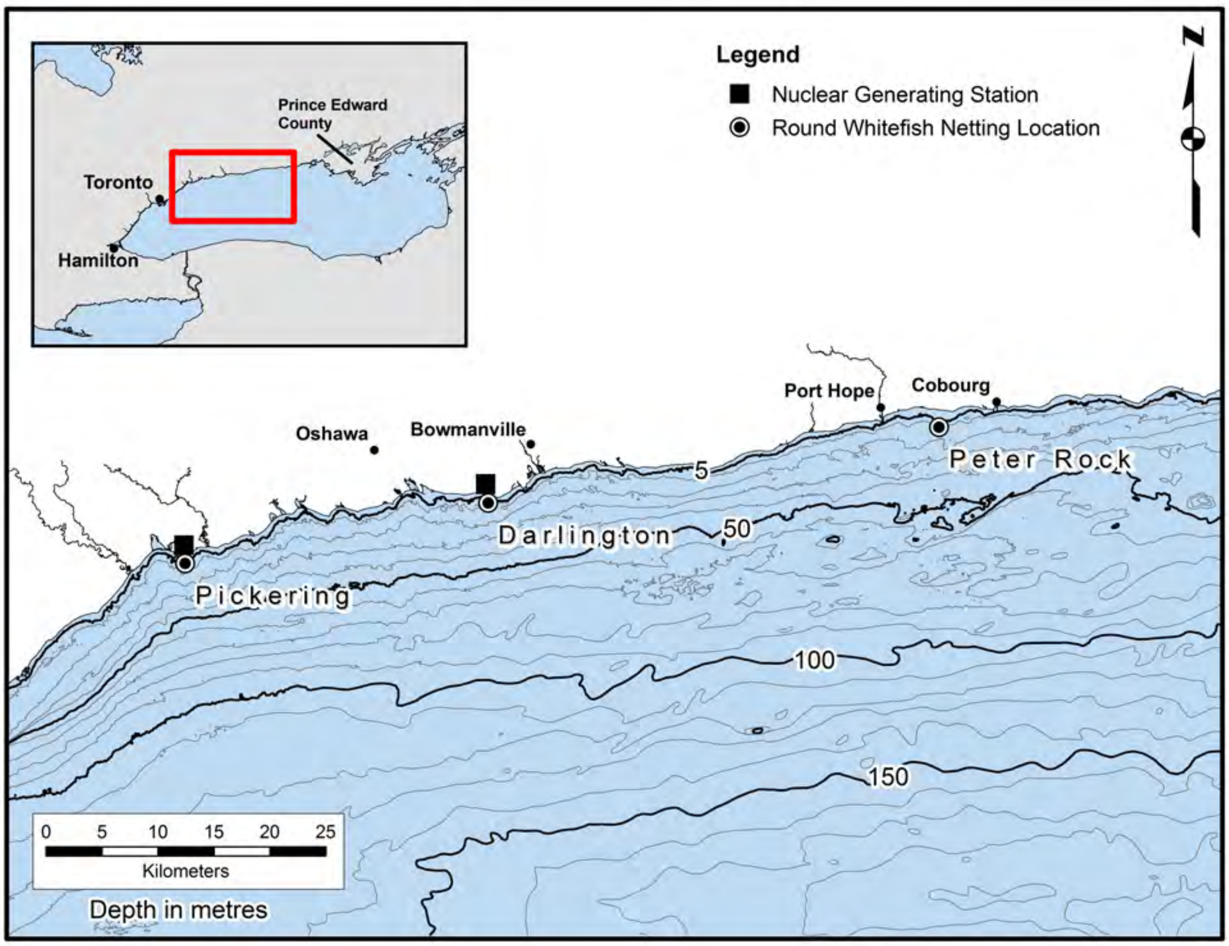

FIG. 8.6.1. Map of Lake Ontario showing locations (Pickering, Darlington, and Peter Rock) of Round Whitefish tissue sample collections.

8.7 Hamilton Harbour Walleye Reintroduction

J. A. Hoyle, Lake Ontario Management Unit

Past Restoration Efforts

Walleye declined in Hamilton Harbour in the early 1900s and were not observed in various fish surveys conducted during the mid-1900s. Walleye were reintroduced in Hamilton Harbour through adult transfer and spring fingerling stocking of Bay of Quinte strain in the 1990s (Table 8.7.1). This initial stocking effort was part of the local Remedial Action Plan (RAP) objective to increase top predators in the Hamilton Harbour fish community. All Walleye subsequently caught in trap net assessments during 2006 and 2008 had DNA showing Bay of Quinte origin, consistent with the 1990s stocking program. Walleye abundance declined and disappeared from the trap net surveys between 2006 and 2012 (Fig. 8.7.1).

Current Restoration Efforts

Walleye stocking commenced again in 2012; 100,000 summer fingerlings stocked in July that year. In addition, 74 adult Walleye (approximately 10-years-old hatchery brood stock) were stocked in November 2012. In 2013, 10,000 July summer fingerlings were stocked, and in 2014, 950,000 day-old swim-up fry were stocked in June. In 2015, over one million swim-up fry and nearly 53,000 summer fingerlings were stocked in May and July, respectively (Table 8.7.1). Early results of the 2012 Walleye stocking were very promising. Fisheries and Oceans Canada electrofishing assessments began to capture Walleye shortly after the 2012 stocking. Growth rate of the fish was very fast and this fast growth rate appears to have continued.

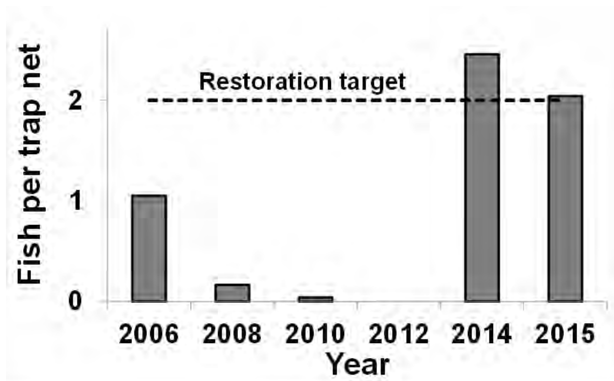

FIG. 8.7.1. Walleye catch (number of fish per trap net lift) for years indicated. Of the 49 Walleye caught in 2015, 45 were age-3 years and (by inference) originated from the 100,000 summer fingerlings stocked in 2012. One Walleye was age-2 from the 10,000 summer fingerlings stocked in 2012.

TABLE 8.71. Walleye stocked into Hamilton Harbour, 1993-2015 and target for 2016*.

Year	Month	Life-Stage	Mean weight (g)	Number of fish	Source
1993	October	adult	600	185	transferred from Bay of Quinte
1994	October	adult	1,500	129	transferred from Bay of Quinte
1997	October	adult	8,900	130	transferred from Bay of Quinte
1998	September	adult	1,364	120	transferred from Bay of Quinte
1999	July	3-months	1	6,000	White Lake FCS (Bay of Quinte strain)
2012	July	3-months	1	100,000	White Lake FCS (Bay of Quinte strain)
2012	November	adult	1,500	74	White Lake FCS (Bay of Quinte strain)
2013	July	3-months	1	10,000	White Lake FCS (Bay of Quinte strain)
2014	June	Swim-up fry	n/a	950,000	White Lake FCS (Bay of Quinte strain)
2015	May	Swim-up fry	n/a	1,017,625	White Lake FCS (Bay of Quinte strain)
2015	July	3-months	0.3	52,963	White Lake FCS (Bay of Quinte strain)
2016*	July	3-months		50,000	White Lake FCS (Bay of Quinte strain)

Monitoring and Assessment

Nearshore fish community index trap netting (NSCIN) was conducted on Hamilton Harbour in August 2015 (see Section 1.4). A mean catch of 2.04 Walleye per trap net was observed (Fig. 8.7.1). This meets the restoration target of 2 fish per net established prior to commencement of the 2012 Walleye stocking initiative. The mean catch of 2.04 fish per net also compares favourably to that from other Lake Ontario and St. Lawrence River nearshore areas (see Section 1.4 and Section 7.4). Sixteen of the 24 trap net sets in Hamilton Harbour caught at least one Walleye (Fig. 8.7.2). Walleye were captured throughout Hamilton Harbour where suitable trap net sampling locations were located.

FIG. 8.7.2. Map of Hamilton Harbour showing number of Walleye caught, in August 2015, at each trap net location. A total of 49 Walleye were captured. Map courtesy of Google Earth.

A total of 49 Walleye were caught in the August netting and all but four of these fish were likely 3-year-olds from the 2012 stocking event. These 3-year-old fish ranged in size from 440-540 mm fork length (mean 473 mm; Fig. 8.7.3). Three of the four other Walleye caught were much larger, ranging in size from 630-660 mm, while the fourth Walleye was smaller (380 mm fork length) and likely originated from the 2013 Walleye stocking event (2-years-old). Some of the Walleye caught in 2015 were provided to Fisheries and Oceans staff for an acoustic tagging study.

Female Walleye state of maturity was determined by examining gonad weight relative to total body weight. Females with mature gonads during late summer are presumed to be capable of spawning the following spring. Of seven female Walleye caught in August 2014, all were age-2 (2012 stocked fish; range in fork length 375-426 mm), judged immature, and therefore not going to spawn in spring 2015. Of ten female Walleye caught in August 2015, nine (range in fork length 467-524 mm) were mature and one, the smallest (450 mm), was immature. The maturing female Walleye are judged to be able to spawn in spring 2016 at age-4 years. Male Walleye often mature one year sooner on average than females. This does not appear to be the case in Hamilton Harbour for the 2012 stocked cohort of fish. Only one of twenty-three male Walleye was mature in 2014. Fourteen of twenty were judged mature in 2015.

An adequate level of top fish predators, such as Walleye, helps to achieve a balanced trophic structure in the fish community, and also complements local remedial action to improve water quality and restore fish habitat in Hamilton Harbour. All indications to date are that the recent Walleye stocking effort in Hamilton Harbour has been highly successful in terms of survival and growth rates. An ongoing plan is in place to monitor contaminant levels for the Hamilton Harbour Walleye. To help further evaluate stocking success, local anglers are encouraged to report on any Walleye caught in Hamilton Harbour. The next trap net survey is planned for 2016. Of particular interest, moving forward, are the distribution and migration patterns as well as any spawning behaviour exhibited by these stocked Walleye.

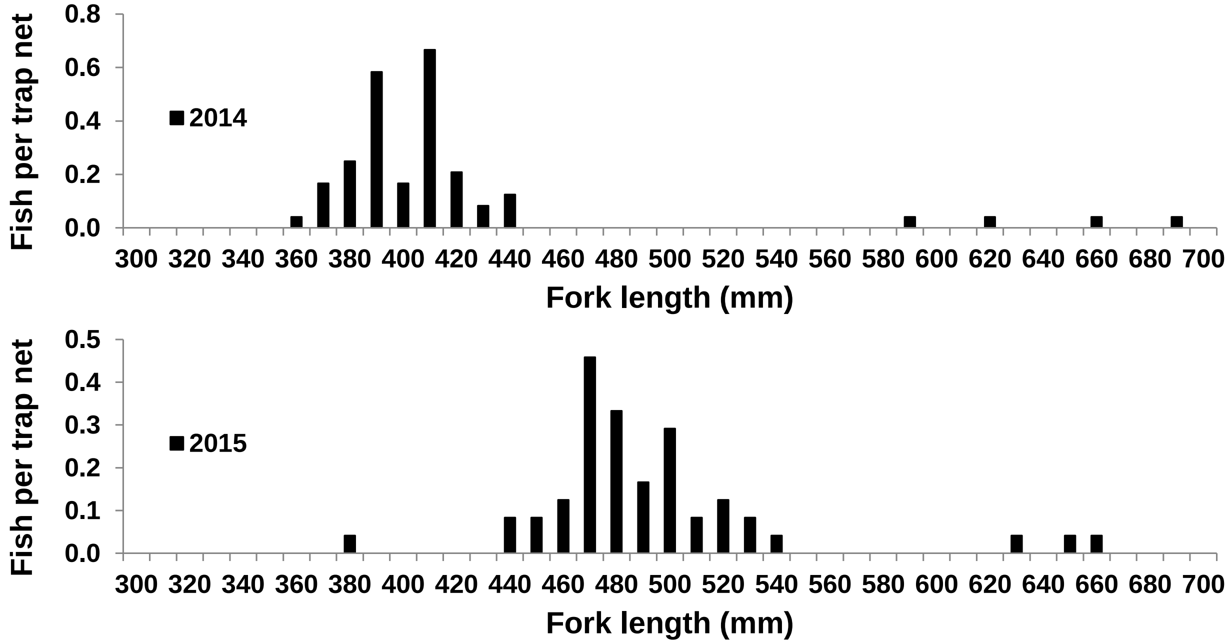

FIG. 8.7.3. Size distribution of Walleye caught during NSCIN trap net surveys conducted in Hamilton Harbour in 2014 and 2015.

9. Research Activities

9.1 Understanding depth and temperature preference of Lake Ontario salmonids using novel pop-off data storage tags

Project leads: Tim Johnson (OMNRF-ARMS), Aaron Fisk, Graham Raby, Tom Stewart (Great Lakes Institute for Environmental Research, University of Windsor)
Collaborators: Lake Ontario Management Unit, New York State Department of Environmental Conservation
Funding: Canada-Ontario Agreement, Great Lakes Fisheries Commission

Lake Ontario contains a diverse salmonid community. With six species overlapping their distributions to varying extents, there is potential for inter-species competition for food resources. Highly valued recreational fisheries for Chinook Salmon *Oncorhynchus tshawytscha* and Rainbow Trout *Oncorhynchus mykiss* (see Section 2.3) are sometimes perceived to be in conflict with efforts to rehabilitate Atlantic Salmon *Salmo salar* and Lake Trout *Salvelinus namaycush* (see sections 8.2 and 8.5) owing to concerns about competition for food. Understanding the movement and distribution of these species in a large and ever-changing ecosystem like Lake Ontario is not an easy task. Pop-off data storage tags (pDST) became available for freshwater fish for the first time in 2013 and provide an ideal tool for collecting information on depth and temperature of fishes for an extended period of time. These pDST record data at specified time intervals and then release from the fish on a programmed date, floating to the surface where they can be recovered.

In 2014, we attached pDSTs to 22 trout and salmon in Lake Ontario, programming the tags to record depth and temperature every 70 seconds before popping off after one year. Recovery of the data depends on the tags being returned to us—a $100 reward is offered as an incentive. Two tagged fish were caught by anglers in 2014 (one Brown Trout (*Salmo trutta*) and one Rainbow Trout, described in the 2014 Annual Report), while five additional tags were returned in 2015 (three Lake Trout, one Chinook Salmon, one Brown Trout). Fifty-six additional fish were tagged in 2015 (36 Lake Trout, 10 Chinook Salmon, and 10 Atlantic Salmon). Preliminary analysis of the data from the recovered tags reveals distinct habitats are selected by each species (Fig. 9.1.1). The example data shown are for a two-week period in the fall of 2014, while the lake was still thermally stratified (warm water above the thermocline (~20m) and cooler water below). The two Lake Trout occupied deeper and colder water than the Chinook Salmon, generally staying below 30 m, but occasionally making short term dives / ascents of greater than 50 m in a matter of minutes. The Lake Trout tended to occupy deeper water during the night (shaded bands on the Figure) but ascend to warmer water near the surface at dawn. In contrast, the Chinook Salmon tended to occupy depths closer to the surface at night, and undergo dynamic movements to greater depths during the day. However, because the Chinook tended to occupy depths at or above the thermocline, the range of temperatures they experienced was much less than the Lake Trout.

As more tags release and are returned in 2016, we will be able to create a more complete picture of salmonid depth and temperature distribution in Lake Ontario. As the Lake Trout data show, individual fish of the same species can exhibit different behaviours, but these preliminary results also suggest that individual differences within a species are less than the differences between species. If this observation holds true with an expanded dataset, then the partitioning of habitat will have important implications for resource use. By combining these data with bioenergetics models and environmental data (lake water temperature, spatial distribution of prey fishes, etc.) we will be able to generate a much more accurate estimate of food consumption and the potential for competition amongst these co-existing salmonid species. This information will be valuable to resource managers when making decisions around stocking levels and species mix, and in understanding the implications of climate change and shifts in prey fish distribution and composition on the production of economically and ecologically important trout and salmon in Lake Ontario.

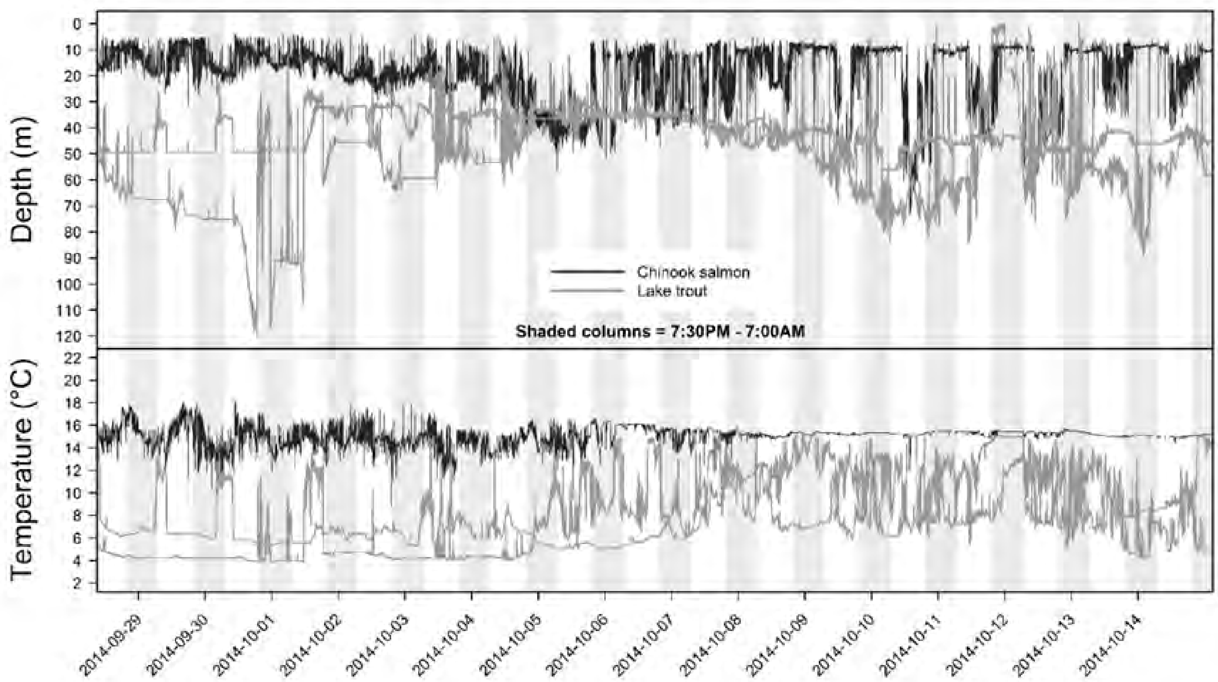

FIG. 9.1.1. Depth and temperature time series for two Lake Trout (grey), and one Chinook Salmon (black) in Lake Ontario for a two-week period in autumn 2014. Data were recorded on externally-attached data storage tags that recorded both depth and temperature every 70 s. The two Lake Trout were tagged on April 21, 2014, near Oswego, NY (eastern basin) while the Chinook Salmon was tagged two weeks before the start of this time series, on September 17, near Port Credit, ON (western basin). The shaded areas indicate nighttime.

9.2 Bloater restoration: using acoustic telemetry to understand post-stocking behaviour

Project leads: Tim Johnson (OMNRF-ARMS), Aaron Fisk, Eddie Halfyard, Tom Stewart (Great Lakes Institute for Environmental Research, University of Windsor)
Collaborators: Lake Ontario Management Unit, New York State Department of Environmental Conservation
Funding: Canada-Ontario Agreement, Great Lakes Fish and Wildlife Restoration Act, Great Lakes Fisheries Commission

Historically, a very diverse assemblage of deepwater ciscoes (five species), including Bloater (*Coregonus hoyi*), inhabited Lake Ontario. Since that time, only the shallow water form (*C. artedi*) remains. OMNRF and New York State Department of Environmental Conservation have jointly developed a plan to re-establish a self-sustaining Deepwater Cisco (Bloater) population with a target to stock 500,000 juvenile Bloater annually (see Section 8.4). One question requiring investigation is what will happen to the stocked fish after introduction. Do hatchery fish survive in the wild and how does that change over time? Do they quickly disperse or do they stay close to their stocking site? Do they school closely together and move as a group? What is their seasonal habitat use and occupied depth and temperature? Answering these questions using acoustic telemetry is the focus of this research. Bloater are generally considered to be a fragile fish not well suited for handling and stressful manipulation and acoustic telemetry may not be feasible with this species. Our laboratory trials (described in Section 9.6 of the 2014 Lake Ontario Annual Report), suggested negligible impact on Bloater growth and survival. After conducting field trials to optimise the configuration of the receiver array, we moved forward with tagging and release of Bloater in the fall of 2015.

Using a natural underwater valley (the St. Lawrence Channel) to help define an area of suitable Bloater habitat, we deployed an array of eighty 69 kHz VR2W acoustic receivers in mid-October (Fig. 9.2.1). We then tagged 70 yearling Bloater (mean length 174 mm) with either V7 or

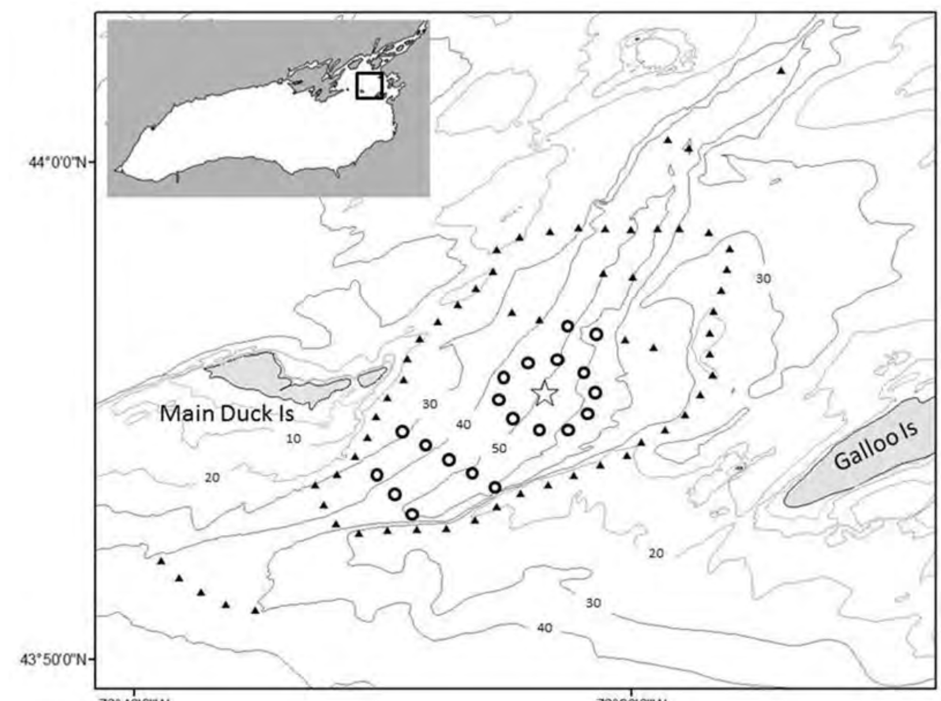

FIG. 9.2.1. Acoustic receiver layout in the St. Lawrence Channel of eastern Lake Ontario used to assess post-stocking behaviour and survival of Bloater *Coregonus hoyi*. The array consists of eighty 69 kHz receivers. The star indicates the point of release, while the circles indicate receivers that were downloaded and re-deployed in early December to assess initial post-stocking behaviour.

V9 tags, and released those fish, along with ~1,700 untagged yearlings and ~32,000 fingerlings, into the centre of the acoustic array in early November. In early December a subset of 20 of the receivers was downloaded (and re-deployed) to obtain preliminary data on Bloater behaviour 21 days post-release.

About 108,000 detections were recorded for the tagged Bloater during the 21 days, with another 36,000 detections of tags deployed by other researchers (e.g. Smallmouth Bass tagged by Dr. Bruce Tufts at Queen's University, and American Eel tagged by Alastair Mathers of LOMU (see section 8.3)). In total, 67 of the 70 tagged Bloater were detected, with multiple fish detected at all 20 of the receiver locations (Fig. 9.2.2). Bloater appeared to move in and out of the detection range of the 20 downloaded receivers during the initial 21-day period. We plan to download the entire 80-receiver array in June of 2016 and data will be analysed to describe movement, habitat use, and survival post-stocking.

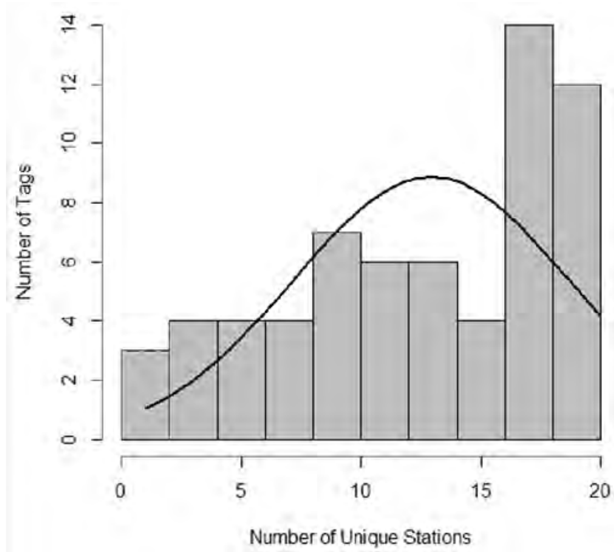

FIG. 9.2.2. Distribution of the number of unique mooring stations where tags were detected within the initial 21 days post-release on the 20 receivers downloaded in early December.

9.3 Diet similarity among benthic fishes in Lake Ontario

Project Leads: Jeff Buckley, Brent Metcalfe & Tim Johnson (OMNRF-ARMS)
Partners: James Mumby and Aaron Fisk (Great Lakes Institute for Environmental Research, University of Windsor), Lake Ontario Management Unit
Funding: Canada-Ontario Agreement

Deepwater Sculpin (*Myoxocephalus thompsonii*) are a benthic fish species that was thought to have been extirpated from Lake Ontario. However, in 1996, they were found once again, and since 2005 have been regularly caught in index trawling programs. Interestingly, the apparent reestablishment of Deepwater Sculpin has occurred coincident with the invasion and establishment of another benthic species, the Round Goby (*Neogobius melanostomus*).

In 2013, intensive sampling of the Lake Ontario benthic fish community was conducted as part of the Cooperative Science and Monitoring Initiative (CSMI). Data from this program were used to analyze the diets of benthic fish species to see how similar (or different) diets of native sculpin species were compared with the invasive Round Goby.

Stable isotopes in fish tissue can be used to describe a species' ecological niche (i.e. the types of foods and habitats it uses). Nitrogen isotopes (δ^{15}N) become enriched in an organism relative to its prey. Therefore, δ^{15}N indicates a fish's trophic level, with higher δ^{15}N indicating a higher trophic position. Carbon isotopes (δ^{13}C) tend not to change between predator and prey, and therefore can be used to identify the source of the food. δ^{13}C tends to be higher (less negative) in nearshore and benthic food sources. Combining these two factors, the 'niche space' of a species can be determined.

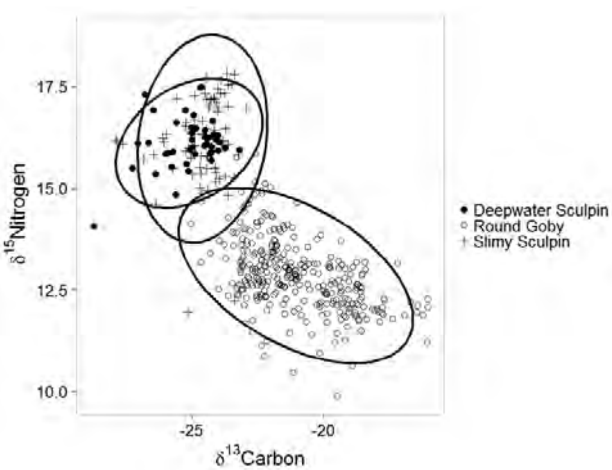

FIG. 9.3.1. Stable isotope bi-plot of Deepwater Sculpin (n = 43), Slimy Sculpin (n = 81), and Round Goby (n = 319), collected in 2013. Ellipses show 95% confidence region for each species.

Isotopic signatures were analyzed in three benthic species from the 2013 CSMI data, Deepwater Sculpin, Slimy Sculpin (*Cottus cognatus*) and Round Goby.

Both sculpin species were found to occupy a similar isotopic niche, feeding on offshore prey at a higher trophic level (Fig. 9.3.1). Round Goby were found to feed on prey from nearshore sources at lower trophic levels, however, Round Goby also demonstrated the greatest range of prey sources (i.e. δ^{13}C range).

Stomach contents of benthic species were also analyzed for the relative count and weight of prey species found in all samples (Fig. 9.3.2). By count, Deepwater Sculpin consumed primarily mysids and fish eggs, while Slimy Sculpin consume mysids, fish eggs, and midges. Round Goby consumed midges, seed shrimp (ostracods), and quagga mussels.

The majority of sculpin samples containing fish eggs as prey items were collected in April, however, two Slimy Sculpin collected in July and October also contained eggs. Twenty-two Round Goby samples contained fish remains (not included in Fig. 9.3.2). In two of these samples the remains were identified as Round Goby.

Overall, diet inferred from stable isotopes and stomach contents suggested that while Deepwater Sculpin and Slimy Sculpin occupy a similar niche, there was little dietary overlap with Round Goby. These results are preliminary, and future analysis will include an examination of the effects of depth, location and season on foraging habits of these benthic fish species.

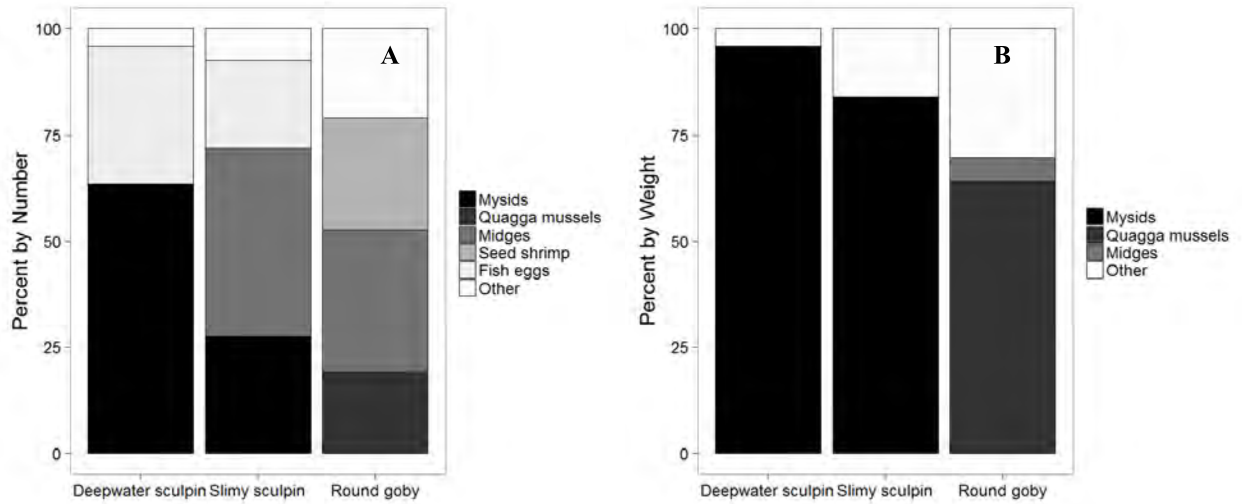

FIG. 9.3.2. Proportion of prey items in stomach contents by (A) count and (B) weight of Deepwater Sculpin (n = 97), Slimy Sculpin (n = 115), and Round Goby (n = 315), collected in 2013. For each predator species, stomach contents were pooled across all locations, sampling dates, sampling depths, and life stages. All invertebrate prey items were pooled to the taxonomic level of Family. ‘Other’ refers to any prey taxa that does not compose at least 5% of the total proportion of stomach contents.

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

Project Leads: Jeff Buckley, Carolina Taraborelli & Tim Johnson (OMNRF-ARMS)
Partners: Lake Ontario Management Unit, Fisheries and Oceans Canada
Funding: OMNRF-ARMS Base

Lower trophic levels, including algae and zooplankton, fill an essential role in the Lake Ontario food web. These biological communities are the primary source of food to many important prey fish species. Therefore, an understanding of the lower trophic levels aids in the management of larger piscivorous species.

Long-term monitoring is an important tool in understanding how changes in the physical and chemical condition of a lake affect the food web. Beginning in 1981, Fisheries and Oceans Canada (DFO) began reporting on the lower trophic levels as well as physical and chemical condition of Lake Ontario at Station 81 (Fig. 9.4.1). Sampling of Station 81 continued each summer until 1995 when the program was cancelled. Data collected through this monitoring program culminated in a report that demonstrated the response of lower trophic levels to the large decrease in phosphorous loadings in the lake and the initial establishment of dreissenid mussels (Johannsson et al. 1998).

In 2007, the OMNRF Aquatic Research and Monitoring Section restarted the long-term monitoring of Station 81 in collaboration with the Lake Ontario Management Unit and DFO.

Station 81 is located in the centre of the eastern basin of Lake Ontario (44º 01.02’ N, 76º 40.23’ W; Fig. 9.4.1). In 2015, samples were collected bi-weekly from May 5-October 26. Data collected included profiles of temperature, dissolved oxygen, and chlorophyll-a (an index of the amount of algae), Secchi depth (transparency), water samples for nutrient analysis, and samples describing the phytoplankton and zooplankton communities.

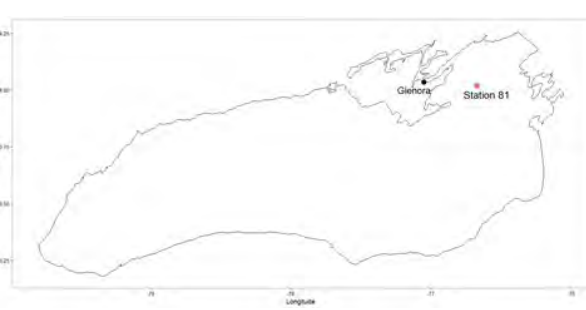

FIG. 9.4.1. Map of Lake Ontario showing location of Station 81.

In 2015, stratification of the water column was first observed on July 6th and was last observed on September 16th. Secchi depth varied between 5 m and 16 m. Mean water column temperature ranged from 10.1˚C to 22˚C, with the highest average temperature observed on September 1. Chlorophyll-a ranged from 8.9 µg/L to 16.2 µg/L with these values being observed on August 18 and October 26, respectively. Nutrient, phytoplankton, and zooplankton samples are currently being analysed.

Since 1981, an overall trend of increasing mean annual water temperature has been observed at Station 81 (Fig. 9.4.2). The lowest mean annual temperature was in 1982 (12.5˚C), while the highest annual temperature was observed in 2012 (16.2˚C).

Finally, long-term monitoring of the lake’s

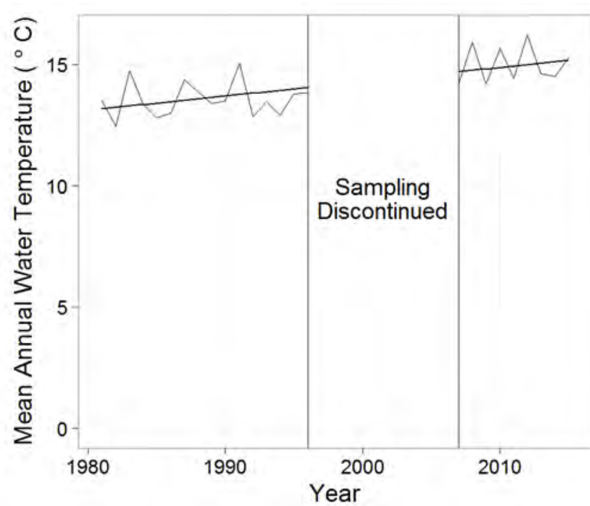

FIG. 9.4.2. Mean annual epilimnetic water temperature, 1981-2015. Daily water temperature was calculated as the mean temperature of the water column from the surface to the thermocline, or to 20 m depth if no thermocline existed. Annual means were seasonally weighted between April 1 and October 31. Trend line is the least-squares linear regression of water temperature over time.

physical condition allows us to see the natural variation in condition and establish ranges of 'normal' values. For example, vertical thermal stratification of the water column regularly occurs during the summer in larger lakes and is an important aspect of the habitat of both fish and zooplankton. Temperature profiles collected from 2007 to 2015 show the development of stratification through the summer months (Fig. 9.4.3). Despite increasing mean annual temperatures (Fig. 9.4.2), seasonal thermal structure of the water column remains consistent across years.

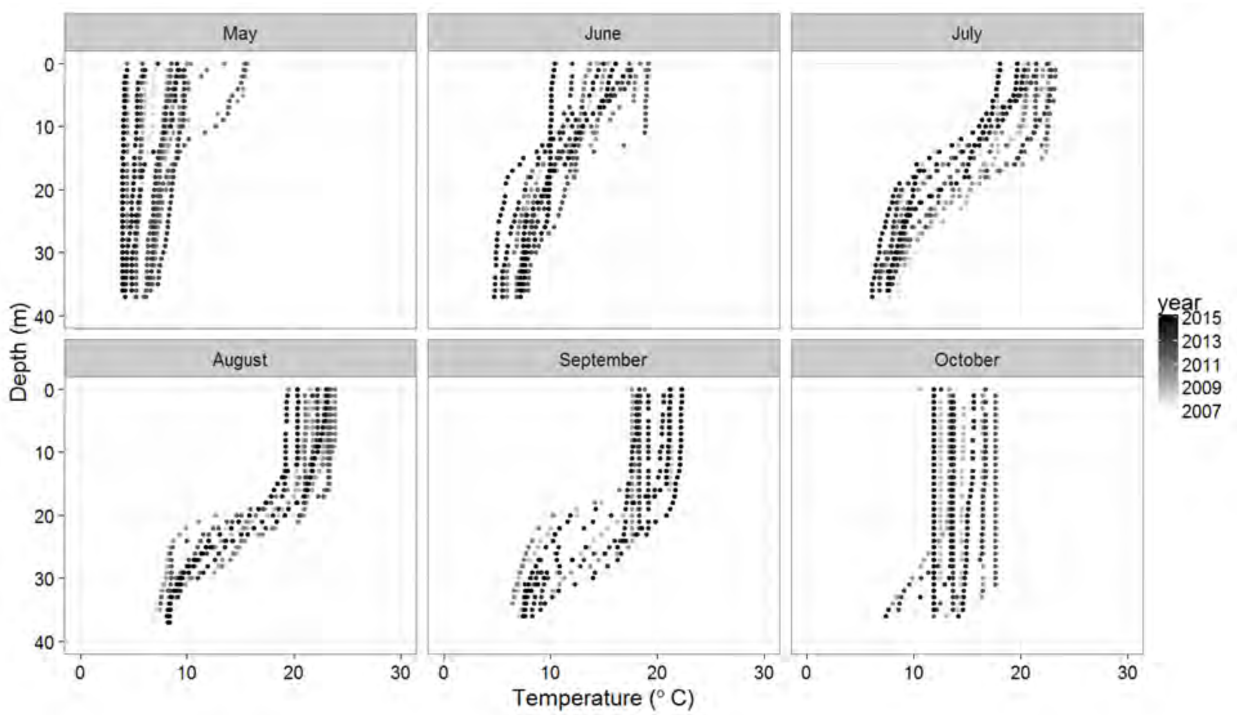

FIG. 9.4.3. All water temperature profiles collected at Station 81, 2007-2015. Darker points represent more recent temperature profiles.

9.5 Understanding human movement patterns and their role in the spread of invasive species in the Great Lakes and the inland lakes of Ontario

Project leads: Shannon Fera & Tim Johnson (MNRF-ARMS), Len Hunt & Allison Bannister (MNRF-CNFER), Andrew Drake (University of Toronto)
Funding: Canada-Ontario Agreement, MNRF, Natural Heritage Section

The spread of aquatic invasive species across the landscape is driven in part by human activities such as boater and angler movement from one waterbody to another. To predict how species may spread, we must first understand what attracts anglers and boaters to a certain body of water. The likelihood of species arriving at or movement within Lake Ontario Fisheries Management Zone (FMZ 20) is not the same as the movement of a species within inland FMZs that consist of many smaller and often unconnected waterbodies. While Lake Ontario may reflect a single lake, there is tremendous variation in habitat features across the lake that will influence where a species may establish.

The likelihood of catching a desired fish species, which is often related to fish abundance, is a large part of the attraction that influences angler movement. As an initial estimate of Great Lakes angler attraction, we used published mass-balance models (Ecopath) to obtain estimates of fish biomass. Within the past few years, researchers have independently developed these models for each Great Lake, using multiple sources of information for the entire food web, and then "balancing" the models to ensure the amount of food consumed by predators is also produced by the prey, and the prey's prey, for each type of organism in the entire food web. Most models have been developed for the open waters (offshore), but some models have been developed for important nearshore ecosystems (e.g., Bay of Quinte, Hamilton Harbour). Model estimates indicate Lake Erie has the highest biomass (amount of desired fish per unit area), while Lake Superior has the lowest (Fig. 9.5.1a). It is not practical to develop similar models for all of Ontario's estimated 250,000 inland lakes, so we turned to the provincial Broadscale Monitoring Program to infer the average catch-per-unit-effort (and approximation of species abundance) within each FMZ within the province. The FMZ average shows the all-species, large-mesh gillnet catches for all road-accessible lakes greater than 50 hectares (Fig 9.5.1b).

Using the two approaches, we are able to describe the relative attraction of each FMZ to anglers within the province, and therefore an important driver of species movement across a varied, heterogeneous landscape. As we wrap up the first year of a 5-year research program to understand the movement and potential distribution of invasive species in the Great Lakes and the province of Ontario, we are developing other ways to describe habitat features and other lake and landscape characteristics that influence where species may arrive and establish.

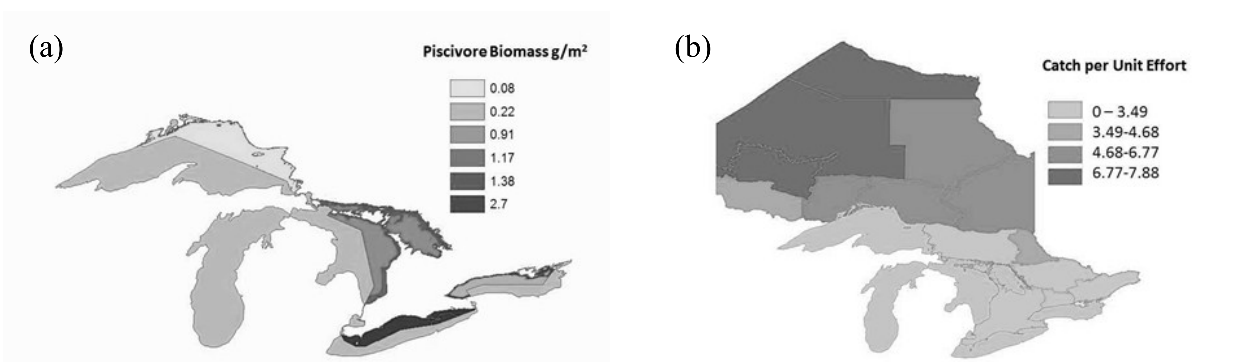

FIG. 9.5.1. (a) Piscivore biomass summarized from mass-balance models (Ecopath) for the Canadian portions of the Great Lakes and (b) Catch-per-unit-effort from the Broadscale Monitoring program by Fisheries Management Zone.

9.6 Is catch of Age-3 Lake Trout a reliable indicator of year-class strength for Lake Ontario Lake Trout?

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

Since being extirpated from Lake Ontario (LO) in the 1950's, restoration of a natural, self-sustaining population of Lake Trout (LT, *Salvelinus namaycush*) has been a primary goal for fisheries managers and is an important fish community object (FCO) for LO (Section 8.5). As a part of their management strategy, the Ontario Ministry of Natural Resources and Forestry (OMNRF) and the New York State Department of Environmental Conservation (NYSDEC) jointly stock ~1 million yearling LT in LO annually (Section 6.1), but despite this consistent level of stocking, survival of stocked LT remains variable between years.

The Lake Ontario Management Unit currently uses catch of age-3 stocked LT as an indicator of stocking survival. With this method, year-class strength (YCS) indices can be calculated from Fish Community Index Gill Netting data (Section 1.2) without the need to process biological aging structures since age-3 stocked LT can be identified based on fin clips and size alone. Therefore, this method offers a significant advantage over YCS estimators that require adult age data. However, selectivity analysis of index gill net catch data shows that age-3 LT are not fully selected by the assessment gear (Fig. 9.6.1). This raises concerns that a YCS index produced by catch of age-3 LT data may not be reliable. We compared the YCS index generated by age-3 data to multiple YCS indices based on catches of adult LT in order to investigate the effects (if any) of the net selectivity issue.

We applied three different methods of evaluating YCS to the catches of adult LT data from the index gill net program. The methods included: a residuals based YCS analysis (Maceina, 1997); a proportional YCS analysis (Johnson, 1957); and a log-linear YCS analysis (Guy and Brown, 2007).

Fig. 9.6.2 shows the comparisons between all 4 methods of YCS estimation. In general, the trends produced by each method are similar. Although there are a few notable differences between each of the methods, these differences

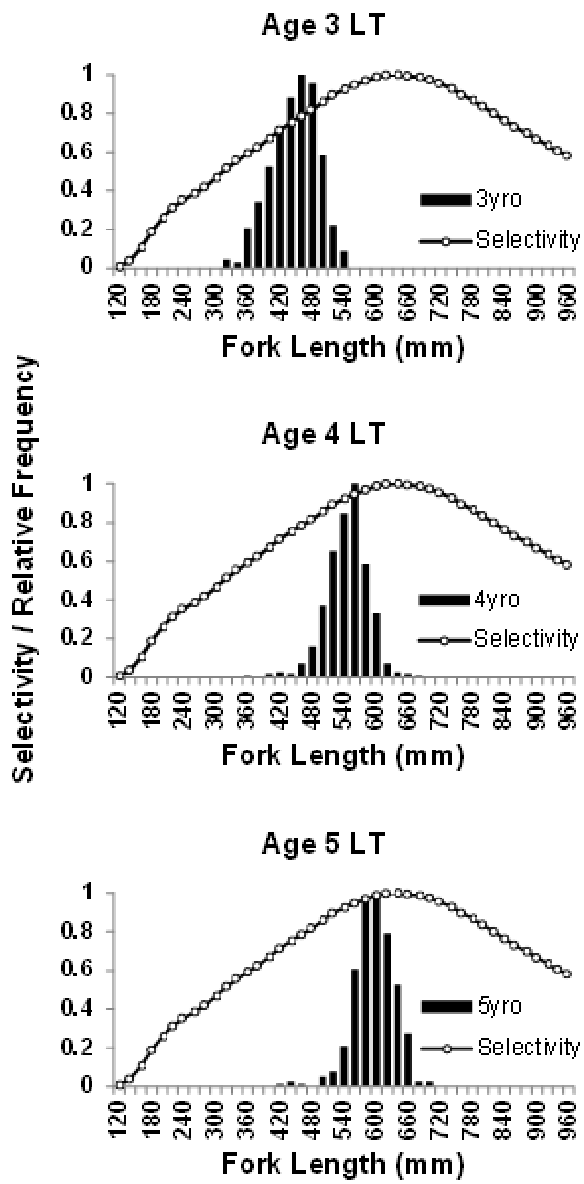

FIG. 9.6.1. Fork length distributions of age-3 to age-5 Lake Trout caught in the index gill net program since 2001. Selectivity curves of the assessment gear are overlaid on top of the fork length distributions to show that age-3 Lake Trout are not fully selected by the assessment gear. Selectivity coefficients for mean FL of age-3 LT = 0.78; age-4 LT = 0.95; and age-5 LT = 0.99. LT older than age -5 are fully recruited to the assessment gear.

can be explained once the biases of each method are accounted for. For example, the log-linear YCS model is heavily influenced by data structure. Year classes that are missing data from young age groups have depressed YCS estimates relative to other year classes, and year classes that are missing data from old age groups have elevated YCS estimates relative to other year classes. This is because the log-linear method predicts each year class' YCS based on the mean predicted CUE (via a linear regression) of that year class in all years where it was detected. As a result, the 1999 year class, which was only represented by fish aged 6 and older in the data, has a low YCS estimate, while the 2009 year class, which was only represented by 4 year old fish in the data, has a relatively high YCS estimate.

One potential weaknesses of using the age-3 YCS index is that it cannot account for variable mortality in adult life stages. Therefore, poor adult LT survival is not observable through the age-3 YCS index. In LO, this may be an important issue since predation of LT by invasive Sea Lamprey only occurs in adult LT. This means that an age-3 YCS index may not reflect a weak adult cohort in years where Sea Lamprey predation on adult LT may have been high due to Sea Lamprey populations exceeding target control levels. The 2003 year class may be an example of this situation. Additionally, variable fishing mortality in adult LT (due to commercial bycatch and recreational harvest) is also not observable through an age-3 YCS index.

In general, given the current operational parameters of the assessment program, and while Sea Lamprey populations remain at levels below the desired maximum population size, we conclude that catch of age-3 LT should be able to produce a reliable YCS index.

Future directions for this line of research include using the YCS index generated by catch of age-3 LT to examine factors that may influence stocking success. These factors may include, stocking locations, size of LT at stocking, age of LT at stocking, stocking temperature, stocking date, and more. This information will be used to inform and update best management practices for Lake Trout stocking.

References:

Guy, C.S. and M.L. Brown, editors. 2007. Analysis and interpretation of freshwater fisheries data. American Fisheries Society, Bethesda, Maryland.

Johnson, F.H. 1957. Northern Pike year-class strength and spring water levels. Transactions of the American Fisheries Society, vol. 86 pp. 285-293

Maceina, M.J. 1997. Simple application of using residuals from catch-curve regressions to assess year-class strength in fish. Fisheries Research, vol. 32 pp. 115-121

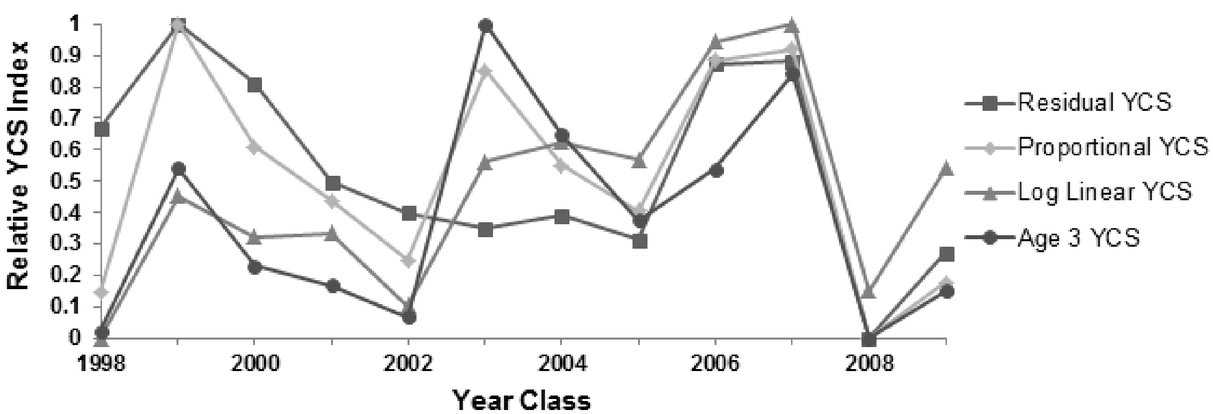

FIG. 9.6.2. Relative YCS indices as estimated by four different methods, one based on catch of age-3 data (Age 3 YCS) and three based on catch of adult LT data (Residual YCS, Proportional YCS, and Log Linear YCS).

10. Partnerships

10.1 Walleye Spawn Collection

J.A. Hoyle, Lake Ontario Management Unit

In April 2015 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 and 2014. In 2015, trap nets were set at three sites (Fig. 10.1.1, Table 10.1.1): Sherman's Point, Trumpour Point and "Beaver Shed" ("high shore" Prince Edward County west of Trumpour Point). The trap nets were set shortly after ice-out in shoreline areas thought to be inhabited by Walleye that were staging to spawn. Netting took place from April 13-20. Water temperature ranged from 2.7-6.3 ^{o}C over this time period. Walleye, in spawning condition, were brought by boat to the Glenora Fisheries Station. White Lake FCS staff collected gametes from 60 Walleye pairs: 15 on each of April 15, 16, 17 and 20. A total of 8.7 million eggs were collected and transferred to the White Lake FCS.

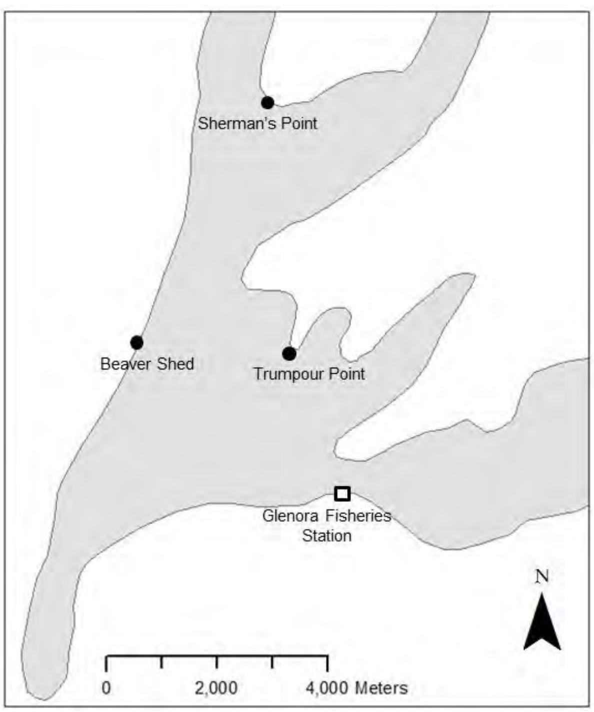

FIG. 10.1.1. Walleye egg collections trap net site locations, 2015.

Walleye gametes collected in 2015 will be used to help re-fresh the captive Walleye broodstock at the White Lake FCS, and to supply walleye fingerlings for stocking in inland lakes. The 2015 spawn collection will also provide wild gametes for restoration Walleye stocking in Hamilton Harbour.

Eighteen species and a total of 766 fish including 464 Walleye were caught in 2015 (Table 10.1.2). Other commonly caught species included: Black Crappie (70), White Sucker (53), Northern Pike (52), Brown Bullhead (29), Cisco (26), Freshwater Drum (21), Rock Bass (17) and Lake Whitefish (14). Catches in 2015 are compared with those in 2014 in Table 10.1.3. A total of 20 species was caught in the last two years.

The size distribution of 380 Walleye 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.

TABLE 10.1.1. Location and sampling information for the Bay of Quinte Walleye egg collection program, 2015.

Location	Sherman's Point	Trumpour Point	Beaver Shed
Latitude (deg decmin)	44 06.20	44 03.96	44 04.04
Longitude (deg decmin)	77 04.03	77 04.37	77 06.43
Site depth (m)	3.6	4.6	2.8
Trap net size (feet)	12	10	6
First set date	13-Apr-15	13-Apr-15	14-Apr-15
Final lift date	20-Apr-15	20-Apr-15	20-Apr-15
Number of days fished	7	7	6
Number of lifts	3	3	4
Water temperature range (^{o}C)	3.5 to 8.0	2.7 to 6.0	4.6 to 5.3
Number of Walleye caught	107	302	55

TABLE 10.1.2. Summary of fish captured (18 species) at three locations during the Bay of Quinte Walleye egg collection program,

Species	Location: Sherman's Point	Trumpour Point	Beaver Shed	Total catch
Bowfin	0	0	4	4
Rainbow Trout	0	0	2	2
Lake Whitefish	5	7	2	14
Lake Herring	8	18	0	26
Northern Pike	2	25	25	52
White Sucker	17	33	3	53
Brown Bullhead	14	15	0	29
Channel Catfish	2	0	0	2
American Eel	0	0	1	1
Rock Bass	4	13	0	17
Pumpkinseed	0	2	0	2
Bluegill	0	1	0	1
Smallmouth Bass	0	2	0	2
Largemouth Bass	0	0	2	2
Black Crappie	1	30	39	70
Yellow Perch	0	2	2	4
Walleye	107	302	55	464
Freshwater Drum	11	10	0	21
Total catch	171	460	135	766

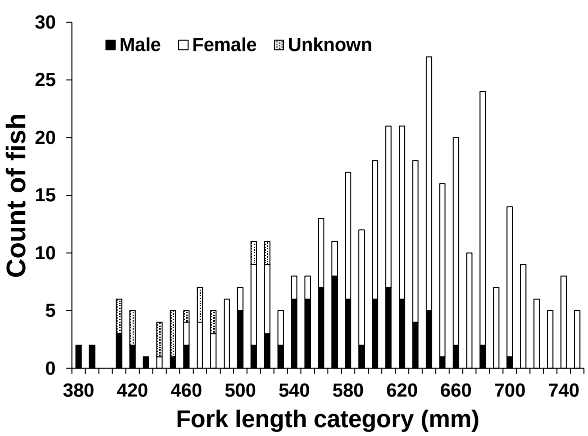

FIG. 10.1.2. Size distribution (10 mm fork length categories) of 380 Walleye caught and measured during the egg collection program, April 2015. Totals: 94 males, 263 females and 23 unknown sex.

TABLE 10.1.3. Summary of fish captured (20 species) during the Bay of Quinte Walleye egg collection program, 2014 and 2015.

Species	2014	2015
Longnose Gar	6	-
Bowfin	8	4
Rainbow Trout	1	2
Lake Whitefish	24	14
Lake Herring	36	26
Northern Pike	26	52
White Sucker	183	53
Brown Bullhead	22	29
Channel Catfish	19	2
American Eel	1	1
White Perch	48	-
Rock Bass	7	17
Pumpkinseed	3	2
Bluegill	-	1
Smallmouth Bass	-	2
Largemouth Bass	6	2
Black Crappie	8	70
Yellow Perch	93	4
Walleye	601	464
Freshwater Drum	35	21
Total catch	1,127	766

TABLE 10.1.4. Sex and gonad classification (based on external characteristics) for 380 Walleye caught and sampled during the 2015 Walleye egg collection program.

Gonad condition	Sex: Male	Female	Unknown	Total
Green	1	51	23	75
Ripe	86	120		206
Spent	7	92		99
Total	94	263	23	380

10.2 St. Lawrence River Seine Netting Survey and Muskellunge Nursery Site Identification

C. Lake, Lake Ontario Management Unit
J. Van Wieren, Parks Canada
J. Hutchings, Muskies Canada Inc.

The St. Lawrence River is home to a prized Muskellunge (*Esox masquinongy*) fishery that attracts both Canadian and American anglers. Identification and subsequent protection of Muskellunge spawning and nursery habitats have been identified as key priorities to successfully manage this species. Young Muskellunge travel only minimal distances during the first few months of life, so capture of individuals at this life stage is a useful way to accurately identify the general location of productive spawning sites.

OMNRF conducted an annual young-of-the-year (YOY) seining program from 1989-1995 in an effort to identify nursery sites within the Canadian waters of the upper St. Lawrence River. Efforts were discontinued in 1996 until 2005 when a partnership between Muskies Canada Inc. (Gananoque Chapter), Parks Canada (Thousand Islands National Park) and OMNRF was formed to resurrect the program.

The project has evolved over time to become a broader monitoring program of near shore fish communities. The project has identified numerous species at risk (SAR) habitats, particularly Pugnose Shiner (*Notropis anogenus*), Grass Pickerel (*Esox americanus vermiculatus*) and to a lesser extent, Bridle Shiner (*Notropis bifrenatus*). In the initial five years of the renewed program (2005-2009), new areas were surveyed each year in order to identify new nursery sites and document near shore fish communities through the 1000 Islands Region. The program now includes 20 permanent monitoring sites that are revisited each year.

In 2015, Round Goby (*Neogobius melanostomus*), Yellow Perch (*Perca flavescens*) and Banded Killifish (*Fundulus diaphanus*) were the most abundant species encountered during the survey, collectively making up 78% of the total catch. Two YOY Muskellunge were captured in 2015 (Table 10.2.1). In addition, two Bridle Shiner, one Grass Pickerel and 50 Pugnose Shiner were captured.

The OMNR would like to thank Muskies Canada and Thousand Islands National Park staff for their continued dedication and hard work on this program.

TABLE 10.2.1. Summary statistics of the St. Lawrence River seining program, 1989-2015.

Year	Muskellunge captured	Species captured	Number of fish captured	Number of seines	Catch per seine
1989	6	19	4,756	26	183
1990	16	16	3,842	58	66
1991	2	30	4,559	31	147
1992	11	32	4,151	21	198
1993	4	27	5,907	22	269
1994	6	21	3,102	15	207
1995	15	26	3,427	16	214
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2005	13	27	8,624	122	71
2006	2	27	4,874	55	89
2007	7	28	4,836	45	107
2008	8	36	6,558	57	115
2009	8	34	6,690	41	163
2010	5	33	7,083	53	134
2011	5	32	8,445	50	169
2012	2	33	5,452	45	121
2013	1	29	3,827	31	123
2014	6	36	7,162	25	286
2015	2	28	2,533	18	90
Mean per yr	7	29	5,324	41	153
Total	119	-	95,828	731	-

10.3 Detection of Grass Carp in Lake Ontario

N.J. Jakobi, Lake Ontario Management Unit
B. Cudmore, Fisheries and Oceans Canada, CCIW, Burlington, ON

There are four species, the Grass, Bighead, Silver and Black Carp, that are collectively referred to as Asian carps. Native to the rivers, reservoirs and lakes in China and southern Russia, Asian carps were introduced to North America in the 1960s in an effort to control aquatic vegetation, algae and mussels in aquaculture ponds. All 4 species have escaped, or were released, into the wild in North America and self-sustaining populations have developed, particularly in the Mississippi River basin. There are two ways for these fishes to reach the Great Lakes. They could spread on their own or be transported by human activity. The nearshore waters of the Great Lakes have been identified through risk assessment as suitable ecological conditions for Asian carp to invade. They can eat up to 40% of their body weight each day, can grow more than 25 cm in their first year and can reach 40 kg and over a metre in length when mature. Direct ecological effects are likely to result from their various diets: Grass Carp eat aquatic plants, Bighead Carp eat zooplankton, Silver Carp eat phytoplankton, and Black Carp eat snails or mussels. Should Silver and Bighead carps become established in the Great Lakes, ecological consequences might include competition for planktonic food, leading to reduced growth rates, and recruitment and abundance of fishes dependent upon this plankton, as well as reduced abundance of fishes with pelagic, early life stages. For additional information on Asian carps see http://www.invasivespeciescentre.ca/. Ministry of Natural Resources and Forestry (MNRF) is concerned about establishment of Asian carps in the Great Lakes because this could result in the decline of native fish species and damage sport and commercial fishing in Ontario, which brings millions of dollars a year into the province's economy.

Fisheries and Oceans Canada (DFO), under its Asian Carp Program, conducts early detection surveillance activities to detect Asian carps in the Canadian waters of the Great Lakes basin as soon as possible after potential arrival and before a population could establish. A co-ordinate response system to evaluate any observations of Asian carp has also been established between DFO and MNRF. Conservation Authorities have participated in these response activities. All these agencies conduct fisheries assessment and sampling activities in Lake Ontario. These activities, along with commercial fishers, also contribute to our ability to detect this invasive species.

In 2015, eight Grass Carp were detected through various methods in Lake Ontario (Table 10.3.1). The first carp was captured during a Toronto Region Conservation Authority (TRCA) fish rescue operation, and subsequent specimens were located through Asian carp response activities, as well as commercial and recreational fishing. DFO conducted detailed biological analyses on each fish. Determining the specimen's ability to reproduce is an important

TABLE 10.3.1. Summary of Grass Carp and their biological attributes observed in Lake Ontario during 2015.

Date captured	Captured by	Capture method	Location description	Weight (kg)	Total length (m)	Ploidy	Sex	~Age (pectoral spine)
27-Jul-15	TRCA	boat electrofisher	Lake Ontario, Tommy Thompson Park	14.7	1.02	Diploid	Male	13
28-Jul-15	DFO	trammel net	Lake Ontario, Tommy Thompson Park	10.2	0.97	Diploid	Male	14
26-Aug-15	DFO	trammel net	Lake Ontario, Jordan Harbour	16.68	1.048	Diploid	Male	16
01-Sep-15	TRCA	boat electrofisher	Lake Ontario, Toronto Islands	10.64	0.91	Diploid	Male	11
01-Sep-15	TRCA	boat electrofisher	Lake Ontario, Toronto Islands	16.56	1.018	Diploid	Female	9
02-Sep-15	DFO	boat electrofisher	Lake Ontario, Toronto Islands	9.1	0.893	Diploid	Male	13
14-Sep-15	Commercial fisher	trap net	Lake Ontario, Bay of Quinte, Muscote Bay	12.7	1.037	Triploid	Female	13
19-Sep-15	Angler	dead on shore	Lower Niagara River	8.1	0.95	Unknown	Unknown	10

piece of information to use towards determination of the appropriate level and type of management activities. Diploid individuals are fertile as they contain two sets of chromosomes, while triploid individuals have three sets of chromosomes rendering them sterile or highly infertile. Analysis of the fish collected this year showed that 6 fish were diploid (Table 10.3.1, Fig. 10.3.1); however, none of the fish showed signs they had recently spawned. The fish captured were roughly the same age. In addition, the oxygen ratios found in the otoliths were consistent with those from aquaculture facilities. Further analyses are being conducted; however at this point in time there is no evidence of an established population of Grass Carp in Lake Ontario.

In addition to conventional sampling methods such as electrofishing and netting, MNRF surveys for Asian carps using a method known as environmental DNA (eDNA). This method examines shed DNA in search for genetic markers unique to each of the four Asian carp species. In aquatic environments, eDNA is diluted and distributed by currents and other hydrological processes, lasting about 7–21 days, depending on environmental conditions. LOMU and TRCA staff collected water samples on Aug 31, 2015 following MNRF's eDNA monitoring and surveillance standard operating procedures. Seven sites were sampled: Humber Bay Marsh, Toronto Island embayments, mouth of Don River, Portland's Energy Centre, Outer Harbour Marina, Tommy Thompson Park and Ashbridges Bay (Fig. 10.3.2). Sampling occurred 31 days after the discovery of two Grass carp in Tommy Thompson Park and 1 day before 2 Grass Carp were captured in the Toronto Island embayments. LOMU staff filtered samples at OMNRF Aquatic Research and Monitoring Section Genetics Laboratory within 12-20 hours of obtaining the samples. At the Portland's Energy Centre sampling location a positive detection resulted specifically for Grass Carp and tested negative for the other three species. Positive detection means DNA from the species was present at that location at the time the sample was collected, but provides no information about the source of the DNA. On September 29, 2015 LOMU staff collected water samples for eDNA analysis from the Bay of Quinte. Sampling occurred 15 days after the capture of the Grass Carp in Muscote Bay. Five sites were sampled: mouth of the Murray Canal, Trent River, Moira River, Blessington Creek and Muscote Bay (Fig. 10.3.2). No Asian carp eDNA was detected in these samples.

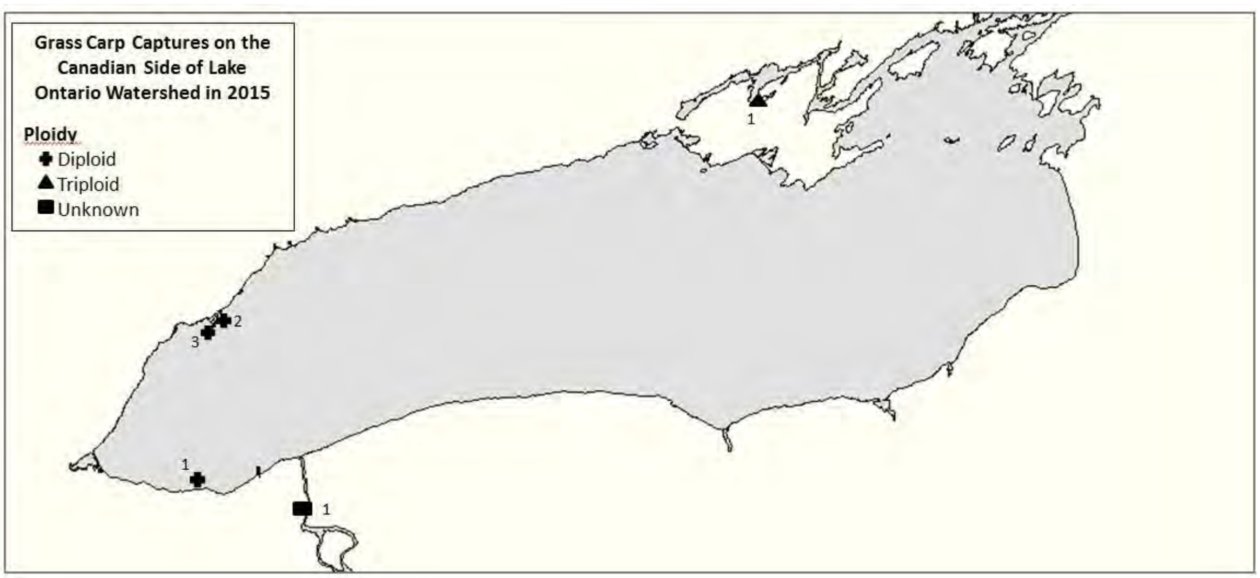

FIG. 10.3.1. Location and ploidy of Grass Carp captured on the Canadian side of Lake Ontario in 2015.

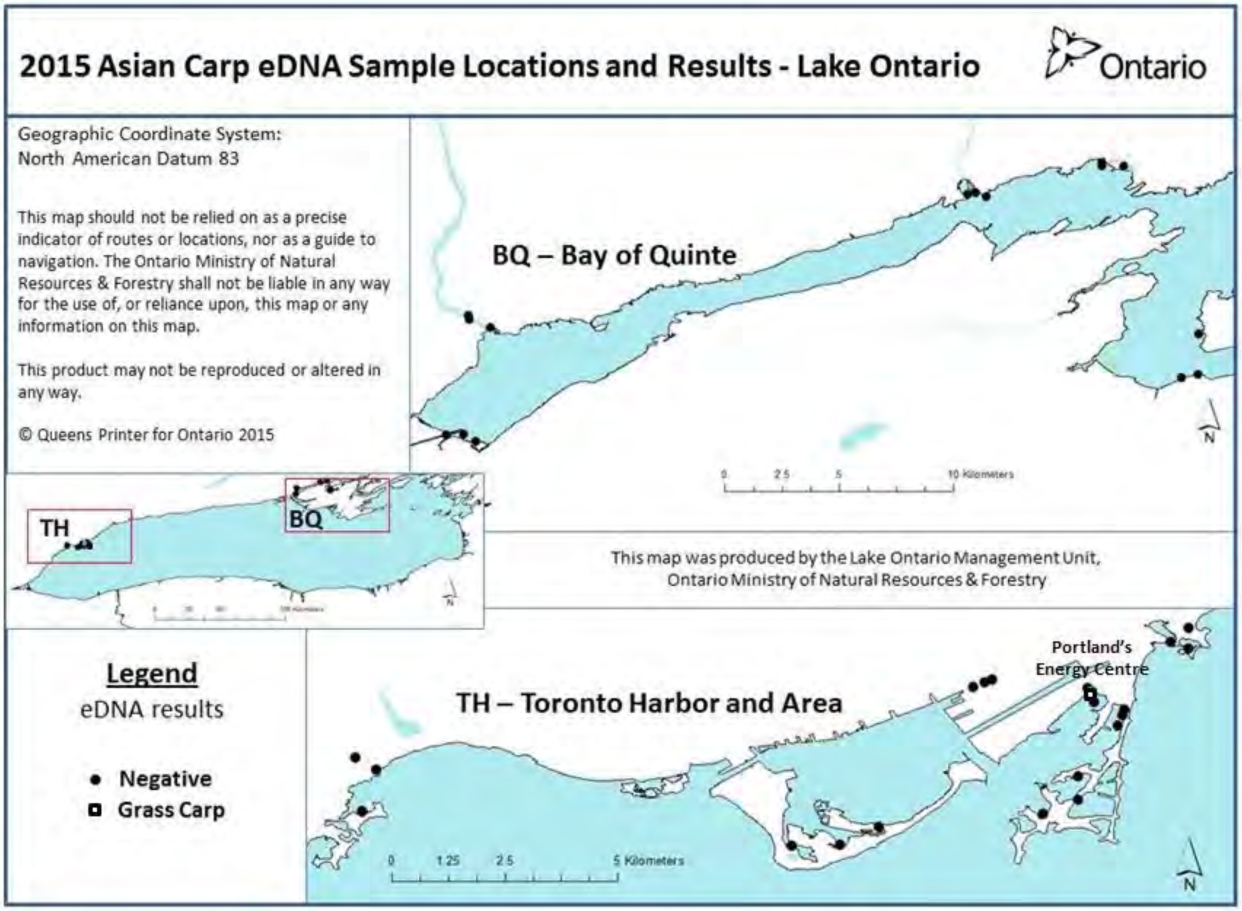

FIG. 10.3.2. Location and results of Grass Carp eDNA sampling in Lake Ontario in 2015.

11. Environmental Indicators

New to this year's Annual Report is this section on environmental variables. Annual variation in fish abundance, distribution, and other biological attributes are often related to variation in environmental factors such as water temperature. While not an exhaustive list or analysis, the environmental variables described here can be used to provide additional context for interpretation of various fish related indices reported elsewhere in the Annual Report.

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 (1944-2015) winter severity index is present in Fig. 11.1.1. The winter of 2015, like 2014, was more severe than the long term average, despite the fact that thirteen of the last twenty years were above 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 (1944-2015) mid-summer water temperature index is presented in Fig. 11.1.2. Water temperature in the summer of 2015 was slightly above the long term average. Sixteen of last twenty years were above the long term average.

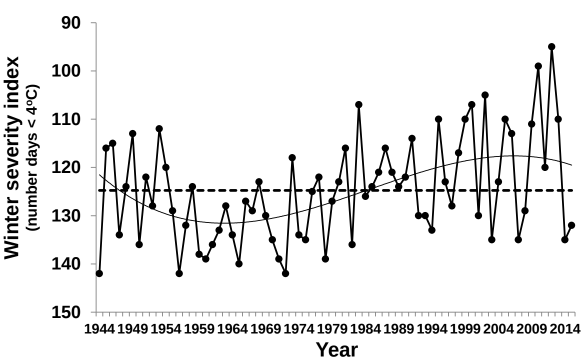

FIG. 11.1.1. Winter severity index, 1944-2015. Winter severity is measured as the number of days with a mean water temperature less than 4^{o}C. By way of example, the 2015 data point includes the mean daily surface water temperature from Dec 21, 2014 to March 20, 2015. The long-term average index is 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.

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). Mean summer water temperatures in 2015 was well below the average for the time series (2001-2015) and is the second coldest after 2014 (Fig. 11.1.3).

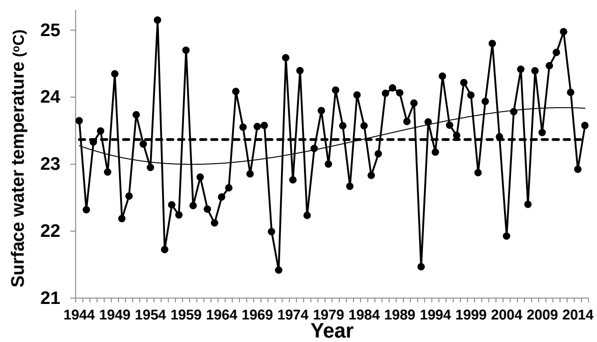

FIG. 11.1.2. Mean mid-summer water temperature (July and August; mean of 62 days) at the Belleville Water Treatment Facility, 1944-2015. The long-term average index is depicted with a dashed line, and a third order polynomial fit to the data is shown as a thin solid line. Mean daily surface water temperature data was obtained from the Belleville (Bay of Quinte) Water Treatment Facility.

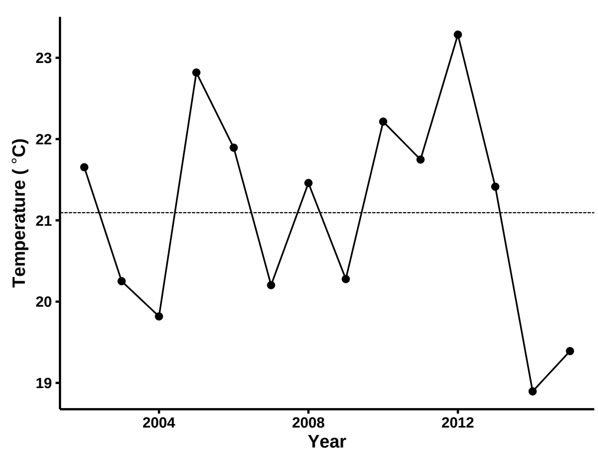

FIG. 11.1.3. Mean mid-summer water temperatures (July and August, mean of 62 days) at the Nation Oceanic and Atmospheric Administration's Station 45012 (East Lake Ontario; 20 nautical miles north of Rochester, NY) from 2001-2015. The long term average index is depicted with a thin dashed line.

Coldwater Habitat

Native coldwater species such as Lake Trout, Lake Whitefish and Cisco (Lake Herring) 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 Fig. 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 Kingston Basin but do not capture the daily variability influenced by thermal mixing due to wind events. The water depth at which water temperature are below 15°C provides an index of the amount of coldwater habitat available between years. A shallower depth of 15°C would indicate a cooler summer and more coldwater habitat available. The index shows the range of annual variability within the Kingston Basin (Fig. 11.1.5) with recent years being cooler (shallower 15°C depth) than the period between 2000 and 2010.

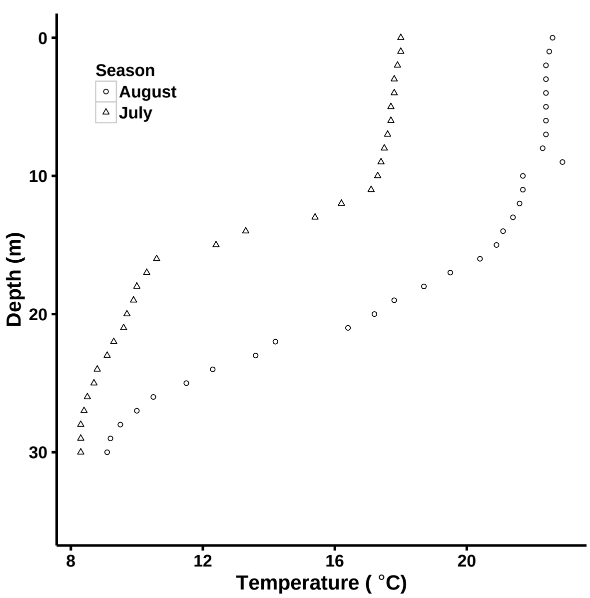

FIG. 11.1.4. Temperature profiles collected in July and August, 2015, at Fish Community Index Gill Net (Section 1.2) site EB06.

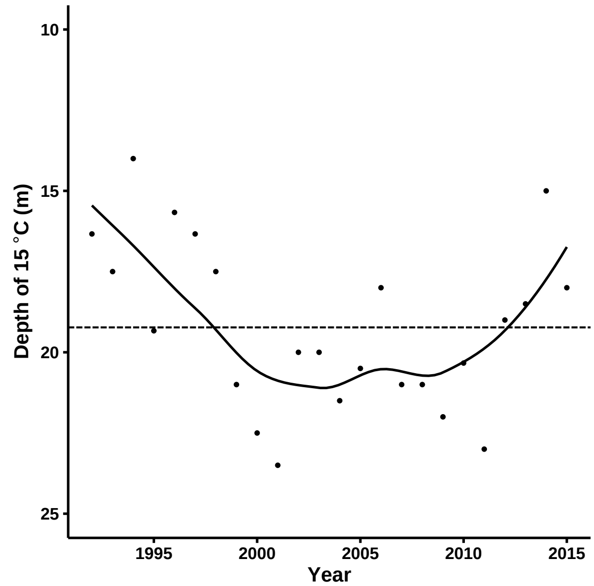

FIG. 11.1.5. Index of coldwater habitat in the Kingston Basin determined by July and August temperature profiles collected at Fish Community Index Gill Net (Section 1.2) site EB06. The solid line is the trend through time (loess fit) and the dotted line is the average depth of 15°C throughout the time-series (1992-2015).

11.2 Wind

M.J. Yuille and J.P. Holden, Lake Ontario Management Unit
N. Craig, McGill University

National Oceanic and Atmospheric Administration (NOAA) records multiple weather variables using a variety of weather buoys deployed throughout Lake Ontario. Data from these buoys are available through the National Data Buoy Center webpage hosted by NOAA (http://www.ndbc.noaa.gov/). The Rochester weather buoy (Station 45012) 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 around the lake).

Two indices were developed to provide a wind index on Lake Ontario from 2002-2015 (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 1 to August 30 each year, where the wind velocity was greater than or equal to 20 knots. This index shows that since 2007, the years 2010, 2011 and 2014 has higher than average small craft warnings (Fig. 11.2.1a). A second index, the East Wind Index, was calculated to determine the total number of hours between July 1 and August 30, each year, that an eastern wind predominated (Fig. 11.2.1b). This index shows that 2014 had higher than average eastern winds and 2015 had below the average index value.

Lastly, wind direction and velocity have been summarized for the months of July and August from 2013-2015 (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.

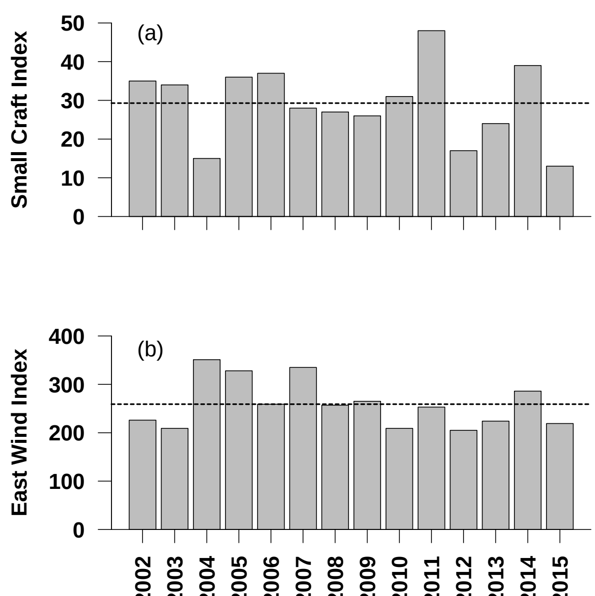

FIG. 11.2.1. Lake Ontario wind as characterized by the Small Craft Index (a) and East Wind Index (b). The Small Craft Index represents the total number of hours from July 1st and August 30th, each year where the wind velocity was ≥ 20 knots. The East Wind Index represents the number of hours between July 1st and August 30theach year that an eastern wind predominated. Data provided by National Data Buoy Center, NOAA (http://www.ndbc.noaa.gov/).

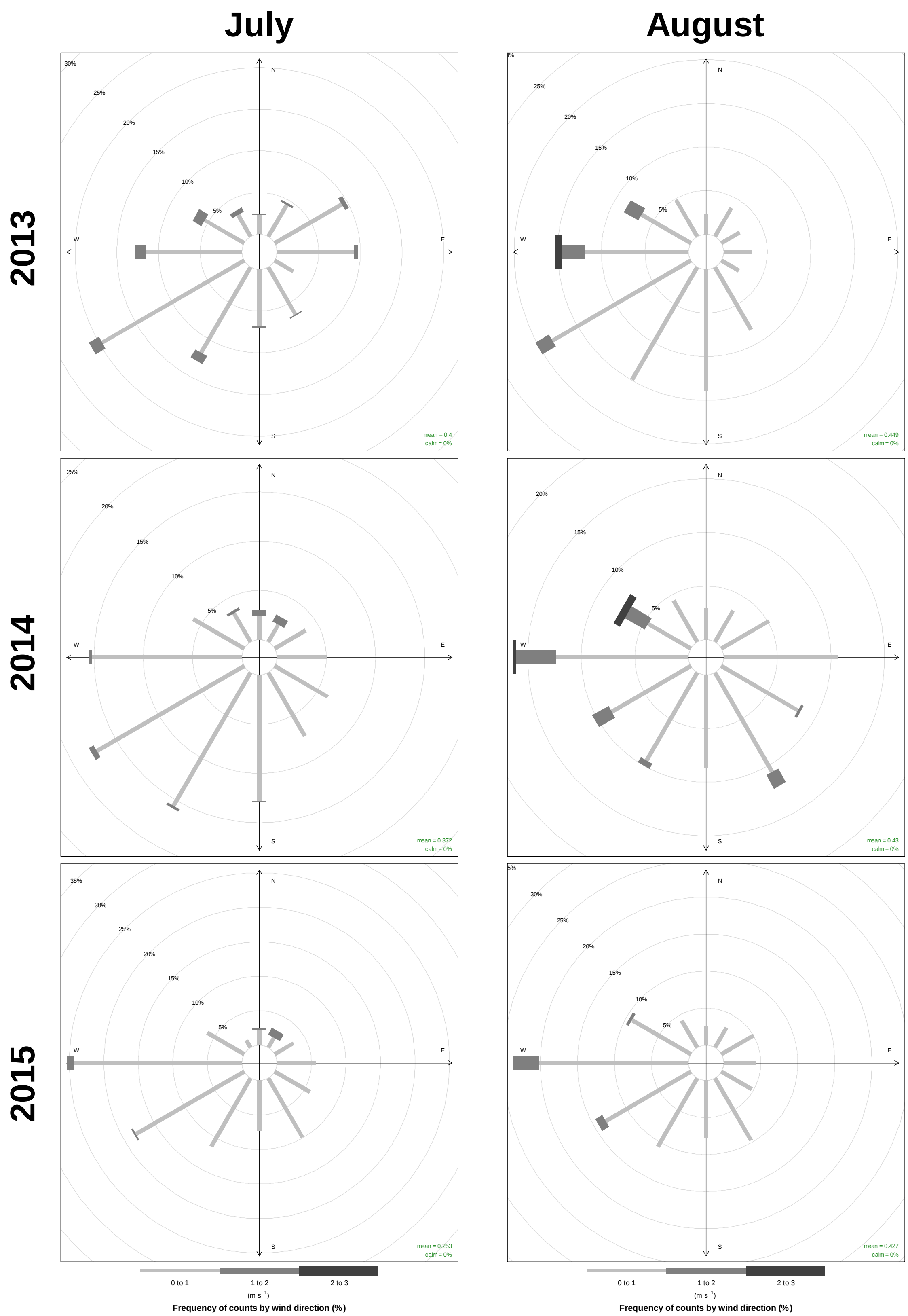

FIG. 11.2.2. Wind direction and velocity represented as a proportional frequency of occurrence for July and August in 2013-2015. Wind velocities of 0 – 1 m·s^{-1} are light grey, 1 – 2 m·s^{-1} are medium grey and > 2 m·s^{-1} are dark grey. Data provided by National Data Buoy Center, NOAA (http://www.ndbc.noaa.gov/).

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 varies between the Bay of Quinte, Kingston Basin and the Eastern Portion of Lake Ontario (measured at Rocky Point gill net sites). Bay of Quinte Secchi depths are generally lower (less clear) than main lake sites and have been stable since the early 2000s. Kingston Basin and Rocky Point have greater variability between years but the most recent two years show greater clarity than the average for the time series. Rocky Point in 2014 and 2015 are the two clearest years in the time-series.

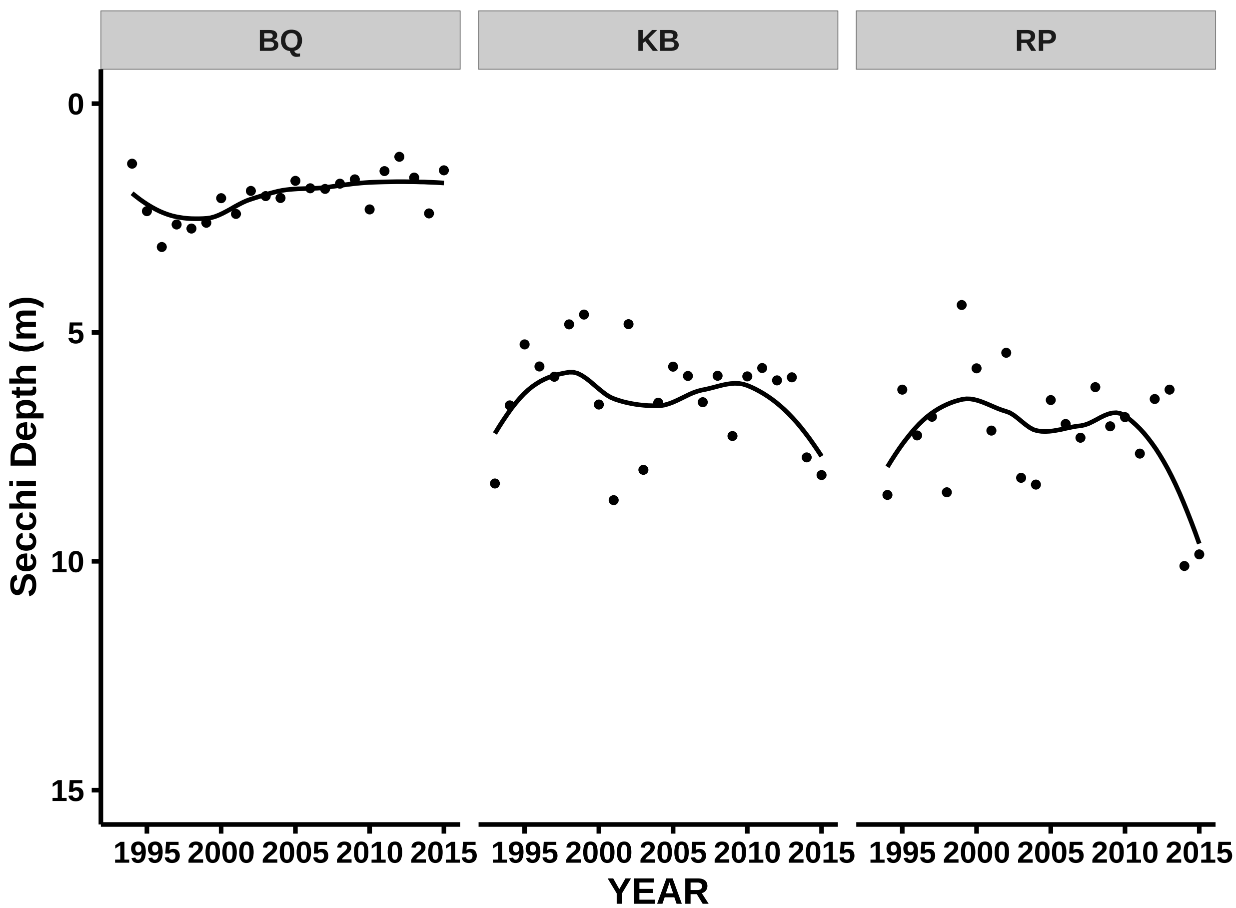

FIG. 11.3.1. Mean annual water clarity determined by Secchi disk readings at Fish Community Index Gill Net sites in June, July and August in Bay of Quinte (BQ), Kingston Basin (KB), and Rocky Point (RP).

11.4 Tributary Water Flow

R. Green, Lake Ontario Management Unit

Tributary flow regime can impact both spring and fall spawning fish species that use Lake Ontario's tributaries for spawning and rearing grounds. Naturalized 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, Lake Sturgeon and others may also use tributary areas for spawning during the spring.

Flow regimes which may have been beneficial to natural reproduction of fish species can be identified using several metrics. Average annual discharge allows for a quick large-scale comparison among years to identify wet or dry years. Central flow timing is the date at which half the annual discharge has been exceeded. This metric can indicate whether the annual discharge occurred early or late in the season relative to the long-term average.

In addition to these metrics, viewing spring and fall flows with higher resolution daily data can give insight to when migratory runs may occur. Spawning runs of migratory fish species typically occur during increased flow events. Increased flows generally result in increased stream depth, decreased clarity and could dislodge aquatic invertebrates or other food items which could stimulate feeding. The Ganaraska River receives annual runs of naturalized Chinook Salmon and Rainbow Trout (Steelhead). Both of these species reproduce naturally within this river system. The average annual discharge (m^3/s) in 2015 was 4.15, well above the long-term average (Fig. 11.4.1). The central flow Julian day date was 102 indicating that flows occurred early relative to the 5-year average (130) for this watershed. During 2015, spring flow began to increase part way through March and peaked in April and fall flows peaked during October (Fig. 11.4.2).

The Credit River drains into the western end of Lake Ontario and provides excellent fishing opportunity for migratory salmonids within the river and lake basin in the area. Fall fishing for staging salmon can depend on discharge from the Credit River and other tributaries in the Greater Toronto Area. The average annual discharge (9.01 m^3/s) for the Credit River at Streetsville Dam in 2015 was slightly below the time-series average (Fig. 11.4.3). The central flow Julian day date in 2015 was 111 indicating that flows occurred early relative to the 5-year average (135). During 2015, spring flow was high during the first half of March at the Streetsville Dam and later peaked in April (Fig. 11.4.4). The fall flow regime in 2015 at the Streetsville Dam was lower and less variable than that observed in 2013 and 2014 (Fig. 11.4.4).

The Salmon River drains into the Bay of Quinte near Shannonville, Ontario. The lower reaches of this system provide spawning and

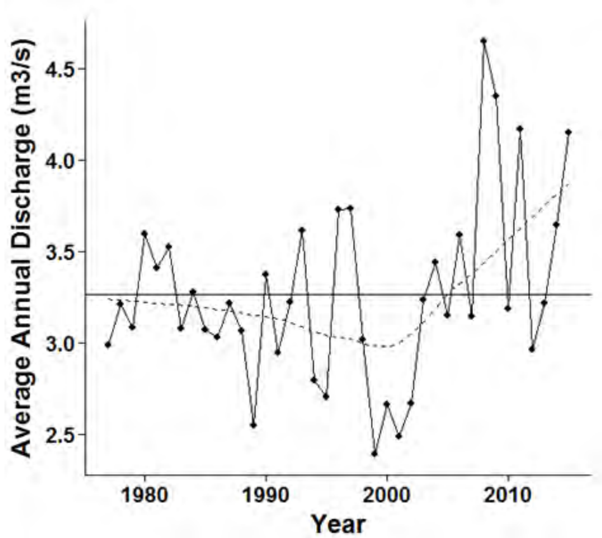

FIG. 11.4.1. Average annual flow (m^3/s) for the Ganaraska River, Dale, Ontario 1976-2015.

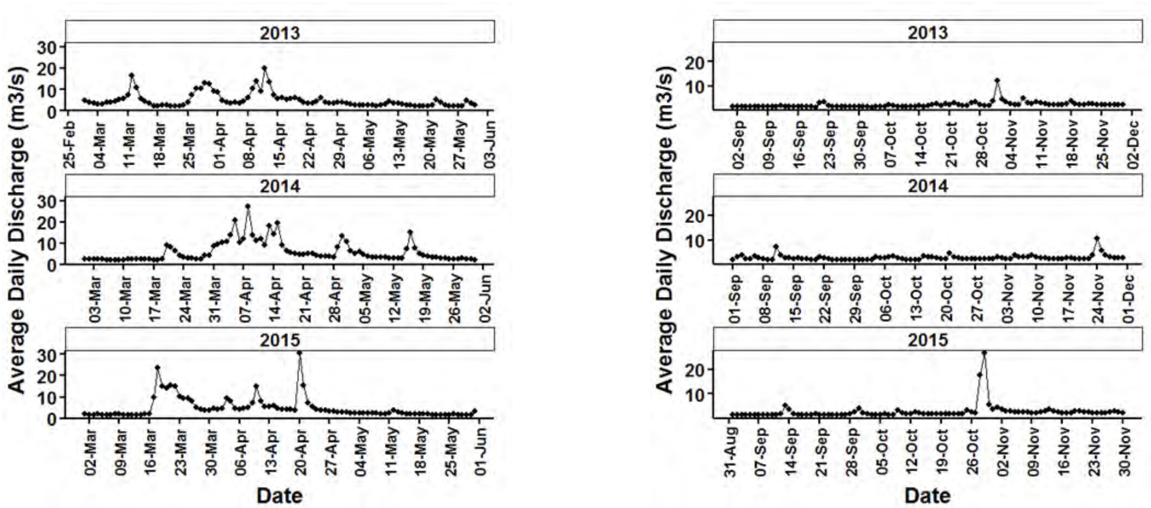

FIG. 11.4.2. Spring (left panel) and fall (right panel) discharge for Ganaraska River, Dale, Ontario 2013-2015.

rearing habitat for warm and coolwater species such as Walleye that inhabit the Bay of Quinte and Lake Ontario. The average annual discharge (8.7 m^3/s) for the Salmon River at Shannonville, Ontario in 2015 was well below the time series average (Fig. 11.4.5). The central flow timing was the 131 Julian day indicating that flows occurred late relative to the 5-year average (109). Spring flow was highest during the month of April in 2015, well below the flow observed in April 2014 and more similar to April 2013 (Fig. 11.4.6). Fall flow peaked at the end of October in 2015 and sustained elevated flows throughout November (Fig. 11.4.6).

Comparison of these three tributaries shows some interesting differences. For example, the

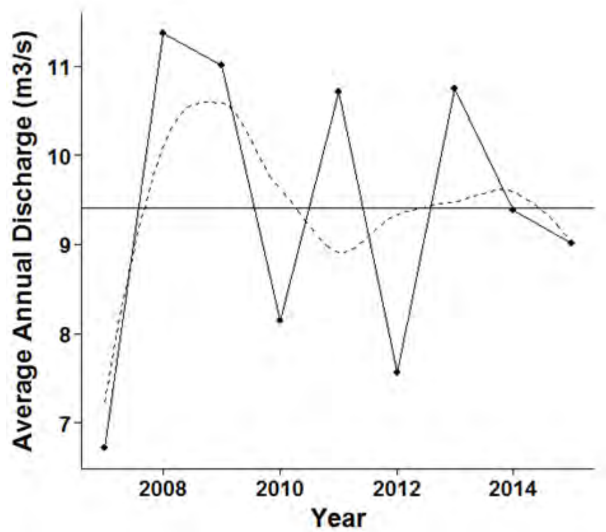

FIG. 11.4.3. Average annual discharge for Credit River, Streetsville Dam, Ontario 2007-2015.

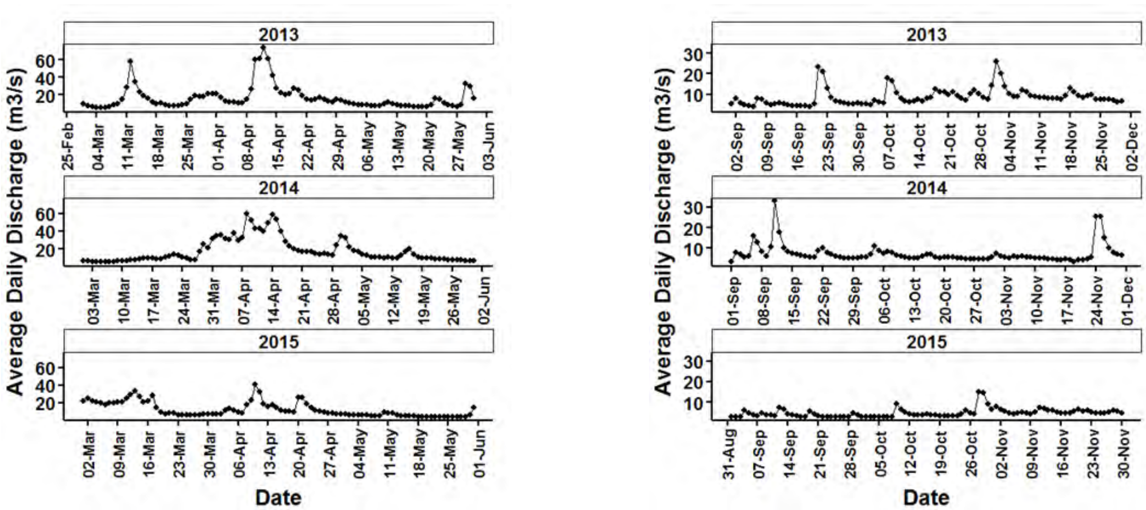

FIG. 11.4.4. Spring (left panel) and fall (right panel) discharge for Credit River, Streetsville, Ontario 2013- 2015.

timing of the central flow during 2015 varied between Julian day 102 and 131. These differences may be related to local weather patterns and/or the level of urban development in these watersheds. Tributaries may also vary within one geographic area. For example, The Salmon River, Trent River, Moira River and Napanee River all drain into the Bay of Quinte. The Trent, Moira and Napanee systems all have more water control structures in place and as a result are not as indicative of natural flow conditions as the Salmon River system.

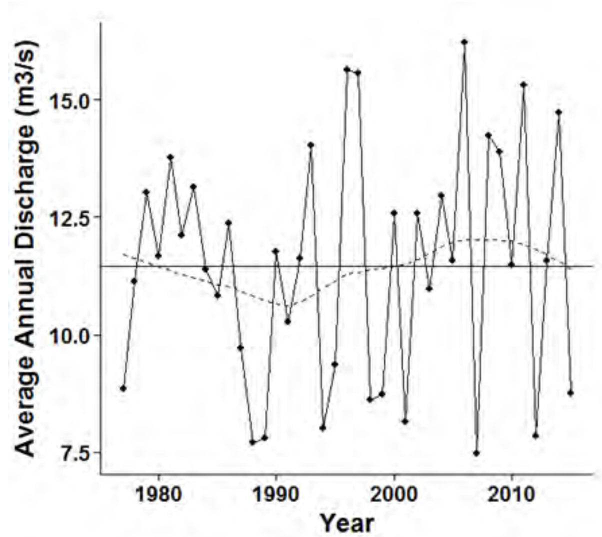

FIG. 11.4.5. Average annual discharge for Salmon River, Shannonville, Ontario 1977-2015.

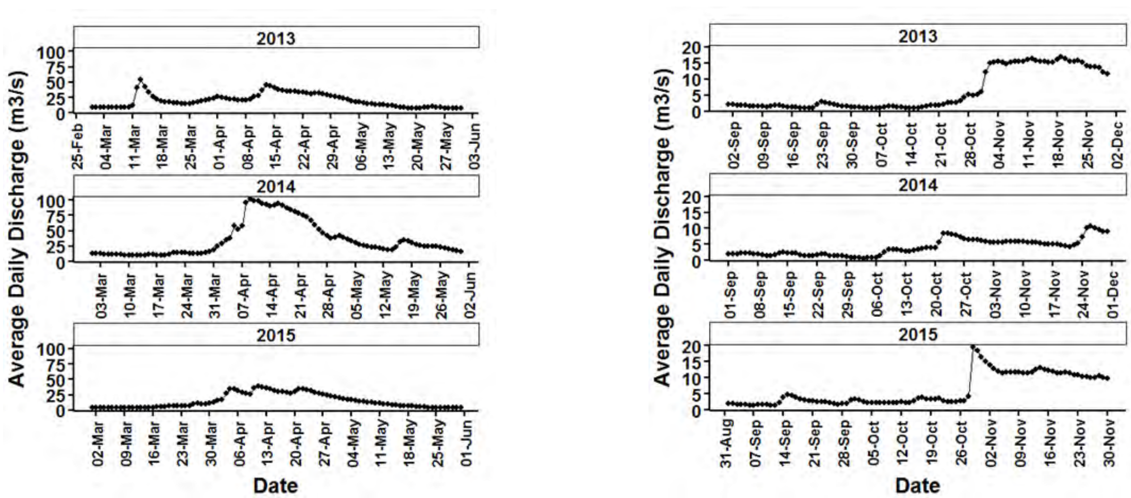

FIG. 11.4.6. Spring (left panel) and fall (right panel) discharge for Salmon River, Shannonville, Ontario 2013- 2015.

12. Staff 2015

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13. Operational Field and Lab Schedule, 2015

(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
Ganaraska Fishway Rainbow Trout Assessment	Mar-Apr	Adult Rainbow Trout	Yuille	Maynard	SPA
Credit River Atlantic Salmon Smolt Survey	Mar-Jun	Atlantic Salmon	Desjardins	Desjardins	COA
Walleye Egg Collection	Mar-Apr	Walleye	McNevin	Kranzl	SPA
Chinook Salmon Net Pens	Apr	Chinook Salmon	Lake	Jakobi	SPA
Lake Trout Tug Stocking	Apr	Juvenile Lake Trout	Lake	Chicoine	SPA
St 81- Offshore Benthos and Zooplankton Survey	May-Oct	Lower Food Web	Dr. Johnson	Taraborelli	SPA
Spring American Eel Trap and Transfer	Apr-Jun	American Eel	Mathers	McNevin	OPG
East and West Tributary Creel	2014-May	Salmonid Species	Yuille	Jakobi	SPA
Juvenile Chinook Assessment	May	Juvenile Chinook Salmon	Yuille	Jakobi	SPA
Duffins Creek Weir	Aug-Sept	Adult Atlantic Salmon	Desjardins	Portiss	TRCA/GLFC/COA
Credit River Fishway	Aug-Sept	Adult Atlantic Salmon	Heaton	Heaton	SPA
DFO Boat Electrofishing - Bay of Quinte	June-July	Nearshore Fish Community	Boston	Kranzl	SPA
Queens University - Acoustic Tag Receiver	Jun-Oct	Largemouth / Smallmouth Bass	Tufts	McIntosh	SPA
Eastern Lake Ontario and Bay of Quinte Community	Jun-Sep	Fish Community	Hoyle	Kranzl	SPA
Western Lake Ontario Community Index Netting	July	Fish Community	Hoyle	Kranzl	SPA
Eastern Lake Ontario and Bay of Quinte Trawling	Jun-Sep	Fish Community	Hoyle	Kranzl	SPA
Western Lake Ontario Trawling	July	Fish Community	Holden	Chicoine	SPA
Lake-wide Hydroacoustic Assessment of Prey fish	July	Prey Fish Community	Holden	Chicoine	COA
Asian Grass Carp Response	July-Sept	Grass Carp	McNevin	Kranzl	SPA
Detection of Grass Carp in L. Ontario eDNA	July-Sept	Grass Carp	Mathers	Jakobi	SPA
Hamilton Harbour Nearshore Community Index	Aug	Nearshore Fish Community	Hoyle	Dale	COA
Upper Bay Nearshore Community Index Netting	Sep	Nearshore Fish Community	Hoyle	Adams	COA
Thousand Islands Community Index Netting	Sep	Fish Community	Hoyle	Scholz	COA
Wellers Bay Nearshore Community Index Netting	Oct	Nearshore Fish Community	Hoyle	Dale	COA
Presquile Bay Nearshore Community Index Netting	Oct	Nearshore Fish Community	Hoyle	Dale	COA
Bay of Quinte Angler Creel	May-Nov	Walleye, Bass, Perch	Hoyle	Kranzl	SPA
Ganaraska Chinook Assessment and Egg Collection	Sep	Chinook Salmon	Yuille	Kranzl	SPA
Fall American Eel Trap and Transfer	Sep-Oct	American Eel	Mathers	McNevin	OPG
Credit River Chinook Assessment and Egg Collection	Oct	Chinook Salmon	Yuille	Maynard	SPA
Credit River Juvenile Atlantic Salmon Electrofishing	Oct	Juvenile Atlantic Salmon	Desjardins	Jakobi	COA
Commercial Catch Sampling	Oct-Nov	Lake Whitefish	Hoyle	Jakobi	SPA
Age and Growth (Lab)	Year-Round	Multiple Species	Multiple	Kranzl	SPA
Deepwater Cisco Research Program	Nov	Deepwater Cisco	Dr. Johnson	Chicoine	SPA

14. Primary Publications of Glenora Fisheries Station Staff[1] in 2015

Carreon-Martinez, L.B., Walter, R.P., **Johnson, T.B.**, Ludsin, S.A., Heath, D.D. 2015. Benefits of turbid river plume habitat for Lake Erie yellow perch (Perca flavescens) recruitment determined by juvenile to larval genotype assignment. PlosOne 10(5) e0125234.

Holeck, K.T., Rudstam, L.G., Watkins, J.M., Luckey, F.J., Lantry, J.R., Lantry, B.F., Trometer E.S., Koops, M.A. and **Johnson, T.B.** 2015. Lake Ontario water quality during the 2003 and 2008 intensive field years and comparison with long-term trends. Aquatic Ecosystem Health Manage 18: 7-17.

Hoyle, J. A. 2015. Fish species composition, distribution and abundance trends in the open-coastal waters of northeastern Lake Ontario, 1992–2012, Aquatic Ecosystem Health & Management, 18:1, 89-100

Johnson, J.H., Farquhar, J.F., Klindt, R.M., Mazzocchi, I., **Mathers, A.** 2015. From yellow perch to round goby: A review of double-crested cormorant diet and fish consumption at Three St. Lawrence River Colonies, 1999–2013. Journal of Great Lakes Research 41 (2015) 259–265.

Marin Jarrin, J.R., Pangle, K.L., Reichert, J.M, **Johnson, T.B**., Tyson, J., Ludsin S.A. 2015. Influence of habitat heterogeneity on the foraging ecology of first feeding yellow perch larvae, Perca flavescens, in western Lake Erie. J. Great Lakes Res. 41: 208-214.

Tufts, B.L., **Holden, J.** and DeMille M.. 2015. Benefits arising from sustainable use of North America's fishery resources: economic and conservation impacts of recreational angling. International Journal of Environmental Studies. Volume 72, Issue 5, Special Issue: Conservation and Hunting in North America, II.

Yuille, M.J., Johnson, T.B., Fisk, A.T. 2015. Comparing Lake Ontario salmonid stable isotope niche space: Are they all the same? J. Great Lakes Res. 41:934-940.

Zhang, H., Rutherford, E.S., Mason, D.M., Breck, J.T., Wittmann, M.E., Cooke, R.M., Lodge, D.M., Rothlisberger, J.D., Zhu, X., and **Johnson, T.B.** 2015. Forecasting impacts of silver and bighead carp on the Lake Erie food web. Trans. Amer. Fish. Soc. 145: 136 -162.

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

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