Ontario

LAKE ONTARIO FISH COMMUNITIES AND FISHERIES:

2013 ANNUAL REPORT OF THE LAKE ONTARIO MANAGEMENT UNIT

LAKE ONTARIO FISH COMMUNITIES AND FISHERIES:

2013 ANNUAL REPORT OF THE LAKE ONTARIO MANAGEMENT UNIT

Prepared for the
Great Lakes Fishery Commission
2014 Lake Committee Meetings
Windsor, ON Canada

March 24-28, 2014

Printed in Picton, Ontario, Canada

March 2014

Report ISSN 1201-8449

Please cite this report as follows:
Ontario Ministry of Natural Resources. 2014. Lake Ontario Fish Communities and Fisheries: 2013 Annual Report of the Lake Ontario Management Unit. Ontario Ministry of Natural Resources, Picton, Ontario, Canada.

Report available on the following website:
http://www.glfc.org/lakecom/loc/mgmt_unit/index.html

TABLE OF CONTENTS

Lake Ontario Fish Communities and Fisheries: 2013 Annual Report of the Lake Ontario Management Unit

Foreword

The Lake Ontario Management Unit (LOMU) is pleased to provide its Annual Report of assessment and management activities carried out during 2013.

Lake Ontario fisheries are managed by MNR in partnership with New York State within the Lake Ontario Committee under the Great Lakes Fishery Commission. Lake Ontario Fish Community Objectives provide bi-national fisheries management direction to protect and restore native species and to maintain sustainable fisheries. Our many partners include: New York Department of Environmental Conservation (NYSDEC), Canadian Department of Fisheries and Oceans (DFO), the U.S. Fish and Wildlife Service (USFWS) and many other Ontario provincial ministries and conservation authorities and U.S. state and federal agencies and non-government partners.

Lake Ontario, the Bay of Quinte, and the St. Lawrence River ecosystem has changed over the last two centuries in response to the pressures of industrial development, land settlement and agricultural practices, fishing, pollution, loss of native species, and the introduction of new species. Fisheries monitoring, assessment and research programs help understand these changes and support informed management decisions that consider the ecological realities that shape the fishery, such as the natural capacity of the lake to produce fish, the decline or recovery of native species, the impact of non-native species, changes to fish habitat and climate change, along with social and economic objectives.

Management highlights from 2013 include the successful delivery of the Cooperative Science Monitoring Initiative with the US Environmental Protection Agency, USFWS, US Geological Survey, NYSDEC, Canada DFO and Environment Canada. Ongoing MNR assessment programs delivered in 2013 include the Bay of Quinte angler winter angling survey, angler diary programs, Chinook Salmon mass marking assessment, Ganaraska River Rainbow Trout assessment, Lake Ontario trout and salmon angling survey, Lake St. Francis angling survey, Atlantic Salmon assessment including a new weir on Duffins Creek and the ongoing delivery of the LOMU fisheries nearshore and offshore assessment programs. The MNR fish culture program produced and stocked more than 2 million fish into Lake Ontario including a new deepwater cisco restoration stocking initiative.

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 MNR 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. LOMU gratefully acknowledges the important contribution of the 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, Chinook Salmon net pen committee, Muskies Canada and the participants in the angler diary and assessment programs.

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 2013.

Andy Todd
Lake Ontario Manager
613-476-3147

For more detailed information or copies of this report please contact:

Lake Ontario Management Unit
Ontario Ministry of Natural Resources
R.R. #4, 41 Hatchery Lane
Picton, ON K0K 2T0 CAN
Telephone: (613) 476-2400
FAX: (613) 476-7131

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

1. Status of Fish Communities

The following is an overview of the 2013 fish community status within three major ecological zones (nearshore, offshore pelagic, and deep pelagic/offshore benthic) in Ontario waters, Lake Ontario. The overview draws upon information presented in the chapters and sections that follow in this report. Lake Ontario fish communities continue to respond to ecosystem change attributed to an overall decline in productivity, invasive species-induced impacts, and other stressors.

1.1 Nearshore Fish Community

Lake Ontario offers a diversity of nearshore habitat types for warm and cool water fish species, including open-coastal areas, embayments, river mouths and wetland areas. The overall management goal for the nearshore fish community is to protect, restore and sustain the diversity of the nearshore fish community, with an emphasis on self-sustaining native fishes such as Walleye, Yellow Perch, Lake Sturgeon, Smallmouth Bass, Largemouth Bass, sunfish species, Northern Pike, Muskellunge and American Eel. Walleye provide a stabilizing influence on fish community trophic structure by virtue of its role as top predator. Important prey fish for nearshore predator species include Alewife (Section 1.2) and Round Goby. Round Goby abundance remains high (Section 2.3).

Walleye support important recreational, commercial and First Nations fisheries. Assessments indicate that Walleye stock status has been stable for at least the last decade (Section 2.2, 2.3, 2.4, 3.4). Overall, Walleye recruitment objectives were met or exceeded over the last 10 years, although a very poor year-class was produced in 2013. Yellow Perch abundance has declined in many areas of the lake and is currently low (Section 2.2). Smallmouth Bass abundance appears to be relatively stable (Section 2.2). There has been a general trend of increasing eel numbers migrating upstream at the ladders, located at the Moses-Saunders Hydroelectric Dam on the St. Lawrence River since 2001; however, the number is still less than 6% of the numbers of eel observed during the early years of the ladder's operation (Section 8.3).

1.2 Offshore Pelagic Fish Community

The overall management goal for the offshore pelagic zone is to maintain a fish community characterized by a diversity of trout and salmon species, including Chinook Salmon, Coho Salmon, Rainbow Trout, Brown Trout and Atlantic Salmon, in balance with prey fish populations and lower trophic levels. Salmon and trout abundance is maintained by stocking and natural reproduction. Prey fish populations are dominated by non-native Alewife, and also include non-native Rainbow Smelt and much smaller populations of native planktivores, including Threespine Stickleback, Emerald Shiner, Spottail Shiner, and Cisco (a.k.a. Lake Herring). Round Goby, a nearshore species (Section 1.1), is another prey species for salmon and trout in Lake Ontario.

Catch rates of Chinook Salmon, Rainbow Trout, and Coho Salmon continued at high levels (Section 3.1), although lower than 2012 as a result of the delayed warming from a late spring. Wild fish contribute about half the Chinook Salmon catch (Section 3.2). Rainbow trout abundance in the Ganaraska River increased again in 2012 to the highest level since 1992 (Section 2.1), and generally reflects increases in catch rate in the boat fishery. The increased catches of Coho Salmon in the boat fishery during 2011-2012 continued into 2013 (Section 3.1). Growth and condition of Chinook Salmon (Section 2.7) and Rainbow Trout (Section 2.1) remained at or above the long term average consistent with adequate abundance of prey fishes.

The presence of Atlantic Salmon in the Lake Ontario boat fishery remains low. Stocked juveniles are growing and surviving well in the streams and good evidence of smolt production has been documented (Section 2.8 and Section 2.9). Returning adults have been observed in streams from 2008 through 2013 (Section 2.10) although adult survey effort is minimal and catches are low. The program is in the early stages and Atlantic Salmon restoration will require a long-term and adaptive approach to management (Section 8.2).

A large 2012 Alewife year-class has contributed to a 2.5 times increase in Alewife abundance in 2013 over 2012. The current level of Alewife abundance has not been observed since 2002 (Section 2.7). Rainbow Smelt populations continue to decline. The 2013 population estimate is the lowest observed since acoustic prey fish surveys have been conducted.

1.3 Deep Pelagic/Offshore Benthic Fish Community

The overall management goal for the deep pelagic/offshore benthic fish community is to protect and restore the diversity of self-sustaining native species. Lake Trout and Lake Whitefish are two important, large-bodied, species in this community. Lake Trout numbers remain low compared to numbers observed through the late 1990s however there has been a marginally increasing trend in the catches of primarily stocked fish in the Community Index gillnetting (Section 2.2, 8.5). A potential indicator towards the goal of self-sustaining Lake Trout is recent catches of wild young-of-year lake trout in the Community Index bottom trawls and new sites where trawls were conducted in association with research activities (Section 2.3, 8.5, 10.2). Lake Whitefish abundance remains low, compared to that of the early 1990s, but stable (Section 2.2). Lake Whitefish recruitment is highly variable (Section 2.3) but many age-classes are present in the population (Section 2.2) and the commercial fishery (Section 4.2).

The management objective for the deep pelagic/offshore benthic prey fish community is to have a diversity of native prey species that include Slimy Sculpin, Deepwater Sculpin and deepwater cisco (such as Bloater). Catches of Slimy Sculpin in the Community Index bottom trawls (Section 2.2) remain low but stable. Similarly, Deepwater Sculpin catches are low but there appears to be a general trend of increasing abundance. The Lake Ontario fish community once included a diversity of deepwater cisoes. A binational effort is underway to restore this component of the fish community with the reintroduction of Bloater. Approximately 16,000 Bloater were stocked from the Lake Ontario Explorer off Rocky Point at 100 m of depth (Section 8.4).

2. Index Fishing Projects

2.1 Ganaraska Fishway Rainbow Trout Assessment

The number of Rainbow Trout running up the Ganaraska River during spring to spawn has been estimated at the fishway at Port Hope since 1974. Prior to 1987 the Rainbow Trout run at the fishway was based completely on hand lift 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 operated from mid to late March to early May. In 2013, the fish counter was installed on March 29 and ran until May 11. During this period the counter was inoperative for all or part of 11 days. An additional 1534 Rainbow Trout were estimated in the run on these days based on modelling the relationship of Rainbow Trout counts with maximum river temperature and stream flow. Using the same relationship, we estimated 579 Rainbow Trout went through the fishway in March, prior to installation of the counter. In May, a handful of Rainbow Trout may have gone through the fishway after counts were concluded. In 2013, the Rainbow Trout run in the Ganaraska River was estimated at 12,021 fish (Table 2.1.1), the second largest run since 1992. The Rainbow Trout run in the Ganaraska River continued a general increasing trend over the last four years (Fig. 2.1.1), consistent with increased catch rates of Rainbow Trout in the Lake Ontario boat fishery (Section 3.1).

Rainbow Trout were measured and weighed in most years since 1974 during the spawning run. Rainbow Trout body condition was determined as the estimated weight of a 635 mm (25 in) fish at the Ganaraska River. In 2013, the condition of male (3,099 g) and female (3,225g) Rainbow Trout were significantly greater ($P \leq 0.05$) than in 2011, and were slightly higher than the long-term average since 1974 (Table 2.1.2).

TABLE 2.1.1. Observed count and estimated run of Rainbow Trout moving upstream at the Ganaraska River fishway at Port Hope, Ontario during spring, 1974-2013. 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

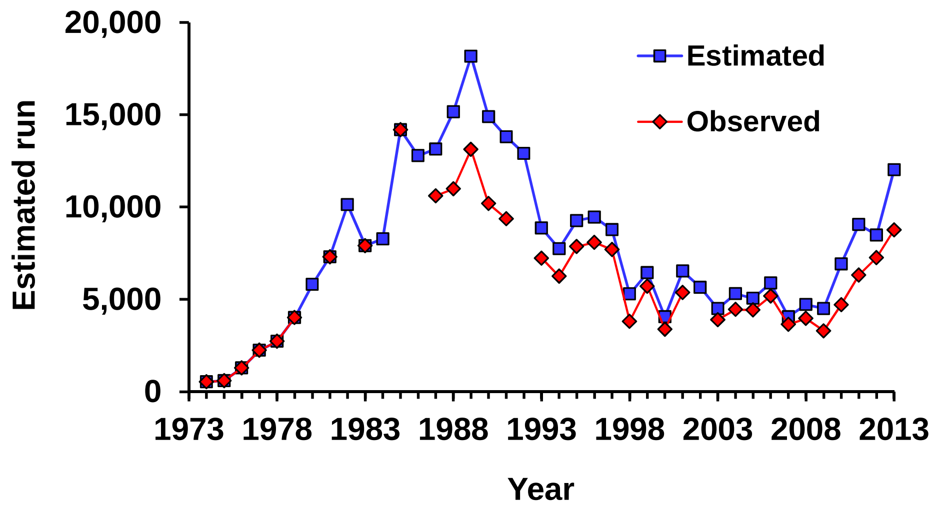


FIG. 2.1.1. Estimated run of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario during spring 1974 to 2013.

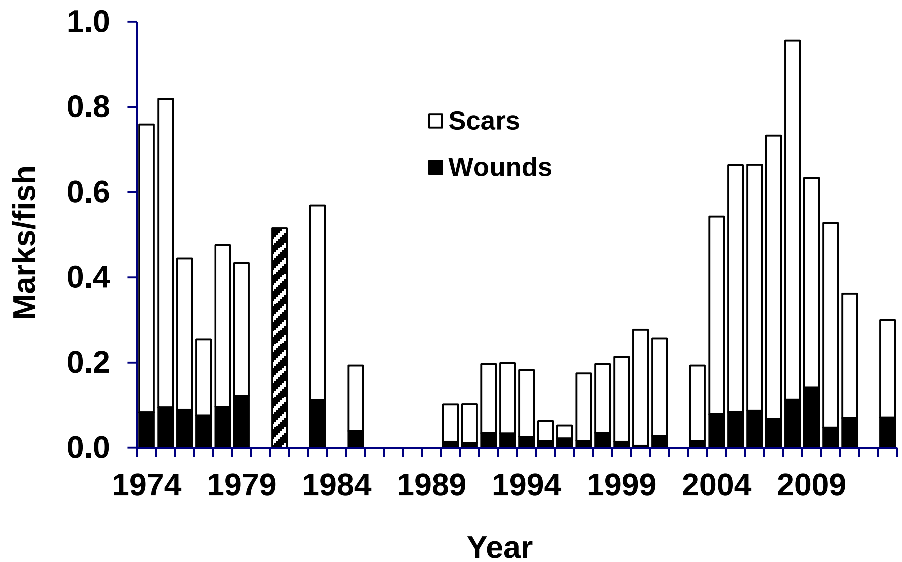


FIG. 2.1.2. Trend in lamprey marks on rainbow trout in April, 1974 to 2013, at the Ganaraska River fishway, in Port Hope, Ontario. Since 1990, A1 and A2 marks (King and Edsall 1979) were called wounds and the remainder of marks were called scars to fit with historical classification. Scars and wounds were combined in 1981.

Lamprey marks on Rainbow Trout in the Ganaraska River in 2013 continued to decline since a recent peak in 2008 to 0.300 marks/fish (Table 2.1.3). The marking rate is still higher than any value during 1990-2003 (Fig. 2.1.2). Marking rates from 2004-2013 are similar to levels in the 1970s (Fig. 2.1.2). In 2013 we no longer saw the high incidence of A1 and B1 marks[1] that was seen from 2004 to 2011 (Table 2.1.4).

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

TABLE 2.1.2. Body condition (estimated weight at 635 mm) of rainbow trout at the Ganaraska River fishway at Port Hope, Ontario during spring, 1974-2013.

Year	Male		Female	
	Weight (g)	Sample size	Weight (g)	Sample size
1974	3,060	173	3,206	231
1975	2,963	183	3,064	279
1976	3,164	411	3,321	588
1977	2,971	635	3,162	979
1978	3,178	255	3,338	512
1979	3,217	344	3,334	626
1981	3,171	252	3,358	468
1983	2,876	308	3,034	132
1984			3,179	120
1985	3,169	410	3,205	154
1987			3,046	74
1990	2,868	259	3,071	197
1991	2,848	126	3,085	289
1992	2,996	138	3,113	165
1993	2,952	84	3,136	166
1994	3,244	109	3,355	178
1995	2,958	146	3,077	154
1997	3,144	140	3,272	127
1998	3,034	96	3,195	222
1999	3,061	173	3,226	290
2000	3,119	121	3,242	226
2001	2,919	295	3,042	290
2003	3,034	92	3,154	144
2004	3,053	143	3,185	248
2005	2,983	142	3,111	173
2006	3,022	101	3,138	217
2007	2,920	75	3,006	132
2008	2,889	125	3,013	148
2009	2,904	74	3,017	209
2010	3,071	72	3,139	156
2011	3,007	91	3,124	203
2013	3,099	163	3,225	217
Average	3,030		3,162	

TABLE 2.1.3. Lamprey marks on rainbow trout in spring, 1974-2013, at the Ganaraska River fishway, in Port Hope, Ontario. Since 1990, A1 and A2 marks[1] 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	N
1974	0.083	0.676	0.759	7.0	33.2	36.8	527
1975	0.095	0.725	0.820	8.0	37.2	40.2	599
1976	0.090	0.355	0.445	6.6	23.3	28.1	1280
1977	0.076	0.178	0.254	6.4	13.5	18.2	2242
1978	0.097	0.380	0.476	8.1	28.4	33.7	2722
1979	0.122	0.312	0.434	10.3	22.8	29.8	3926
1981			0.516			36.2	5489
1983	0.113	0.456	0.569	9.7	33.4	38.8	833
1985	0.040	0.154	0.193	3.7	11.5	14.5	1256
1990	0.015	0.087	0.102	0.0	0.1	0.1	470
1991	0.012	0.091	0.103	1.2	7.4	8.4	419
1992	0.035	0.162	0.197	2.9	14.3	16.5	315
1993	0.034	0.165	0.199	3.1	15.3	17.2	261
1994	0.027	0.156	0.183	0.0	0.1	0.2	301
1995	0.017	0.046	0.063	1.7	4.3	5.9	303
1996	0.023	0.030	0.053	2.3	3.0	5.3	397
1997	0.017	0.158	0.175	1.7	12.7	13.7	291
1998	0.035	0.162	0.197	0.0	0.1	0.2	340
1999	0.015	0.199	0.214	0.0	0.2	0.2	477
2000	0.005	0.272	0.278	0.5	23.2	23.5	371
2001	0.028	0.229	0.257	2.5	17.8	18.8	608
2003	0.017	0.176	0.193	1.7	14.3	15.1	238
2004	0.079	0.464	0.543	6.9	33.7	37.5	392
2005	0.084	0.579	0.664	6.9	39.6	41.4	321
2006	0.088	0.577	0.665	6.9	40.1	44.5	319
2007	0.068	0.665	0.733	5.3	46.6	49.0	206
2008	0.113	0.843	0.956	8.8	48.5	51.5	274
2009	0.142	0.491	0.633	12.5	36.3	42.2	289
2010	0.048	0.481	0.528	3.0	36.4	38.1	231
2011	0.070	0.292	0.362	6.0	25.8	29.9	298
2013	0.071	0.229	0.300	6.1	18.7	22.4	380

TABLE 2.1.4. Classification of lamprey marks[1] on rainbow trout in spring, 1990-2013, at the Ganaraska River fishway, in Port Hope, Ontario.

Year	Marks/fish							
	A1	A2	A3	A4	B1	B2	B3	B4
1990	0.000	0.015	0.009	0.009	0.000	0.002	0.017	0.051
1991	0.000	0.012	0.012	0.002	0.029	0.010	0.019	0.019
1992	0.013	0.022	0.025	0.019	0.079	0.006	0.010	0.022
1993	0.011	0.023	0.019	0.023	0.061	0.000	0.008	0.054
1994	0.007	0.020	0.010	0.007	0.076	0.010	0.010	0.043
1995	0.007	0.010	0.017	0.003	0.000	0.000	0.020	0.007
1996	0.013	0.010	0.003	0.003	0.005	0.013	0.000	0.008
1997	0.003	0.014	0.021	0.000	0.000	0.021	0.017	0.100
1998	0.012	0.024	0.012	0.041	0.012	0.003	0.015	0.079
1999	0.000	0.013	0.023	0.021	0.010	0.023	0.019	0.105
2000	0.000	0.005	0.027	0.057	0.000	0.003	0.003	0.183
2001	0.002	0.026	0.021	0.069	0.000	0.000	0.002	0.137
2003	0.000	0.013	0.021	0.029	0.000	0.008	0.004	0.118
2004	0.020	0.059	0.084	0.064	0.186	0.005	0.031	0.094
2005	0.016	0.069	0.075	0.072	0.315	0.003	0.040	0.075
2006	0.028	0.060	0.147	0.050	0.150	0.031	0.047	0.150
2007	0.010	0.058	0.087	0.044	0.432	0.000	0.034	0.068
2008	0.022	0.091	0.142	0.018	0.380	0.015	0.161	0.128
2009	0.087	0.055	0.073	0.042	0.225	0.010	0.017	0.125
2010	0.026	0.022	0.061	0.026	0.242	0.004	0.039	0.104
2011	0.040	0.030	0.027	0.027	0.158	0.000	0.020	0.050
2013	0.018	0.053	0.034	0.079	0.018	0.013	0.024	0.016

2.2 Eastern Lake Ontario and Bay of Quinte Fish Community Index Gill Netting

This gill netting program is used to monitor the abundance of a variety of warm, cool and cold -water fish species in the eastern 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 change in the Lake Ontario ecosystem.

Gill netting areas are shown in Fig. 2.2.1 and the basic sampling design is summarized in Table 2.2.1. 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 (See Table 2.2.1) because the probability of encountering a wide range of water temperatures across the depth ranges sampled varies 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 one of two possible configurations. Either, each of the ten mesh sizes (panels) is 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

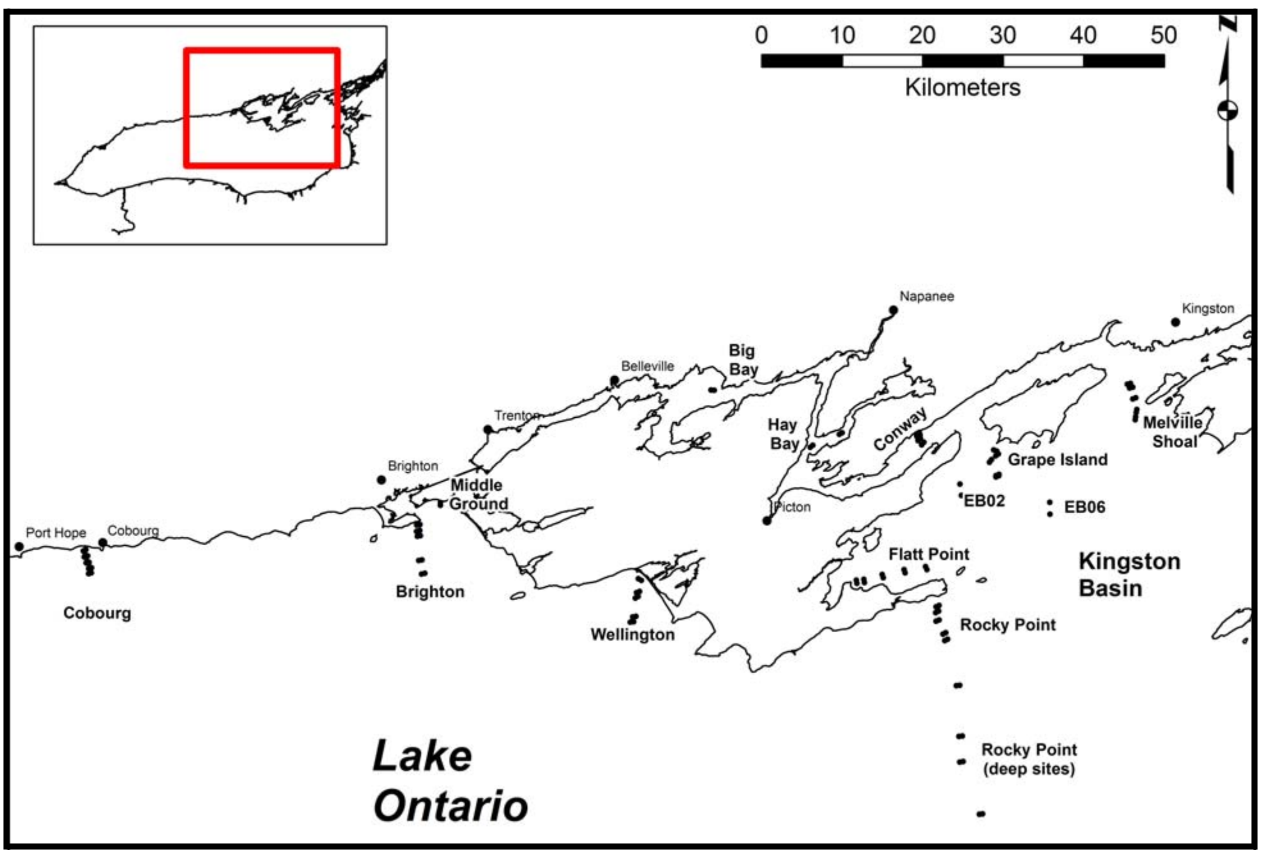


FIG. 2.2.1. Map of north eastern Lake Ontario. Shown are eastern Lake Ontario and Bay of Quinte fish community index gill netting sites.

TABLE. 2.2.1. Sampling design (2013) of the eastern Lake Ontario and Bay of Quinte fish community index gillnetting program including geographic and depth stratification, number of visits, number of replicate gillnet gangs set during each visit, and the time-frame for completion of visits.

Region name	Area Name (Area code)	Design	Site name	Depth (m)	Visits	Replicates[3] 465 feet	Replicates[3] 500 feet	Site location (approx) Latitude (dec min)	Site location (approx) Longitude (dec min)	Visits x Replicates	Time-frame	Start-up year	Number years[4]
Northeastern Lake Ontario	Cobourg (CB)	Depth stratified area	CB08	7.5	2	2		435701	781167	4	Aug 1-Sep 15	2010	4
Northeastern Lake Ontario	Cobourg	Depth stratified area	CB13	12.5		2		435661	781157	4			
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	Brighton (BR)	Depth stratified area	BR08	7.5	2	2		435955	774058	4	Aug 1-Sep 15	1988	26
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	35
Northeastern Lake Ontario	Wellington (WE)	Depth stratified area	WE08	7.5	2	2		435622	772011	4	Aug 1-Sep 15	1988	26
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	26
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 (offshore)	Rocky Point	Depth stratified area	0060	60	2		3	434950	765029	6	Jul 1-Jul 31	1997	17
Northeastern Lake Ontario (offshore)	Rocky Point	Depth stratified area	0080	80			3	434633	765006	6			
Northeastern Lake Ontario (offshore)	Rocky Point	Depth stratified area	0100	100			3	434477	764998	6			
Northeastern Lake Ontario (offshore)	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	28
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	28
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	28
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	46
Kinston Basin (offshore)	Eastern Basin (EB)	Fixed site	EB06	30	3		8	440220	764210	24	Last week Jun-Sep 15	1968	46
Bay of Quinte	Conway (CO)[1]	Depth stratified area	CO08	7.5	2		2	440664	765463	4	Jul 21-Aug 21	1972	42
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	55
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	42

[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 a

[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.

15.2 m (50 ft) each in length (total gang length is 141.7 m (465 ft)) (see Table 2.2.1). 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 2.2.1. Gill net set duration ranges from 18-24 hr.

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 2013, gill netting occurred from 24-Jun to 3-Sep. Twenty-six different species and over twenty-two thousand individual fish were caught. About 84% of the catch was alewife (Table 2.2.2). Species-specific gill net catch summaries are shown by geographic area/site in Tables 2.2.3-2.2.15.

Selected biological information is also presented below for selected species including Lake Whitefish, Walleye and Lake Herring.

TABLE 2.2.2. Species-specific catch per gillnet set in 2013. "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	77	77	1700
Alewife	18,617	55,530	34
Gizzard shad	44	44	99
Chinook salmon	17	19	1859
Rainbow trout	5	5	1851
Brown trout	45	45	2863
Lake trout	396	401	3111
Lake whitefish	37	37	846
Cisco (Lake Herring)	10	10	761
Rainbow smelt	6	6	38
Northern pike	6	6	2412
White sucker	47	47	624
Common carp	1	1	5942
Golden shiner	1	1	30
Brown bullhead	7	7	336
Channel catfish	1	1	36
White perch	1,359	1,359	81
Rock bass	27	36	58
Pumpkinseed	15	15	55
Bluegill	68	68	32
Smallmouth bass	16	18	452
Black crappie	1	1	49
Yellow perch	1,000	1,461	63
Walleye	184	184	1238
Round goby	134	438	40
Freshwater drum	71	71	537

Lake Ontario

Cobourg (Table 2.2.3)

Alewife dominate the catches at Cobourg but the salmonid fish community is also well represented at this location.

Middle Ground (Table 2.2.4)

Yellow Perch dominate the catch at Middle Ground but Alewife were also abundant in 2011 and 2013.

Northeast (Brighton, Wellington and Rocky Point) and Kingston Basin (Melville Shoal, Grape Island and Flatt Point) Nearshore Areas (Tables 2.2.5-2.2.10 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-

TABLE 2.2.3. Species-specific catch per gillnet set at **Cobourg, Lake Ontario**, 2010-2013. Annual catches are averages for 2 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 1-3 visits during summer. The total number of species caught and gillnets set each year are indicated.

	2010	2011	2012	2013
Alewife	351.96	196.13	56.77	23.78
Coho salmon	-	-	0.10	-
Chinook salmon	0.68	2.05	1.82	0.44
Rainbow trout	0.51	0.25	0.80	0.05
Brown trout	0.13	0.65	0.50	0.42
Lake trout	0.37	0.05	-	1.26
Lake whitefish	-	0.05	-	-
Round whitefish	0.07	0.05	-	-
Rainbow smelt	-	0.33	-	-
White sucker	0.10	0.37	0.50	0.26
Greater redhorse	-	-	0.10	
Smallmouth bass	-	0.05	-	-
Yellow perch	0.33	-	0.10	-
Walleye	0.03	-	0.40	-
Round goby	2.20	9.91	3.30	0.40
Freshwater drum	-	0.05	0.10	-
Total catch	356	210	65	27
Number of species	10	12	11	7
Number of sets	30	20	10	19

TABLE 2.2.4. Species-specific catch per gillnet set at **Middle Ground in Northeastern Lake Ontario**, 1992-2013 (no sampling in 2012). Annual catches are averages for 2 gillnet 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 gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013
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
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
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		-
Common carp	**0.41**	0.50	-	0.75	0.50	-	-	-	-	-	-	**0.18**	-		-
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
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
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
Number of species	**8**	7	7	7	8	8	7	9	7	7	8	**8**	8		6
Number of sets		4	4	4	4	4	4	4	4	4	4		4	-	4

TABLE 2.2.5. Species-specific catch per gillnet set at **Brighton in northeastern Lake Ontario**, 1992-2013. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 1-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013
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
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	-
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
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
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
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	-	-
White sucker	**0.41**	-	0.10	-	0.05	0.15	0.05	0.10	-	-	0.05	**0.05**	0.05	-	-
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**	-	-	-
Channel catfish	**0.01**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
American eel	**0.00**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Burbot	**0.05**	0.05	-	-	-	-	0.05	0.05	-	-	-	**0.02**	-	-	-
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	-
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
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
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
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
Number of species	**13**	6	9	15	12	12	12	14	11	10	12	**11**	9	8	10
Number of sets		20	20	20	20	20	20	20	20	20	20		20	10	20

TABLE 2.2.6. Species-specific catch per gillnet set at **Wellington in northeastern Lake Ontario**, 1992-2013. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 1-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000											**2001-2010**			
	mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013
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
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
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
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
Lake whitefish	**0.61**	0.10	0.05	-	-	-	-	-	-	-	-	**0.02**	0.35	-	-
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	-
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	-
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
Walleye	**0.36**	-	0.10	0.20	0.25	0.20	0.10	0.10	-	-	0.05	**0.10**	0.05	-	0.10
Round goby	-	-	-	0.33	0.99	25.92	18.39	2.03	11.50	1.16	6.94	**6.73**	3.35	2.97	3.30
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
Number of species	**11**	9	10	11	12	11	8	8	9	7	11	**10**	12	8	9
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20

TABLE 2.2.7. Species-specific catch per gillnet set at **Rocky Point (nearshore sites only) in northeastern Lake Ontario**, 1992-2013. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 1-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000											**2001-2010**			
	mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013
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
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
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
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
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
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**	-	-	-
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
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
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
Round goby	-	-	-	-	-	2.15	8.48	71.25	9.50	28.26	15.93	**13.56**	6.54	7.60	13.88
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
Number of species	**10**	10	11	11	12	12	13	13	12	10	11	**12**	11	9	11
Number of sets		20	20	20	20	20	20	20	20	20	20		20	10	20

TABLE 2.2.8. Species-specific catch per gillnet set at **Flatt Point in the Kingston Basin of Lake Ontario**, 1992-2013. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 2-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013
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
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
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
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
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	-
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	-
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
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
Walleye	**0.10**	-	-	-	-	0.05	0.05	0.05	0.10	0.15	0.25	**0.07**	0.10	0.10	-
Round goby	-	-	-	-	0.99	4.96	12.26	8.18	1.70	0.50	2.81	**3.14**	1.49	3.97	0.17
Freshwater drum	**0.08**	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-
Total catch	**119**	60	14	19	149	179	269	172	308	314	638	**212**	923	828	341
Number of species	**10**	11	9	11	10	11	11	11	11	10	11	**11**	12	14	8
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20

TABLE 2.2.9. Species-specific catch per gillnet set at **Grape Island in the Kingston Basin of Lake Ontario**, 1992-2013. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 2-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013
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
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
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
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
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	-
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
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
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
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
Round goby	-	-	-	1.32	49.22	4.51	8.35	7.97	1.09	-	1.65	**7.41**	1.16	1.42	1.98
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
Number of species	**11**	9	9	16	11	11	11	11	10	8	11	**11**	11	10	10
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20

coastal waters out to about 30 m water depth. Results were summarized and presented graphically (Fig. 2.2.2) to illustrate abundance trends of the most abundant nearshore (Yellow Perch, Round Goby, Walleye, and Smallmouth Bass), offshore benthic (Lake Trout, Lake Whitefish, Round Whitefish and Burbot), and offshore pelagic (Alewife, Chinook Salmon, Brown Trout and Cisco) fish species.

Most species showed peak abundance levels in the early 1990s followed by dramatic abundance decline. Recent abundance trends varied among species in the nearshore zone but all species remain at moderate abundance levels. Offshore benthic species all remained at extremely low abundance levels. Offshore pelagic species showed increasing or steady abundance levels in recent years. Alewife, the most common species caught, has occurred at very high abundance levels the last few years.

Rocky Point—Deep Sites (Table 2.2.11)

Eight species have been captured at the Rocky Point deep sampling sites since 1997.

TABLE 2.2.10. Species-specific catch per gillnet set at **Melville Shoal in the Kingston Basin of Lake Ontario**, 1992-2013. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 2-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013
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
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	-
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
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	-
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**	-	-	-
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
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	-
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
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
Round goby	-	-	-	-	9.02	9.80	5.34	4.84	2.18	1.16	0.50	**3.28**	0.71	1.16	1.16
Freshwater drum	**0.09**	0.05	-	0.05	-	-	-	0.22	-	-	0.10	**0.04**	0.05	-	-
Total catch	**118**	61	72	40	149	210	253	137	164	516	662	**227**	691	243	560
Number of species	**12**	12	9	12	9	7	8	10	10	8	12	**10**	10	9	6
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20

TABLE 2.2.11. Species-specific catch per gillnet set at **Rocky Point (deep sites only) in northeastern Lake Ontario**, 1997-2013 (no sampling in 2006, 2007 or 2010). Annual catches are averages for 2 or 3 gillnet 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

	1997-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013
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
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
Lake whitefish	**0.50**	0.13	-	0.08	-	0.08	-	-	0.25	0.50	-	**0.15**	0.13	-	0.67
Cisco (Lake herring)	**0.13**	-	0.13	0.08	0.21	-	-	-	-	-	-	**0.06**	-	-	-
Rainbow smelt	**0.41**	-	0.19	-	-	-	-	-	0.08	0.08	-	**0.05**	0.08	-	0.08
Burbot	**0.09**	-	-	-	0.04	-	-	-	-	-	-	**0.01**	-	-	-
Round goby	-	-	-	-	-	-	-	-	-	-	-	-	-	0.08	
Slimy sculpin	**0.08**	0.06	-	0.04	0.04	-	-	-	0.08	-	-	**0.03**	-	-	-
Total catch	**11**	19	7	14	17	4	-	-	26	43	-	**18**	38	5	20
Number of species	**6**	4	4	5	5	3	-	-	5	4	-	**3**	4	3	4
Number of sets		16	16	24	24	24	-	-	24	24	-		24	12	12

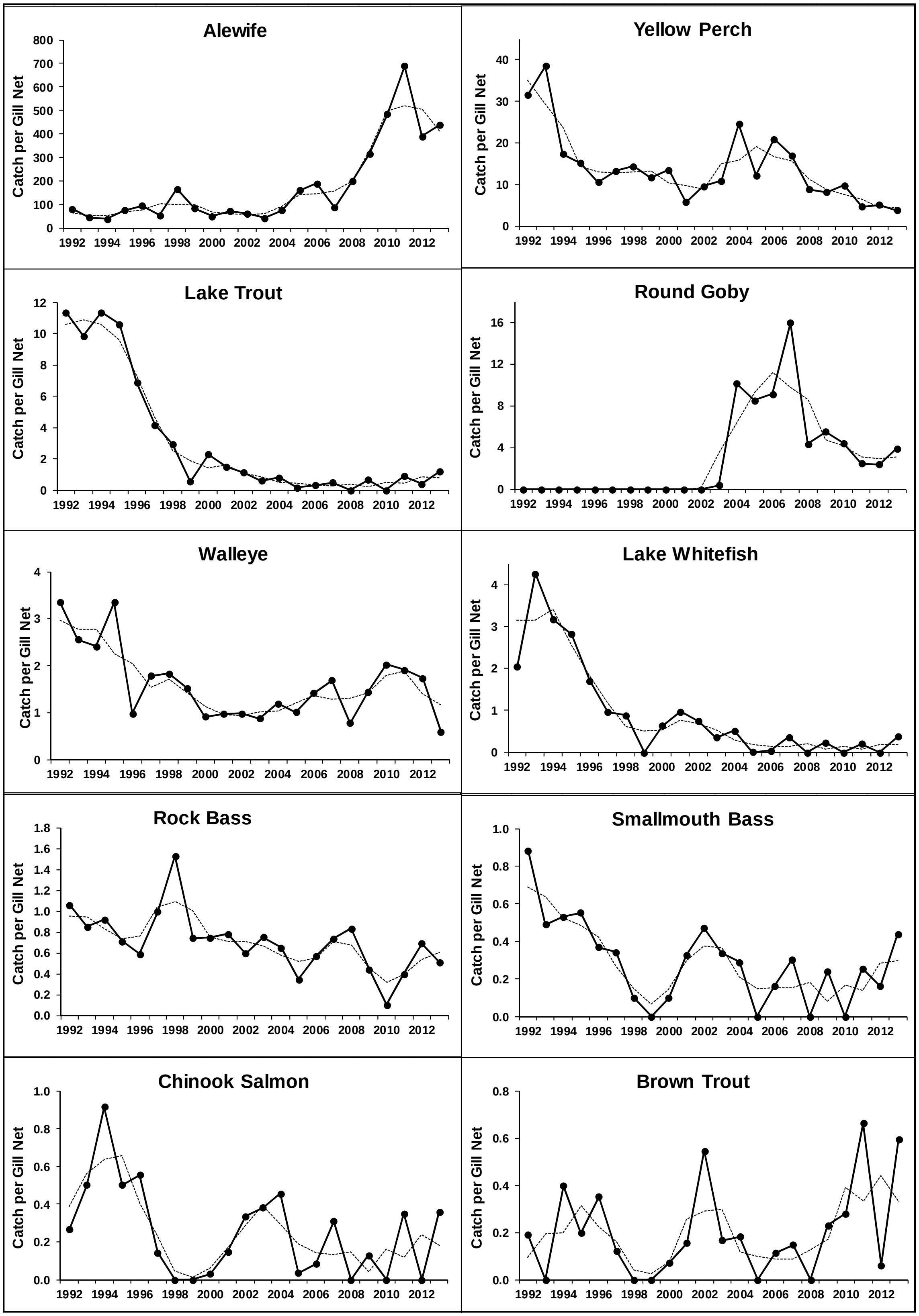


FIG. 2.2.2. Abundance trends for the most common species caught in gill nets at six depth-stratified transects (nearshore out to 30 m) in north eastern Lake Ontario (Melville Shoal, Grape Island, Flatt Point, Rocky Point, Wellington and Brighton; see Fig. 2.2.1). Annual catch per gillnet values are arithmetic means. Dotted lines show 3-yr running averages (two years for first and last years graphed).

Alewife and Lake Trout are the two most abundant species. Lake Trout abundance was relatively stable from 1997-2002, declined significantly through 2004 and remained steady in the following years although the 2013 catch was the higest since 2002. Round Goby appeared for the first time in 2012 (at the 60 m site).

Kingston Basin—Deep Sites (EB02 and EB06; Table 2.2.12 and 2.2.13)

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

TABLE 2.2.12. Species-specific catch per gillnet set at **EB02 in the Kingston Basin of Lake Ontario**, 1992-2013. Annual catches are averages for 4-8 gillnet gangs set during each of 2-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000											**2001-2010**			
	mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013
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
Chinook salmon	**0.05**	0.25	-	0.04	0.04	-	-	0.04	-	0.13	0.08	**0.06**	-	0.13	0.04
Rainbow trout	-	-	-	-	-	-	-	-	-	-	-	-	0.04	-	-
Atlantic salmon	-	-	-	-	-	-	-	-	0.04	-	-	**0.00**	-	-	-
Brown trout	**0.02**	0.08	-	-	-	-	-	-	0.04	-	0.21	**0.03**	0.04	-	-
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
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	-	-
Cisco (Lake herring)	**0.20**	-	-	-	0.04	-	-	-	-	-	0.21	**0.03**	0.04	-	0.08
Rainbow smelt	**0.56**	-	-	-	0.04	0.04	0.08	0.04	-	0.17	0.17	**0.05**	-	-	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**	-	-	-
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
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
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
Number of species	**7**	6	4	5	9	5	6	7	7	7	10	**7**	7	4	7
Number of sets		12	12	24	24	24	24	24	24	24	24		24	16	24

TABLE 2.2.13. Species-specific catch per gillnet set at **EB06 in the Kingston Basin of Lake Ontario**, 1992-2013. Annual catches are averages for 4-8 gillnet 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 gillnets set each year are indicated.

	1992-2000											**2001-2010**			
	mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013
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
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	-
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
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
Cisco (Lake herring)	**0.03**	-	-	-	-	-	-	-	-	-	-	-	-	0.19	0.17
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
Number of species	**6**	4	5	6	5	6	6	6	6	5	5	**5**	7	7	7
Number of sets		12	12	24	24	24	24	24	24	24	24		24	16	24

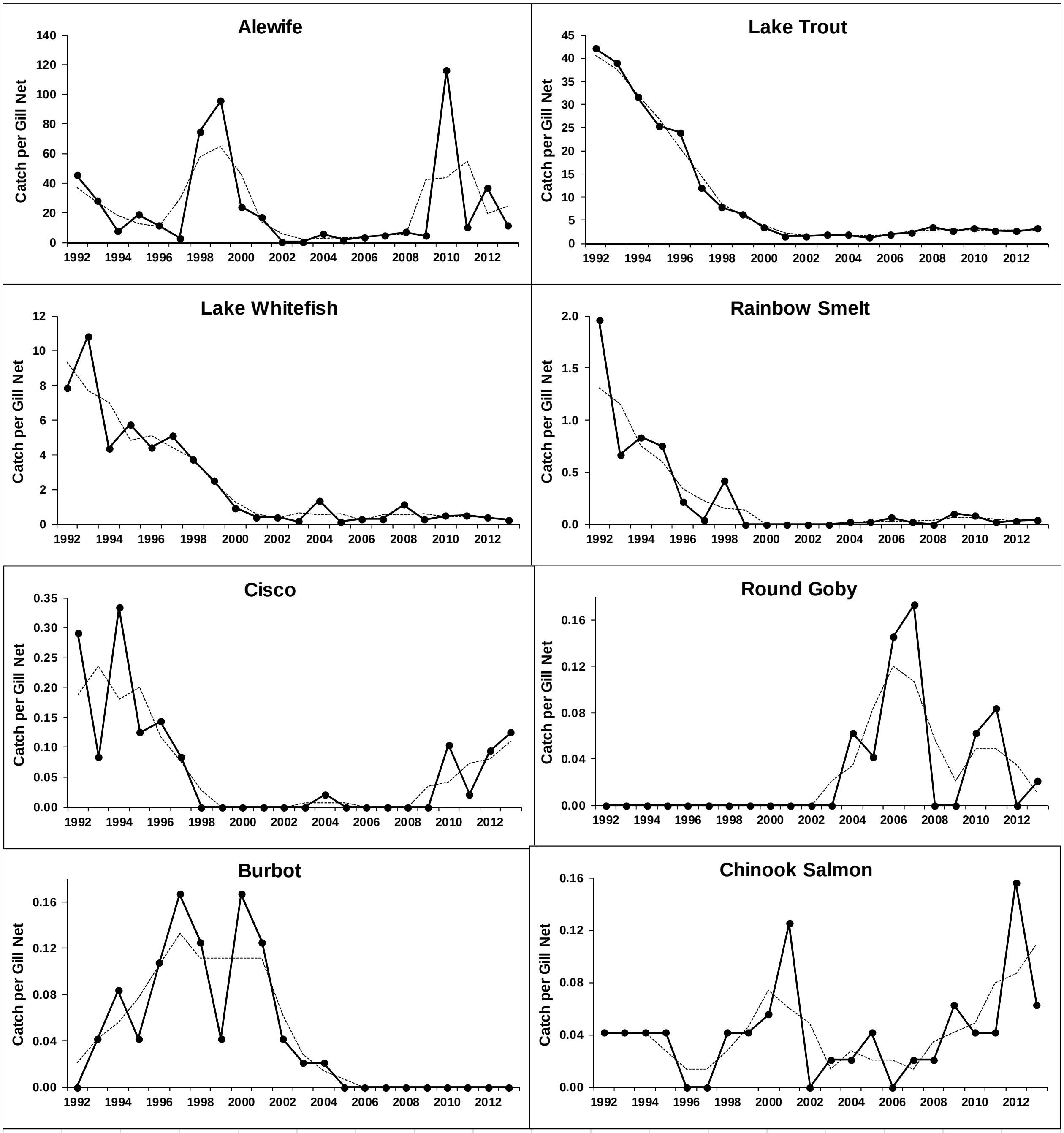


FIG. 2.2.3. Abundance trends (annual means) for the most common species caught in gill nets at the Kingston Basin deep sites, in eastern Lake Ontario (EB02 and EB06; see Fig. 2.2.1). Dotted lines show 3-yr running averages (two years for first and last years graphed).

graphically (Fig. 2.2.3) to illustrate abundance trends of the most abundant species (Alewife, Lake Trout, Lake Whitefish, Rainbow Smelt, Cisco, Round Goby, Burbot and Chinook Salmon). Alewife catches were variable with high catches in some years, 1998-1999 and 2010. Lake Trout, Lake Whitefish, Rainbow Smelt, and Cisco abundance declined throughout the 1990s and remained low during the years that followed except that Cisco has increased in the last four years. Burbot catches peaked in the late-1990s then declined to zero for the last nine years.

Bay of Quinte *(Conway, Hay Bay and Big Bay; Tables 2.2.14-2.2.16 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. 2.2.4 to illustrate abundance trends of the most abundant species from 1992-2012. 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, and finally increased in 2012 and again in 2013. Alewife abundance has been relatively high for the last six years. Walleye abundance declined from 1992-2000 but has remained very stable since. Walleye abundance increased in 2013. 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 although it did increase slightly in 2013. 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

TABLE 2.2.14. Species-specific catch per gillnet set at **Conway in the Bay of Quinte**, 1993-2013. Annual catches are averages for 2-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 20, 30 and 45 m) during each of 2-3 visits during summer. Mean catches for 1993-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1993-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013
Sea lamprey	**0.00**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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
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	-	-
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
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
Cisco (Lake herring)	**0.19**	0.20	-	-	-	-	0.05	-	0.10	0.05	0.15	**0.06**	-	0.15	-
Coregonus sp.	**0.00**	-	-	-	0.05	-	-	-	-	-	-	**0.01**	-	-	-
Rainbow smelt	**0.08**	0.20	-	-	0.05	0.20	0.05	-	0.35	0.10	0.15	**0.11**	0.10	-	0.10
Northern pike	**0.04**	0.05	-	0.05	-	-	-	0.05	0.05	-	0.05	**0.03**	-	-	-
White sucker	**2.36**	3.30	2.60	2.15	1.05	0.60	0.45	1.45	0.55	0.30	0.20	**1.27**	0.05	0.05	0.10
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
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
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
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
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
Total catch	**150**	81	89	75	89	105	77	51	106	90	196	**96**	211	128	119
Number of species	**14**	19	14	15	16	15	15	18	17	13	16	**16**	16	12	12
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20

TABLE 2.2.15. Species-specific catch per gillnet set at **Hay Bay in the Bay of Quinte**, 1992-2013. Annual catches are averages for 1-3 gillnet 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 gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013
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
Gizzard shad	**0.71**	-	0.25	-	-	-	0.50	0.13	0.13	-	-	**0.10**	-	0.38	5.38
Chinook salmon	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**	-	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**	-	-	-
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	-
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
River redhorse	**-**	-	-	-	-	-	-	0.13	-	-	-	**0.01**	-	-	-
Common carp	**0.23**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	0.13
Golden shiner	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.25	0.13
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**	-	-	-
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
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	-	-
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
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
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
Total catch	**193**	176	138	127	120	149	116	130	127	111	266	**146**	116	55	79
Number of species	**14**	12	14	11	11	10	11	14	13	10	9	**12**	10	11	8
Number of sets		8	8	8	8	8	8	8	8	8	4		8	8	8

TABLE 2.2.16. Species-specific catch per gillnet set at **Big Bay in the Bay of Quinte**, 1992-2013. Annual catches are averages for 2 gillnet gangs set during each of 2-4 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013
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
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
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	-
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
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
Channel catfish	**0.37**	-	0.13	-	0.17	-	0.25	-	-	0.17	-	**0.07**	-	-	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
White bass	**0.08**	-	0.13	-	-	-	-	0.17	0.17	-	-	**0.05**	-	0.17	-
Rock bass	**0.26**	-	-	-	-	0.17	-	-	-	-	-	**0.02**	-	-	0.17
Pumpkinseed	**3.97**	17.00	8.25	0.83	4.33	0.33	3.25	0.50	1.00	0.67	0.17	**3.63**	0.83	1.00	2.50
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
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
Walleye (Yellow pick	**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
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
Total catch	**292**	277	270	199	273	249	371	164	223	286	173	**248**	254	189	227
Number of species	**14**	14	15	15	16	14	16	13	13	12	12	**14**	11	12	12
Number of sets		8	8	6	6	6	4	6	6	6	6		6	6	6

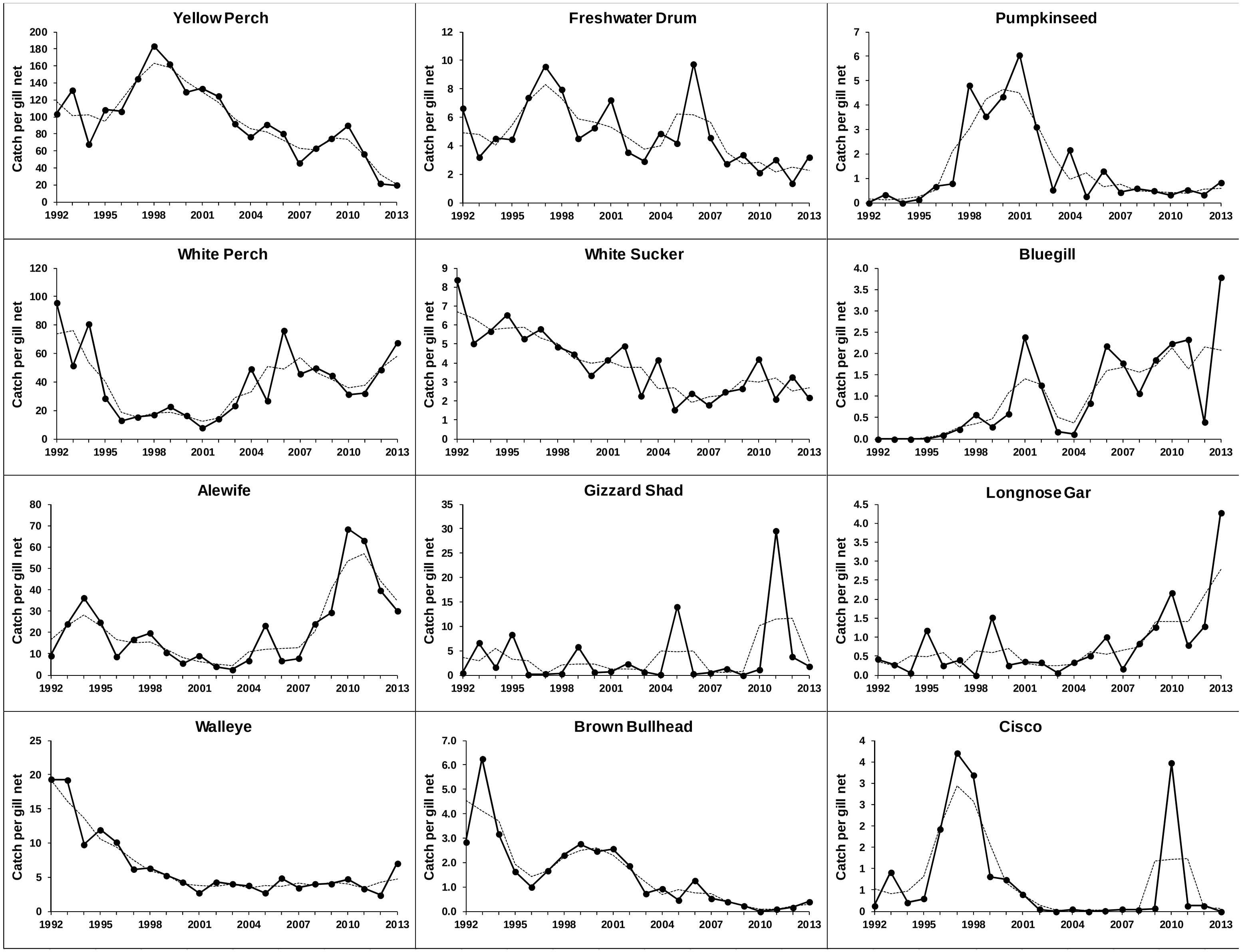


FIG. 2.2.4. Abundance trends (annual means) for the most common species caught in gillnets at three areas in the Bay of Quinte (Conway, Hay Bay and Big Bay; see Fig. 2.2.1). Dotted lines show 3-yr running averages (two years for first and last years graphed).

late-1990s then declined. Round Goby, a recent invader to the Bay of Quinte area, peaked in abundance in 2004 then declined.

Species Highlights

Lake Whitefish

Thirty-six Lake Whitefish were caught in the 2013 index gill nets (Table 2.2.17). Eleven (31%) of these were from the 2003 and 2005 year-classes. Lake Whitefish mean fork length-at-age for the 2003 and 2005 year-classes is shown in Fig. 2.2.5. Lake Whitefish body condition is shown in Fig. 2.2.6.

Walleye

One hundred and seventy-eight Walleye were caught in the 2013 index gill nets (Table 2.2.18). One hundred and twelve (82%) of 136 Walleye caught in the Bay of Quinte gill nets were age 1-4 years. In the Kingston Basin nearshore gill nets, all of the 18 Walleye were age -5 or greater. Walleye mean fork length-at-age for the 2003 year-class is shown in Fig. 2.2.7. Walleye body condition is shown in Fig. 2.2.8.

Lake Herring

Ten Lake Herring were caught in the 2013 index gill nets (Table 2.2.19).

TABLE 2.2.17. Age distribution of **36 Lake Whitefish** sampled from summer index gillnets, by region, 2013. 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	15	18	19	21	Total
Region	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	1998	1995	1994	1992	
Northeast	4		1	1	1		1		1	1					10
Kingston Basin (nearshore)					1			2		3					6
Kingston Basin (deep)						1	2	2		3		1	1	2	12
Bay of Quinte		5	2								1				8
Total	4	5	3	1	2	1	3	4	1	7	1	1	1	2	36
Mean fork length (mm)	169	195	259	291	383	383	441	414	405	486	544	515	548	552	
Mean weight (g)	47.3	72.9	173	245	727	595	1109	922	825	1409	1861	1718	1938	2150	
Mean GSI (females)			0.06				0.53	0.34		0.52				0.56	
% mature (females)	0	0	0				100	100		100				100	

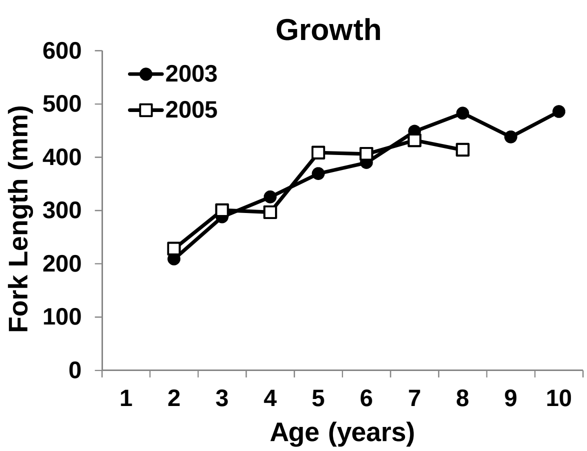


FIG. 2.2.5. Lake Whitefish mean fork length-at-age for the 2003 and 2005 year-classes.

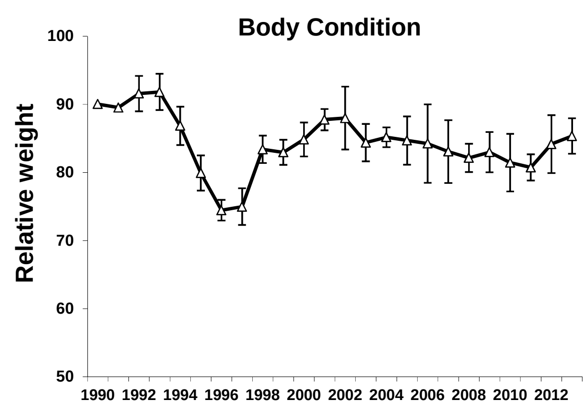


FIG. 2.2.6. Lake Whitefish relative weight (see Rennie and Verdon, 2008) for fish, greater than 4-years-old, caught in summer index gillnets, 1990-2013. Error bars are +-2 SE.

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.

TABLE 2.2.18. Age distribution of 173 Walleye sampled from summer index gillnets, by region, 2013. 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	12	13	14	16	19	23	Total
Region	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2001	2000	1999	1997	1994	1990	
Northeast		1						3	4	2	1	1	1	1	2		16
Middle Ground	1	1														1	3
Kingston Basin (nearshore)					1	1	2	4	2	7			1				18
Bay of Quinte	15	49	39	9	14	5	1	2	1		1						136
Total	16	51	39	9	15	6	3	9	7	9	2	1	2	1	2	1	173
Mean fork length (mm)	243	330	428	455	487	477	569	601	572	601	573	573	659	692	674	536	
Mean weight (g)	161	406	912	1094	1373	1613	2559	3033	3013	3107	2972	2602	4127	4649	4041	2631	
Mean GSI (females)	0.08	0.12	0.22	0.24	0.26	0.36	0.41	0.36	0.39	0.33	0.26	0.25	0.48	0.49	0.35		
% mature (females)	0	4	52	33	50	100	100	100	100	100	100	100	100	100	100		

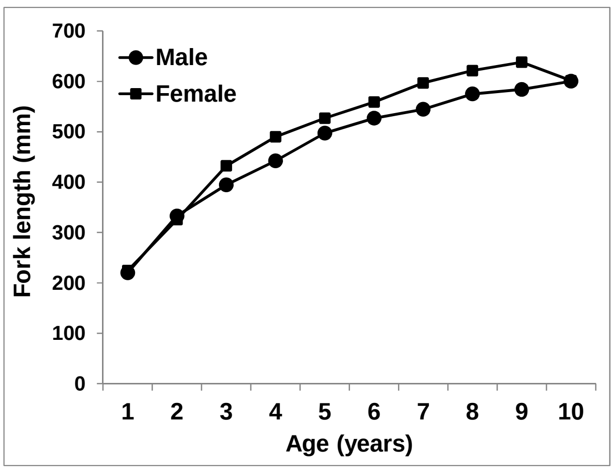


FIG. 2.2.7. Walleye mean fork length-at-age for the 2003 year-class caught in summer index gillnets.

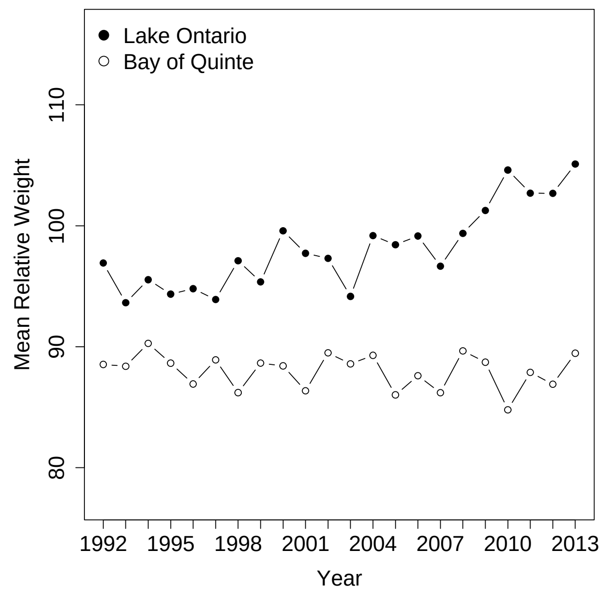


FIG. 2.2.8. Walleye relative weight for fish in Lake Ontario and the Bay of Quinte caught in summer index gillnets, 1992-2013.

TABLE 2.2.19. Age distribution of 10 Lake Herring sampled from summer index gillnets, by region, 2013. Also shown are mean fork length and mean weight.

	Age/Year-class						
	8	9	10	11	12	14	
	2005	2004	2003	2002	2001	1999	Total
Kingston Basin (deep)	3	1	1	1	0	0	6
Kingston Basin (nearshore)	1	0	0	0	1	1	3
Northeast	0	0	1	0	0	0	1
Total Count	4	1	2	1	1	1	10
Mean fork length (mm)	341	389	445	395	405	350	
Mean weight (g)	557	599	1213	866	939	550	

2.3 Eastern Lake Ontario and Bay of Quinte Fish Community Index Trawling

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 2.3.1).

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, south of Rocky Point (visited twice annually with a trawling distance of 1 mile; 90 m water depth), to give a total of four Lake sites (Fig. 2.3.1). 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-one species and over 85,000 fish were caught in 82 bottom trawls in 2013 (June 24-September 5,Table 2.3.2). White Perch (35%), Alewife (26%), Yellow Perch (13%), Gizzard Shad (10%), and Round Goby (8%), collectively made up 92% of the catch by number. Species-specific catches in the 2013 trawling program are shown in Tables 2.3.3-2.3.12.

Lake Ontario

EB02 (Table 2.3.3)

Four species, Alewife, Round Goby, Rainbow Smelt and Lake Trout were caught at EB02 in 2013. A single young-of-the-year wild Lake Trout was caught (fork length 33 mm; weight 0.17 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 seven years. Slimy Sculpin, another formally abundant species has also absent for seven years.

TABLE 2.3.1. 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

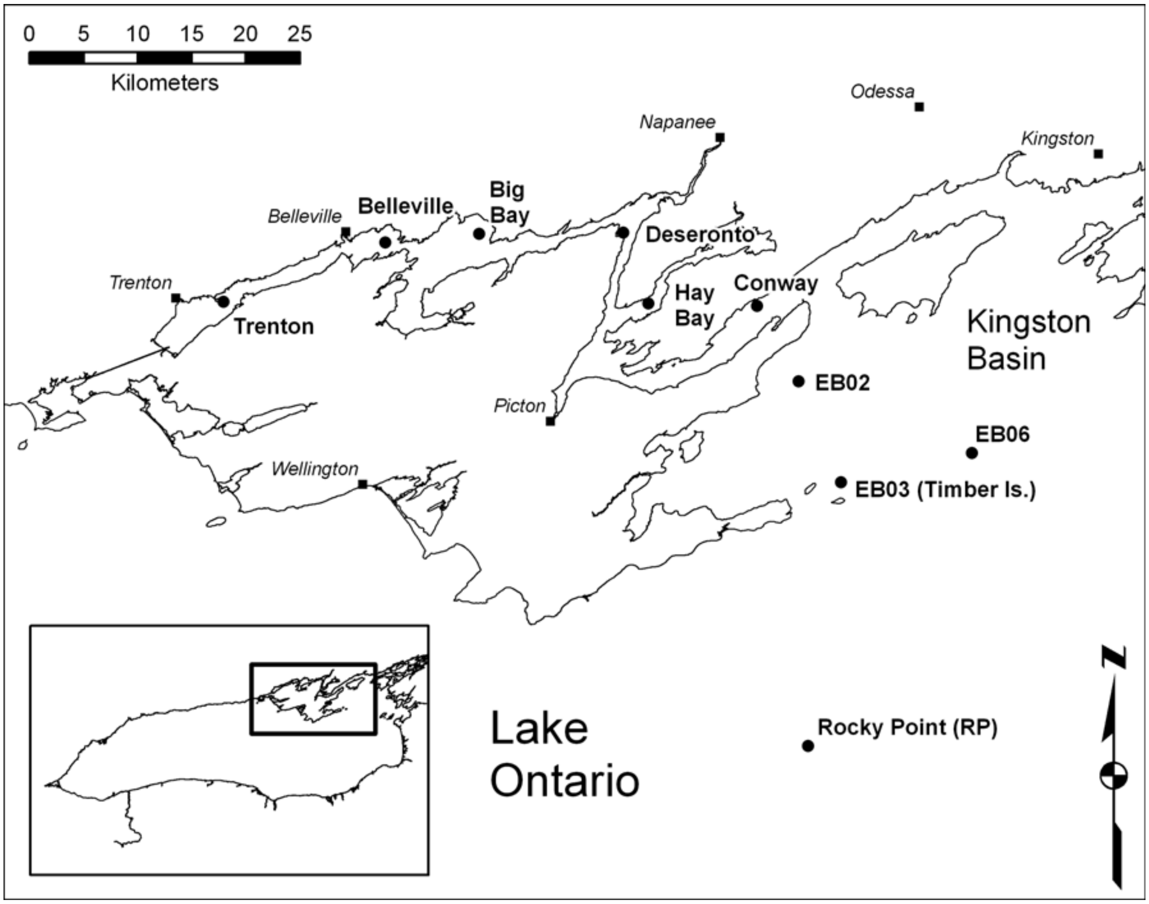


FIG. 2.3.1. Map of north eastern Lake Ontario. Shown are eastern Lake Ontario and Bay of Quinte fish community index bottom trawling site locations.

EB03 (Table 2.3.4)

Four species, Alewife, Round Goby, Rainbow Smelt and Lake Trout were caught at EB03 in 2013. Round Goby, having first appeared in the EB03 catches in 2004, now dominate the total catch. As was the case for EB02, Threespine Stickleback have been absent from the EB03 catches for seven years.

EB06 (Table 2.3.5)

Four species Round Goby, Rainbow Smelt, Alewife and Slimy Sculpin were caught at EB06 in 2013.

Rocky Point (Table 2.3.6)

Four species Alewife, Rainbow Smelt, Slimy Sculpin and Deepwater Sculpin were caught at Rocky Point in 2013.

Bay of Quinte

Conway (Table 2.3.7)

Ten species were caught at Conway in 2013. The most abundant species were Round Goby, Yellow Perch and Alewife.

Hay Bay (Table 2.3.8)

Eighteen species were caught at Hay Bay in 2013. The most abundant species were Alewife, White Perch, Yellow Perch, Freshwater Drum and Trout-perch.

Deseronto (Table 2.3.9)

Twenty-one species were caught at Deseronto in 2013. The most abundant species were Alewife, White Perch, Yellow Perch, Trout-perch and Gizzard Shad. For the second year in succession, an American Eel was caught in 2013.

Big Bay (Table 2.3.10)

Twenty-one species were caught at Big Bay in 2013. The most abundant species were White Perch, Alewife, Yellow Perch, and Trout-perch. Brown Bullhead catch increased slightly in 2013. No American Eel have been caught in the last eleven years.

Belleville (Table 2.3.11)

Seventeen species were caught at Belleville in 2013. White Perch, Gizzard Shad, and Alewife were the most abundant species in the catch. Brown Bullhead catch remained low. No American Eel have been caught in the last 15 years.

Trenton (Table 2.3.12)

Fifteen species were caught at Trenton in 2013. The most abundant species were Alewife, Yellow Perch, and Pumpkinseed.

Species Trends (Fig. 2.3.2)

Bottom trawl results were summarized across the six Bay of Quinte sites and presented graphically to illustrate abundance trends for major species in Fig. 2.3.2. All species show significant abundance changes over the long-term. The most abundant species remain White Perch, Yellow Perch and Alewife with Alewife showing an increase in recent years. 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 Trout-perch, Brown Bullhead, Rainbow Smelt, White Sucker, Lake Whitefish, Johnny Darter and American Eel.

TABLE 2.3.2. Species-specific total catches in bottom trawls in 2013. Frequency of occurrence (FO) is the number of trawls out of a possible 82 in which each species was caught.

Species	FO	Catch	Biomass (kg)	Mean weight (g)
Alewife	61	22,175	80.51	4
Gizzard shad	32	8,718	28.31	3
Lake trout	7	7	1.03	147
Lake whitefish	3	56	0.37	7
Cisco (Lake Herring)	6	13	0.17	13
Rainbow smelt	25	1,137	4.41	4
White sucker	27	92	33.11	360
Common carp	2	2	13.65	6825
Golden shiner	1	1	0.03	30
Spottail shiner	36	915	5.38	6
Fathead minnow	1	1	n/a	n/a
Brown bullhead	31	326	51.71	159
Channel catfish	3	3	0.39	130
American eel	1	1	0.68	680
Trout-perch	37	1,870	4.54	2
White perch	40	29,409	116.44	4
White bass	9	22	0.59	27
Rock bass	3	6	0.05	8
Pumpkinseed	33	1,189	29.26	25
Bluegill	19	64	2.38	37
Smallmouth bass	1	2	2.48	1240
Largemouth bass	25	128	1.19	9
Black crappie	8	24	4.56	190
Lepomis sp.	16	138	0.05	0.4
Yellow perch	46	11,361	118.55	10
Walleye	22	93	48.02	516
Logperch	9	23	0.08	3
Brook silverside	5	7	0.01	1
Round goby	52	6,983	26.00	4
Freshwater drum	28	434	57.71	133
Slimy sculpin	4	26	0.24	9
Deepwater sculpin	2	12	0.14	12

TABLE 2.3.3. 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**, 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.

Species	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2001-2010 mean	2011	2012	2013
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	288.115
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
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
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
Cisco	**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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	**1685**	253	64	115	365	56	70	135	34	357	623	**207**	11	112	321
Number of species	**9**	6	5	8	8	7	7	5	4	4	6	**6**	3	6	4
Number of trawls		12	12	12	10	12	12	12	12	12	12		12	12	12

TABLE 2.3.4. 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**, 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.

Species	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2001-2010 mean	2011	2012	2013
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
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
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
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
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
Cisco	**0.292**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.125	0.000	0.000
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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	410.770
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
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
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
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
Total catch	**2004**	320	1502	695	3254	943	902	968	1257	2565	1303	**1371**	2354	998	598
Number of species	**10**	4	5	10	10	9	9	9	5	6	7	**7**	8	5	4
Number of trawls		8	8	16	12	12	8	12	8	12	12		8	7	8

TABLE 2.3.5. 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**, 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.

	Year														
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013
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
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
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
Cisco	**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
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
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
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
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
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
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	208.833
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
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
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
Total catch	**843**	30	55	16	434	173	38	85	3	24	954	**181**	22	314	218
Number of species	**6**	5	5	6	7	4	5	4	3	5	6	**5**	3	5	4
Number of trawls		12	12	12	12	12	12	12	12	12	12		12	8	12

TABLE 2.3.6. Species-specific catch per trawl (24 min duration; 1mile) by year in the fish community index bottom trawling program during summer at **Rocky Point** (90 m water depth) 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	**1997-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013
Alewife	**4.125**	5.500	0.750	3.000	11.500	0.250		13.750	3.000	0.750		**4.813**	1.000	0.000	169.000
Lake trout	**0.125**	1.000	0.000	0.000	0.250	0.000		0.000	0.250	0.000		**0.188**	0.500	0.000	0.000
Lake whitefish	**0.188**	0.000	0.250	0.000	0.000	0.000		0.000	0.000	0.000		**0.031**	0.000	0.000	0.000
Rainbow smelt	**401.000**	159.500	75.250	8.250	22.750	11.000		4.500	14.500	13.500		**38.656**	11.000	11.000	23.000
Threespine stickleback	**0.000**	0.000	0.000	0.000	0.250	0.250		0.000	0.000	0.000		**0.063**	0.000	0.000	0.000
Slimy sculpin	**11.250**	0.500	0.250	4.500	191.500	28.500		49.500	17.750	10.000		**37.813**	4.500	0.000	24.000
Deepwater sculpin	**0.000**	0.000	0.000	0.000	0.000	0.250		1.500	0.500	0.250		**0.313**	15.000	3.000	12.000
Total catch	**417**	167	77	16	226	40		69	36	25		**82**	32	14	228
Number of species	**3**	4	4	3	5	5		4	5	4		**4**	5	2	4
Number of trawls		4	4	4	4	4	0	4	4	4	0		4	2	2

Species Highlights

Catches of age-0 fish in 2013 for selected species and locations are shown in Tables 2.3.13-2.3.16 for Lake Whitefish, Lake Herring, Yellow Perch and Walleye respectively.

Age-0 Lake Whitefish were relatively abundant at Conway but none was caught at Timber Island in 2013 (Table 2.3.13). Note however that water temperatures at Timber Island have been relatively warm in recent years and not always conducive to the presence of coldwater species. Except for the 2003 and 2005 year-classes, age-0 Lake Whitefish abundance has been low over the last 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 gill net surveys (Section 2.2) and the commercial harvest (Section 4.2).

Age-0 Lake Herring catches at Conway were relatively low in 2013 (Table 2.3.14).

Age-0 catches of Yellow Perch were low in 2013(Table 2.3.15).

Age-0 Walleye catches were very low in 2013 (Table 2.3.16). Age-1 were relatively

TABLE 2.3.7. 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
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
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
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
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
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
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
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
Cisco	**2.301**	0.000	0.250	3.000	0.083	7.667	4.500	2.000	0.167	0.000	6.333	**2.400**	8.250	23.500	1.625
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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	103.466
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
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
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
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
Total catch	**403**	412	310	545	197	216	215	238	428	91	212	**286**	780	301	199
Number of species	**9**	8	9	13	12	11	14	9	10	7	8	**10**	11	9	10
Number of trawls		8	8	12	12	12	12	12	12	12	12		8	8	8

uncommon while age-2 and age-3 fish were relatively common in the trawl catch (Table 2.3.17).

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 2013.

TABLE 2.3.8. 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
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	360.739
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
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
Cisco	**0.056**	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.100**	0.000	0.000	0.000
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
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
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
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
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
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
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
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
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
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
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
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
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	271.760
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
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
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
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
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
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
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
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
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
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	96.127
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
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
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
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
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
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
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
Total catch	**792**	1380	1055	179	1233	466	1598	1749	996	1050	1285	**1099**	706	774	768
Number of species	**14**	15	14	12	14	14	16	16	17	17	17	**15**	16	18	18
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8

TABLE 2.3.9. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Deseronto** (5 m depth), Bay of Quinte. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated.

	Year													
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013
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
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	632.440
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	67.768
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
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
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
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
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
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
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
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	27.586
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
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
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
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	122.989
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	341.355
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
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
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
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
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
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
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
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
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
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	247.864
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
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
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
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
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
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
Total catch	**904**	887	900	1451	3403	2021	1738	2511	1863	1457	605	**1684**	3357	1266	1514
Number of species	**16**	21	19	19	16	22	20	17	16	19	21	**19**	20	20	21
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8

TABLE 2.3.10. 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
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
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	313.148
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
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
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
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
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
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
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
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
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
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
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
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
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
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	540.966
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
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	4.500
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
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
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
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
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
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
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	0.750
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
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
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
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
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
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
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
Total catch	**891**	721	1511	442	2301	2017	1700	661	1586	1543	1109	**1359**	2310	827	1077
Number of species	**18**	18	23	15	17	18	20	19	20	17	18	**19**	18	18	21
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8

TABLE 2.3.11. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Belleville** (5 m depth), Bay of Quinte. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated.

Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013
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
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
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	272.314
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	1011.860
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
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
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
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
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
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
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
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
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
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
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
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	2497.237
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Total catch	**1042**	453	724	365	2691	1318	1161	1421	1571	2213	1385	**1330**	2193	893	3900
Number of species	**19**	20	22	20	17	19	19	19	19	17	20	**19**	19	17	17
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8

TABLE 2.3.12. 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
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	353.933
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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	1.625
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
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	118.615
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
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
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
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
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	1.500
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	892.913
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
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
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
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
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
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
Total catch	**1155**	781	547	1203	353	1381	781	751	1145	2186	688	**982**	1849	1081	1420
Number of species	**20**	20	19	19	15	19	20	15	19	19	21	**19**	22	20	15
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8

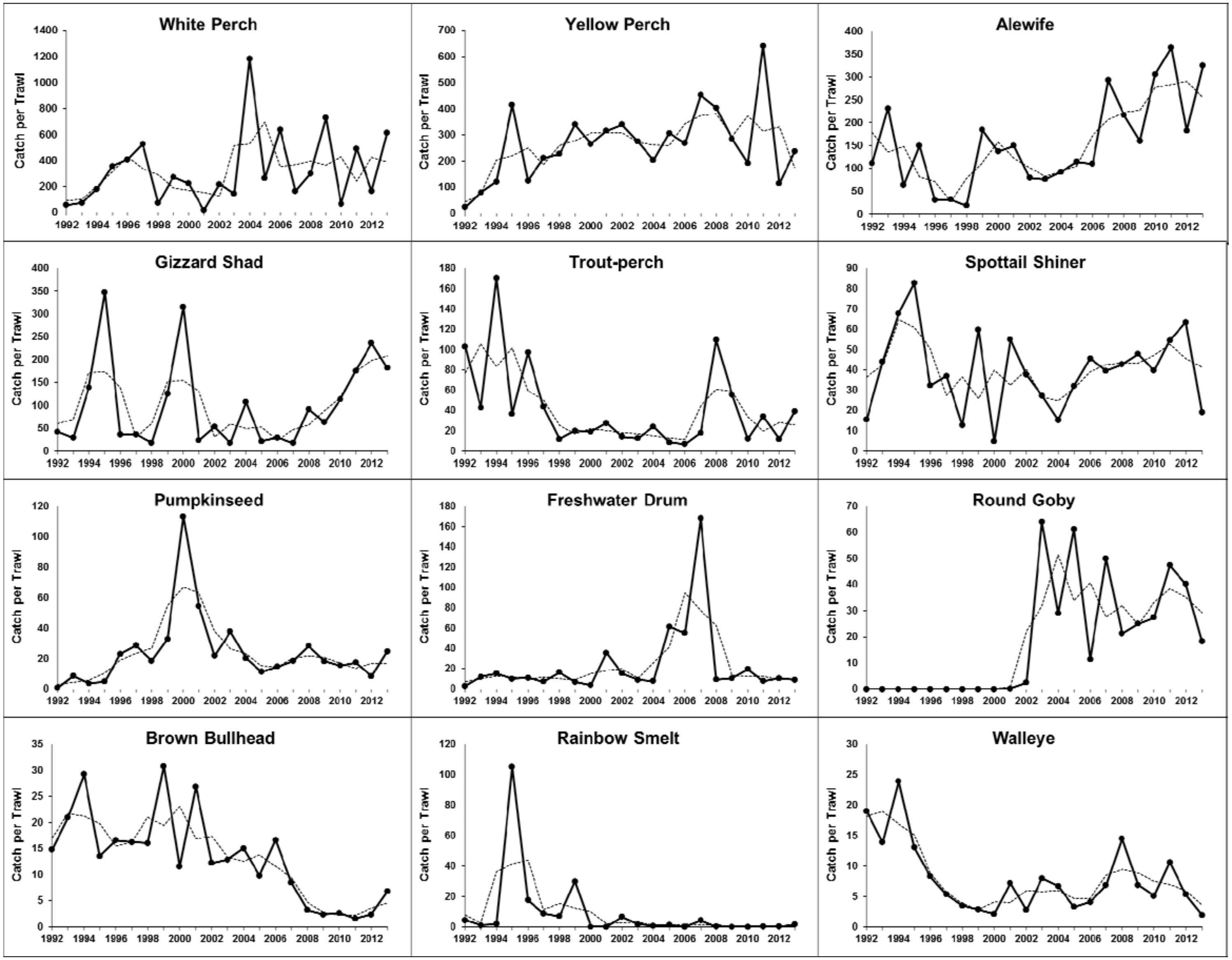


FIG. 2.3.2. Abundance trends (annual means) for the most common species caught in bottom trawls at six sites in the Bay of Quinte (Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton; see Fig. 2.3.1). Values shown here are 3-yr running averages (two years for first and last years graphed).

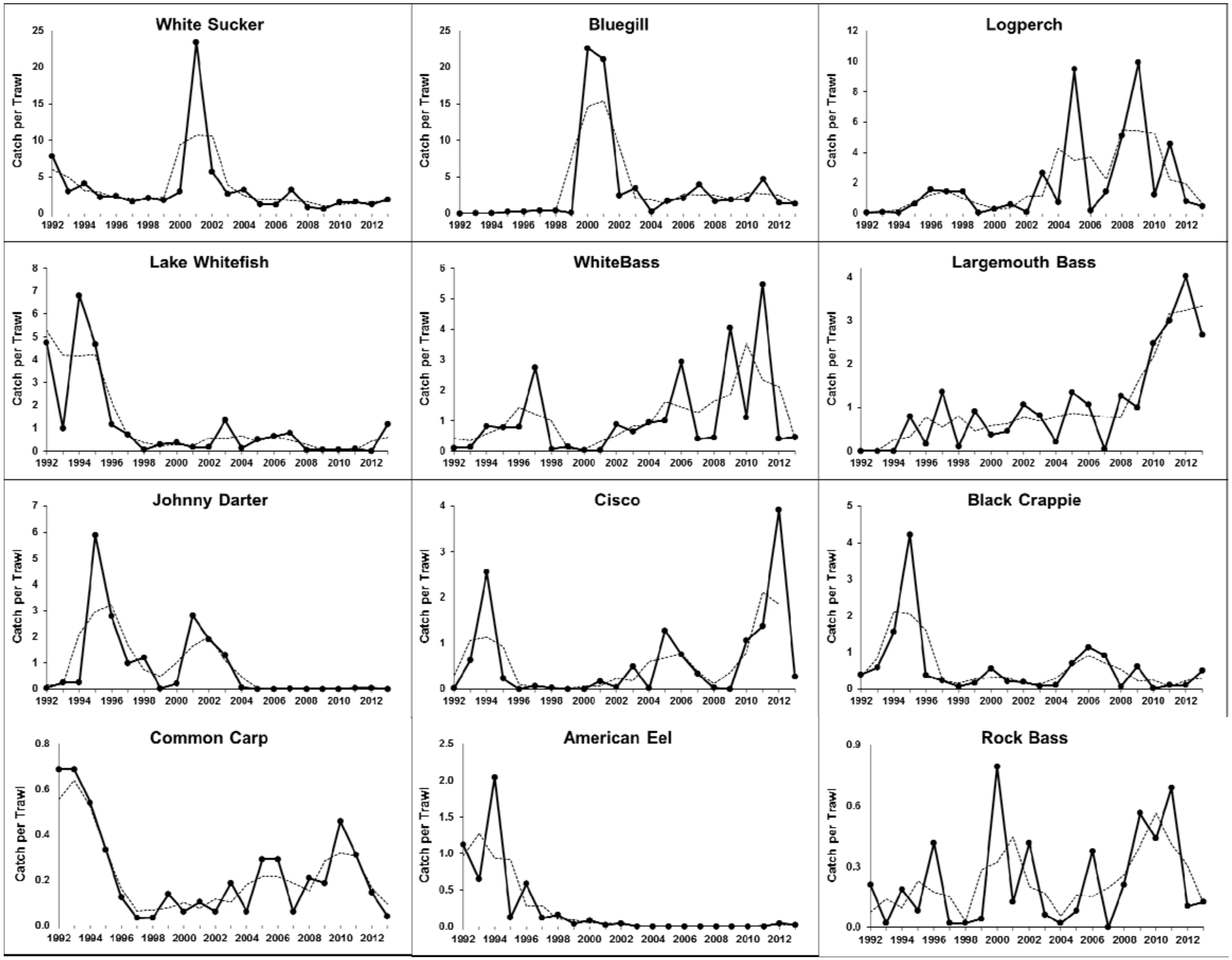


FIG. 2.3.2 (continued). Abundance trends for the most common species caught in bottom trawls at six sites in the Bay of Quinte (Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton; see Fig. 2.3.1). Values shown here are 3-yr running averages (two years for first and last years graphed).

TABLE 2.3.13. 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, 1992-2013. 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

TABLE 2.3.14. Mean catch-per-trawl of **age-0 Lake Herring** at Conway in the lower Bay of Quinte, 1992-2013. 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

TABLE 2.3.15. Mean catch-per-trawl of **age-0 Yellow Perch** at six Bay of Quinte sites, 1992-2013. 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

TABLE 2.3.16. Mean catch-per-trawl of **age-0 Walleye** at six Bay of Quinte sites, 1992-2013. 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

TABLE 2.3.17. Age distribution of 93 **Walleye** sampled from summer bottom trawls, Bay of Quinte, 2013. Also shown are mean fork length and mean weight. Fish of less than 150 mm fork length (n = 8) were assigned an age of 0, fish between 150 and 290 mm (n = 25) were aged using scales; and those over 290 mm fork length (n = 60) were aged using otoliths.

	Age / Year-class									
	0	1	2	3	4	5	6	8	20	
	2013	2012	2011	2010	2009	2008	2007	2005	1993	Total
Number	16	19	35	13	3	4	1	1	1	93
Mean fork length (mm)	148	250	339	436	459	501	538	539	612	
Mean weight (g)	41	165	427	948	1187	1618	2135	1795	2852	

2.4 Lake Ontario Nearshore Community Index Netting

The nearshore community index netting program (NSCIN) was initiated on the upper Bay of Quinte (Trenton to Deseronto) in 2001, and was expanded to include the lower Bay of Quinte (Deseronto to Lake Ontario) in 2002. Both upper and lower Bay of Quinte were sampled from 2002 -2005. In 2006, the NSCIN program was conducted on Hamilton Harbour and the Toronto waterfront area thanks to partnerships developed with the Department of Fisheries and Oceans Canada and the Toronto Region Conservation Authority. In 2007, NSCIN was conducted in five areas: Lake St. Francis (St. Lawrence River), the upper Bay of Quinte, East and West Lakes (two Lake Ontario embayments on the southwest side of Prince Edward County), and the Toronto Waterfront area. In 2008, NSCIN was conducted in five areas: Lake St. Francis (St. Lawrence River), the upper Bay of Quinte, Weller's Bay, Presqu'ile Bay, and Hamilton Harbour. In 2009, five areas were completed: upper Bay of Quinte, lower Bay of Quinte, Prince Edward Bay, North Channel/Kingston, and the Thousand Islands. In 2010, three areas were completed: Hamilton Harbour, the Toronto Waterfront, and the upper Bay of Quinte. In 2011, two areas were completed: upper and lower Bay of Quinte. In 2012, three areas were completed: Hamilton Harbour, the Toronto Waterfront, and the upper Bay of Quinte. In 2013, four areas were completed: East Lake, West Lake, Prince Edward Bay and the upper Bay of Quinte (Fig. 2.4.1).

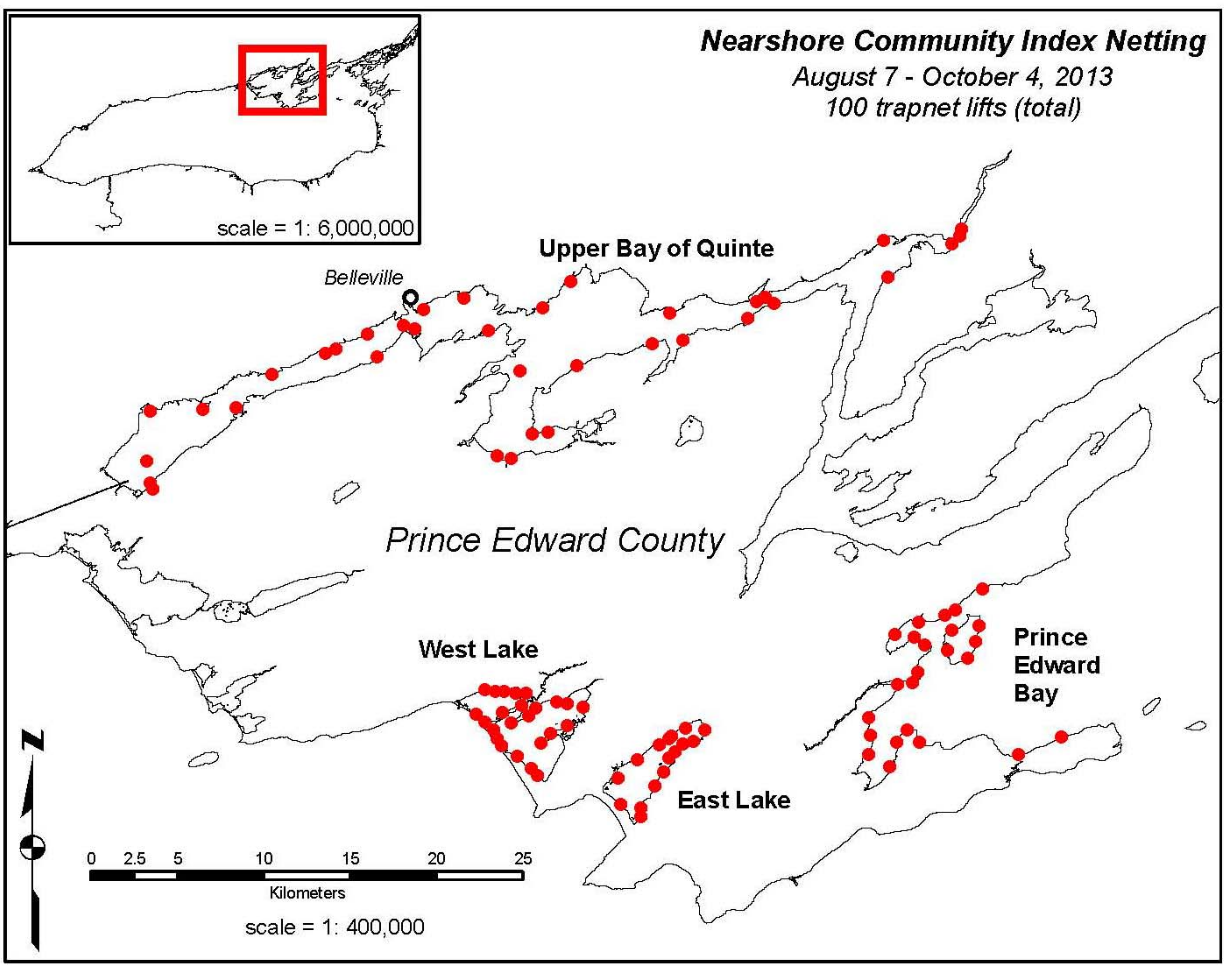


FIG. 2.4.1. Map of Lake Ontario indicating NSCIN trap net locations in East Lake, West Lake, Prince Edward Bay and the upper Bay of Quinte, 2013 .

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.

East Lake

Sixteen trap net sites were sampled on East Lake from Aug 20-23 with water temperatures ranging from 22.4-23.8 ^{o}C (Table 2.4.1). More than 1,100 fish comprising 14 species were captured (Table 2.4.2). The most abundant species by number were Pumpkinseed (379), Bluegill (339) and Brown Bullhead (165).

The age distribution and mean length by age-class of selected species are shown in Tables 2.4.3 and Table 2.4.4. Abundance trends for all species are presented in Table 2.4.5 and graphically for selected species in Fig. 2.4.2. Abundance of all major species was lower in 2013 than in 2007 except for Largemouth Bass and Yellow Perch.

West Lake

Twenty-four trap net sites were sampled on West Lake from Aug 7-16 with water temperatures ranging from 19.4-23.3 ^{o}C (Table 2.4.1). Over 1,600 fish comprising 18 species were captured (Table 2.4.2). The most abundant species by number were Bluegill (749), Brown Bullhead (272), Pumpkinseed (261), Black Crappie (116), Rock Bass (66), and Longnose Gar (44). A single American Eel was captured. This Eel was caught on Aug 8, was 844 mm total length and weighed 1,812 g.

Northern Pike, White Perch, Smallmouth Bass, and Yellow Perch abundance was lower in 2013. American Eel abundance was higher in 2013. Largemouth Bass and Black Crappie abundance were also higher (Table 2.4.5 and Fig. 2.4.2).

Prince Edward Bay

Twenty-four trap net sites were sampled on Prince Edward Bay from Sep 10-20 with water

TABLE 2.4.1. Survey information for the 2013 NSCIN trap net program on East Lake, West Lake, Prince Edward Bay and the upper Bay of Quinte. Shown for each embayment are the survey dates, the range of observed surface water temperatures, the total number of trap net lifts, and the number of trap net lifts broken down by target sampling depth, and observed substrate and cover types.

		East Lake	West Lake	Prince Edward Bay	Upper Bay of Quinte
Survey dates		Aug 20-23	Aug 7-16	Sep 10-20	Sep 17-Oct 4
Water temperature range (^{o}C)		22.4-23.8	19.4-23.3	16.5-20.9	14.9-18.4
No. of trap net lifts		16	24	24	36
No. of lifts by depth:					
	Target (2-2.5 m)	5	8	8	14
	> Target	2	3	8	19
	< Target	9	13	8	3
No. of lifts by substrate type:					
	Hard	5	7	9	17
	Soft	11	17	15	19
No. of lifts by cover type:					
	None	5	3	9	2
	1-25%	8	16	7	8
	26-75%	3	5	3	19
	76-100%	0	0	5	7

TABLE 2.4.2. Species-specific catch in the 2013 NSCIN trap net program on East Lake, West Lake, Prince Edward 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 25 species were caught.

	East Lake				West Lake				Prince Edward Bay				Upper Bay of Quinte			
Species	Arithmetic mean	Geometric mean	Relative standard error (%)	Mean length (mm)	Arithmetic mean	Geometric mean	Relative standard error (%)	Mean length (mm)	Arithmetic mean	Geometric mean	Relative standard error (%)	Mean length (mm)	Arithmetic mean	Geometric mean	Relative standard error (%)	Mean length (mm)
Longnose gar	5.125	3.698	14	710	1.833	0.908	26	713	0.125	0.091	55	803	0.194	0.122	45	800
Bowfin	0.438	0.330	34	544	0.208	0.128	56	424	1.625	0.960	22	581	0.917	0.493	26	551
Gizzard shad					0.042	0.029	100	310					0.056	0.039	70	390
Rainbow trout									0.083	0.059	69	295				
Northern pike	0.625	0.451	32	496	0.583	0.463	22	537	1.458	1.145	15	641	0.278	0.180	36	644
White sucker	0.250	0.189	45	435	0.292	0.142	62	414	1.500	0.845	24	451	0.861	0.634	17	415
Silver redhorse													0.833	0.438	29	501
Shorthead redhorse													0.306	0.178	40	429
Greater redhorse													0.833	0.380	32	428
River redhorse													0.139	0.051	100	600
Common carp	0.063	0.044	100	380	0.333	0.260	29	505	0.625	0.272	50	674	0.250	0.170	35	588
Golden shiner									0.042	0.029	100	140	0.056	0.039	70	130
Brown bullhead	10.313	6.709	11	282	11.333	5.179	13	278	66.042	17.177	13	249	15.278	6.445	11	275
Channel catfish					0.125	0.091	55	333					0.056	0.039	70	585
American eel					0.042	0.029	100	840	0.167	0.091	73	790	0.444	0.151	57	698
White perch	0.063	0.044	100	190	1.042	0.624	27	208	0.208	0.128	56	200	19.417	2.824	19	183
Rock bass	2.813	2.002	17	189	2.750	1.575	19	171	3.833	1.704	21	185	7.972	1.800	19	177
Pumpkinseed	23.688	20.157	5	171	10.875	7.611	8	152	2.875	1.031	28	121	14.722	5.509	12	134
Bluegill	21.188	20.557	2	158	31.208	20.860	7	136	2.125	0.790	31	129	53.556	16.849	9	132
Smallmouth bass	0.813	0.475	38	342	0.083	0.047	100	360	1.417	0.833	24	314	0.472	0.268	34	333
Largemouth bass	2.750	1.778	20	262	1.750	1.090	20	242	2.750	1.369	21	281	4.333	2.043	14	251
Black crappie					4.833	3.912	8	195	2.292	1.152	23	217	11.361	5.383	11	232
Yellow perch	0.625	0.488	27	203	0.208	0.155	41	183	0.417	0.217	47	197	2.694	1.331	18	193
Walleye	1.313	0.900	25	394	1.250	0.901	19	390	0.083	0.059	69	530	7.556	3.278	13	431
Freshwater drum									0.042	0.029	100	530	0.944	0.477	27	467
Total catch per net	70				69				88				144			
Number of species	14				18				18				23			
Number of nets	16				24				24				36			
Total catch	1121				1651				2105				5167			

Table 2.4.3. Age distribution of selected species caught in Hamilton Harbour, the Toronto Waterfront, and the upper Bay of Quinte, 2013.

	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2000
Location / Species	1	2	3	4	5	6	7	8	9	10	13
West Lake											
Northern Pike		4	4	5	1						
Pumpkinseed			4	6	2	4	8	5			
Bluegill			1	6	13	3	6	2			
Smallmouth Bass		1		1							
Largemouth Bass	7	12	3	4	1	1	3				
Black Crappie		25	4	1							
Yellow Perch			2	2	1						
Walleye	3	11	2	2	3	2	1		2	3	1
East Lake											
Northern Pike		4	4						1		
Pumpkinseed		1	2	3	8	6	8	2			
Bluegill			7	4	6	9		2	1		
Smallmouth Bass	1	1	3	1	1	1					
Largemouth Bass	3	8	10	7	2			1			
Yellow Perch		1	2	3			2				
Walleye		10		1	4	2	3			1	
Prince Edward Bay											
Northern Pike		3	12	6	6	1			2		
Pumpkinseed		7	9	6	2	5	1				
Bluegill	1	16	6			1					
Smallmouth Bass	1	1	11	3	10	3	1				
Largemouth Bass	10	4	2			3	7	1	2	2	
Black Crappie		23	6	1	1						
Yellow Perch		3	1	3	1						
Walleye				1						1	
Upper Bay of Quinte											
Northern Pike		3	3	2		2					
Pumpkinseed		2	10	13	5	2					
Bluegill		2	17	8	5						
Smallmouth Bass		1	4	3				1			
Largemouth Bass	7	20	6	4							
Black Crappie	5	44	3								
Yellow Perch		4	12	8	3	3	5		1		
Walleye	1	19	8	1	5	3			1		

Table 2.4.4. Mean fork length (mm) of selected species caught in Hamilton Harbour, the Toronto Waterfront, and the upper Bay of Quinte, 2013.

	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2000	
Location / Species	1	2	3	4	5	6	7	8	9	10	13	Total
West Lake												
Northern Pike		463	521	536	703							523
Pumpkinseed			124	145	164	167	173	178				160
Bluegill			108	127	151	169	157	171				149
Smallmouth Bass		300		394								347
Largemouth Bass	165	229	297	348	372	381	358					258
Black Crappie		193	246	281								203
Yellow Perch			181	199	177							187
Walleye	263	317	411	449	453	449	450		530	425	454	383
East Lake												
Northern Pike		442	458						772			486
Pumpkinseed		92	112	132	153	171	179	180				159
Bluegill			94.3	102	132	152		171	194			130
Smallmouth Bass	187	260	307	343	368	388						308
Largemouth Bass	155	247	275	299	310			405				268
Yellow Perch		143	187	210			274					212
Walleye		323		362	441	430	454			558		387
Prince Edward Bay												
Northern Pike		509	585	608	673	789			843			624
Pumpkinseed		106	116	130	137	142	135					123
Bluegill	101	133	146			199						138
Smallmouth Bass	165	235	285	287	342	376	416					312
Largemouth Bass	178	223	254			359	380	376	409	409		288
Black Crappie		198	224	235	289							207
Yellow Perch		192	216	211	260							211
Walleye				483						550		517
Upper Bay of Quinte												
Northern Pike		547	602	710		727						632
Pumpkinseed		127	135	143	154	178						143
Bluegill		104	131	141	160							137
Smallmouth Bass		234	256	362				439				309
Largemouth Bass	192	260	321	351								267
Black Crappie	168	226	232									220
Yellow Perch		176	175	199	199	228	238		284			199
Walleye	261	380	473	477	473	486			534			424

TABLE 2.4.5. Species-specific abundance trends (mean catch per trap net) in East Lake West Lake, Prince Edward Bay, and the upper Bay of Quinte. Annual total catch per net lift, number of net sets, and number of species are also indicated.

	East Lake		West Lake			Prince Edward Bay		Upper Bay of Quinte											
Species	2007	2013	2001	2007	2013	2009	2013	2001	2002	2003	2004	2005	2007	2008	2009	2010	2011	2012	2013
Longnose gar	2.44	5.13	0.33	2.56	1.83	0.07	0.13	0.25	0.33	1.14	1.94	0.39	2.92	0.36	0.44	1.56	0.50	2.08	0.19
Bowfin	0.28	0.44	0.33	0.06	0.21	0.89	1.63	0.36	0.14	0.58	0.53	0.25	0.92	1.11	0.50	0.81	0.75	0.50	0.92
Alewife	-	-	-	-	-	8.07	-	-	-	-	-	-	-	-	-	-	-	-	-
Gizzard shad	-	-	0.17	0.11	0.04	-	-	1.11	1.44	2.00	0.06	20.42	0.39	1.00	0.06	0.64	0.14	0.33	0.06
Rainbow trout	-	-	-	-	-	-	0.08	-	-	-	-	-	-	-	-	-	-	-	-
Lake trout	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-
Lake whitefish	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-	-	-
Northern pike	1.33	0.63	0.67	2.06	0.58	1.70	1.46	1.03	0.58	0.86	0.69	0.64	0.44	0.33	0.28	0.83	0.78	0.53	0.28
Mooneye	-	-	-	-	-	-	-	0.03	-	-	-	-	-	-	-	-	-	-	-
Quillback	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-
White sucker	1.00	0.25	0.50	0.33	0.29	0.63	1.50	1.03	1.47	1.72	1.25	1.11	0.44	0.92	0.64	0.44	0.42	0.72	0.86
Silver redhorse	-	-	-	-	-	0.04	-	-	-	0.69	0.81	0.28	0.64	0.50	1.44	0.44	0.17	0.47	0.83
Shorthead redhorse	-	-	-	-	-	-	-	-	-	0.08	0.47	0.25	0.19	0.33	0.36	0.06	0.19	0.08	0.31
Greater redhorse	-	-	-	-	-	-	-	-	-	0.22	0.06	-	-	0.08	0.06	-	0.44	0.28	0.83
River redhorse	-	-	-	-	-	-	-	0.06	-	0.14	0.17	0.14	0.11	0.44	0.03	-	0.14	0.08	0.14
Moxostoma sp.	-	-	-	-	-	-	-	0.78	0.42	0.08	-	-	-	-	-	-	-	-	-
Common carp	0.17	0.06	0.17	0.11	0.33	0.37	0.63	0.08	0.11	0.28	0.08	0.11	0.19	0.22	0.19	0.33	0.22	0.47	0.25
Golden shiner	-	-	-	0.06	-	0.04	0.04	0.03	-	0.03	-	0.03	-	0.22	-	0.06	0.14	0.03	0.06
Brown bullhead	19.11	10.31	19.67	12.22	11.33	55.41	66.04	167.67	95.83	37.33	20.83	17.89	7.25	6.42	2.56	10.56	13.69	7.11	15.28
Channel catfish	0.06	-	-	0.06	0.13	-	-	2.17	2.17	1.50	1.33	1.72	0.72	0.81	0.28	0.53	0.58	0.31	0.06
American eel	-	-	-	-	0.04	-	0.17	0.44	0.14	-	0.03	0.06	-	-	-	-	0.11	0.03	0.44
White perch	0.17	0.06	1.33	10.89	1.04	0.11	0.21	2.19	2.89	7.69	3.67	2.75	4.61	4.31	3.86	1.69	3.75	3.58	19.42
White bass	-	-	-	-	-	-	-	0.06	0.14	0.11	0.11	0.19	0.03	0.14	-	-	0.17	0.08	-
Rock bass	1.78	2.81	1.67	2.17	2.75	24.11	3.83	0.92	0.67	0.64	0.58	0.50	4.83	3.97	3.89	2.44	4.50	1.08	7.97
Pumpkinseed	38.50	23.69	15.83	16.61	10.88	18.15	2.88	89.39	73.08	26.94	15.33	15.97	18.61	18.14	23.42	29.08	37.53	28.11	14.72
Bluegill	42.22	21.19	88.33	29.00	31.21	0.15	2.13	169.58	142.64	66.25	75.19	44.44	63.92	159.11	71.75	61.50	136.03	74.92	53.56
Smallmouth bass	2.50	0.81	1.83	0.72	0.08	1.11	1.42	0.94	1.67	0.36	1.64	1.11	0.11	0.92	0.56	0.44	0.47	0.14	0.47
Largemouth bass	1.89	2.75	1.17	1.06	1.75	1.74	2.75	2.47	6.11	7.92	6.08	2.75	4.53	5.39	4.33	4.25	10.39	2.72	4.33
Black crappie	0.11	-	7.83	1.72	4.83	0.74	2.29	9.81	15.00	10.22	16.11	8.11	12.92	17.33	10.03	7.53	8.64	4.78	11.36
Yellow perch	0.33	0.63	1.17	0.50	0.21	4.70	0.42	3.75	3.42	1.94	0.83	1.00	4.72	7.00	2.64	6.11	6.25	1.31	2.69
Walleye	1.83	1.31	1.17	1.50	1.25	0.70	0.08	3.17	2.47	2.22	2.56	2.14	1.61	2.50	1.75	2.53	2.36	1.44	7.56
Freshwater drum	0.17	-	0.17	0.17	-	0.41	0.04	6.36	3.31	3.81	2.14	4.36	1.25	1.17	1.89	1.97	1.67	2.19	0.94
Total catch per net	114	70	142	82	69	119	88	464	354	175	153	127	131	233	131	134	230	133	144
Number of net lifts	18	16	6	18	24	27	24	36	36	36	36	36	36	36	36	36	36	36	36
Number of species	17	14	17	19	18	19	19	24	21	25	25	25	22	24	23	21	25	25	24

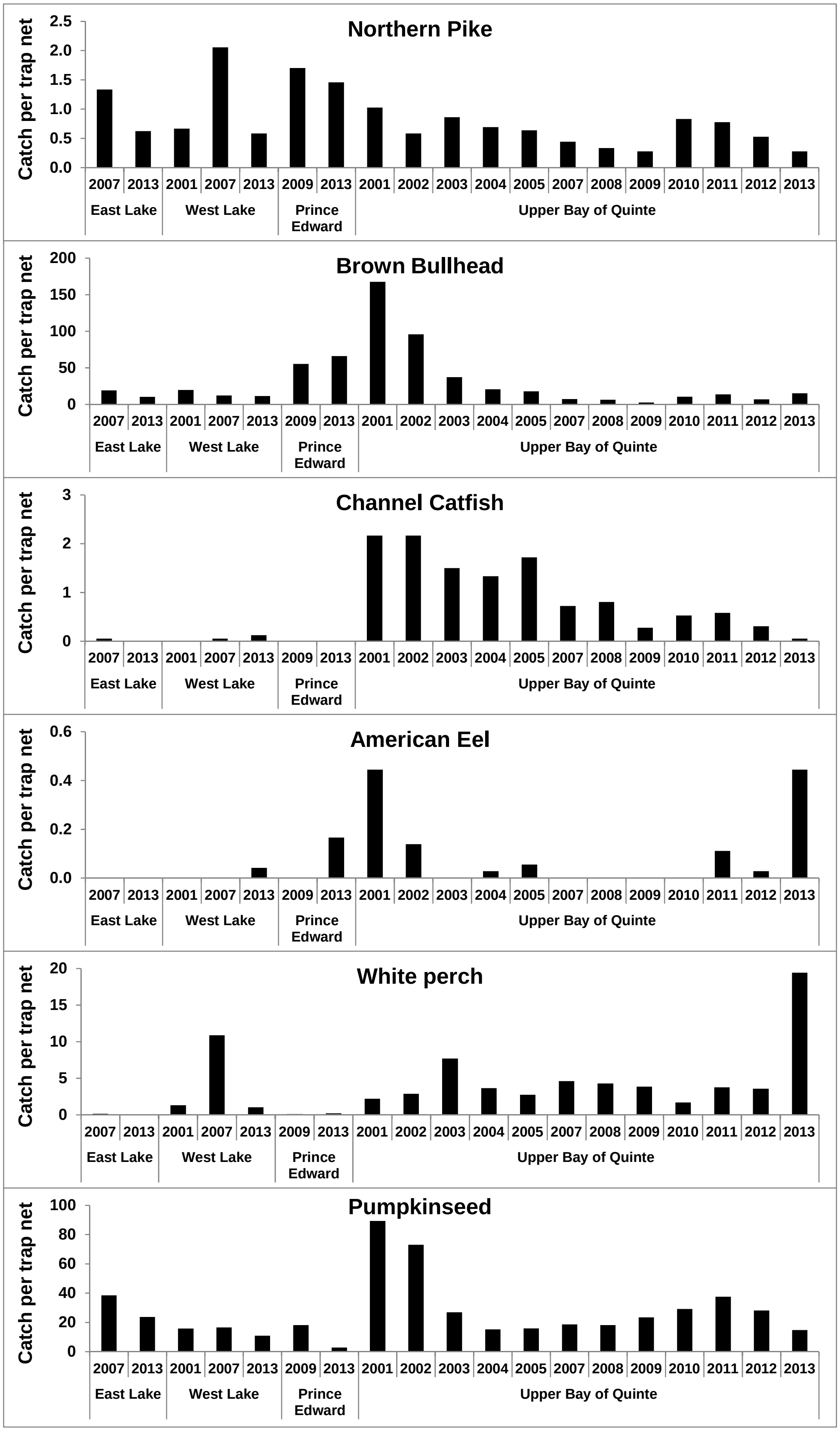


FIG. 2.4.2. Abundance trends for selected species caught in nearshore trap nets in East Lake, West Lake, Prince Edward Bay, and the upper Bay of Quinte. Values shown are annual arithmetic means.

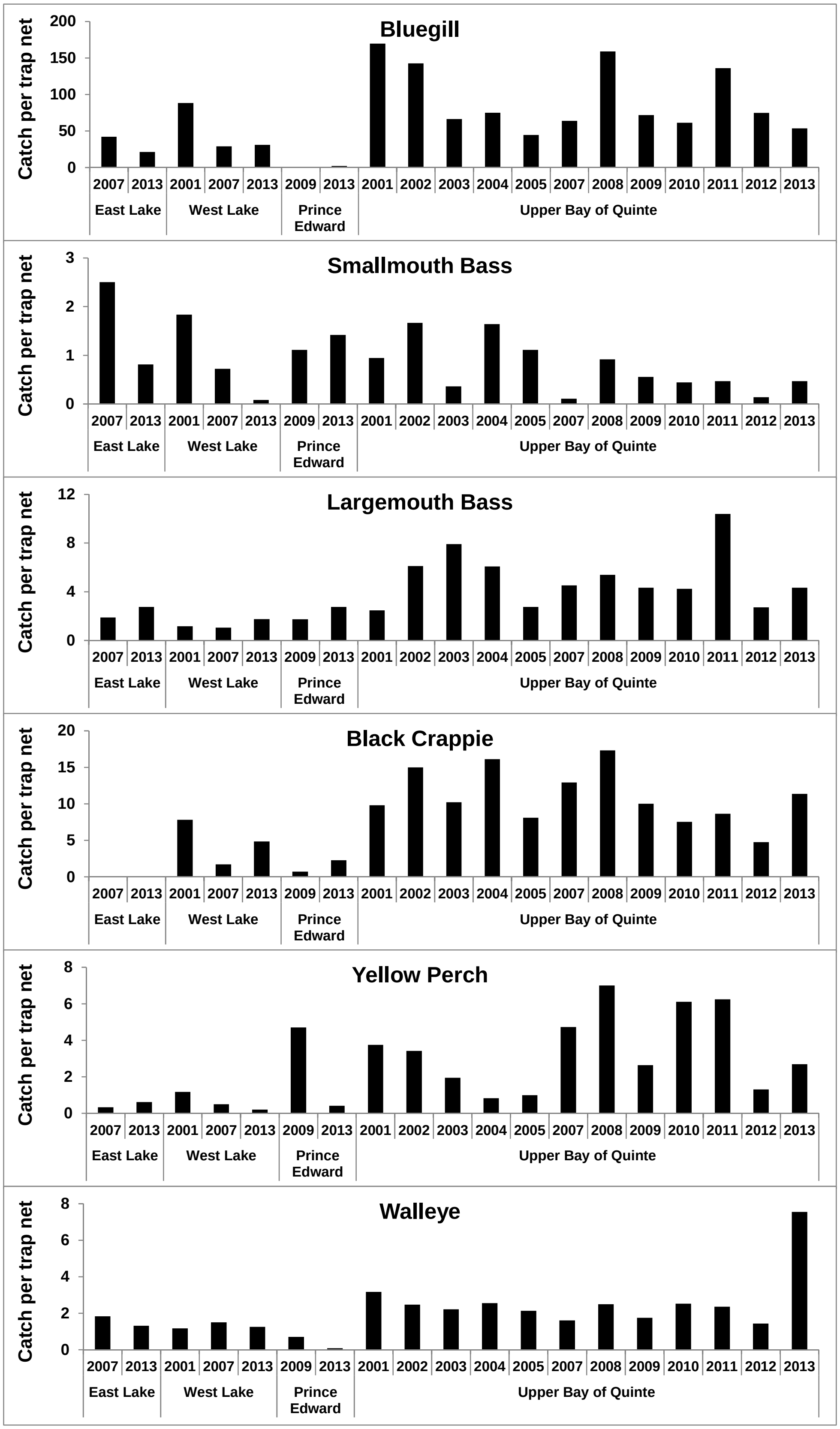


FIG. 2.4.2. (continued) Abundance trends for selected species caught in nearshore trap nets in East Lake, West Lake, Prince Edward Bay, and the upper Bay of Quinte. Values shown are annual arithmetic means.

temperatures ranging from 16.5-20.9 ^{o}C (Table 2.4.1). Over 2,100 fish comprising 18 species were captured (Table 2.4.2). The most abundant species by number were Brown Bullhead (1,585), Rock Bass (92), Pumpkinseed (69), Largemouth Bass (66), Black Crappie (55), and Bluegill (51). Four American Eel were caught in 2013. These eel ranged in size from 732-823 mm total length and 918-1,457 g in weight.

The abundance of Pumpkinseed, Yellow Perch, and Walleye was lower in 2013 than 2007. (Table 2.4.5 and Fig. 2.4.2).

Upper Bay of Quinte

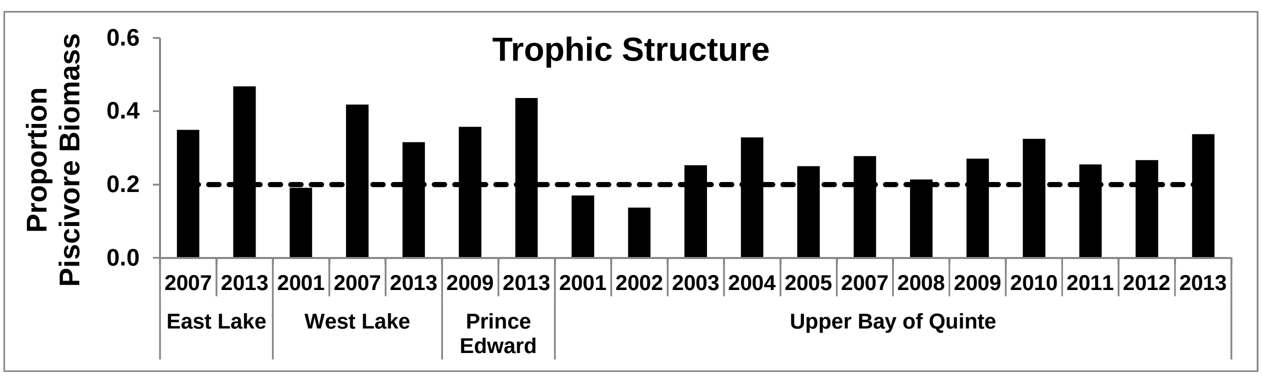
Thirty-six trap net sites were sampled on the upper Bay of Quinte from Sep 17-Oct 4 with water temperatures ranging from 14.9-18.4 ^{o}C (Table 2.4.1). Over 5,100 fish comprising 23 species were captured (Table 2.4.2). The most abundant species by number were Bluegill (1,928), White Perch (699), Brown Bullhead (550), Pumpkinseed (530), Black Crappie (409), Rock Bass (287), Walleye (272), and Largemouth Bass (156). Sixteen American Eel were caught in 2013. These eel ranged in size from 612-806 mm total length and 527-1,413 g in weight.

Northern Pike abundance declined from 2001-2009, increased significantly in 2010, then declined through 2013. Brown Bullhead and Channel Catfish remained at low abundance. American Eel abundance in 2013 was the highest since 2001. White Perch abundance was unusually high in 2013. Pumpkinseed and Bluegill abundance declined slightly. Smallmouth Bass, Largemouth Bass, Black Crappie and Yellow Perch abundance increased slightly in 2013 compared to 2012. Walleye abundance was very high relative to previous years (Table 2.4.5 and Fig. 2.4.2).

Piscivore Biomass

Trophic structure is an indicator of general health of a fish community. A proportion of the fish community assemblage comprised of piscivores greater than 0.2 (biomass) reflects a healthy trophic structure. The proportion of piscivore biomass in 2013 was 0.47, 0.32. 0.44 and 0.34 in East Lake, West Lake, Prince Edward Bay, and the upper Bay of Quinte, respectively (Fig. 2.4.3).

FIG. 2.4.3. Proportion of total fish community biomass represented by piscivore species (PPB) in the nearshore trap net surveys in East Lake, West Lake, Prince Edward Bay, and the upper Bay of Quinte. 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.



2.5 Lake-wide Hydroacoustic Assessment of Prey Fish

The status of prey fish in Lake Ontario has been assessed since 1991 with a mid-summer hydroacoustic survey conducted jointly by the Ontario Ministry of Natural Resources (OMNR) and the New York State of Department of Environmental Conservation (NYSDEC). Results from the hydroacoustic survey complement information obtained in spring bottom trawling surveys conducted in the U.S. waters of the lake, and provides whole-lake indices of abundance for Alewife, Rainbow Smelt, and mysis, and can provide information about the midsummer distribution of these important species.

The survey consists of five, north-south shore-to-shore transects in the main lake, and one transect in the Kingston Basin. (Fig. 2.5.1). Hydroacoustic data was collected beginning at approximately one hour after sunset from 10m depth on one shore and running to the opposite shore at 10m of depth or until approximately one hour before sunrise. Since 2005, transects have been randomly selected annually from within 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 distance of the transect that occurs in less than 100m of water along the southern shore which has a much steeper slope than the northern shore. Temperature profiles and mysis hauls are conducted at multiple intervals along each transect. Floating vertical gillnets were used to collect fish to ground truth the acoustic information.

Acoustic data are collected using a Biosonics 120 kHz split-beam echosounder set at a rate of 1 ping per second and a pulse width of 0.4 milliseconds. Raw acoustic data are stratified based on thermal layer, bottom depth and geographical zone. Data are processed with Echoview software (Sonardata, version 4.9),

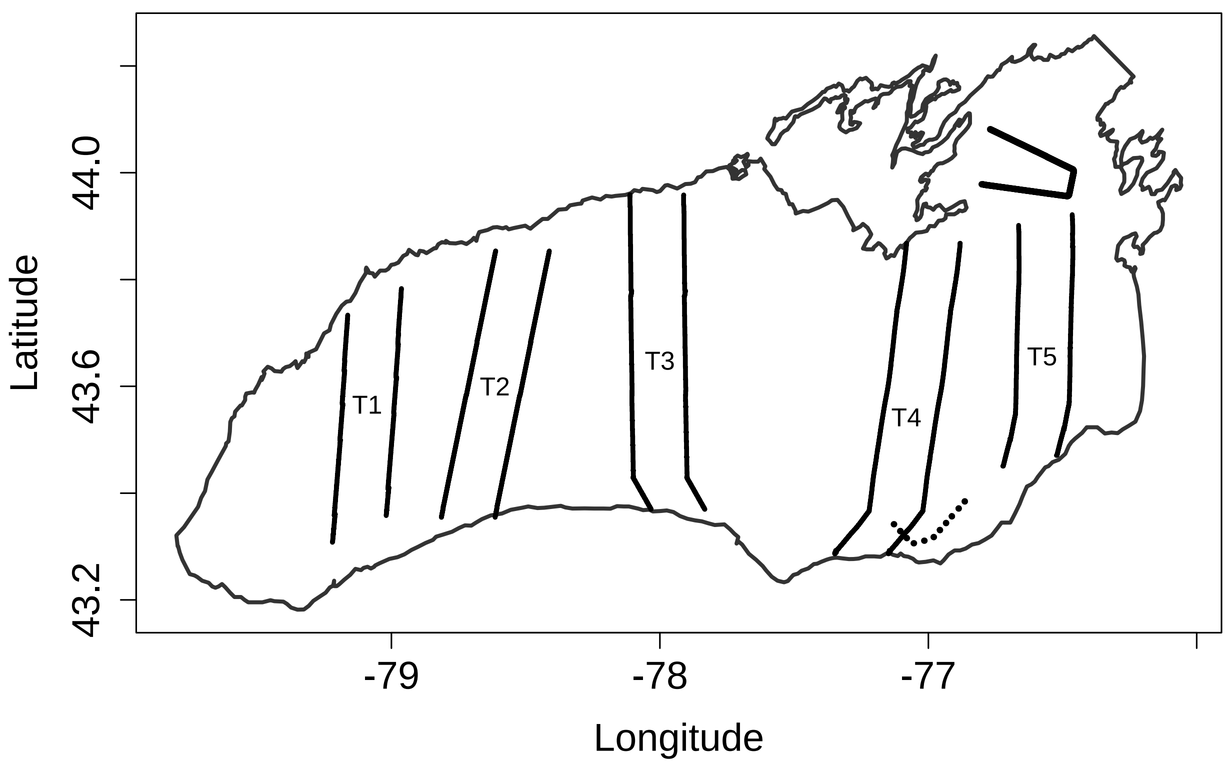


FIG. 2.5.1. The Lake Ontario Lake-wide prey fish survey uses cross-lake hydroacoustic transects. Transect corridors are logistically constrained but utilize a random starting point within the corridor for each annual survey. The dotted line represents an additional transect that was used in 2013 for comparison of upward and downward looking acoustic methods.

using -64 dB volume backscattering strength and target strength thresholds.

In recent years the southern portions of transect 4 and 5 and an additional transect (indicated by a dotted line in Fig. 2.5.1 for 2013) have been used in comparisons between down-looking and up-looking acoustics as part of an ongoing effort to address sampling issues arising from near-surface distribution of fish.

The 2013 survey was conducted from July 14th to July 21st using two vessels, OMNR's Lake Ontario Explorer and NYSDEC's Seth Green. Weather and vessel impairments reduced the amount of time available for the survey and as a result transects 1 and 2 were combined as a single, modified transect (see cruise path in Figs. 2.5.2 and 2.5.3).

An index of yearling-and-older Alewife abundance was derived from the scaled integrated voltage of Alewife sized targets in the epilimnion and metalimnion, which are the water temperature layers that Alewife were caught in the vertical gill -nets. The 2013 Alewife index is 681 million yearling-and-older fish, which is 2.5 times higher than the abundance observed in 2012 and 3.7 times higher than the previous ten-year average (Fig. 2.5.4). The Alewife index in 2013 was similar to levels observed between 1997-2002 (701 million fish). Higher Alewife abundance is likely due to the strong 2012 year class, as well as moderate to strong year classes in 3 out of the last 5 years[1]. The increase in the biomass index (14,034 metric tonnes) mostly reflects the increase in abundance and not an increase in Alewife size, as the mean Alewife size varied only slightly between 2012 and 2013 (20.0 and 20.6 g, respectively). Mean Alewife size was determined from the NYSDEC and US Geological Survey (USGS) spring Alewife trawling program[1]. The Alewife distribution during the survey period appeared to largely be

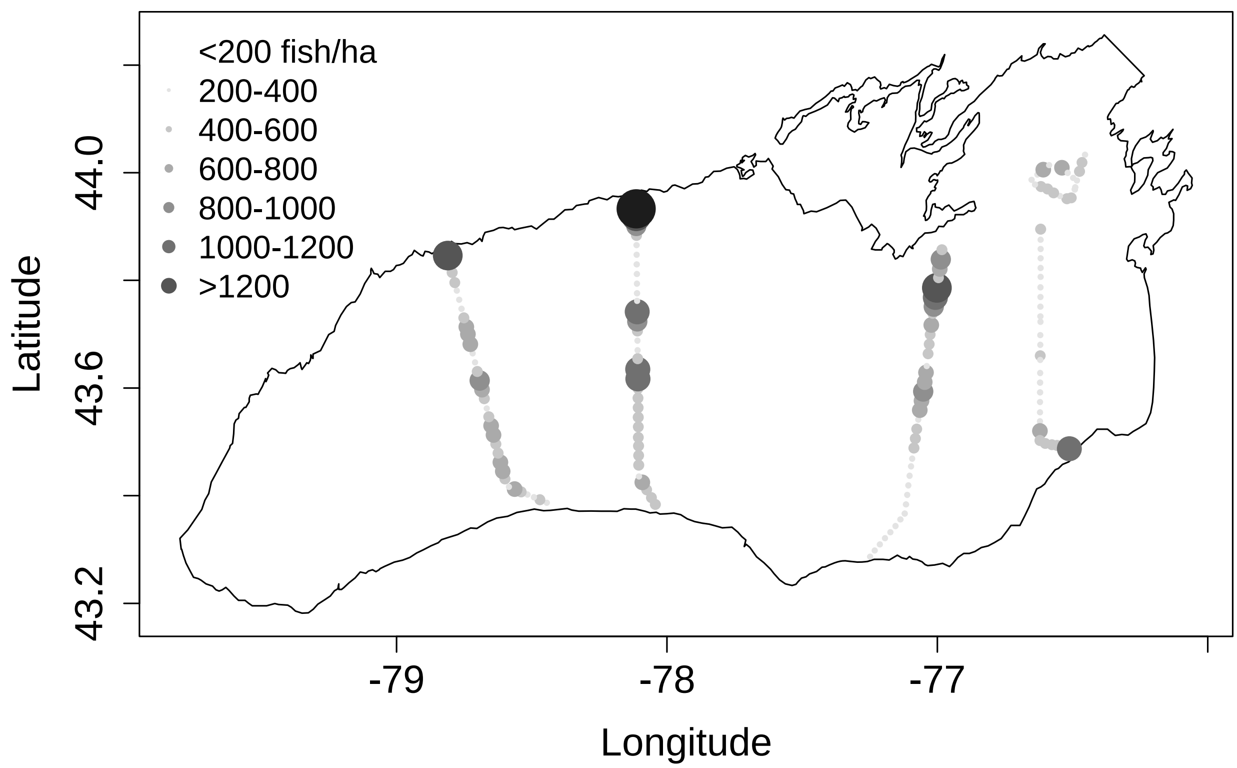


FIG. 2.5.2. Relative distribution of Alewife observed during the hydroacoustic survey in July 2013. The standard survey design was modified in 2013 due to logistical constraints which resulted in a single western transect.

distributed along the north shore of Lake Ontario (Fig. 2.5.4) with the highest densities observed in close proximity to Cobourg, ON. The spatial distribution at a whole lake scale is a unique product provided by the hydroacoustic survey.

The Rainbow Smelt index consists of all targets below the thermocline with a target strength greater than -55dB. The 2013 estimate of yearling-and-older Rainbow Smelt was 19 million fish which is the lowest estimate in the time series. Rainbow Smelt Lake-wide biomass is estimated to be 110 metric tonnes based on a mean Rainbow Smelt weight of 5.8 grams derived from the NYSDEC and USGS summer Rainbow Smelt bottom trawling program[2]. The highest densities of smelt were observed in the eastern portion of the lake (Fig. 2.5.5). Relatively low densities of smelt were observed in the main basin of the lake and with the absence of the western most transect it is possible the lake-wide estimate is biased low.

Citations:

[1] Walsh, M. G., B. C. Weidel, and M. J. Connerton. 2014. Status of Alewife in the U.S. waters of Lake Ontario, 2013. Section 12, In 2013 NYSDEC Annual Report, Bureau of Fisheries Lake Ontario Unit and St. Lawrence River Unit to Great Lakes Fishery Commission's Lake Ontario Committee.

[2] Weidel, B.C., M.G. Walsh, and M.J. Connerton 2014. Status of Rainbow Smelt in the U.S. waters of Lake Ontario, 2013. Section 12, In 2013 NYSDEC Annual Report Bureau of Fisheries Lake Ontario Unit and St. Lawrence River Unit to Great Lakes Fishery Commission's Lake Ontario Committee.

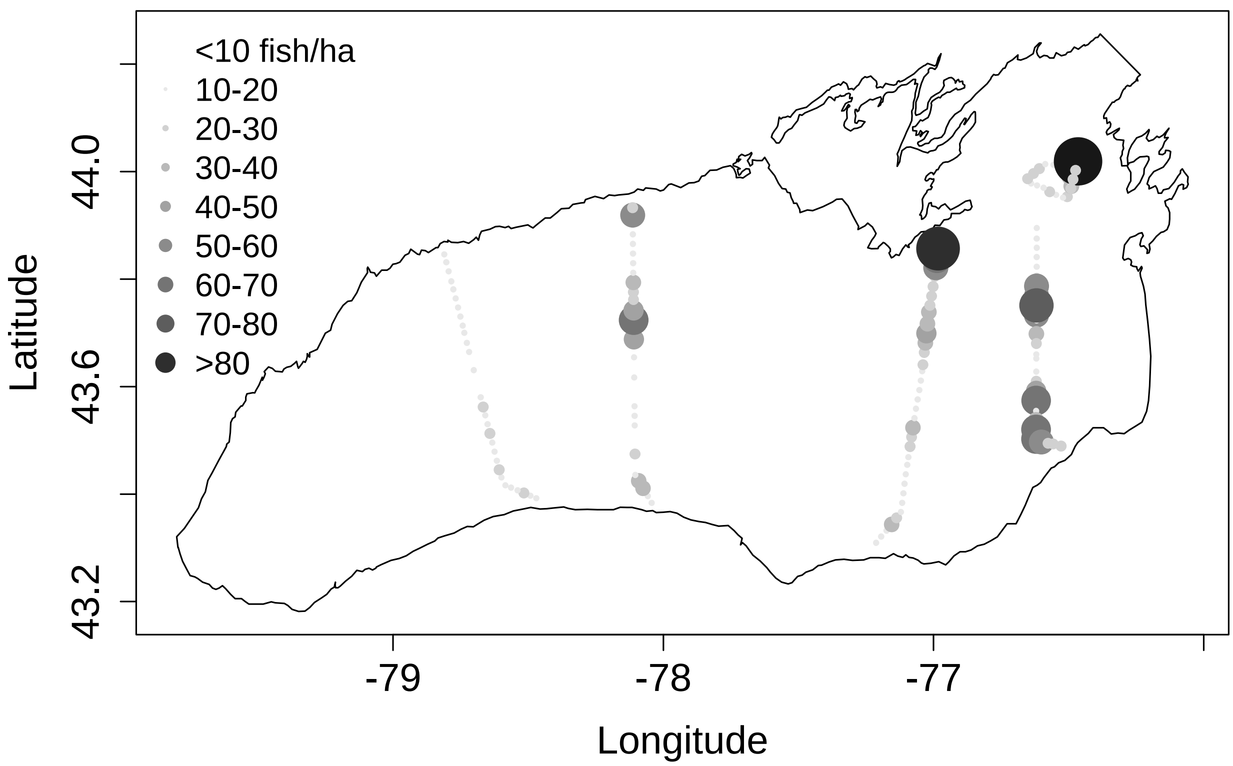


FIG. 2.5.3. Relative distribution of Rainbow Smelt observed during the hydroacoustic survey in July 2013. The standard survey design was modified in 2013 due to logistical constraints which resulted in a single western transect.

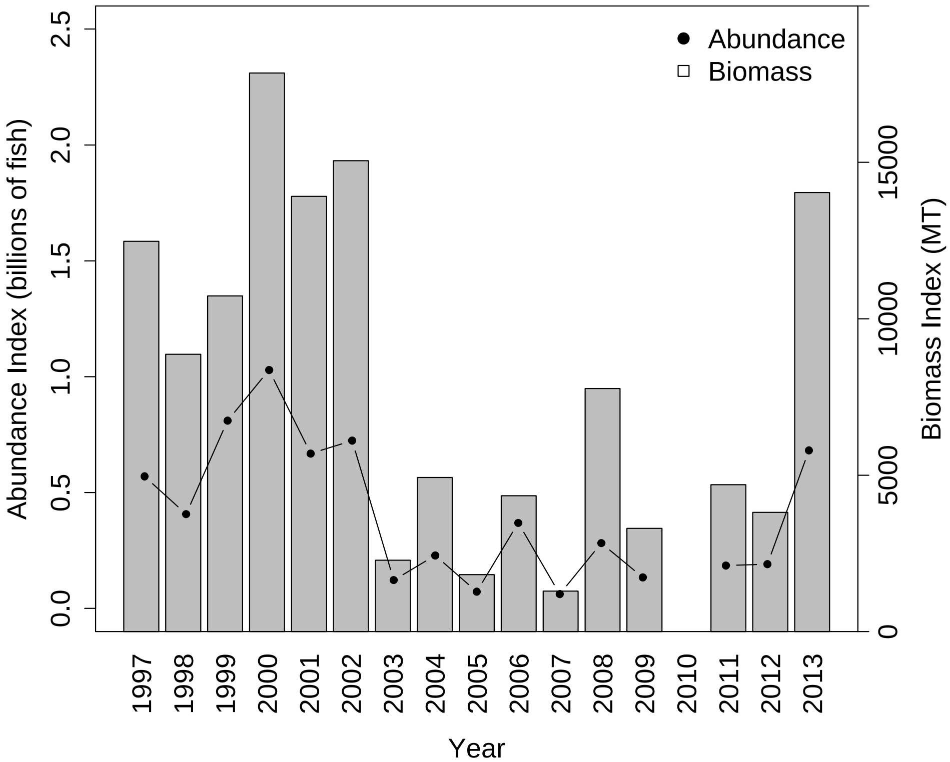


FIG. 2.5.4. Abundance and biomass of yearling-and-older Alewife from 1997-2013. Abundance estimates were obtained directly from hydroacoustic surveys. Biomass estimates were obtained by multiplying average weights of Alewife measured during spring bottom trawling surveys for Alewife[1].

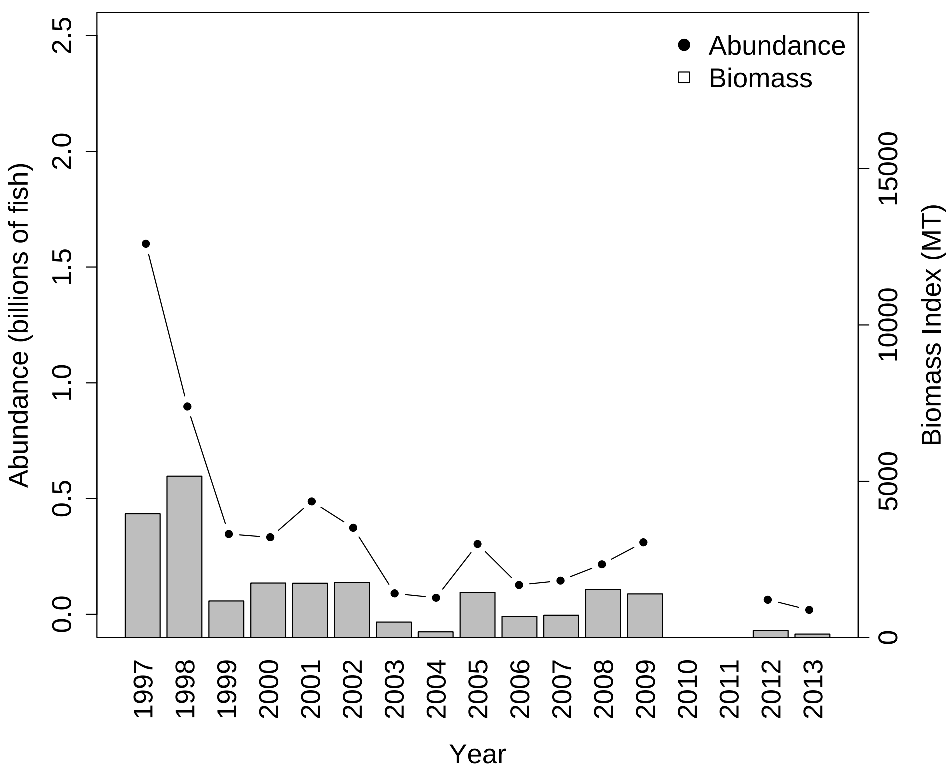


FIG. 2.5.5. Abundance and biomass of yearling-and-older Rainbow Smelt from 1997-2012. Abundance estimates were obtained directly from hydroacoustic surveys, biomass estimates were obtained by multiplying average weights of smelt measured during spring bottom trawling surveys for smelt[2].

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

Every other year in early fall, the Lake Ontario Management Unit conducts an index gillnet survey in the Thousand Islands. The survey is used to estimate fish abundance and measure biological attributes. Structures and tissues are collected for age determination, stomach content analysis, contaminant analysis, and pathological examination. The survey is part of a larger effort to monitor changes in the fish communities in four sections of the St. Lawrence River (Thousand Islands, Middle Corridor, Lake St. Lawrence, and Lake St. Francis), and it is coordinated with the New York State Department of Environmental Conservation (NYSDEC) to provide comprehensive assessment of the river's fisheries resources.

In 2013, the survey was conducted between September 3rd and September 18th. Forty eight sets were made, using standard gillnets consisting of 25-foot panels of monofilament meshes

TABLE 2.6.1. Catches per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2013. Catches from multifilament nets (all catches prior to 2001, and a portion of catches in 2001-2005) were increased by a factor of 1.58 to adjust to the modern monofilament netting standards initiated in 2001.

	1987	1989	1991	1993	1995	1997	1999	2001	2003	2005	2007	2009	2011	2013
Lake sturgeon	--	--	--	--	--	--	0.03	--	0.02	0.02	0.02	0.04	0.04	--
Longnose gar	--	--	0.03	--	--	0.03	--	--	0.07	0.04	--	0.04	0.04	--
Bowfin	0.08	0.13	--	0.08	0.03	0.07	--	0.03	0.07	0.05	0.08	0.06	0.13	0.02
Alewife	0.49	--	0.10	0.04	0.03	--	--	--	--	0.02	0.13	0.06	--	0.10
Gizzard shad	--	0.41	0.46	--	--	--	0.03	0.06	--	0.04	0.02	--	0.08	0.13
Chinook salmon	--	--	0.03	--	--	--	0.03	0.02	--	--	--	--	0.02	--
Rainbow trout	--	--	--	--	--	0.03	--	--	--	--	--	--	--	--
Brown trout	--	0.05	--	--	--	--	--	--	--	--	--	--	0.04	0.02
Lake trout	--	0.13	--	0.12	0.13	0.13	--	--	--	--	--	--	--	--
Cisco (Lake herring)	--		--	--	0.07	--	--	--	--	--	--	--	--	--
Chub	--	0.05	--	--	--	--	--	--	--	--	--	--	--	--
Northern pike	4.46	6.73	4.35	3.65	2.60	2.40	2.14	1.65	2.05	1.78	1.25	0.88	1.15	0.98
Muskellunge	--	--	0.03	--	0.03	--	--	0.03	0.04	--	--	--	--	--
Chain pickerel	--	--	--	--	--	--	--	--	--	--	--	0.02	--	--
White sucker	1.09	2.10	1.38	1.58	1.38	1.25	1.78	1.00	0.93	0.64	0.38	0.23	0.58	0.27
Silver redhorse	--	--	--	--	--	--	0.23	0.05	--	0.07	0.06	0.02	0.10	0.06
Shorthead redhorse	--	--	--	--	--	--	--	--	--	0.03	--	--	--	--
Greater redhorse	--	--	--	--	--	--	--	0.07	0.11	--	--	--	--	--
Moxostoma sp.	--	0.08	0.07	0.12	0.33	--	--	--	--	--	--	--	--	--
Common carp	0.05	0.13	0.10	0.04	0.10	0.36	0.13	0.10	0.12	0.04	0.02	--	0.04	--
Golden shiner	0.05	0.05	--	0.04	0.03	--	0.03	--	--	0.04	0.06	0.31	0.13	0.08
Brown bullhead	2.56	1.79	2.47	1.01	0.95	1.91	3.85	3.74	2.66	4.69	1.13	3.58	1.67	0.58
Channel catfish	0.81	0.08	0.56	0.16	0.30	0.30	0.56	0.31	0.35	0.20	0.67	0.54	0.63	0.25
White perch	0.08	--	0.36	0.04	0.07	--	0.07	0.12	0.02	0.15	--	--	--	0.10
White bass	0.05	0.60	0.43	0.24	--	0.07	--	--	--	--	--	--	0.29	--
Rock bass	4.14	4.46	5.43	4.13	5.56	4.94	7.54	11.26	7.27	7.28	10.77	7.00	7.54	4.56
Pumpkinseed	4.61	6.19	5.83	4.09	2.80	2.40	3.23	1.89	1.21	0.67	0.63	0.44	0.35	0.29
Bluegill	0.65	0.88	0.43	0.04	--	0.16	0.07	0.02	0.14	0.10	0.02	0.08	0.06	0.06
Smallmouth bass	3.16	5.67	4.31	1.82	1.55	1.48	3.19	2.05	3.97	7.59	5.06	3.79	3.54	2.69
Largemouth bass	0.13	0.36	0.13	0.20	0.16	0.03	0.23	0.12	0.22	0.33	0.63	0.27	0.40	0.25
Black crappie	0.13	0.16	0.10	0.08	0.03	0.03	0.10	0.06	0.07	0.16	0.06	0.04	0.13	0.04
Yellow perch	27.79	17.62	15.41	17.62	22.68	21.43	22.22	22.13	20.44	14.26	28.65	20.88	35.27	11.98
Walleye	0.21	0.60	0.33	0.36	0.26	0.59	0.07	0.21	0.23	0.23	0.60	0.60	0.77	0.46
Round goby	--	--	--	--	--	--	--	--	--	0.77	0.19	0.19	0.02	0.02
Freshwater drum	--	0.03	0.10	--	0.03	0.10	--	0.07	0.04	0.30	0.04	0.21	0.13	0.08
Total Catch	50.54	48.30	42.43	35.49	39.14	37.72	45.52	45.00	40.03	39.52	50.46	39.29	53.15	23.04

ranging from 1.5 to 6 inches in half-inch increments. The average set duration was 21.1 hours (range 19.93-22.95). The overall catch was 1,106 fish comprising 21 species (summary in Table 2.6.1). The average number of fish per set was 23.04, the lowest since 1984 (Fig. 2.6.1), mostly due to the lowest catches of Yellow Perch in the history of this survey. Despite low catches, Yellow Perch remained the dominate species caught in the nets followed by: Rock Bass, Smallmouth Bass, Northern Pike and Brown Bullhead (Fig. 2.6.2). Less common species included Walleye, Largemouth Bass, Pumpkinseed, Channel Catfish, and Common White Sucker, while the remaining species each contributed less than 1% to the total catch.

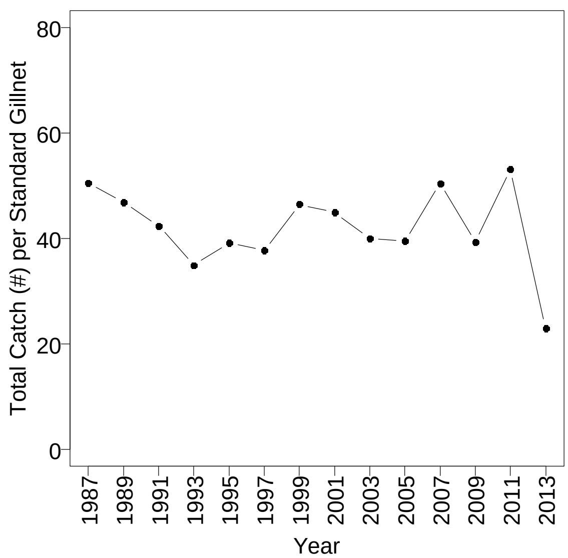


FIG. 2.6.1. Total number of fish (all species) per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2013.

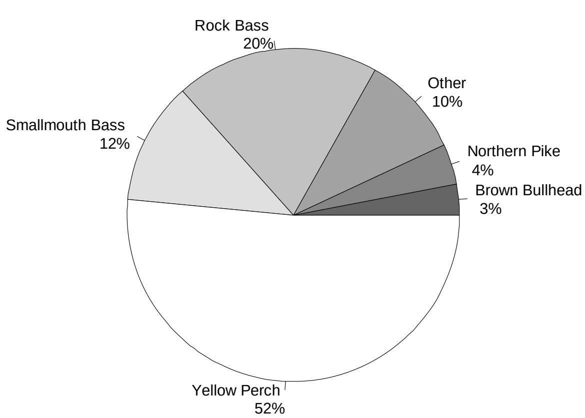


FIG. 2.6.2. Species composition in the 2013 gillnet survey in the Thousand Island area of the St. Lawrence River.

Species Highlights

Yellow Perch started increasing in abundance in most areas of the St. Lawrence River around 2005. In the 2013 Thousand Islands survey, catches of Yellow Perch were the lowest ever, approximately 50% of the average level since 2001 (Fig. 2.6.3).

From the beginning of the Thousand Island survey, Brown Bullhead have gone through periods of high and low catches (Fig. 2.6.4). Since their peak in the 2005 survey, Brown Bullhead have declined to their lowest abundance recorded in the history of this survey. This decline, starting in 2005, is comparable to declines observed in Brown Bullhead commercial harvest (see Section 4.1).

The centrarchids are represented by six species in the upper St. Lawrence: Rock Bass, Pumpkinseed, Bluegill, Smallmouth Bass, Largemouth Bass and Black Crappie (Fig. 2.6.5 and 2.6.6). While Rock Bass remain the most abundant of the centrarchids, catches in 2013 were 50% of catches observed in the previous decade. Despite a couple of strong year classes

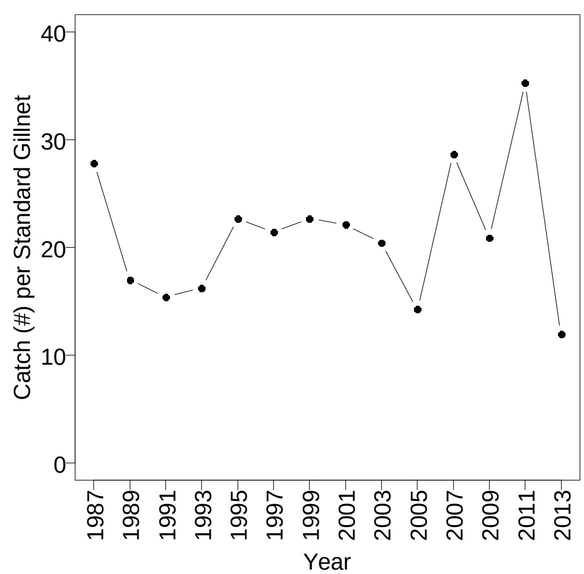


FIG. 2.6.3. Yellow Perch catch per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2013.

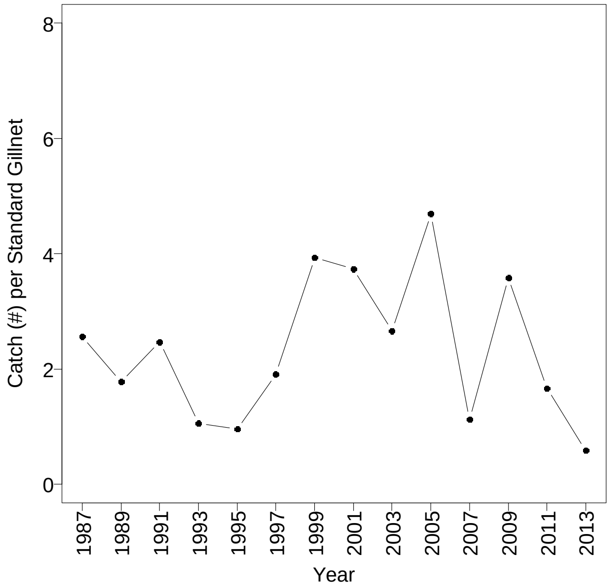


FIG. 2.6.4. Brown Bullhead catch per standard gillnet set in the Thousand Islands area od the St. Lawrence River, 1987-2013.

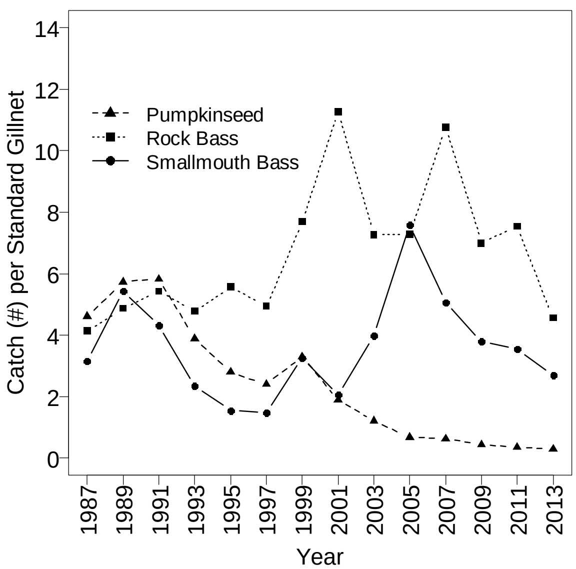


FIG. 2.6.5. Centrarchid catches per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2013.

(Fig. 2.6.7a; Table 2.6.2), Smallmouth Bass have continued to decline since 2005; however the mean total length of age five Smallmouth Bass has slowly increased since 2001 (Fig. 2.6.7b; Table 2.6.3). Pumpkinseed are at a low level after a steady decline spanning the entire survey period. Bluegill, Largemouth Bass and Black Crappie continue to remain at much lower levels than the former three Centrarchid species,

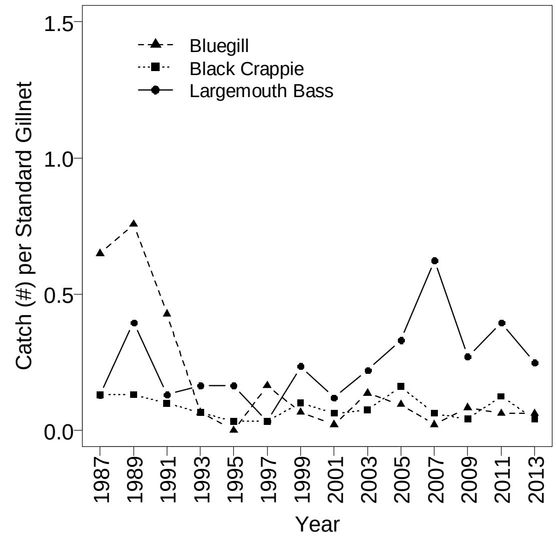


FIG. 2.6.6. Centrarchid catches per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2013.

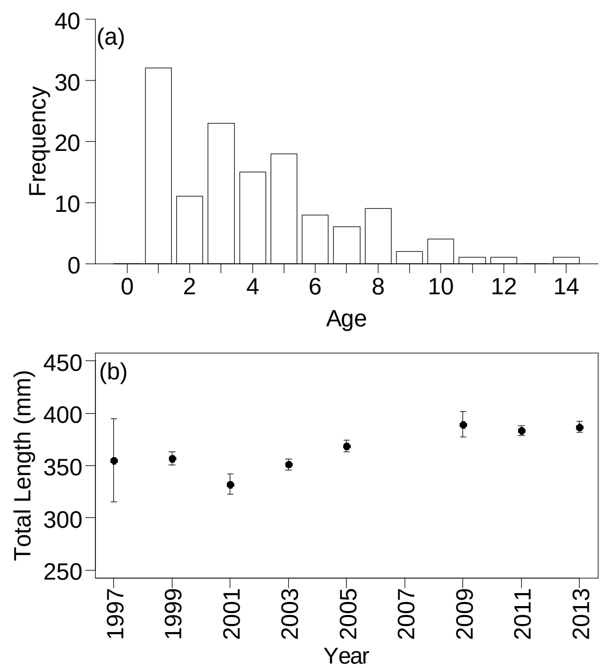


FIG. 2.6.7. Age distribution of Smallmouth Bass caught in the Thousand Islands, 2013 (a). Mean total length (mm) of age five Smallmouth Bass from 1997 to 2013 (b). Error bars represent one standard deviation.

although Largemouth Bass had a moderate increase over the last decade.

Northern Pike remain at very low abundance levels, reached after a slow steady decline spanning almost the entire history of the Thousand Islands survey (Fig. 2.6.8). Currently,

TABLE 2.6.2. Age distribution of selected species caught in the Thousand Islands, 2013.

	Year-class/Age															
	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998
Species	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Yellow Perch			28	19	29	30	23	12	5	3		2				
Walleye		2	3	4			3		3	2					4	1
Northern Pike			3	8	19	5	4	4	2	1	1					
Smallmouth Bass		32	11	23	15	18	8	6	9	2	4	1	1		1	
Largemouth Bass		9		1			2									

TABLE 2.6.3. Mean fork length (mm) of selected species caught in the Thousand Islands, 2013.

	Year-class/Age															
	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998
Species	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Yellow Perch			155	169	202	199	236	256	248	279		311				
Walleye		291	390	466			531		569	570					652	686
Northern Pike			520	546	557	626	606	611	658	800	525					
Smallmouth Bass		167	225	298	310	367	391	398	432	448	439	449	461		476	
Largemouth Bass		148		304			351									

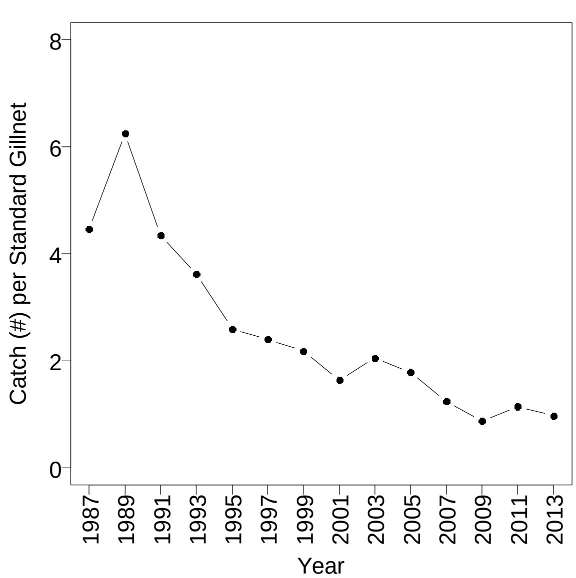


FIG. 2.6.8. Northern Pike catch per standard gillnet set in the Thousand Islands area of the St. Lawrence River, 1987-2009.

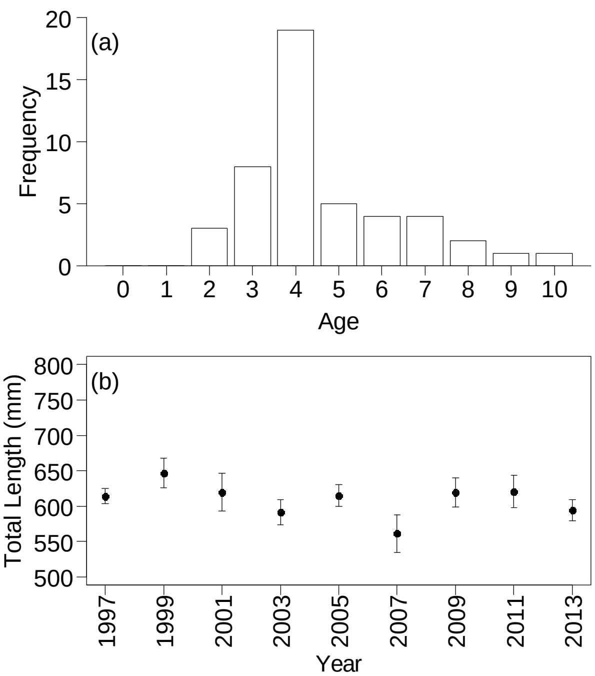


FIG. 2.6.9. Age distribution of Northern Pike caught in the Thousand Islands, 2013 (a). Mean total length (mm) of age four Northern Pike from 1997 to 2013 (b). Error bars represent one standard deviation.

Northern Pike abundance is roughly 15% of its peak observed in 1989. A strong Northern Pike year class has not been observed since the 2009 cohort, which represented approximately 40% of the Northern Pike catch in 2013 (Fig. 2.6.9a, Table 2.6.2). Despite their steady decline in abundance, the growth rate of individual fish has remained stable since 1997 (as shown by the mean total length of age four Northern Pike, Fig. 2.6.9, Table 2.6.3).

2.7 Credit River Chinook Assessment

The Credit River below the Kraft Dam in Streetsville has been the long term collection site for hatchery collections of Chinook Salmon gametes. Chinook Salmon are captured during the fall spawning run at the beginning of October using electrofishing gear. Since 2012, egg collections have been led by staff at the Normandale Fish Culture Station where Chinook Salmon are raised. LOMU staff has utilized the spawn collections to index growth, condition, and lamprey marking of Chinook Salmon.

Weight and otoliths are collected from fish used in 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 measured and checked for clips prior to fish being sorted for spawn collection and detailed sampling. Detailed sampling included collection of data on length, weight, fin clips, coded-wire tag, lamprey marks and a subsample also had otoliths collected for age determination.

Samples for the Chinook salmon Index were taken over four days between October 1st and 4th. Detailed sampling occurred on 263 Chinook Salmon, 200 fish were sampled for the representative length sample and 32 Chinook Salmon were checked only for fin clips and coded -wire tags.

The mean size of age-2 Chinook Salmon continues to increase for both males and females (Fig. 2.7.1). The mean length of age-2 female Chinook salmon (839 mm, fork length) in 2013 is the highest in the time series and age-2 males (841mm, fork length) is the second highest. The size of age-3 spawners decreased for both males (898 mm, fork length) and females (877 mm, fork length), and are just below the long term means (910 mm and 886 mm, respectively).

The estimated weight (based on a log-log regression) of 900 mm (fork length) Chinook Salmon is used as an index of condition. The overall condition of Chinook Salmon in the Credit River in 2013 remained low (male = 8.22 kg, female = 8.88 kg) and was virtually unchanged from 2012 levels (Fig. 2.7.2). There was a concurrent decline in the condition of Chinook Salmon sampled in the Boat Angler Survey (Section 3.1) during August. While each of the indices show a decline in condition, all three are within a half kilogram of the long term average

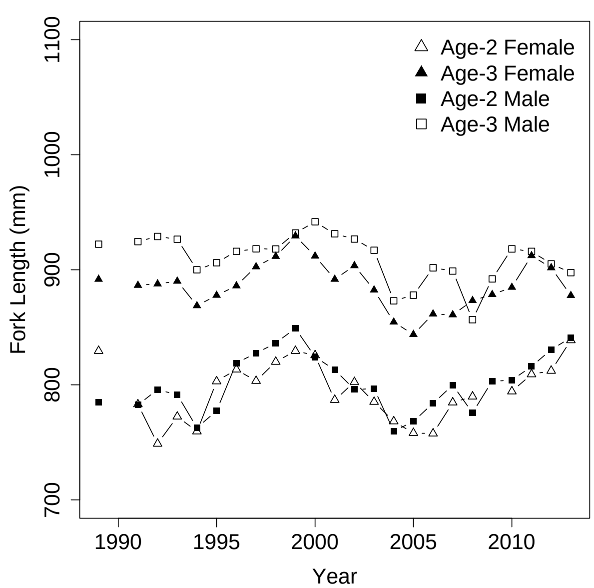


FIG. 2.7.1. Fork length of age-2 and age-3 Chinook Salmon by sex, caught for spawn collection in the Credit River during spawning run (approximately October 1), 1989 to 2013.

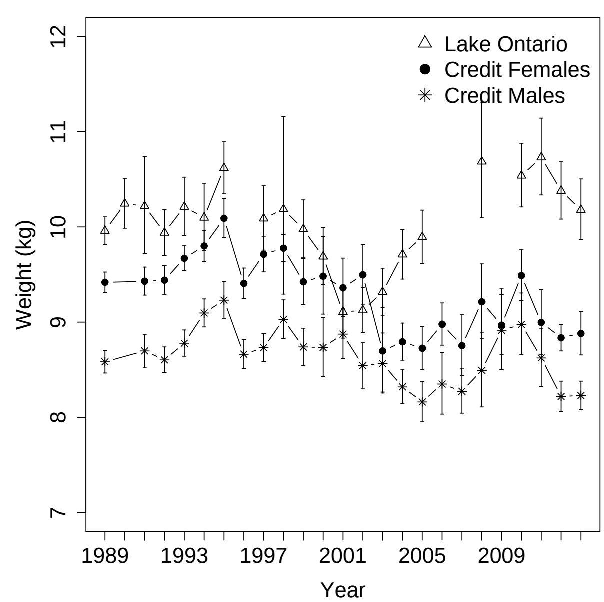


FIG. 2.7.2. Mean weight of a 900 mm Chinook Salmon in Lake Ontario during August and the Credit River during the spawning run (approximately October 1), 1989-2013. Error bars indicate the 95% confidence intervals.

and overall condition remains stable. Over the past decade, the condition of Chinook Salmon in the Credit River has provided a less accurate indicator of the condition of Chinook Salmon in the lake and alternative indices are being considered.

Fin-clips and coded-wire tags indicated that 85% of the age-2 and older Chinook sampled were stocked fish (age-1 fish all unclipped). Forty-eight stocked fish also had coded-wire tags. Coded-wire tag numbers indicated that 19 (40%) originated from 2010 stocking on the Credit River, 18 (37%) from 2011 Credit River stocking and 11 (23%) from 2011 Bronte Creek stocking.

Sea Lamprey wounding rates on Chinook Salmon remain low. Only 27 of the 495 Chinook Salmon sampled had lamprey scars, of which, only 4 had A1 scars (0.81 A1 wounds per 100 Chinook Salmon).

2.8 Juvenile Atlantic Salmon Parr Survey

In 2013, Atlantic Salmon spring fingerlings (2.1 g) were stocked in the Credit River and its tributaries (Section 7) 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 2.9), to evaluate the relative contribution of each reach to the smolt migration.

Atlantic salmon parr were surveyed at seven reaches in the Credit River, Silver Creek, and Black Creek (Table 2.8.1, Fig. 2.8.1) during October 2013, after most of the year's growth was complete, and when fish size (>98 mm) indicates potential smolting. Atlantic Salmon were captured by electrofishing. Largely, other species were released upon capture, and were not generally recorded. Atlantic Salmon were individually tagged with half-duplex passive integrated transponders (PIT) at all sites. Two thousand and eight (2,008) PIT tags were

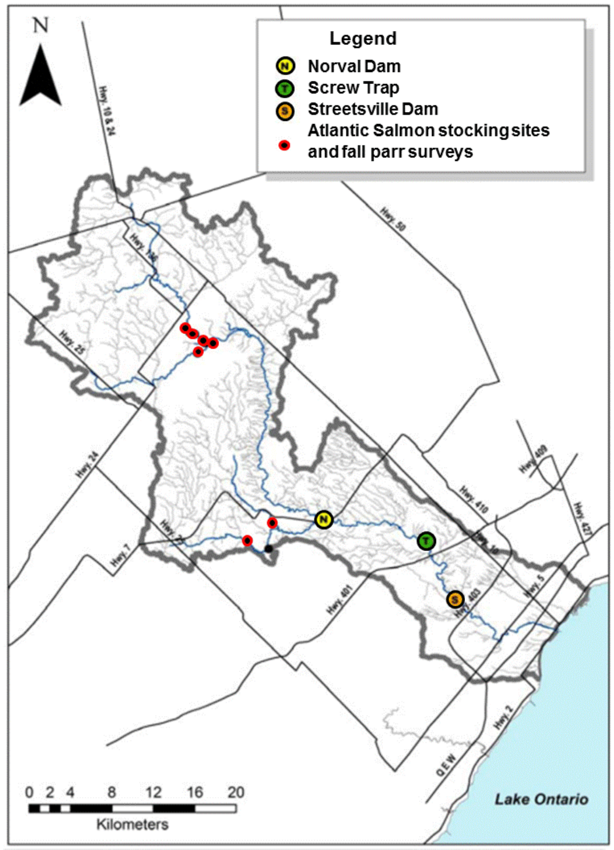


FIG. 2.8.1. Map of the Credit River showing locations of the fishways at Norval and Streetsville Dams, the smolt screw trap site (Section 2.9), Atlantic salmon spring fingerling stocking locations, and parr survey sites (Section 2.8).

TABLE 2.8.1. Geo-coordinates (downstream end) and dimensions population sampling sites in the Credit River in 2013.

Reach	Latitude	Longitude	Sample length (m)	Stream width (m)	Days sampled
Meadow (Forks Prov. Park)	43° 48.76'	80° 00.87'	460	9.0	2
Stuck truck (Forks Prov. Park)	43° 48.66'	80° 00.39'	432	9.9	2
Brimstone (Forks Prov. Park)	43° 48.17'	79° 59.69'	689	12.1	2
Ellies (Forks o' Credit Rd.)	43° 48.29'	79° 59.47'	273	15.7	2
West Credit Belfountain C.A.	43° 47.79'	80° 00.40'	273	9.8	1
Black Creek 6th Line	43° 37.80'	79° 56.89'	321	5.9	1
Silver Creek Cedarvale Park	43° 48.83'	80° 00.94'	97	6.4	1

implanted into the body cavity of Atlantic Salmon parr (Table 2.8.2). Larger PIT tags (23 mm) were used on fish >108 mm. Smaller PIT tags (12 mm) were used on fish <108 and >68 mm. The smallest fish (<67 mm) were not tagged. As well, 21 Atlantic Salmon parr were marked using red Visible Implant Elastomer (VIE) placed under the jaw (Table 2.8.2). Sixty-seven (67) tagged/ marked Atlantic Salmon were recaptured generally at the same location (Table 2.8.2) as originally tagged/marked.

Growth of age-0 Atlantic Salmon in the main branch of the Credit River ranged from 101.8 mm at the Forks, increasing consistently upstream to 119.8 mm (mean fork lengths) at the Meadow (Table 2.8.3). In these reaches growth was excellent and is expected to result in the majority of these Atlantic Salmon smolting to Lake Ontario at age 1 (Table 2.8.3). Growth of age-0 Atlantic salmon was moderate in the West Credit River and Black Creek (90.0 and 96.5 mm mean fork length, respectively), and less than half of these fish are expected to smolt out at age 1 (Table 2.8.3). At Silver Creek, growth of age-0 Atlantic Salmon was low (66.8 mm), and none of these fish are expected to smolt at age 1. These are the slowest growing Atlantic salmon parr observed among 12 Ontario tributaries of Lake Ontario (OMNR unpublished data). The density of age-0 Atlantic Salmon at three Credit River sites (0.35 to 0.53 m^{-2}: Table 2.8.4) continued to meet or exceed the restoration target (0.05 to 0.5 m-2)[1]. At Silver Creek the density was much higher (1.28 m^{-2}), and it is unclear how this result might be related to the low growth rate at this site.

[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 2.8.2. Number of applied and recaptured PIT tags and VIE marks showing VIE colour and location by Atlantic Salmon age group in 2013.

Reach	Age 0					Age 1 and older					Total number
	Number of PIT tags	Number of VIE	VIE Colour	VIE Location	Not tagged	Number of PIT	Number of VIE*	VIE Colour	VIE Location	Not tagged	
Applied											
Meadow (Forks Prov. Park)	335				5	22					
Stuck truck (Forks Prov. Park)	316				10	11					
Brimstone (Forks Prov. Park)	396	21	Red	Right Jaw	14	11					
Ellies (Forks o' Credit Rd.)	415				7	5					
West Credit Belfountain C.A.	247				18	46				1	
Black Creek 6th Line	172				17	8				2	
Silver Creek Cedarvale Park	24				29						
Total Applied	1,905	21			100	103				3	2,132
Recaptured											
Meadow (Forks Prov. Park)	18						1	Blue	Left Jaw		
Stuck truck (Forks Prov. Park)	18					1	2	Blue	Left Jaw		
Brimstone (Forks Prov. Park)	2					1	1	Blue	Left Jaw		
Ellies (Forks o' Credit Rd.)	22										
West Credit Belfountain C.A.							1	Orange	Right Jaw		
Total Recaptured	60					2	5				67

* Recaptured fish with VIE marks were PIT tagged and are also included in other columns.

TABLE 2.8.3. Mean fork length and weight of Atlantic Salmon by location and age group in 2013.

Reach	Age 0		Expect to smolt in 2014	Age 1 and older	
	Length (mm)	Weight (g)		Length (mm)	Weight (g)
Meadow (Forks Prov. Park)	119.8	20.4	91%	163.9	50.9
Stuck truck (Forks Prov. Park)	112.0	16.9	79%	166.3	55.8
Brimstone (Forks Prov. Park)	109.5	14.9	78%	152.3	40.2
Ellies (Forks o' Credit Rd.)	101.8	12.8	58%	167.8	53.2
West Credit Belfountain C.A.	90.0	8.7	22%	132.2	26.8
Black Creek 6th Line	96.5	10.6	47%	141.8	31.9
Silver Creek Cedarvale Park	66.8	3.5	0%	*not present*	

TABLE 2.8.4. Population estimates, density, and biomass of Age-0 Atlantic salmon in the Credit River and Silver Creek. Mark -recapture methods were used in the Credit River and single pass removal in Silver Creek.

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	625	369	1,036	0.15	1.35
	Age 0 $\geq$98	1,489	843	2,552	0.35	7.44
Stuck truck (Forks Prov. Park)	Age 0 <98	226	106	435	0.05	0.46
	Age 0 $\geq$98	1,279	770	2,086	0.30	5.70
Ellies (Forks o' Credit Rd.)	Age 0 <98	44	19	88	0.02	0.13
	Age 0 $\geq$98	1,417	867	2,279	0.51	8.21
Silver Creek Cedarvale Park	Age 0	785	-	-	1.28	4.43

2.9 Credit River Atlantic Salmon Smolt Survey

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 ‘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 2013, the Lake Ontario Management Unit and Credit Valley Conservation conducted the third year of out-migrant sampling on the Credit River using a Rotary Screw Trap (see Section 2.8, Fig. 2.8.1 for location of the screw trap). This report will compare the attributes of out-migrating Atlantic Salmon across years. The composition (stocked life stage and strain) of the catch was determined following DNA extraction from fin tissues and parentage assignment conducted at the MNR’s Aquatic Research and Monitoring Section’s Genetic Lab.

2013 Fish Collections

Although the trap is designed to capture out -migrating salmonids, it also captures a variety of species. All species collected in the trap were tallied and bulk weights recorded. In 2013, 8,657 fish representing 24 species were collected over a 52-day sampling period (Table 2.9.1).

The timing of Atlantic Salmon out-migration has been consistent across years with peak out-migration occurring in the first two weeks of May (Fig. 2.9.1).

TABLE 2.9.1. List of species collected using Rotary Screw Trap, 2013.

Species	Catch
Chinook Salmon	6,745
Common Shiner	636
Atlantic Salmon	311
Rainbow Trout	208
Longnose Dace	204
Fathead Minnow	102
Pumpkinseed	85
Hornyhead Chub	80
Rainbow Darter	77
Brown Trout	47
Sea Lamprey	35
Bluntnose Minnow	31
White Sucker	29
Blacknose Dace	21
Creek Chub	9
Stonecat	8
Coho Salmon	6
Golden Shiner	6
Largemouth Bass	6
River Chub	4
Brown Bullhead	3
Northern Hog Sucker	2
Brook Stickleback	1
Johnny Darter	1
Total	8,657

Comparison of Atlantic Salmon Catches in 2011, 2012 and 2013

A total of 812 Atlantic Salmon representing fish collected from sampling years 2011 to 2013 were submitted to Trent University for genetic analysis. Parentage was confirmed for 622 of the samples. The remainder require a more detailed assessment to determine parentage. This analysis allows LOMU to link biological information (size, timing of out-migration) of individual fish captured in the rotary screw trap back to their stocked life stage (spring fingerling, fall fingerling, or spring yearling) and strain (LaHave, Sebago, or Lac St. Jean).

When the catch is partitioned across stocked life stages (spring fingerling, fall fingerling, or spring yearling) the majority of the catch is represented by those fish stocked as spring fingerlings at 85% of the catch (Table 2.9.2). Lower catches of the more advanced life stages (fall fingerlings and spring yearlings) may indicate that out-migration is occurring for those stocked life stages at times when the gear is not in operation (April – June). This may be particularly true for fish stocked as spring yearlings that are stocked in March. These fish may be out-migrating prior to trap installation.

When the size of the out-migrating fish (strains combined) are compared across stocked life stages those stocked as spring fingerlings are significantly larger than those stocked as spring yearlings ($p=0.015$) but not significantly larger than those stocked as fall fingerlings ($p=0.64$) (Fig. 2.9.2). Comparison across the stocked strains is not appropriate at this time as strains have not been equivalently stocked at all life stages. When all three strains are introduced at all life stages, comparison of strain performance will be achievable.

TABLE 2.9.2. Composition of Atlantic Salmon Catch from rotary screw trap 2011-2013. Data are partition by stocked strain (LaHave or Sebago), age, and stocked life stage. Life stage abbreviations are as follows: Spring Fingerling (SPF), Fall Fingerling (FAF), and Spring Yearling (SPY).

Strain	Life Stage Stocked	Smolt Age	Catch
LaHave	SPF	1	219
	FAF	1	4
	SPY	1	27
	SPF	2	127
	FAF	2	25
	SPY	2	31
LaHave Total			433
Sebago	SPF	1	165
	FAF	1	5
	SPY	1	
	SPF	2	18
	FAF	2	1
	SPY	2	
Sebago Total			189
Total			622

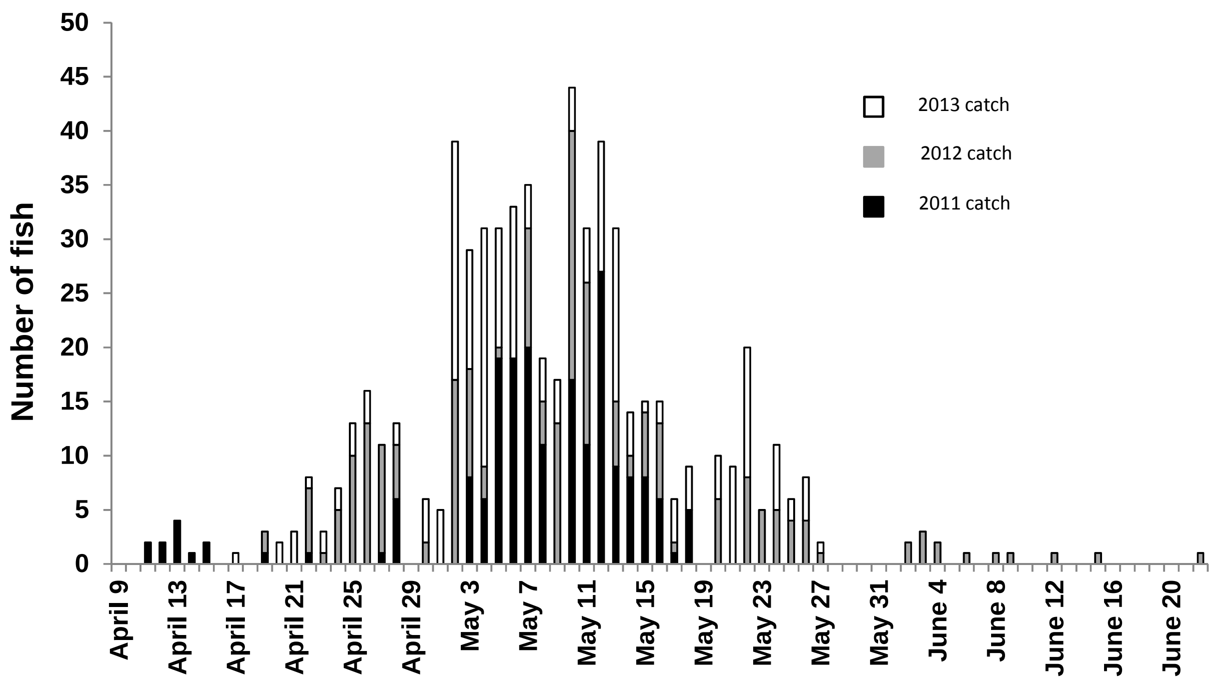


FIG. 2.9.1. Timing of out-migration of Atlantic Salmon 2011-2013.

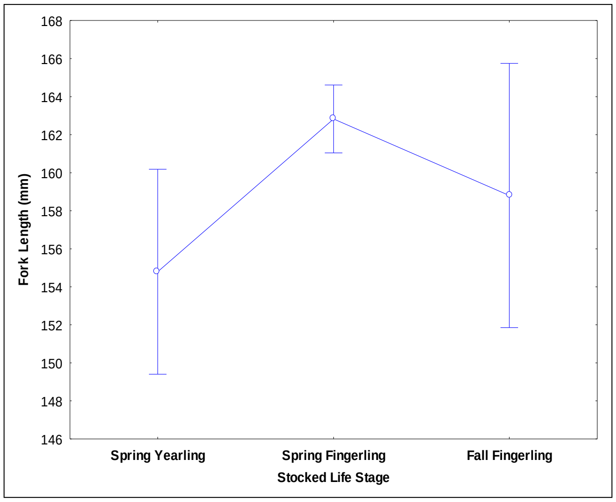


FIG. 2.9.2. Mean fork length of fish stocked as spring yearling. spring fingerling, and fall fingerling, captured during out-migration at the rotary screw trap.

2.10 Credit River Fishway Atlantic Salmon Assessment

Management efforts are underway to restore Atlantic Salmon to Lake Ontario (Section 8.2), focusing on a few high-quality cold water streams. The Credit River was selected as one of three streams to restore a self-sustaining wild population of Atlantic Salmon, and is stocked annually (Section 7). After Atlantic Salmon smolts out-migrate to Lake Ontario, they will spend at least a year feeding and growing until they mature and return to the Credit River to spawn. Fishways at Streetsville and Norval (Fig. 2.10.1) allow for the passage of fish around barriers to gain access to quality spawning habitat and provide an opportunity to count and sample returning adults.

The dam at Streetsville is the first barrier adult Atlantic Salmon face moving upstream on the Credit River, 15 km from Lake Ontario. A step-pool design fishway was constructed at this dam in 1981. This fishway is in place to provide selective passage for salmonids. A screen can be placed at the top of the fishway to stop fish from passing through, thereby providing an opportunity to monitor adults in the step pools and the channel below. Due to the step-pool design, only jumping fish (mainly adults) are passed through the fishway. Continuing upstream, the next major obstacle to fish movement is the dam at Norval,

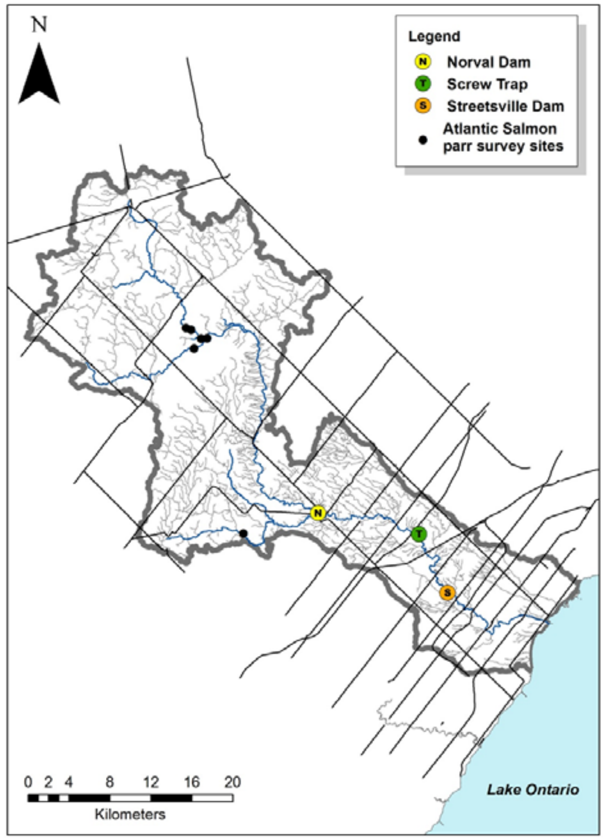


FIG. 2.10.1. Map of the Credit River, Lake Ontario showing locations of the fishways at Norval (N) and Streetsville (S) dams, the smolt screw trap (T) site (Section 2.9), and Atlantic Salmon parr assessment survey (●) sites (Section 2.8).

40 km by river from Lake Ontario. A Denil fishway was constructed in 2011 to facilitate fish movement beyond this dam. A cage lowered into the fishway structure enables monitoring of fishes as they move upstream. This structure is capable of passing all species and sizes of fish.

Assessment of adult Atlantic Salmon moving up the Credit River through the two fishways occurred between June 25 and November 8, 2013 (Table 2.10.1). See Tables 2.10.2 and 2.10.3 for operational summaries of the Streetsville and Norval fishways, respectively.

A total of 21 (including one recapture) adult Atlantic Salmon were caught in the two Credit River fishways in 2013. All 20 individual fish were given unique Passive Integrated Transponder (PIT) tags. PIT tags were inserted into the fleshy part of the left cheek of individuals using a custom syringe, and were scanned before and after being inserted into the fish to ensure the tags were working properly. Adipose fins were clipped from individuals for genetic analysis, and to make identification of recaptured fish easier.

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

TABLE 2.10.1. Operational details of the Streetsville and Norval fishways: 2011-2013.

Year	Fishway	Operational Duration	Days Operated	Adult Atlantic Salmon Captured (recaptures)
2011	Streetsville	Sep 8 - Nov 20	48	21
	Norval	Aug 23 - Nov 25	58	8 (2)
	Total		106	29
2012	Streetsville	Sep 10 - Nov 3	30	2
	Norval	Jun 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

TABLE 2.10.2. Numbers of trout and salmon caught (including recaptures) from the Streetsville fishway in 2013.

Species	Life Stage	Number Caught
Atlantic Salmon	Adult	9
Brown Trout	Adult	33
Rainbow Trout	Adult	200
Coho Salmon	Adult	1571
Chinook Salmon	Adult	378 (*wild - unclipped*) 1039 (*stocked - clipped*) 1417 (*total*)

TABLE 2.10.3.Numbers of trout and salmon caught (including recaptures) from the Noral fishway in 2013.

Species	Life Stage	Number Caught
Atlantic Salmon	Adult	12
	Juvenile	11
Brown Trout	Adult	30
	Juvenile	23
Rainbow Trout	Adult	22
	Juvenile	684
Coho Salmon	Adult	52
	Juvenile	250
Chinook Salmon	Adult	23
	Juvenile	3
Brook Trout*	Adult	1

**first time captured at the Norval fishway.*

2.11 Duffins Creek Resistance Board Weir

Introduction

Atlantic Salmon were endemic to Lake Ontario before their extirpation in the late 19th century. Since 2006, an enhanced restoration effort has resulted in the adult Atlantic Salmon returning to spawn in three targeted tributaries: Credit River, Cobourg Creek and Duffins Creek. The surviving adults originate from various stocking life-stages and genetic strains, and it is important to capture these fish and determine their origin to enhance restoration efforts. Capturing these rare and elusive returning adults is difficult. Of the targeted tributaries, only the Credit River has a fishway that allows for effective capture and sampling of returning adults. Recently, with the support of the Great Lakes Fishery Commission (GLFC), the Ontario Ministry of Natural Resources and the Toronto Region Conservation Authority installed an Resistance Board Weir (RBW) in Duffins creek in 2013.

RBWs are proven technology pioneered on the west coast of North America to capture returning salmon in rivers. Pictures and videos of the weirs in operation can be found at http://weir.fishsciences.net/ . The weirs are site-adaptable, temporary, portable, safe, inexpensive, and capable of handling extreme flow variation and debris. Funding is available to run the weir for three years. Here we report on the result of the initial installation and operation of the weir in 2013.

Methods

During the first week of May the RBW was installed on the main stem of Duffins Creek several kilometres upstream of Lake Ontario between Highway 401 and Highway 2 (Kingston Road). The original plan was to start operating the RBW on May 8. Due to some minor vandalism and concerns about stranding drop-back rainbow trout, several panels were removed and the RBW was not reassembled until May 31. The crew started to operate the RBW on June 3. There were 16 sampling events up to June 28 when the weir was shut down for the summer. It was again reassembled on August 20 at the beginning of the fall upstream migration of Chinook salmon. There were 60 fall sampling events up to November 15 when the RBW was shut down and removed for the winter. Total number of sampling events was 76.

On a typical sampling day, the crew would arrive at the site in the morning to check the holding cage. If fish were in the cage, the downstream gate would be closed and the fish netted out for processing. All captured fish were identified and counted and checked for tags, fin punches or other markings. Non-salmonids were counted and passed upstream. All salmonids were measured for length and hole punched in the caudal fin. All Chinook Salmon were checked for an adipose fin clip, and if present, scanned for an implanted coded wire tag. All Atlantic Salmon were measured for fork length, round weight, sex, clips, tags, lamprey marks, scales , a genetic sample and photographed.

This was the first year of operating the RBW and several problems were encountered which required some modifications to the set up and operation of the RBW. During low flow periods in the spring it was essential to maintain a channel of flowing water to allow drop back Rainbow Trout and Common White Suckers to move downstream over the RBW without becoming trapped on the dry panels. This was achieved by a combination of adjusting the ratchet device on the side upright panels and placing sandbags on the floating panels. It was important to ensure that the downstream end of the floating panel was not depressed too much or fish moving upstream would swim up this channel and bypass the RBW. During low flow periods of the fall migration, large numbers of Chinook Salmon congregated downstream of the RBW. Many of these fish would "charge" through the shallow water and become trapped under the panels. To attempt to prevent this problem, sandbags were placed on the bottom of the stream channel at the downstream end of the panels where the water depth was quite shallow. However, some Chinook Salmon were still being trapped under the shallow sections of the panels. When one of the panels was removed the Chinook Salmon seemed to be able to detect that there was a clear passage and the holding fish would quickly pass through the open channel. There were several occasions during the fall run when rainfall events triggered a large upstream migration of fish. The crew would process the fish captured in the cage during the morning and afternoon. Due to concerns about large numbers of fish entering the cage overnight and potential mortality being caused by overcrowding, the upstream cage door would be left open for the overnight period. However, this strategy allowed some Atlantic salmon to bypass the RBW.

Results

During normal stream flow conditions the RBW was quite efficient at capturing upstream migrating fish. In the spring period it was not operated until the majority of the annual Rainbow Trout upstream migration was completed (Table 1). Initially some drop-back post-spawn Rainbow Trout were stranded on the floating panels. The configuration of the RBW was adjusted to create a flowing channel over a section of the panels and no further live Rainbow Trout were stranded. The first upstream migrating Atlantic Salmon adult was captured on June 13 and a total of six Atlantic Salmon were captured by June 26. The RBW was shut down on June 28. Chinook Salmon began to enter the river in mid August, and the RBW was re-assembled on Aug 20. During the late-summer low flow period many Chinook Salmon would congregate below the RBW. Some would swim up through the deep channel and enter the chute leading into the cage, but some were trapped underneath the panels in the shallow section of the stream. When significant rainfall events occurred in September large numbers of Chinook Salmon congregated downstream of the RBW. The cage did not have sufficient capacity to hold the many fish attempting to swim upstream, and the high flows prevented the crew from safely accessing the cage. It was necessary to open the cage and remove several panels to allow the hundreds of Chinook to move upstream. It was not possible to determine if any Atlantic Salmon were also moving upstream during these high flow events. An Atlantic Salmon was handled on September 29, and a second Atlantic Salmon was processed on October 17.

Discussion

The most significant recommended modification to the RBW will be to increase the cage capacity so that more fish can be captured during peak runs without overcrowding and stressing the fish. Consideration should be given to the installation of baffles to provide caged fish with some respite from the stream current, and rubber mats placed above water to darken the cage and provide some protection for jumping fish. The RBW should be installed and activated earlier in the spring in order to better characterize the timing of the spring migration of Atlantic Salmon. In consultation with the RBW manufacturer, several options are being consider to facilitate improved downstream passage of fish including, shortening the panels, removing the resistance board on some panels, or a downstream passage chute. We were not able to recover a temperature logger, so we will consider alternative and back-up placements and download the data periodically. More crew time should also be dedicated to the operation of the RBW to allow full time operation during peak migration periods.

TABLE 2.11.1. Summary of sampling events and species captured during operation of the Duffins Creek resistance board weir in 2013 by month. (D.I.W.= Days in Water—total days per month that the RBW was set up in the stream, D.O = Days Open---total days per month when the RBW was open and not catching fish, D.C./S.= Days Closed/Sampling---total days per month when the RBW was closed and fish could be sampled, CWS—Common white sucker.

Month	D.I.W.	D. O.	D.C./S	Atlantic Salmon	Rainbow Trout	Chinook Salmon	Coho Salmon	Brown Trout	CWS
June	25	9	16	6	2	0	0	1	17
July	0	0	0	0	0	0	0	0	0
August	11	5	6	0	0	39	3	2	0
Sept.	30	10	20	1	0	217	29	3	0
Oct.	31	8	23	1	44	183	4	10	0
Nov.	15	3	12	0	27	4	1	1	0
Total	112	35	67	8	73	443	37	17	17

3. Recreational Fishing Surveys

3.1 Western Lake Ontario Boat Angling Fishery

Stocking of Coho Salmon and Chinook Salmon by New York State and Ontario in the late 1960s created an angling fishery for salmon and trout in Lake Ontario. Rainbow Trout, Atlantic Salmon, Brown Trout, and Lake Trout were later stocked (see Section 7) creating a world-class fishery. Significant natural reproduction of Rainbow Trout and Chinook Salmon has further added to the quality of angling in Lake Ontario. OMNR has surveyed this fishery in most years since 1977. This survey provides the only statistics for this fishery, and is the primary source for biological monitoring of salmon and trout in the Ontario waters of Lake Ontario. We have relied on catch rates to index the abundance of these salmon and trout populations. Moreover, this survey has provided a broad geographic and seasonal array of biological samples, and is our best source of Chinook Salmon fin clips and coded wire tags for the mass marking study (see Section 3.2).

This fishery was monitored at boat launch ramps during April to September from the Niagara River to Wellington (Fig 3.1.1). The survey design was similar to most previous surveys in the past three decades. The survey was stratified by month and spatially by six sectors. Catch, harvest, and effort information were obtained through angler interviews at selected high-effort ramps (one in each sector) after fishing trips were completed. Fishing effort was monitored by counting boat trailers at all ramps on a weekly basis. We limited interviews to the Niagara and Hamilton sectors in April and May, as past surveys indicated effort was sparse elsewhere during these months. Anglers were surveyed in most sectors during June to September, except during September in the Whitby-Cobourg and Brighton-Wellington sectors. When and where no interviews were conducted we estimated effort based on trailer counts, and we assumed catch was zero, based on previous surveys. Fishery statistics for marina-based anglers were estimated based on the 2011 marina-based fishery scaled to the 2013 ramp-based fishery.

Angling statistics for the salmon and trout fishery in the Ontario waters of Lake Ontario for 1977 to 2013 are provided in Table 3.1.1.

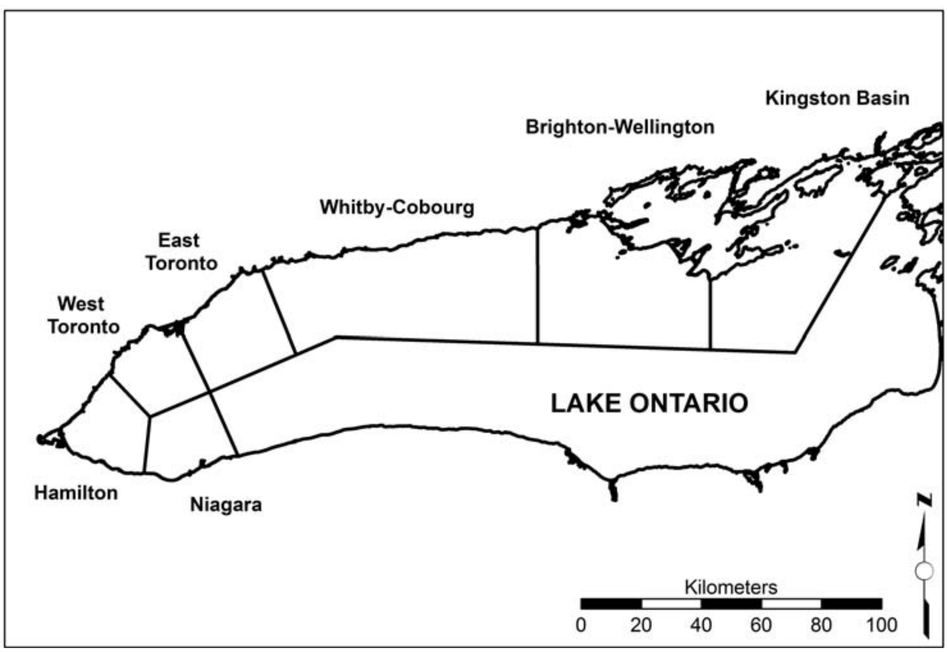


FIG. 3.1.1. Spatial stratification of OMNR angler surveys in Lake Ontario.

TABLE 3.1.1. Angling statistics for the salmon and trout fishery in the Ontario waters of Lake Ontario (excluding Kingston Basin), 1977 to 2013. Anglers were only allowed to fish with one rod prior to 1998.

Year	Catch						Harvest						Effort	
	Chinook Salmon	Rainbow Trout	Coho Salmon	Atlantic Salmon	Brown Trout	Lake Trout	Chinook Salmon	Rainbow Trout	Coho Salmon	Atlantic Salmon	Brown Trout	Lake Trout	Rod-hr	Angler-hr
1977	4,047	N/A	72,718	-	N/A	N/A	3,972	N/A	72,586	-	N/A	N/A	465,137	465,137
1978	1,928	2,109	97,924	-	450	72	1,892	2,096	97,746	-	450	72	418,895	418,895
1980	1,774	5,769	79,326	-	86	317	1,774	5,756	79,129	-	86	273	656,086	656,086
1982	2,730	5,435	74,854	-	129	1,512	2,447	4,126	66,998	-	129	1,172	744,802	744,802
1983	23,303	21,774	16,049	-	1,566	4,627	17,083	17,190	13,546	-	1,190	3,537	534,473	534,473
1984	41,764	43,774	12,867	-	5,224	9,259	32,906	35,627	10,458	-	3,991	6,242	444,448	444,448
1985	187,686	98,471	34,203	3,432	7,032	42,147	125,322	83,530	22,239	569	4,108	25,305	1,157,073	1,157,073
1986	268,877	100,824	43,294	1,843	2,831	24,775	157,675	73,377	29,200	187	1,471	9,013	1,363,082	1,363,082
1987	155,796	62,565	27,380	455	2,905	21,225	108,024	44,977	12,262	124	1,399	8,391	1,215,219	1,215,219
1988	112,289	96,008	27,983	1,382	5,542	9,307	74,606	73,561	16,180	140	3,100	3,012	1,233,013	1,233,013
1989	103,796	52,545	15,082	721	3,029	11,868	71,025	35,230	11,315	491	1,548	3,856	1,010,516	1,010,516
1990	94,786	84,229	15,906	1,628	2,817	12,201	60,701	67,529	10,516	162	1,040	2,832	1,112,047	1,112,047
1991	99,841	57,281	17,643	471	7,151	41,277	66,079	38,712	14,574	68	3,119	6,843	1,082,287	1,082,287
1992	69,959	26,742	3,222	2,516	4,010	7,891	50,182	18,381	1,826	413	1,761	2,997	1,012,822	1,012,822
1993	111,852	51,733	6,845	1,238	2,174	6,332	64,444	28,738	4,643	288	1,208	3,434	836,572	836,572
1994	66,031	25,227	2,254	203	3,983	13,623	38,170	14,382	1,517	129	2,251	5,443	601,325	601,325
1995	34,791	15,998	1,525	168	1,929	10,603	20,387	9,743	765	139	1,068	3,937	498,743	498,743
1997	43,566	7,077	2,777	35	1,003	10,427	23,890	3,979	1,453	19	619	2,113	508,297	508,297
1998	40,723	25,075	3,541	480	1,204	1,831	25,841	16,766	2,257	316	508	540	473,105	440,653
1999	47,899	26,080	3,669	120	953	7,331	27,542	18,616	3,529	30	387	1,114	593,233	469,117
2000	46,612	9,405	2,095	20	1,502	4,638	27,352	5,284	1,228	12	527	857	588,006	453,065
2001	40,140	16,683	2,689	60	1,508	3,008	18,525	10,828	1,596	0	787	387	505,616	369,407
2002	29,699	10,876	1,702	0	555	445	15,054	7,341	1,442	0	247	94	500,372	366,549
2003	44,500	7,176	2,145	24	914	2,216	15,843	4,437	1,763	12	240	528	411,011	286,384
2004	42,298	4,583	1,288	29	570	2,290	17,263	3,570	1,177	5	135	364	366,349	259,584
2005	42,711	16,154	1,254	83	221	1,214	18,601	15,667	694	83	66	75	474,114	333,952
2008	43,584	25,169	2,310	114	1,522	1,397	11,880	20,730	1,843	14	957	38	521,586	340,255
2011	39,172	25,588	7,128	456	1,392	1,756	17,820	16,185	5,078	254	1,159	642	443,548	293,952
2012	50,063	40,603	18,110	340	926	8,004	19,032	26,616	12,419	48	626	585	509,060	319,576
2013	37,413	33,027	8,424	103	1,121	14,477	16,024	23,115	6,103	12	431	532	539,185	345,568

Angling effort in 2013 (539,185 rod-hrs) has not varied greatly since 1994 (Fig. 3.1.2). The catches of Chinook Salmon, Rainbow Trout, and Coho Salmon remained high in 2013, but declined from 2012 (Table 3.1.1). This decline was related to poor catch in the first half of the season, likely related cooler temperatures during this period. Chinook Salmon dominated the catch (37,413), followed by Rainbow Trout (33,027), Lake Trout (14,477) and Coho Salmon (8,424). Together they represented about 99% of the total catch. This is a large increase in Lake Trout catch, and may be related to increased survival of juvenile Lake Trout, and increased targeting of Lake Trout by anglers during spring when Chinook Salmon fishing was poor. Catch rates for the time series from 1977-2013 show major shifts in salmon and trout populations and the quality of angling in Lake Ontario (Fig. 3.1.3). Although the quality of Chinook salmon angling was lower in 2013, the overall quality of salmon and trout angling remained excellent in Lake Ontario.

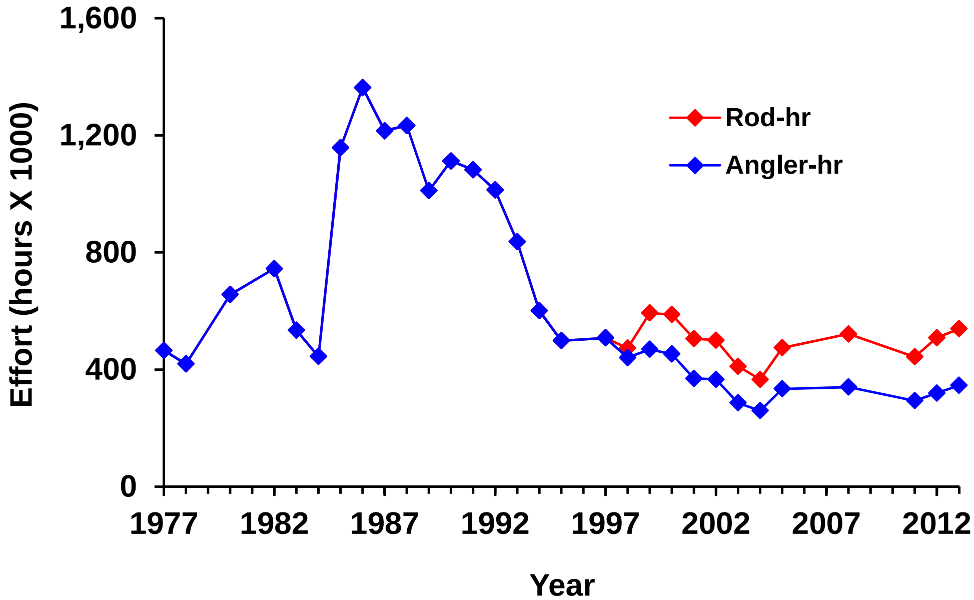


Fig. 3.1.2. The angler effort in the Ontario waters of Lake Ontario (excluding Kingston Basin), 1977 to 2013.

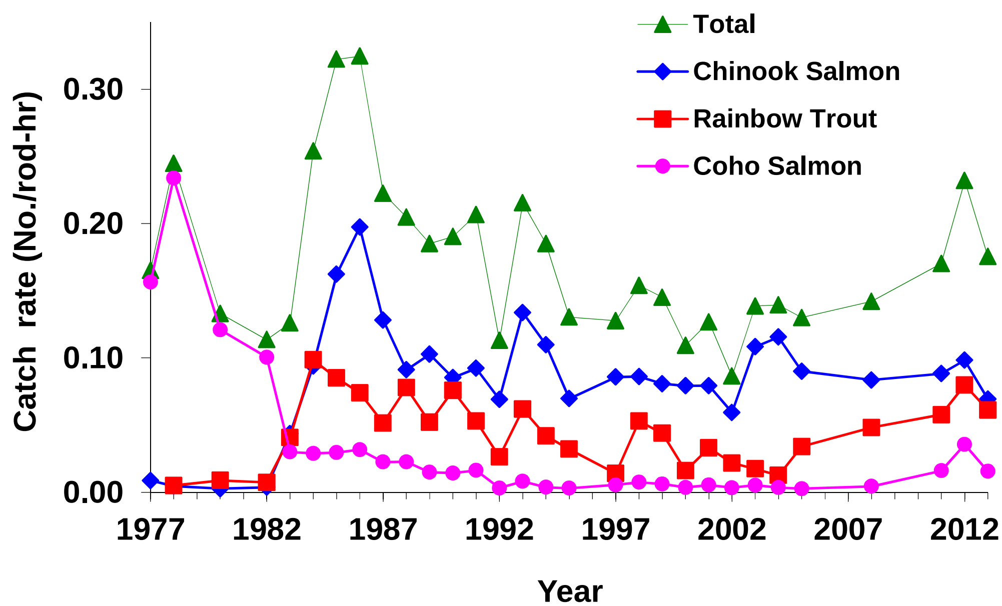


Fig. 3.1.3. The catch rate of salmon and trout in the Ontario waters of Lake Ontario (excluding Kingston Basin), 1977 to 2013.

3.2 Chinook Salmon Mark and Tag Monitoring

NYSDEC and OMNR 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). Detailed results from OMNR surveys are reported here. NYSDEC and OMNR will be reporting jointly when this study is complete. In 2008, NYSDEC acquired an AutoFish System from Northwest Marine Technology to apply fin clips and coded wire tags to fish stocked in Lake Ontario. NYSDEC and OMNR used this system to mark all Chinook Salmon stocked into Lake Ontario from 2008 to 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 of ages 2 to 4 observed in Lake Ontario in 2013 should be marked.

Returns of Chinook Salmon fin clips and CWT are reported from five OMNR surveys: i) Western Lake Ontario Boat Angling Survey (Section 3.1), ii) Chinook Salmon Angling Tournament and Derby Sampling (reported here, only), iii) Lake Ontario Volunteer Angler Survey (Section 3.3), iv) Eastern Lake Ontario and Bay of Quinte Fish Community Index Gillnetting (Section 2.2), and v) Credit River Chinook Assessment (Section 2.7). As well, Bowmanville Creek Anglers Association sampled Chinook Salmon migrating up Bowmanville Creek (Section 11.5). Methods and detailed results from these surveys can be found in this Annual Report (Sections indicated in parenthesis). 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 and Bowmanville Creek surveys targeted fish returning to spawn.

Angling tournament and derby sampling was conducted alongside the Western Lake Ontario Angling Survey from April to August, 2012 at selected boat ramps and marinas. Salmon were measured, weighed, and examined for fin clips and CWTs. A subsample of Chinook salmon otoliths and noses were collected for ageing and for CWT extraction, respectively. These samples were combined with Western Lake Ontario Boat Angling Survey for analysis.

In the angler surveys a total of 599 Chinook Salmon aged 1-4 were sampled in 2013 (Table 3.2.1). During 2013 volunteer anglers measured 340 Chinook salmon from the 2009 to 2011 year classes. These fish were aged with age-length keys from the Angler Surveys. The results for stocked origin from the angler diaries and other programs were consistent. The percent of stocked Chinook Salmon varied among the four year classes from 40% (2010 year class) to 67% (2008 year class).

CWTs were retrieved from 80 Chinook Salmon in the angler surveys in western Lake

TABLE 3.2.1. Catch of Chinook Salmon in index gill nets by fin clip and year class during 2008-2013, showing percent stocked origin.

Year		Gill nets						Angler Surveys				Angler Diaries				Percent
class	Fin clip	2008	2009	2010	2011	2012	2013	2010	2011	2012	2013	2011	2012	2013	Total	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	3	72	263	288	465	515	149	1807	40%
	Adipose	-	-	3	14	0	0	0	48	176	118	326	412	83	1180	
2011	No clip	-	-	-	3	4	4	-	3	61	104	-	195	47	421	58%
	Adipose	-	-	-	11	4	1	-	0	116	79	-	315	57	583	
Total		3	5	42	76	10	6	256	482	877	599	1941	2120	340	6757	

Ontario (Table 3.2.2). These data require further analysis. One interesting result is clear: most of the 3 yr-old Chinook Salmon harvested east of Toronto originated from the eastern half of New York, but 2 yr-olds showed greater mixing.

One hundred and ninety-three (193) Chinook Salmon were sampled in the Credit River as part of the spawn collection for Normandale Fish Culture Station. Most of these fish were age 1-3 and 15% were unclipped, consistent with a small amount of natural reproduction in the Credit River during 2009-2011 (Table 3.2.3). Forty-eight (48) CWTs collected from these fish indicated that 77% were stocked in the Credit River (Table 3.2.4). Salmon usually imprint to the stream where they were raised or stocked, and so straying from other locations was higher than expected. All strays came from Bronte Creek.

Bowmanville Creek Anglers Association examined 6,906 age-2 to age-4 Chinook Salmon in Bowmanville Creek during fall 2013. Only 18 adipose clips were found among these fish indicating 99.7% were wild. We expected to see more stocked fish returning to Bowmanville Creek, as it received about 30% stocking number compared with the Credit River. Under the assumption that most of these fish return at age 2 and age 3 the return rate of stocked Chinook salmon to Bowmanville Creek was 0.06%.

TABLE 3.2.2. Number of angler-caught Chinook Salmon with coded wire tags in 2013 by stocking and capture locations (for a map of capture locations, see Section 3.1, Fig. 3.1.1).

Stocking year	Stocking location	Capture location					
		Niagara	Hamilton	West Toronto	East Toronto	Whitby-Cobourg	Brighton-Wellington
2010	Sandy Cr.				1	2	
	Salmon R.	2			1	5	
	Oswego River				1	2	
	Sodus Bay				1		
	Sterling Cr.					1	
	Genesee R.				2	1	
	Oak Orchard Cr.			2	1		
	Eighteenmile Cr.			1	1		
	Niagara R. NY			1	3	4	
	Niagara R. ON			1		1	
	Burlington Canal			1			
	Credit R.	1		2		1	
	Bluffer's Park					1	
2011	Oswego River			1		1	
	Sodus Bay			2		1	
	Genesee R.			2		3	3
	Sterling Cr.			1		1	
	Oak Orchard Cr.		1		2	2	1
	Eighteenmile Cr.	1		3	4	2	1
	Niagara R. NY				1	3	
	Port Dalhousie						1
	Bronte Cr.	1					
	Credit R.				1	1	

TABLE 3.2.3. The number of stocked and wild Chinook Salmon by year-class observed in the Credit River in 2013.

Year class	Origin	Number	Percent stocked
2009	Stocked	5	71%
	Wild	2	
2010	Stocked	65	82%
	Wild	14	
2011	Stocked	95	89%
	Wild	12	

TABLE 3.2.4. Number of Chinook Salmon observed with coded wire tags in the Credit River in 2013 by stocking location.

Year class	Stocking Location	Number	Straying rate
2010	Credit River	19	0%
2011	Credit River	18	38%
	Bronte Creek	11	

3.3 Lake Ontario Volunteer Chinook Angler Diary Program

A mass-marking and tag monitoring study was initiated in 2008 by NYSDEC and OMNR, to determine the origin (stocked or wild), distribution, and movement (Section 3.2) of Chinook Salmon in Lake Ontario. 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 these marked Chinook Salmon through a volunteer diary program. Since 2011, a volunteer dairy program, geared specifically to collect information on the marking rates of Chinook Salmon in the recreational fishery, has been conducted. Sampling occurred during the months of April to October from the Niagara River to Wellington; providing good temporal and spatial distribution of Chinook Salmon samples.

In 2013, 21 anglers participated in the program. Anglers participating in the diary program fished from April to October 2013. There was a large spatial distribution of the origin of participating anglers (Fig. 3.3.1). Eighty-five percent (18) of volunteer anglers were affiliated with an angling club, 10% (2) were anglers at large, and 5% (1) were charter boat operators. Anglers were asked to record location (nearest port), fork length (FL), disposition (kept or released), and examine for fin clips on every Chinook Salmon landed. In 2013, anglers made 424 angling trips and recorded marking data on 932 Chinook Salmon (Table 3.3.1).

Reported catches of Chinook Salmon varied in length from 215 mm to 1168 mm FL; with the majority of fish over 800 mm FL (Fig. 3.3.2). Harvest rates for Chinook Salmon (39% of catch) were lower than those for other salmonids (48% of catch). In total, six species of salmonid were caught, with Chinook Salmon composing 61% of the total catch (Fig. 3.3.3). See Section 3.2 for further details on the origin of Chinook Salmon in Lake Ontario.

We would like to thank all those participants who generously volunteered their time to collect marking and biological information for this program. Those participants that gave permission for their names to appear in this report include:

John Foley, Blue Knight Charters
Kevin Gibson, Central Lake Ontario Sport Anglers
Oli Hajny, Credit River Anglers Association
Dave Hill, St. Catherines Game & Fish Association
Jack Laki, Port Whitby Sport Fishing Association
Paul Paulin, St. Catherines Game & Fish Association
Al Vandusen, Central Lake Ontario Sport Anglers
Larry & Jean Zimmerman, Up4fishn Charters

FIG. 3.3.1. Spatial distribution of the origin of anglers participating in the 2013 Lake Ontario Volunteer Chinook Angler Dairy Program.

TABLE 3.3.1. Annual angler participation and spatial distribution of Chinook Salmon captured in the Lake Ontario Volunteer Angler Diary Program, 2011-2012. See Section 3.1 (Fig. 3.1.1) 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
2011	26	626	757	19	370	120	309	635	47	2883
2012	31	645	676	195	367	39	324	488	147	2236
2013	21	424	246	145	84	24	105	331	10	945
Total	78	1695	1679	359	821	183	738	1454	204	6064

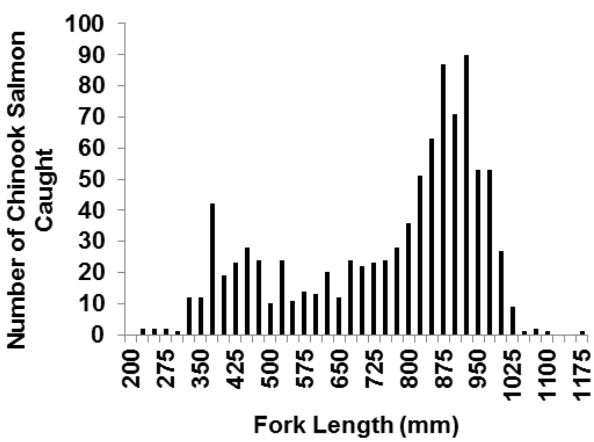


FIG. 3.3.2. Fork length distribution of Chinook Salmon caught in the 2013 Lake Ontario Volunteer Chinook Angler Dairy Program.

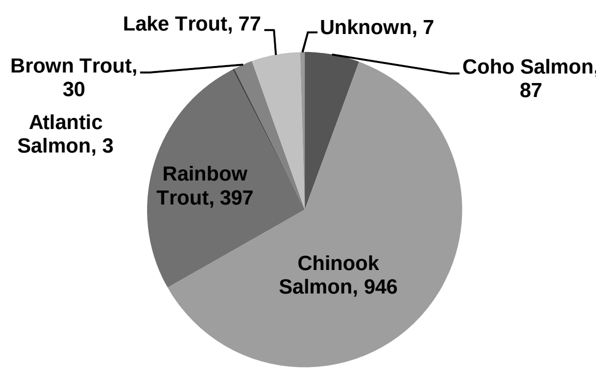


FIG. 3.3.3. Relative compositions of species catch during the 2013 Lake Ontario Volunteer Chinook Angler Dairy Program.

3.4 Bay of Quinte Ice Angling Survey

Only the ice-fishing component of the Bay of Quinte recreational angling fishery was monitored in 2013 (Jan 1-Mar 1); the open-water fishery was not surveyed. This was the first ice-fishing survey since 2009. The ice-fishing survey was conducted from Trenton to just east of Glenora. Angling effort was measured using aerial counts of anglers and huts (two days per week; one weekday and one weekend day) while on-ice angler interviews (three days per week; one weekday and two weekend days) provided information on hut occupancy rates, catch/harvest rates, and biological characteristics of the harvest.

Ice conditions were generally quite good. For analysis, the angling season was considered to be January 1 (safe ice-conditions) to March 1 (last day of Walleye open season) time-period. Fifteen aerial flights were conducted from Jan 5-Feb 25, 2013. The maximum number of ice-huts counted during aerial flights was 317 huts (February 23); while the maximum number of on-

TABLE 3.4.1. Bay of Quinte ice angling fishery statistics, 1982-2013, including angling effort (angler hours), 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.

	Walleye Anglers					
	Effort	Catch rate	Harvest rate	Catch	Harvest	Mean weight (kg)
1982	80,129		0.103		8,223	1.209
1984	108,024		0.091		9,869	1.924
1986	143,960		0.165		23,768	2.272
1988	163,669		0.045		7,416	2.198
1989	175,119	0.145	0.109	25,458	19,147	1.738
1990	164,916					
1991	194,088	0.212	0.165	41,204	32,111	1.909
1992	327,546	0.172	0.132	56,494	43,343	1.388
1993	271,088	0.079	0.055	21,326	14,816	1.603
1994	300,049	0.104	0.029	31,060	8,557	2.239
1995	215,518	0.134	0.081	28,939	17,445	1.900
1996	392,602	0.149	0.053	58,468	20,972	1.563
1997	220,263	0.192	0.103	42,315	22,631	1.563
1998	117,602	0.095	0.052	11,167	6,089	2.327
1999	140,363	0.166	0.109	23,293	15,285	2.300
2000	139,047	0.072	0.066	9,949	9,240	2.359
2001	77,074	0.013	0.012	982	938	2.546
2002	37,129	0.070	0.066	2,601	2,468	2.358
2003	16,237	0.020	0.004	321	70	3.391
2004	79,767	0.105	0.051	8,413	4,075	1.668
2005	58,091	0.059	0.034	3,450	1,947	1.879
2007	99,368	0.176	0.114	17,480	11,313	1.008
2009	128,415	0.114	0.083	14,666	10,695	1.607
2013	141,660	0.084	0.062	11,943	8,716	1.374

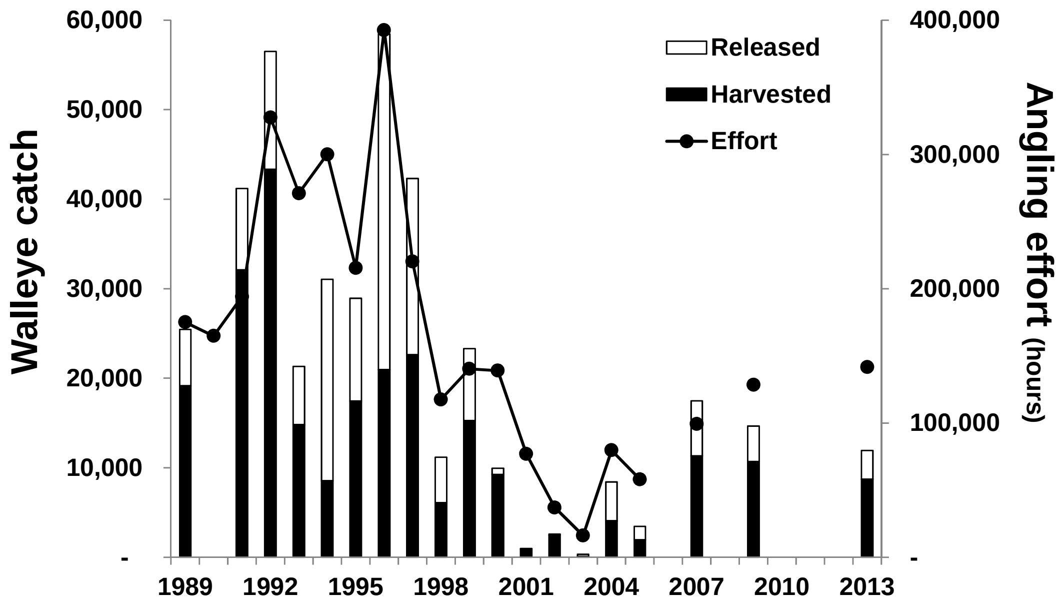


FIG. 3.4.1. Fishing effort and walleye catch (released and harvested) during the winter ice-fishery, 1989-2013. No data for 2006, 2008, 2010, 2011 or 2012.

ice anglers observed was 300 (also on February 23). A total of 1382 anglers were interviewed during 15 on-ice surveys. Forty-six percent of anglers interviewed were local, 48% were from Ontario (outside the local area), 5% were from the US and 1% was from elsewhere. Table 3.4.1 and Fig. 3.4.1 summarize ice-fishing survey results for 1993-2013.

The 2013 survey estimated a total of 146,304 hours of ice-fishing effort, slightly higher than the last ice-fishery survey in 2009 (131,312 hours). Of the total angling effort, Walleye anglers accounted for 141,660 hours. Walleye anglers caught 11,943 Walleye of which 8,716 were harvested. Walleye fishing success rate (11.9 hours to catch a Walleye) this winter was average. The size distribution of Walleye harvested is shown in Fig. 3.4.2.

Anglers also caught an estimated 63,568 Yellow Perch of which 24,089 were harvested during the winter ice-fishery (Fig. 3.4.2). The size distribution of Yellow Perch harvested is shown in Fig. 3.4.3.

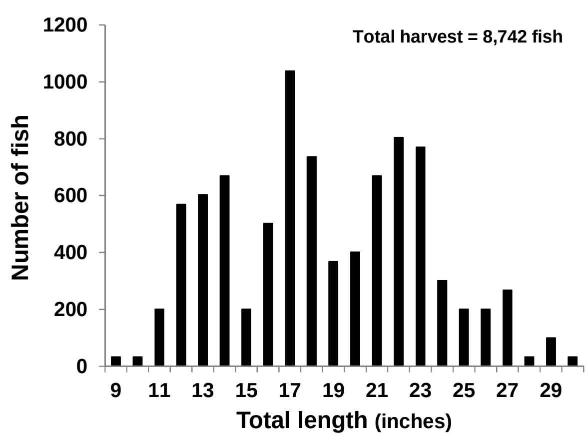


FIG. 3.4.2. Size (total length in inches) distribution of Walleye harvested during the 2013 winter ice-fishery based on measuring 261 fish.

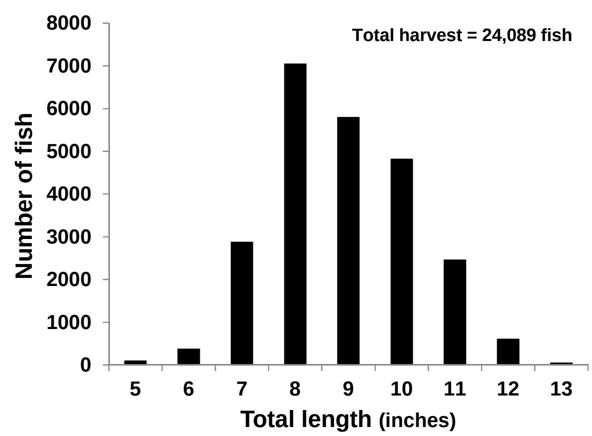


FIG. 3.4.3. Size (total length in inches) distribution of Yellow Perch harvested during the 2013 winter ice-fishery based on measuring 520 fish.

TABLE 3.4.2. Species-specific catch and harvest by all anglers during the 2013 winter ice-fishery.

Species	Catch	Harvest	% kept
Lake Whitefish	110	-	
Cisco (Lake Herring)	191	-	
Northern Pike	152	34	22
White Perch	166	85	51
Yellow Perch	63,568	24,089	38
Walleye	12,018	8,742	73

3.5 Bay of Quinte Volunteer Walleye Angler Diary Program

A volunteer angler diary program was conducted on the Bay of Quinte during fall 2013 . The diary program focused on the popular fall recreational fishery for “trophy” Walleye on the middle and lower reaches of Bay of Quinte. This was the second year of the diary program. Anglers that volunteered to participate in the program were given a personal diary and asked to record information about their daily fishing trips and catch (see Fig. 3.5.1). A total of 22 diaries were returned as of February 2013. We thank all volunteer anglers for participating in the program. Volunteer anglers originated from across a wide-range of southern Ontario and south western Quebec (Fig. 3.5.2).

Objectives of the diary program included:
1) engage and encourage angler involvement in monitoring the fishery;
2) characterize fall Walleye angling effort, catch, and harvest (including geographic distribution);
3) characterize the size distribution of Walleye caught (kept and released);
4) characterize species catch composition;
5) engage and train volunteers to tag released Walleye (new pilot project for 2013)

Three of the 22 returned diaries reported zero fishing trips. The number of fishing trips reported in each of the remaining 19 diaries ranged from one to 35 trips. Fishing trips were

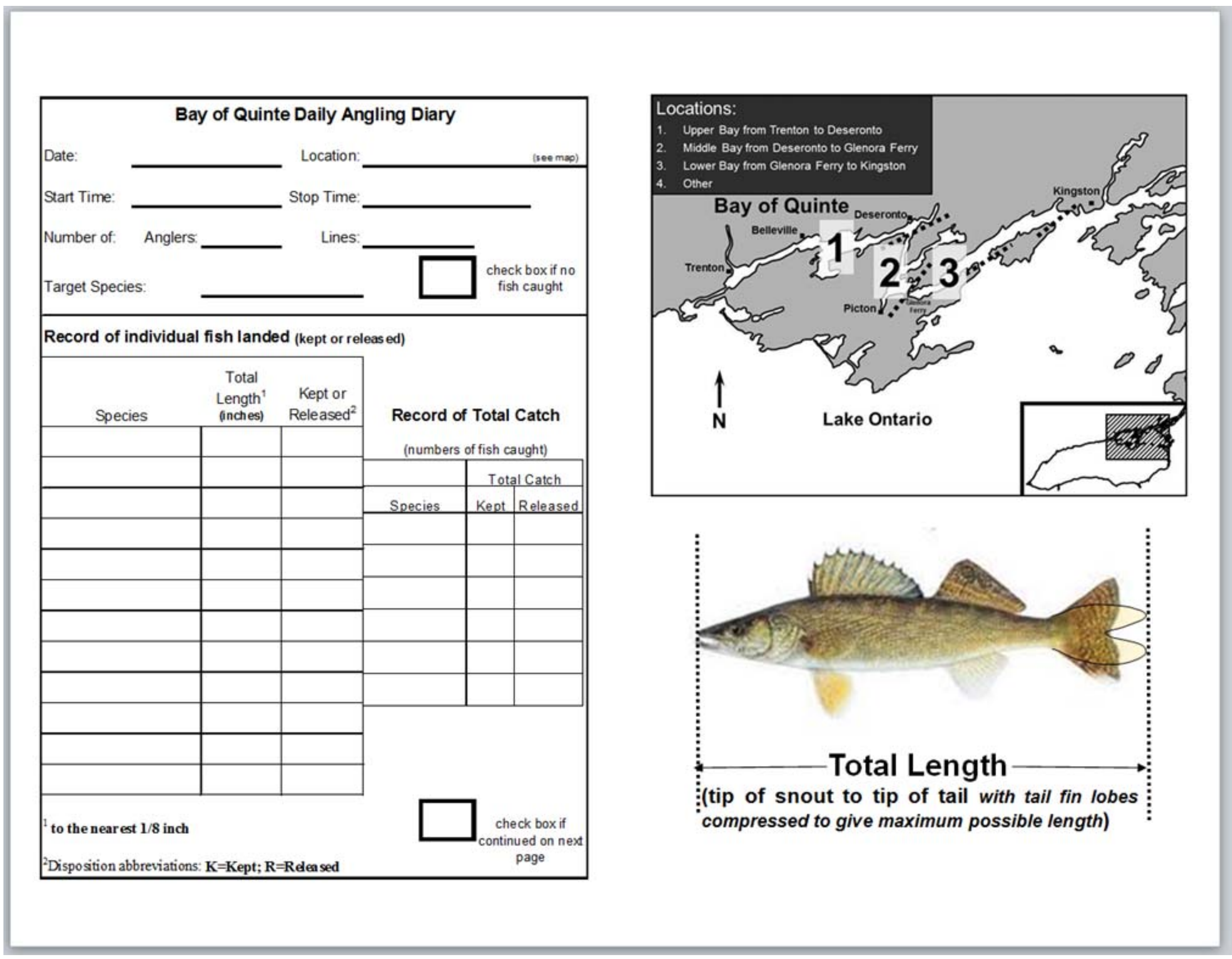


FIG. 3.5.1. Volunteer angler diary used to record information about daily fishing trips and catch.

reported for 61 out of a possible 91 calendar days from Sep 9 to Dec 8. There were from one to ten volunteers fishing on each of the 61 days. A total of 155 trip reports targeted Walleye: 72 charter boat trips and 83 non-charter boat trips (Table 3.5.1). Of the 155 trips, 148 (95%) were made on Locations 2 and 3, the middle and lower reaches of the Bay of Quinte (see Fig. 3.5.1). The overall average fishing trip duration was 7.4 hours for charter boats and 4.9 hours for non-charter boats, and the average numbers of anglers per boat trip were 4.0 and 2.1 for charter and non-charter boats, respectively (Table 3.5.1). In Location 3, where two lines are permitted, most anglers used two lines (1.8 rods per angler on average).

Fishing Effort

A total of 3,093 angler hours of fishing effort was reported by volunteer anglers (Table 3.5.2). Reported fishing effort increased steadily from late Sep until late Nov and then declined rapidly (Fig. 3.5.3). Most (56%) fishing effort occurred in Nov followed by October (30%). Most fishing effort occurred in Locations 2 (37%; middle Bay) or 3 (60%; lower Bay) (Fig. 3.5.4).

Catch

Seven species and a total of 649 fish were reported caught by volunteer anglers. The number of Walleye caught was 574 (307 kept and 267 released; Table 3.5.3). The next most abundant species caught was Freshwater Drum (25) followed by Northern Pike (24).

Fishing Success

The overall fishing success for Walleye in fall 2013 was 3.7 Walleye per boat trip or 0.193 fish per angler hour of fishing (Table 3.5.2). This represents a nearly 2-fold increase compared to the previous year (fall 2012). Eighty percent of all boat trips reported catching at least one Walleye (“skunk” rate 20%). Seasonal fishing success, for geographic Locations 2 and 3 combined, is shown in Fig. 3.5.5. Success generally increased from Sep through to late Nov

FIG. 3.5.2. Map showing the distribution of volunteer addresses of origin.

Table 3.5.1. 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 and 2013 on the Bay of Quinte.

	2012		2013	
	Charter	Non-charter	Charter	Non-charter
Total number of boat trips	121	137	72	83
Average trip duration (hours)	7.7	5.6	7.4	4.9
Average number of anglers per trip	4.4	2.3	4.0	2.1

Table 3.5.2. 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 angler hour, and the "skunk" rate (percentage of trips with no Walleye catch) for Walleye fishing trips during fall 2012 and 2013 on the Bay of Quinte.

Year	2012	2013
Number of diaries	22	19
Number of boat trips	258	155
Boat effort (hours)	1,694	941
Angler effort (hours)	5,915	3,093
Catch	542	574
Harvest	291	307
Released	251	267
Fish per boat trip	2.1	3.7
Fish per angler hour	0.102	0.193
"Skunk" rate	36%	20%

TABLE 3.5.3. Number of fish, by species, reported caught (kept and released) by volunteer anglers during the fall Walleye diary program, 2013.

	2012			2013		
Species	Kept	Released	Total	Kept	Released	Total
Chinook salmon	0	1	1	0	0	0
Brown trout	1	0	1	0	0	0
Lake trout	0	1	1	0	0	0
Lake whitefish	0	1	1	0	0	0
Northern pike	1	47	48	4	20	24
White perch	0	0	0	0	12	12
White bass	0	0	0	0	3	3
Morone sp.	1	15	16	0	0	0
Smallmouth bass	0	0	0	0	3	3
Yellow perch	4	32	36	2	6	8
Walleye	292	252	544	307	267	574
Freshwater drum	1	43	44	0	25	25
Total	300	392	692	313	336	649

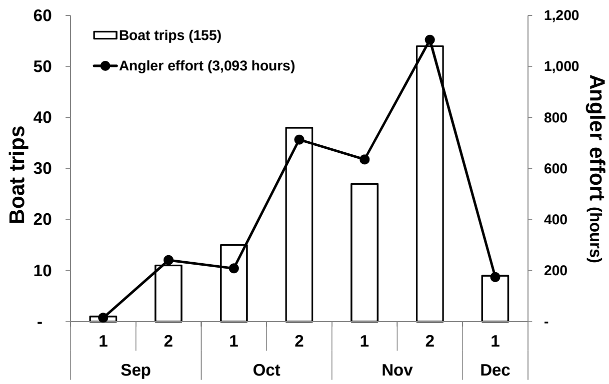


FIG. 3.5.3. Seasonal breakdown (summarized by first and second half of each month from the first half of Sep to the first half of Dec.) of fishing effort (boat trips and angler hours) reported by volunteer Walleye anglers during fall 2013 on the Bay of Quinte.

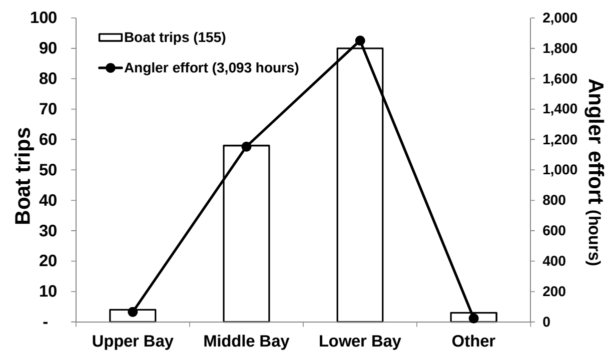


FIG. 3.5.4. Seasonal breakdown (summarized by first and second half of each month from the first half of Sep to the first half of Dec.) of fishing effort (boat trips and angler hours) reported by volunteer Walleye anglers during fall 2013 on the Bay of Quinte.

and early Dec. Fishing success was higher in location 3 (lower Bay; 4.2 Walleye per boat trip or 0.214 fish per angler hour) than in Location 2 (middle Bay; 2.9 Walleye per boat trip or 0.151 fish per angler hour).

Length Distribution of Walleye Caught

Of the 574 Walleye caught, 307 (53%) were harvested and 267 (47%) were released. Harvested Walleye were smaller than released Walleye (24.0 vs. 26.8 inches; Fig. 3.5.6). The mean total length of Walleye caught (harvested and released fish) increased steadily from October through late November and early December (Fig. 3.5.7).

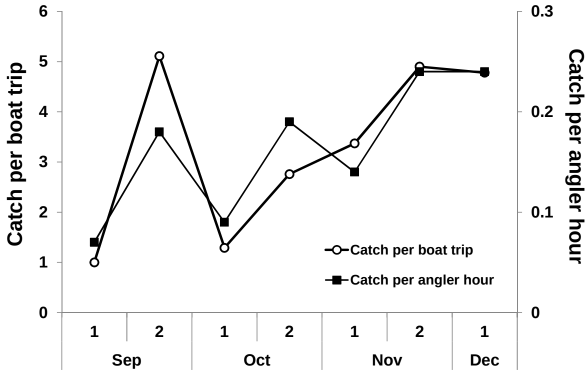


FIG. 3.5.5. Walleye fishing success (catch per boat trip and per angler hours) reported by volunteer Walleye anglers during fall 2013 on the Bay of Quinte (summarized by first and second half of each month from the first half of Sep to the first half of Dec).

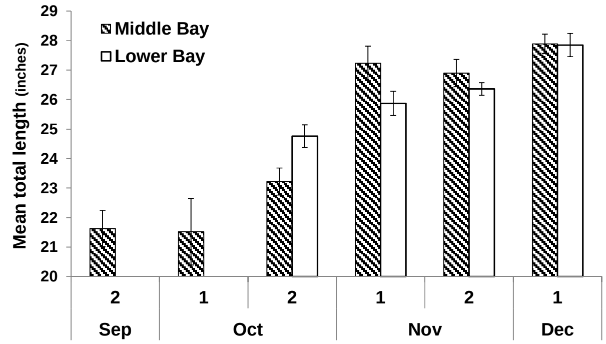


FIG. 3.5.7. Mean total length (inches) of Walleye caught by volunteer Walleye anglers during fall 2013 on the Bay of Quinte by location (summarized by first and second half of each month from the second half of Sep to the first half of Dec.). Error bars are +- 1SE.

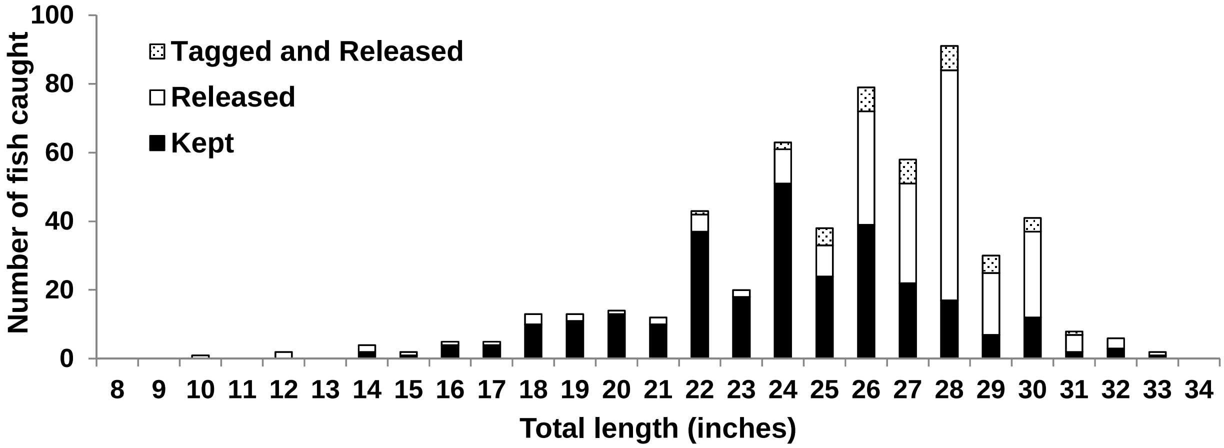


FIG. 3.5.6. Length distribution of Walleye caught (kept and released) by volunteer Walleye anglers during fall 2013 on the Bay of Quinte.

Walleye Tagging

Thirty-nine Walleye were tagged (Fig. 3.5.7) and released by volunteer anglers. Tagged fish ranged in total length from 22-31 inches (mean length 27.1 inches; Fig. 3.5.6). One of the tagged Walleye was reported caught and released by an angler about one month after being tagged. Special thanks to Scott Walcott and Joe Pickstock for participating in the Walleye tagging pilot project.

FIG. 3.5.7. Walleye tagged during the 2013 volunteer angler diary program.

3.6 Lake St. Francis Recreational Fishery

The Ontario portion of Lake St Francis is approximately 7,380 ha in size, and is relatively shallow and eutrophic compared to the rest of the St. Lawrence River. These conditions are favourable for Yellow Perch production, the most popular species in the Lake St. Francis fishery.

The Yellow Perch fishery in Lake St. Francis is significant to the local area. Renowned for its abundance of "jumbo" perch, it was once the only area in Ontario where anglers were legally allowed to sell their catch. During the mid -1990s concerns were raised about declines in Yellow Perch abundance, particularly large perch. With the goal of increasing Yellow Perch abundance, more restrictive angling regulations were put in place. These included changes in perch harvest and possession limits, a spring season closure (late-1990s), and prohibiting the sale of angler caught perch (2005).

Angling surveys have been conducted periodically, over the years, on this important fishery. The 2013 survey replicated the design of the most recent two surveys (2003 and 2009), beginning in May and consisting of three seasons: spring (May 11 to Jun 14), summer (Jun 15 to Sep 2), and fall (Sep 3 to Oct 4). The survey used both on-water boat counts and on-water angler interviews to determine angler activity and catch.

Nearly 2,100 anglers were interviewed (1,185 boats) by field crews. Eighty-one percent

TABLE. 3.6.1. Species-specific statistics for open-water angling from May 10 to Oct 4, 2013 on Lake St. Francis, St. Lawrence River. Shown are angling effort (for anglers targeting specific species), number of fish caught and harvested (by all anglers), percent of fish kept, and angling success (CUE; measured as the number of fish caught per hour for anglers targeting a specific species). Total estimated angling effort was 63,121 hours; some anglers target more than one species, therefore the sum of species-specific targeted angling effort (73,749 hours) is greater than the actual total angling effort by all anglers.

Species	Angling effort	Catch	Harvest	% kept	CUE
Lake Sturgeon	-	122	-	-	
Chinook Salmon	-	1	-	-	
Northern Pike	2,040	282	101	36	0.082
Muskellunge	1,168	80	-	-	0.065
Common Carp	-	127	90	71	
Fallfish	-	283	110	39	
Brown Bullhead	83	1,952	206	11	-
American Eel	-	41	13	31	
White Perch	-	27	-	-	
Rock Bass	34	4,758	-	-	0.885
Pumpkinseed	-	193	-	-	
Bluegill	-	75	-	-	
Smallmouth Bass	9,525	7,544	1,716	23	0.472
Largemouth Bass	6,496	3,195	883	28	0.330
Sunfish	24	959	44	5	1.445
Yellow Perch	39,949	363,217	144,925	40	9.061
Walleye	13,897	7,671	4,498	59	0.532
Round Goby	-	13,381	3,803	28	
Freshwater Drum	-	13	-	-	
Total	73,749	403,930	156,388		

of anglers interviewed were local, 13% were from Quebec, 6% were from Ontario (but not local), and <1% were U.S. residents. Total angler effort was estimated to be 63,121 hours. Anglers reported catching 19 different species (Tables 3.6.1 and 3.6.2). Most angling effort was targeted toward Yellow Perch (39,949 hours) followed by Walleye (13,949 hours), Smallmouth Bass (9,525 hours) and Largemouth Bass (6,496 hours).

Anglers caught an estimated 363,217 Yellow Perch and harvested 144,925 (release rate 60%). Angling success was relatively high at 9.0 Yellow Perch caught (3.6 fish harvested) per hour

TABLE. 3.6.2. Seasonal breakdown of selected creel survey statistics for open-water angling from May 10 to Oct 4, 2013 on Lake St. Francis. Shown are "Spring" (May 11 to Jun 14; 35 days), "Summer" (Jun 15 to Sep 2; 80 days), and "Fall" (Sep 3 to Oct 4; 32 days). Shown are angling effort (both for all anglers and for anglers targeting specific species), number of fish caught and harvested (all anglers), angling success (measured as the number of fish caught per hour for anglers targeting a specific species), and the release rate (percent of fish released).

		Season			
	Species	Spring	Summer	Fall	Total
Angling effort (angler hours):					
	Total all anglers	12,796	43,693	6,632	63,121
	Northern Pike	491	1,436	114	2,040
	Muskellunge	-	779	389	1,168
	Smallmouth Bass	-	7,692	1,833	9,525
	Largemouth Bass	-	6,050	446	6,496
	Yellow Perch	10,466	25,893	3,591	39,949
	Walleye	2,067	10,950	880	13,897
Number of fish caught (all anglers):					
	Northern Pike	31	210	40	282
	Muskellunge		68	12	80
	Smallmouth Bass	200	5,726	1,618	7,544
	Largemouth Bass	58	2,893	245	3,195
	Yellow Perch	116,857	199,948	46,412	363,217
	Walleye	749	6,734	188	7,671
Number of fish harvested (all anglers):					
	Northern Pike	12	89	-	101
	Muskellunge		-	-	-
	Smallmouth Bass	-	1,637	79	1,716
	Largemouth Bass	-	785	97	883
	Yellow Perch	45,444	80,780	18,701	144,925
	Walleye	618	3,745	135	4,498
Angling success (number of fish per hour):					
	Northern Pike	0.040	0.074	0.353	0.082
	Muskellunge		0.087	0.021	0.065
	Smallmouth Bass		0.405	0.754	0.472
	Largemouth Bass		0.317	0.518	0.330
	Yellow Perch	11.142	7.695	12.842	9.061
	Walleye	0.349	0.593	0.190	0.532
Release rate					
	Northern Pike	100%	51%	100%	69%
	Muskellunge		100%	100%	100%
	Smallmouth Bass		78%	98%	84%
	Largemouth Bass		72%	59%	71%
	Yellow Perch	61%	59%	59%	60%
	Walleye	18%	44%	20%	41%

of fishing. Anglers caught 7,671 and harvested 4,498 Walleye. Walleye catch rate was 0.532 fish per hour, and release rate was over 40%; both figures indicate a high quality fishery. Anglers also caught 7,544 Smallmouth Bass (0.472 fish per hour) and 3,195 Largemouth Bass (0.330 fish per hour).

The average size of Yellow Perch harvested was 210 mm and the average age was 4.3 years (Fig. 3.6.1). Sixty-four percent of anglers indicated that the Yellow Perch fishery was unchanged (19%) or had improved (45%) in the last five years. Forty-six percent thought that the fishery was worse (21%) or had no opinion (15%).

The age distributions of harvested Northern Pike, Smallmouth and Largemouth Bass, and Walleye are shown in Fig. 3.6.2.

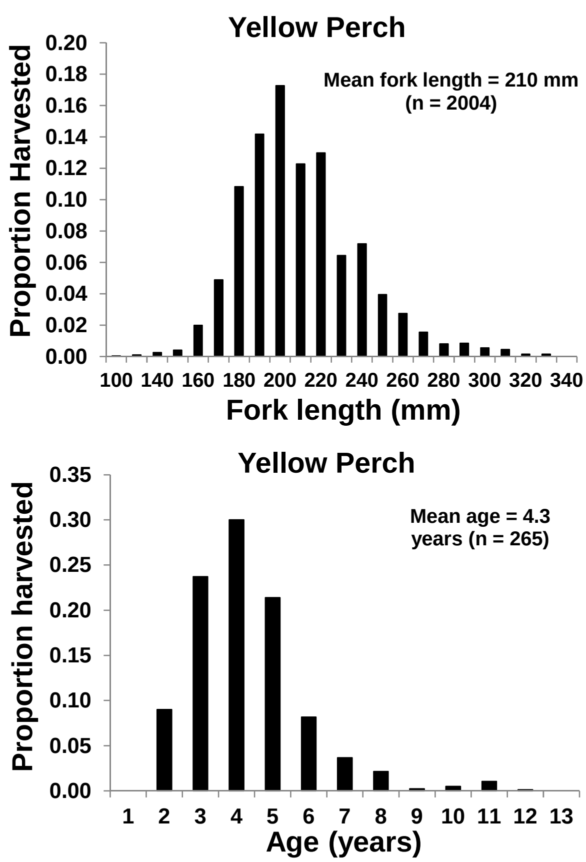


FIG. 3.6.1. Length (upper panel) and age (lower panel) distributions of Yellow Perch sampled (harvested fish) during the Lake St. Francis recreational fishery survey, 2013. Mean fork length and age, and sample sizes are indicated.

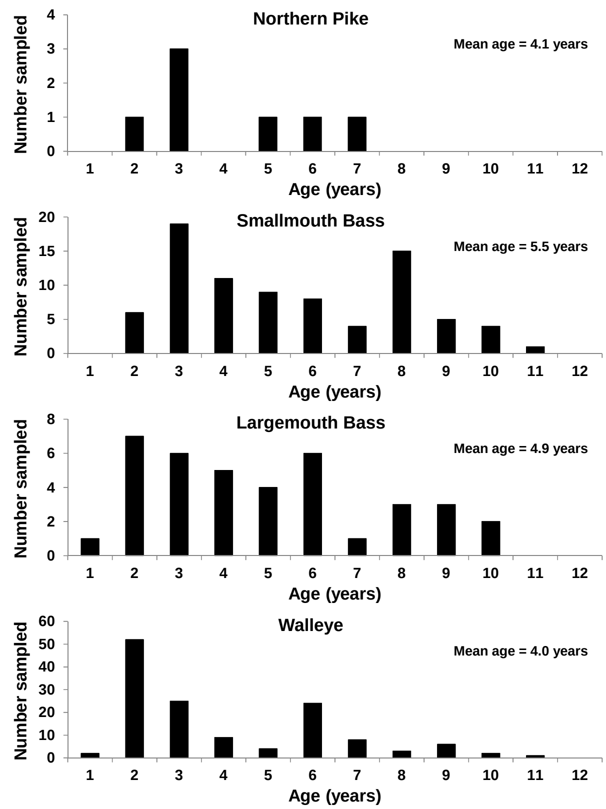


FIG. 3.6.2. Age distributions of Northern Pike, Smallmouth Bass, Largemouth Bass, and Walleye (harvested fish) during the Lake St. Francis recreational fishery survey, 2013. Mean ages are indicated.

4. Commercial Fishery

4.1 Quota and Harvest Summary

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. 4.1.1). Commercial harvest statistics for 2013 were obtained from the commercial fish harvest information system (CFHIS) which is managed, in partnership, by the Ontario Commercial Fisheries Association (OCFA) and the Ontario Ministry of Natural Resources. Commercial quota, harvest and landed value statistics for Lake Ontario, the St. Lawrence River and East and West Lakes, for 2013, are shown in Tables 4.1.1 (base quota), 4.1.2 (issued quota), 4.1.3 (harvest) and 4.1.4 (landed value).

The total harvest of all species was 495,011 lb ($545,746) in 2013, down 139,900 lb (22%) from 2012. The respective harvest (landed value) for Lake Ontario, the St. Lawrence River, and East and West Lakes was 340,467 lb ($353,948), 120,643 lb ($156,284), and 33,901 lb ($35,514), respectively (Fig. 4.1.2 and Fig. 4.1.3). Lake Whitefish and Yellow Perch 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. 4.1.4 and Fig. 4.1.5. Having declined in the early 2000s, commercial harvest appears to have stabilized at about 400,000 lb and 150,000 lb for Lake Ontario (Fig. 4.1.4) and the St. Lawrence River (Fig. 4.1.5) respectively.

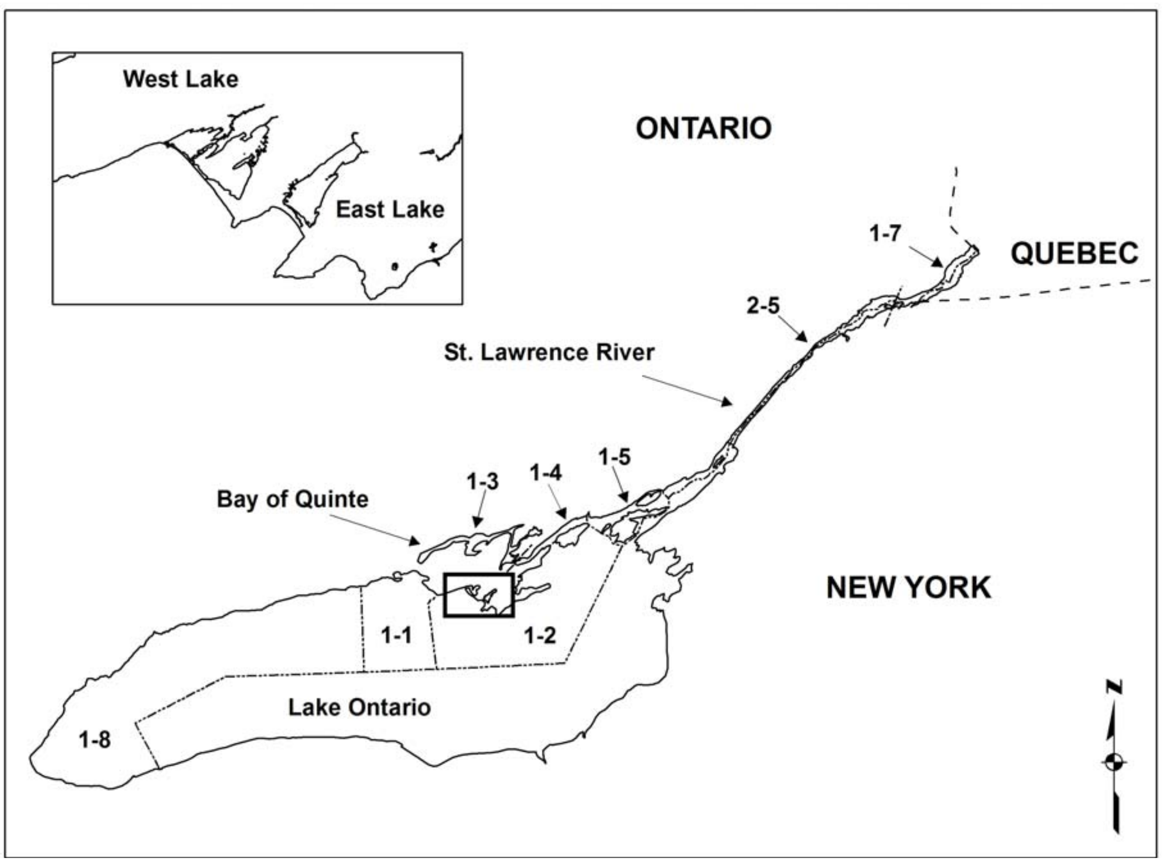


FIG. 4.1.1. Map of Lake Ontario and the St. Lawrence River showing commercial fishing quota zones in Canadian waters.

TABLE 4.1.1. Commercial fish **base quota** (lb), by quota zone, in the Canadian waters of Lake Ontario and the St. Lawrence River, East and West Lakes (two Lake Ontario embayments), 2013.

	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	800	2,800	14,170	17,590	4,840	3,100	9,850	25,964	36,600	75,514
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	35,308	0	8,308	800	0	0	0	0	0	48,671	0	48,671
Yellow Perch	35,590	143,473	100,928	126,170	13,000	68,976	82,814	22,560	1,400	4,420	419,161	174,350	599,331
Total	115,990	257,804	129,427	155,591	17,308	83,146	100,404	27,400	33,450	59,570	676,120	210,950	980,090

TABLE 4.1.2. Commercial fish **issued quota** (lb), by quota zone, in the Canadian waters of Lake Ontario and the St. Lawrence River, East and West Lakes (two Lake Ontario embayments), 2013.

	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	12,671	400	1,400	10,870	8,795	3,245	3,100	9,850	18,241	22,910	54,101
Bowfin	0	0	0	0	500	0	0	0	0	0	500	0	500
Brown Bullhead	18,100	0	0	0	0	0	0	0	14,350	27,220	18,100	0	59,670
Lake Whitefish	958	117,779	7,755	5,268	104	0	0	0	0	0	131,864	0	131,864
Sunfish	14,065	0	0	0	0	0	0	0	14,600	18,080	14,065	0	46,745
Walleye	2,708	17,757	0	30,387	400	0	0	0	0	0	51,252	0	51,252
Yellow Perch	17,795	72,938	71,949	71,053	6,500	58,640	41,407	22,910	1,400	4,420	240,235	122,957	369,012
Total	55,896	209,974	92,375	107,108	8,904	69,510	50,202	26,155	33,450	59,570	474,257	145,867	713,144

TABLE 4.1.3. Commercial **harvest** (lb), by quota zone, for fish species harvested from the Canadian waters of Lake Ontario and the St. Lawrence River, East and West Lakes (two Lake Ontario embayments), 2013.

	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	0	0	9,513	13	0	5,478	1,292	1,076	7	2,586	9,526	7,846	19,965
Bowfin	0	0	3,783	0	0	2,632	2,645	158	186	358	3,783	5,435	9,762
Brown Bullhead	128	9	3,484	111	0	1,415	5,088	17,962	24	980	3,732	24,465	29,201
Common Carp	0	132	17	41	0	526	28	0	0	16	190	554	760
Freshwater Drum	118	479	8,538	22,354	0	0	0	0	0	6	31,489	0	31,495
Cisco	0	75	1,423	700	0	0	0	0	0	5	2,198	0	2,203
Lake Whitefish	282	98,018	2,906	799	0	0	0	0	0	0	102,005	0	102,005
Northern Pike	133	471	25,314	2,457	0	7,424	0	0	621	3,502	28,375	7,424	39,922
Rock Bass	57	856	4,326	1,112	0	661	851	24	949	1,185	6,351	1,536	10,021
Sunfish	17	0	36,389	463	0	5,134	4,343	2,795	9,471	9,676	36,869	12,272	68,288
Walleye	436	2,730	0	21,219	0	0	0	0	0	0	24,385	0	24,385
White Bass	13	186	140	3,436	0	0	0	0	0	3	3,775	0	3,778
White Perch	19	311	14,304	7,217	0	211	0	0	14	2,671	21,851	211	24,747
White Sucker	0	169	8,698	1,634	0	364	0	11	261	612	10,501	375	11,749
Yellow Perch	0	6,674	29,991	18,772	0	24,789	14,499	21,237	145	623	55,437	60,525	116,730
Total	1,203	110,110	148,826	80,328	0	48,634	28,746	43,263	11,678	22,223	340,467	120,643	495,011

TABLE 4.1.4. Commercial **harvest (lb), price per lb, and landed value** for fish species harvested from the Canadian waters of Lake Ontario and the St. Lawrence River, and the total for all waterbodies including East and West Lakes, 2013.

	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	9,526	$3.23	$30,772	7,846	$2.73	$21,411	19,965	$2.98	$59,569
Bowfin	3,783	$0.35	$1,339	5,435	$0.64	$3,464	9,762	$0.51	$4,941
Brown Bullhead	3,732	$0.19	$702	24,465	$0.42	$10,211	29,201	$0.39	$11,278
Common Carp	190	$0.10	$19	554	$0.36	$199	760	$0.38	$289
Freshwater Drum	31,489	$0.09	$2,901	0			31,495	$0.09	$2,902
Lake Herring (Cisco)	2,198	$0.23	$499	0			2,203	$0.23	$500
Lake Whitefish	102,005	$1.08	$110,325	0			102,005	$1.08	$110,325
Northern Pike	28,375	$0.28	$7,866	7,424	$0.30	$2,215	39,922	$0.28	$11,014
Rock Bass	6,351	$0.49	$3,130	1,536	$0.49	$760	10,021	$0.49	$4,944
Sunfish	36,869	$1.26	$46,577	12,272	$1.30	$15,946	68,288	$1.28	$87,143
Walleye	24,385	$2.39	$58,209	0			24,385	$2.39	$58,209
White Bass	3,775	$0.44	$1,671	0			3,778	$0.44	$1,669
White Perch	21,851	$0.44	$9,588	211	$0.45	$95	24,747	$0.45	$11,129
White Sucker	10,501	$0.10	$1,049	375	$0.10	$38	11,749	$0.10	$1,171
Yellow Perch	55,437	$1.43	$79,300	60,525	$1.68	$101,947	116,730	$1.55	$180,664
Total	340,467		$353,948	120,643		$156,284	495,011		$545,746

Major Species

For major species, commercial harvest relative to issued and base quota information, including annual trends, is shown in Fig. 4.1.6 to Fig. 4.1.17. 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 2013 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 4.1.6. Overall, only 19% (116,730 lb) of the Yellow Perch base quota was harvested in 2013. The highest Yellow Perch harvest came from quota zones 1-3, 1-5 and 1-7. A very small proportion of base quota was harvested in quota zones 1-1 and 1-2.

Trends in Yellow Perch quota (base), harvest and price-per-lb are shown Fig. 4.1.7. Quota has remained more or less constant since 2000 except in quota zone 1-7 where quota has increased significantly and allowed for increased harvest. All base quota is issued and most quota is harvested in quota zone 1-7. Harvest has declined significantly since the early 2000s in quota zone 1-2. Harvest decreased in all the major quota zones in 2013 (Fig. 4.1.7). Yellow Perch price-per-lb was down somewhat in 2013.

Lake Whitefish

Lake Whitefish 2013 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 4.1.8. Overall, 87% (102,005 lb) of the Lake Whitefish base quota was harvested in 2013. The highest Lake Whitefish harvest came from quota zone 1-2. Lake Whitefish is managed as 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. 4.1.8). Relatively small proportions of base quota were harvested in quota zones 1-1, 1-3 and 1-4.

Trends in Lake Whitefish quota (base), harvest and price-per-lb are shown Fig. 4.1.9. Quota has remained constant for the last four years (just under 120,000 lb for all quota zones combined).

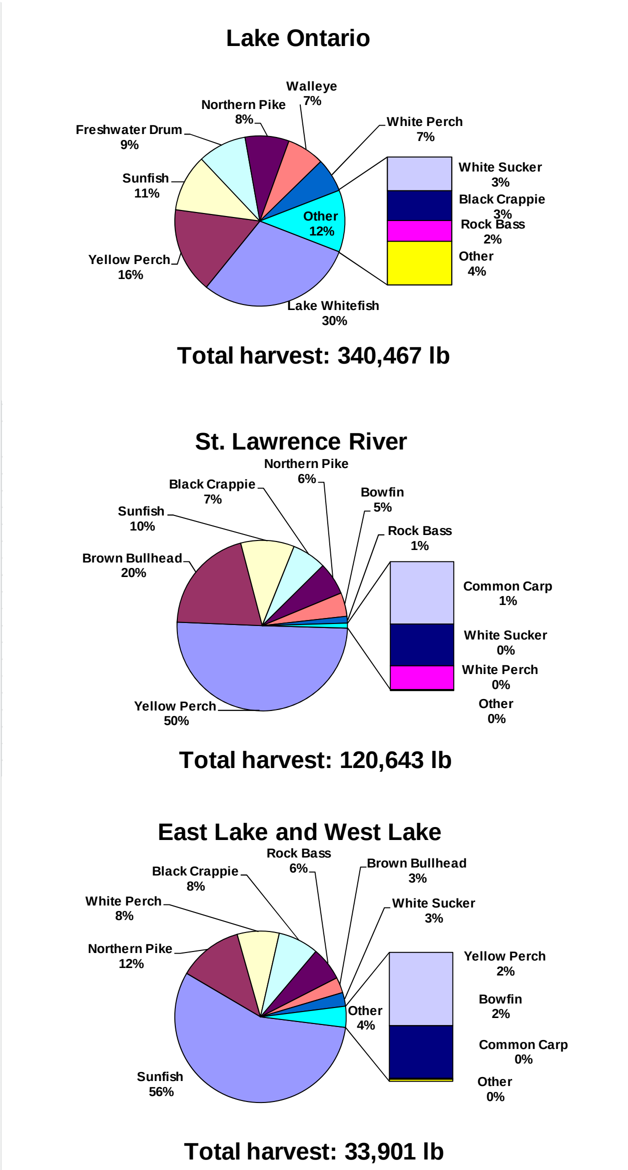


FIG. 4.1.2. Pie-charts showing breakdown of 2013 commercial harvest by species **(% by weight)** for Lake Ontario (quota zones 1-1, 1-2, 1-3, 1-4 and 1-8), the St. Lawrence River (quota zones 1-5, 2-5 and 1-7), and for East and West Lakes combined.

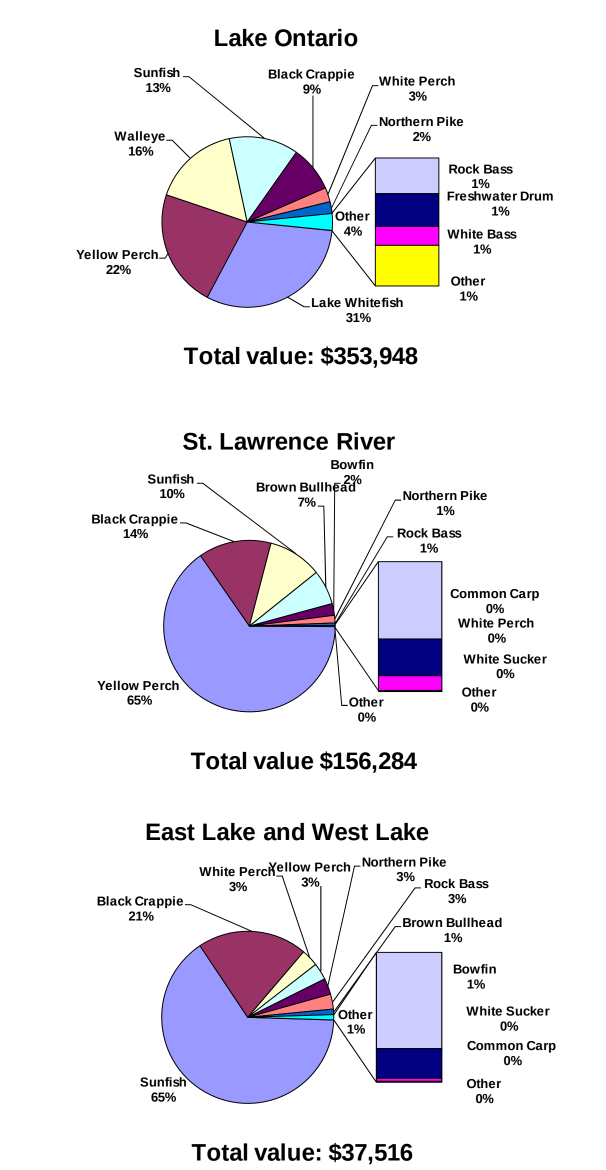


FIG. 4.1.3. Pie-charts showing breakdown of 2013 commercial harvest by species **(% by landed value)** for Lake Ontario (quota zones 1-1, 1-2, 1-3, 1-4 and 1-8), the St. Lawrence River (quota zones 1-5, 2-5 and 1-7), and for East and West Lakes combined.

Seasonal whitefish harvest and biological attributes (e.g., size and age structure) information are reported in Section 4.2. Lake Whitefish price-per-lb is currently relatively high.

Walleye

Walleye 2013 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 4.1.10. Overall, 48% (24,385 lb) of the Walleye base quota was harvested in 2013. 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 2013, this resulted in issued quota and harvest being considerably higher than base quota in quota zone 1-4 (Fig. 4.1.10).

Trends in Walleye quota (base), harvest and price-per-lb are shown Fig. 4.1.11. Quota has

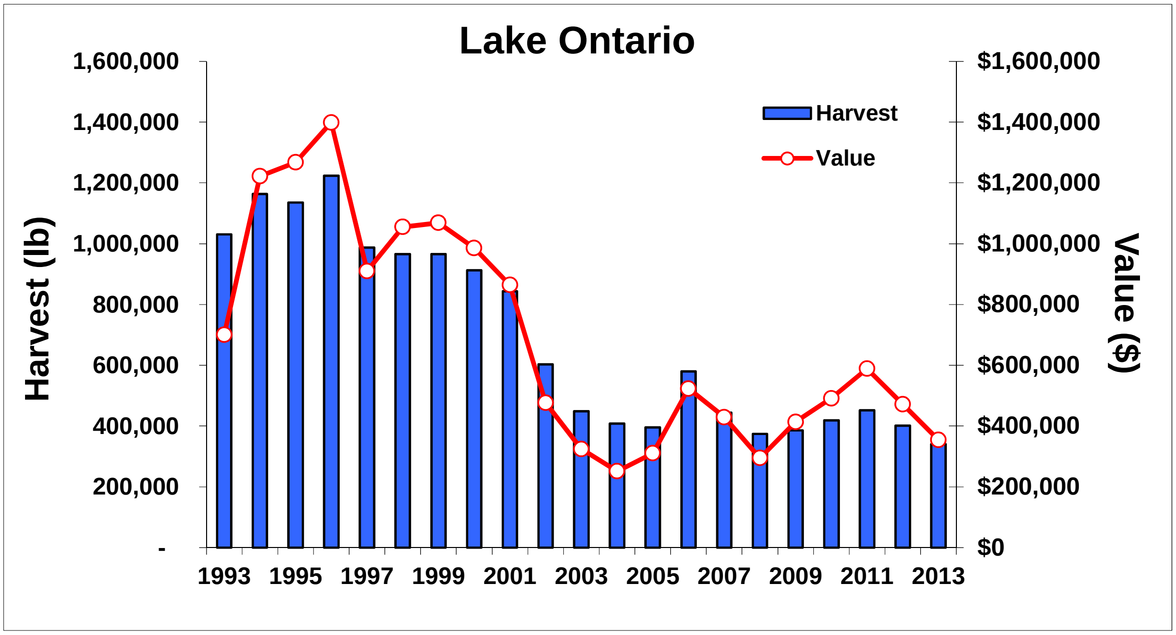


FIG. 4.1.4. Total commercial fishery harvest and value for **Lake Ontario** (Quota Zones 1-1, 1-2, 1-3 ,1-4 and 1-8) 1993-2013.

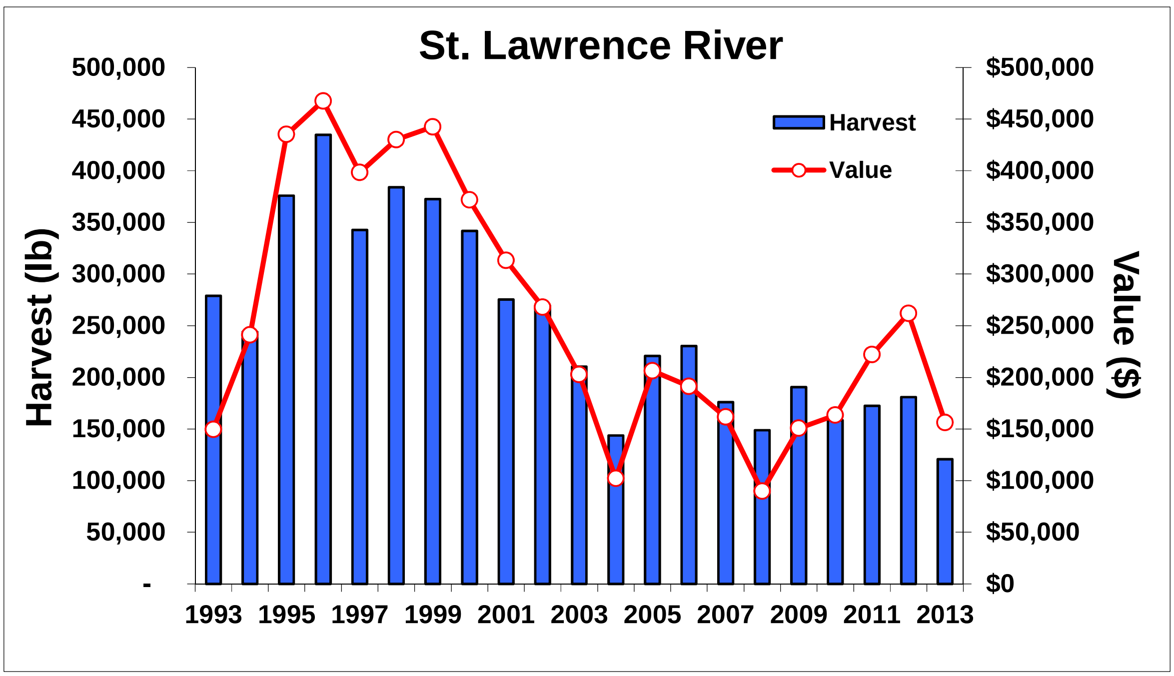


FIG. 4.1.5. Total commercial fishery harvest and value for the **St. Lawrence River** (Quota Zones 1-5, 2-5 and 1-7), 1993-2013.

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

Black Crappie

Black Crappie 2013 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 4.1.12. Overall, only 26% (19,965 lb) of the Black Crappie base quota was harvested in 2013. The highest Black Crappie harvest came from quota zones 1-3, 1-5 and West Lake. Only a small proportion of base quota was harvested in other quota zones .

Trends in Black Crappie quota (base), harvest and price-per-lb are shown Fig. 4.1.13. Harvest in West Lake increased in 2013. Black Crappie price-per-lb is currently high.

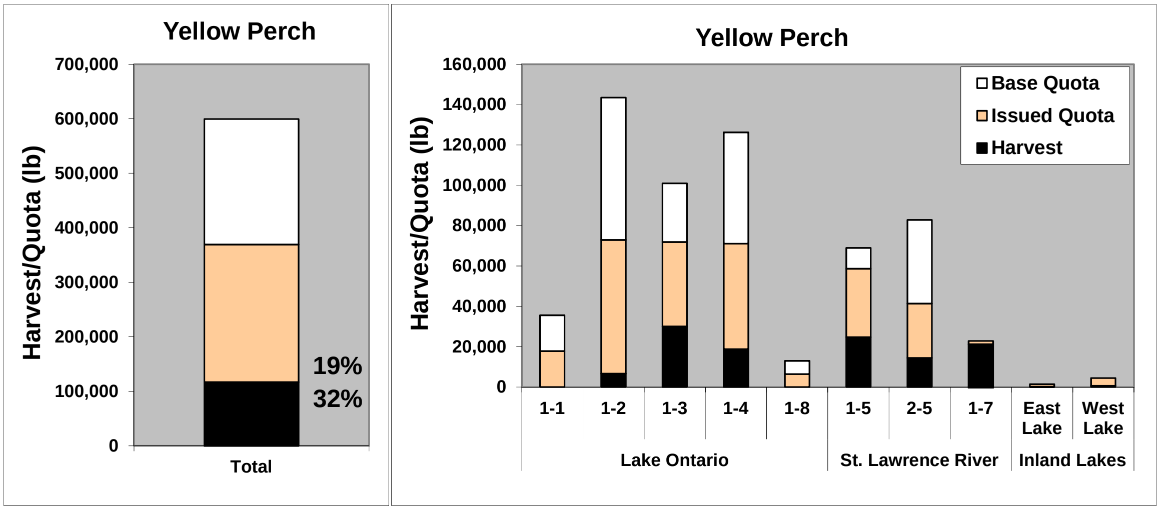


FIG. 4.1.6. **Yellow Perch** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2013.

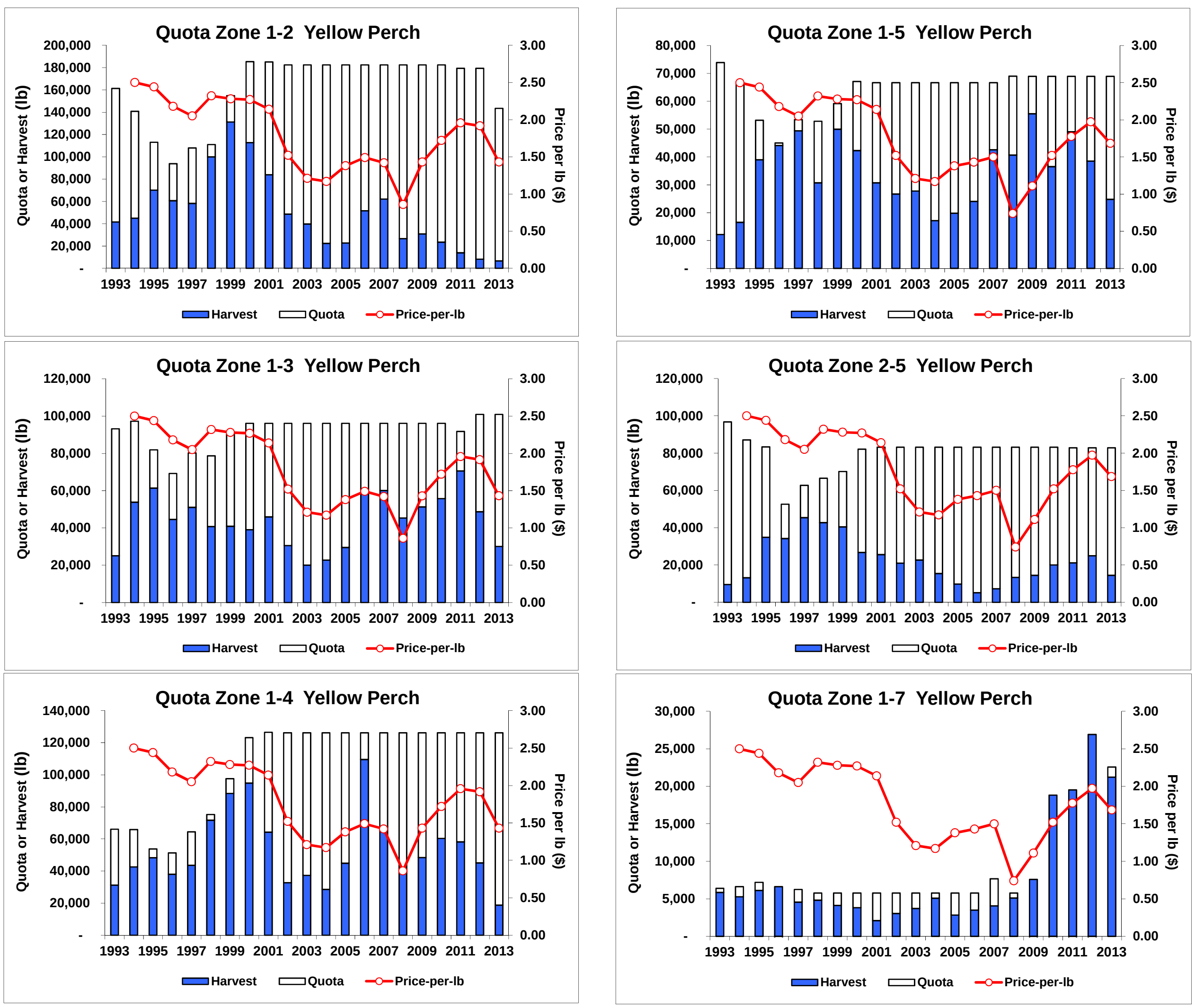


FIG. 4.1.7. Commercial base quota, harvest and price-per-lb for **Yellow Perch** in Quota Zones 1-2, 1-3, 1-4, 1-5, 2-5 and 1-7, 1993-2013.

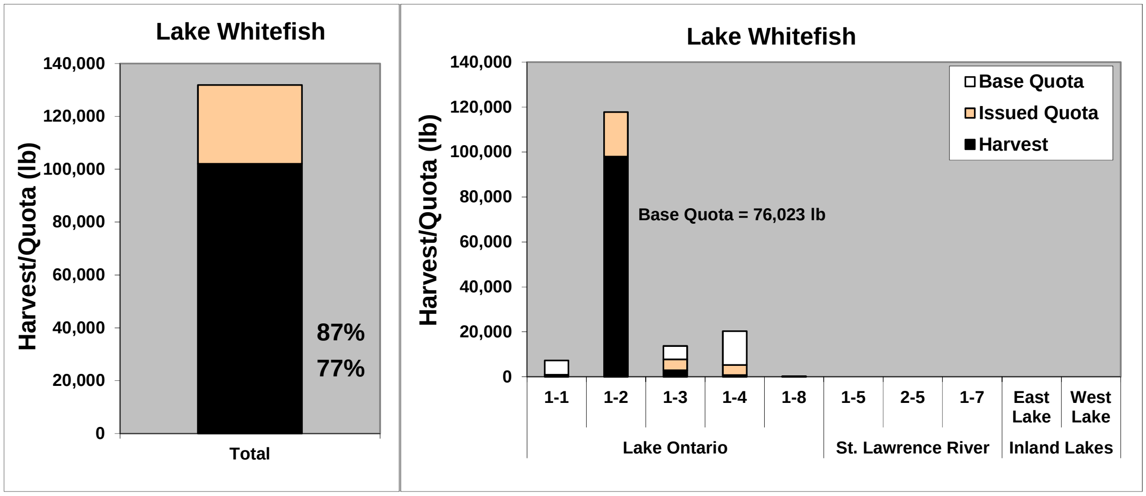


FIG. 4.1.8. **Lake Whitefish** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2013.

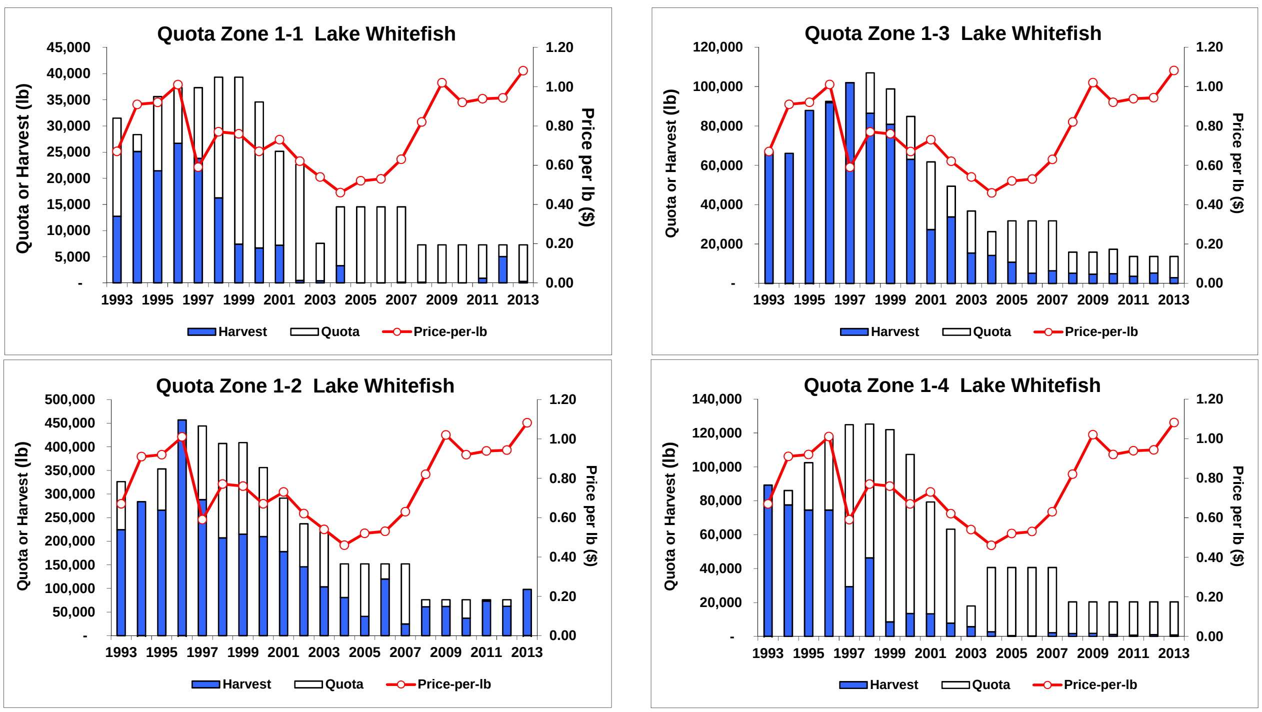


FIG. 4.1.9. Commercial base quota, harvest and price-per-lb for **Lake Whitefish** in Quota Zones 1-1, 1-2, 1-3 and 1-4, 1993-2013.

Sunfish

Sunfish 2013 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 4.1.14. Only quota zones 1-1, 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 Fig. 4.1.15. Harvest declined in all quota zones in 2013. Sunfish price -per-lb is currently high.

Brown Bullhead

Brown Bullhead 2013 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 4.1.16. Only quota zones 1-1, East Lake and

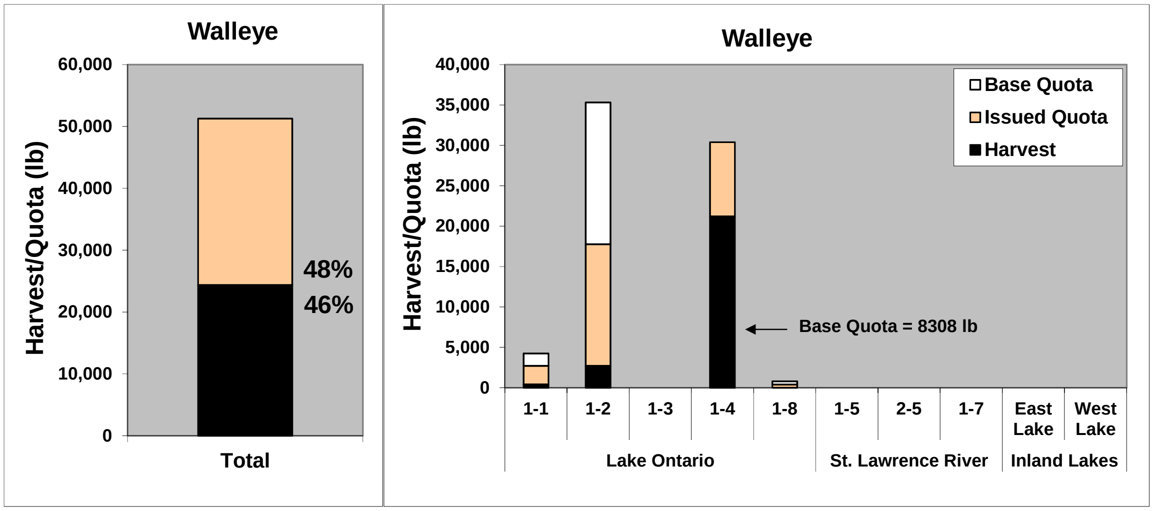


FIG. 4.1.10. **Walleye** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2013.

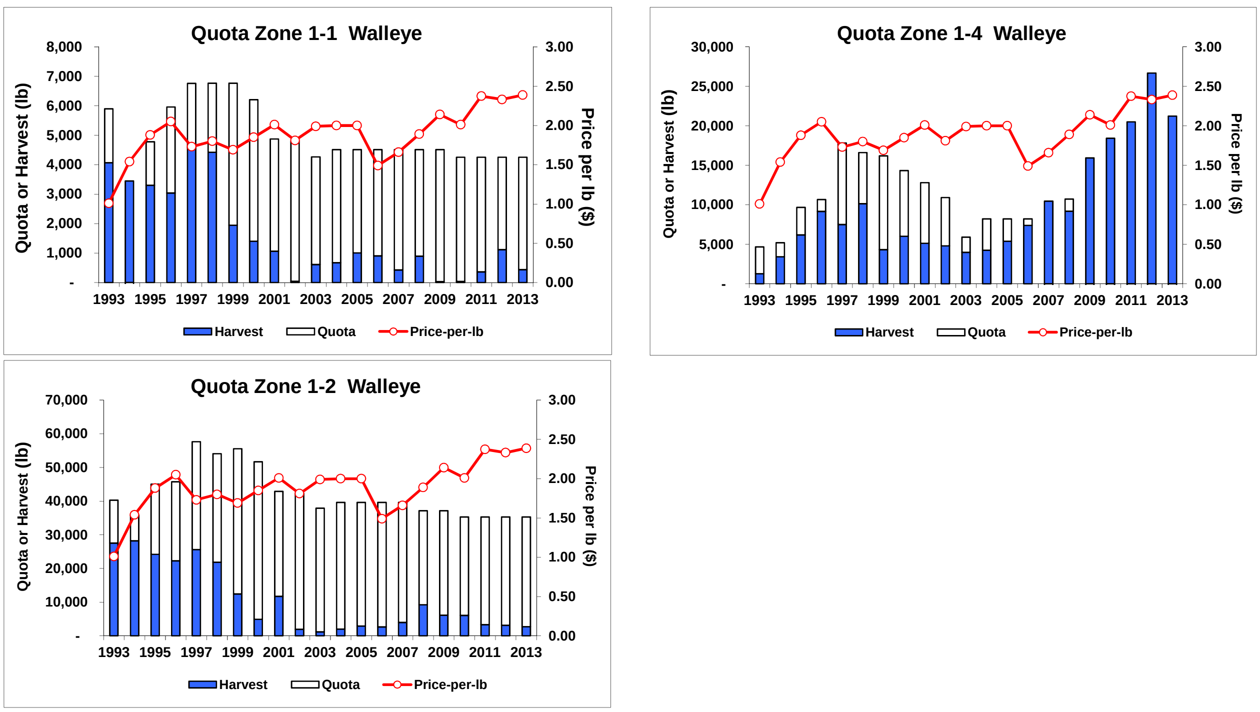


FIG. 4.1.11. Commercial base quota, harvest and price-per-lb for **Walleye** in Quota Zones 1-1, 1-2 and 1-4, 1993-2013.

West Lake have quotas for Brown Bullhead; quota is unlimited in the other zones. In the quota zones with quota restrictions, only a very small proportion 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 Fig. 4.1.17. With the exception of quota zone 1-7, current harvest levels are extremely low relative to past levels.

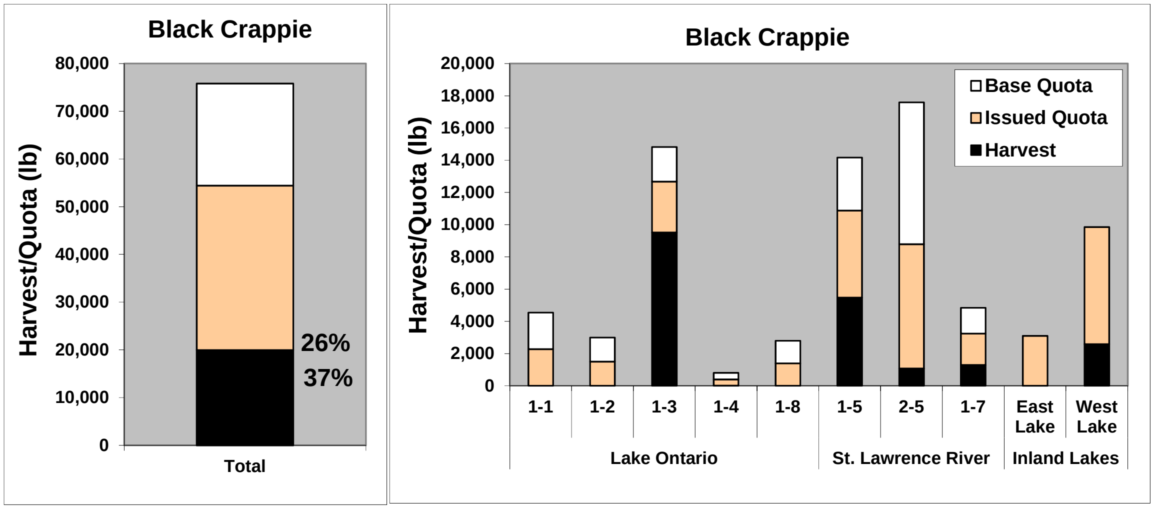


FIG. 4.1.12. **Black Crappie** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2013.

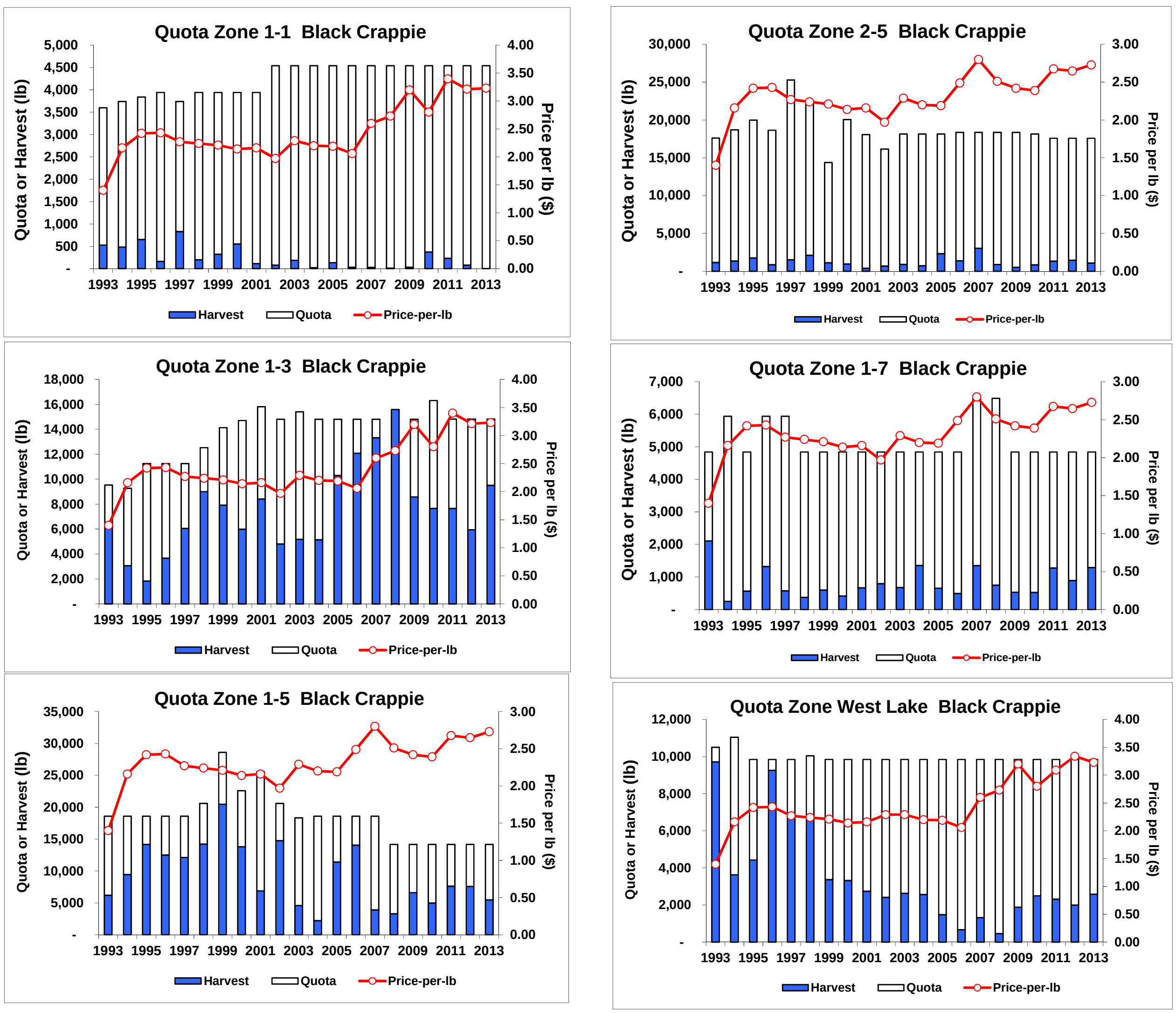


FIG. 4.1.13. Commercial base quota, harvest and price-per-lb for **Black Crappie** in Quota Zones 1-1, 1-3, 1-5, 2-5, 1-7 and West Lake, 1993-2013.

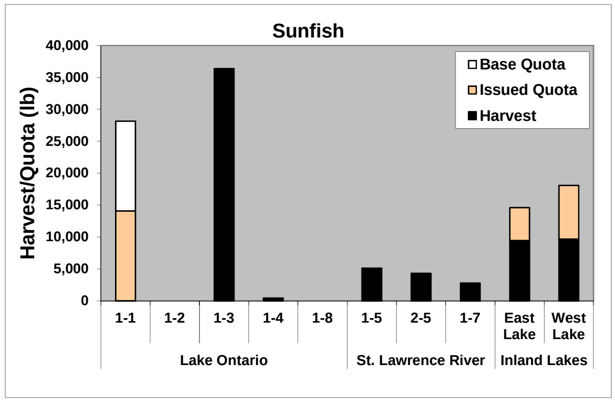


FIG. 4.1.14. **Sunfish** commercial harvest relative to issued and base quota for quota zones 1-1, East Lake and West Lake, 2013. The remaining quota zones have unlimited quota.

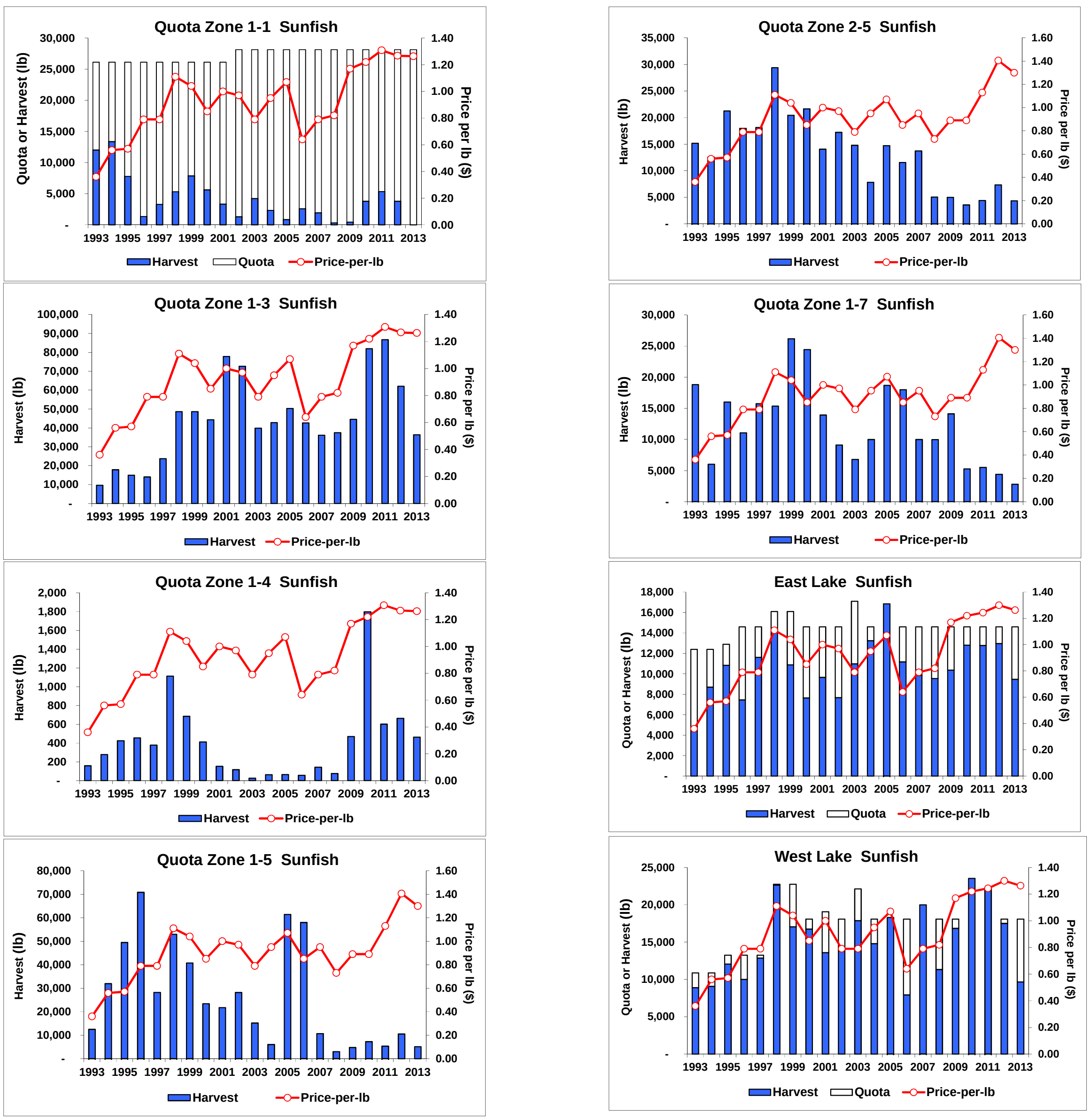


FIG. 4.1.15. Commercial base quota, harvest and price-per-lb for **Sunfish** in Quota Zones 1-1, 1-3, 1-4, 1-5, 2-5 and 1-7, East Lake and West Lake, 1993-2013.

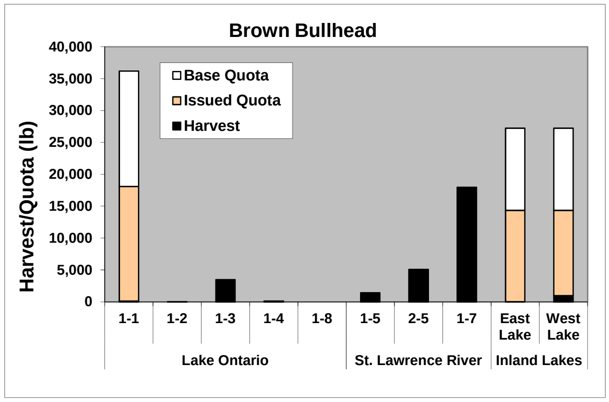


FIG. 4.1.16. **Brown Bullhead** commercial harvest relative to issued and base quota for quota zones 1-1, East Lake and West Lake, 2013. The remaining quota zones have unlimited quota.

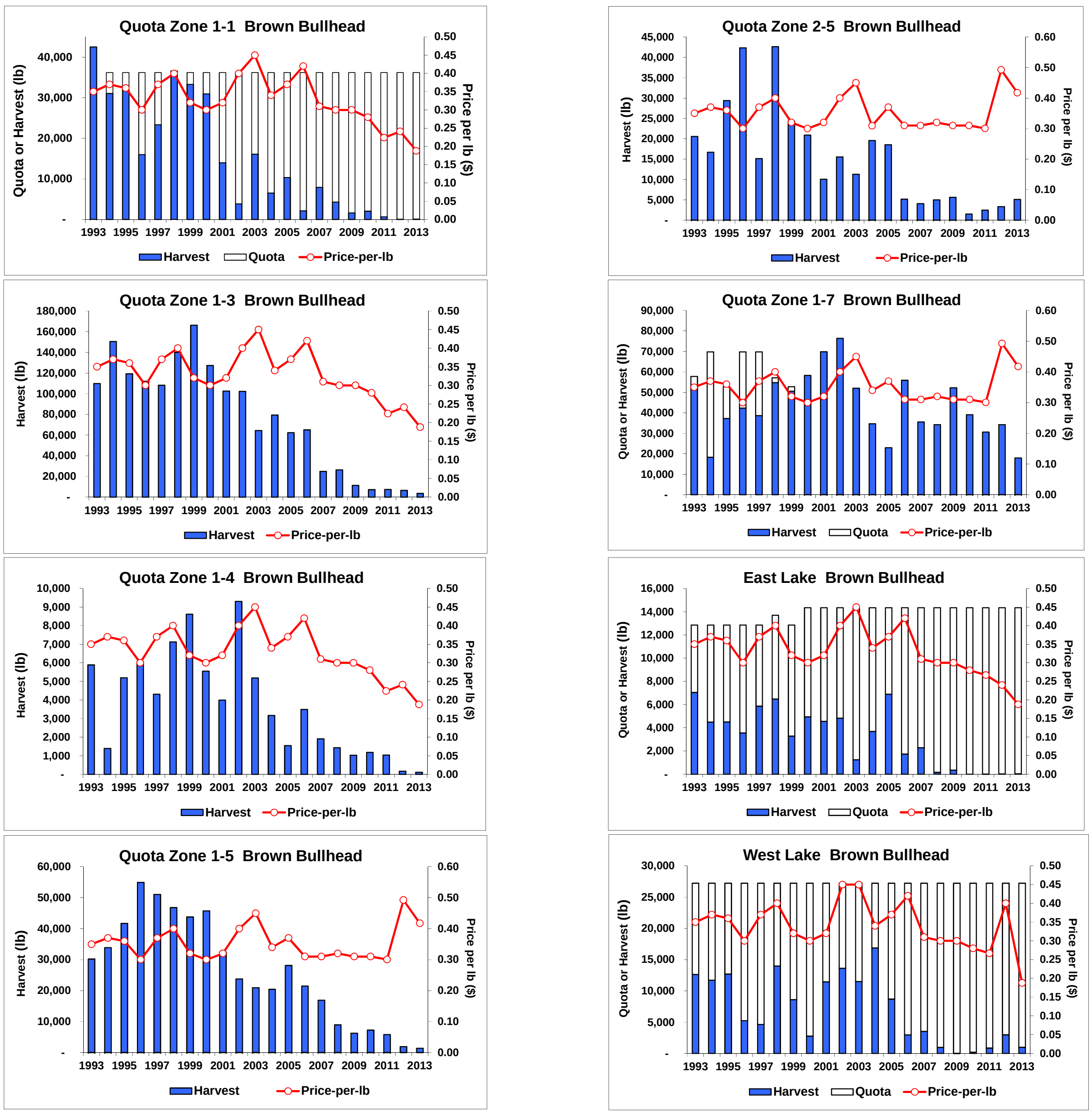


FIG. 4.1.17. Commercial base quota, harvest and price-per-lb for **Brown Bullhead** in Quota Zones 1-1, 1-3, 1-4, 1-5, 2-5 and 1-7, East Lake and West Lake, 1993-2013.

4.2 Lake Whitefish Commercial Catch Sampling

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 4.1), 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 2013 is reported in Table 4.2.1. Most of the harvest was taken in gillnets, 97% by weight; 3% of the harvest was taken in impoundment gear. Ninety-nine percent of the gill net harvest occurred in quota zone 1-2. Seventy-five percent of the gill net harvest in quota zone 1-2 was taken in November and December. Most impoundment gear harvest and effort occurred in October and November in quota zone 1-3 (Table 4.2.1).

Biological sampling focused on the November spawning-time gillnet 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. 4.2.1 and Fig. 4.2.2). In total, fork length was measured for 4,480 fish and age was interpreted using otoliths for 313 fish (Table 4.2.2, Fig. 4.2.1 and 4.2.2).

Lake Ontario Gillnet Fishery (quota zone 1-2)

The mean fork length and age of Lake Whitefish harvested during the gillnet fishery in quota zone 1-2 were 470 mm and 10.0 years respectively (Fig. 4.2.1). Fish ranged from ages 5-26 years. The most abundant age-classes in

TABLE 4.2.1. Lake Whitefish harvest (lb) and fishing effort (yards of gillnet 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	-	-	-	50	-	-	-	1,320
	Feb	-	-	-	24	-	-	-	360
	Mar	-	24	-	29	-	1,200	-	440
	Apr	-	131	-	-	-	3,000	-	-
	May	-	2,009	-	1	-	11,400	-	600
	Jun	-	10,522	-	-	-	24,500	-	-
	Jul	-	7,812	-	-	-	26,000	-	-
	Aug	-	4,053	-	-	-	18,300	-	-
	Sep	-	95	-	300	-	2,600	-	2,740
	Oct	-	147	-	291	-	1,360	-	1,400
	Nov	282	***47,001***	-	83	1,000	***36,520***	-	1,360
	Dec	-	26,233	-	15	-	15,880	-	200
Impoundment	Apr	-	-	10	-	-	-	38	-
	May	-	-	10	-	-	-	36	-
	Sep	-	-	-	6	-	-	-	4
	Oct	-	-	***372***	-	-	-	***120***	-
	Nov	-	-	***2,513***	-	-	-	***167***	-

TABLE 4.2.2. 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, 2013.

Quota zone 1-2 (Lake stock)								Quota zone 1-3 (Bay stock)							
	Sampled			Harvested					Sampled			Harvested			
Age (years)	Number aged	Number lengthed	Proportion	Number	Weight (kg)	Mean weight (kg)	Mean length (mm)	Age (years)	Number aged	Number lengthed	Proportion	Number	Weight (kg)	Mean weight (kg)	Mean length (mm)
1	-	-	0.000	-	-			1	-	-	0.000	-	-		
2	-	-	0.000	-	-			2	-	-	0.000	-	-		
3	-	-	0.000	-	-			3	-	-	0.000	-	-		
4	-	-	0.000	-	-			4	-	-	0.000	-	-		
5	8	57	0.019	710	612	0.862	420	5	11	49	0.129	156	154	0.988	443
6	8	131	0.044	1,631	1,606	0.984	438	6	20	70	0.186	224	206	0.919	431
7	14	189	0.064	2,347	2,256	0.961	432	7	8	29	0.077	92	104	1.130	457
8	50	1,010	0.341	12,547	13,870	1.105	453	8	14	40	0.106	127	154	1.209	470
9	20	425	0.144	5,281	6,044	1.144	461	9	17	59	0.155	187	236	1.258	479
10	32	689	0.233	8,560	11,109	1.298	481	10	12	28	0.074	89	113	1.266	483
11	3	39	0.013	484	705	1.456	475	11	11	35	0.093	112	131	1.176	479
12	1	25	0.008	311	391	1.260	490	12	5	12	0.031	38	48	1.257	489
13	-	-	0.000	-	-			13	2	3	0.007	9	14	1.572	528
14	3	64	0.022	797	1,052	1.320	478	14	2	5	0.013	16	23	1.453	499
15	3	25	0.008	308	452	1.466	501	15	2	5	0.013	15	24	1.550	524
16	-	-	0.000	-	-			16	-	-	0.000	-	-		
17	2	10	0.003	126	207	1.640	551	17	-	-	0.000	-	-		
18	4	23	0.008	280	517	1.848	534	18	7	13	0.033	40	81	2.012	552
19	3	48	0.016	593	897	1.512	494	19	4	7	0.019	23	37	1.597	529
20	4	28	0.009	349	550	1.579	531	20	1	3	0.007	8	16	1.950	553
21	14	112	0.038	1,395	2,379	1.705	531	21	6	9	0.024	29	59	2.005	563
22	1	8	0.003	95	151	1.587	517	22	4	7	0.019	23	43	1.930	569
23	1	13	0.004	164	225	1.369	511	23	1	2	0.005	6	11	1.996	565
24	3	35	0.012	438	684	1.564	524	24	2	4	0.009	11	19	1.692	549
25	1	13	0.005	166	331	2.000	550	25	-	-	0.000	-	-		
26	1	15	0.005	186	423	2.272	568	26	-	-	0.000	-	-		
27	-	-	0.000	-	-			27	-	-	0.000	-	-	1.542	561
28	-	-	0.000	-	-			28	-	-	0.000	-	-		
29	-	-	0.000	-	-			29	-	-	0.000	-	-		
30	-	-	0.000	-	-			30	-	-	0.000	-	-		
Total	177	2,960	1	36,769	44,461			Total	129	379	1	1,205	1,318		
Weighted mean						**1.209**		Weighted mean						**1.094**	

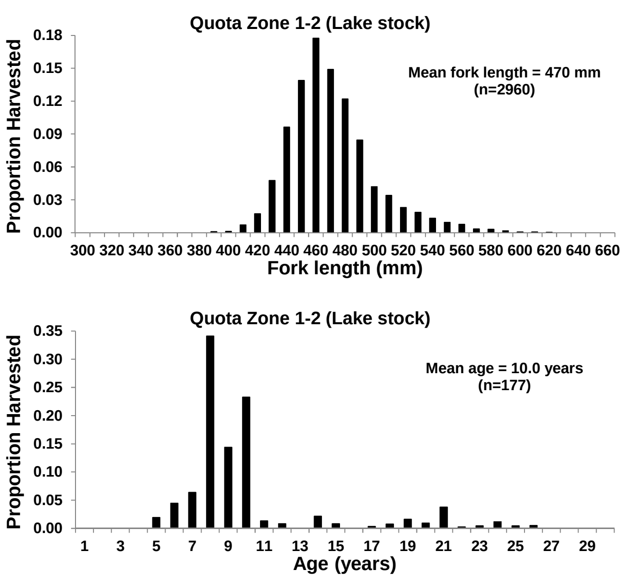


FIG. 4.2.1. Size and age distribution (by number) of **Lake Whitefish** sampled in quota zone 1-2 during the 2013 commercial catch sampling program.

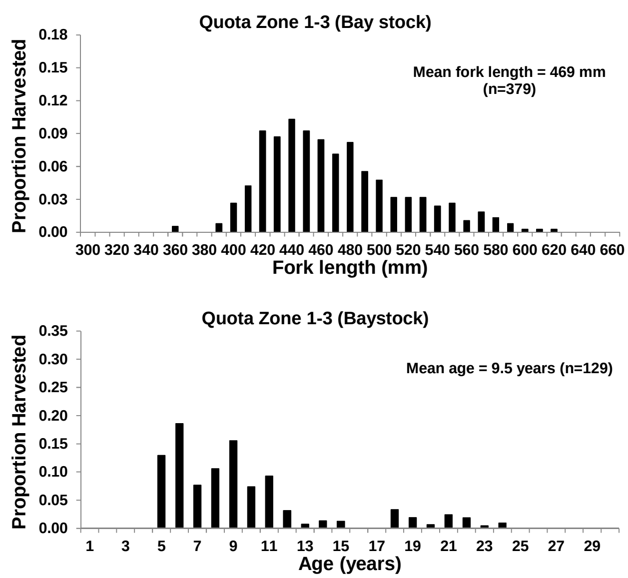


FIG. 4.2.2. Size and age distribution (by number) of **Lake Whitefish** sampled in quota zone 1-3 during the 2013 commercial catch sampling program.

the fishery were aged 7-10 years which together comprised 78% of the harvest by number (75% by weight).

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

Mean fork length and age were 469 mm and 9.5 years, respectively (Fig. 4.2.2). Fish ranged from ages 5-24 years. The most abundant age-classes in the fishery were aged 5-11 years which together comprised 82% of the harvest by number (83% 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 Figure 4.2.3. Condition declined markedly in 1994 and remained low, although there appears to be a gradual increase through 2013.

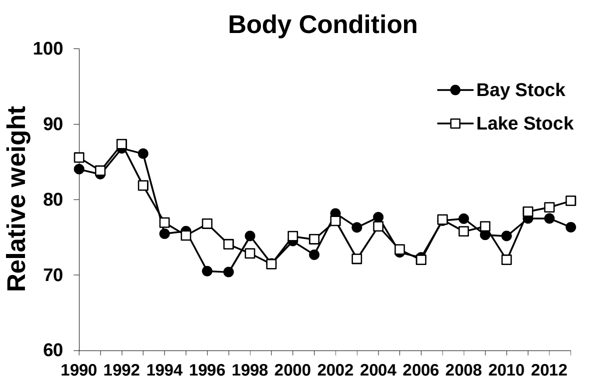


FIG. 4.2.3. **Lake Whitefish** (Lake Ontario and Bay of Quinte spawning stocks and sexes combined) relative weight (see [1]Rennie et al. 2008), 1990-2013.

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

4.3 Lake Herring Commercial Catch Sampling

Seventy Lake Herring were obtained from the Bay of Quinte (Quota Zone 1-3) commercial trap net fishery in fall 2013. The mean length and weight of these fish were 342 mm and 564 g respectively (Fig. 4.3.1). A length vs. weight plot is shown in Fig. 4.3.2 and the age distribution of these Lake Herring is shown in Table 4.3.1.

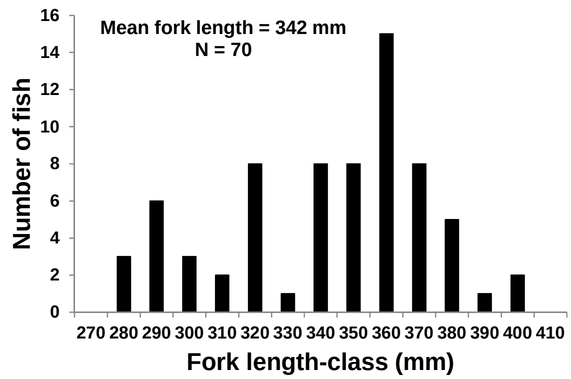


FIG. 4.3.1. Size distribution (by number) of **Lake Herring** sampled in quota zone 1-3 during the 2013 commercial catch sampling program.

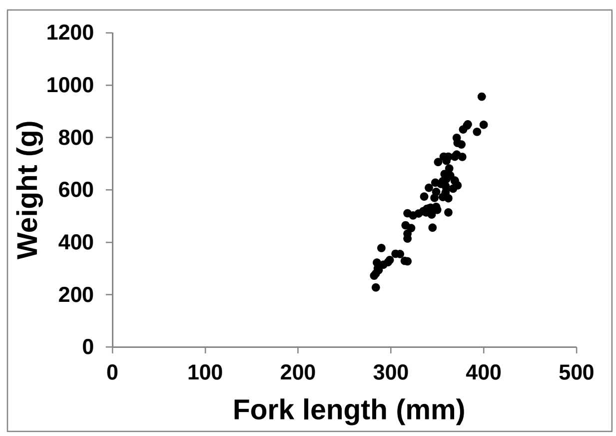


FIG. 4.3.2. Length vs. weight scatter plot of **Lake Herring** sampled in quota zone 1-3 during the 2013 commercial catch sampling program.

TABLE 4.3.1. Age distribution of 70 **Lake Herring** sampled from the Bay of Quinte commercial trap net fishery, 2013. Also shown are age-specific mean fork length and mean weight.

	Year-class / Age											
	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	1997	1995
	3	4	5	6	7	8	9	10	11	12	16	18
Count of fish	4	16	8	9	12	11	2	3	2	1	1	1
Mean fork length (mm)	295	307	329	357	363	356	386	375	368	369	362	350
Mean weight (g)	329	402	498	685	676	611	825	722	618	635	513	523

5. Age and Growth Summary

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 2013, a total of 3456 structures were processed from 14 different field projects (Table 5.1) and interpreted from 14 different fish species (Table 5.2)

TABLE 5.1. Project-specific summary of age and growth structures interpreted for age (n= 3456) in support of 14 different Lake Ontario Management Unit field projects, 2013.

Project	Species	Structure	n
Ganaraska Fishway Rainbow Trout Assessment			
	Rainbow Trout	Scales	102
Chinook Salmon Mark/Tag Monitoring and Angling Survey			
	Rainbow Trout	Scales	102
	Chinook Salmon	Otoliths	200
	Chinook Salmon	CWT	92
Lake St. Francis Recreational Fishery			
	Northern Pike	Scales	7
	Smallmouth Bass	Scales	82
	Largemouth Bass	Scales	38
	Yellow Perch	Scales	265
	Walleye	Scales	136
Nearshore-Offshore Linkage Study			
	Lake Trout	CWT	24
Eastern Lake Ontario and Bay of Quinte Community Index Gillnetting			
	Northern Pike	Cleithra	6
	Smallmouth Bass	Scales	16
	Yellow Perch	Scales	428
	Walleye	Otoliths	184
	Lake Trout	CWT	2
	Lake Whitefish	Otoliths	37
	Lake Herring	Otoliths	10
Eastern Lake Ontario and Bay of Quinte Community Index Trawling			
	Walleye	Otoliths	60
	Walleye	Scales	25
West Lake Nearshore Community Index Netting			
	Northern Pike	Cleithra	14
	Pumpkinseed	Scales	29
	Bluegill	Scales	31
	Smallmouth Bass	Scales	2
	Largemouth Bass	Scales	31
	Black Crappie	Scales	30
	Yellow Perch	Scales	5
	Walleye	Otoliths	30
East Lake Nearshore Community Index Netting			
	Northern Pike	Cleithra	9
	Pumpkinseed	Scales	30
	Bluegill	Scales	29
	Smallmouth Bass	Scales	8
	Largemouth Bass	Scales	31
	Yellow Perch	Scales	8
	Walleye	Otoliths	21
(continued)			
Upper Bay of Quinte Nearshore Community Index Netting			
	Northern pike	Cleithra	10
	Pumpkinseed	Scales	32
	Bluegill	Scales	32
	Smallmouth bass	Scales	9
	Largemouth bass	Scales	37
	Black crappie	Scales	53
	Yellow perch	Scales	37
	Walleye	Otoliths	38
Prince Edward Bay Nearshore Community Index Netting			
	Northern pike	Cleithra	30
	Pumpkinseed	Scales	31
	Bluegill	Scales	24
	Smallmouth bass	Scales	30
	Largemouth bass	Scales	31
	Black crappie	Scales	31
	Yellow perch	Scales	8
	Walleye	Otoliths	2
St. Lawrence River Fish Community Index Netting - 1000 Islands			
	Northern pike	Cleithra	47
	Smallmouth bass	Scales	128
	Largemouth bass	Scales	12
	Yellow perch	Scales	148
	Walleye	Otoliths	22
Credit River Chinook Assessment and Egg Collection			
	Chinook salmon	Otoliths	106
	Chinook salmon	CWT	48
Commercial Catch Sampling			
	Lake whitefish	Otoliths	305
	Lake herring	Otoliths	75
Round Whitefish Spawning Assessment			
	Round whitefish	Otoliths	6
Total			3456

TABLE 5.2. Species-specific summery of age and growth structures interpreted for age (3456) in 2013.

	Structure				
Species	Scales	Otoliths	Cleithra	Code Wire Tags	Total
Black crappie	114				114
Bluegill	116				116
Chinook salmon		306		140	446
Lake herring		85			85
Lake trout				26	26
Lake whitefish		342			342
Largemouth bass	180				180
Northern pike	7		116		123
Pumpkinseed	122				122
Rainbow trout	204				204
Round whitefish		6			6
Smallmouth bass	275				275
Walleye	161	357			518
Yellow perch	899				899
Total	2078	1096	116	166	3456

6. Contaminant Monitoring

Lake Ontario Management Unit cooperates annually with several agencies to collect fish samples for contaminant testing. In 2013, 545 contaminant samples were collected for Ontario's Ministry of the Environment Sport Fish Monitoring program (Table 6.1). 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 Ministry of Environment 2000-2013 is shown in Table 6.2.

TABLE 6.1. Number of fish samples collected, by region and species, for contaminant analysis by the Ministry of Environment, 2013.

Region	Block	Species	Total
Ganaraska River	7	Rainbow Trout	20
Northeastern Lake Ontario	8	Chinook Salmon	6
		Rock Bass	6
		Walleye	9
		Yellow Perch	10
Upper Bay of Quinte	9	Black Crappie	20
		Brown Bullhead	34
		Channel Catfish	3
		Freshwater Drum	20
		Northern Pike	5
		Walleye	21
		White Perch	20
		Yellow Perch	20
Trenton Nearshore Area	9a	Brown Bullhead	3
Belleville Nearshore Area	9b	Brown Bullhead	6
Middle Bay of Quinte	10	Black Crappie	15
		Brown Bullhead	15
		Channel Catfish	1
		Freshwater Drum	20
		Northern Pike	3
		Walleye	3
		White Perch	20
		Yellow Perch	12
Lower Bay of Quinte/	11	Brown Trout	6
Eastern Lake Ontario		Freshwater Drum	2
		Lake Trout	20
		Lake Whitefish	20
		Northern Pike	20
		Rainbow Trout	2
		Walleye	20
		Yellow Perch	20
Thousand Islands	12	Bluegill	3
		Brown Bullhead	20
		Largemouth Bass	11
		Northern Pike	19
		Pumpkinseed	14
		Rock Bass	18
		Smallmouth Bass	19
		Walleye	20
		Yellow Perch	19
Total			545

TABLE 6.2. Summary of the number of fish samples collected, by species, for contaminant analysis by the Ministry of Environment, 2000-2013.

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

7. Stocking Program

In 2013, OMNR stocked about 2.1 million salmon and trout into Lake Ontario (Table 7.1; Fig. 7.1). This number of fish equaled over 27,000 kilograms of biomass added to the Lake (Fig. 7.1.b). Figure 7.1 shows stocking trends in Ontario waters from 1968 to 2013. The New York State Department of Environmental Conservation (NYSDEC) also stocked 3.75 million salmon and trout into the lake in 2013.

Approximately 700,000 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 120,000 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.

From 2008 to 2011, all Chinook Salmon stocked were marked with an adipose fin and/or coded-wire tag clip. This was done using Northwest Marine Technology's AutoFish, a unique, highly automated clipping and tagging system. This marking program has been very helpful in determining levels of natural reproduction of Chinook Salmon in Lake Ontario and evaluate the effectiveness of our stocking program (see Section 3.2 for results). The study is being done cooperatively between New York and Ontario. Although marking ceased in 2011, anglers may still have seen adipose-clipped Chinook Salmon in the fishery during 2013.

TABLE 7.1. Fish stocked into Province of Ontario waters of Lake Ontario, 2013, and target for 2014.

Species	Life Stage	2013*	2014
Atlantic Salmon	Eyed Eggs	108,950	30,000
	Spring Fingerlings (fry)	439,488	400,000
	Fall Fingerlings	181,114	150,000
	Spring Yearlings	78,981	75,000
	Adult	20	-
		699,603	**625,000**
Brown Trout	Fall Fingerlings	25,287	40,000
	Spring Yearlings	166,308	140,000
		191,595	**180,000**
Chinook Salmon	Spring Fingerlings	**707,634**	**540,000**
Coho Salmon	Fall Fingerlings	**60,322**	**80,000**
Rainbow Trout	Fall Fingerlings	31,000	15,000
	Spring Yearlings	105,578	140,000
	Fall Yearlings	12,000	-
		148,578	**155,000**
Lake Trout	Spring Yearlings	**385,064**	**440,000**
Walleye	Spring Fingerlings	**10,000**	**100,000**
Bloater	Sub-Adults	**15,187**	**25,000**
STOCKING TOTALS (excluding eggs)		**2,217,983**	**2,145,000**

* includes fish reared by MNR and its partners

** excludes eggs

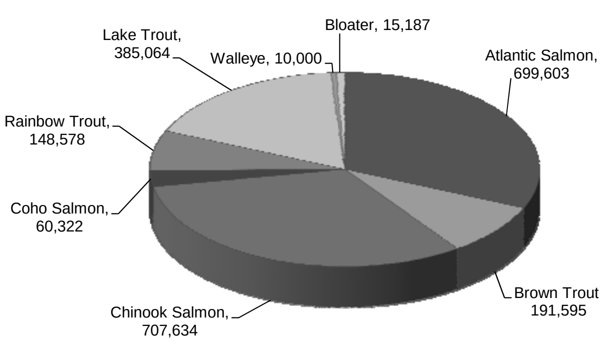


FIG. 7.1a. Number of fish stocked into Lake Ontario (excludes eggs) in 2013. Total = 2,217,983 fish.

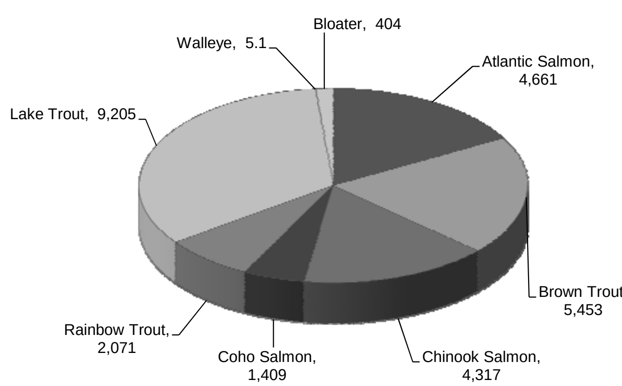


FIG. 7.1b. Weight (in kilograms) of fish stocked into Lake Ontario (excludes eggs) in 2013. Total = 27,526 kgs. For a small number of stocking events, fish weight was not recorded so the total weight should be considered an estimate only.

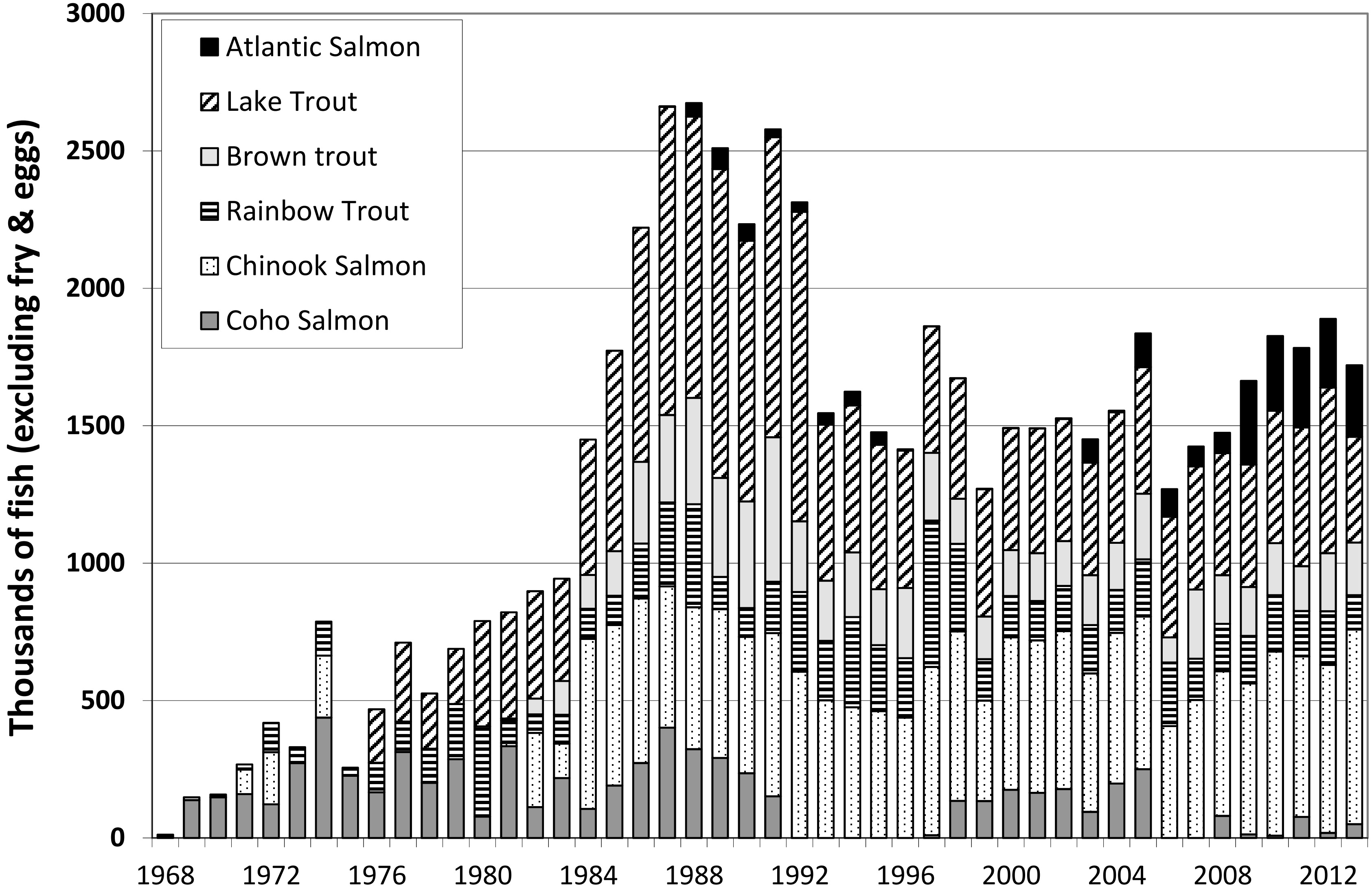


FIG. 7.2. Trends in salmon and trout stocking in Ontario waters of Lake Ontario, 1968-2013.

Atlantic Salmon were stocked in support of an ongoing program to restore self-sustaining populations of this native species to the Lake Ontario basin (Section 8.2). Approximately 700,000 Atlantic Salmon of various life stages were released into current restoration streams in 2013: Credit River, Duffins Creek, Cobourg Brook and the Humber River. OMNR 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 OMNR and partner facilities. Three Atlantic Salmon brood stocks from different source populations in Nova Scotia, Quebec and Maine are currently housed at OMNR's Harwood and Normandale Fish Culture Stations. For the first time in 2013, over 55,000 Lac St. Jean (Quebec) Atlantic Salmon were stocked, allowing another strain to be assessed in the restoration program. All fish have been genotyped to facilitate follow-up assessment on stocked fish and their progeny in the wild.

Nearly 400,000 Lake Trout yearlings were stocked as part of an established, long-term rehabilitation program (Section 8.5). Lake Trout stocking is focused in the eastern basin of Lake Ontario where most of the historic spawning shoals are found. Three strains, originating from Seneca Lake, Slate Islands and Michipicoten Island are stocked as part of our annual target.

A new species was stocked into the Ontario waters of Lake Ontario for the first time in November of 2013: the Deepwater Cisco, or Bloater. 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 approximately 15,000 Bloater being stocked in 100 m of water in the Eastern Basin of Lake Ontario in 2013. See section 8.4 for a detailed description of this restoration effort.

Rainbow Trout and Brown Trout were stocked at various locations to provide shore and boat fishing opportunities. A portion of the Rainbow Trout target is stocked into streams with a potential to establish wild populations. About 50,000 Coho Salmon fall fingerlings and 18,000 spring yearling Rainbow Trout were produced by stocking partner Metro East Anglers.

Continuing a new program started in 2012, 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. Since Walleye are a very popular species for stocking across the province, Hamilton Harbour takes advantage of surplus production fish; 10,000 Walleye were available in 2013. These small stocking events were done in anticipation of fish habitat improvements in Hamilton Harbour, as outlined in the Hamilton Harbour Fisheries Management Plan.

OMNR remains committed to providing diverse fisheries in Lake Ontario and its tributaries, based on wild and stocked fish, as appropriate. Salmon and trout fisheries support valued boat, shore, pier and stream fisheries, as well as an active charter industry and a number of world-class fishing derbies. These fisheries contribute significantly to regional and local economies. OMNR is committed also to restoration of native species and supports efforts to maintain / restore healthy, stable Lake Ontario fish communities.

Detailed information about OMNR's 2013 stocking activities is found in Tables 7.2 to 7.9.

TABLE 7.2 . Atlantic Salmon stocked in the Province of Ontario waters of Lake Ontario, 2013.

WATERBODY	SITE	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN (EGG SOURCE)	AGE (MONTHS)	MEAN WT (g)	TOTAL WT (kg)	MARKS	NUMBER STOCKED
				ATLANTIC SALMON - EYED EGGS						
Bronte Cr.	Various sites	01	2012	Harwood FCS	LaHave River (HWC)		-	-	None	**37,800**
Credit R.	Various sites	01-02	2012	Normandale FCS	LaHave River (HWC)		-	-	None	**71,150**
				ATLANTIC SALMON - SPRING FINGERLINGS (FRY)						
Cobourg Br.	Ball's Mill	05	2012	Sir Sandford Fleming College	Sebago Lake (HWC)	5	1.07	22.37	None	20,904
	Dale Rd.	05	2012	Normandale FCS	LaHave River (NMC)	5	2.26	55.79	None	24,686
	Hie Property	05	2012	Normandale FCS	LaHave River (NMC)	5	2.54	53.92	None	21,228
										66,818
Credit R.	Belfountain	05	2012	Normandale FCS	LaHave River (NMC)	5	2	59.98	None	29,990
	Black Cr. - 15th Sideroad	04	2012	Normandale FCS	Sebago Lake (HWC)	4	2.2	65.99	None	29,996
	Black Cr. - 6th Line	04	2012	Normandale FCS	Sebago Lake (HWC)	4	2.32	69.63	None	30,015
	Forks of the Credit	05	2012	Normandale FCS	LaHave River (NMC)	5	1.895	56.82	None	29,985
	Forks of the Credit	05	2012	Normandale FCS	Sebago Lake (HWC)	5	2.05	61.44	None	29,969
	Meadow	05	2012	Normandale FCS	Sebago Lake (HWC)	5	2.02	30.30	None	15,002
	Meadow	05	2012	Normandale FCS	LaHave River (NMC)	5	2.31	34.66	None	15,005
										179,962
Duffins Cr.	East Duffins Cr. - Claremont Field Centre	05	2012	Normandale FCS	Sebago Lake (HWC)	5	2.1	41.98	None	19,990
	East Duffins Cr. - Claremont Field Centre	05	2012	Normandale FCS	LaHave River (NMC)	5	2.3	15.75	None	6,848
	East Duffins Cr. - Pickering Museum	05	2012	Sir Sandford Fleming College	LaHave River (NMC)	5	0.61	2.60	None	4,270
	Mitchell Cr.	05	2012	Normandale FCS	LaHave River (NMC)	5	2.35	32.90	None	14,001
	West Duffins Cr. - Sideline 32	05	2012	Normandale FCS	Sebago Lake (HWC)	5	1.91	34.03	None	18,427
	West Duffins Cr. - Sideline 32	05	2012	Normandale FCS	LaHave River (NMC)	5	2.23	45.78	None	20,530
										84,066
Humber R.	Patterson Rd.	05	2012	Normandale FCS	Sebago Lake (HWC)	5	2.36	70.81	None	30,004
	Castlederg Rd.	05	2012	Normandale FCS	Sebago Lake (HWC)	5	2.53	75.87	None	29,987
	Coffey Creek	04	2012	Islington Sportsmen's Club	Sebago Lake (HWC)	4	0.285	9.02	None	31,636
	Centreville Creek	5	2012	Belfountain Community Hatchery	LaHave	5	0.18	3.06	None	17,015
										108,642
				ATLANTIC SALMON - FALL FINGERLINGS						
Cobourg Br.	Division St.	10	2012	Normandale FCS	LaHave River (NMC)	9	11.14	138.40	None	12,424
	Division St.	10	2012	Normandale FCS	Sebago Lake (HWC)	10	10.71	161.19	None	15,050
	Division St.	10	2012	Normandale FCS	Lac Saint-Jean, Quebec (HWC)	10	11.67	117.23	None	10,045
	Hie / McNichol Properties	10	2012	Sir Sandford Fleming College	Sebago Lake (HWC)		10.66	109.44	None	10,266
										47,785
Credit R.	McLaren Rd.	10	2012	Normandale FCS	LaHave River (NMC)	9	9.78	256.43	None	26,220
	Grange Sideroad	10	2012	Normandale FCS	Lac Saint-Jean, Quebec (HWC)	10	10.43	187.78	None	18,004
	Eldorado Park	10	2012	Normandale FCS	Sebago Lake (HWC)	10	13.4	458.29	None	34,201
										78,425
Duffins Cr.	East Duffins Cr. - 5th Conc.	10	2012	Normandale FCS	Sebago Lake (HWC)	10	12.99	12.98	None	999
	East Duffins Cr. - Paulynn Park	10	2012	Normandale FCS	LaHave River (NMC)	9	9.86	69.14	None	7,012
	East Duffins Cr. - Paulynn Park	10	2012	Normandale FCS	Sebago Lake (HWC)	10	12.99	65.05	None	5,008
	East Duffins Cr. - Paulynn Park	10	2012	Normandale FCS	Lac Saint-Jean, Quebec (HWC)	10	13.19	59.46	None	4,508
	East Duffins Cr. - Paulynn Park	10	2012	Metro East Anglers	Sebago Lake (HWC)	11	18	356.78	None	19,821
	West Duffins Cr. - Wixon Cr.	10	2012	Normandale FCS	LaHave River (NMC)	9	9.82	68.92	None	7,018
	West Duffins Cr. - Wixon Cr.	10	2012	Normandale FCS	Lac Saint-Jean, Quebec (HWC)	10	9.34	42.16	None	4,514
	West Duffins Cr. - Wixon Cr.	10	2012	Normandale FCS	Sebago Lake (HWC)	10	12.81	77.17	None	6,024
										54,904

Continued on next page

TABLE 7.2 (continued) Atlantic Salmon stocked in the Province of Ontario waters of Lake Ontario, 2013.

WATERBODY	SITE	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN (EGG SOURCE)	AGE (MONTHS)	MEAN WT (g)	TOTAL WT (kg)	MARKS	NUMBER STOCKED
				ATLANTIC SALMON - SPRING YEARLINGS						
Cobourg Br.	Division St.	03	2011	Normandale FCS	LaHave River (NMC)	14	14.3	202.40	None	14,154
	Division st.	04	2011	Sir Sandford Fleming College	LaHave River (NMC)	16	38.1	83.29	None	2,186
	Hie / McNichol Properties	04	2011	Sir Sandford Fleming College	LaHave River (NMC)	16	35.18	64.91	None	1,845
	Hie / McNichol Properties	05	2011	Sir Sandford Fleming College	LaHave River (NMC)	17	43.05	43.48	None	1,010
										19,195
Credit R.	Inglewood	03	2011	Normandale FCS	LaHave River (NMC)	14	13.4	152.64	None	11,391
	Norval	03	2011	Normandale FCS	Lac Saint-Jean, Quebec (HWC)	15	13.8	272.65	None	19,757
	Norval	03	2011	Normandale FCS	Sebago Lake (HWC)	15	24.9	219.94	None	8,833
										39,981
Duffins Cr.	East Duffins Cr. - 5th Conc.	03	2011	Normandale FCS	Sebago Lake (HWC)	15	28.1	446.62	None	15,894
	Brock/Finch	04	2011	Sir Sandford Fleming College	LaHave River (NMC)	16	29.6	8.97	None	303
	East Duffins Cr. - Greenwood C.A.	04	2011	Sir Sandford Fleming College	LaHave River (NMC)	16	38.28	76.06	None	1,987
	East Duffins Cr. - Greenwood C.A.	05	2011	Sir Sandford Fleming College	LaHave River (NMC)	16	43.05	69.78	None	1,621
										19,805
				ATLANTIC SALMON - ADULTS						
Lake Ontario	Graham Creek	01	-	Sir Sandford Fleming College		-	-	-	None	**20**
					Totals (all strains and life stages except eggs):			**4664 kg.**		**699,603**

TABLE 7.3. Brown Trout stocked in the Province of Ontario waters of Lake Ontario, 2013.

WATERBODY	SITE	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN (EGG SOURCE)	AGE (MONTHS)	MEAN WT (g)	TOTAL WT (kg)	MARKS	NUMBER STOCKED
				BROWN TROUT - FALL FINGERLINGS						
Lake Ontario	Athol Bay	10	-	Metro East Anglers	Ganaraska River (TTC)	11	23.00	122.41	None	5,322
	Oshawa Creek	10	-	Metro East Anglers	Ganaraska River (TTC)	11	24.00	236.26	None	9,844
	Whitby Harbour	10	-	Metro East Anglers	Ganaraska River (TTC)	11	24.00	242.90	None	10,121
										25,287
				BROWN TROUT - SPRING YEARLINGS						
Bronte Cr.	Bronte Beach Park	03	2011	Chatsworth FCS	Ganaraska River (TTC)	15	27.16	400.01	ADIPO	**14,728**
Duffin Cr.	401 Bridge	04	2011	Chatsworth FCS	Ganaraska River (TTC)	15	30.66	299.95	ADIPO	**9,783**
Ontario, L.	Ashbridge's Bay	04	2011	Chatsworth FCS	Ganaraska River (TTC)	15	30.66	454.99	ADIPO	14,840
	Athol Bay	04	2011	Chatsworth FCS	Ganaraska River (TTC)	15	30.66	349.98	ADIPO	11,415
	Bluffer's Park	03	2011	Chatsworth FCS	Ganaraska River (TTC)	15	29.5	441.73	ADIPO	14,974
	Burlington Canal	03	2011	Chatsworth FCS	Ganaraska River (TTC)	15	28.22	415.00	ADIPO	14,706
	Fifty Point CA	03	2011	Chatsworth FCS	Ganaraska River (TTC)	15	28.22	414.98	ADIPO	14,705
	Humber Bay Park	03	2011	Chatsworth FCS	Ganaraska River (TTC)	15	27.16	270.00	ADIPO	9,941
	Jordan Harbour	03	2011	Chatsworth FCS	Ganaraska River (TTC)	15	29.05	287.91	ADIPO	9,911
	Millhaven Wharf	04	2011	Chatsworth FCS	Ganaraska River (TTC)	15	30.66	519.99	ADIPO	16,960
	Oshawa Harbour	03	2011	Chatsworth FCS	Ganaraska River (TTC)	15	28.98	285.05	ADIPO	9,836
	Port Dalhousie East	03	2011	Chatsworth FCS	Ganaraska River (TTC)	15	29.05	711.99	ADIPO	24,509
										141,797
					Totals (all strains and life stages):			**5453 kg.**		**191,595**

TABLE 7.4. Rainbow Trout stocked in the Province of Ontario waters of Lake Ontario, 2013.

WATERBODY	SITE	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN (EGG SOURCE)	AGE (MONTHS)	MEAN WT (g)	TOTAL WT (kg)	MARKS	NUMBER STOCKED
				RAINBOW TROUT - FALL FINGERLINGS						
Lake Ontario	Wellington	10	2013	Springside Park	Ganaraska River (TTC)	6	-	-	None	20,000
Lake Ontario	Credit River	10	2013	CRAAH*	Ganaraska River (TTC)	6	-	-	None	11,000
										31,000
				RAINBOW TROUT - SPRING YEARLINGS						
Bronte Cr.	2nd Side Road Bridge	04	2012	Normandale FCS	Ganaraska River (TTC)	12	18.1	220.01	None	**12,155**
Credit R.	Norval Nashville North	04	2012	Normandale FCS	Ganaraska River (TTC)	12	20.7	499.04	None	**24,108**
Humber R.	King Vaughan Line	04	2012	Normandale FCS	Ganaraska River (TTC)	12	19.1	218.68	None	**11,449**
Lake Ontario	Jordan Harbour	04	2012	Normandale FCS	Ganaraska River (TTC)	12	15.7	314.14	None	20,009
Lake Ontario	Port Dalhousie East	04	2012	Normandale FCS	Ganaraska River (TTC)	12	17.7	351.47	None	19,857
Lake Ontario	Rouge River	05	2012	Metro East Anglers	Wild Collection (Rouge R.)	12	26	468.00	None	18,000
										57,866
				RAINBOW TROUT - FALL YEARLINGS						
Lake Ontario	Credit River	01		CRAAH*	Ganaraska River (TTC)	-	-	-	None	**12,000**
					Totals (all strains and life stages):			**2071 kg.**		**148,578**

CRAAH - Credit River Angler's Association Hatchery. Data were not received from CRAAH, numbers are estimates only.

TABLE 7.5. Chinook Salmon stocked in the Province of Ontario waters of Lake Ontario, 2013.

WATERBODY	SITE	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN (EGG SOURCE)	AGE (MONTHS)	MEAN WT (g)	TOTAL WT (kg)	MARKS	NUMBER STOCKED
				CHINOOK SALMON - SPRING FINGERLINGS						
Bowmanville Cr.	CLOCA Ramp	05	2012	Normandale FCS	Wild Egg Collection	6	6.13	183.99	None	**30,014**
Bronte Cr.	2nd Side Road Bridge	04	2012	Normandale FCS	Wild Egg Collection	5	5.28	158.48	None	30,015
	5th Side Road Bridge	04	2012	Normandale FCS	Wild Egg Collection	5	5.28	158.52	None	30,022
										60,037
Credit R.	Eldorado Park	05	2012	Normandale FCS	Wild Egg Collection	6	4.91	164.10	None	33,421
	Norval Nashville North	05	2012	Normandale FCS	Wild Egg Collection	6	5.22	348.25	None	66,715
										100,136
Don R.	East Don R. - Donalda Golf Club	05	2012	Normandale FCS	Wild Egg Collection	6	5.12	281.64	None	**55,007**
Humber R.	East Branch Islington	05	2012	Normandale FCS	Wild Egg Collection	6	6.40	383.97	None	**59,996**
Lake Ontario	Ashbridge's Bay	05	2012	Normandale FCS	Wild Egg Collection	6	4.91	147.33	None	30,006
	Bluffer's Park	05	2012	Net Pen - MEA*	Wild Egg Collection	6	9.75	170.59	None	17,496
	Bluffer's Park	05	2012	Normandale FCS	Wild Egg Collection	6	6.54	196.15	None	29,992
	Brighton	05	2012	Net Pen - CLOSA*	Wild Egg Collection	6	6.70	83.49	None	12,461
	Burlington Canal	05	2012	Normandale FCS	Wild Egg Collection	6	5.22	234.95	None	45,010
	Jordan Harbour	05	2012	Normandale FCS	Wild Egg Collection	6	6.21	155.24	None	24,998
	Lakeport	05	2012	Normandale FCS	Wild Egg Collection	6	5.63	95.68	None	16,994
	Oshawa Harbour	04	2012	Net Pen - MEA*	Wild Egg Collection	6	6.98	87.04	None	12,470
	Oshawa Harbour	05	2012	Normandale FCS	Wild Egg Collection	6	5.67	85.05	None	15,000
	Port Credit	05	2012	Net Pen - PCSTA*	Wild Egg Collection	6	7.00	70.00	None	10,000
	Port Dalhousie	05	2012	Net Pen - SCGFA*	Wild Egg Collection	6	9.40	281.94	None	29,994
	Port Dalhousie East	05	2012	Normandale FCS	Wild Egg Collection	6	6.11	435.17	None	71,223
	Port Darlington	05	2012	Net Pen - MEA*	Wild Egg Collection	6	9.15	114.36	None	12,498
	Wellington	05	2012	Net Pen - CLOSA*	Wild Egg Collection	6	6.79	80.58	None	11,868
	Wellington Channel	05	2012	Normandale FCS	Wild Egg Collection	6	5.60	197.28	None	35,229
	Whitby Harbour	05	2012	Net Pen - MEA*	Wild Egg Collection	6	9.10	111.02	None	12,200
	Whitby Harbour	05	2012	Normandale FCS	Wild Egg Collection	6	6.13	91.98	None	15,005
										402,444
					Totals (all strains and life stages):			**4317 kg.**		**707,634**

* Pen-imprinted by the following clubs:
MEA - Metro East Anglers
CLOSA - Central Lake Ontario Sport Anglers
PCSTA - Port Credt Salmon and Trout Association
SCGFA - St. Catharines Game and Fish Association

TABLE 7.6. Coho Salmon stocked in the Province of Ontario waters of Lake Ontario, 2013.

WATERBODY	SITE	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN (EGG SOURCE)	AGE (MONTHS)	MEAN WT (g)	TOTAL WT (kg)	MARKS	NUMBER STOCKED
				COHO SALMON - FALL FINGERLINGS						
Credit R.	Norval	10	2012	Metro East Anglers	Wild Collection	11	28	1409.02	None	50,322
Credit R.	-	-	-	CRAAH	-	-	-	-	-	10,000
										60,322

CRAAH - Credit River Angler's Association Hatchery. Data were not received from CRAAH, numbers are estimates only.

TABLE 7.7. Lake Trout stocked in the Province of Ontario waters of Lake Ontario, 2013.

WATERBODY	SITE	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN (EGG SOURCE)	AGE (MONTHS)	MEAN WT (g)	TOTAL WT (kg)	MARKS	NUMBER STOCKED
					LAKE TROUT - SPRING YEARLINGS					
Lake Ontario	Cobourg Harbour Pier	04	2011	North Bay FCS	Seneca Lake (TTC)	15	13.30	480.00	ADIPO	36,090
	Cobourg Harbour Pier	05	2011	North Bay FCS	Seneca Lake (TTC)	15	13.30	389.57	ADIPO	29,291
										65,381
	Fifty Point CA	04	2011	North Bay FCS	Seneca Lake (TTC)	15	13.30	959.99	ADIPO	72,180
	Fifty Point CA	04	2011	Harwood FCS	Slate Islands (DNC)	17	26.26	328.46	RPAD	12,508
										84,688
	North of Long Point	04	2011	Harwood FCS	Seneca Lake (TTC)	16	38.62	131.85	RPAD	3,414
	North of Long Point	04	2011	Harwood FCS	Slate Islands (DNC)	17	27.82	334.65	RPAD	12,029
	North of Long Point	04	2011	Harwood FCS	Michipicoten Island (TTC)	18	34.39	533.18	RPAD	15,504
	North of Long Point - Grape Is.	04	2011	Harwood FCS	Seneca Lake (TTC)	16	34.92	915.86	RPAD	26,231
	North of Long Point - K10 buoy	04	2011	Harwood FCS	Michipicoten Island (TTC)	18	34.39	700.83	RPAD	20,379
	North of Long Point - Timber Island	04	2011	Harwood FCS	Michipicoten Island (TTC)	18	30.22	767.31	RPAD	25,395
	North of Long Point - The Head	04	2011	Harwood FCS	Seneca Lake (TTC)	16	37.95	651.97	RPAD	17,182
										120,134
	South of Long Point	04	2011	Harwood FCS	Seneca Lake (TTC)	16	34.99	316.33	RPAD	9,042
	South of Long Point - Traverse Shoal	04	2011	Harwood FCS	Seneca Lake (TTC)	16	32.29	843.99	RPAD	26,142
	South of Long Point	05	2011	North Bay FCS	Seneca Lake (TTC)	15	13.30	480.00	ADIPO	36,090
	South of Long Point	04	2011	Harwood FCS	Seneca Lake (TTC)	16	31.35	584.08	RPAD	18,631
	William Shoal	04	2011	Harwood FCS	Seneca Lake (TTC)	16	31.54	787.11	RPAD	24,956
										114,861
					Totals (all strains and life stages):			**9205 kg.**		**385,064**

TABLE 7.8. Walleye stocked in Hamilton Harbour and Toronto Harbour, Lake Ontario, 2013.

WATERBODY	SITE	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN (EGG SOURCE)	AGE (MONTHS)	MEAN WT (g)	TOTAL WT (kg)	MARKS	NUMBER STOCKED
				WALLEYE - SPRING FINGERLINGS						
Hamilton Harbour	Hamilton Harbour	07	2013	White Lake FCS	Bay of Quinte (Wild)	3	0.51	5.10	None	**10,000**

TABLE 7.9. Bloater stocked in Hamilton Harbour and Toronto Harbour, Lake Ontario, 2013.

WATERBODY	SITE	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN (EGG SOURCE)	AGE (MONTHS)	MEAN WT (g)	TOTAL WT (kg)	MARKS	NUMBER STOCKED
				BLOATER - SUB-ADULT						
Ontario, L.	RP 100	11	2012	White Lake FCS	Wild Collection	20	26.6	403.97	None	**15,187**

8. Biodiversity and Species Rehabilitation

8.1. Introduction

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.

A number of fish species have been lost or persist in low numbers in the Lake Ontario basin. Table 8.1.1 lists twenty-four fish species that formerly occurred or are currently 'rare' in the Lake Ontario basin. The recent observation of a population of Eastern Sand Darter in West Lake is an addition to the list this year. The Blackfin Cisco (note that there is debate about historic existence of Blackfin Cisco in Lake Ontario), the Lake Ontario Kiyi, Atlantic Salmon and Blue Pike (a subspecies of Walleye) are thought to be extinct. Three species, Lake Trout, Bloater, and Shortnose Cisco have been extirpated (i.e., local extinction) from the Lake Ontario basin. Four species, American Eel, Burbot, Deepwater Sculpin and Lake Sturgeon that were once very common in the basin are now considered to be rare. The remaining species on this list were either uncommon historically or their historic status is uncertain. In addition, we acknowledge that there may be other species, small cyprinids for example, which may have been present historically but were lost prior to their documentation of their presence in the basin.

The sections below describe the planning and efforts to restore Atlantic Salmon, American Eel, Bloater and Lake Trout. Successful restoration of these native species would be a significant milestone in improving Ontario's biodiversity.

8.2 Atlantic Salmon Restoration

Atlantic Salmon were extirpated from Lake Ontario by the late 1800s, primarily as a result of the 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 Ministry of Natural Resources 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, a 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. More recently, the Humber River has been added to the program. Demonstrated success in these systems will pave the way for restoration of Atlantic Salmon to other suitable streams in future phases of the program. Three broodstocks from different source populations in Nova Scotia (LaHave), Quebec (Lac St-Jean) and Maine (Sebago Lake) have been established and are currently housed at OMNR's Harwood Fish Culture Station and the newly constructed Normandale Fish Culture Station. To date, the LaHave strain has been dominant strain stocked, followed by the Sebago strain. The next strain to come on-line was the Lac St-Jean strain. In 2013, approximately 57,000 progeny from this strain were stocked as fall fingerlings (37,071) and spring yearlings

TABLE 8.1.1. Status of ‘rare’ fishes in the Lake Ontario basin and their designation (as of December 18, 2013) under the Ontario Endangered Species Act (ESA) and the Canadian Species at Risk Act (SARA).

Name	Status in Lake Ontario Basin	Ontario ESA Designation	SARA Designation
American Eel, *Anguilla rostrata*	Historically very abundant throughout the nearshore zone of the basin; now rare.	Endangered	No Status - proposed as Threatened pending public consultation
Atlantic Salmon (Lake Ontario population), *Salmo salar*	Historically abundant throughout Lake Ontario and major tributaries; Extirpated prior to 1900’s; restoration efforts underway.		No Status - Extinct
Bigmouth Buffalo, *Ictiobus cyprinellus*	Rare historic observations; one recent observation in Lake Ontario.		Special Concern
Black Redhorse, *Moxostoma duquesnei*	Historic abundance unclear; currently found at low abundance in Spencer Creek.	Threatened	No Status - proposed as Threatened pending public consultation
Blackfin Cisco, *Coregonus nigripinnis*	Historically abundance in offshore pelagic zone is unclear; thought to have become extinct by 1900.		Threatened
Bloater, *Coregonus hoyi*	Historically abundant in offshore pelagic zone; extirpated; last recorded in 1983.		Not at Risk
Blue Pike, *Sander vitreus glaucus*	Historically abundant in western Lake Ontario and Niagara River; extinct prior to 1970’s.		No Status - Extinct
Bridle Shiner, *Notropis bifrenatus*	Historic abundance unclear; Currently at low abundance in upper St. Lawrence River and tributaries, as well as Napanee River and Bay of Quinte	Special Concern	Special Concern
Burbot, *Lota lota*	Abundant in the offshore zone up to the 1920; declined steadily to virtual extirpation by about 1950; now rare.		
Channel Darter, *Percina copelandi*	Historic abundance unclear but occurred in the upper St. Lawrence River; currently found at low abundance in Moira River (including the Skootamatta River) and Salmon River.	Threatened	Threatened
Cutlip Minnow, *Exoglossum maxillingua*	Historic abundance unclear; Currently at low abundance in St. Lawrence River and tributaries.	Threatened	Not at Risk
Deepwater Sculpin (Great Lakes population), *Myoxocephalus thompsonii*	Historically very abundant in offshore pelagic zone; currently rare.		Threatened
Eastern Sand Darter, *Ammocrypta pellucida*	Unknown in Lake Ontario watershed until a new population was discovered in West Lake in 2013.	Endangered	Endangered
Grass Pickerel, *Esox americanus vermiculatus*	Historic abundance unclear; currently in low abundance in St. Lawrence River, Bay of Quinte, Lake Consecon, Wellers Bay.	Special Concern	Special Concern
Lake Chubsucker, *Erimyzon sucetta*	Present in wetlands that drain into the lower Niagara River. Not observed until 1949, may always have been rare.	Threatened	Endangered
Lake Ontario Kiyi, *Coregonus kiyi orientalis*	Historically abundant in offshore pelagic zone; extinct; last recorded in 1964.		No Status - Extinct
Lake Sturgeon (Great Lakes and Western St. Lawrence populations), *Acipenser fulvescens*	Common in the nearshore zone and large tributaries throughout the basin prior to 1900; now rare.	Threatened	No Status - proposed as Threatened pending public consultation
Lake Trout, *Salvelinus namaycush*	The most abundant piscivore in the offshore zone up to the 1920s; declined steadily to virtual extirpation by about 1950; Restoration efforts underway.		
Pugnose Shiner, *Notropis anogenus*	Historic abundance is unclear; currently at low abundance in Thousand Islands area of St. Lawrence River.	Endangered	Endangered
Redside Dace, *Clinostomus elongatus*	Historic abundance unclear, but occurred in tributaries from Oshawa to Hamilton; currently rare.	Endangered	Special Concern – proposed as Endangered pending public consultation
River Redhorse, *Moxostoma carinatum*	Historic abundance unclear; currently at low abundance in Bay of Quinte and Trent River.	Special Concern	Special Concern
Round Whitefish, *Prosopium cylindraceum*	Formerly abundant in offshore benthic zone of north central Lake Ontario; currently low abundance.		
Shortnose Cisco, *Coregonus reighardi*	Historically abundant in offshore pelagic zone; extirpated; last recorded in 1964.	Endangered	Endangered
Silver Shiner, *Notropis photogenis*	Historic abundance unclear; currently at low abundance in Bronte Creek.	Threatened	Special Concern – proposed as Threatened pending public consultation
Spotted Gar, *Lepisosteus oculatus*	Limited historic abundance in sheltered nearshore zone; two recent observations in Bay of Quinte and East Lake.	Threatened	Threatened

(19,757). The performance of all three strains will be evaluated in the Lake Ontario environment. Unlike traditional put-grow-and-take stocking, restoration stocking involves introducing large numbers of very young fish (spring fingerlings) so that the survivors are more likely to naturalize to stream conditions. We have designed a long-term study to compare the effectiveness of stocking spring fingerlings, fall fingerlings and spring yearlings for the purpose of restoration. 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 2.8 and 2.9). 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 upstream, as well as collect important biological data on individual fish (Section 2.10). 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 2.11).

To find out more about the program, meet our partners and discover volunteer opportunities, please visit *bringbackthesalmon.ca.*

8.3 American Eel Restoration

American eel were historically a very important predator in the nearshore fish community of Lake Ontario and upper St. Lawrence River (LOuSLR). Eels were an important component of the LOuSLR commercial fishery during the latter part of the 20th century and are highly valued by aboriginal peoples. American Eel abundance declined in the LOuSLR 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 eel in Ontario to protect the eels that remained. In 2007, American Eel was identified as Endangered under Ontario's Endangered Species Act (ESA). Subsequently, the Committee on the Status of Endangered Wildlife in Canada recommended in 2012 that American Eel be identified as Threatened under the Canadian Species at Risk Act. These events led to additional efforts to protect American Eel. This section describes the current status of eel in LOuSLR as well actions taken by the Lake Ontario Management Unit and its partners during 2013 to reverse the decline of eel.

The Moses-Saunders Dam located on the upper St. Lawrence River between Cornwall, Ontario and Massena, New York, is an impediment to migration of eels in this system. From 1974 to 2007, MNR and Ontario Power Generation (OPG) collaborated on the operation of an eel ladder to facilitate upstream migration in the Ontario portion of the dam (R.H. Saunders

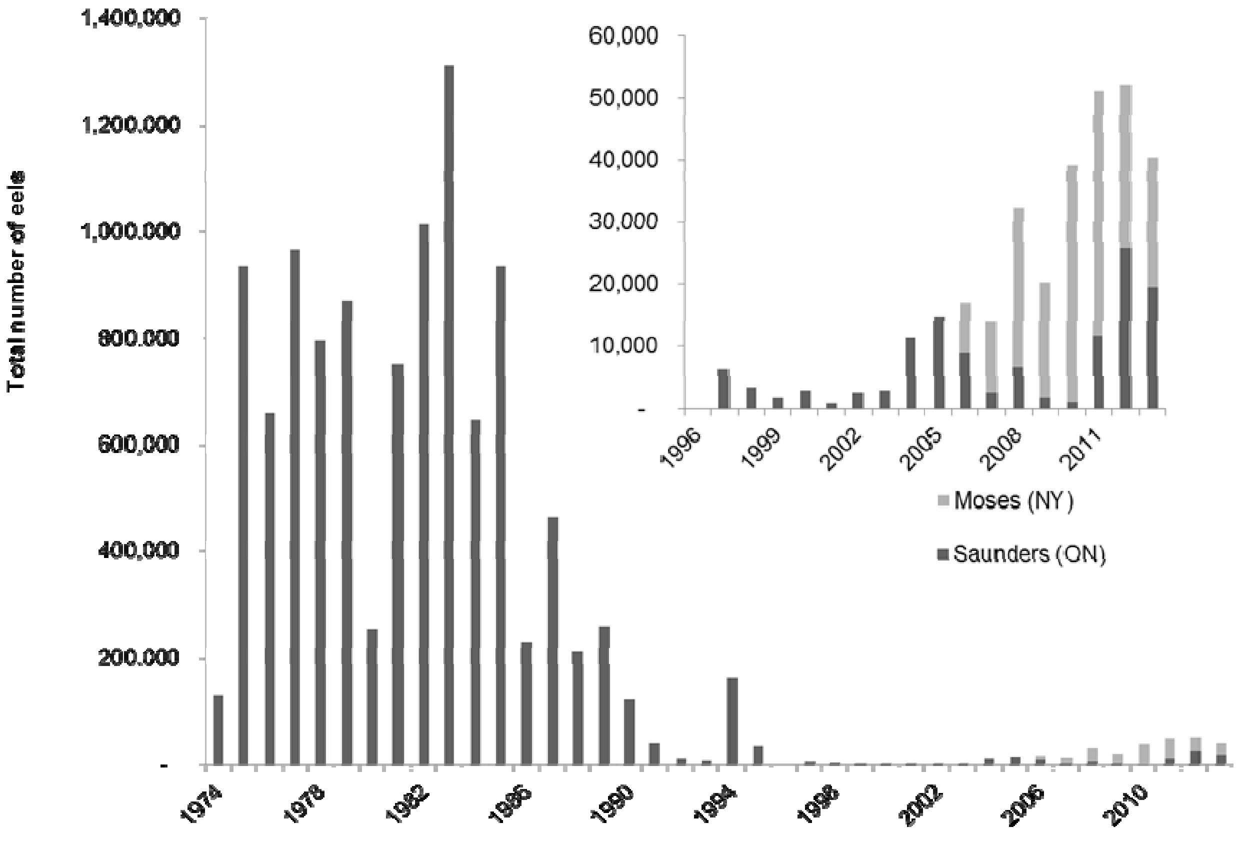


FIG. 8.3.1. Total number of eels ascending the eel ladder(s) at the Moses-Saunders Dam, Cornwall, Ontario for 1974-2013[1] . During 1996, the ladder operated however no counts are available.

[1]Ault, S. R., L. H. Harper, and R. W. Threader. 2014. 2013 Monitoring of the eel passage facility at the R. H. Saunders Generating Station. Ontario Power Generation Report Number NA9-07015-0122. February 2014. 42 pp

Hydroelectric Dam). Since 2007 OPG has assumed full responsibility for ladder operation. The Saunders eel ladder was opened on June 15, 2013 and closed on October 16 (123 days). A total of 19,410 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. The numbers of eels exiting the Moses ladder during 2013 was 20,978. The combined number (40,388 eels) was lower than observed during 2011 and 2012 but was the third largest observed since 1994 (163,518 eels). There has been a general trend of increasing exiting eel numbers since 2001. However, the numbers migrating upstream last year are still less than 6% of the numbers of eel observed during the early years of the ladder's operation (Fig. 8.3.1, over 600,000 eels per year during the 1970s and 1980s).

A sub-sample of 142 eels was collected by OPG from the ladder and sampled for biological characteristics. The average length (371.6 mm, n=883, range 219-700 mm, S.D.=73.8, Fig. 8.3.2) was similar to what has been observed in recent years with some minor variations. Age distribution of the eels sampled ranged from 3 to 15 years (mean 6.04±2.06). All eels from the sub-sample were determined to be female and an oxytetracycline mark present on one of 50 eels examined indicated that this fish was from a stocking program.

The abundance of larger 'yellow' eels in the upper St. Lawrence River (uSLR) and eastern Lake Ontario (ELO) was measured with three assessment programs. Bottom trawling in the Bay of Quinte has been conducted since 1972 as part of the fish community index program (see Section 2.3). The average catch of American Eel in 511 trawls conducted (June to 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. In both 2012 and 2013, one eel was captured during the forty trawls conducted in each of these years.
Nearshore trap netting was conducted using the NSCIN fish community index protocol (see Section 2.4). Sixteen eels were captured in 36 net sets in the upper Bay of Quinte, 4 eels were captured in 24 nets set in Prince Edward Bay and

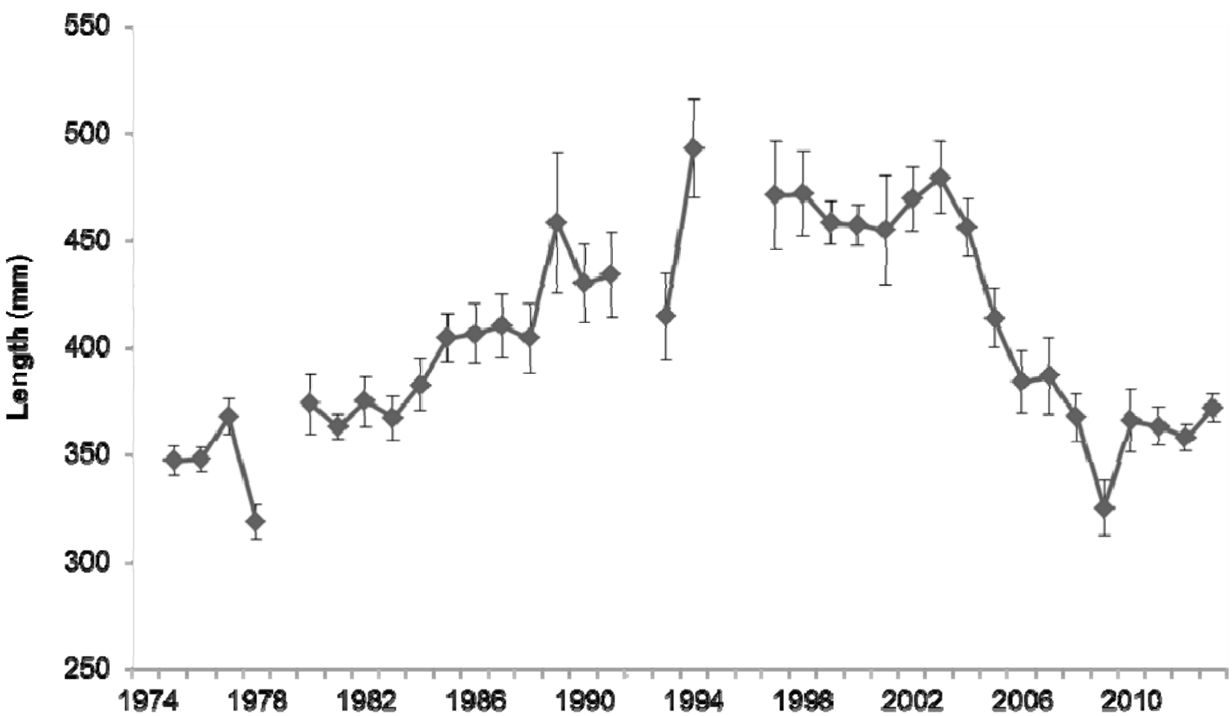


FIG. 8.3.2. . Length of eel migrating upstream through the eel ladder located at the R.H. Saunders Hydroelectric Dam, 1975-2013. Error bars represent the 95% confidence limits[1].

no eels captured in 24 nets set in East Lake.

Quantitative electrofishing for American Eel was conducted in the Mallorytown area (uSLR) and Main Duck Island - Yorkshire Bar area (ELO) by Dr. J. Casselman and L. Marcogliese of Queen's University. During 2013, eel abundance in the uSLR was 14.781 ± 9.980 eels/hr while in ELO 1.000 ± 0.032 eels/hr were captured during night-time surveys (Fig. 8.3.3). Oxytetracycline marks on eel otoliths indicated that 100% of the eels from uSLR and 83% of the eels at ELO originated from the eel stocking program. One eel in 99 sampled from uSLR and ELO had a single *Anguillicoloides crassus* parasite in its swimbladder. A. crassus was first detected in eels from the LOuSLR in 2011. The occurrence rate observed during 2013 does not appear to be higher than rates in 2011 and 2012. It is not known if the parasite has an impact on the American Eel survival, however scientists suspect that the reproductive output of eels with large infestations of the parasite may be negatively affected.

In 2006, Fisheries and Oceans Canada (DFO), MNR and OPG developed an Action Plan for Offsetting Turbine Mortality of American Eel for the Saunders Generating Station (GS). In one component of the OPG plan, over 4 million glass eel were stocked into the USLR and Bay of Quinte 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 were not stocked in recent years.

DFO and OPG have collaborated to evaluate the effectiveness of stocking of eels using spring boat electrofishing surveys. Results of the first four years of this monitoring program

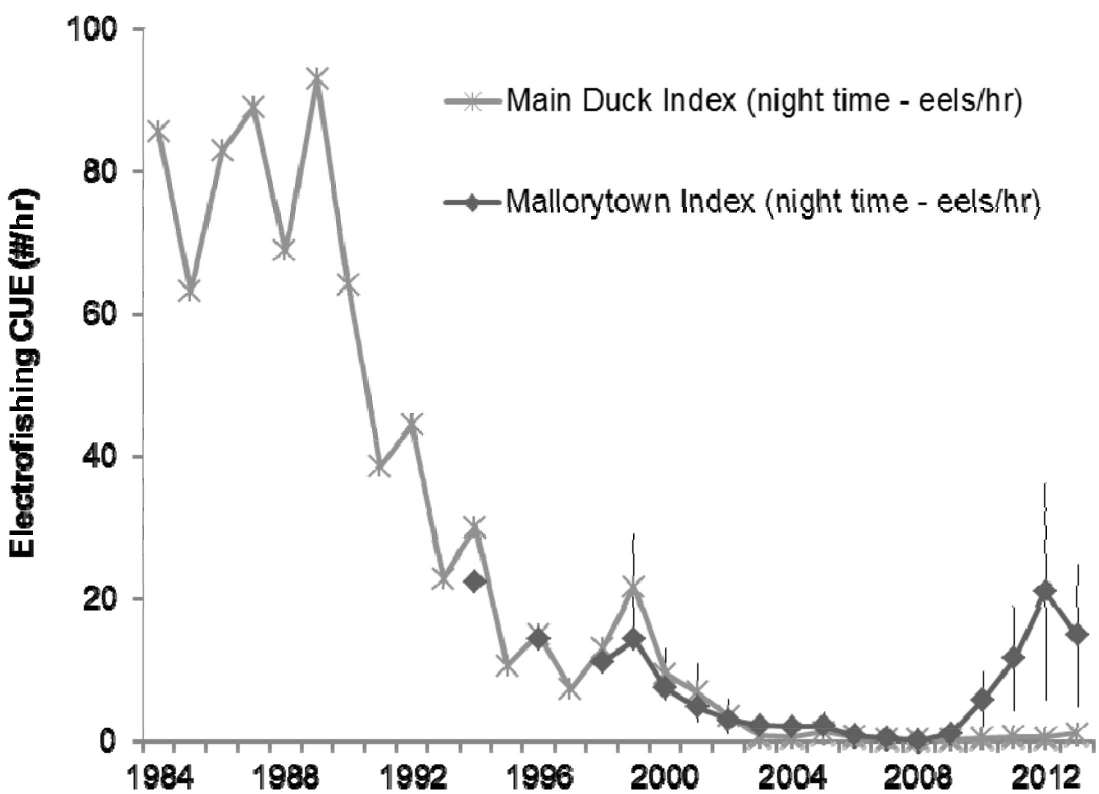


FIG. 8.3.3. Numbers of eel caught in the vicinity of Main Duck Island in eastern Lake Ontario and Mallorytown Landing in the upper St. Lawrence River per hour of night electrofishing[2].

[2]Casselman, J.M., and L.A. Marcogliese. 2014. Wild and stocked eel abundance in the upper St. Lawrence River and eastern Lake Ontario – index quantitative electrofishing, 2013. Conducted for Ontario Ministry of Natural Resources by AFishESci Inc., Mallorytown, Ontario. Research report, January 2014, 24 pages.

show that stocked eels have survived over a seven year period however the rate of survivorship remains unknown. The estimated density and biomass of stocked eels continues to increase, despite the fact that no stocking has occurred since 2010. Stocked eels have continued to disperse throughout Lake Ontario and its tributaries. There is evidence from the silver eel fishery that stocked eels continue to silver and out -migrate. Growth of older fish at the uSLR stocking location continues to be rapid, while growth has now slowed in the Bay of Quinte and for younger age-classes in the uSLR. The size of eels captured continued to grow. Four specimens captured in the spring were larger than 700 mm. This is an indicator that some eels will continue to grow to the sizes historically reached by naturally recruiting female eels.

Safe downstream passage past hydro turbines during the eel's spawning migration is a second obstacle identified in the OPG Action Plan. MNR staff assisted in the capture, tagging and transport of large yellow eels from the uSLR, ELO and Lake St. Francis (LSF) to Lac St. Louis (a section of the St. Lawrence River below all barriers to downstream migration). Trap and Transport' of large yellow eels was initiated in 2008 as an OPG pilot project to investigate the economic and practical feasibility as an alternative for mitigating turbine mortality at the Saunders GS. The project also involved local commercial fishers and Quebec MRNF.

A total of 1,447 large yellow eels from LSF (1,292 eels) and the LOuSLR (155 eels) were released in Lac St. Louis immediately downstream of the Beauharnois GS. Another 10 eels collected from LSF were returned to LSF as a reference sample. During the release program, all the eels were observed to be in good health. The mortality rate during capture holding and transport was less than 0.1%.

Quebec MRNF staff sampled 8,776 eels (99.5% of the total catch) from the silver eel fishery in the St. Lawrence River estuary during the fall of 2013 to assess the survival, condition, maturation and migration of the transported yellow eels. MRNF biologists detected 23 PIT tagged eels from the trap and transport program; none were from 2008; 3 were from 2009; 5 from 2010 and 15 from 2011. No trap and transport eels were PIT tagged in 2012 or 2013.

The 2013 trap and transport project continued to demonstrate that, where abundant, large yellow eels can be caught, held for brief periods, and transported successfully with limited mortality. Transported eels are detected in the estuarial fishery. After 4 years, 75% of the transported eels have migrated towards the spawning grounds.

MNR OPG and DFO developed a new five year American Eel Action Plan that took effect in 2013. Actions include 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 will be implemented using an adaptive management strategy, which will allow modifications to be made based upon findings that emerge.

8.4 Deepwater Cisco Restoration

Prior to the mid 1950's, 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 Herring (*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 (OMNR), 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 2013, 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 OMNR, White Lake Fish Culture Station and the USGS Laboratory at Tunison, New York. The White Lake facility received approximately 440,000 eggs and the Tunison laboratory received approximately 57,000 eggs. Eggs in both facilities survived well; 227,000 eggs hatched and 145,000 survived to the end of the early rearing period.

A key restoration goal with this program is to be able to stock 500,000 fish per year by 2015. To help achieve this goal, a brood stock is being developed at White Lake based on 200 Bloater from the 2011 and 2,000 fish from the 2012 collection (Fig. 8.4.1).

In November of 2013, the OMNR successfully released approximately 16,000 Bloater into Lake Ontario (Fig. 8.4.2) approximately eight nautical miles south of Prince Edward County in roughly 100 m of water. The Bloater that were released originated as eggs collected in January and February of 2012 by the USFWS staff on Lake Michigan, east of Green bay and the Door Peninsula.

A hydroacoustic sounder was used at the time of release (Fig. 8.4.3) to track the distribution through the water column. The acoustic echogram (Fig. 8.4.4) showed distinct tracks of Bloater descending to depths greater than 80 m. Comparisons of acoustic data collected immediately prior to stocking and following stocking show an increased fish density in the 80-100 m depth strata following the stocking. The data collected during the release of

FIG. 8.4.1. Bloater at 18 months.

FIG. 8.4.2. Bloater being transferred from White Lake Fish Culture Station to the Ontario Explorer (November 2013).

FIG. 8.4.3. GoPro footage showing Bloater heading for deep water following their release.

the Bloater in combination with biological samples retained for analysis will aide future acoustic work to distinguish Bloater from other pelagic prey fish.

OMNR staff also kept 161 fish for scientific purposes (Fig. 8.4.5). Average length and weight measurements were taken with the average total length of the Bloater being 145.7 mm and an average weight of 25.6 g. Genetic and morphometric samples were also taken from these fish. Plans are in place to survey the stocking area next season to search for surviving stocked fish. Continued collection of eggs from the wild and development of a cultured brood stock will result in more fish being stocked in future years.

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.

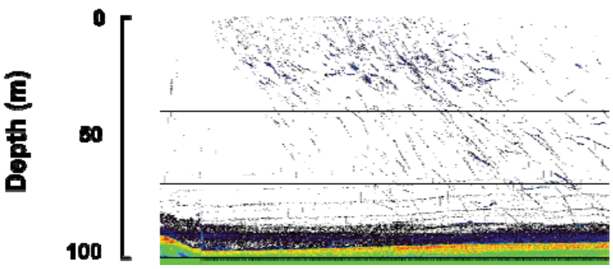


FIG. 8.4.4. Acoustic echogram showing distinct tracks of Bloater descending to depths greater than 80 m.

FIG. 8.4.5. OMNR's Lake Ontario Management Unit staff holding a Bloater being taken for scientific purposes.

8.5 Lake Trout Restoration

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, and revisions in 1990 and 1997 were made to evaluate the methodology and the progress of rehabilitation. A management strategy for the rehabilitation of lake trout in Lake Ontario was developed during 2013 and is currently in review. The two objectives of the plan are to: increase abundance of stocked adult Lake Trout to a level allowing for significant natural reproduction; and improve production of wild offspring and their recruitment to adult stock.

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). Reduced stocking levels and a decline in early survival of the stocked fish contributed to the decline. Since 2005 there has been a gradual increase in the relative abundance of adult Lake

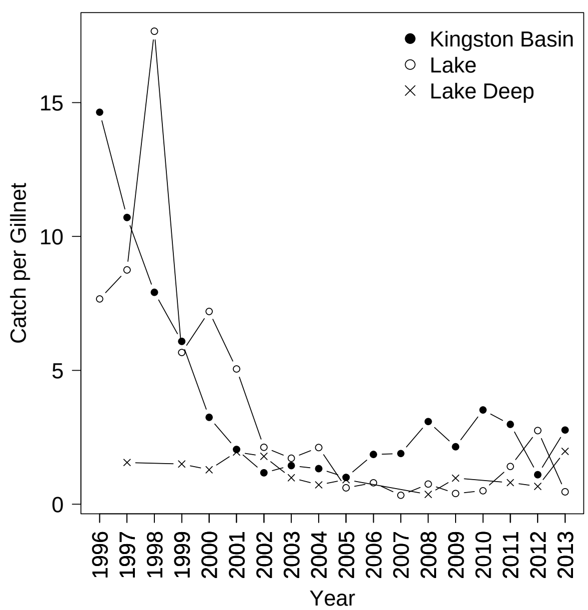


FIG. 8.5.1 Catch per unit effort (# fish per set-night) of adult lake trout in bottom-set gillnets in three areas of eastern Lake Ontario. Deep sets off Rocky Point were not fished in 2006, 2007, and 2010.

Trout although catches are still well below those seen in the late 1990s. Relative abundance of Lake Trout is tracked in three areas in the Community Index Gillnetting program (Kingston Basin, Main Lake and Deep Main Lake). Abundance increased in two areas (Kingston Basin and the Deep Main Lake) while recent increases seen in the Main Lake returned to 2005 to 2010 levels. Overall, a slight increase in CUE was observed which is largely due to catches of hatchery origin fish (Fig. 8.5.2).

Survival of juvenile Lake Trout was identified as one factor contributing to the decline in abundance. Catches of stocked age-2 and age-3 fish per million stocked are used as a measure of juvenile survival. Survival to age-2 peaked in 2007 and then rapidly declined and remains low

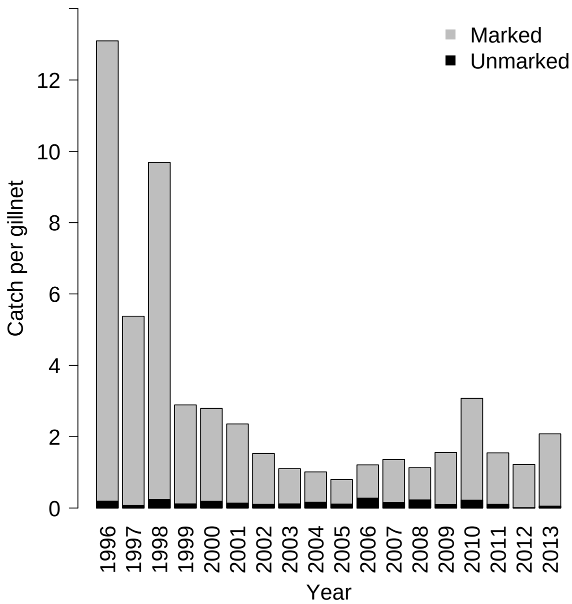


FIG. 8.5.2. Catch per unit effort of marked (hatchery) and un-marked (wild) Lake Trout in the Community Index Gillnetting (Section 2.2).

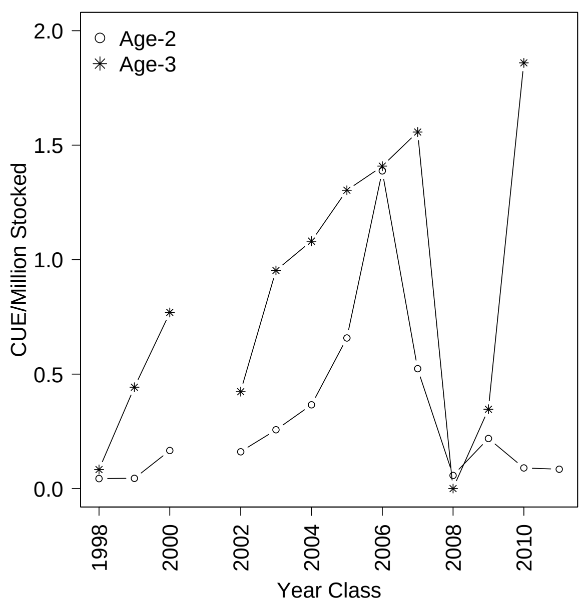


FIG. 8.5.3. Survival of juvenile Lake Trout as represented by Community Index Gillnetting (Section 2.2) catches of age-2 and age -3per million Lake Trout stocked.

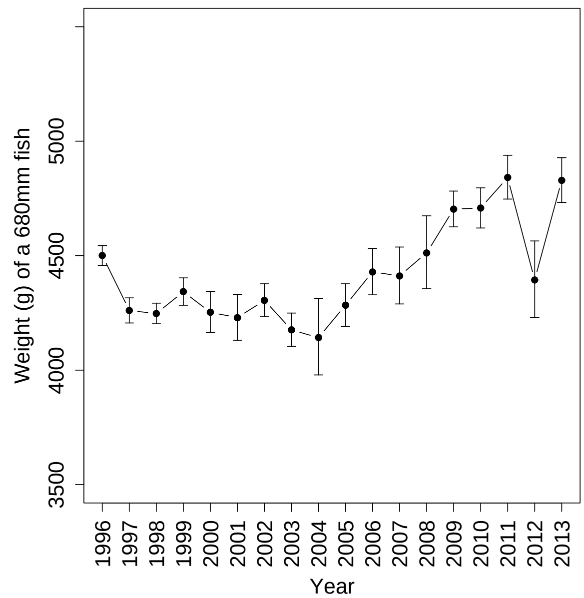


FIG. 8.5.4. . Index of Condition measured as the predicted weight of a 680 mm (fork length) Lake Trout.

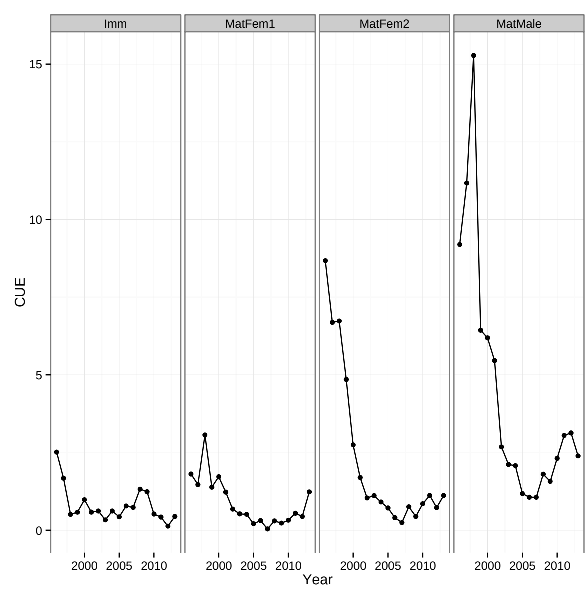


FIG. 8.5.5. Catch per unit effort (CUE) of immature (Imm), mature females greater than 4 kg (MatFem1), mature females less than 4 kg (MatFem2) and mature males (MatMale) Lake Trout in the Community Index Gillnetting (Section 2.2).

in 2013 (Fig. 8.5.3). Survival to age-3 of the 2010 cohort is the highest in the time series following a relatively low survival to age-2 in 2012.

The condition of Lake Trout is reported as the average weight of a 680 mm (fork length) Lake Trout. The condition index returned to the 2011 series high following a decrease in 2012 (Fig. 8.5.4). The rapid response in condition may be attributed to an increase in mature females, especially mature females greater than 4 kg (Fig. 8.5.5).

The second objective of the plan is to improve the production of wild offspring and recruitment to adults. The occurrence of wild Lake Trout is measured through catches of fish that do not bear hatchery fin clips (e.g. unclipped). Stable isotope analysis has shown that more than 90% of unclipped fish are of wild origin.

Catches of Lake Trout in the Community Index bottom trawls (Section 2.3) remain low, although catches are higher than between 2009 and 2011 (Fig. 8.5.6). Only since 2010 have wild young-of-year Lake Trout been captured in the Community Index bottom trawls. One wild Lake Trout was caught in Community Index bottom trawls in 2013 but an additional 10 were caught in trawl sites conducted as part of other research activities (Section 10.2).

The proportion of wild fish in the Community Index gillnet program (Section 2.2) increased as relative abundance of Lake Trout declined from 1996 through to 2005. The proportion of wild fish peaked in 2006 (23%) was followed by a rapid decline (Fig. 8.5.7). The percentage of wild origin fish increased in 2013 over 2012 (2.7% and 1.0% respectively) but remained low.

Wild and stocked Lake Trout catches have been thought to be related to changing temperatures at the index sites. Between 2008 and 2012 increasing temperatures during the index season reduced the proportion of nets that were fished in water temperatures below the 12°C threshold (Fig. 8.5.8). In 2010, and especially in 2012 the Community Index gillnets were fished in waters that were warmer than usual; potentially under-representing the abundance of juvenile and wild fish. Site temperatures in 2013 were colder and the proportion of nets fished below the 12°C target was at comparable level to when Lake Trout catches were high.

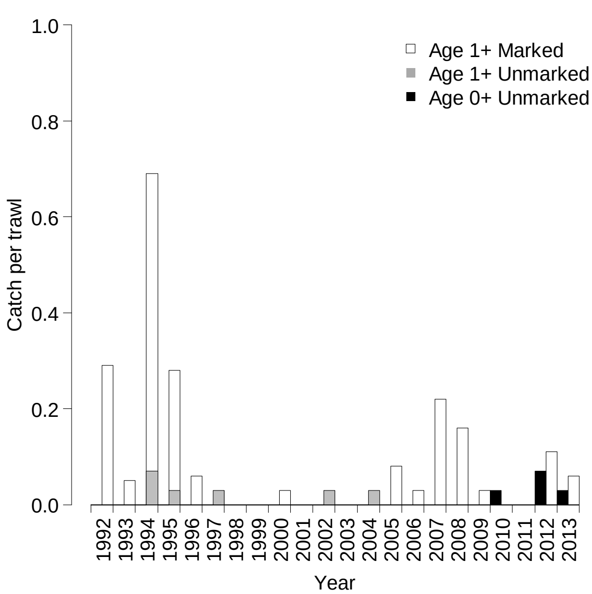


FIG. 8.5.6. Catch per trawl of age-0 and age-1 marked (hatchery) and unmarked (wild) Lake Trout in the Community Index Bottom Trawls (Section 2.3).

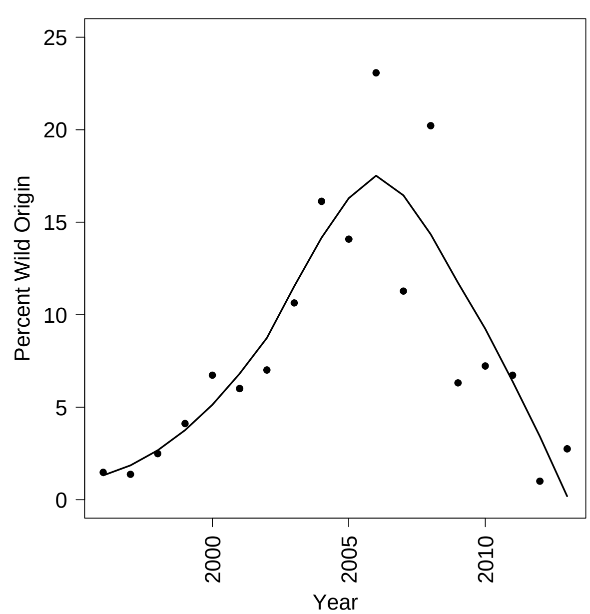


FIG. 8.5.7. The proportion of wild origin Lake Trout captured in the Community Index Gillnetting (Section 2.2). Trend line is a LOESS fit to the data series.

Lake Trout are particularly vulnerable to Sea Lamprey induced mortality. Sea Lamprey control is monitored through the number of A1 (fresh wounds) observed on Lake Trout. The management target of less than two wounds per 100 Lake Trout has been consistently met since 1996 with the exception of 2012 (Fig. 8.5.9). Wounding rates were below target again in 2013 (0.5 wounds/100 Lake Trout).

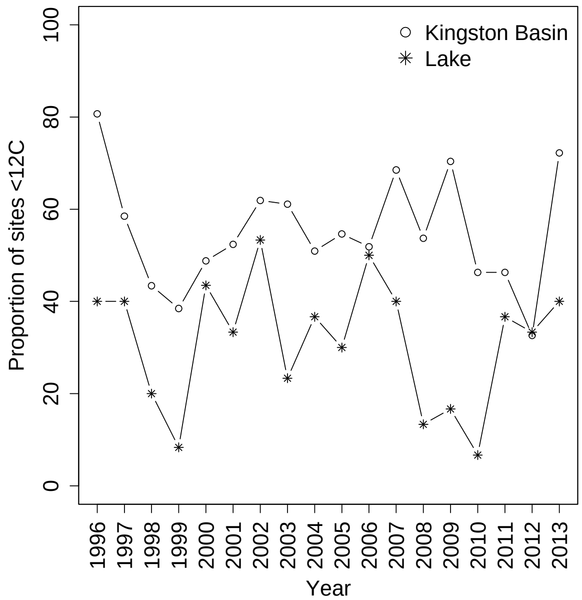


FIG. 8.5.8. The proportion of gillnet sets in the Kingston Basin and Main Lake sites of Community Index Gillnetting (Section 2.2).

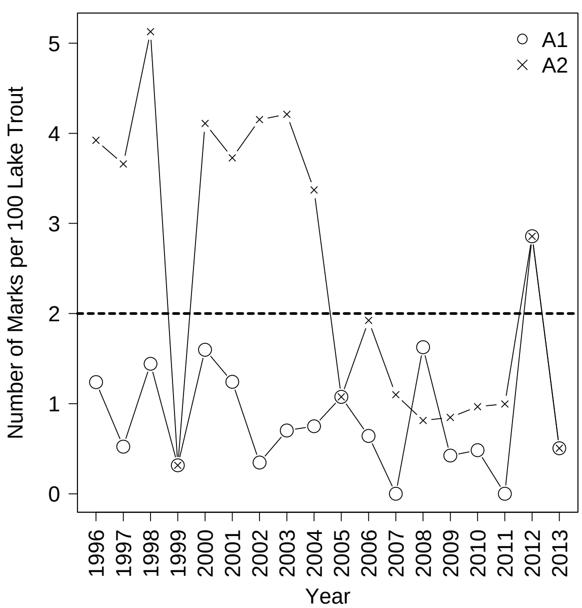


FIG. 8.5.9. Frequency of A1 (fresh) and A2 (partially healed) lamprey wounds observed on Lake Trout. The lamprey control target of 2.0 A1 wounds per 100 fish is indicated by the horizontal line.

8.6 Round Whitefish Population Assessment

An exploratory Round Whitefish spawning assessment program was conducted along the north central shoreline of Lake Ontario during early December, 2013. The objectives of the program were to:

- identify spawning Round Whitefish aggregations at several locations;
- collect biological samples to examine size and age structure, obtain tissue samples for genetic and isotope studies—which may help identify population strucutre;
- supplement Round Whitefish spawning work conducted by Ontario Power Generation (OPG);
- learn for future years.

Standard fish community gill nets were employed (see Section 2.2) except that only mesh sizes ranging from 2 to 4 in (½ in increments for a total of five mesh sizes, each 50 ft in length) were used. Two of these 250 ft gangs were attached together to form one continuous 500 ft gill net. A total of six overnight gill net sets were made at five areas (Table 8.6.1). Sample depth ranged from 3.2 to 5.7 m, and water temperature ranged from 2.4 to 2.6 ^{o}C. Unfavourable weather conditions prevented further sampling. Three species were captured: Rainbow Trout (n=7); Brown Trout (n=3); and Round Whitefish (n=6).

Biological data for each fish captured is shown in Table 8.6.2. Round Whitefish ranged in total length from 460 to 525 mm and in weight from 837 to 1,638 g. The sex ratio of the six Round Whitefish was 3:3 and all were mature in pre-spawning or spawning condition. Tissue samples were also collected and archived from all Round Whitefish for genetic and isotope analysis.

LOMU plans to continue and expand on this work during the next few years, with an ultimate objective to determine whether the north shore Lake Ontario Round Whitefish is composed of one population or several meta-populations.

TABLE 8.6.1. Summary of gill net site locations , dates, depths, water temperatures and catches for the Round Whitefish population assessment program, 2013.

Sample	Area	Latitude (decimal degrees)	Longitude (decimal degrees)	Set date	Lift date	Depth (m)	Water temperature (^{o}C)	Species	Catch
1	Bond Head	43.89417	-78.56367	2-Dec-13	3-Dec-13	3.2	2.4	*no catch*	
2	Bouchette Point	43.90283	-78.45433	2-Dec-13	3-Dec-13	3.8	2.4	Rainbow Trout	4
								Brown Trout	2
3	Chrysler Point	43.91067	-78.41033	2-Dec-13	3-Dec-13	5.5	2.4	Round Whitefish	1
4	Otty Point	43.93183	-78.33883	2-Dec-13	3-Dec-13	3.5	2.4	Rainbow Trout	3
								Brown Trout	1
5	Peter Rock	43.93983	-78.23183	3-Dec-13	4-Dec-13	5.7	2.6	Round Whitefish	2
6	Peter Rock	43.93850	-78.23000	3-Dec-13	4-Dec-13	4.0	2.6	Round Whitefish	3

TABLE 8.6.2. Biological data for 16 fish (three species) captured during the Round Whitefish population assessment program, 2013. Shown are total and fork length, round weight, sex, and state of maturity and otolith age for Round Whitefish only.

Sample	Species	Fish number	Gill net mesh (inches)	Total length (mm)	Fork length (mm)	Round weight (g)	Sex	State of Maturity	Age (years)
2	Rainbow trout	1	2	610	584	2,410	Male		
2	Rainbow trout	2	3	323	305	332	Male		
2	Rainbow trout	3	4	609	582	2,525	Female		
2	Rainbow trout	4	4	520	497	1,718	Male		
2	Brown trout	1	3.5	384	366	572	Female		
2	Brown trout	2	3.5	409	395	878	Male		
3	Round whitefish	1	3	525	489	1,363	Female	Spawning	n/a
4	Rainbow trout	1	2.5	275	262	208	Male		
4	Rainbow trout	2	4	563	535	2,031	Male		
4	Rainbow trout	3	4	745	711	4,944	Female		
4	Brown trout	1	3	351	332	414	Male		
5	Round whitefish	1	2	481	445	973	Male	Pre-spawning	8
5	Round whitefish	2	3	516	475	1,052	Female	Spawning	15
6	Round whitefish	1	3	460	433	837	Male	Pre-spawning	15
6	Round whitefish	2	3.5	521	487	1,638	Female	Spawning	18
6	Round whitefish	3	3.5	479	446	863	Male	Pre-spawning	12

9. Management Planning

9.1 Fisheries Management Zone 20 Council (FMZ20)

Fisheries Management Zone 20 (FMZ20) Council provides recommendations to the Lake Ontario Manager regarding the management of the recreational fishery. The council has been instrumental in advancing many regulatory and planning initiatives. In 2013 the two sub-councils (Eastern and Western Lake Ontario) helped finalize the Fish Community Objectives for Lake Ontario. This document will provide updated goals and objectives for management of the Lake Ontario fish community, excluding the St. Lawrence River. These objectives are also a starting point for discussions with management agencies, interest groups and the general public for developing more specific fisheries, habitat, and watershed management plans. The FMZ 20 council also helped initiate a review of MNR's stocking strategy for Lake Ontario. This initiative seeks to align provincial and partner stocking practices with fishery and species rehabilitation needs to ensure that stocking practices are being optimized toward the achievement of the revised Fish Community Objectives for Lake Ontario. Council members have participated in two productive planning workshops working toward the delivery of a Lake Ontario stocking strategy in 2014.

Members on the council continue to work on pen imprinting projects lake-wide and will be working toward the development of fish community objectives for the St. Lawrence River.

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

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 MNR. Election of one or two quota zone representatives (2-year term) took place during 2013.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 MNR and the commercial industry.

One of the major topics of discussion at the LOLC during 2013 was bycatch of turtles in hoopnets. As a result of these discussions, the *Lake Ontario Commercial Fishers Voluntary Biodiversity Protocol* was introduced and unanimously accepted by all fishers. Under this protocol all hoopnets fished during May 20 to June 20 had to participate in the eel trap and transport program (see Section 8.3) and had to use some type of turtle mitigation during fishing. MNR conducted preliminary field work to evaluate the effectiveness of mitigation measures and diaries recording turtle observations were kept by fishermen. MNR will continue to work with the industry on this important issue.

Other notable topics of discussion at the LOLC meetings included discussion of quota and harvest levels for yellow perch, whitefish and walleye. Results of contaminant testing conducted on samples collected from the whitefish fishery in eastern Lake Ontario and the Bay of Quinte were also reviewed by the committee. This testing showed a significant reduction in contaminant levels during the past decade.

10. Research Activities

10.1 Linking Nearshore to Offshore Production in Lake Ontario

Project leads: Tim Johnson & Brent Metcalfe (ARMS) and Tom Stewart (LOMU)
Partners: Dr. Marten Koops, Dr. Warren Currie, Kelly Bowen (Fisheries and Oceans Canada), Dr. Aaron Fisk, James Mumby (University of Windsor)
Funding: Canada-Ontario Agreement

Building on a successful pilot program in 2012, OMNR's Aquatic Research and Monitoring Section (ARMS) and the Lake Ontario Management Unit (LOMU) undertook an intensive field program to explore the flows and linkages between nearshore and offshore production in Lake Ontario. Nutrient and fisheries management programs initiated in the 1970s halted, and in many cases, reversed patterns of deteriorating water quality and loss of ecosystem services in Lake Ontario and elsewhere in the Great Lakes. However, invasion and proliferation of invasive species including zebra and quagga mussels, spiny- and fishhook water fleas, and Round Goby have significantly altered the structure and function of food webs in the Great Lakes. Resource management decisions, and ultimately the quality of the fisheries and other ecological and economic benefits of the Lakes require a comprehensive understanding of the relationships between nutrient loading, fisheries production, and the effects of invasive species on food web structure.

Our nearshore-offshore project was part of a bi-national, lakewide intensive monitoring program described more fully in Section 11.2. OMNR utilised both small (*C.R. Wood, Seacow, Peewee*) and large (*Ontario Explorer*) vessels to undertake a seasonal (April-November), multi-trophic level (from plankton to fish), nearshore-to-offshore (beach to midlake) survey to obtain samples to describe key food web components and their interrelatedness. For logistic reasons, we concentrated our efforts in the eastern (Kingston) basin and midlake off Cobourg (Fig. 10.1.1). Other agencies sampled the western basin and US portions of Lake Ontario (Section 11.2). In total, OMNR invested 122 vessel days on the project, collecting hundreds of samples describing physico-chemical habitat, lower trophic levels (algae, plankton and benthos), and fish (Table 10.1.1). Numerous staff continue to process these samples and preliminary statistical analyses have begun for those samples already analysed. The results and data from this intensive sampling will be used to 1) describe the state of the Lake Ontario ecosystem in 2013 and 2) feed into a whole lake ecological model currently under development which will provide scientists and managers with a tool for exploring different scenarios related to on-going ecological change (i.e. increase our confidence in quantifying the effects of AIS, climate change, and / or changes in nutrient regime on the production and composition of important fisheries). Preliminary results will be discussed at the upcoming International Conference on Great Lakes Research to be held in Hamilton, while more in-depth analyses will continue over the next year.

Several notable project elements include:

- Using data loggers to provide continuous vertical and horizontal distribution of oxygen in the water column as a predictor of primary production (in essence how much energy is available to fuel the rest of the food web);
- Coupling multi-frequency hydroacoustics with an optical plankton counter to provide a complete nearshore-to-offshore, day and night, distribution of plankton and fish biomass;
- High spatial and temporal resolution plankton community and alewife diet analysis to understand the energy sources for this key prey fish;
- Comprehensive diet and demographic analysis of benthic fishes (Round Goby, Slimy Sculpin and Deepwater Sculpin) to learn more about the ecology of these important prey fishes;
- Using stable isotopes and diets of trout and salmon to better understand the potential competition and overall health of these economically important fishes.

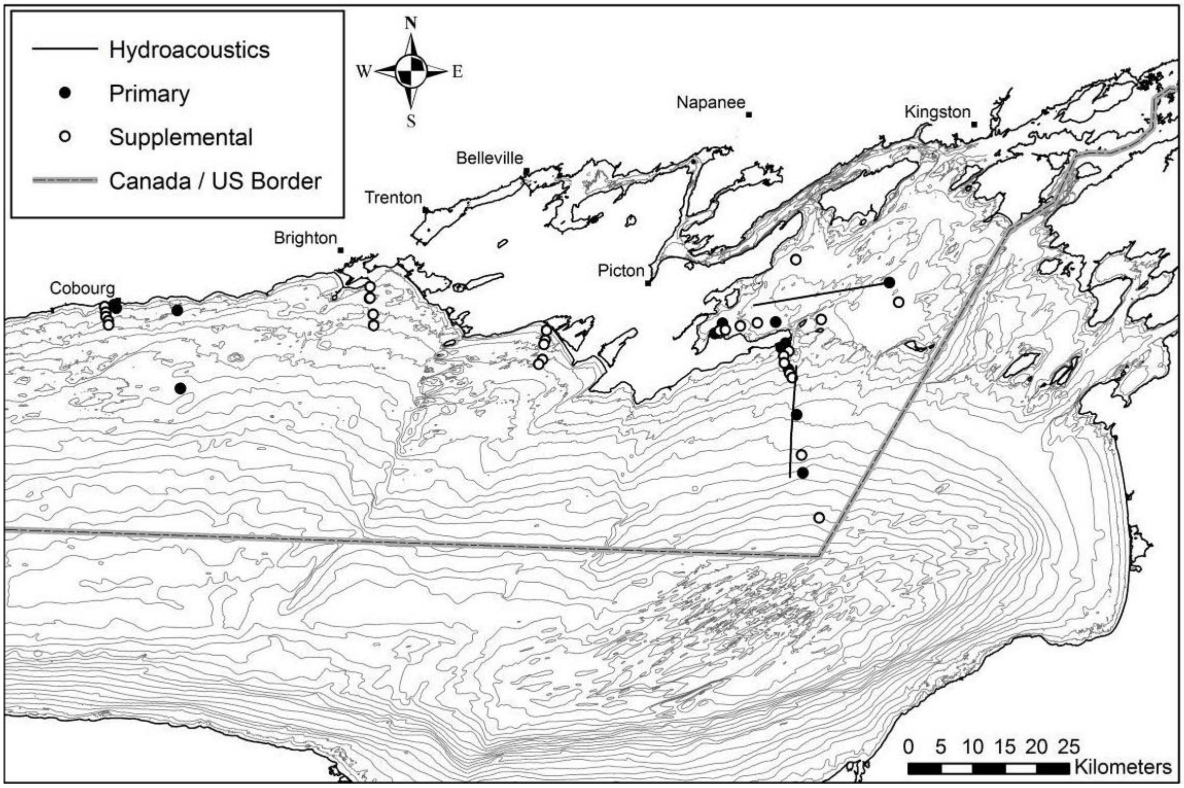


FIG. 10.1.1. OMNR nearshore-offshore project sampling efforts in the eastern (Kingston) basin of Lake Ontario and mid-lake off Cobourg, at both new and historic sampling sites. Sampling efforts recurred seasonally at primary locations, while mid-summer samples were collected at numerous supplemental locations. Complementary hydroacoustic data were collected seasonally along a 'dog-leg' transect spanning the nearshore-offshore habitat continuum.

TABLE 10.1.1. Number of samples by type collected by OMNR during the 2013 nearshore-offshore project.

- Water chemistry profile (58)
- Sensor buoys (9) & loggers (64)
- Particulate organic carbon (66)
- Chlorophyll (58)
- Phytoplankton (15)
- Rotifer (58)
- Zooplankton net hauls (421)
- Benthic invertebrates (106)
- Hydroacoustic transects (27)
- Fish trawls (116)
- Vertical gillnets (44)
- Horizontal gillnets (301)
- Fish caught (20,171)
- Fish diets (3,491)
- Fish diets from anglers (270)
- Stable isotopes (3,326)

10.2 Are 2013 nearshore-offshore fish data comparable to longterm indexing data?

Project leads: Julie Munro and Tim Johnson
Funding: Canada-Ontario Agreement

Fish catch and demographic data collected annually from the eastern Lake Ontario fish community index gill netting program is used to help manage local recreational and commercial fisheries and monitor long-term changes in the fish community (see Section 2.2 for a full program description). As described in Section 10.1, the 2013 nearshore-offshore project (N-O project) provided seasonal, multi-trophic level sampling in both eastern and central Lake Ontario. The objective of the analysis described here was to determine whether the patterns seen in the temporally intensive N-O project reflect the patterns of the spatially intensive long-term index gill netting data, and whether 2013 was anomalous to any long-term trends in the demographics of the eastern Lake Ontario fish community. We restricted our analyses of the long-term data to the years 2000-2013 and to sites reflecting open Lake Ontario (i.e. BR, CB, FP, RP, and WE; see Section 2.2, Table 2.2.1). Fish community and demographic attributes that were analyzed for each year, site, and species included: catch- and biomass-per-unit-effort, fork length, total length, round weight, length frequency distributions, sex ratio, Gonadosomatic Index for females, relative weight, Fulton's K, and Von Bertalanffy growth coefficients. The same attributes were calculated and analyzed for the 2013 N-O project data and the two programs were compared.

A complete analyses will be available in a separate report but for illustrative purposes we present the relative weight of lake trout as a reflection of changes in the well-being of this species (Fig. 10.2.1). In the early part of the time series (prior to 2008), lake trout had a lower relative weight compared to more recent years. This result could be interpreted as an improvement in the health of lake trout, as individuals were heavier per unit length. The 2013 N-O project data were not significantly different from the 2013 index gillnetting data (t_{189} = -0.57, p = 0.57), although significant inter-annual differences were evident within the long-term index gill netting data ($F_{13, 950}$ = 14.9, p < 0.001).

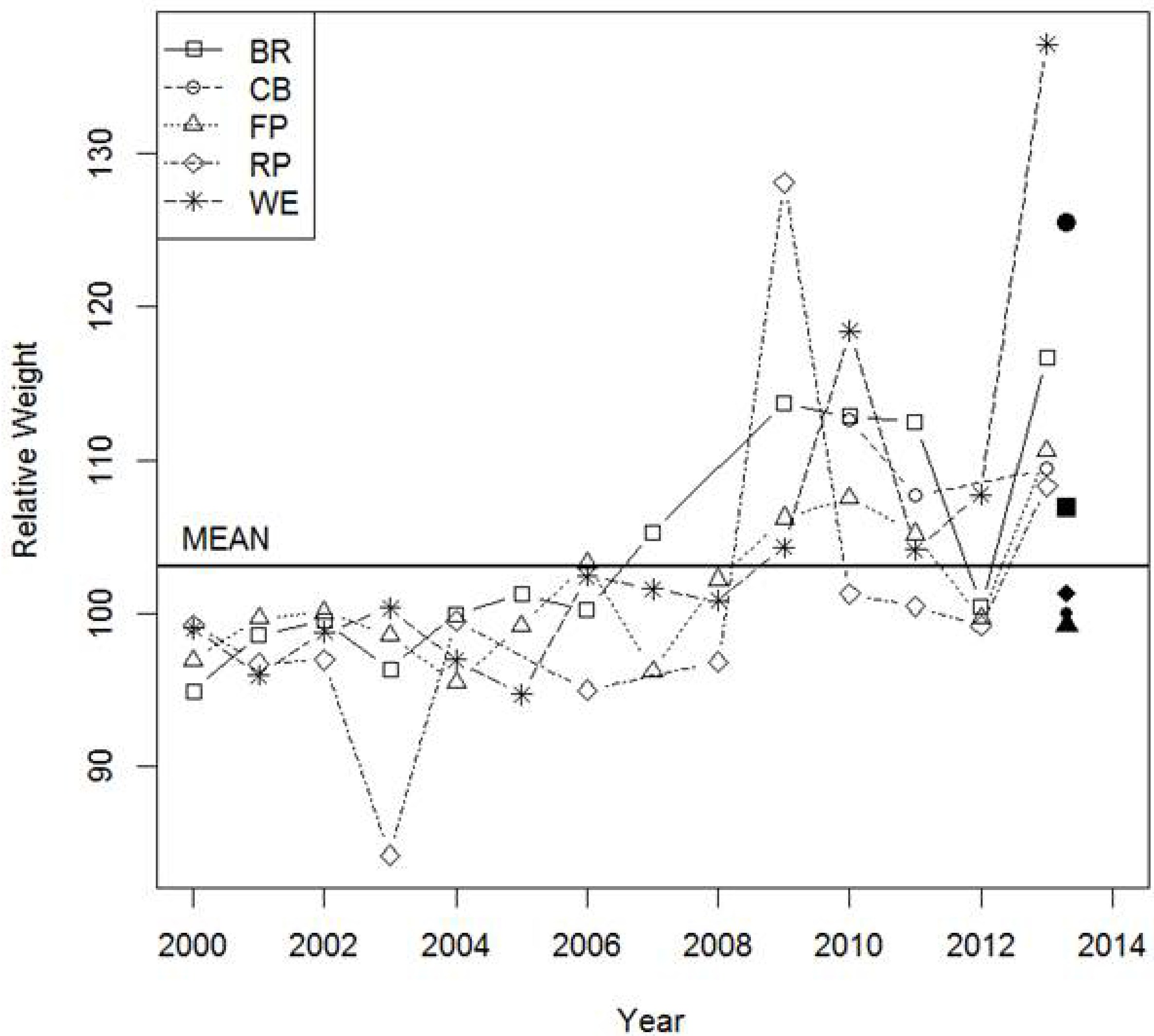


FIG. 10.2.1. Lake trout relative weight between 2000 and 2013 at different sites in eastern Lake Ontario. Open symbols represent data from the eastern Lake Ontario fish community index gill netting program (see Section 2.2) while the solid black symbols in the graph reflect data from the 2013 nearshore-offshore program. Legend: BR = Brighton, CO = Cobourg, FP = Flatt Point, RP = Rocky Point shallow sites, WE = Wellington.

10.3 Shocking results: A novel approach to estimating Round Goby density in Lake Ontario

Project leads: Mike Yuille & Tim Johnson
Partner: Lake Ontario Management Unit
Funding: Invasive Species Centre

Since their discovery in 1990, Round Goby (*Neogobius melanostomus*) have become a dominant component of the nearshore community in all of the Great Lakes. They are native to the Ponto-Caspian region of Eastern Europe and are thought to have gained access to the Great Lakes basin via ballast water exchange.

The rapid spread and aggressive behaviour of Round Goby has had serious impacts on native biota. They compete with other bottom dwelling fish species, eat fish eggs and fry (e.g., smallmouth bass and lake trout) and compete with young fish for food resources. In contrast, the Round Goby is one of few fish that feed on zebra and quagga mussels, enabling food energy previously trapped in these mussels to re-enter the food webs. Furthermore, many economically and ecologically important fish, waterbirds, and reptiles are incorporating Round Goby into their diets, altering growth and production of higher trophic levels.

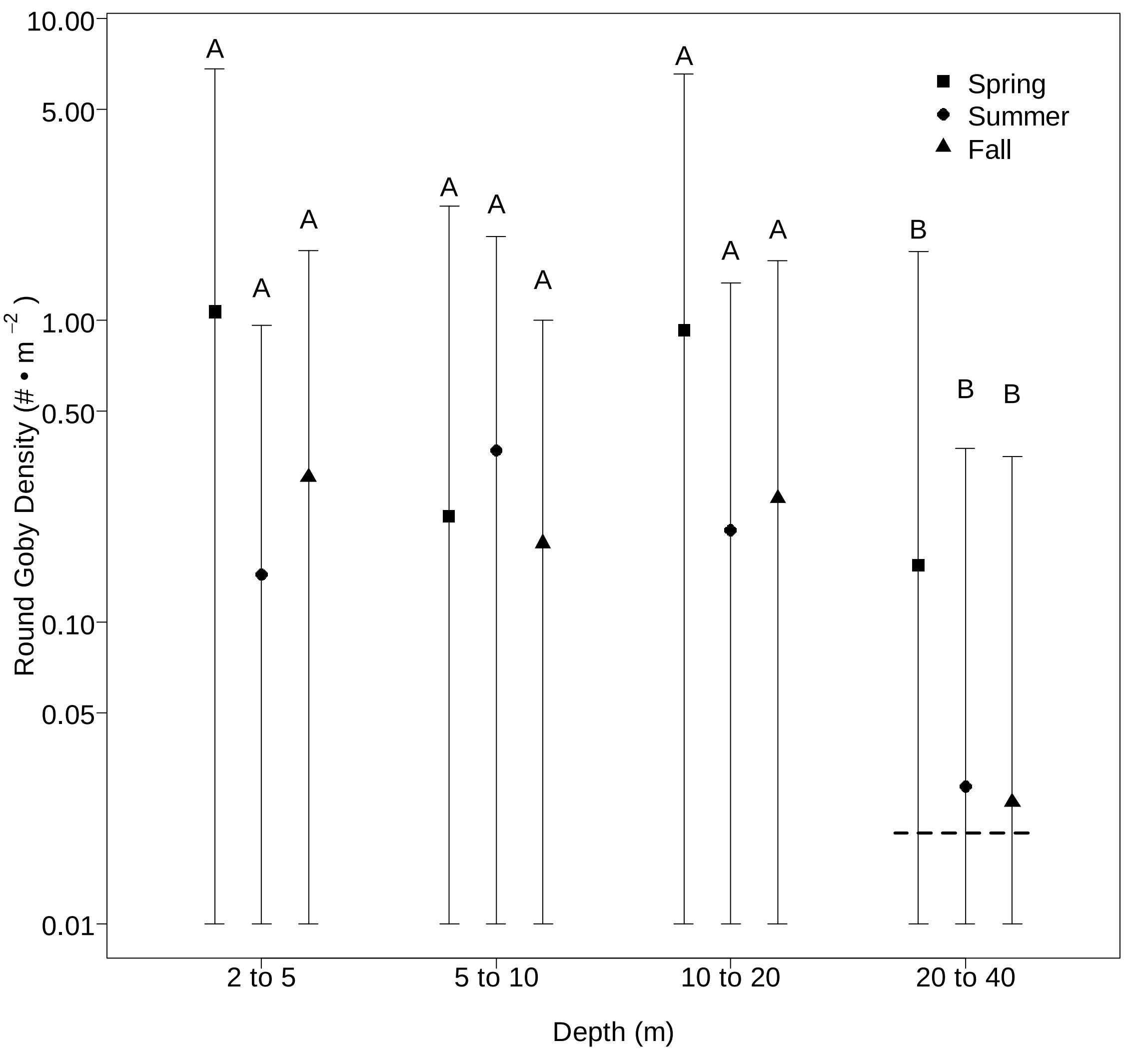


FIG. 10.3.1. Round Goby densities through three seasons (square = spring; circle = summer; triangle = fall) in four depth strata. Letter differences indicate significant differences in Round Goby density between depth strata within seasons (TukeyHSD, $p < 0.01$). Within each depth strata no differences were detected between seasons. Dashed line indicated Round Goby density calculated from bottom trawls at the 20 to 40 m depth strata. Error bars correspond to one standard error and are constrained to a minimum value of 0.

Research has found that traditional bottom trawling and gillnetting are not effective in accurately sampling Round Goby across the diverse habitats they occupy. Our study used a deep-water high resolution camera attached to an electrofishing frame to assess the effectiveness and efficiency of this technique in estimating Round Goby abundances in Lake Ontario.

We found Round Goby abundance was highest in the spring while there was no difference between summer and fall (Fig. 10.3.1). Round Goby abundance was significantly lower at the 20 to 40 m depth strata relative to the other three depth strata. Round Goby abundance was not significantly different between depths of 2 to 20 m (Fig. 10.3.1). Our density estimates from the deep-water electrofisher were comparable to those derived from bottom trawls conducted in our deep (20 to 40 m) depth strata. However, tank validation experiments suggested that, depending on substrate characteristics, only 0.3 to 30% of Round Goby were detected with the camera. Further, a higher resolution camera did detect more goby. Both of these factors, suggest the density estimates obtained with the deep-water electrofisher were conservative, and therefore the traditional trawl estimates may be underestimating true Round Goby density.

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

Project leads: Brent Metcalfe & Tim Johnson
Partners: Lake Ontario Management Unit, Fisheries and Oceans Canada
Funding: OMNR Base

In 2013, the Ontario Ministry of Natural Resources' Aquatic Research and Monitoring Section (ARMS) and Lake Ontario Management Unit (LOMU) continued to partner with Fisheries and Oceans Canada to collect information on lower trophic levels of Lake Ontario's aquatic community. This multi-agency partnership facilitates regular bi-weekly sampling at Station 81 (44º 01.02' N, 76º 40.23' W; 38 m water depth), a historic sampling site situated in the approximate centre of Lake Ontario's eastern basin. Measurements made at this location are used to describe the lake's physical limnology (e.g., water temperature, dissolved oxygen, water transparency), primary production (e.g., algal and microbial composition and abundance), and secondary production (e.g., zooplankton and benthic invertebrates). Recently, this long-term monitoring program has documented high variability in primary productivity (via increased chlorophyll and surface temperature measures), a dramatic decline in seasonal mean epilimnetic zooplankton densities (relative to the 1980s and 1990s), and significant changes in zooplankton community composition (e.g., > 90% declines in some native plankton, while the community as a whole is increasingly dominated by invasive dreissenid veligers).

In 2013, samples were collected from the station 11 times, from April 29th to October 29th, with some complementary plankton stable isotope samples collected in other concurrent research programs; all samples are presently undergoing chemical and taxonomic analysis. Thermal stratification established in late June and persisted until late October. Secchi depth (water transparency) progressively got shallower as the open-water season progressed until stratification broke down in the fall. Mean Secchi depth was shallower in 2013 than in the previous five years, while mean total phosphorus was the highest since 2007 (Table 10.4.1). Estimates of primary productivity such as chlorophyll a and potential productivity remain essentially unchanged from previous years (Table 10.4.1).

Long-term, regular monitoring of the lower trophic levels of Lake Ontario will provide scientists with critical information about the effect aquatic invasive species, climate change, and other large ecological phenomena may have on the lake's fishery and overall ecosystem health.

TABLE 10.4.1. Select limnological parameters measured in the eastern basin of Lake Ontario, for 2007-2013. Mean, standard error, and sample size are shown.

	2007 May-Oct	2008 May-Aug	2009 May-Oct	2010 May-Oct	2011 May-Nov	2012 May-Oct	2013 May-Oct
Secchi depth (m)	7.95 (±0.87, 11)	8.71 (±1.20, 7)	6.91 (±0.88, 11)	6.75 (±0.81, 11)	6.78 (±0.61, 10)	6.80 (±0.73, 10)	6.41 (±0.84, 11)
Surface temperature (°C)	16.08 (±1.43, 12)	13.73 (±2.48, 8)	16.98 (±1.43, 11)	17.65 (±1.50, 11)	16.75 (±1.88, 10)	17.55 (±1.95, 10)	15.69 (±2.13, 11)
Total phosphorus (mgL^{-1})	0.0216 (±0.003,11)	0.0114 (±0.001, 8)	0.0109 (±0.001,10)	0.0103 (±0.001,10)	0.0095 (±0.000,10)	0.0097 (±0.001, 9)	0.0214 (±0.003, 11)
Chlorophyll *a*, uncorr., (μgL^{-1})	1.66 (±0.292, 12)	1.65 (±0.41, 8)	2.29 (±0.29, 10)	2.28 (±0.35, 10)	2.39 (±0.36, 10)	1.88 (±0.16, 10)	1.94 (±0.31, 11)
Potential productivity (mg C m^{-3} hr^{-1})	2.55 (±0.440, 12)	2.00 (±0.26, 7)	5.46 (±1.13, 10)	4.82 (±0.91, 10)	3.90 (±0.72, 9)	4.43 (±0.76, 10)	4.46 (±0.84, 11)

10.5 Aquatic invasive species awareness in Ontario

Project leads: Shannon Fera and Tim Johnson
Partner: Dr. Shelley Arnott (Queen's University)
Funding: OMNR Biodiversity Section

We undertook two separate projects for OMNRs Biodiversity Section this past year: a comparative analysis of the recreational boater surveys conducted in 1998, 2004, and 2009, and a jurisdictional scan of aquatic invasive species (AIS) awareness programs in North America. On -going work is investigating bait release behaviour by anglers, as well as enhancing the jurisdictional scan to provide more specific recommendations on effective outreach tactics.

The first project compared the results of three surveys conducted by OMNR in 1998, 2004 and 2009 designed to assess the boating and fishing public's knowledge and participation in AIS spread-prevention practices. Trends indicate the public has always received information about invasive species and prevention strategies from numerous sources, but the most recent survey suggests a greater number of sources of information are now being utilised. The internet, signage at marinas and bait shops and kiosks at events and trade shows are currently the most important sources of information (Fig. 10.5.1). As a likely result of the outreach, progressively more people are visually inspecting their boats. However, preventative boat cleaning strategies (e.g., pressure / hot water washing, physical removal of plants and debris, drying, and/or flushing the motor) have not changed or have declined in rate of participation since the initial survey in 1998 (Fig 10.5.2). While far fewer individuals are indicating 'lack of knowledge' as the reason for not participating in prevention practices, many respondents believe their boating practices are not contributing to the spread of invasive species.

Little change was observed in bait release habits between 1998 and 2009. Central, western and Metro Toronto regions of Ontario show the highest levels of release in the province, and the

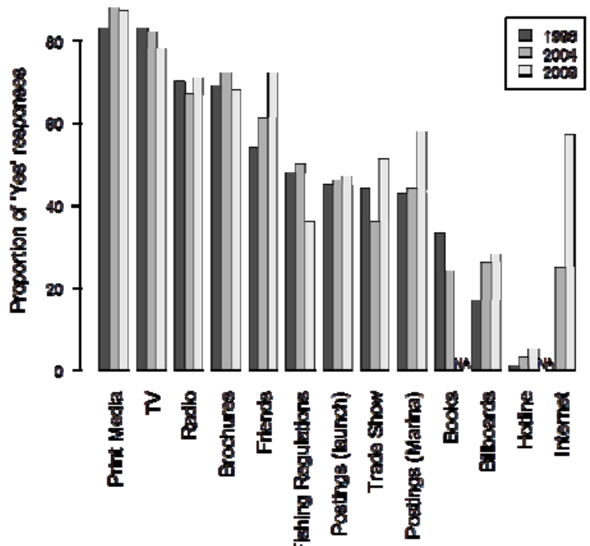


FIG. 10.5.1. Responses in 1998, 2004 and 2009 to the question, "From which of the following sources have you heard of about aquatic invasive (exotic) species?" Print media refers to both magazines and newspapers in 2004 and 2009, but only to magazines in 1998. "Books" was not listed on the 2009 survey and "Internet" was not listed on the 1998 survey.

reasons for releasing bait back into lakes and rivers were primarily compassionate: a desire to provide the bait as food for fish, or not wanting to unnecessarily kill the bait. Northern Ontario anglers report the highest use of live bait in the province, but this region also sees the lowest reported rate of bait release.

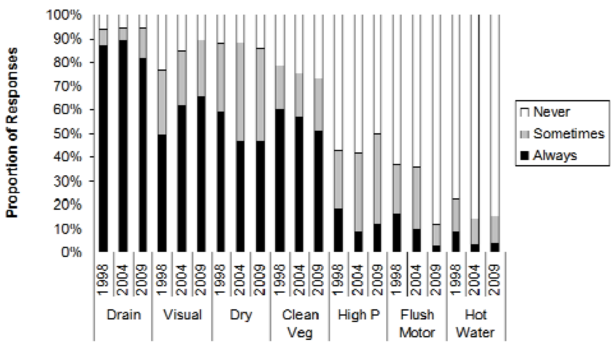


FIG. 10.5.2. Proportion of Always, Sometimes and Never answers in response to the questions “How often did you take the following precautions when transporting your boat and launch into a new waterbody?” Visual refers to ‘visual inspection of boats and equipment’, Drain refers to ‘draining water from boat, bilge, and live well’, Dry refers to ‘allowing boat to dry for 5 days’, Clean Veg refers to physically ‘cleaning vegetation or mussels from the boat and equipment’, High P and Hot water, refer to ‘rinsing boat with high pressure or hot water’, and Flush Motor refers to ‘flushing the motor’s cooling system with clean water’.

The second project assessed public outreach strategies and resources used in 10 North American jurisdictions and compared them to the Ontario Invading Species Awareness Program. Evaluation focused on aquatic invasive species (AIS) and outreach tactics directed towards recreational boaters and anglers who risk spreading AIS to new waterbodies through their activities. Our scan included the US states bordering the Great Lakes, Quebec and Manitoba as provinces directly bordering Ontario, and California and British Columbia. Our goal was to determine what types of outreach successfully influence angler / boater behaviour with respect to AIS. AIS awareness programs developed at different stages in the different jurisdictions and the amount of resource (both dollars and staff) vary several orders of magnitude (Fig. 10.5.3). Most jurisdictions continue to use legacy techniques (signs, brochures, media and public service announcements) but more are bringing in active AIS management such as accessible boat cleaning equipment, watercraft inspections, and targeted messaging to key stakeholder groups. Anglers and boaters have been receptive to this more personalised outreach, although our analysis above suggests actions may not be changing, at least in Ontario. Social media is seeing increased use to distribute AIS messaging, but as this information easily crosses jurisdictions, consistency in messaging among programs and jurisdictions is key. Some more recent, innovative techniques include providing hooks and brushes to enable boaters to more conveniently (and completely) clean their watercraft before leaving one waterbody; a car wash partnership – providing directions and incentives for anglers participating in angling tournaments to clean their boat and trailer at nearby car washes before leaving the region; and community-based social marketing which encourage individuals to sign or verbally pledge a commitment to recommended prevention strategies. Stricter regulations, including making transport and/or bait violations a ticketable offence are effective deterrents for non-compliance. Many jurisdictions suggested coordination of regulations and consistent messaging among jurisdictions were key to increasing success of AIS awareness in the future. Our report also contains information on current impediments and recommendations for a successful AIS awareness program in Ontario.

ARMS also contributed to the design and execution of a three-round Delphi survey used to solicit expert opinion on AIS science and information needs in the province of Ontario. The results of that survey will be released by OMNRs Biodiversity Section shortly.

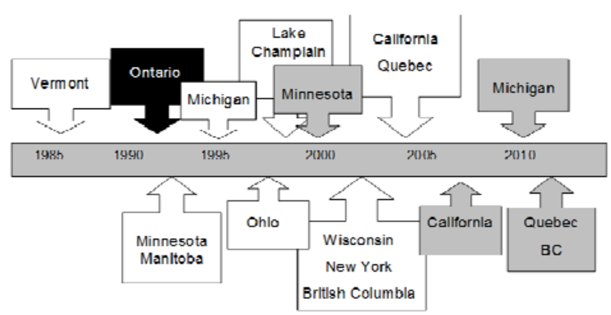


FIG. 10.5.3. Timeline of invasive species awareness programs in this jurisdictional scan. The white boxes indicate the original formation of the program, and the grey boxes indicate when the programs were redesigned (new councils, watercraft inspection programs, new resources) or when outreach became more effective (where applicable).

10.6 Developing indicators of fish health

Project leads: Nick Kelly and Tim Johnson
Funding: Canada-Ontario Agreement

Energy density (calories or joules per gram) and body composition (e.g. percent lipid, protein, water, or major elements such as carbon and nitrogen) provide valuable insight into the energetic state of organisms, their nutritional status, quality of prey resources, and generally the health of entire populations. We compiled published energetic data on fish and aquatic invertebrates to 1) create a searchable database to support bioenergetics and food web modelling analyses, and 2) to conduct multivariate analyses to identify proxies and correlates for energetic condition of fish species that could be used by the OMNR and other fishery agencies to easily and accurately assess fish health and fitness.

We are investigating how body size (mass and length), season, life stage, and taxonomic group affect the relationships between water content and energy density, lipid (%), protein (%), and carbon to nitrogen ratios (C:N). If we can establish predictable effects of these factors on energy density and body composition, we may then be able to identify cost- and time-effective methods to estimate the nutritional status of fish. For example, there is a strong linear relationship between water content and energy density of fish which does not differ significantly among different family groups of fish (Fig. 10.6.1). Moisture content can be much more readily assessed in the lab or field (e.g., microwave moisture meters) and may provide an accurate estimate of the fish's energy density without having to perform calorimetry experiments. Similarly, large amounts of carbon and nitrogen data are being generated for stable isotope analyses, which may provide a reliable predictor of lipid or energy content of the organism. Deriving proxies of fish health from routinely collected fishery assessment data will provide managers and scientists' valuable information to report on the nutritional status and fitness of fish populations.

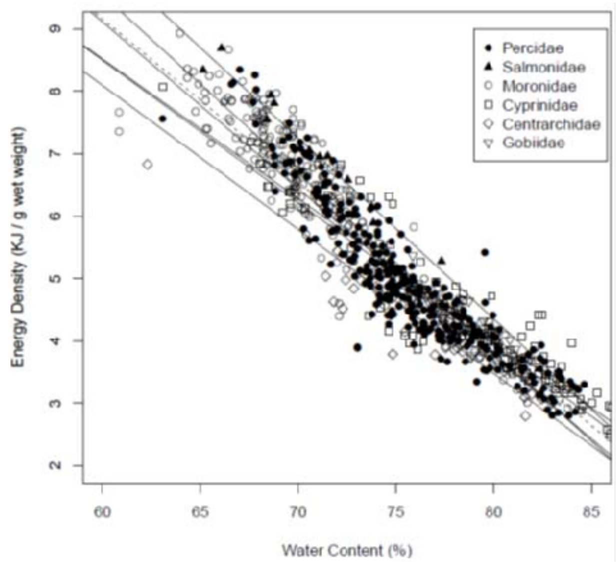


FIG. 10.6.1. Energy density (KJ g^{-1} wet weight) and water content (%) of Lake Erie fish sampled from 2004-2006 separated by taxonomic family group. Solid lines represent the slopes of the linear relationships for each taxonomic family. Dashed line represents the linear model for all species combined.

10.7 Canadian Aquatic Invasive Species Network–Reducing uncertainty in management of AIS

Project leads: Jessica O'Neil, Xin Sun, Nicholas Kosmenko (all M.Sc. students, Windsor) and Tim Johnson
Partners: Dr. Ken Drouillard and Dr. Christina Semeniuk (University of Windsor)
Funding: Natural Sciences and Engineering Research Council of Canada, OMNR Base

ARMS Research Scientist Tim Johnson is a co-investigator on the Canadian Aquatic Invasive Species Network (CAISN) which has general objectives of advancing science and providing tools to managers with respect to early detection and identification of aquatic invasive species (AIS), rapid response to new AIS, AIS as one of multiple stressors affecting aquatic ecosystems, and reducing uncertainty in prediction and management of AIS. Johnson co-advised 3 graduate students on CAISN projects in 2013. Jessica O'Neil (completed M.Sc. August 2013) compared the metabolic rates of Round and Tubenose Goby to understand how differences in physiological tolerance can affect success of invasive species (see Section 10.8 below). Xin Sun (commenced M.Sc. Sept 2013) will expand on Jessica's work by refining methods to determine field metabolic rates of invasive species under changing environmental conditions. Nicholas Kosmenko (commenced M.Sc. Sept 2013) is relating morphometric, physiological, and ecological attributes with consumption and metabolic rates of native, successful and unsuccessful invasive fish with the goal of predicting potential impacts of AIS from examination of easily attainable traits for newly arrived or anticipated species. Collectively, these projects, and other CAISN projects supported by OMNR staff, will contribute to the development of cost-effective tools to support risk assessment and decisions regarding management of aquatic invasive species in Canada.

10.8 Using fish metabolic rate to predict success of invasive fish

Project leads: Jessica O'Neil (M.Sc. Windsor) and Tim Johnson
Partner: Dr. Ken Drouillard, (University of Windsor)
Funding: Natural Sciences and Engineering Research Council of Canada, OMNR Base

Jessica O'Neil successfully defended her M.Sc. (Windsor) developing methods to determine metabolic rates of Round and Tubenose Goby as a predictor of potential success of invasive fish in novel ecosystems. Although both Round (*Neogobius melanostomus*) and Tubenose (*Proterorhinus semilunaris*) Goby were introduced to the Great Lakes around 1990, factors contributing to differential range expansion post-invasion remains poorly understood. Metabolic rates of Round and Tubenose Goby were evaluated to determine the role of physiological tolerance in governing invasive species success. Standard metabolic rates (SMR) of Round and Tubenose Goby were measured across temperatures using intermittent flow respirometry. Tubenose Goby showed significantly higher SMR, reaching metabolic optima at lower temperatures (23ºC) and exhibiting elevated stress responses at high temperatures (Fig. 10.8.1). The field metabolic rates (FMR) of Round Goby from three genetically distinct Great Lakes populations were also compared. Although genetic differences between Round Goby populations have been documented, similar FMRs were seen among populations. These results suggest that SMR is a useful approach to compare differences in temperature dependent physiological tolerance of invasive species, and that FMR can be used to evaluate metabolic costs among wild populations.

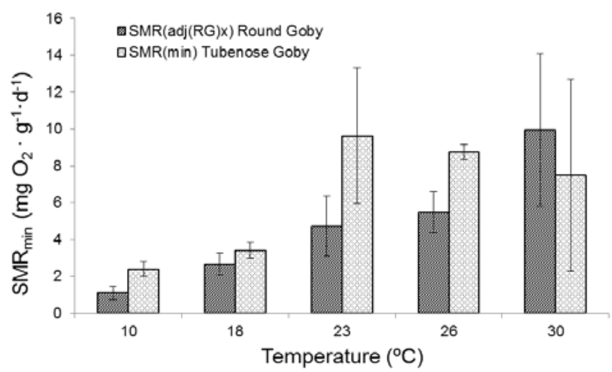


FIG. 10.8.1.Minimum standard metabolic rates (mean mg $O_2 \cdot g^{-1} \cdot d^{-1}$ ± 1 S.E.) for size-adjusted Round Goby and Tubenose Goby across temperature treatments (ºC). Round Goby minimum standard metabolic rate SMR(adj(RG)x) was size-adjusted to account for the larger size of Round Goby compared to Tubenose Goby, which was adapted from Lee and Johnson (2005).

10.9 Community-level response following treatment with Zequanox© - a biocide for invasive zebra and quagga mussels

Project leads: Michele Nicholson (M.Sc. Queen's) and Tim Johnson
Partners: Dr. Shelley Arnott (Queen's University)
Funding: Invasive Species Centre

Zebra and Quagga (dreissenid) Mussels have been implicated with billions of dollars in damages and losses to fisheries, recreational water use, industry, and ecosystem services each year. They also threaten biodiversity, and are key drivers in the listing of several Species at Risk. Existing treatments rely on chemicals with known negative environmental impacts, including being broad spectrum in affecting many organisms. Recently, a dreissenid-specific biopesticide, Zequanox®, made from dead bacterial cells occurring naturally in soil-water has received restricted use authorization by the Canadian Pest Management Regulatory Agency (PMRA) for use in hydroelectric facilities. This limited use decision is based on reported low toxicity to non-target organisms and consideration of currently registered alternative biocides (largely chlorine). The current lack of a rapid response tool, such as may exist with Zequanox®, is inhibiting our fight against the continued spread of dreissenid mussels. Michele Nicholson (M.Sc. Queen's University) will undertake experiments in the summer of 2014 using replicated mesocosms (self -contained environments) to simulate natural ecosystems while complying with PMRA and MOE restrictions on permitted uses of Zequanox in Ontario. Michele's research will help provincial and federal regulators, and eventually resource managers, understand the effectiveness and potential effects of open-water application of dreissenid specific biocides, including Zequanox®.

10.10 Predicting the consequences of Asian Carp establishment in the Great Lakes

Project leads: Tom Stewart and Monir Hossain
Partners: Dr. Ed Rutherford, (National Oceanic and Atmospheric Administration (NOAA))
Funding: Invasive Species Centre

It is probable that Asian Carp will be introduced to Great Lakes waters, and if established, would disrupt exiting food webs and impact commercial and recreational fisheries. Despite these risks, there are few robust and objective decision support tools to forecast the consequences of Asian Carp establishment to facilitate management and policy responses. Building on past work, and successful ongoing collaborations, the establishment of Asian Carp in Lakes Erie and Ontario is being simulated using two different methods dealing with uncertainty. One involves re-programming of the ECOPATH food web modeling software to include uncertainty determined from structured expert judgement (SEJ). SEJ involves structured questioning of experts and quantifing their uncertainty statistically. The other approach uses linear inverse modeling (LIM) to model the same food web structures but uses Markov Chain Monte Carlo (MCMC) methods to fit observed data taking into account uncertainty in parameter values and predict food web outcomes. Partner funding has resulted in an ECOPATH/ECOSIM model simulations of Asian Carp establishment, applying SEJ in Lake Erie. An early ECOPATH/ ECOSIM model of Lake Ontario has been programmed and implemented in LIM (Fig. 10.10.1). The next phase of the project, if funded, will update of the Lake Ontario ECOPATH/ ECOSIM model and application of SEJ and LIM models to simulate the establishment of Asian Carp in both Lake Erie and Ontario. The results will be used to predict how the biomass and production of food web components may change as a function of increasing biomass of Asian Carp, compare measures of impact, and evaluate the advantages and disadvantages of the two simulation approaches.

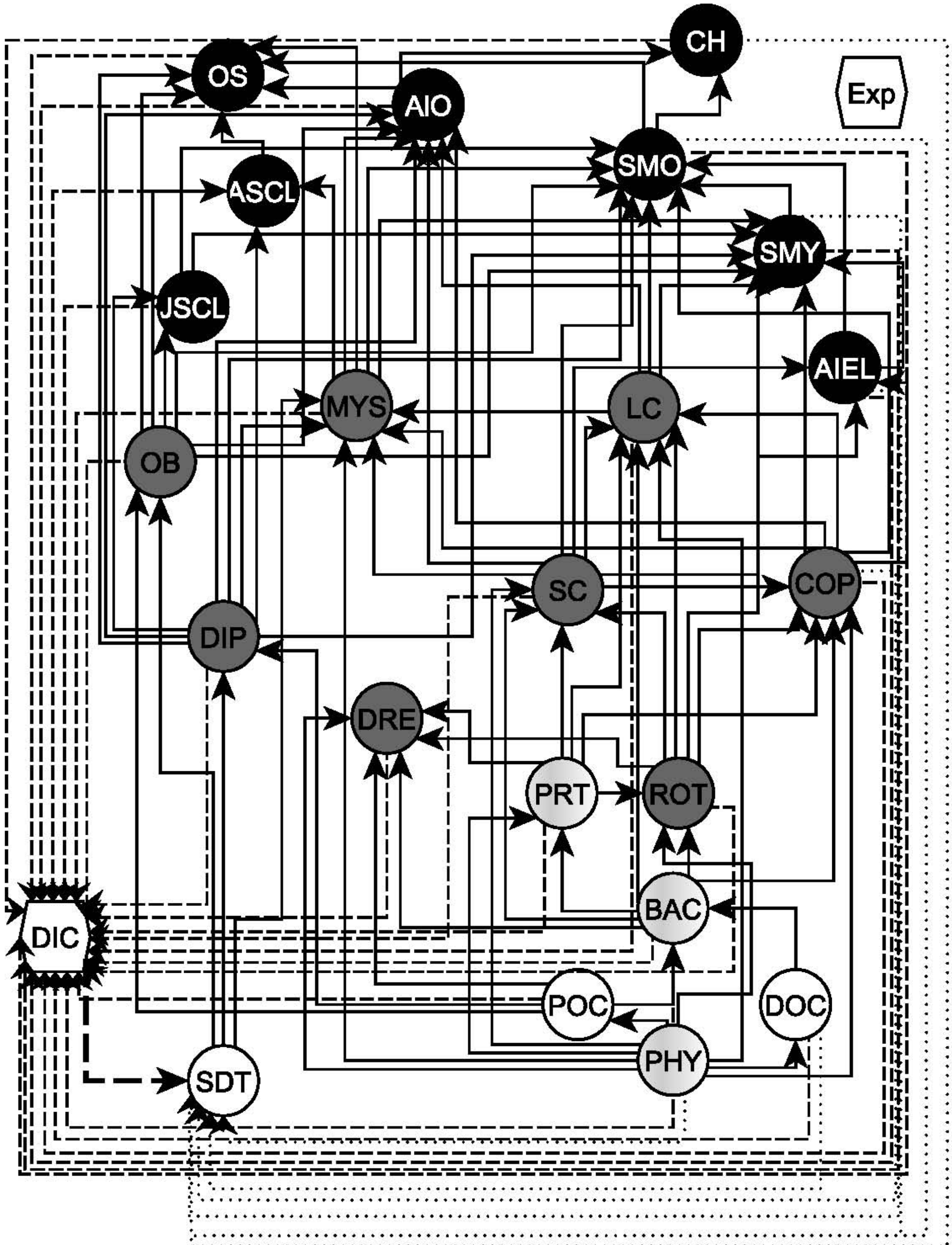


FIG. 10.10.1. Schematic of the Lake Ontario food web as implemented in a Linear Inverse Model (LIM). Connecting lines with arrows show the direction of trophic among compartments. (PHY=Phytoplankton, BAC=heterotrophic bacteria, PRT = Nanoflagellates and ciliates , ROT=Rotifers and veligers, LC=Large cladocerans, SC=Small cladocerans, COP=Copepods, DRE=Dreissenid mussels, DIP=Diporeia, OB=Other benthos, MYS=Mysis, SMO=smelt age 1 and older, SMY=Smelt YOY, ASCL=Adult sculpin, JSCL=juvenile sculpin, ALO=Late YOY and older alewife, ALEY= Early YOY alewife, CH=Chinook salmon, OS=Other salmonines, DOC=Dissolved organic carbon, POC= Particulate organic carbon, SDT = Sediment detritus, DIC= Dissolved inorganic carbon).

10.11 Waterlevel impacts on muskrat house density in coastal wetlands

Muskrats have the ability to manipulate ecosystems and promote wetland diversity, through influences associated with their foraging, house construction, and transportation systems. Muskrats are sensitive to environmental conditions, particularly wetland water depth conditions. The objectives of this survey are to assess the muskrat populations and their relationship to water levels in selected wetlands.

During the winter of 2013, a total of 25 wetlands were surveyed by the Central Lake Ontario Conservation Authority, Quinte Conservation, Cataraqui Region Conservation Authority and the LOMU (Fig. 10.11.1). The primary objectives of the first season of data collection were to assess the methodology and consider the effect of general wetland classification on muskrat house density.

Wetlands were assessed through a survey of 10, one hectare plots randomly assigned within a wetland (Fig. 10.11.2). Additional houses encountered within the wetland were inventoried but were not included in the waterlevel analysis.

A total of 239 muskrat houses and 102 feeding push-ups were inventoried. Muskrat house density was highly variable between sites (Fig. 10.11.3). The effect of waterlevel on house density was analyzed indirectly through three wetland classifications: barrier beach, open coast and drowned river mouth. Wetland classification appears to have less of an effect on the density of muskrat houses than individual wetland characteristics (Fig. 10.11.4).

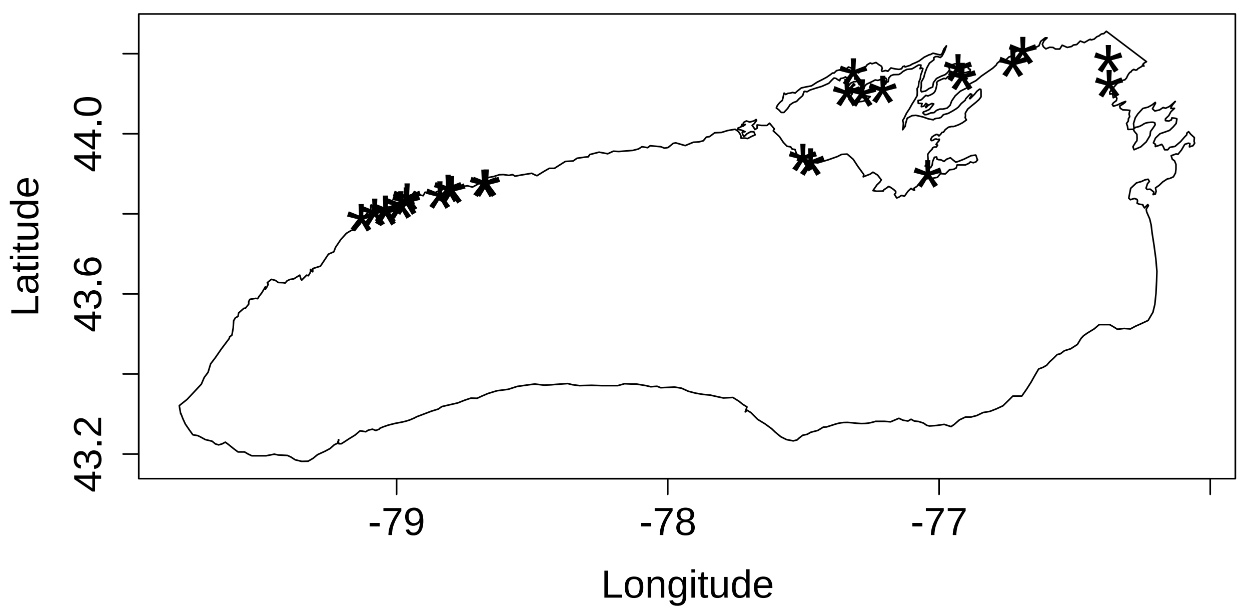


FIG. 10.11.1. Coastal wetlands assessed for muskrat house density.

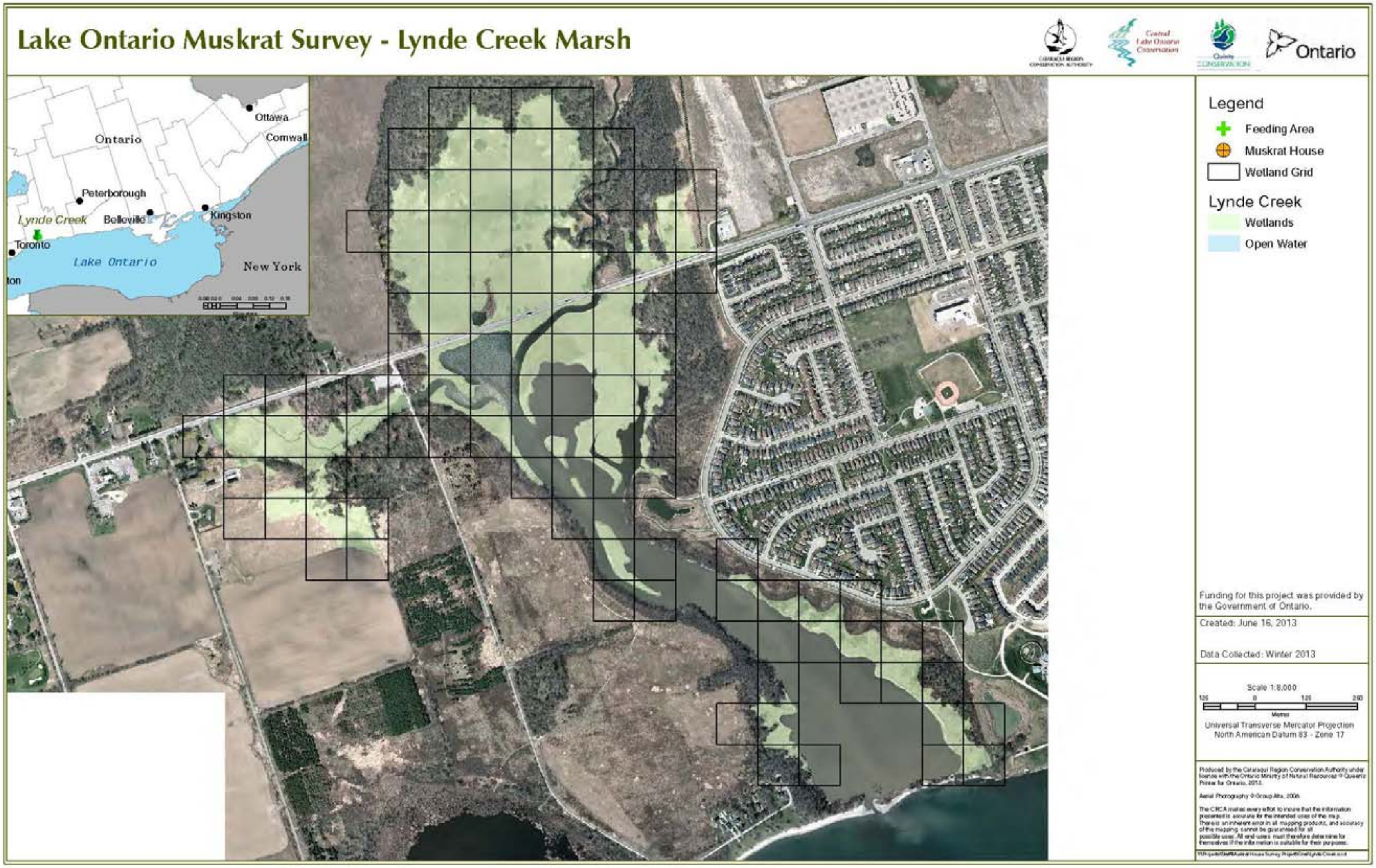


FIG. 10.11.2. Sample map of a muskrat house inventory conducted on Parrot's Bay. Circles indicate houses that were inventoried. Wetland grid is 100 m x 100 m (1 ha) cells. For each wetland, 10 random cells were inventoried.

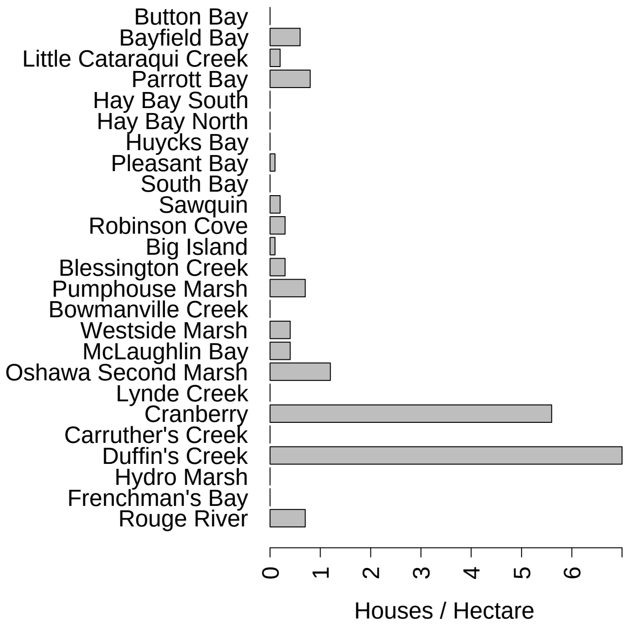


FIG. 10.11.3. Muskrat house density (houses/hectare) across selected Lake Ontario coastal wetlands.

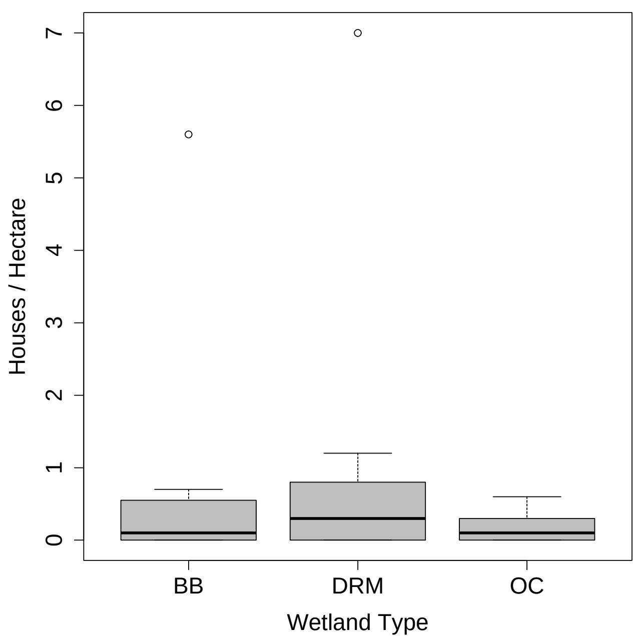


FIG. 10.11.4. Muskrat house density (houses/ha) in three classifications of wetland type. BB is barrier beach, DRM is drowned river mouth, and OC represents open coast. The dark bar corresponds to the median, the box captures 50% of the samples and the whiskers indicate the 95% quartile.

11. Partnerships

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

This report was not available at time of publication. It will be added to the on-line version of this Annual Report at: http://www.glfc.org/lakecom/loc/mgmt_unit/index.html.

11.2 Coordinated Science and Monitoring Initiative

The Great Lakes Water Quality Agreement between the United States and Canada was updated and renewed in 2012 (http://www.ijc.org/en_/Great_Lakes_Water_Quality). Annex 10 of the agreement commits the signatories to implementation of a binational Cooperative Science and Monitoring Initiative (CSMI) for each Great Lake on a five-year rotational basis focusing on priorities identified through the Lakewide Management Plan (LaMP) process. Lake Ontario was the first Great Lake to initiate the CSMI under the new agreement. In 2013, the Lake Ontario agency partners took a collaborative approach focusing on five research and management themes:

- Nutrient loading and fate
- Nearshore and offshore linkages
- Dynamics of primary & secondary production
- Fish production, distribution & diet
- Trophic transfer & food web mass-balance

The multi-agency research and monitoring effort was on a whole-lake scale from April to October and sampled all components of the Lake Ontario food web using a variety of modern and innovative sampling methods. A few examples to illustrate the scale of the effort include the deployment and maintenance of 34 sensor buoys, deployment of 532 bottom trawls and 71 vertical gillnets, completion of 69 hydroacoustic transects and the collection of 7,151 fish diet samples. Secondary processing of these samples and analysis is underway. The first preliminary findings will be presented at the International Association of Great Lake Research (IAGLR) conference May 26-30, 2014 in Hamilton, Ontario (www.iaglr.org).

A survey of this scale required the hard work and dedication of vessel crews, administrative, and technical operations staff. The EPA's *Lake Guardian* & Canadian Coast Guard research vessel *Limnos* and *Kelso* provided wide spatial sampling while the new vessels in the fleet, including the OMNR *Ontario Explorer* and USGS *RV Kaho*, sampled monthly along transects extending from nearshore to deep-water habitats. Smaller research vessels, such as the USGS RV *Lacustris*, DFO's *RV Leslie*, OMNR's small vessels (*C.R. Wood*, *Seacow*, and *PeeWee*) played important roles collecting nearshore samples and filling in for offshore sampling when large vessels were unavailable.

This 2013 CSMI, system-wide investigation of Lake Ontario would not be possible without the direct and in-kind support from the US Environmental Protection Agency (EPA), Canada Ontario Agreement (COA), Environment Canada (EC), New York State Department of Environmental Conservation (NYSDEC), US Geological Survey (USGS), US Fish and Wildlife Service (USFWS), Ontario Ministry of Natural Resources (OMNR), Fisheries and Oceans Canada (DFO), National Oceanic and Atmospheric Administration (NOAA), and academics from the University of Windsor, Cornell, Buffalo State, University of Michigan, University of Buffalo, SUNY Brockport, Syracuse, SUNY ESF, Bowling Green, Clarkson, and Notre Dame.

11.3 Bass Tagging

During the 2013 bass fishing season MNR staff from LOMU and the Aquatic Research and Monitoring Section partnered with Queen's University (Dr. B. Tufts) to collect samples and tag Smallmouth and Largemouth Bass at competitive fishing events (a.k.a. tournaments). Events in the Bay of Quinte, Eastern Basin and the St. Lawrence River were visited during the weigh-in ceremony at the end of each tournament day. In total, 21 tournaments were sampled resulting in almost 3000 fish being tagged (Table 11.3.1). A total of 139 tagged fish were recaptured in 2013 (Table 11.3.2).

Most bass tournaments use a single point weigh-in location. At some of the larger events, several hundred fish are weighed-in. Following the official weigh-in, fish are held in large holding tanks aboard specialized live release boats to be transported back out to the main body of water for release. The distance from weigh-in site to release site varies between tournaments and is dependent on the number of fish to be released as well as the proximity to suitable habitat.

Research on inland lakes has suggested that bass will disperse fairly well following a competitive event. Great Lakes systems are much larger and fish could potentially be transported as far as 100km between capture location and the weigh-in site. Two objectives of the research are to assess displacement from release locations and site fidelity following displacement.

Anglers that catch a tagged bass are asked to report the tag number and provide a general catch location (e.g. mouth of Trent River or Telegraph Narrows). Where capture location could be approximated to a one kilometer area, estimates of displacement distances from release sites were calculated. In general, Smallmouth Bass tend to travel greater distances between the tournament release site and where an angler eventually catches the fish. More than half of the Largemouth Bass recaptured were within 1 km of the tournament release location; however one Largemouth Bass is estimated to have moved 100km. Half of the Smallmouth Bass were caught at least 10 km from the release location (Fig. 11.3.1).

Fish are tagged with brightly coloured tags just posterior to the dorsal fin. Anglers are encouraged to record the tag number and report catches online at fisheriesQU.ca. Data on the number of fish tagged at weigh-in events and tag recaptures reported by anglers are used to estimate population parameters such as survival and abundance.

TABLE 11.3.1. Summary of the number of bass tagged at competitive (tournament) fishing events during 2013 .

Species	*Total Tagged*	*Lake Ontario/St. Lawrence River*	*Bay of Quinte*
Largemouth Bass	1724	125	1599
Smallmouth Bass	1113	823	290
Total	**2837**	**948**	**1889**

TABLE 11.3.2. Summary of the number of recaptured tagged bass by fishery source, 2013.

Source of Recaptured Fish	*Largemouth Bass*	*Smallmouth Bass*	*Total*
Recreational	42	25	67
Tournament	57	2	59
Commercial/ MNR	0	13	13
Total	**99**	**40**	**139**

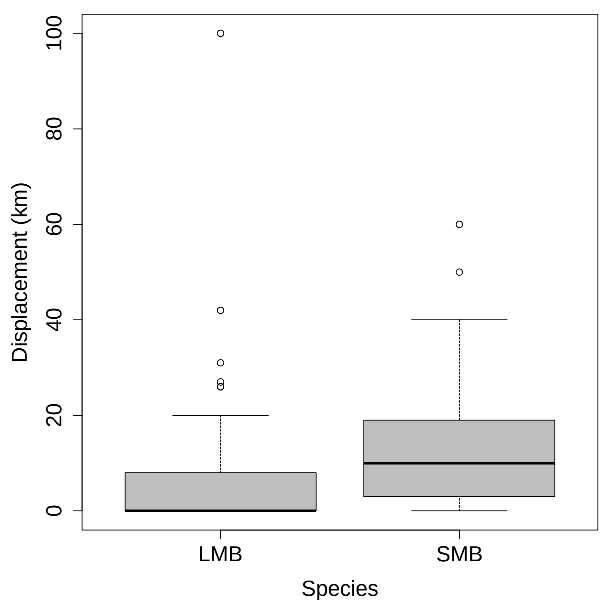


FIG. 11.3.1. Estimate of the displacement distance between the tournament release site and reported recapture site. Only recaptures that could be approximated to a 1 km area from the general description of the catch location are presented. The dark bar corresponds to the median, the box captures 50% of the samples and the whiskers indicate the 95% quartile.

Section 11.4 Walleye Spawn Collection

MNR's White Lake Fish Culture Station (FCS) maintains a captive broodstock of walleye to supply walleye fingerlings for stocking in inland lakes. Prior to the establishment of a broodstock, wild collections of walleye gametes were routinely collected by LOMU staff or commercial fishermen to supply the needs of White Lake FCS and other community operated hatcheries. The 2013 wild collection will provide wild gametes for restoration stocking of fingerlings in Hamilton Harbour and refresh the existing broodstock.

Collections occurred from April 8th – 23rd. Standard 6' trap nets (Nearshore Community Index Netting trap nets) were used to live capture fish. A total of 14 sites were fished between Big Island and Telegraph Narrows on the Upper Bay of Quinte (Fig. 11.4.1). Several sites were fished for multiple nights resulting in a total of 46 net lifts.

In total, 66 families were created and 4.4 million eggs were collected. The number of Walleye captured during the netting period was 259 (Fig. 11.4.2). In addition to walleye, 23 other species were captured (Table 11.4.1). A mix of green, spent and immature walleye (Fig. 11.4.3) account for the difference between total catch and fish used for collections. Throughout the collection period water temperatures first declined due to inclement weather but then gradually increased to a maximum recorded temperature of 7°C.

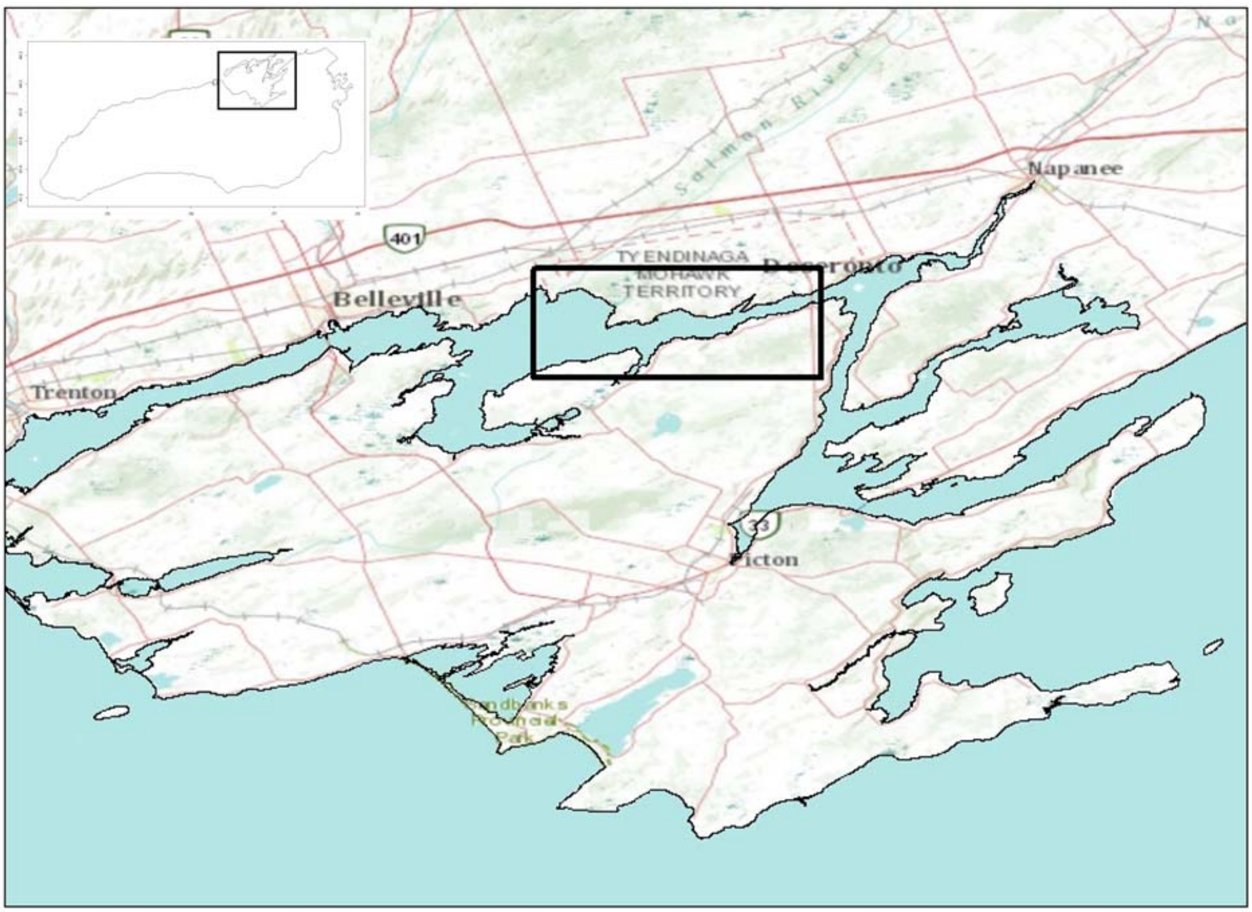


FIG. 11.4.1. Walleye egg collections were conducted using trap nets to live capture fish at 14 sites between Big Island and Telegraph narrows (indicated by the box).

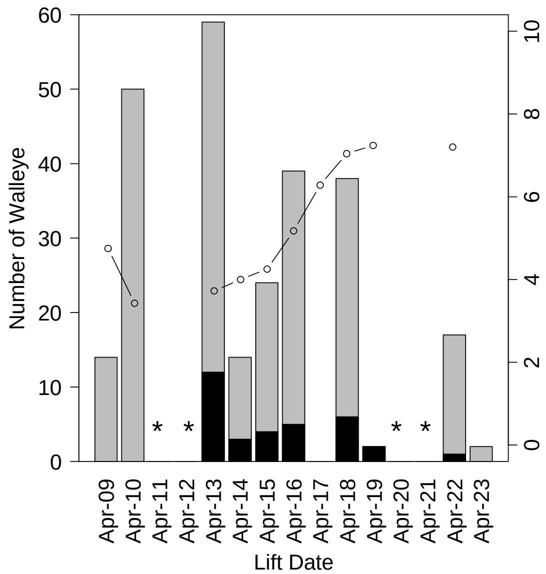


FIG. 11.4.2. Walleye catches during the egg collection period. Grey bars indicate the total of number of walleye captured on the lift date. Solid black bars indicate the number of families that were mated. The line indicates mean water temperature at the net location. "*" indicate days where nets were not lifted.

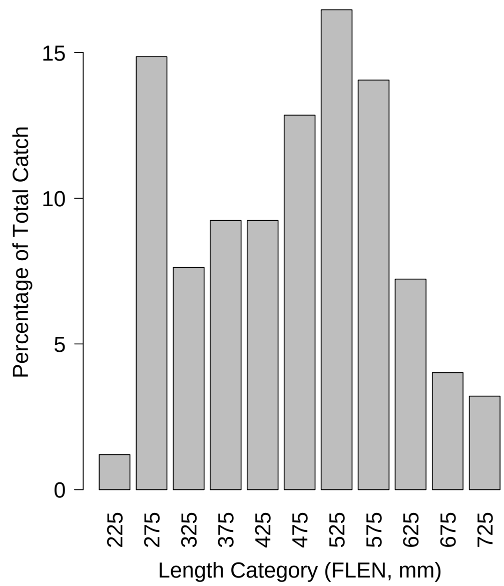


FIG. 11.4.3. Size distribution of Walleye captured during the egg collection period.

TABLE 11.4.1. Catch summary of all species captured during the Walleye egg collection trap netting.

Species	Catch Total	Species	Catch Total
Yellow Perch	2530	White Perch	9
Rock Bass	525	Golden Shiner	8
Pumpkinseed	312	Rainbow Trout	3
Brown Bullhead	310	Lake Whitefish	3
Bluegill	277	Smallmouth Bass	2
Walleye	259	Freshwater Drum	2
Northern Pike	143	Sea Lamprey	1
Black Crappie	117	Brown Trout	1
White Sucker	60	Greater Redhorse	1
Bowfin	58	Redhorse Sp.	1
Largemouth Bass	35	Channel Catfish	1
Cisco	17	Trout-perch	1

11.5 Salmon and Trout Spawning Runs on Bowmanville Creek

In 2013, the Bowmanville Creek Anglers Association (BCAA), in partnership with Aurora District MNR and LOMU, monitored the spring run of Rainbow Trout, and the run of fall-spawning Chinook Salmon, Coho Salmon, and Brown Trout at the Goodyear Dam on Bowmanville Creek. The fishway at this dam was not functioning, and was being rebuilt. Volunteers from BCAA moved fish past the fishway to maintain the spawning runs of these species. During spring BCAA collected 211 scale samples from female Rainbow Trout to go along with samples they collected in the past. LOMU is processing these samples and will report on them in 2014.

During August 27 to October 8, 2013 BCAA lifted 9,031 salmon and trout past the Goodyear Dam (Table 11.5.1). Most of these fish were Chinook Salmon (7,376). Only 18 Chinook Salmon had an adipose fin clip indicating they were stocked at age 2-4. Three of these fish had a coded wire tag in the nose indicating they had been stocked in Bowmanville Creek in 2010 (1) or 2011(2). A significant run of Coho Salmon was also observed (1,340). The Chinook Salmon and Coho Salmon runs were dwindling by October 8 and assumed to be almost finished. The Brown Trout run (196) appeared to peak on October 5 and in comparison to results from the Ganaraska fishway was about half finished. BCAA lifted 113 Rainbow Trout and most of these were in October. Fall Rainbow Trout runs in north shore Lake Ontario tributaries generally peak in November, and so we expect significantly more fish to migrate into Bowmanville Creek after October 8. In addition, five Atlantic Salmon were lifted past the dam. DNA samples were collected on two of these fish, and this will determine the strain and whether they were stocked or wild. These fish are significant as Bowmanville Creek has not been stocked with Atlantic Salmon since 1996.

TABLE 11.5.1. Number of fish lifted past the Goodyear Dam on Bowmanville creek during August 27 to October 8, 2013 by species and fin clip.

Species	Age/Origin	Number lifted
Chinook Salmon	Age 2- 4/wild (no fin clip)	6,987
	Age 2- 4/stocked (Adipose fin clip)	18
	Age 2- 4 (clip not recorded)	45
	Age 1 (no fin clip)	326
Coho Salmon	No fin clip	1,333
	Clip not recorded	7
Brown Trout	No fin clip	196
Rainbow Trout	No fin clip	113
Atlantic Salmon	No fin clip	5
Not recorded	No fin clip	1
Total		9,031

12. Staff 2013

Glenora Fisheries Station, 41 Hatchery Lane, R.R. #4, Picton, ON KOK 2TO
Tel: 613-476-2400 Fax: 613-476-7131

PROVINCIAL SERVICES DIVISION

Fish and Wildlife Service Branch
Lake Ontario Management Unit

Andy Todd	Lake Manager
Linda Blake	Administrative Assistant
Dawn Young	Administrative Assistant (Acting)
Bruce Morrison	Assessment Supervisor
Alastair Mathers	Assessment Supervisor (Acting)
Tom Stewart	Program Advisor Great Lakes Ecosystems
Colin Lake	Lead Management Biologist
Jim Bowlby	Assessment Biologist, Lake Ontario COA Coordinator (Acting)
Jim Hoyle	Assessment Biologist
Ted Schaner (retired)	Assessment Biologist
Jeremy Holden	Assessment Biologist
Mike Yuille	Assessment Biologist (Acting)
Marc Desjardins	Management Biologist
Shane Wood	Project Management Biologist
Evan Hall	Lake Ontario Aquatic Ecologist Intern
Dale Dewey	Operations Supervisor (Acting)
Steve McNevin	Operations Coordinator (Acting)
Kelly Sarley	Support Services/Data Technician
Wayne Miller (retired)	Senior Technician Base Operations
Sonya McMillian	Great Lakes Fisheries Technician, Senior Technician Base Operations
Jon Chicoine	Vessel Master
Nina Jakobi	Great Lakes Technician
Alan McIntosh	Boat Captain
Gord Meadows	Great Lakes Fisheries Technician
Tim Dale	Great Lakes Fisheries Technician
Ted Allan	Great Lakes Fisheries Technician
Glen Hales	Great Lakes Fisheries Technician
Derek Lipskie	Great Lakes Fisheries Technician
Andrew Lowles	Great Lakes Fisheries Technician
Robert McGowan	Great Lakes Fisheries Technician
Amy McPherson	Great Lakes Fisheries Technician
Willi Powell	Great Lakes Fisheries Technician
Tyson Scholz	Great Lakes Fisheries Technician
Megan Smith	Great Lakes Fisheries Technician
Mary Hanley	Student Biologist, Great Lakes Fisheries Technician
Kody Adams	Student Fisheries Technician
Tyler Peat	Student Fisheries Technician
Scott Brown	Student Fisheries Technician
Kassandra Robinson	Student Fisheries Technician
Christine Poon	Student GIS Technician
Kyle O’Halloran	Student Fisheries Technician

Enforcement Branch

Matt Orok	Enforcement Supervisor, Lake Ontario
Aaron Barber	Enforcement Supervisor, Lake Ontario (Acting)
Jeff Fabian	Conservation Officer
Kyle Wood	Conservation Officer
Laurie Allin	Conservation Officer (Acting)
Jaime Sperl	Conservation Officer
Randy Tippin	Conservation Officer (Vineland)
Rick Andrews	Conservation Officer (Aurora)
Edwin Van Den Oetelaar	Enforcement Supervisor, Bancroft/Minden

Science and Research Branch
Aquatic Research and Monitoring Section

Dr. Tim Johnson	Research Scientist
Brent Metcalfe	Research Biologist
Shannon Fera	Project Biologist (Invasive Species Policy)
Nick Kelly	Project Biologist (Energetics)
Liang Zhang	Project Biologist (Invasive Species Impact)
Monir Hossain	Project Biologist (Food Web Modelling)
Julie Munro	Analytical Biologist
Mike Yuille	Research Biologist
Jessica Ives	Research Technician
Amy McPherson	Research Technician
Karla Passow	Research Technician
Carolina Taraborelli	Research Technician
Sonya McMillian	Research Technician
Jaclyn Brown	Student Research Technician
Les Stanfield	Senior Research Biologist

13. Operational Field and Lab Schedule, 2013

(SPA = Special Purpose Account; COA = Canada Ontario Agreement; 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	Bowlby	McNevin	SPA
Credit River Atlantic Salmon Smolt Survey	Mar-Jun	Atlantic Salmon	Desjardins	Desjardins	COA
Walleye egg collection	Mar-Apr	Walleye	Holden	McMillan	SPA
Lake Trout Tug Stocking	Apr	Juvenile Lake Trout	Lake	Chicoine	SPA
American Eel Trap and Transfer	Apr-Jun	American Eel	Mathers	Meadows	OPG
Duffins Creek Weir (adult atlantic salmon Assessment)	May-Nov	Adult Atlantic Salmon	Stewart	Portiss	GLFC
Entrapment Gear Turtle Monitoring	May-June	Turtles / Fishing Gear	Mathers	Hanley	SPA
Chinook Salmon Mark/Tag Monitoring and Western Lake Ontario Boat Angling Survey	Apr-Sep	Salmon and Trout	Bowlby	Hall	SPA
Lake St. Francis Open Water Angling Survey	May-Oct	Walleye, Perch, Bass, Pike	Hoyle	McNevin	SPA
Bay of Quinte Ice Angling Survey	Jan-Feb	Walleye and Perch	Hoyle	McNevin	SPA
Coordinated Science Monitoring Initiative	May-Oct	Nearshore & Offshore Food Webs	Drs. Stewart/Johnson	McNevin/Metcalfe	COA
Station 81: Offshore Benthos and Zooplankton Survey	May-Oct	Lower Food Web	Dr. Johnson	McNevin	COA
Eastern Lake Ontario and Bay of Quinte Community Index Netting	Jun-Sep	Fish Community	Hoyle	McNevin	SPA
Lake-wide Hydroacoustic Assessment of Prey Fish	Jul	Prey Fish Community	Schaner/Holden	Chicoine	COA
Prince Edward Bay Nearshore Community Index Netting	Aug	Nearshore Fish Community	Hoyle	Dale	COA
East/West Lake Nearshore Community Index Netting	Aug	Nearshore Fish Community	Hoyle	Jakobi/McMillan	COA
Upper Bay of Quinte Nearshore Community Index Netting	Sep	Nearshore Fish Community	Hoyle	Meadows	COA
St. Lawrence River Fish Community Index Netting - Thousand Islands	Sep	Fish Community	Hoyle	McNevin	COA
Credit River Chinook Assessment and Egg Collection	Oct	Chinook Salmon	Bowlby	McNevin	SPA
Deepwater Cisco Stocking	Nov	Deepwater Cisco	Lake	Chicoine	SPA
Credit River Juvenile Atlantic Salmon Electrofishing	Oct	Juvenile Atlantic Salmon	Bowlby	Jakobi	COA
Round Whitefish Spawning Location Identification	Nov-Dec	Round Whitefish	Hoyle/Desjardins	McNevin	SPA
Commercial Catch Sampling	Oct-Nov	Lake Whitefish	Hoyle	Jakobi	SPA
Age and Growth	Year-round	Multiple Species	Multiple	McNevin	SPA/COA

14. Primary Publications of Glenora Fisheries Station Staff[1] in 2013

Ives, J.T., Marty, J., de Lafontaine, Y., **Johnson, T.B**., Koops, M.A., Power, M. 2013. Spatial variability in trophic position and food sources of *Hemimysis anomala* in lentic and lotic ecosystems within the Great lakes basin. Journal of Plankton Research 35: 772-784.

Ochs, C.L., Laframboise, A.J., Green, W.W., Basilious, A., **Johnson, T.B**., Zielinski, B.S. 2013. Response to putative round goby (*Neogobius melanostomus*) pheromones by percid and centrarchid fish species in the Laurentian Great Lakes. Journal of Great Lakes Research 39: 186-189.

O'Neil, J.A., **Johnson, T.B**., Drouillard, K.G. 2013. Validation of rapid assimilation of PCBs following IP dosing in the round goby (*Neogobius melanostomus*). Bulletin of Environmental Contaminants and Toxicology 91: 135-140.

Zhu, X., Zhao, Y., **Mathers, A**., Corkum, L.D. 2013. Length frequency age estimations of American Eel recruiting to the Upper St. Lawrence River and Lake Ontario. Transactions of the American Fisheries Society 142(2): 333-344.

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

50968
(0.3 k P.R., 14 03 21)
ISSN 1201-8449