LAKE ONTARIO FISH COMMUNITIES AND FISHERIES:

2014 ANNUAL REPORT OF THE LAKE ONTARIO MANAGEMENT UNIT

LAKE ONTARIO FISH COMMUNITIES AND FISHERIES:

2014 ANNUAL REPORT OF THE LAKE ONTARIO MANAGEMENT UNIT

Prepared for the
Great Lakes Fishery Commission
2015 Lake Committee Meetings
Ypsilanti, Michigan USA

March 23-27, 2015

Printed in Picton, Ontario, Canada

March 2015

Report ISSN 1201-8449

Please cite this report as follows:
Ontario Ministry of Natural Resources and Forestry. 2015. Lake Ontario Fish Communities and Fisheries: 2014 Annual Report of the Lake Ontario Management Unit. Ontario Ministry of Natural Resources and Forestry, Picton, Ontario, Canada.

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

TABLE OF CONTENTS

Lake Ontario Fish Communities and Fisheries: 2014 Annual Report of the Lake Ontario Management Unit

Foreword

The Lake Ontario Management Unit (LOMU) and the Lake Ontario research staff from the Applied Research and Monitoring Section are pleased to provide the Annual Report of monitoring, assessment, research and management activities carried out during 2014.

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

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. These decisions need to 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.

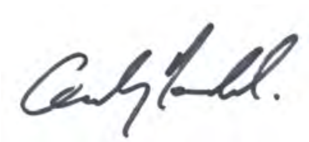
Management highlights from 2014 include the development of a Proposed Lake Ontario Stocking Plan for Canadian Waters and completion of a comprehensive science review of the Lake Ontario Atlantic Salmon Restoration Program. Assessment program highlights include initiation of the first ever lake-wide tributary angler creel, the promising results from the Hamilton Harbour Walleye restoration program, continued analysis of the data collected in the 2013 Collaborative Science and Monitoring Initiative and the successful late season sampling of Round Whitefish along the north shore of Lake Ontario in partnership with Ontario Power Generation.

Ongoing MNRF assessment programs delivered in 2014 include the Chinook Salmon mass marking assessment, Ganaraska River Rainbow Trout assessment, angler diary programs, Lake St. Francis index netting , Atlantic Salmon assessment, and the ongoing delivery of the LOMU fisheries nearshore and offshore assessment programs. The MNRF fish culture program produced and stocked more than 2 million fish into Lake Ontario including the second stocking of Deepwater Cisco.

We express our sincere appreciation to the many partners and volunteers who contributed to the successful delivery of LOMU initiatives. Special thanks to the Aurora MNRF District, Credit Valley Conservation and the Toronto Region Conservation Authority for their leadership and operational excellence in the delivery of the Atlantic Salmon program on the Credit River and Duffins Creek and to the Ontario Federation of Anglers and Hunters and the many other partners committed to the Lake

Ontario Atlantic Salmon restoration program. Work with University of Windsor and Queen's University is ongoing and should provide unique insight into Lake Ontario fisheries. LOMU gratefully acknowledges the important contribution of the 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 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 2014.



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 and Forestry
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. Index Fishing Projects

1.1 Ganaraska Fishway Rainbow Trout Assessment

J.N. Bowlby, Lake Ontario Management Unit

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 counts at the fishway were based completely on hand lifts and visual counts. Since 1987, fish counts were made with a Pulsar Model 550 electronic fish counter. Based on visual counts the electronic counter is about 85.5% efficient, and the complete size of the run has been estimated accordingly. In years where no observations were made the run was estimated with virtual population analysis. The counter is usually operated from mid to late March until early May. In 2014, the fish counter was installed later, on April 11, and ran until May 18. The Rainbow Trout runs were late in 2014 and the fishway still contained ice in early April. A handful of Rainbow Trout may have gone through the fishway after counts were concluded in May.

In 2014, the Rainbow Trout run in the Ganaraska River was estimated at 9,611 fish (Table 1.1.1), the second largest run since 1992. The Rainbow Trout run in the Ganaraska River has maintained a higher level over the last 4 years than the previous decade (Fig. 1.1.1). Biological samples were not collected at the Ganaraska Fishway in 2014.

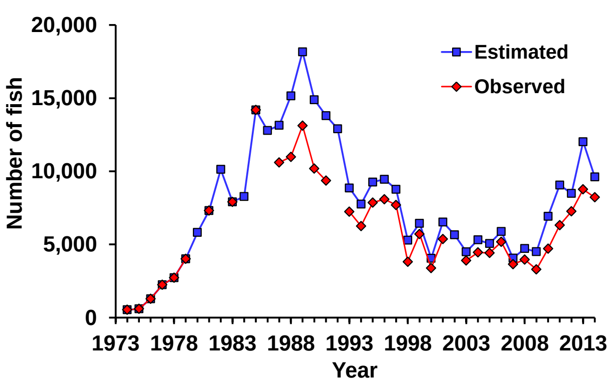


FIG. 1.1.1. Estimated run of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario, during spring 1974-2014.

TABLE 1.1.1. Observed count and estimated run of Rainbow Trout moving upstream at the Ganaraska River fishway at Port Hope, Ontario during spring, 1974-2014. Estimates for 1980, 1982, 1984, 1986, 1992, and 2002 were interpolated from adjacent years with virtual population analysis.

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

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

J. A. Hoyle, Lake Ontario Management Unit

This gill netting program is used to monitor the abundance of a variety of warm, cool and cold -water fish species in Lake Ontario and Bay of Quinte. Data from the program are used to help manage local commercial and recreational fisheries as well as for detecting long-term change in the aquatic ecosystem.

Gill net sampling areas are shown in Fig. 1.2.1 and the basic sampling design is summarized in Table 1.2.1. Included in the design are fixed, single-depth sites and depth-stratified sampling areas. Each site or area is visited from one to three times within a specified time-frame and using 2, 3 or 8 replicate gill net gangs.

Annual index gill netting field work occurs during summer months. Summer was chosen based on an understanding of water temperature stability, fish movement/migration patterns, fish growth patterns, and logistical considerations. The time-frames for completion of field work varies among sampling sites/areas (See Table 1.2.1) 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

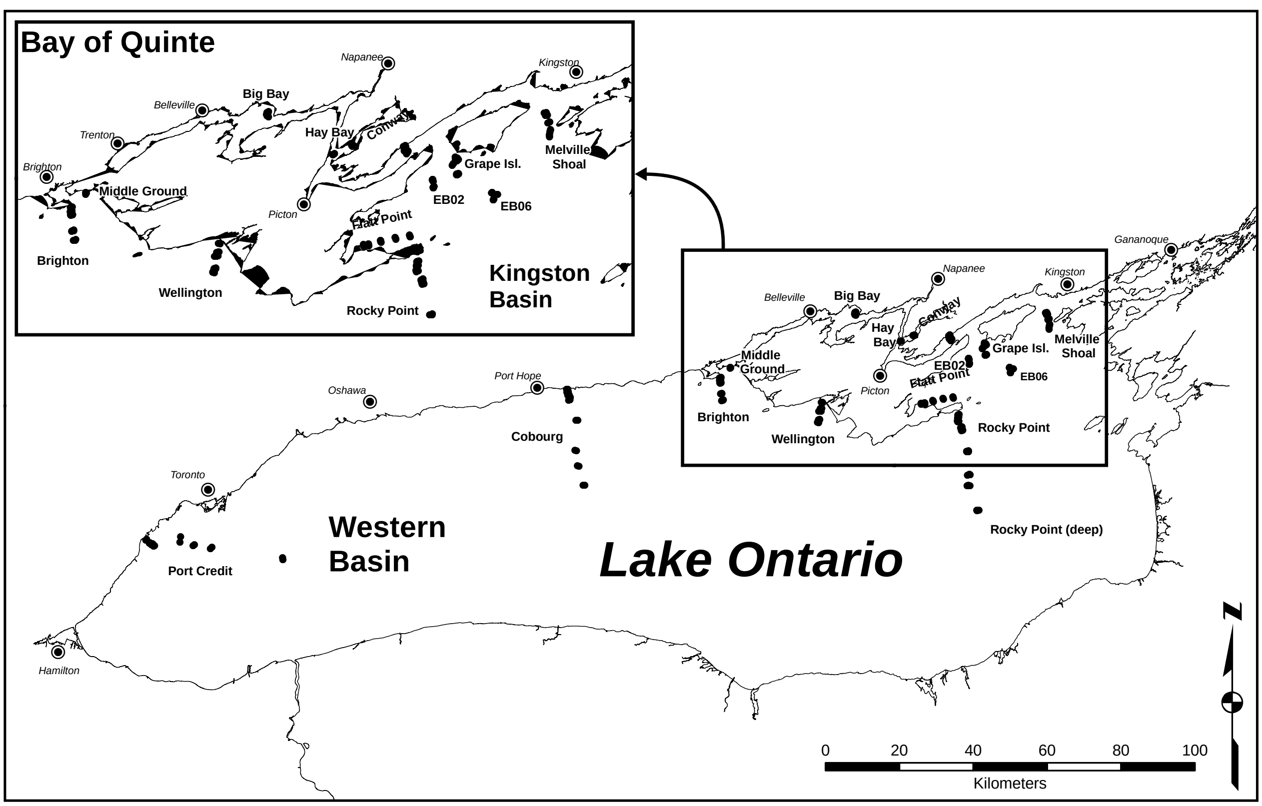


FIG. 1.2.1. Map of north eastern Lake Ontario. Shown are eastern Lake Ontario and Bay of Quinte fish community index gill netting sites.

TABLE. 1.2.1. Sampling design (2014) of the Lake Ontario and Bay of Quinte fish community index gill netting program including geographic and depth stratification, number of visits, number of replicate 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	500 feet	Site location (approx) Latitude (dec min)	Longitude (dec min)	Visits x Replicates	Time-frame	Start-up year	Number years[4]
Northwestern Lake Ontario	Port Credit (PC)	Depth stratified area	PC08	7.5	1	2		433230	793476	2	Jul 1-Jul 31	2014	1
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC13	12.5		2		433182	793403	2			
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC18	17.5		2		433164	793355	2			
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC23	22.5		2		433156	793335	2			
Northwestern Lake Ontario	Port Credit	Depth stratified area	PC28	27.5		2		433143	793308	2			
Northwestern Lake Ontario	Port Credit	Depth stratified area	0060	60	1		3	433213	792808	3	Jul 1-Jul 31	2014	1
Northwestern Lake Ontario	Port Credit	Depth stratified area	0080	80			3	433190	792515	3			
Northwestern Lake Ontario	Port Credit	Depth stratified area	0100	100			3	433162	792161	3			
Northwestern Lake Ontario	Port Credit	Depth stratified area	0140	140			3	433065	790735	3			
Northeastern Lake Ontario	Cobourg (CB)	Depth stratified area	CB08	7.5	2	2		435701	781167	4	Jul 1-Jul 31 and Aug 1-Sep 15	2010	5
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	Cobourg	Depth stratified area	0060	60	1		3	435257	780916	3	Jul 1-Jul 31	2014	1
Northeastern Lake Ontario	Cobourg	Depth stratified area	0080	80			3	434813	780919	3			
Northeastern Lake Ontario	Cobourg	Depth stratified area	0100	100			3	434589	780857	3			
Northeastern Lake Ontario	Cobourg	Depth stratified area	0140	140			3	434310	780728	3			
Northeastern Lake Ontario	Brighton (BR)	Depth stratified area	BR08	7.5	2	2		435955	774058	4	Aug 1-Sep 15	1988	27
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	36
Northeastern Lake Ontario	Wellington (WE)	Depth stratified area	WE08	7.5	2	2		435622	772011	4	Aug 1-Sep 15	1988	27
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	27
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP13	12.5		2		435460	765230	4			
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP18	17.5		2		435415	765222	4			
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP23	22.5		2		435328	765150	4			
Northeastern Lake Ontario	Rocky Point	Depth stratified area	RP28	27.5		2		435285	765135	4			
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0060	60	2		3	434950	765029	6	Jul 1-Jul 31	1997	18
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0080	80			3	434633	765006	6			
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0100	100			3	434477	764998	6			
Northeastern Lake Ontario	Rocky Point	Depth stratified area	0140	140			3	434122	764808	6			
Kingston Basin (nearshore)	Flatt Point (FP)	Depth stratified area	FP08	7.5	2	2		435665	765993	4	Jul 1-Jul 31	1986	29
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	29
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	29
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	47
Kinston Basin (offshore)	Eastern Basin (EB)	Fixed site	EB06	30	3		8	440220	764210	24	Last week Jun-Sep 15	1968	47
Bay of Quinte	Conway (CO)[1]	Depth stratified area	CO08	7.5	2		2	440664	765463	4	Jul 21-Aug 21	1972	43
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	56
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	43

[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

[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

length (total gang length is 152.4 m (500 ft)), or, the 38 mm (1½ in) mesh size (panel) is 4.6 m (15 ft) in length and the remaining mesh sizes are 15.2 m (50 ft) each in length (total gang length is 141.7 m (465 ft)) (see Table 1.2.1). Note that use of the shorter 38 mm gill net panel is related to the processing time required to deal with large numbers of small fish (e.g., Alewife and Yellow Perch) caught in this small mesh size. Gill net gangs are connected in series (i.e., cork lines and lead lines attached), but are separated by a 15.2 m (50 ft) spacer to minimize "leading" of fish. The 152 mm (6 in) end of one gang is connected to the 38 mm (1 ½ in) gang of the adjoining gang. The entire gill net strap (all joined gangs) is set within 2.5 m of the site depth listed in Table 1.2.1. Gill net set duration ranges from 18-24 hr.

TABLE 1.2.2. Species-specific catch per gillnet set in 2014. "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)
Sea lamprey	1	1	65
Longnose gar	1	1	4527
Alewife	6,773	14,232	32
Coho salmon	1	1	1836
Chinook salmon	21	21	3105
Brown trout	14	14	3477
Lake trout	502	504	3474
Lake whitefish	30	30	730
Cisco (Lake herring)	4	4	689
Coregonus sp.	1	1	2729
Rainbow smelt	4	4	43
Northern pike	16	16	2753
White sucker	75	75	615
Brown bullhead	5	7	452
Channel catfish	1	1	180
Burbot	4	4	2480
White perch	111	111	108
White bass	2	2	454
Rock bass	40	58	51
Pumpkinseed	8	8	61
Bluegill	26	26	36
Smallmouth bass	20	25	335
Yellow perch	1,308	1,744	48
Walleye	337	339	2605
Round goby	33	104	39
Freshwater drum	52	52	458
Deepwater sculpin	68	68	31

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 2014, gill netting occurred from 9-Jun to 3-Sep. Twenty-seven different species and over nine thousand individual fish were caught. About 72% of the observed catch was alewife (Table 1.2.2). Species-specific gill net catch summaries are shown by geographic area/site in Tables 1.2.3-1.2.15.

TABLE 1.2.3. Species-specific catch per gillnet set at **Cobourg (nearshore sites only) in Northeastern Lake Ontario**, 2010-2014. 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	2014
Alewife	351.96	196.13	56.77	23.78	7.48
Coho salmon	-	-	0.10	-	0.05
Chinook salmon	0.68	2.05	1.82	0.44	0.40
Rainbow trout	0.51	0.25	0.80	0.05	-
Brown trout	0.13	0.65	0.50	0.42	0.25
Lake trout	0.37	0.05	-	1.26	0.70
Lake whitefish	-	0.05	-	-	-
Round whitefish	0.07	0.05	-	-	-
Rainbow smelt	-	0.33	-	-	-
White sucker	0.10	0.37	0.50	0.26	0.15
Greater redhorse	-	-	0.10	-	-
Burbot	-	-	-	-	0.05
Smallmouth bass	-	0.05	-	-	-
Yellow perch	0.33	-	0.10	-	-
Walleye	0.03	-	0.40	-	0.05
Round goby	2.20	9.91	3.30	0.40	0.17
Freshwater drum	-	0.05	0.10	-	-
Total catch	356	210	65	27	9
Number of species	10	12	11	7	9
Number of sets	30	20	10	19	20

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

Lake Ontario

Cobourg (Tables 1.2.3 and 1.2.4)

Nearshore sites: Alewife dominate the catch at the Cobourg nearshore sites but the salmonid fish community is also well represented (Table 1.2.3). Alewife catch has declined significantly from 2010-2014. Of note in 2014 was the capture of a Burbot.

Deep sites: The deep sites at Cobourg were sampled in 2014 for the first time since 1998 (Table 1.2.4). Alewife were abundant. Remarkably, Deepwater Sculpin were also common in the gill net catch.

TABLE 1.2.4. Species-specific catch per gillnet set at **Cobourg (deep sites only) in Northeastern Lake Ontario**, 1997, 1998, and 2014. Annual catches are averages for 2 or 3 gillnet gangs set at each of 4 depths (60, 80, 100 and 140 m) during each of 1-2 visits during summer. The total number of species caught and gillnets set each year are indicated.

	1997	1998	2014
Alewife	67.16	42.75	29.75
Coho salmon	-	-	0.08
Lake trout	0.50	0.88	0.17
Cisco (Lake herring)	-	0.13	-
Rainbow smelt	2.88	0.50	-
Slimy sculpin	0.06	-	-
Deepwater sculpin	-	-	3.67
Total catch	71	44	30
Number of species	4	4	4
Number of sets	16	16	12

Middle Ground (Table 1.2.5)

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 1.2.6-1.2.11 inclusive)

Six depth-stratified sampling areas (Melville Shoal, Grape Island, Flat Point, Rocky Point, Wellington and Brighton) that employ a common and balanced sampling design are used here to provided a broad picture of the warm, cool and coldwater fish community inhabiting open-coastal waters out to about 30 m water depth. Results were summarized and presented graphically (Fig. 1.2.2) to illustrate abundance trends of the most abundant fish species.

Many species showed peak abundance levels in the early 1990s followed by dramatic abundance decline. Alewife, the most common species caught, has occurred at very high abundance levels the last few years until 2014 when abundance declined precipitously. Yellow Perch remained at a very low level of abundance in 2014. Lake Trout appear to be increasing slowly but steadily over the last few years. Round Goby abundance declined to its lowest level since 2004. Walleye catch rebounded in 2014 after an unusually low catch in 2013. Lake Whitefish remain at a very low abundance level. Rock Bass and Smallmouth Bass abundance levels have been generally stable for over a decade.

Rocky Point—Deep Sites (Table 1.2.12)

Eight species have been captured at the Rocky Point deep sampling sites since 1997. Alewife and Lake Trout are the two most abundant species. Lake Trout abundance was relatively stable from 1997-2002, declined significantly through 2004 and remained steady in the following years . Round Goby appeared for the first time in 2012 (at the 60 m site). Unlike Cobourg and Port Credit deep gill net sites (see below), Deepwater sculpin have never been caught in the Rocky Point gillnet sites.

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

Two single-depth sites (EB02 and EB06) are used to monitor long-term trends in the deep water fish community the Kingston Basin. Results were summarized and presented graphically (Fig. 1.2.3) to illustrate abundance trends of the most abundant species (Alewife,

TABLE 1.2.5. Species-specific catch per gillnet set at **Middle Ground in Northeastern Lake Ontario**, 1992-2014 (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	2014
Longnose gar	**-**	-	-	0.25	-	-	-	-	-	-	-	**0.03**	-		-	-
Alewife	**3.61**	0.83	0.83	-	-	-	-	-	0.83	8.26	3.30	**1.40**	190.83		39.90	23.96
Gizzard shad	**0.39**	-	-	-	-	0.50	-	0.25	-	-	0.25	**0.10**	-		-	-
Brown trout	**0.11**	-	-	-	-	-	0.25	-	0.25	0.50	0.25	**0.13**	0.25		-	-
Lake trout	**0.90**	-	-	-	-	-	0.25	-	-	-	-	**0.03**	-		-	-
Northern pike	**0.34**	-	-	0.50	-	0.25	0.25	1.50	1.00	1.25	0.25	**0.50**	1.25		1.25	2.00
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	25.53
Walleye	**2.44**	0.25	0.50	1.00	0.50	0.75	1.25	3.50	0.75	0.75	0.25	**0.95**	0.25		0.50	2.33
Freshwater drum	**0.57**	-	0.25	-	3.00	0.25	-	0.50	-	0.50	-	**0.45**	-		-	-
Total catch	**70**	50	66	31	75	34	110	41	50	35	24	**52**	264		123	54
Number of species	**8**	7	7	7	8	8	7	9	7	7	8	**8**	8		6	4
Number of sets		4	4	4	4	4	4	4	4	4	4		4	-	4	4

TABLE 1.2.6. Species-specific catch per gillnet set at **Brighton in northeastern Lake Ontario**, 1992-2014. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 1-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Alewife	**34.82**	49.58	107.40	31.81	22.39	41.27	72.52	3.52	89.17	209.81	67.05	**69.45**	307.74	138.36	295.25	70.48
Gizzard shad	**0.44**	-	-	-	-	-	-	-	-	-	0.15	**0.02**	-	-	0.05	-
Coho salmon	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Chinook salmon	**0.74**	0.10	0.35	1.25	0.45	0.42	0.20	0.62	0.30	0.05	0.71	**0.44**	0.83	0.10	-	0.20
Rainbow trout	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	0.10	-
Brown trout	**0.12**	-	-	0.35	0.20	0.05	0.15	0.10	0.30	0.15	1.25	**0.26**	0.60	0.50	0.15	0.10
Lake trout	**5.22**	1.30	1.05	0.40	0.95	0.15	0.30	0.05	-	0.05	0.10	**0.44**	0.15	0.20	0.10	0.85
Lake whitefish	**0.42**	0.05	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-
Cisco (Lake herring)	**0.12**	-	-	0.05	-	0.10	0.10	0.05	0.25	0.05	-	**0.06**	0.05	-	0.05	0.05
Round whitefish	**1.19**	-	0.25	0.05	0.05	-	-	-	-	-	-	**0.04**	-	-	-	-
Rainbow smelt	**0.11**	-	-	-	-	-	-	-	-	-	0.10	**0.01**	0.22	-	0.05	-
Northern pike	**0.08**	-	-	0.05	-	0.10	-	0.20	0.05	0.05	-	**0.05**	0.05	-	-	0.15
White sucker	**0.41**	-	0.10	-	0.05	0.15	0.05	0.10	-	-	0.05	**0.05**	0.05	-	-	0.15
Lake Chub	**-**	-	-	-	-	-	-	-	0.17	-	-	**0.02**	-	-	-	-
Common carp	**0.12**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-
Brown bullhead	**0.10**	0.52	0.20	0.85	0.27	0.35	-	0.25	0.22	0.05	-	**0.27**	-	-	-	0.17
Channel catfish	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
American eel	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Burbot	**0.05**	0.05	-	-	-	-	0.05	0.05	-	-	-	**0.02**	-	-	-	0.05
White perch	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Rock bass	**0.88**	-	0.32	0.63	0.76	0.32	0.15	0.32	0.80	0.33	0.33	**0.39**	-	1.65	-	0.22
Pumpkinseed	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Smallmouth bass	**0.00**	-	-	-	-	-	-	-	-	-	0.05	**0.01**	-	-	-	-
Yellow perch	**15.64**	-	0.50	0.50	0.33	1.16	2.99	1.57	4.83	0.17	0.17	**1.22**	-	1.98	2.36	0.17
Walleye	**0.44**	-	0.15	0.25	0.50	0.20	0.05	0.75	0.10	-	0.10	**0.21**	-	0.43	0.05	0.15
Round goby	**-**	-	-	0.17	0.17	4.45	1.98	0.63	1.70	1.32	0.99	**1.14**	1.21	2.31	0.99	0.17
Freshwater drum	**0.17**	-	-	0.15	0.10	-	0.05	0.05	-	-	-	**0.04**	-	-	-	-
Total catch	**61**	52	110	37	26	49	79	8	98	212	71	**74**	311	146	299	73
Number of species	**13**	6	9	15	12	12	12	14	11	10	12	**11**	9	8	10	13
Number of sets		20	20	20	20	20	20	20	20	20	20		20	10	20	20

TABLE 1.2.7. Species-specific catch per gillnet set at **Wellington in northeastern Lake Ontario**, 1992-2014. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 1-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Alewife	**17.25**	20.85	50.58	62.26	38.23	83.22	137.33	1.54	79.05	447.66	215.85	**113.66**	475.42	140.74	460.72	99.79
Gizzard shad	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Chinook salmon	**0.33**	0.10	0.20	0.35	1.20	0.10	0.20	0.35	0.45	-	0.10	**0.31**	0.65	-	0.15	0.15
Rainbow trout	**-**	-	-	-	-	-	-	-	-	-	0.05	**0.01**	-	-	-	-
Brown trout	**0.11**	0.15	0.30	0.15	0.40	0.15	-	0.10	0.40	0.45	1.55	**0.37**	0.60	0.80	0.40	0.05
Lake trout	**7.58**	2.40	2.20	0.85	1.85	0.45	0.70	0.40	0.05	0.25	0.10	**0.93**	0.25	0.40	0.05	0.20
Lake whitefish	**0.61**	0.10	0.05	-	-	-	-	-	-	-	-	**0.02**	0.35	-	-	0.20
Cisco (Lake herring)	**0.11**	-	-	-	-	-	0.05	-	-	0.05	0.05	**0.02**	0.05	-	-	-
Round whitefish	**0.06**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Rainbow smelt	**0.07**	-	-	-	-	-	-	-	0.05	0.10	0.17	**0.03**	0.05	0.10	-	0.05
Northern pike	**0.01**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	0.05	-	0.05	-
White sucker	**0.05**	-	-	-	0.17	-	-	0.05	-	-	-	**0.02**	-	-	-	-
Greater redhorse	**-**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-
Lake chub	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Common carp	**0.02**	-	-	-	-	0.05	-	-	-	-	-	**0.01**	-	-	-	-
Brown bullhead	**0.00**	0.05	0.10	-	0.05	0.15	-	-	-	-	-	**0.04**	-	-	-	-
Burbot	**0.23**	0.10	0.25	0.05	0.05	-	0.10	-	0.05	-	0.05	**0.07**	-	0.10	-	0.05
White perch	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Rock bass	**0.35**	0.17	-	0.52	0.10	0.05	-	-	0.58	-	-	**0.14**	-	-	0.05	-
Smallmouth bass	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	0.05	-	-	-
Yellow perch	**31.00**	12.67	6.22	17.96	10.31	14.51	7.25	23.48	17.65	25.87	14.11	**15.00**	2.47	19.87	11.71	16.80
Walleye	**0.36**	-	0.10	0.20	0.25	0.20	0.10	0.10	-	-	0.05	**0.10**	0.05	-	0.10	0.05
Round goby	**-**	-	-	0.33	0.99	25.92	18.39	2.03	11.50	1.16	6.94	**6.73**	3.35	2.97	3.30	0.33
Freshwater drum	**0.25**	-	0.05	-	0.05	0.05	-	-	-	-	-	**0.02**	-	0.10	-	-
Total catch	**58**	37	60	83	54	125	164	28	110	476	239	**137**	483	165	477	118
Number of species	**11**	9	10	11	12	11	8	8	9	7	11	**10**	12	8	9	10
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20

TABLE 1.2.8. Species-specific catch per gillnet set at **Rocky Point (nearshore sites only) in northeastern Lake Ontario**, 1992-2014. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 1-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Alewife	**131.93**	105.42	141.61	86.90	155.51	293.30	142.82	135.36	231.74	176.68	662.38	**213.17**	530.40	127.84	512.07	192.74
Chinook salmon	**0.23**	-	0.10	0.25	0.55	0.15	0.27	0.10	0.15	-	0.70	**0.23**	0.20	-	0.25	0.15
Rainbow trout	**-**	-	-	-	-	-	0.05	-	-	-	-	**0.01**	-	-	0.05	-
Atlantic salmon	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Brown trout	**0.09**	-	1.20	0.05	0.25	0.25	0.45	0.10	0.50	-	0.80	**0.36**	1.55	1.10	0.95	0.05
Lake trout	**5.40**	1.67	0.80	0.10	0.60	-	0.47	0.05	0.25	0.05	0.32	**0.43**	1.35	4.10	0.75	1.90
Lake whitefish	**0.69**	0.05	-	0.30	0.10	0.05	0.10	0.05	0.25	0.45	-	**0.14**	0.10	0.30	0.10	0.10
Cisco (Lake herring)	**0.07**	-	-	-	-	-	-	-	-	-	-	**-**	0.05	-	-	-
Chub	**-**	0.17	-	-	-	-	-	-	-	-	-	**0.02**	-	-	-	-
Rainbow smelt	**0.03**	-	-	-	-	-	-	-	0.17	-	-	**0.02**	-	-	-	-
White sucker	**0.04**	0.05	-	-	-	-	-	0.05	-	-	-	**0.01**	-	-	-	-
Lake chub	**0.11**	-	0.17	-	-	-	-	0.05	-	-	-	**0.02**	-	-	-	-
Common carp	**0.01**	-	-	-	0.10	0.05	-	-	-	-	-	**0.02**	-	-	-	-
Brown bullhead	**-**	-	-	-	0.05	-	-	-	-	-	-	**0.01**	-	-	-	-
Channel catfish	**-**	-	-	-	-	-	-	-	-	0.05	-	**0.01**	-	-	-	-
Stonecat	**0.01**	0.70	0.17	0.05	-	0.10	0.05	0.27	-	-	-	**0.13**	-	-	-	-
Burbot	**0.28**	0.15	0.35	0.10	0.05	0.30	-	-	-	-	0.05	**0.10**	-	-	-	0.05
White perch	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	0.05	
Rock bass	**0.31**	0.32	0.53	0.87	0.05	0.35	0.55	0.63	0.86	0.32	0.86	**0.53**	0.05	0.73	0.48	0.27
Smallmouth bass	**1.05**	0.70	0.65	0.67	0.80	0.42	0.42	0.52	0.55	0.15	0.50	**0.54**	0.20	0.53	0.37	0.10
Yellow perch	**0.06**	-	-	-	-	0.17	0.81	0.88	0.22	0.33	1.75	**0.42**	0.60	0.66	-	-
Walleye	**0.67**	-	0.25	0.10	0.80	1.60	0.65	0.85	0.65	0.15	0.45	**0.55**	0.10	0.20	0.70	1.10
Round goby	**-**	-	-	-	-	2.15	8.48	71.25	9.50	28.26	15.93	**13.56**	6.54	7.60	13.88	4.51
Freshwater drum	**0.19**	0.10	0.05	0.05	0.30	-	0.10	-	0.20	0.15	0.15	**0.11**	-	-	-	-
Total catch	**141**	109	146	89	159	299	155	210	245	207	684	**230**	541	143	530	201
Number of species	**10**	10	11	11	12	12	13	13	12	10	11	**12**	11	9	11	10
Number of sets		20	20	20	20	20	20	20	20	20	20		20	10	20	20

TABLE 1.2.9. Species-specific catch per gillnet set at **Flatt Point in the Kingston Basin of Lake Ontario**, 1992-2014. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 2-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Lake sturgeon	**0.01**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-
Alewife	**78.18**	45.97	5.17	6.87	101.38	141.78	203.18	140.02	297.45	305.56	620.72	**186.81**	908.17	818.60	337.43	11.57
Chinook salmon	**0.16**	-	-	-	0.35	0.05	-	0.10	-	-	0.05	**0.06**	0.05	0.15	-	-
Rainbow trout	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.15		
Brown trout	**0.02**	0.10	-	-	-	-	0.10	-	0.10	0.05	0.10	**0.05**	0.55	0.55	0.20	0.05
Lake trout	**10.72**	2.47	0.75	1.25	0.98	0.88	0.30	1.22	0.92	2.07	1.00	**1.18**	1.95	0.60	2.20	2.45
Lake whitefish	**4.17**	4.60	2.72	0.85	2.80	0.55	0.20	1.30	0.75	0.15	0.25	**1.42**	0.25	0.95	0.20	0.05
Cisco (Lake herring)	**0.83**	-	-	0.10	-	0.05	-	-	-	-	-	**0.02**	-	0.05	0.05	-
Coregonus sp.	**0.00**	0.05	-	-	-	-	-	-	-	-	-	**0.01**	-	-	-	-
Rainbow smelt	**0.22**	-	-	-	-	-	0.05	-	0.05	-	0.10	**0.02**	-	-	-	-
Northern pike	**0.08**	0.10	-	-	0.05	0.15	0.05	0.05	0.25	0.15	0.10	**0.09**	0.10	0.10	-	0.05
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	1.16
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	15
Number of species	**10**	11	9	11	10	11	11	11	11	10	11	**11**	12	14	8	6
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20

TABLE 1.2.10. Species-specific catch per gillnet set at **Grape Island in the Kingston Basin of Lake Ontario**, 1992-2014. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 2-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Lake sturgeon	**0.01**	0.05	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-
Alewife	**116.14**	155.14	15.03	47.83	42.83	225.83	376.62	153.49	358.67	244.82	719.98	**234.02**	1,244.67	675.03	463.46	43.11
Chinook salmon	**0.02**	-	-	-	-	0.15	-	0.10	-	-	-	**0.03**	-	-	-	-
Brown trout	**0.02**	-	-	-	0.05	0.05	0.10	-	-	-	0.05	**0.03**	0.25	0.10	0.10	0.10
Lake trout	**6.56**	0.30	0.57	0.45	0.10	0.15	0.15	0.57	0.05	0.40	0.20	**0.29**	0.20	0.20	1.78	2.27
Lake whitefish	**2.86**	0.20	0.20	0.15	-	0.10	0.10	0.20	0.10	0.10	0.10	**0.13**	0.10	0.10	0.15	-
Cisco (Lake herring)	**0.08**	-	-	-	-	-	-	-	-	-	0.15	**0.02**	0.05	-	0.10	0.05
Rainbow smelt	**0.03**	-	-	-	-	-	-	-	-	0.05	-	**0.01**	-	-	-	-
Northern pike	**-**	-	-	-	-	-	-	0.05	-	-	-	**0.01**	-	-	-	-
White sucker	**0.04**	-	-	0.05	-	-	-	0.05	0.05	-	-	**0.02**	0.10	0.05	-	0.05
Silver redhorse	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Brown bullhead	**-**	-	-	0.15	0.17	-	0.05	-	-	-	-	**0.04**	-	-	-	-
Channel catfish	**0.02**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-
Stonecat	**0.04**	-	0.17	0.43	0.33	-	-	-	-	-	-	**0.09**	-	-	-	-
Burbot	**0.17**	-	0.10	0.05	-	-	-	-	-	-	-	**0.02**	-	-	-	-
Threespine stickleback	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
White perch	**0.07**	-	-	0.10	0.10	0.05	-	-	-	-	-	**0.03**	-	-	-	-
Rock bass	**1.43**	1.01	0.05	0.72	0.33	0.17	0.37	0.93	1.01	0.43	0.35	**0.54**	0.05	0.80	0.20	0.05
Smallmouth bass	**0.68**	0.15	0.48	0.47	0.48	0.05	0.52	0.15	0.35	0.32	0.25	**0.32**	0.50	0.85	0.50	0.27
Yellow perch	**14.36**	3.54	19.72	18.54	45.07	12.18	18.13	15.82	7.44	6.98	6.91	**15.43**	4.61	0.98	2.63	1.37
Walleye	**2.90**	0.50	0.10	0.80	0.37	0.20	2.55	0.50	0.95	0.15	1.05	**0.72**	0.70	1.30	0.40	0.35
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	48
Number of species	**11**	9	9	16	11	11	11	11	10	8	11	**11**	11	10	10	9
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20

TABLE 1.2.11. Species-specific catch per gillnet set at **Melville Shoal in the Kingston Basin of Lake Ontario**, 1992-2014. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 2-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Lake sturgeon	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Alewife	**71.63**	40.83	39.19	14.14	82.41	177.38	195.64	83.04	134.66	496.46	620.85	**188.46**	666.70	223.18	553.63	93.28
Gizzard shad	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Chinook salmon	**0.03**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Rainbow trout	**-**	-	-	-	-	-	-	0.05	-	-	-	**0.01**	-	-	-	-
Brown trout	**-**	-	-	-	-	-	0.05	-	0.10	-	0.15	**0.03**	0.05	0.05	-	0.05
Lake trout	**3.54**	0.10	0.05	0.05	0.05	-	0.05	0.05	0.10	0.40	0.15	**0.10**	1.02	0.10	0.35	1.00
Lake whitefish	**1.59**	0.10	0.20	0.30	-	-	-	0.05	-	-	-	**0.07**	-	-	-	-
Cisco (Lake herring)	**0.04**	-	-	-	-	-	-	-	-	-	0.20	**0.02**	0.05	0.05	-	0.05
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	1.99
Pumpkinseed	**-**	0.17	-	-	-	-	-	-	-	-	-	**0.02**	-	-	-	-
Smallmouth bass	**0.53**	0.42	0.25	0.40	0.27	0.15	0.20	0.57	0.70	0.25	0.60	**0.38**	0.40	1.00	-	0.87
Yellow perch	**28.76**	12.57	26.57	20.20	49.72	16.14	44.66	38.74	18.75	9.75	25.97	**26.31**	10.38	8.82	3.92	12.58
Walleye	**8.73**	4.63	3.90	3.50	5.08	4.45	5.25	7.30	4.55	7.50	12.45	**5.86**	10.10	7.05	0.55	11.70
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	122
Number of species	**12**	12	9	12	9	7	8	10	10	8	12	**10**	10	9	6	8
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20

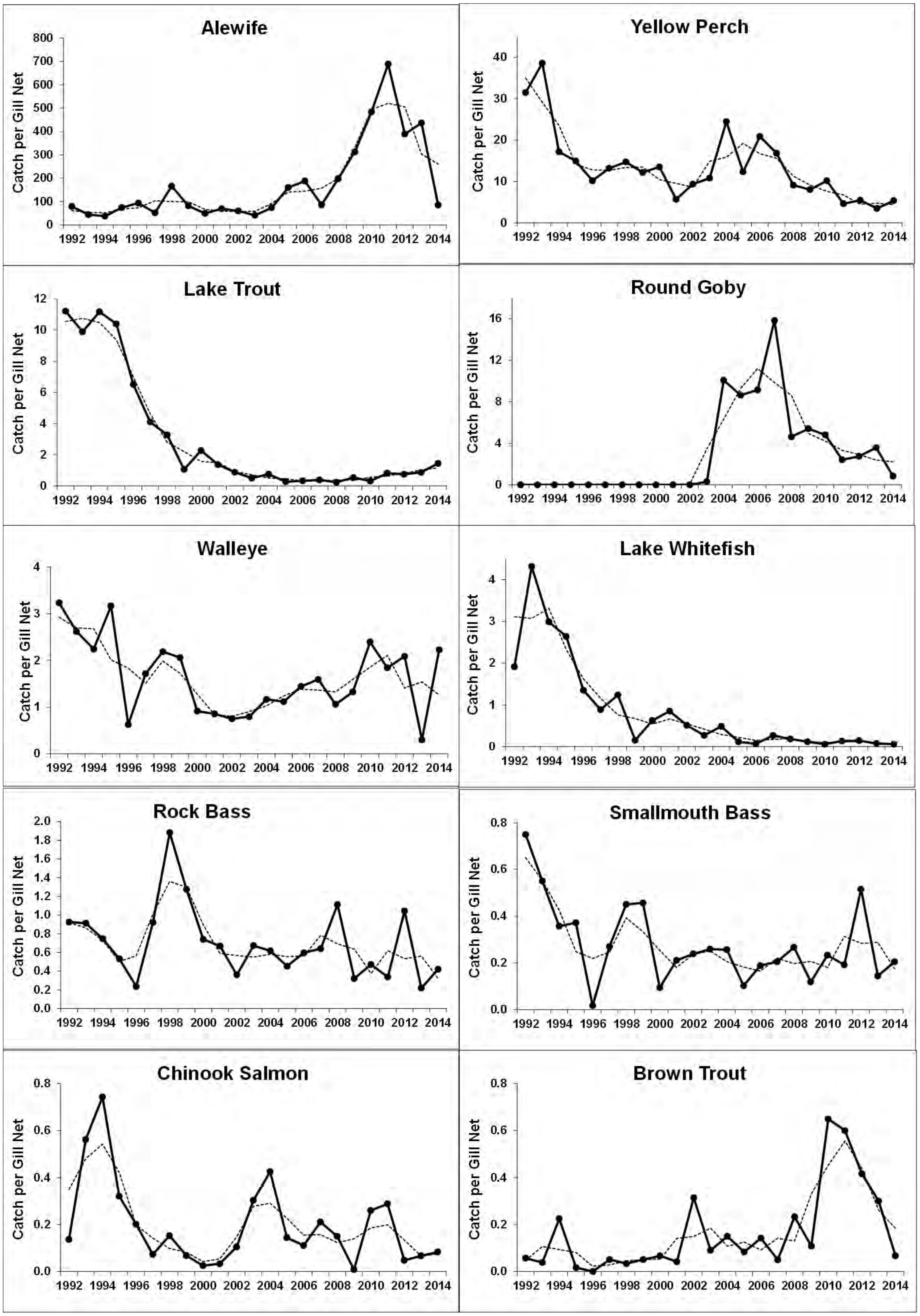


FIG. 1.2.2. Abundance trends for the most common species caught in gill nets at six depth-stratified transects (nearshore out to 30 m) in northeastern Lake Ontario (Melville Shoal, Grape Island, Flatt Point, Rocky Point, Wellington and Brighton; see Fig. 1.2.1). Annual catch per gill net values were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

TABLE 1.2.12. Species-specific catch per gillnet set at **Rocky Point (deep sites only) in northeastern Lake Ontario**, 1997-2014 (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 and gillnets set each year are indicated.

	1997-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Alewife	**4.69**	12.25	0.38	9.21	14.46	1.83			23.92	40.67		**14.67**	35.13	2.58	13.50	41.46
Lake trout	**5.05**	6.81	6.25	4.17	2.17	1.83			1.46	1.88		**3.51**	2.42	2.00	5.92	1.46
Lake whitefish	**0.50**	0.13	-	0.08	-	0.08			0.25	0.50		**0.15**	0.13	-	0.67	0.67
Cisco (Lake herring)	**0.13**	-	0.13	0.08	0.21	-			-	-		**0.06**	-	-	-	0.04
Rainbow smelt	**0.41**	-	0.19	-	-	-			0.08	0.08		**0.05**	0.08	-	0.08	0.13
Burbot	**0.09**	-	-	-	0.04	-			-	-		**0.01**	-	-	-	-
Round goby	**-**	-	-	-	-	-			-	-		**-**	-	0.08	-	-
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	44
Number of species	**6**	4	4	5	5	3			5	4		**4**	4	3	4	5
Number of sets		16	16	24	24	24	-	-	24	24	-		24	12	12	24

TABLE 1.2.13. Species-specific catch per gillnet set at **EB02 in the Kingston Basin of Lake Ontario**, 1992-2014. 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 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Sea lamprey	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Lake sturgeon	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Alewife	**40.00**	17.83	0.25	0.25	8.67	1.75	4.50	3.25	2.92	7.46	157.00	**20.39**	2.45	60.75	9.13	1.50
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	4.17
Lake whitefish	**3.76**	0.25	0.42	0.08	0.17	-	0.25	0.17	0.46	0.08	0.04	**0.19**	0.13	-	-	0.13
Cisco (Lake herring)	**0.20**	-	-	-	0.04	-	-	-	-	-	0.21	**0.03**	0.04	-	0.08	-
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	0.04
Freshwater drum	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Sculpin sp.	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Total catch	**65**	20	2	2	13	3	7	6	8	10	160	**23**	5	62	12	6
Number of species	**7**	6	4	5	9	5	6	7	7	7	10	**7**	7	4	7	4
Number of sets		12	12	24	24	24	24	24	24	24	24		24	16	24	24

TABLE 1.2.14. Species-specific catch per gillnet set at **EB06 in the Kingston Basin of Lake Ontario**, 1992-2014. 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 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014	2015	2016
Sea lamprey	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-
Lake sturgeon	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-	-	-
Alewife	**28.50**	15.67	0.58	0.79	2.79	1.88	2.46	6.44	11.25	1.29	75.88	**11.90**	17.96	13.19	13.75	1.46	-	-
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	4.08	-	-
Lake whitefish	**6.36**	0.58	0.42	0.25	2.54	0.29	0.33	0.42	1.79	0.46	0.92	**0.80**	0.92	0.75	0.50	0.13	-	-
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	6		
Number of species	**6**	4	5	6	5	6	6	6	6	5	5	**5**	7	7	7	3	-	-
Number of sets		12	12	24	24	24	24	24	24	24	24		24	16	24	24	-	-

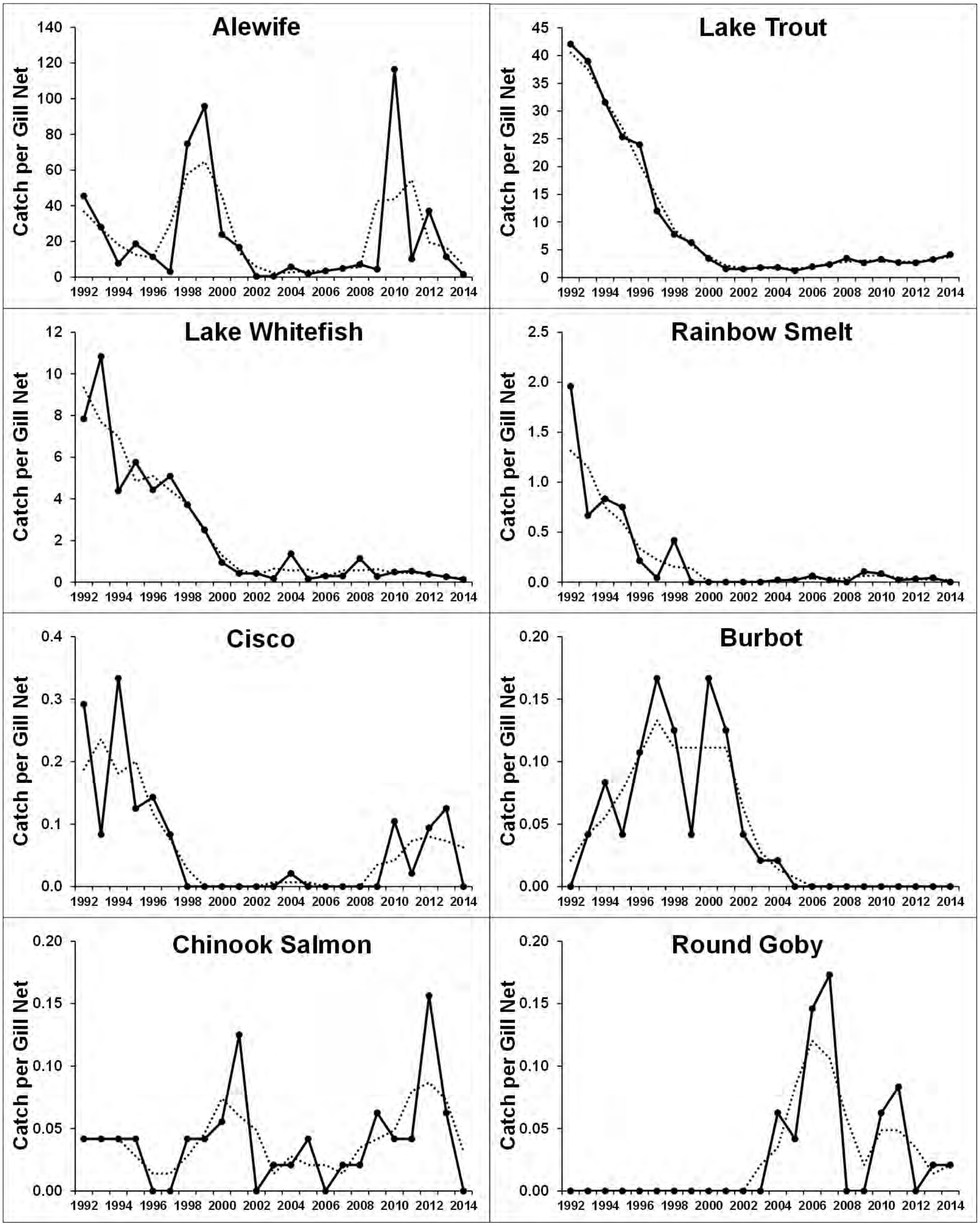


FIG. 1.2.3. Abundance trends (annual means) for the most common species caught in gill nets at the Kingston Basin deep sites, in eastern Lake Ontario (EB02 and EB06; see Fig. 1.2.1). Dotted lines show 3-yr running averages (two years for first and last years graphed).

Lake Trout, Lake Whitefish, Rainbow Smelt, Cisco, Burbot, Chinook Salmon and Round Goby). Alewife catches were variable with high catches in some years, 1998-1999, 2010 and 2012. Lake Trout, Lake Whitefish, Rainbow Smelt, and Cisco abundance declined throughout the 1990s and remained low during the years that followed except that Cisco abundance increased during 2010-2013. Burbot catches peaked in the late-1990s then declined to zero for the last nine years.

Port Credit (Tables 1.2.15 and 1.2.16)

Port Credit was sampled for the first time in 2014.

Nearshore sites: Alewife dominate the catches at the Port Credit nearshore sites (Table 1.2.15).

Deep sites: Alewife were abundant. As at the Cobourg deep sites, Deepwater Sculpin were also common in the catch (Table 1.2.16)

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

For the first time, in 2014, three lakewide depth stratified gill net transects, spanning a wide depth range (7.5 to 140 m), were sampled (Table 1.2.17). Fifteen species were caught. Of particular note, relatively large numbers of Deepwater Sculpin were caught at the 140 m depth sites at both Cobourg and Port Credit but not at Rocky Point.

Bay of Quinte *(Conway, Hay Bay and Big Bay; Tables 1.2.18-1.2.20 inclusive)*

Three sites are used to monitor long-term trends in the Bay of Quinte fish community. Big Bay is a single-depth site; Hay Bay has two depths and Conway five depths. Average catch for the three sites are summarized graphically in Fig. 1.2.4 to illustrate abundance trends of the most abundant species from 1992-2014. Yellow Perch abundance peaked in 1998 then gradually declined. White Perch catches were high in 1992, declined through 2001, increased to a peak in 2006 then declined through 2011, increased in 2012 and again in 2013. In 2014, White Perch abundance declined to its lowest level since 2001. Alewife abundance increased from 2007-2010 but declined from 2010-2014. Walleye abundance declined from 1992-2000 but has remained very stable since. Freshwater Drum and Gizzard Shad catches show no remarkable trends. White Sucker abundance declined gradually since 1992, gradually levelling off in recent years. Brown Bullhead abundance has declined precipitously to low levels . Bluegill and Pumpkinseed abundance increased in the late-1990s then declined through 2004. Thereafter, Bluegill catches increased but Pumpkinseed catches did not. Cisco catches increased in the late-1990s then declined.

TABLE 1.2.15. Species-specific catch per gillnet set at **Port Credit (nearshore sites only) in Northwestern Lake Ontario**, 2014. Annual catches are averages for 2 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during summer. The total number of species caught and gillnets set each year are indicated.

	2014
Alewife	24.12
Coho salmon	0.10
Lake trout	1.20
White sucker	0.20
Total catch	26
Number of species	4
Number of sets	10

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

	2014
Alewife	79.92
Lake trout	1.17
Deepwater sculpin	2.00
Total catch	83
Number of species	3
Number of sets	10

TABLE 1.2.17. Species-specific catch per gillnet set at **Rocky Point, Cobourg and Port Credit by site depth, Lake Ontario**, 2014. Catches are averages for 2 or 3 gill net gangs during each of 1 or 2 visits during summer. The total number of species caught and number of gill nets set are indicated.

	Northeast (Rocky Point)									North Central (Cobourg)									Northwest (Port Credit)								
Site depth (m)	7.5	12.5	17.5	22.5	27.5	60	80	100	140	7.5	12.5	17.5	22.5	27.5	60	80	100	140	7.5	12.5	17.5	22.5	27.5	60	80	100	140
Alewife	273.11	171.83	94.17	159.43	265.17	81.83	36.00	32.83	15.17	11.57	9.34	2.48	12.39	1.65	12.67	61.33	34.00	11.00	14.87	23.13	16.52	41.30	24.78	66.00	163.00	83.67	7.00
Coho salmon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chinook salmon	0.00	0.25	0.25	0.00	0.25	0.00	0.00	0.00	0.00	0.50	0.75	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brown trout	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.75	0.25	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake trout	0.00	0.25	0.50	3.25	5.50	3.50	1.33	0.50	0.50	0.00	0.25	0.75	2.00	0.50	0.00	0.33	0.00	0.33	0.00	0.00	0.50	3.50	2.00	3.00	0.67	0.67	0.33
Lake whitefish	0.00	0.00	0.00	0.00	0.50	2.33	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cisco (Lake herring)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rainbow smelt	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
White sucker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Burbot	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock bass	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Smallmouth bass	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Walleye	5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Round goby	0.25	3.30	0.83	9.09	9.09	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Deepwater sculpin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	14.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	7.67
Total catch	280	176	96	172	281	88	38	34	16	13	12	4	15	2	13	62	34	26	15	25	17	45	27	69	164	85	15
Number of species	5	6	4	3	6	4	3	3	3	5	6	4	3	3	1	3	2	3	1	3	2	2	2	2	2	3	3
Number of sets	4	4	4	4	4	6	6	6	6	4	4	4	4	4	3	3	3	3	2	2	2	2	2	3	3	3	3

TABLE 1.2.18. Species-specific catch per gillnet set at **Conway in the Bay of Quinte**, 1993-2014. Annual catches are averages for 2-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 20, 30 and 45 m) during each of 2-3 visits during summer. Mean catches for 1993-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1993-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Sea lamprey	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	0.05
Lake sturgeon	**0.00**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Longnose gar	**0.00**	0.05	-	-	-	-	-	-	-	-	-	**0.01**	-	-	-	-
Alewife	**46.74**	8.25	2.90	6.00	16.20	69.45	11.55	19.35	71.00	74.95	175.35	**45.50**	176.44	112.70	86.30	54.60
Gizzard shad	**0.01**	-	-	-	0.05	-	-	0.20	0.10	-	-	**0.04**	0.10	-	-	-
Chinook salmon	**0.03**	0.05	-	0.05	0.10	-	-	0.10	0.10	0.10	0.05	**0.06**	0.15	-	-	0.10
Rainbow trout	**-**	-	-	-	-	0.05	-	-	-	-	-	**0.01**	-	-	-	-
Atlantic salmon	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Brown trout	**0.29**	0.10	0.05	0.35	0.10	0.25	0.25	0.15	0.45	0.15	0.05	**0.19**	0.40	-	0.05	-
Lake trout	**2.02**	0.75	2.30	1.75	2.05	2.75	1.15	1.35	0.95	0.10	0.15	**1.33**	0.95	1.80	2.25	2.80
Lake whitefish	**0.96**	0.45	0.25	0.75	0.10	0.60	0.30	0.25	0.20	0.05	0.20	**0.32**	0.30	0.20	0.40	0.05
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**	-	-	-	0.05
Rainbow smelt	**0.08**	0.20	-	-	0.05	0.20	0.05	-	0.35	0.10	0.15	**0.11**	0.10	-	0.10	-
Northern pike	**0.04**	0.05	-	0.05	-	-	-	0.05	0.05	-	0.05	**0.03**	-	-	-	0.10
White sucker	**2.36**	3.30	2.60	2.15	1.05	0.60	0.45	1.45	0.55	0.30	0.20	**1.27**	0.05	0.05	0.10	0.10
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	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	7.10
Walleye	**8.23**	1.00	1.45	2.70	1.05	1.25	1.90	2.50	1.60	1.40	1.25	**1.61**	2.10	0.60	1.00	0.35
Round goby	**-**	-	1.00	11.00	31.05	0.80	0.15	0.10	0.25	-	0.05	**4.44**	-	0.05	-	-
Freshwater drum	**0.54**	0.05	0.10	0.15	0.65	0.50	1.20	1.35	0.75	0.40	0.75	**0.59**	3.25	0.10	0.40	0.05
Total catch	**150**	81	89	75	89	105	77	51	106	90	196	**96**	211	128	119	66
Number of species	**14**	19	14	15	16	15	15	18	17	13	16	**16**	16	12	12	12
Number of sets		20	20	20	20	20	20	20	20	20	20		20	20	20	20

TABLE 1.2.19. Species-specific catch per gillnet set at **Hay Bay in the Bay of Quinte**, 1992-2014. 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	2014
Sea lamprey	**-**	-	-	-	-	-	-	-	0.13	-	-	**0.01**	-	-	-	-
Lake sturgeon	**0.01**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Longnose gar	**-**	-	-	-	-	-	-	0.13	-	-	-	**0.01**	-	-	-	-
Alewife	**8.33**	19.25	8.13	-	1.25	0.25	7.50	3.75	0.13	9.75	28.75	**7.88**	12.00	5.38	3.75	4.88
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	-	0.25
White sucker	**6.12**	5.63	2.88	2.25	6.13	1.50	1.75	1.38	2.50	4.25	8.75	**3.70**	2.25	2.75	0.88	5.38
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**	-	-	-	0.25
Channel catfish	**0.01**	-	-	0.13	0.13	-	-	-	-	-	-	**0.03**	-	-	-	-
Burbot	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
White perch	**11.00**	0.50	5.38	8.38	14.50	0.13	30.13	16.25	20.75	9.38	1.75	**10.71**	4.00	7.88	55.63	1.00
White bass	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	0.13	-	-
Rock bass	**0.03**	-	-	-	-	-	-	-	0.13	-	-	**0.01**	-	-	-	-
Pumpkinseed	**0.86**	1.13	1.00	0.63	2.13	0.38	0.63	0.75	0.75	0.75	0.75	**0.89**	0.75	-	-	0.50
Bluegill	**-**	-	-	-	-	-	-	-	-	-	-	**-**	0.13	-	-	-
Smallmouth bass	**0.10**	0.13	0.13	-	-	-	-	-	-	-	-	**0.03**	-	-	-	-
Black crappie	**-**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	0.13	-
Yellow perch	**154.09**	144.13	112.13	110.50	86.00	142.75	64.00	102.00	98.88	81.63	210.00	**115.20**	94.63	35.75	6.13	53.50
Walleye	**4.39**	2.50	3.75	2.75	2.13	0.88	1.75	2.50	1.13	2.75	2.00	**2.21**	1.50	1.25	2.88	2.13
Round goby	**-**	-	0.25	0.25	0.25	0.13	-	-	-	-	-	**0.09**	-	-	-	-
Freshwater drum	**1.08**	0.25	3.13	1.25	6.63	2.50	8.25	1.00	0.88	1.00	0.75	**2.56**	0.25	0.63	3.88	2.75
Total catch	**193**	176	138	127	120	149	116	130	127	111	266	**146**	116	55	79	71
Number of species	**14**	12	14	11	11	10	11	14	13	10	9	**12**	10	11	8	9
Number of sets		8	8	8	8	8	8	8	8	8	4		8	8	8	8

TABLE 1.2.20. Species-specific catch per gillnet set at **Big Bay in the Bay of Quinte**, 1992-2014. Annual catches are averages for 2 gillnet gangs set during each of 2-4 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in **bold**. The total number of species caught and gillnets set each year are indicated.

	1992-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Lake sturgeon	**0.02**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
Longnose gar	**1.39**	1.00	1.00	0.17	1.00	1.50	3.00	0.33	2.50	3.77	6.50	**2.08**	2.33	3.83	12.83	0.17
Alewife	**0.70**	-	0.88	1.67	3.17	-	0.75	-	1.00	2.67	1.00	**1.11**	0.50	0.50	0.17	2.17
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	3.50
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	0.33
Channel catfish	**0.37**	-	0.13	-	0.17	-	0.25	-	-	0.17	-	**0.07**	-	-	0.17	0.17
Burbot	**0.04**	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	-
White perch	**90.12**	22.00	36.38	59.83	130.50	79.50	196.75	119.00	127.50	123.17	92.00	**98.66**	91.83	138.00	144.17	17.17
White bass	**0.08**	-	0.13	-	-	-	-	0.17	0.17	-	-	**0.05**	-	0.17	-	0.33
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	0.67
Bluegill	**0.57**	7.13	3.75	0.50	0.33	2.50	6.50	5.33	3.17	5.55	6.67	**4.14**	6.83	1.17	11.33	4.33
Smallmouth bass	**1.11**	0.50	-	-	-	-	0.50	-	-	0.17	-	**0.12**	-	-	-	-
Largemouth bass	**0.02**	-	-	-	-	-	0.25	-	-	-	0.17	**0.04**	-	-	-	-
Black crappie	**0.11**	0.25	0.38	0.33	0.17	0.17	2.25	1.00	0.33	-	-	**0.49**	-	-	-	-
Yellow perch	**138.65**	190.63	182.88	115.33	109.67	103.00	119.00	16.50	63.00	129.54	43.17	**107.27**	47.17	17.67	26.67	71.67
Walleye	**16.88**	4.50	7.63	6.50	8.00	5.83	10.75	5.33	9.17	8.00	10.83	**7.65**	6.33	5.17	17.17	6.33
Round goby	**-**	-	-	0.33	0.33	0.50	-	-	-	-	-	**0.12**	-	-	-	-
Freshwater drum	**15.50**	21.25	7.38	7.33	7.33	9.50	19.75	11.33	6.50	8.67	4.83	**10.39**	5.50	3.33	5.33	4.83
Total catch	**292**	277	270	199	273	249	371	164	223	286	173	**248**	254	189	227	112
Number of species	**14**	14	15	15	16	14	16	13	13	12	12	**14**	11	12	12	12
Number of sets		8	8	6	6	6	4	6	6	6	6		6	6	6	6

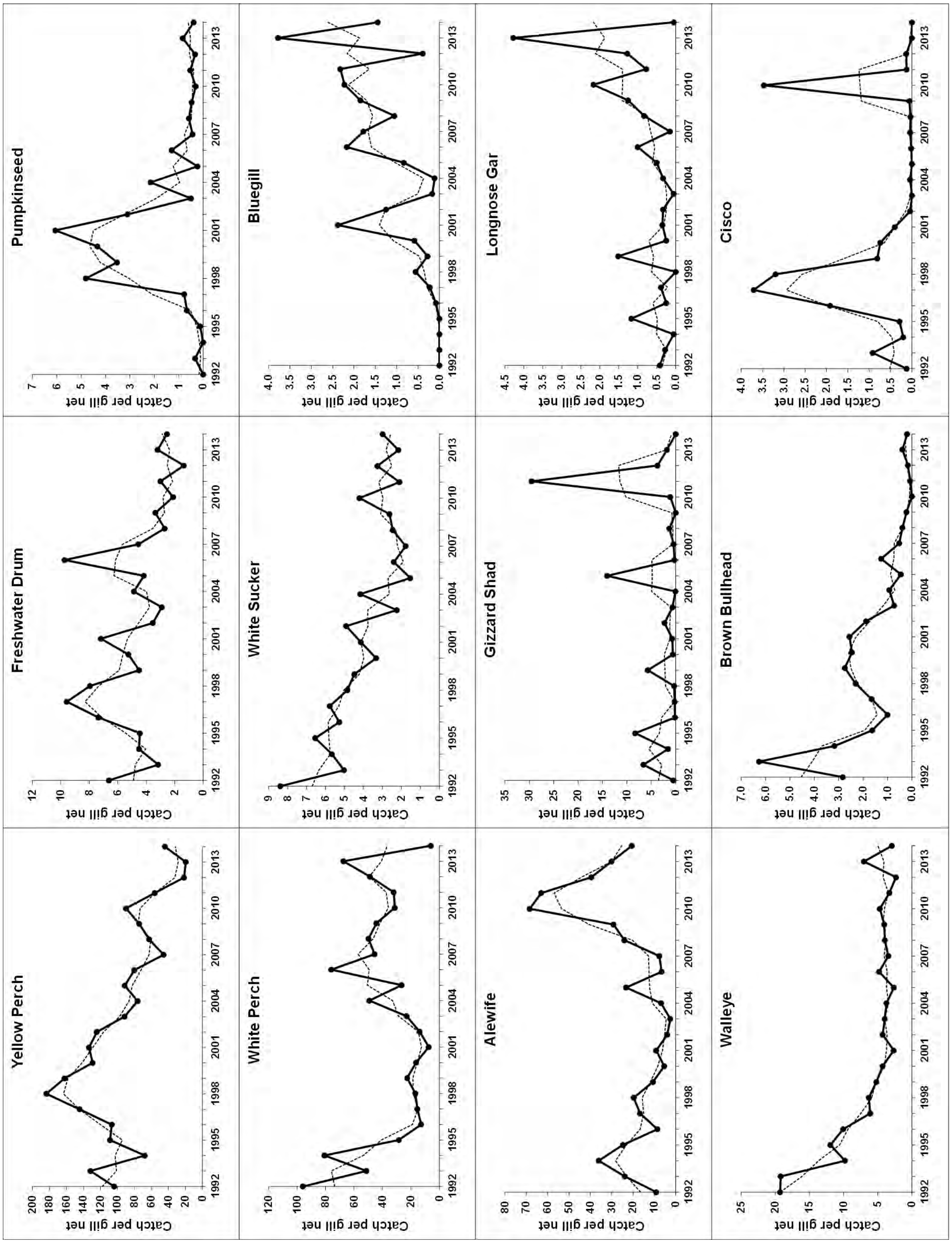


FIG. 1.2.4. Abundance trends (annual means) for the most common species caught in gillnets at three areas in the Bay of Quinte (Conway, Hay Bay and Big Bay, see Fig. 1.2.1). Dotted lines show 3-yr running averages (two years for first and last years graphed).

Species Highlights

Lake Whitefish

Twenty-eight Lake Whitefish were caught in the 2014 index gill nets (Table 1.2.21). Eleven (31%) of these were from the 2012 year-class.

Walleye

Three hundred and thirty Walleye were caught in the 2014 index gill nets (Table 1.2.22). Fifty-three (87%) of 61 Walleye caught in the Bay of Quinte gill nets were age 1-4 years. In the Kingston Basin nearshore gill nets, nearly all (233)of the 235 Walleye were age-5 or greater.

TABLE 1.2.21. Age distribution of **28 Lake Whitefish** sampled from summer index gill nets, by region, 2014. Also shown are mean fork length, mean weight, mean GSI (females), and percent mature (females). GSI = gonadal somatic index calculated for **females only** as log10 (gonad weight + 1)/log10(weight). Note that a GSI greater than approximately 0.25 indicates a mature female.

	Age (years) / Year-class												
	1	2	4	5	8	9	10	11	12	19	20	22	Total
Region	2013	2012	2010	2009	2006	2005	2004	2003	2002	1995	1994	1992	
Northeast	2	11	1	1	2	1			1	1	1		21
Kingston Basin (nearshore)								1					1
Kingston Basin (deep)							1	3				2	6
Bay of Quinte													0
Total	2	11	1	1	2	1	1	4	1	1	1	2	28
Mean fork length (mm)	160	219	364	339	463	494	485	496	492	500	561	500	
Mean weight (g)	45	99	507	464	1232	1409	1314	1449	1395	1460	2098	1564	
Mean GSI (females)		0.06			0.47				0.55	0.50	0.55	0.50	
% mature (females)		0			100				100	100	100	100	

TABLE 1.2.22. Age distribution of 330 Walleye sampled from summer index gill nets, by region, 2014. Also shown are mean fork length, mean weight, mean GSI (females), and percent mature (females). GSI = gonadal somatic index calculated for females only as log10(gonad weight + 1)/log10(weight). Note that a GSI greater than approximately 0.25 indicates a mature female.

	Age (years) / Year-class																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	23	24	
Region	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1992	1991	1990	Total
Central									1															1
Northeast			2	1		1	1	1		1	5		1	1	1	3	1		4		1	1	1	26
Middle Ground		1	4						1		1													7
Kingston Basin			2		7	17	25	18	44	19	46	1	13	5	26	5	3	1	1	2				235
Bay of Quinte	12	17	16	8		6	1	1																61
Total Aged	12	18	24	9	7	24	27	20	46	20	52	1	14	6	27	8	4	1	5	2	1	1	1	330
Mean fork length (mm)	262	333	423	474	549	556	584	600	624	623	627	653	618	606	642	625	627	691	673	681	638	642	676	
Mean weight (g)	260	387	905	1,262	2,249	2,197	2,650	2,818	3,108	3,164	3,309	3,715	3,283	2,959	3,477	3,387	3,046	3,653	4,293	3,738	3,546	3,402	3,725	
Mean GSI (females)	0.04	0.13	0.22	0.31	0.35	0.37	0.39	0.43	0.44	0.45	0.44	0.45	0.41	0.48	0.47	0.45	0.24	0.56	0.41	0.52			0.52	
% mature	-	-	33	75	100	93	94	100	97	100	100	100	100	100	100	100	100	100	100	100			100	

1.3 Lake Ontario and Bay of Quinte Fish Community Index Trawling

J. A. Hoyle, Lake Ontario Management Unit

Bottom trawling has been used to monitor the relative abundance of small fish species and the young of large-bodied species in the fish community since the 1960s. After some initial experimentation with different trawl specifications, two trawl configurations (one for the Bay of Quinte and one for Lake Ontario) were routinely employed (see trawl specifications Table 1.3.1).

In the Kingston Basin of eastern Lake Ontario, six sites, ranging in depth from about 20 to 35 m, were visited about four times annually up until 1992 when three sites were dropped. 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; about 100 m water depth), to give a total of four Lake sites (Fig. 1.3.1). In 2014, a second trawl site was added at Rocky Point (60 m) and two trawl sites at each of Cobourg and Port Credit (60 and 100 m depths at both locations). In 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 70,000 fish were caught in 106 bottom trawls in 2013 (June 10-September 4,Table 1.3.2). Alewife (29%) Yellow Perch (29%), Round Goby (24%), and Trout-perch (8%), collectively made up 90% of the catch by number. Species-specific catches in the 2014 trawling program are shown in Tables 1.3.3-1.3.13.

Lake Ontario

EB02 (Table 1.3.3)

Four species Round Goby, Rainbow Smelt Alewife, and Lake Trout were caught at EB02 in 2014. A single yearling wild Lake Trout was

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

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

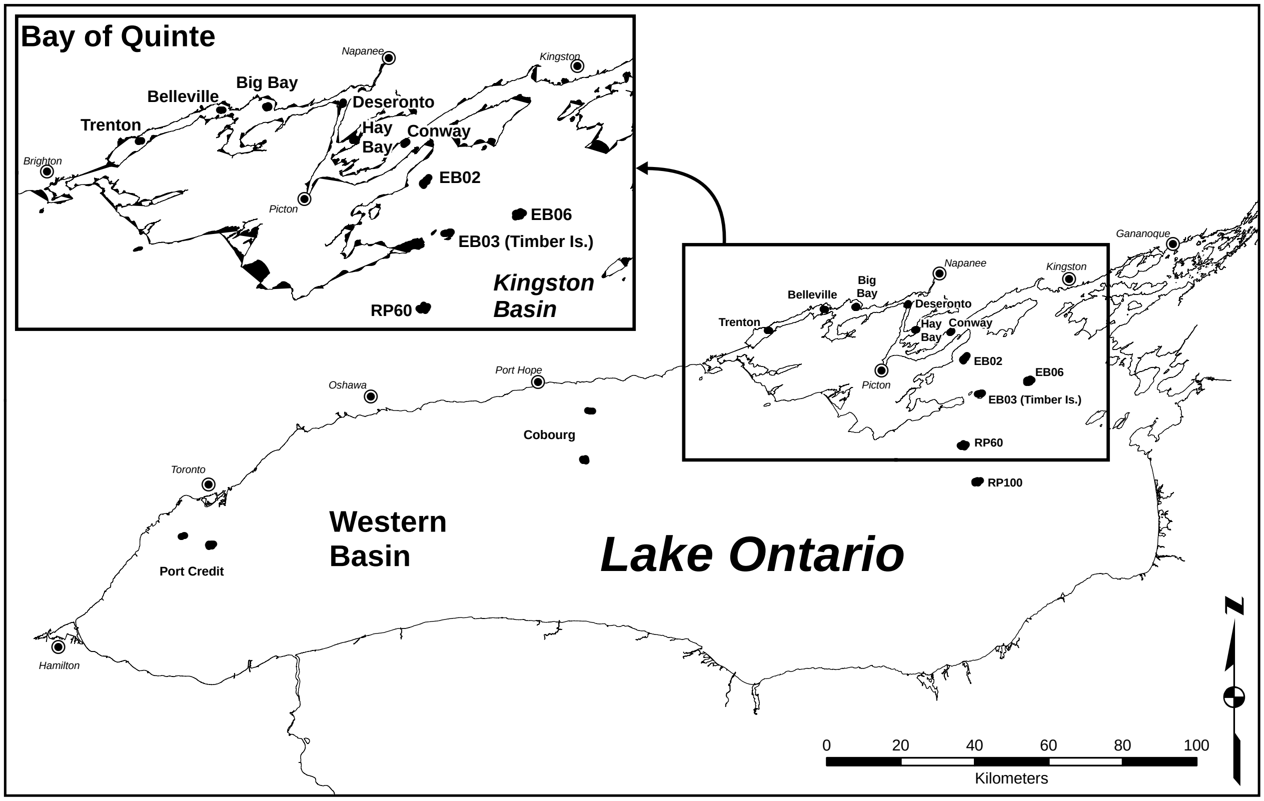


FIG. 1.3.1. Map of north eastern Lake Ontario. Shown are eastern Lake Ontario and Bay of Quinte fish community index bottom trawling site locations.

caught (fork length 101 mm; weight 8.72 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 eight years. Slimy Sculpin, another formally abundant species has also been absent for eight years.

EB03 (Table 1.3.4)

Four species, Round Goby, Alewife, Rainbow Smelt and Spottail Shiner were caught at EB03 in 2014. 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 eight years.

EB06 (Table 1.3.5)

Only two species Round Goby and Rainbow Smelt, were caught at EB06 in 2014.

Rocky Point (Table 1.3.6)

Six species Alewife, Slimy Sculpin, Deepwater Sculpin, Rainbow Smelt, Rock Bass and Round Goby were caught at Rocky Point in 2014. This was the first Round Goby caught at the Rocky Point trawl site.

Deep Trawl Sites 2014 (Rocky Point, Cobourg and Port Credit; Table 1.3.7)

Eight species were caught at the deep trawl sites at Rocky Point, Cobourg and Port Credit in 2014. The most abundant species were Alewife, Rainbow Smelt, Slimy Sculpin and Deepwater Sculpin.

Bay of Quinte

Conway (Table 1.3.8)

Nine species were caught at Conway in 2013. The most abundant species were Alewife, Yellow Perch, Round Goby, Spottail Shiner, Rainbow Smelt and Cisco.

Hay Bay (Table 1.3.9)

Fourteen species were caught at Hay Bay in 2014. The most abundant species were Alewife, and Yellow Perch.

Deseronto (Table 1.3.10)

Eighteen species were caught at Deseronto in 2014. The most abundant species were Alewife, Yellow Perch, Spottail Shiner, Pumpkinseed and White Perch.

Big Bay (Table 1.3.11)

Sixteen species were caught at Big Bay in 2014. The most abundant species were Trout-perch, Yellow Perch and Alewife. Brown Bullhead catch increased slightly in 2013 and again in 2014. No American Eel have been caught in the last twelve years.

Belleville (Table 1.3.12)

Sixteen species were caught at Belleville in 2014. Yellow Perch, Trout-perch and White Perch were the most abundant species in the catch. Brown Bullhead catch increased slightly in 2014. No American Eel have been caught in the last 16 years.

Trenton (Table 1.3.13)

Eighteen species were caught at Trenton in 2014. The most abundant species were Yellow Perch, Alewife and Logperch.

Species Trends (Fig. 1.3.2)

Bottom trawl results were summarized across the six Bay of Quinte sites and presented graphically to illustrate abundance trends for major species in Fig. 1.3.2. All species show significant abundance changes over the long-term. The most abundant species remain White Perch, Yellow Perch and Alewife with Alewife showing an increase in recent years. White Perch

TABLE 1.3.2. Species-specific total catches in bottom trawls in 2014. 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	58	20,471	154.60	8
Gizzard shad	2	2	0.01	5
Chinook salmon	1	1	0.05	47
Lake trout	2	2	0.06	28
Lake whitefish	6	28	0.61	22
Cisco (Lake herring)	5	95	2.17	23
Rainbow smelt	33	880	5.18	6
Northern pike	2	2	2.59	1295
White sucker	24	84	23.12	275
Common carp	1	1	5.59	5590
Spottail shiner	36	2,137	9.45	4
Brown bullhead	37	214	50.42	236
Channel catfish	4	6	1.32	220
Trout-perch	41	5,881	12.59	2
White perch	29	696	7.40	11
White bass	10	22	0.48	22
Rock bass	7	15	0.09	6
Pumpkinseed	27	492	17.05	35
Bluegill	11	68	2.41	35
Smallmouth bass	1	1	0.81	806
Largemouth bass	1	1	0.00	1
Black crappie	2	2	0.60	302
Lepomis sp.	22	378	0.10	0
Yellow perch	44	20,253	196.17	10
Walleye	41	700	24.18	35
Johnny darter	5	5	0.01	1
Logperch	25	439	0.93	2
Round goby	46	17,017	46.20	3
Freshwater drum	33	175	94.89	542
Slimy sculpin	22	694	4.99	7
Deepwater sculpin	11	55	0.67	12

TABLE 1.3.3. Species-specific catch per trawl (12 min duration; 1/2 mile) by year in the fish community index bottom trawling program during summer at **EB02**, 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	2014
Alewife	**1220.379**	203.397	20.917	19.500	27.100	0.000	0.417	11.000	0.667	72.429	464.097	**81.952**	1.667	24.291	288.143	2.667
Rainbow trout	**0.019**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Lake trout	**0.202**	0.000	0.083	0.083	0.000	0.583	0.167	0.583	0.500	0.000	0.167	**0.217**	0.000	0.333	0.333	0.167
Lake whitefish	**3.203**	0.167	0.000	0.583	0.400	0.250	0.000	0.167	0.000	0.250	0.000	**0.182**	0.000	0.083	0.000	0.000
Cisco (Lake herring)	**0.362**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Coregonus sp.	**0.006**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Rainbow smelt	**440.950**	29.667	7.917	0.917	5.000	19.750	28.750	3.583	5.667	114.416	14.667	**23.033**	1.083	10.333	3.917	8.833
Emerald shiner	**0.009**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Burbot	**0.009**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Threespine stickleback	**13.395**	18.750	34.417	49.500	6.200	9.000	0.167	0.000	0.000	0.000	0.000	**11.803**	0.000	0.000	0.000	0.000
Trout-perch	**4.675**	0.250	0.000	0.167	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.042**	0.000	0.000	0.000	0.000
Yellow perch	**0.019**	0.000	0.000	0.000	0.700	0.333	0.083	0.000	0.000	0.000	0.083	**0.120**	0.000	0.167	0.000	0.000
Walleye	**0.056**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083	**0.008**	0.000	0.000	0.000	0.000
Johnny darter	**0.077**	0.000	0.000	0.000	0.400	0.000	0.000	0.000	0.000	0.000	0.000	**0.040**	0.000	0.000	0.000	0.000
Round goby	**0.000**	0.000	0.000	0.083	250.100	24.833	40.083	119.750	26.667	169.907	143.933	**77.536**	8.083	77.144	28.500	31.083
Sculpin sp.	**0.046**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Slimy sculpin	**2.084**	0.417	0.667	44.083	74.900	0.750	0.167	0.000	0.000	0.000	0.000	**12.098**	0.000	0.000	0.000	0.000
Total catch	**1685**	253	64	115	365	56	70	135	34	357	623	**207**	11	112	321	43
Number of species	**9**	6	5	8	8	7	7	5	4	4	6	**6**	3	6	4	4
Number of trawls		12	12	12	10	12	12	12	12	12	12		12	12	12	12

TABLE 1.3.4. Species-specific catch per trawl (12 min duration; 1/2 mile) by year in the fish community index bottom trawling program during summer at **EB03**, 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	2014
Alewife	**704.463**	57.375	21.375	8.000	168.385	14.833	15.250	33.917	156.339	0.000	0.250	**47.572**	0.125	33.292	75.500	43.125
Gizzard shad	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.250	0.000	0.000	0.000	**0.025**	0.000	0.000	0.000	0.000
Chinook salmon	**0.014**	0.000	0.000	0.000	0.000	0.667	0.000	0.000	0.000	0.000	0.000	**0.067**	0.000	0.000	0.000	0.000
Lake trout	**0.847**	0.000	0.000	0.000	0.000	0.000	0.000	0.250	0.000	0.083	0.000	**0.033**	0.000	0.000	0.125	0.000
Lake whitefish	**14.412**	0.000	0.000	43.938	2.333	50.000	3.000	1.417	0.000	0.083	4.667	**10.544**	0.125	0.000	0.000	0.000
Cisco	**0.292**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.125	0.000	0.000	0.000
Rainbow smelt	**517.419**	20.000	207.511	109.245	1.917	25.667	20.625	21.500	0.250	11.583	217.947	**63.624**	30.750	3.250	111.500	20.625
White sucker	**0.093**	0.000	0.000	0.000	0.000	0.000	0.000	0.083	0.000	0.000	0.000	**0.008**	0.000	0.000	0.000	0.000
Common carp	**0.130**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Spottail shiner	**42.456**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.250	0.083	**0.033**	0.375	0.000	0.000	0.125
American eel	**0.056**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Brook stickleback	**0.009**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Threespine stickleback	**32.894**	67.375	680.287	459.421	2781.754	116.083	8.500	0.000	0.000	0.000	0.000	**411.342**	0.000	0.000	0.000	0.000
Trout-perch	**689.171**	175.000	592.212	56.298	255.161	3.417	3.750	0.417	0.000	0.000	0.000	**108.625**	0.125	0.000	0.000	0.000
White perch	**0.032**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Pumpkinseed	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083	**0.008**	0.000	0.000	0.000	0.000
Smallmouth bass	**0.014**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Largemouth bass	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083	**0.008**	0.000	0.000	0.000	0.000
Yellow perch	**0.093**	0.000	0.000	0.625	0.083	0.000	0.500	0.167	0.125	0.000	0.000	**0.150**	0.000	0.000	0.000	0.000
Walleye	**0.236**	0.000	0.000	0.063	0.000	0.000	0.125	0.000	0.000	0.417	0.000	**0.060**	0.250	0.250	0.000	0.000
Johnny darter	**0.875**	0.000	0.000	9.875	32.833	0.167	0.000	0.000	0.000	0.000	0.000	**4.288**	0.000	0.000	0.000	0.000
Round goby	**0.000**	0.000	0.000	0.000	0.333	732.449	850.448	910.409	1100.409	2552.195	1079.944	**722.619**	2322.465	960.945	410.800	1968.925
Freshwater drum	**0.046**	0.000	0.000	0.000	0.083	0.000	0.125	0.000	0.125	0.000	0.000	**0.033**	0.000	0.250	0.000	0.000
Sculpin sp.	**0.194**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Mottled sculpin	**0.000**	0.000	0.000	0.688	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.069**	0.000	0.000	0.000	0.000
Slimy sculpin	**0.370**	0.000	0.250	6.750	10.833	0.083	0.000	0.000	0.000	0.000	0.000	**1.792**	0.000	0.000	0.000	0.000
Total catch	**2004**	320	1502	695	3254	943	902	968	1257	2565	1303	**1371**	2354	998	598	2033
Number of species	**10**	4	5	10	10	9	9	9	5	6	7	**7**	8	5	4	4
Number of trawls		8	8	16	12	12	8	12	8	12	12		8	7	8	8

TABLE 1.3.5. Species-specific catch per trawl (12 min duration; 1/2 mile) by year in the fish community index bottom trawling program during summer at **EB06**, 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														
	1992-2000										**2001-2010**				
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013	2014
Alewife	**85.631**	5.583	0.250	0.083	1.250	0.417	8.000	0.917	0.667	10.833	1.083	**2.908**	0.667	0.625	0.583	0.000
Lake trout	**0.611**	0.083	0.083	0.083	0.083	0.000	0.000	0.000	0.000	0.000	0.000	**0.033**	0.000	0.125	0.000	0.000
Lake whitefish	**4.546**	0.000	0.167	0.167	0.250	0.000	0.000	0.083	0.000	0.000	0.083	**0.075**	0.000	0.000	0.000	0.000
Cisco (Lake herring)	**0.028**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Rainbow smelt	**743.701**	21.417	6.750	0.250	25.083	142.583	23.917	0.583	1.000	3.500	73.167	**29.825**	18.917	112.933	8.750	0.333
Threespine stickleback	**7.722**	2.583	47.750	11.417	7.500	13.917	1.083	0.000	0.000	0.000	0.000	**8.425**	0.000	0.000	0.000	0.000
Trout-perch	**0.991**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Yellow perch	**0.019**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Johnny darter	**0.000**	0.000	0.000	0.000	0.333	0.000	0.000	0.000	0.000	0.000	0.000	**0.033**	0.000	0.000	0.000	0.000
Round goby	**0.000**	0.000	0.000	0.000	0.000	0.000	5.000	82.934	1.667	8.667	877.914	**97.618**	1.917	200.416	208.949	0.333
Sculpin sp.	**0.009**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Slimy sculpin	**0.083**	0.083	0.000	3.583	399.183	15.750	0.250	0.000	0.000	0.500	1.500	**42.085**	0.000	0.125	0.167	0.000
Deepwater sculpin	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083	0.167	**0.025**	0.000	0.000	0.000	0.000
Total catch	**843**	30	55	16	434	173	38	85	3	24	954	**181**	22	314	218	1
Number of species	**6**	5	5	6	7	4	5	4	3	5	6	**5**	3	5	4	2
Number of trawls		12	12	12	12	12	12	12	12	12	12		12	8	12	12

TABLE 1.3.6. Species-specific catch per trawl (adjusted to 12 min duration; 1/2 mile) by year in the fish community index bottom trawling program during summer at **Rocky Point** (about 100 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. No sampling in 2006, 2010.

Species	1997-2000 mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2001-2010 mean	2011	2012	2013	2014
Alewife	**2.063**	2.750	0.375	1.500	5.750	0.125		6.875	1.500	0.375		**2.406**	0.500	0.000	84.500	13.000
Lake trout	**0.063**	0.500	0.000	0.000	0.125	0.000		0.000	0.125	0.000		**0.094**	0.250	0.000	0.000	0.000
Lake whitefish	**0.094**	0.000	0.125	0.000	0.000	0.000		0.000	0.000	0.000		**0.016**	0.000	0.000	0.000	0.000
Rainbow smelt	**200.500**	90.625	37.625	4.125	11.375	5.500		2.250	7.250	6.750		**20.688**	5.500	5.500	11.500	3.333
Threespine stickleback	**0.000**	0.000	0.000	0.000	0.125	0.125		0.000	0.000	0.000		**0.031**	0.000	0.000	0.000	0.000
Rock bass	**0.000**	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000		**0.000**	0.000	0.000	0.000	0.167
Round goby	**0.000**	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000		**0.000**	0.000	0.000	0.000	0.167
Slimy sculpin	**5.625**	1.250	0.125	2.250	95.750	14.250		24.750	8.875	5.000		**19.031**	2.250	0.000	12.000	8.000
Deepwater sculpin	**0.000**	0.000	0.000	0.000	0.000	0.125		0.750	0.250	0.125		**0.156**	7.500	1.500	6.000	3.833
Total catch	**208**	95	38	8	113	20		35	18	12		**42**	16	7	114	29
Number of species	**3**	4	4	3	5	5		4	5	4		**4**	5	2	4	6
Number of trawls		4	4	4	4	4	0	4	4	4	0		4	1	2	6

TABLE 1.3.7. Species-specific catch per trawl (adjusted to 12 min duration; 1/2 mile) in the fish community index bottom trawling program during summer at **Rocky Point, Cobourg and Port Credit (60 and 100 m water depths),** Lake Ontario, 2014. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated. No sampling in 2006, 2010.

Area	Rocky Point		Cobourg		Port Credit	
Site depth (m)	60	100	60	100	60	100
Alewife	1188.82	13.00	60.50	19.00	1.50	45.50
Lake whitefish	1.25	0.00	0.00	0.00	0.00	0.00
Rainbow smelt	42.63	3.33	0.00	0.00	0.00	1.25
Rock bass	0.00	0.17	0.00	0.00	0.00	0.00
Smallmouth bass	0.13	0.00	0.00	0.00	0.00	0.00
Round goby	0.00	0.17	0.00	0.00	0.00	0.00
Slimy sculpin	30.25	8.00	18.50	84.25	1.00	7.00
Deepwater sculpin	0.00	3.83	0.00	5.25	0.00	2.75
Total catch	1263	29	79	109	3	57
Number of species	5	6	2	3	2	4
Number of trawls	8	6	2	4	2	4

abundance declined significantly in 2014. Most Centrarchid species are currently at moderate to high levels of abundance as are Gizzard Shad, Spottail Shiner, Round Goby, Logperch, and Cisco. Species currently at low abundance levels relative to past levels include Brown Bullhead, Rainbow Smelt, White Sucker, Lake Whitefish, Johnny Darter and American Eel. Trout-perch abundance increased in 2014.

Species Highlights

Catches of age-0 fish in 2014 for selected species and locations are shown in Tables 1.3.14-1.3.17 for Lake Whitefish, Lake Herring, Yellow Perch and Walleye respectively.

Age-0 Lake Whitefish were moderately abundant at Conway but none was caught at Timber Island in 2014 (Table 1.3.14). 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 1.2) and the commercial harvest (Section 3.2).

Age-0 Lake Herring catches at Conway were relatively high in 2014 (Table 1.3.15).

Age-0 catches of Yellow Perch were high in 2014 (Table 1.3.16).

Age-0 Walleye catches were very high in 2014 (Tables 1.3.17 and 1.3.18).

Round Goby first appeared in bottom trawl catches in the Bay of Quinte in 2001 and in the Kingston Basin of eastern Lake Ontario in 2003. The species was caught at all Bay of Quinte trawling sites by 2003, peaking in abundance, at each site, between 2003 and 2005. Catches have been quite variable since but remain high. Round Goby catches in the Kingston Basin remained high in 2014.

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

	Year														
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Silver lamprey	**0.000**	0.000	0.000	0.000	0.083	0.000	0.000	0.000	0.000	0.000	0.000	**0.008**	0.000	0.000	0.000	0.000
Alewife	**121.972**	0.000	0.000	2.250	1.917	0.417	9.667	0.083	214.622	1.583	0.333	**23.087**	375.352	0.125	14.875	97.809
Gizzard shad	**0.000**	0.000	0.000	0.000	0.000	0.000	1.167	0.000	0.000	0.000	0.000	**0.117**	0.000	0.000	0.000	0.000
Chinook salmon	**0.028**	0.000	0.000	0.000	0.000	0.167	0.083	0.000	0.000	0.000	0.000	**0.025**	0.000	0.000	0.000	0.125
Brown trout	**0.000**	0.000	0.125	0.167	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.029**	0.000	0.000	0.000	0.000
Lake trout	**0.014**	0.000	0.250	0.000	0.417	0.000	0.000	0.000	0.000	0.000	0.000	**0.067**	0.000	0.125	0.375	0.000
Lake whitefish	**13.208**	1.000	1.000	8.083	0.750	3.083	3.833	4.750	0.250	0.333	0.333	**2.342**	0.625	0.000	7.000	2.250
Cisco (Lake herring)	**2.301**	0.000	0.250	3.000	0.083	7.667	4.500	2.000	0.167	0.000	6.333	**2.400**	8.250	23.500	1.625	11.750
Coregonus sp.	**0.000**	0.000	0.000	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.008**	0.000	0.000	0.000	0.000
Rainbow smelt	**112.713**	0.000	39.625	10.167	3.583	6.750	0.083	25.167	1.083	0.083	0.000	**8.654**	0.625	0.500	8.750	29.875
White sucker	**4.412**	134.836	28.750	6.667	7.417	4.750	3.167	11.250	0.500	0.000	0.167	**19.750**	0.500	1.375	1.375	0.000
Moxostoma sp.	**0.000**	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000
Spottail shiner	**0.000**	0.625	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.063**	0.000	0.000	0.000	0.000
American eel	**0.056**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Burbot	**0.000**	0.000	0.000	0.000	0.083	0.000	0.000	0.000	0.000	0.000	0.000	**0.008**	0.000	0.000	0.000	0.000
Threespine stickleback	**0.019**	0.000	0.000	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.008**	0.000	0.000	0.000	0.000
Trout-perch	**132.813**	139.443	58.234	53.667	43.333	12.250	0.500	1.000	13.000	0.083	0.000	**32.151**	0.500	0.000	1.125	38.875
White perch	**0.116**	0.000	0.000	0.000	0.000	0.000	3.000	0.000	0.000	0.250	0.167	**0.342**	5.500	0.250	0.375	0.000
White bass	**0.000**	0.000	0.000	0.000	0.000	0.000	0.833	0.000	0.000	0.000	0.000	**0.083**	1.125	0.000	0.000	0.000
Rock bass	**0.028**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Bluegill	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.125	0.000	0.000
Yellow perch	**12.597**	134.715	181.251	178.153	58.667	53.750	146.584	20.000	108.980	8.250	56.956	**94.731**	125.915	70.580	59.875	47.000
Walleye (Yellow pickerel)	**2.764**	1.250	0.000	0.250	1.000	0.083	0.417	0.417	0.083	0.000	0.333	**0.383**	0.375	0.000	0.000	0.125
Johnny darter	**0.306**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Round goby	**0.000**	0.000	0.500	282.241	79.167	127.225	40.833	173.211	89.723	80.768	146.979	**102.065**	261.710	203.978	103.471	81.375
Freshwater drum	**0.000**	0.125	0.000	0.250	0.000	0.083	0.500	0.000	0.083	0.000	0.000	**0.104**	0.000	0.000	0.000	0.000
Sculpin sp.	**0.009**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Mottled sculpin	**0.009**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Slimy sculpin	**0.079**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Total catch	**403**	412	310	545	197	216	215	238	428	91	212	**286**	780	301	199	309
Number of species	**9**	8	9	13	12	11	14	9	10	7	8	**10**	11	9	10	9
Number of trawls		8	8	12	12	12	12	12	12	12	12		8	8	8	8

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

Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Alewife	**204.149**	566.143	21.125	1.750	67.067	72.097	394.507	695.331	631.710	713.136	967.999	**413.086**	561.676	530.946	360.990	498.796
Gizzard shad	**10.153**	2.625	0.125	0.000	0.125	0.000	0.375	0.125	7.000	0.750	4.000	**1.513**	1.375	100.159	3.250	0.000
Lake whitefish	**0.019**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Cisco (Lake herring)	**0.056**	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.100**	0.000	0.000	0.000	0.125
Rainbow smelt	**3.958**	0.000	0.000	0.000	0.000	0.000	0.125	0.000	0.375	0.000	0.000	**0.050**	0.000	0.000	0.000	0.000
Northern pike	**0.069**	0.000	0.000	0.125	0.000	0.000	0.000	0.125	0.000	0.125	0.000	**0.038**	0.000	0.000	0.000	0.250
White sucker	**3.579**	3.500	0.125	5.875	8.250	0.000	0.625	4.875	3.000	0.000	3.625	**2.988**	4.375	2.125	3.625	3.250
Common carp	**0.343**	0.250	0.000	0.000	0.000	0.875	0.000	0.000	0.750	0.125	0.000	**0.200**	0.000	0.125	0.000	0.000
Golden shiner	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.125	0.000	**0.013**	0.000	0.375	0.125	0.000
Common shiner	**0.000**	0.000	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000
Fathead minnow	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.125	0.000
Brown bullhead	**15.046**	32.750	15.750	8.000	10.375	10.500	15.000	8.875	0.750	3.500	2.500	**10.800**	0.250	1.750	5.375	2.125
Channel catfish	**0.028**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.125	0.000	0.125	0.000
American eel	**1.579**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Burbot	**0.023**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Trout-perch	**65.125**	5.750	2.750	3.750	77.500	1.750	3.000	59.500	6.625	3.750	4.375	**16.875**	22.875	1.125	6.250	4.625
White perch	**94.666**	9.250	132.573	14.750	495.340	24.625	504.187	27.500	163.757	167.704	54.875	**159.456**	73.281	57.750	271.752	0.875
White bass	**0.185**	0.000	0.000	1.750	0.125	0.125	1.375	1.375	0.875	0.500	2.000	**0.813**	9.500	0.250	0.000	0.125
Sunfish	**0.056**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Rock bass	**0.028**	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.125	**0.025**	0.000	0.125	0.000	0.000
Pumpkinseed	**10.231**	19.625	11.875	0.750	4.625	1.125	44.500	11.375	8.625	0.250	13.250	**11.600**	0.875	2.500	4.000	2.750
Bluegill	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.125	3.625	0.125	0.250	**0.413**	0.125	0.375	0.125	0.000
Smallmouth bass	**0.000**	0.000	1.250	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.125**	0.000	0.000	0.000	0.000
Largemouth bass	**0.000**	0.250	1.750	0.000	0.000	0.000	0.000	0.000	0.375	1.375	2.125	**0.588**	1.000	1.250	0.125	0.000
Black crappie	**0.000**	0.000	0.000	0.000	0.000	1.375	0.875	0.000	0.000	0.000	0.000	**0.225**	0.500	0.000	0.125	0.000
Lepomis sp.	**0.000**	0.000	0.000	0.000	0.000	13.375	0.000	0.000	0.000	0.000	0.000	**1.338**	0.000	0.000	0.000	0.000
Yellow perch	**372.617**	726.620	856.879	119.203	551.884	278.670	580.861	906.704	138.067	146.065	206.695	**451.165**	14.125	61.500	96.130	274.987
Walleye (Yellow pick	**7.333**	7.125	3.250	1.750	3.125	4.125	7.125	8.500	13.375	5.000	8.500	**6.188**	7.750	3.375	3.250	7.000
Johnny darter	**0.079**	0.000	1.750	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	**0.188**	0.000	0.000	0.000	0.125
Logperch	**0.046**	0.250	0.000	0.000	0.125	0.375	0.250	1.250	0.250	0.250	0.125	**0.288**	0.000	0.000	0.000	0.000
Brook silverside	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.875	**0.088**	0.000	0.375	0.125	0.000
Round goby	**0.000**	0.125	1.250	14.250	3.500	40.125	6.000	17.125	11.375	1.625	2.375	**9.775**	0.125	3.500	0.875	2.125
Freshwater drum	**2.773**	4.375	4.875	6.875	10.500	16.375	39.125	6.000	5.000	5.125	11.125	**10.938**	8.250	6.250	11.875	2.375
Slimy sculpin	**0.009**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Total catch	**792**	1380	1055	179	1233	466	1598	1749	996	1050	1285	**1099**	706	774	768	800
Number of species	**14**	15	14	12	14	14	16	16	17	17	17	**15**	16	18	18	14
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8

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

	Year														
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Longnose gar	**0.014**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Alewife	**120.590**	180.074	47.625	277.403	55.380	54.219	106.270	1037.631	217.123	16.250	447.062	**243.903**	1017.115	332.364	1099.888	511.081
Gizzard shad	**54.324**	32.000	20.875	11.875	1.375	22.000	62.100	29.250	109.387	47.539	20.500	**35.690**	53.000	453.242	67.765	0.125
Rainbow smelt	**0.028**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Northern pike	**0.028**	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000
White sucker	**1.028**	0.625	0.375	1.250	1.250	0.125	0.375	0.375	0.625	2.625	0.125	**0.775**	1.375	0.375	4.875	4.000
Lake chub	**0.000**	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000
Common carp	**0.278**	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.125	**0.025**	0.375	0.000	0.000	0.000
Emerald shiner	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	1.125	0.000	0.000
Spottail shiner	**29.194**	25.250	25.000	35.625	1.500	18.875	54.750	28.750	104.125	38.625	18.000	**35.050**	40.250	25.625	29.250	126.375
Brown bullhead	**24.250**	69.250	10.625	21.500	37.000	12.500	11.625	18.125	2.500	4.000	1.000	**18.813**	1.250	5.625	27.580	13.250
Channel catfish	**0.083**	0.000	0.000	0.000	0.125	0.250	0.125	0.000	0.000	0.000	0.000	**0.050**	0.000	0.000	0.125	0.125
Ictalurus sp.	**0.000**	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000
American eel	**0.861**	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.250	0.125	0.000
Trout-perch	**35.125**	4.750	7.500	0.125	4.500	6.000	12.375	18.375	550.279	226.843	1.750	**83.250**	58.875	4.250	122.986	6.000
White perch	**273.179**	10.250	194.882	306.265	3076.179	237.616	794.071	226.216	298.129	811.713	25.250	**598.057**	658.175	276.439	341.366	27.250
White bass	**0.403**	0.000	0.000	0.500	1.625	1.250	4.250	0.375	0.000	1.250	0.250	**0.950**	4.500	0.750	0.000	0.125
Sunfish	**0.125**	0.375	0.000	0.000	0.000	0.000	1.375	0.000	0.125	0.000	0.000	**0.188**	0.000	0.000	0.000	0.000
Rock bass	**0.014**	0.125	1.750	0.250	0.000	0.000	0.000	0.000	0.000	0.500	0.250	**0.288**	0.000	0.125	0.250	0.000
Pumpkinseed	**15.042**	118.095	17.500	67.500	19.500	14.750	15.500	19.125	11.500	30.500	11.000	**32.497**	26.000	3.750	9.375	36.500
Bluegill	**0.014**	0.500	0.125	4.500	0.000	0.125	0.875	0.375	0.000	0.250	1.250	**0.800**	2.750	3.875	1.750	0.125
Smallmouth bass	**0.500**	0.500	0.125	1.000	1.250	0.625	0.250	0.000	0.000	0.250	0.000	**0.400**	0.125	0.000	0.000	0.000
Largemouth bass	**0.083**	0.000	1.125	0.000	0.250	1.125	2.125	0.000	0.125	0.375	2.750	**0.788**	2.375	1.750	5.500	0.000
Black crappie	**0.028**	0.125	0.625	0.125	0.000	1.750	1.375	4.875	0.000	3.375	0.125	**1.238**	0.125	0.625	2.875	0.250
Lepomis sp.	**0.000**	0.000	0.000	0.000	0.000	483.734	0.000	1.000	0.250	0.000	1.875	**48.686**	0.000	0.000	3.250	0.250
Yellow perch	**320.934**	412.720	555.437	683.480	152.149	1031.209	638.509	1087.358	531.795	219.331	66.231	**537.822**	1466.894	126.916	247.843	425.715
Walleye (Yellow pick	**17.486**	12.500	2.875	7.500	15.125	5.000	5.250	9.875	19.875	15.875	1.875	**9.575**	11.875	4.875	3.500	22.375
Johnny darter	**0.403**	0.625	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.063**	0.000	0.000	0.000	0.250
Logperch	**0.278**	1.000	0.125	0.375	0.000	3.625	0.125	0.750	2.875	23.625	0.250	**3.275**	2.875	0.000	0.125	1.500
Brook silverside	**0.306**	0.000	0.000	0.000	0.000	0.750	0.000	0.000	0.000	0.000	3.000	**0.375**	0.125	2.750	0.125	0.000
Round goby	**0.000**	1.250	11.500	16.125	20.625	117.305	4.625	4.250	4.500	2.750	1.625	**18.456**	1.625	13.875	2.000	0.375
Freshwater drum	**9.111**	16.500	1.875	15.375	15.625	8.250	22.000	24.000	10.125	11.500	0.875	**12.613**	7.375	7.125	10.375	2.625
Total catch	**904**	887	900	1451	3403	2021	1738	2511	1863	1457	605	**1684**	3357	1266	1981	1178
Number of species	**16**	21	19	19	16	22	20	17	16	19	21	**19**	20	20	21	19
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8

TABLE 1.3.11. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Big Bay** (5 m depth), Bay of Quinte. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated.

	Year															
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Longnose gar	**0.111**	0.000	0.000	0.000	0.000	0.000	0.000	0.250	0.000	0.000	0.000	**0.025**	0.000	0.000	0.000	0.000
Alewife	**33.495**	0.000	224.952	0.000	407.516	35.750	13.000	0.375	190.282	37.875	332.829	**124.258**	52.055	122.472	313.093	100.931
Gizzard shad	**228.179**	0.000	52.250	23.250	58.375	25.875	2.250	2.250	68.745	0.000	66.222	**29.922**	52.250	82.732	3.375	0.125
Rainbow smelt	**0.039**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Northern pike	**0.056**	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000
White sucker	**4.031**	0.750	2.875	1.125	1.375	0.875	0.125	0.375	0.375	0.625	3.750	**1.225**	2.500	2.000	1.250	2.875
Moxostoma sp.	**0.007**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Common carp	**0.545**	0.250	0.000	0.500	0.375	0.250	0.875	0.125	0.375	0.000	1.000	**0.375**	1.375	0.375	0.125	0.000
Emerald shiner	**0.042**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Spottail shiner	**16.069**	12.125	63.625	8.875	20.250	56.250	18.625	15.375	10.625	19.500	37.625	**26.288**	53.750	92.750	11.000	82.728
Brown bullhead	**29.570**	16.375	32.625	38.000	23.750	12.125	54.625	9.750	8.750	3.000	4.750	**20.375**	4.250	1.875	6.375	7.875
Channel catfish	**0.151**	0.000	0.125	0.000	0.000	0.125	0.375	0.000	0.000	0.000	0.000	**0.063**	0.000	0.000	0.125	0.500
Ictalurus sp.	**0.000**	0.375	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.038**	0.000	0.000	0.000	0.000
American eel	**0.337**	0.125	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.025**	0.000	0.000	0.000	0.000
Trout-perch	**23.320**	1.375	9.125	5.000	3.125	21.625	21.000	14.000	65.875	67.750	45.625	**25.450**	86.750	40.875	64.250	643.990
White perch	**446.656**	18.250	793.237	145.125	1499.098	554.616	1252.318	363.567	456.729	1117.116	190.786	**639.084**	1552.354	240.164	540.939	34.250
White bass	**1.221**	0.000	2.125	0.000	0.250	2.625	3.875	0.250	0.750	8.250	0.375	**1.850**	2.375	0.375	0.750	0.625
Sunfish	**1.708**	50.000	0.000	0.000	0.000	0.000	25.250	0.000	9.750	0.000	0.000	**8.500**	0.000	0.000	0.000	0.000
Rock bass	**0.000**	0.000	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000
Pumpkinseed	**18.612**	83.875	64.125	67.625	36.625	3.750	6.875	1.875	5.750	12.125	5.875	**28.850**	10.250	4.500	16.250	2.125
Bluegill	**1.930**	124.875	13.625	14.625	0.750	9.625	6.750	16.000	3.875	10.375	4.250	**20.475**	13.000	3.250	2.125	2.250
Smallmouth bass	**0.032**	0.125	0.250	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.038**	0.000	0.000	0.000	0.000
Largemouth bass	**0.000**	0.000	0.250	0.000	0.250	0.000	0.000	0.000	0.125	1.500	1.625	**0.375**	0.125	9.500	1.000	0.000
Black crappie	**0.356**	0.625	0.500	0.375	0.375	1.000	2.625	0.250	0.125	0.250	0.000	**0.613**	0.000	0.000	0.000	0.000
Lepomis sp.	**0.000**	0.000	66.625	0.000	0.000	1060.443	0.000	4.125	56.481	41.500	170.465	**139.964**	0.500	59.625	5.250	10.750
Yellow perch	**62.998**	381.125	153.463	107.650	200.266	90.623	99.395	33.750	660.643	197.790	184.258	**210.896**	435.501	121.071	82.625	577.728
Walleye (Yellow pick	**10.485**	7.500	6.125	19.250	16.875	6.500	8.125	8.750	28.125	10.750	7.250	**11.925**	26.750	11.000	4.125	23.375
Johnny darter	**0.037**	1.250	0.250	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.150**	0.000	0.000	0.000	0.000
Logperch	**0.053**	0.125	0.000	0.250	0.000	0.000	0.125	0.250	3.250	2.250	0.000	**0.625**	0.125	0.000	0.125	3.125
Brook silverside	**0.069**	0.000	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.375	**0.050**	0.000	1.125	0.625	0.000
Round goby	**0.000**	0.000	0.125	1.375	15.750	9.500	4.750	50.423	1.125	0.625	0.375	**8.405**	0.750	1.625	0.625	0.375
Freshwater drum	**10.894**	21.750	24.375	9.000	15.625	125.520	178.465	139.361	14.625	11.625	51.500	**59.185**	15.750	31.500	22.750	4.125
Total catch	**891**	721	1511	442	2301	2017	1700	661	1586	1543	1109	**1359**	2310	827	1077	1498
Number of species	**18**	18	23	15	17	18	20	19	20	17	18	**19**	18	18	20	16
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8

TABLE 1.3.12. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Belleville** (5 m depth), Bay of Quinte. Catches are the mean number of fish observed for the number of trawls indicated. Total catch and number of species caught are indicated.

	Year														
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Sea lamprey	**0.014**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Longnose gar	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.000	**0.600**	0.000	0.000	0.000	0.000
Alewife	**92.034**	0.250	82.375	0.125	11.500	13.875	9.750	0.125	34.875	78.782	59.821	**29.148**	128.250	24.750	272.438	0.000
Gizzard shad	**266.440**	99.204	234.375	46.029	581.893	50.571	88.327	73.318	326.992	321.441	500.849	**232.300**	920.843	708.151	1011.184	0.000
Rainbow smelt	**0.111**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Northern pike	**0.111**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Mooneye	**0.014**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
White sucker	**2.648**	0.375	0.375	0.500	0.125	0.000	0.750	0.250	0.250	0.125	0.625	**0.338**	0.125	0.000	0.375	0.250
Common carp	**0.319**	0.125	0.125	0.625	0.000	0.500	0.625	0.250	0.125	1.000	1.500	**0.488**	0.000	0.375	0.125	0.125
Spottail shiner	**71.584**	10.625	21.500	4.750	3.875	13.250	23.875	3.750	17.375	33.375	8.125	**14.050**	26.750	2.750	13.500	9.250
Brown bullhead	**17.824**	32.000	10.875	5.375	17.875	15.000	14.875	9.375	6.000	2.750	6.250	**12.038**	1.250	1.125	1.250	2.375
Channel catfish	**0.069**	0.000	0.125	0.125	0.000	0.375	0.000	0.000	0.000	0.000	0.000	**0.063**	0.000	0.250	0.000	0.000
American eel	**0.194**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Burbot	**0.014**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Trout-perch	**78.532**	13.000	5.500	12.750	14.375	9.750	4.000	14.250	19.000	32.125	18.625	**14.338**	32.000	22.250	39.125	38.875
White perch	**306.900**	6.625	154.625	165.015	1930.129	476.087	880.660	338.969	845.077	1601.655	104.285	**650.313**	394.588	50.125	2494.625	24.375
White bass	**1.509**	0.125	3.000	1.625	3.625	2.000	6.000	0.250	1.000	13.375	3.875	**3.488**	13.750	0.750	2.000	1.875
Sunfish	**4.472**	48.125	0.000	14.625	0.000	0.000	14.500	0.000	42.125	0.000	0.000	**11.938**	0.000	0.000	0.000	0.000
Rock bass	**0.236**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.125	0.000	0.000	0.000
Pumpkinseed	**26.422**	21.750	5.125	1.875	4.125	1.750	1.125	0.875	0.500	0.250	0.375	**3.775**	0.500	0.125	0.375	0.125
Bluegill	**13.431**	0.250	0.500	0.125	0.000	0.375	1.250	1.875	0.000	0.000	0.625	**0.500**	0.375	0.000	0.125	3.625
Smallmouth bass	**0.296**	0.125	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.025**	0.000	0.000	0.000	0.000
Largemouth bass	**0.157**	0.125	0.375	0.250	0.625	0.375	0.000	0.125	0.625	0.000	1.500	**0.400**	0.375	0.375	3.875	0.000
Black crappie	**3.389**	0.375	0.000	0.000	0.250	0.125	2.000	0.375	0.250	0.125	0.000	**0.350**	0.000	0.000	0.000	0.000
Lepomis sp.	**0.014**	0.000	88.375	0.000	2.375	409.720	0.250	5.125	9.000	17.875	293.990	**82.671**	13.375	30.625	5.625	31.250
Yellow perch	**116.494**	37.875	53.250	14.250	66.250	47.375	14.625	78.750	214.729	44.375	300.513	**87.199**	637.039	21.750	40.750	681.156
Walleye (Yellow pick	**13.352**	5.375	0.750	8.500	2.625	2.000	2.750	8.625	18.125	3.500	10.375	**6.263**	8.750	3.500	0.750	18.625
Johnny darter	**1.481**	12.500	2.125	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**1.475**	0.000	0.000	0.000	0.125
Logperch	**0.347**	0.250	0.500	0.125	0.125	0.125	0.000	0.750	1.000	1.000	0.250	**0.413**	0.125	0.000	0.000	1.500
Brook silverside	**0.139**	0.000	0.500	0.000	0.000	0.000	1.250	0.000	0.000	0.000	8.500	**1.025**	0.125	2.000	0.000	0.000
Round goby	**0.000**	0.000	1.625	67.000	47.250	60.250	7.125	53.875	8.625	30.500	5.875	**28.213**	1.250	6.500	1.250	7.000
Freshwater drum	**23.412**	163.750	58.250	20.875	4.375	214.777	87.000	830.175	25.000	31.000	53.375	**148.858**	13.875	17.625	9.250	11.250
Sculpin sp.	**0.019**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Total catch	**1042**	453	724	365	2691	1318	1161	1421	1571	2213	1385	**1330**	2193	893	3897	832
Number of species	**19**	20	22	20	17	19	19	19	19	17	20	**19**	19	17	17	16
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8

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

	Year														
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**	2011	2012	2013	2014
Alewife	**66.911**	149.297	98.611	174.137	8.625	508.870	126.639	24.500	8.750	112.375	26.875	**123.868**	49.500	86.639	354.152	56.754
Gizzard shad	**165.299**	4.125	6.375	22.250	0.000	30.375	23.375	1.375	38.500	5.750	84.234	**21.636**	25.625	70.000	4.125	0.000
Rainbow smelt	**0.056**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Northern pike	**0.069**	0.000	0.000	0.000	0.000	0.125	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000
Mooneye	**0.056**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
White sucker	**3.000**	0.500	1.625	0.625	1.125	1.875	2.125	2.125	0.375	0.500	0.750	**1.163**	0.625	1.625	0.000	0.125
Minnow	**0.014**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Common carp	**0.278**	0.000	0.250	0.000	0.000	0.000	0.250	0.000	0.000	0.000	0.125	**0.063**	0.125	0.000	0.000	0.000
Spottail shiner	**88.467**	217.425	60.875	60.875	1.250	24.500	41.750	0.000	76.000	148.410	120.061	**75.115**	158.481	189.616	5.875	1.000
Brown bullhead	**26.431**	10.625	3.500	4.250	1.125	8.750	3.750	4.500	1.375	0.875	1.500	**4.025**	2.375	3.875	0.125	1.125
Channel catfish	**0.236**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.125	0.000	0.125
American eel	**0.250**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Banded killifish	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.125	**0.013**	0.000	0.000	0.000	0.000
Burbot	**0.000**	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000
Trout-perch	**27.139**	0.500	0.500	0.000	0.000	0.125	0.125	0.000	0.250	1.625	1.500	**0.463**	3.250	1.750	0.000	2.750
White perch	**321.116**	54.250	19.875	240.032	80.777	279.018	388.312	29.875	33.750	669.313	16.250	**181.145**	261.900	361.891	27.125	0.250
White bass	**0.403**	0.000	0.125	0.000	0.000	0.000	1.250	0.125	0.000	0.875	0.125	**0.250**	1.625	0.250	0.000	0.000
Sunfish	**13.764**	33.250	0.000	22.375	0.000	0.000	11.500	0.000	0.875	0.000	0.000	**6.800**	0.000	0.000	0.000	0.000
Rock bass	**0.889**	0.625	0.625	0.125	0.000	0.500	2.250	0.000	1.250	2.875	2.250	**1.050**	4.000	0.375	0.500	1.750
Pumpkinseed	**86.353**	84.750	32.250	88.887	56.794	46.750	20.000	77.522	143.790	66.250	62.250	**67.924**	67.062	40.125	118.617	20.000
Bluegill	**0.750**	1.125	0.500	1.500	0.875	0.375	3.875	5.250	2.625	0.625	5.125	**2.188**	11.875	1.000	3.875	2.500
Smallmouth bass	**0.556**	0.375	0.250	0.500	0.500	0.125	0.000	0.000	0.125	0.250	0.000	**0.213**	0.125	0.000	0.250	0.000
Largemouth bass	**2.236**	2.375	2.875	4.625	0.125	6.625	4.250	0.125	6.375	2.750	6.875	**3.700**	14.125	11.250	5.500	0.125
Black crappie	**1.681**	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.013**	0.000	0.000	0.000	0.000
Lepomis sp.	**0.764**	0.000	64.796	0.000	0.000	59.750	10.250	0.000	17.000	0.625	7.125	**15.955**	24.875	6.500	3.125	5.000
Yellow perch	**317.772**	200.638	239.014	544.694	186.465	340.868	130.139	584.825	769.635	1095.367	335.295	**442.694**	1169.504	278.565	892.895	525.098
Walleye (Yellow pick	**9.764**	9.625	3.625	10.500	1.500	1.875	0.750	4.750	7.375	6.125	2.125	**4.825**	8.000	9.000	0.000	16.000
Johnny darter	**5.458**	2.500	7.250	7.625	0.375	0.000	0.000	0.000	0.000	0.000	0.000	**1.775**	0.250	0.250	0.000	0.125
Logperch	**3.097**	2.000	0.000	15.250	4.250	52.750	0.625	5.625	23.375	32.375	6.875	**14.313**	24.375	4.750	2.625	48.750
Brook silverside	**0.000**	0.000	0.000	0.250	0.000	0.000	0.000	0.125	0.000	0.000	0.125	**0.050**	0.125	0.000	0.000	0.000
Round goby	**0.000**	0.000	0.000	2.875	8.500	13.125	5.250	0.750	12.375	34.125	7.375	**8.438**	18.750	12.125	1.875	19.750
Freshwater drum	**11.931**	6.750	3.625	2.000	0.375	4.125	4.875	9.500	1.500	4.875	1.375	**3.900**	2.125	1.125	0.000	1.500
Total catch	**1155**	781	547	1203	353	1381	781	751	1145	2186	688	**982**	1849	1081	1421	703
Number of species	**20**	20	19	19	15	19	20	15	19	19	21	**19**	22	20	14	18
Number of trawls		8	8	8	8	8	8	8	8	8	8		8	8	8	8

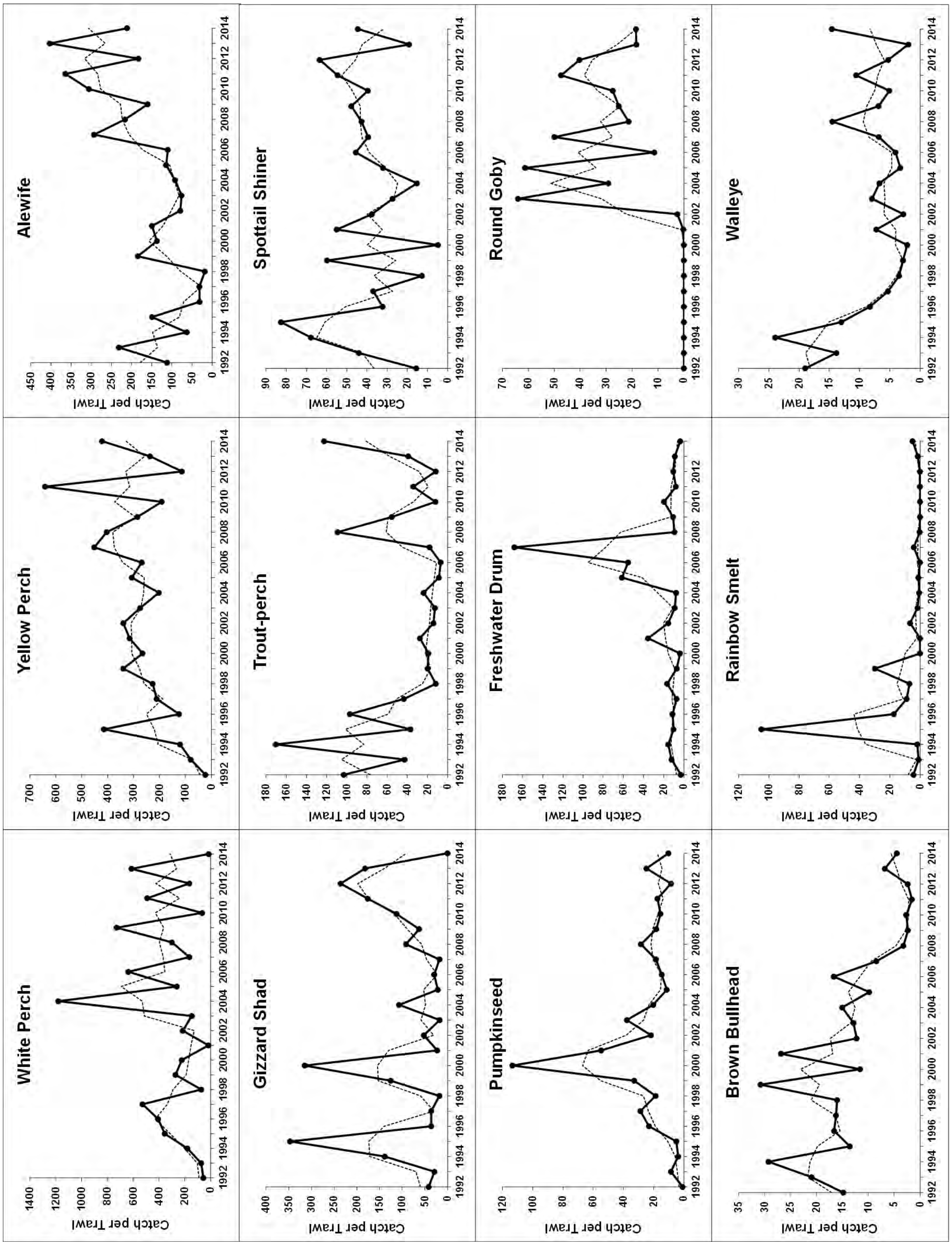


FIG. 1.3.2. Abundance trends (annual means) for the most common species caught in bottom trawls at six sites in the Bay of Quinte (Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton; see Fig. 1.3.1). Values shown here are 3-yr running averages (two years for first and last years graphed).

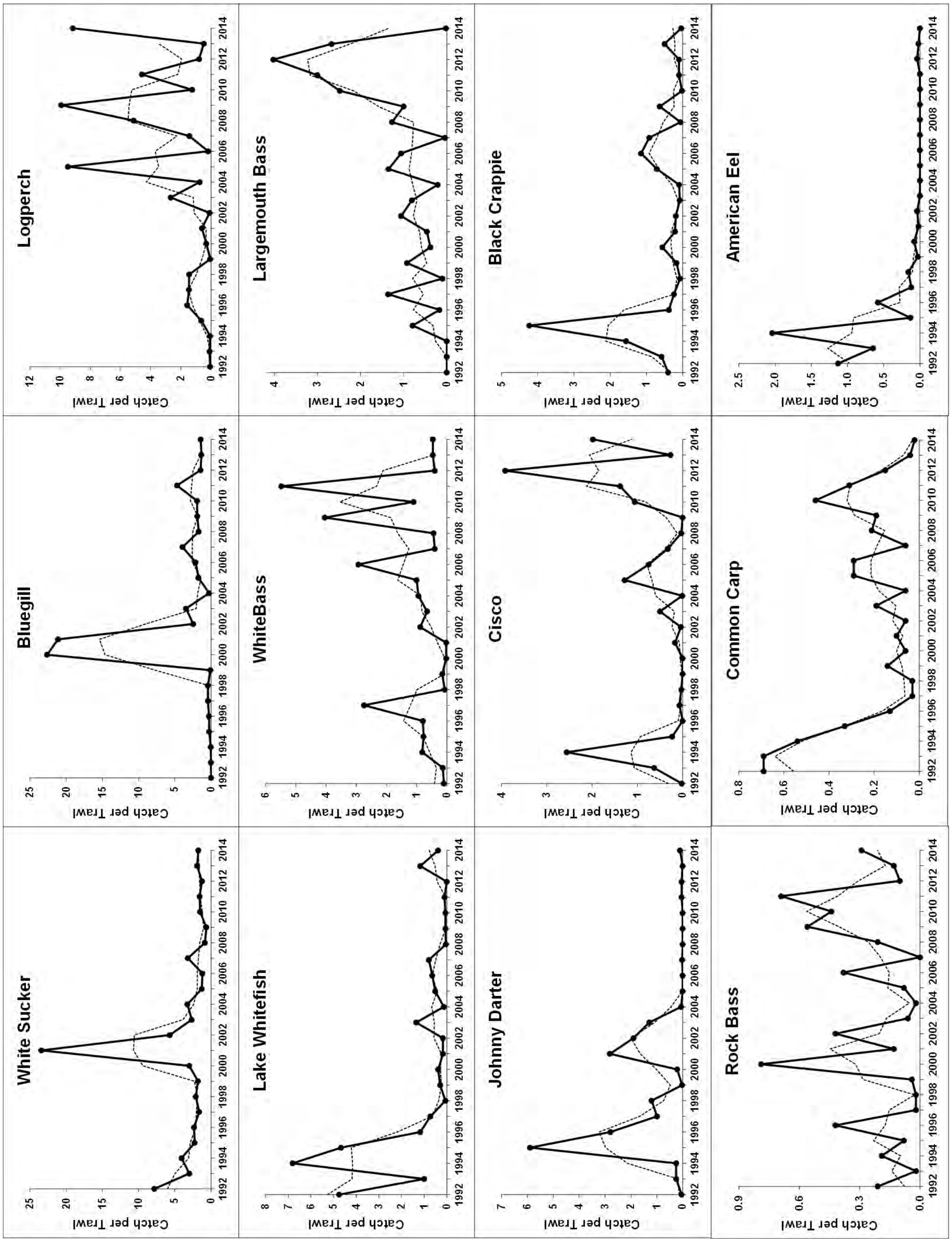


FIG. 1.3.2 (continued). Abundance trends for the most common species caught in bottom trawls at six sites in the Bay of Quinte (Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton; see Fig. 1.3.1). Values shown here are 3-yr running averages (two years for first and last years graphed).

TABLE 1.3.14. Mean catch-per-trawl of **age-0 Lake Whitefish** at two sites, Conway in the lower Bay of Quinte and EB03 near Timber Island in eastern Lake Ontario, 1992-2014. Four replicate trawls on each of two to four visits during August and early September were made at each site. Distances of each trawl drag were 1/4 mile for Conway and 1/2 mile for EB03.

	Conway	N	EB03 (Timber Island)	N
1992	23.4	8	0.9	12
1993	3.1	8	4.7	12
1994	40.5	8	79.7	8
1995	27.1	8	17.1	8
1996	2.6	8	0.8	8
1997	5.1	8	6.0	8
1998	0.4	8	0.0	8
1999	0.0	8	0.0	8
2000	0.4	8	0.0	8
2001	0.1	8	0.0	8
2002	0.1	8	0.0	8
2003	8.1	12	44.9	16
2004	0.0	12	2.1	12
2005	2.8	12	49.8	12
2006	2.4	12	3.6	8
2007	0.8	12	0.3	12
2008	0.1	12	0.0	8
2009	0.3	12	0.1	12
2010	0.3	12	4.7	12
2011	0.1	8	0.0	8
2012	0.0	8	0.0	8
2013	7.0	8	0.0	8
2014	2.3	8	0.0	8

TABLE 1.3.15. Mean catch-per-trawl of **age-0 Lake Herring** at Conway in the lower Bay of Quinte, 1992-2014. Four replicate trawls on each of two to four visits during August and early September were made at the Conway site. Distances of each trawl drag was 1/4 mile.

	Conway	N
1992	0.0	8
1993	1.5	8
1994	7.7	8
1995	1.3	8
1996	0.0	8
1997	0.0	8
1998	0.1	8
1999	0.0	8
2000	0.0	8
2001	0.0	8
2002	0.1	8
2003	2.8	12
2004	0.1	12
2005	7.2	12
2006	4.5	12
2007	2.0	12
2008	0.2	12
2009	0.0	12
2010	6.3	12
2011	8.3	8
2012	23.3	8
2013	1.5	8
2014	11.6	8

TABLE 1.3.16. Mean catch-per-trawl of **age-0 Yellow Perch** at six Bay of Quinte sites, 1992-2014. Four replicate trawls on each of two to three visits during August and early September were made at each site. Distance of each trawl drag was 1/4 mile.

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

TABLE 1.3.17. Mean catch-per-trawl of **age-0 Walleye** at six Bay of Quinte sites, 1992-2014. Four replicate trawls on each of two to three visits during August and early September were made at each site. Distance of each trawl drag was 1/4 mile.

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

TABLE 1.3.18. Age distribution of 193 **Walleye** sampled from summer bottom trawls, Bay of Quinte, 2014. 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 (years)	0	1	2	3	4	5	6	Total
Year-class	2014	2013	2012	2011	2010	2009	2008	
Number	146	35	9	1	1		1	193
Mean Fork Length (mm)	124	260	340	395	458		450	
Mean Weight (g)	19	179	426	676	1125		1003	

1.4 Lake Ontario Nearshore Community Index Netting

J. A. Hoyle, Lake Ontario Management Unit

The nearshore community index netting program (NSCIN) was initiated on the upper Bay of Quinte (Trenton to Deseronto), West Lake and Weller's Bay in 2001, and was expanded to include the lower Bay of Quinte (Deseronto to Lake Ontario) in 2002. In 2006, the NSCIN program was conducted on Hamilton Harbour and the Toronto harbour area thanks to partnerships developed with the Fisheries and Oceans Canada and the Toronto and Region Conservation Authority. NSCIN was further expanded to other Lake Ontario nearshore areas in subsequent years (Fig. 1.4.1). In 2014, three areas were completed: Hamilton Harbour, Toronto Harbour, and the upper Bay of Quinte (Fig. 1.4.2).

Annual NSCIN Trap Net Schedule on Lake Ontario

	Hamilton Harbour	Toronto Harbour	Prequille Bay	Weller's Bay	West Lake	East Lake	Prince Edward Bay	Bay of Quinte (upper)	Bay of Quinte (lower)	North Channel
2014	√	√						√		
2013					√	√	√	√		
2012	√	√						√		
2011								√	√	
2010	√	√						√		
2009							√	√	√	√
2008	√		√	√				√		
2007		√			√	√		√		
2006	√	√								
2005								√	√	
2004								√	√	
2003								√	√	
2002								√	√	
2001				√	√			√		

FIG. 1.4.1. Annual NSCIN trap net schedule for Lake Ontario nearshore areas, 2001-2014.

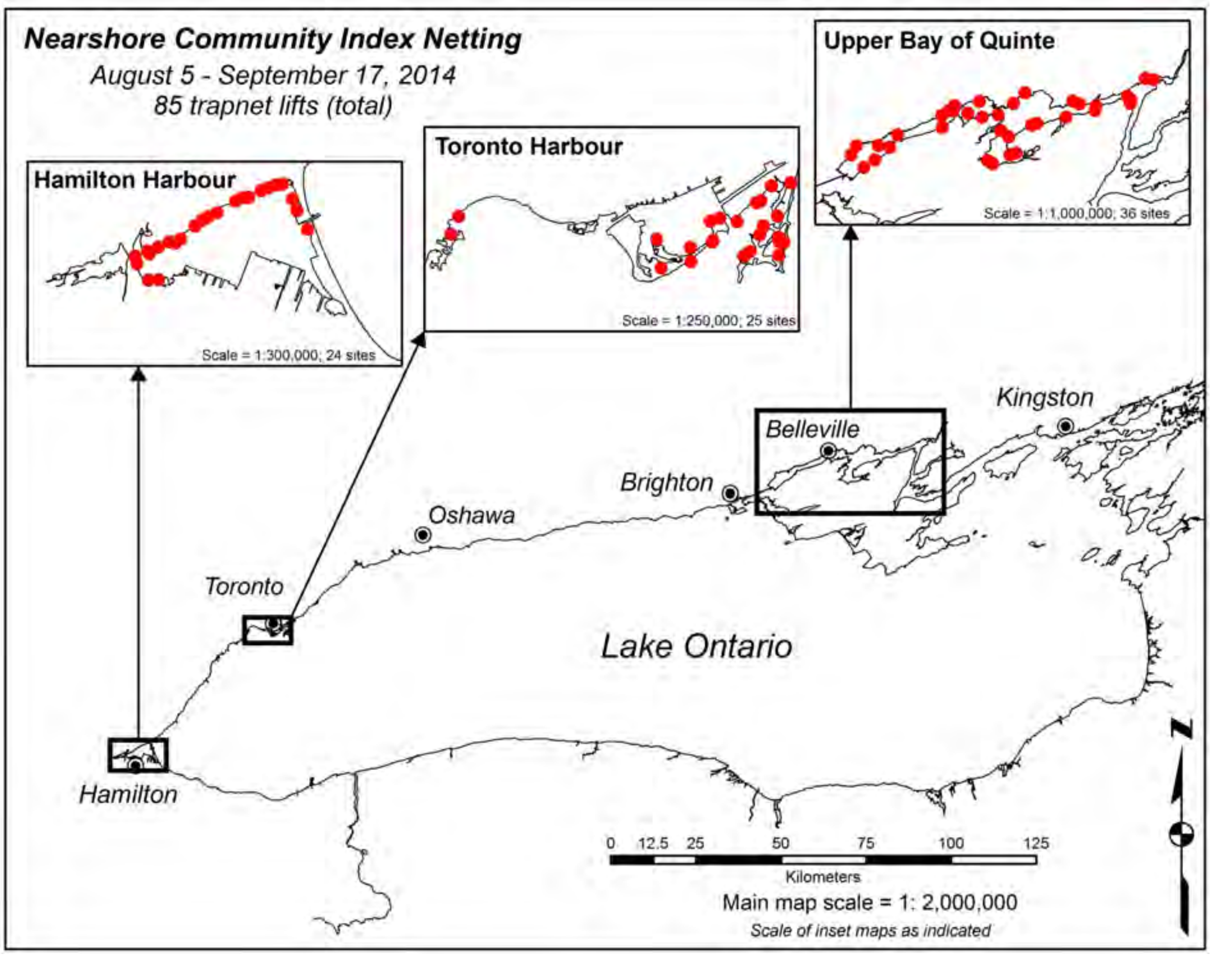


FIG. 1.4.2. Map of Lake Ontario indicating NSCIN trap net locations in Hamilton Harbour, Toronto Harbour, and the upper Bay of Quinte, 2014 .

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

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

Twenty-four trap net sites were sampled on Hamilton Harbour from Aug 5-14 with water temperatures ranging from 20.2-22.3 ^{o}C (Table 1.4.1). More than 12,000 fish comprising 25 species were captured (Table 1.4.2). The most abundant species by number were Brown Bullhead (6,041), White Perch (4,063) and Channel Catfish (1,190). Two American Eel were captured; their total lengths were both 697mm.

The age distribution and mean length by age-class of selected species are shown in Tables 1.4.3 and Table 1.4.4. Abundance trends for all species are presented in Table 1.4.5 and graphically for selected species in Fig. 1.4.3. Of particular note was the strong showing of age-2 Walleye from the 2012 stocking event.

Toronto Harbour *(partnership program with Toronto and Region Conservation Authority)*

Twenty-four trap net sites were sampled on Toronto Harbour from Sep 8-18 with water temperatures ranging from 15.2-19.1 ^{o}C (Table 1.4.1). Nearly 2,600 fish comprising 24 species were captured (Table 1.4.2). The most abundant species by number were Brown Bullhead (1,772), Alewife (442), Pumpkinseed (62), Yellow Perch (55), and Common Carp (50). Two American Eel were captured; their total lengths were 731 and 821 mm respectively.

Brown Bullhead and American Eel catches were higher in 2014 than prior years. Pumpkinseed and Largemouth Bass abundance was lower (Table 1.4.5 and Fig. 1.4.3).

Upper Bay of Quinte

Thirty-six trap net sites were sampled on the upper Bay of Quinte from Sep 2-Oct 19 with water temperatures ranging from 15.0-22.9 ^{o}C (Table 1.4.1). Over 4,400 fish comprising 23 species were captured (Table 1.4.2). The most abundant species by number were Bluegill

TABLE 1.4.1. Survey information for the 2014 NSCIN trap net program on Hamilton Harbour, Toronto Harbour and the upper Bay of Quinte. Shown for each embayment are the survey dates, the range of observed surface water temperatures, the total number of trap net lifts, and the number of trap net lifts broken down by target sampling depth, and observed substrate and cover types.

		Hamilton Harbour	Toronto Harbour	Upper Bay of Quinte
Survey dates		Aug 5-14	Sep 8-18	Sep 2-Sep 19
Water temperature range (^{o}C)		20.2-22.3	15.2-19.1	15.0-22.9
No. of trap net lifts		24	24	36
No. of lifts by depth:				
	Target (2-2.5 m)	12	11	15
	> Target	6	10	16
	< Target	6	3	5
No. of lifts by substrate type:				
	Hard	5	9	25
	Soft	19	15	11
No. of lifts by cover type:				
	None	2	5	0
	1-25%	10	13	12
	26-75%	12	5	24
	76-100%	0	1	0

TABLE 1.4.2. Species-specific catch in the 2014 NSCIN trap net program in Hamilton Harbour, Toronto Harbour, 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.

	Hamilton Harbour				Toronto Waterfront				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)
Longnose gar	0.167	0.122	47	748	0.167	0.109	57	815	1.417	0.650	26	824
Bowfin	1.542	0.956	21	628	0.125	0.078	71	597	1.306	0.690	22	584
Alewife	0.708	0.217	63	161	17.708	8.094	12	146				
Gizzard shad	1.208	0.576	33	315	0.333	0.161	60	331	0.250	0.126	52	364
Atlantic salmon					0.042	0.029	100	540				
Brown trout	0.042	0.029	100	430	0.125	0.091	55	647				
Northern pike	0.250	0.189	36	680	0.958	0.670	23	704	0.278	0.170	40	604
Muskellunge									0.028	0.019	100	1020
Quillback	0.083	0.059	69	445								
White sucker	2.167	0.808	31	262	1.250	0.830	21	431	0.722	0.417	27	398
Bigmouth buffalo	0.042	0.029	100	670								
Silver redhorse					0.042	0.029	100	540	0.472	0.262	35	491
Shorthead redhorse									0.167	0.105	49	407
Greater redhorse	0.083	0.059	69	375					0.111	0.080	48	453
Goldfish	0.583	0.421	26	334								
Common carp	2.250	1.313	19	553	2.000	1.184	21	646	0.250	0.157	40	599
Brown bullhead	251.708	79.751	9	275	69.125	4.052	24	291	6.083	3.776	10	273
Channel catfish	49.583	7.160	15	403	0.042	0.029	100	690	0.528	0.241	40	572
American eel	0.083	0.047	100	685	0.083	0.059	69	775	0.278	0.157	42	745
White perch	169.292	84.446	7	204	0.042	0.029	100	220	0.194	0.114	50	213
White bass	0.750	0.376	36	273	0.208	0.155	41	293				
Rock bass	2.000	1.174	21	170	2.000	1.132	22	154	4.917	2.029	17	167
Pumpkinseed	1.000	0.495	33	134	4.375	1.123	32	106	15.250	7.822	9	134
Bluegill	14.958	7.553	12	153	0.958	0.269	57	136	75.806	36.118	6	133
Smallmouth bass					0.083	0.047	100	355	0.028	0.019	100	160
Largemouth bass	0.125	0.091	55	330	0.708	0.358	40	195	3.583	1.904	14	239
Black crappie	0.083	0.059	69	235	0.708	0.484	27	164	5.361	2.729	12	233
Yellow perch	1.083	0.650	27	224	2.625	1.102	27	175	4.944	1.482	20	179
Walleye	2.458	1.503	18	417	0.125	0.091	55	453	1.333	0.741	21	496
Freshwater drum	1.083	0.508	36	450	0.833	0.506	29	616	0.944	0.508	25	519
Total catch per net	503				105				124			
Number of species	25				24				23			
Number of nets	24				24				36			
Total catch	12080				2512				4473			

Table 1.4.3. Age distribution of selected species caught in Hamilton Harbour, the Toronto Harbour, and the upper Bay of Quinte, 2014.

		Year-class / Age (years)							
		2013	2012	2011	2010	2009	2008	2007	2006
Location	Species	1	2	3	4	5	6	7	8
Hamilton Harbour									
	Northern Pike	1		1	1	1		2	
	White Bass		14	2	2				
	Pumpkinseed	5	6	5	3	1			
	Bluegill		11	5	9	4	1		
	Largemouth Bass		1	1	1				
	Black Crappie	1				1			
	Yellow Perch	1	22	2					
	Walleye		30						
Toronto Islands									
	Northern Pike	3	4	1	3	2	1	2	1
	Pumpkinseed	2	15	2	4				
	Bluegill	2	4	3					
	Smallmouth Bass			1				1	
	Largemouth Bass	11		1	2				
	Black Crappie	4	5	4	1	1			
	Yellow Perch	6	14	7					
	Walleye		3						
Upper Bay of Quinte									
	Northern Pike	1	1	3	2	3			
	Pumpkinseed			7	12	9	2		
	Bluegill			10	14	5	1	1	
	Largemouth Bass	12	5	6	5	1	1		1
	Black Crappie	4	10	16	3				
	Yellow Perch			9	18	2	1	1	
	Walleye		1	16			2	3	1

Table 1.4.4. Mean fork length (mm) of selected species caught in Hamilton Harbour, the Toronto Harbour, and the upper Bay of Quinte, 2014.

		Year-class / Age (years)							
		2013	2012	2011	2010	2009	2008	2007	2006
Location	Species	1	2	3	4	5	6	7	8
Hamilton Harbour									
	Northern Pike	499		706	609	608		772	
	White Bass		251	325	322				
	Pumpkinseed	114	119	145	140	170			
	Bluegill		141	152	162	170	166		
	Largemouth Bass		291	330	353				
	Black Crappie	147				311			
	Yellow Perch	162	217	267					
	Walleye		388						
Toronto Islands									
	Northern Pike	507	638	662	728	789	757	834	781
	Pumpkinseed	95	112	124	136				
	Bluegill	93.5	137	143					
	Smallmouth Bass			294				403	
	Largemouth Bass	143		289	353				
	Black Crappie	116	164	182	217	221			
	Yellow Perch	144	178	194					
	Walleye		440						
Upper Bay of Quinte									
	Northern Pike	497	584	584	656	585			
	Pumpkinseed			123	139	149	162		
	Bluegill			128	143	149	158	173	
	Largemouth Bass	199	263	285	350	362	396		426
	Black Crappie	135	210	247	268				
	Yellow Perch			178	190	207	208	227	
	Walleye		372	437			508	579	592

TABLE 1.4.5. Species-specific abundance trends (mean catch per trap net) in Hamilton Harbour, Toronto Harbour, and the upper Bay of Quinte. Annual total catch per net lift, number of net sets, and number of species are also indicated.

	Hamilton Harbour					Toronto Waterfront					Upper Bay of Quinte												
Species	2006	2008	2010	2012	2014	2006	2007	2010	2012	2014	2001	2002	2003	2004	2005	2007	2008	2009	2010	2011	2012	2013	2014
Longnose gar	0.47	0.71	0.28	0.67	0.17	0.17			0.04	0.17	0.25	0.33	1.14	1.94	0.39	2.92	0.36	0.44	1.56	0.50	2.08	0.19	1.42
Spotted gar			0.04																				
Bowfin	0.58	1.17	2.42	1.17	1.54	0.33	0.08	0.46	0.42	0.13	0.36	0.14	0.58	0.53	0.25	0.92	1.11	0.50	0.81	0.75	0.50	0.92	1.31
Alewife				0.04	0.71	3.79	4.58	0.42	9.50	17.71													
Gizzard shad	3.42	0.50	2.38	2.13	1.21	2.71	0.42	0.04	1.08	0.33	1.11	1.44	2.00	0.06	20.42	0.39	1.00	0.06	0.64	0.14	0.33	0.06	0.25
Chinook salmon						0.08																	
Rainbow trout	0.05	0.04						0.04															
Atlantic salmon										0.04													
Brown trout					0.04	0.04			0.08	0.13													
Lake trout	0.05													0.03									
Lake whitefish															0.03								
Coregonus sp.				0.25																			
Northern pike	1.11	1.08	1.08	0.29	0.25	1.17	0.83	1.38	1.25	0.96	1.03	0.58	0.86	0.69	0.64	0.44	0.33	0.28	0.83	0.78	0.53	0.28	0.28
Muskellunge		0.04																					0.03
Mooneye											0.03												
Suckers	0.05																						
Quillback		0.04			0.08													0.03					
White sucker	0.11	0.21	0.46	0.29	2.17	4.17	3.83	2.29	1.13	1.25	1.03	1.47	1.72	1.25	1.11	0.44	0.92	0.64	0.44	0.42	0.72	0.86	0.72
Bigmouth buffalo	0.05				0.04																		
Silver redhorse		0.04								0.04			0.69	0.81	0.28	0.64	0.50	1.44	0.44	0.17	0.47	0.83	0.47
Shorthead redhorse	0.11	0.04	0.25			0.04							0.08	0.47	0.25	0.19	0.33	0.36	0.06	0.19	0.08	0.31	0.17
Greater redhorse					0.08								0.22	0.06			0.08	0.06		0.44	0.28	0.83	0.11
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										
Minnow		0.04																					
Goldfish	0.32	0.92	2.71	0.88	0.58	0.04		0.04															
Common carp	4.47	3.92	2.20	1.21	2.25	1.58	2.50	4.75	3.67	2.00	0.08	0.11	0.28	0.08	0.11	0.19	0.22	0.19	0.33	0.22	0.47	0.25	0.25
Golden shiner											0.03		0.03		0.03		0.22		0.06	0.14	0.03	0.06	
Rudd				0.04																			
Black bullhead	0.05																						
Brown bullhead	380.79	189.33	482.67	76.25	251.71	32.63	14.79	8.42	198.00	69.13	167.67	95.83	37.33	20.83	17.89	7.25	6.42	2.56	10.56	13.69	7.11	15.28	6.08
Channel catfish	34.84	15.92	8.00	14.17	49.58	0.04		0.17	0.08	0.04	2.17	2.17	1.50	1.33	1.72	0.72	0.81	0.28	0.53	0.58	0.31	0.06	0.53
American eel					0.08					0.08	0.44	0.14		0.03	0.06					0.11	0.03	0.44	0.28
White perch	48.42	34.88	84.38	69.92	169.29	0.04		0.25	0.92	0.04	2.19	2.89	7.69	3.67	2.75	4.61	4.31	3.86	1.69	3.75	3.58	19.42	0.19
White bass	2.00	1.75	1.46	0.29	0.75	0.33		0.04	0.04	0.21	0.06	0.14	0.11	0.11	0.19	0.03	0.14			0.17	0.08		
Rock bass	0.58	1.08	1.48	1.17	2.00	0.33	1.13	2.58	4.75	2.00	0.92	0.67	0.64	0.58	0.50	4.83	3.97	3.89	2.44	4.50	1.08	7.97	4.92
Green sunfish	0.05																						
Pumpkinseed	0.68	1.13	3.33	2.04	1.00	7.29	16.29	7.67	12.75	4.38	89.39	73.08	26.94	15.33	15.97	18.61	18.14	23.42	29.08	37.53	28.11	14.72	15.25
Bluegill	4.05	3.21	9.08	14.42	14.96	0.54	3.96	1.13	2.04	0.96	169.58	142.64	66.25	75.19	44.44	63.92	159.11	71.75	61.50	136.03	74.92	53.56	75.81
Smallmouth bass	0.11		0.13			0.04	0.04	0.08	0.08	0.08	0.94	1.67	0.36	1.64	1.11	0.11	0.92	0.56	0.44	0.47	0.14	0.47	0.03
Largemouth bass	0.26	0.17	0.33	0.25	0.13	1.08	1.25	1.38	5.00	0.71	2.47	6.11	7.92	6.08	2.75	4.53	5.39	4.33	4.25	10.39	2.72	4.33	3.58
Black crappie	2.32	0.17	0.42	0.58	0.08	0.83	0.42	0.13	1.13	0.71	9.81	15.00	10.22	16.11	8.11	12.92	17.33	10.03	7.53	8.64	4.78	11.36	5.36
Yellow perch	0.11	0.63	4.16	0.25	1.08	1.08	5.96	2.63	20.63	2.63	3.75	3.42	1.94	0.83	1.00	4.72	7.00	2.64	6.11	6.25	1.31	2.69	4.94
Walleye	1.05	0.17	0.04		2.46	0.38	0.08			0.13	3.17	2.47	2.22	2.56	2.14	1.61	2.50	1.75	2.53	2.36	1.44	7.56	1.33
Round goby	0.05																						
Freshwater drum	1.37	1.71	1.24	0.33	1.08	1.08	1.29	0.83	0.63	0.83	6.36	3.31	3.81	2.14	4.36	1.25	1.17	1.89	1.97	1.67	2.19	0.94	0.94
Total catch per net	488	259	609	187	503	60	57	35	263	105	464	354	175	153	127	131	233	131	134	230	133	144	124
Number of net lifts	19	24	25	24	24	24	24	24	24	24	36	36	36	36	36	36	36	36	36	36	36	36	36
Number of species	28	25	22	21	25	24	16	20	20	24	24	21	25	25	25	22	24	23	21	25	25	24	23

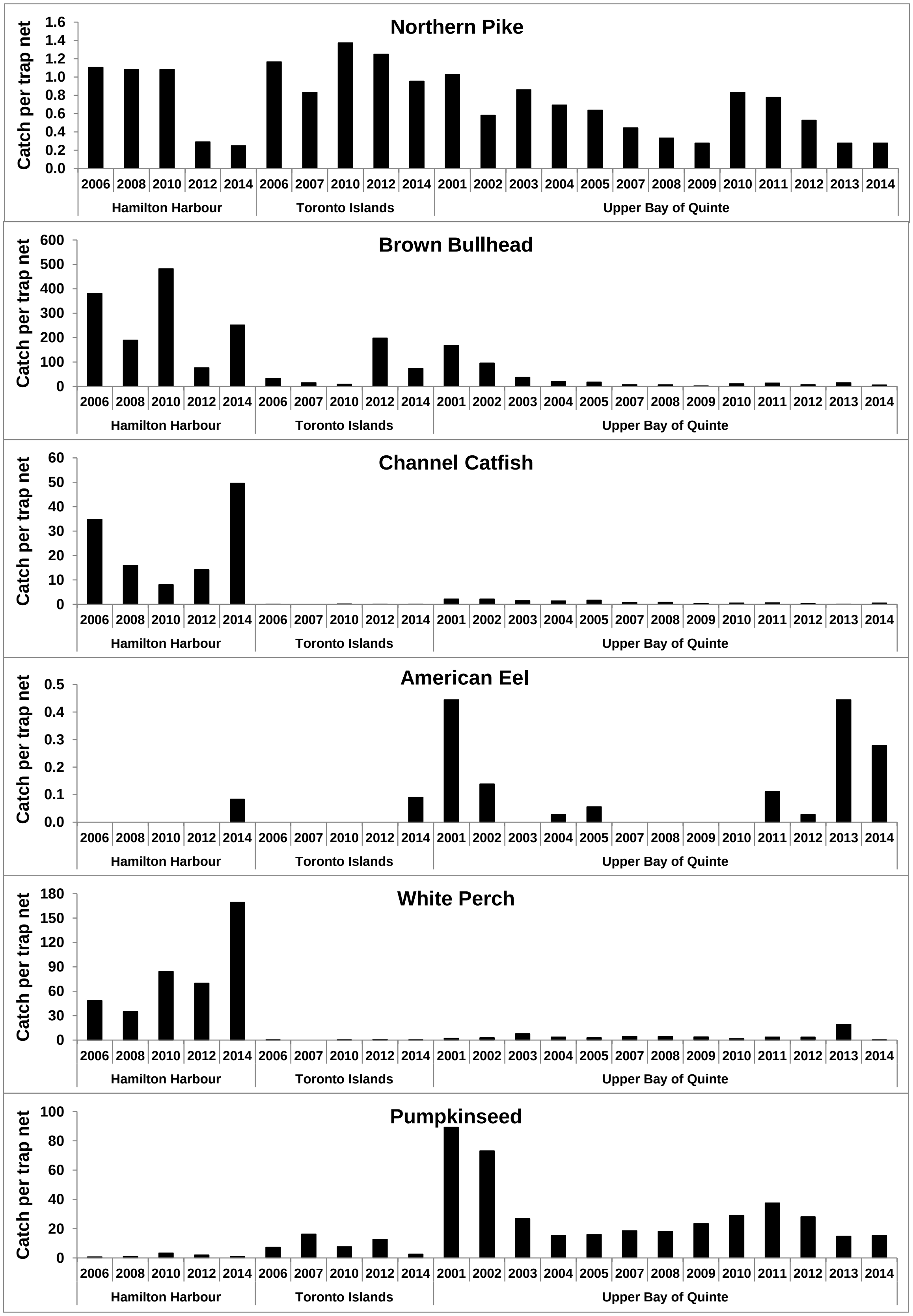


FIG. 1.4.3. Abundance trends for selected species caught in nearshore trap nets in Hamilton Harbour, Toronto Harbour, and the upper Bay of Quinte. Values shown are annual arithmetic means.

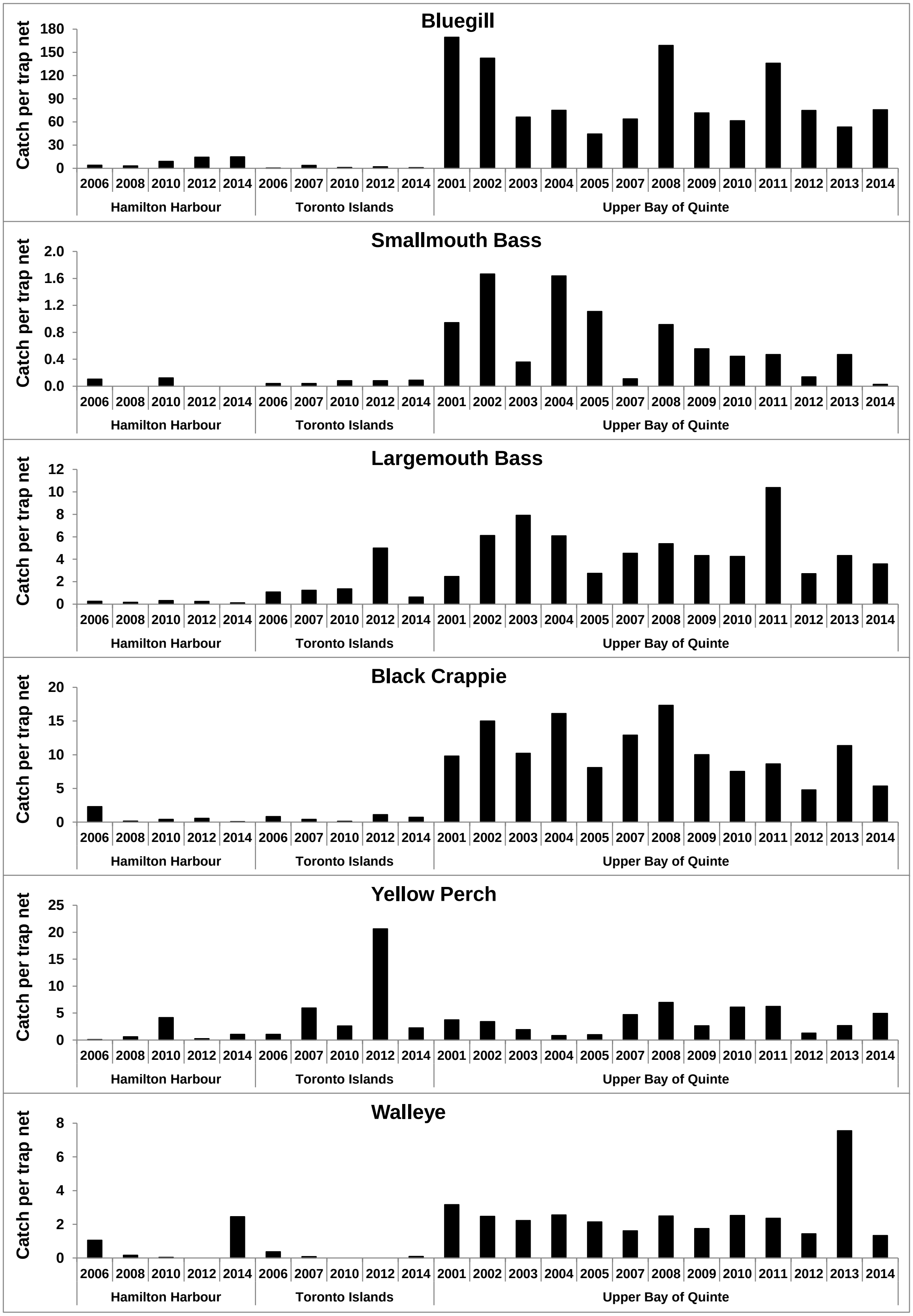


FIG. 1.4.3. (continued) Abundance trends for selected species caught in nearshore trap nets in Hamilton Harbour, Toronto Harbour, and the upper Bay of Quinte. Values shown are annual arithmetic means.

(2,729), Pumpkinseed (549), Brown Bullhead (219), Black Crappie (193), Yellow Perch (178), and Rock Bass (177). Ten American Eel were caught in 2014. These eel ranged in size from 632-800 mm total length and 725-1,462 g in weight.

Northern Pike abundance declined from 2001-2009, increased significantly in 2010, then declined through 2014. Brown Bullhead and Channel Catfish remained at low abundance. American Eel abundance has been relatively high the last two years. White Perch abundance was unusually high in 2013 but very few (7) were caught in 2014. Pumpkinseed, Bluegill and Largemouth Bass abundance was similar to recent years. Smallmouth Bass were very low in 2014. Black Crappie abundance declined in 2014 compared to 2013 while Yellow Perch abundance increased. Walleye abundance, having been unusually high in 2013, declined to low level in 2014 (Table 1.4.5 and Fig. 1.4.3).

Piscivore Biomass and Index of Biotic Integrity

Trophic structure and overall ecosystem health indicators are presented in Fig, 1.4.4 and 1.4.5).

A proportion of the fish community assemblage comprised of piscivores greater than 0.20 (biomass; PPB) reflects a healthy trophic structure. The PPB in 2014 was 0.10, 0.31 and 0.35 in Hamilton Harbour, Toronto Harbour, and the upper Bay of Quinte, respectively (Fig. 1.4.4).

The index of biotic integrity (IBI) is a measure of ecosystem health. IBI classes can be described as follows: 0-20 very poor, 20-40 poor, 40-60 fair, 60-80 good, and 80-100 excellent ecosystem health. The IBI was 50 (fair), 42 (fair), and 73 (good) in Hamilton Harbour, Toronto Harbour, and the upper Bay of Quinte, respectively (Fig. 1.4.5).

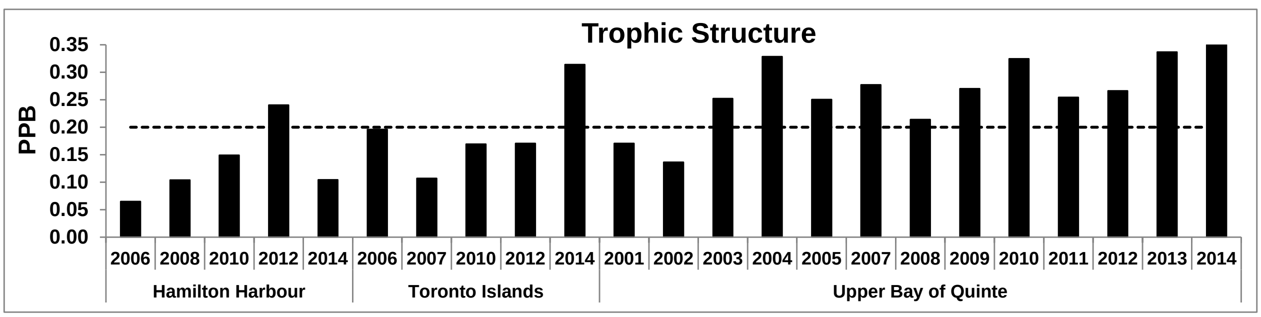


FIG. 1.4.4. Proportion of total fish community biomass represented by piscivore species (PPB) in the nearshore trap net surveys in Hamilton Harbour, Toronto Harbour, and the upper Bay of Quinte. A PPB>0.2 is indicative of a balanced trophic structure (depicted by a dashed line). Piscivore species included Longnose Gar, Bowfin, Northern Pike, Smallmouth Bass, Largemouth Bass, and Walleye.

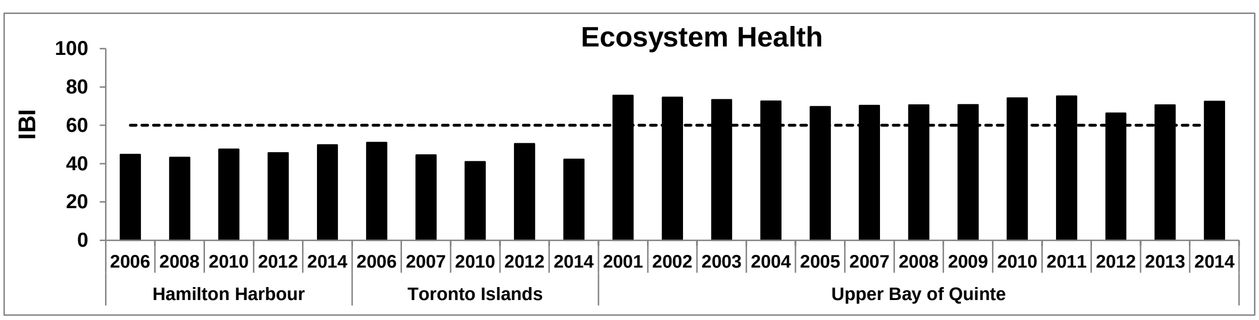


FIG. 1.4.5. Index of biotic integrity (IBI), as a measure of ecosystem health, in the nearshore trap net surveys in Hamilton Harbour, Toronto Harbour, and the upper Bay of Quinte. An IBI of 60 is depicted by a dashed line. IBI classes can be described as follows: 0-20 very poor, 20-40 poor, 40-60 fair, 60-80 good, and 80-100 excellent ecosystem health.

1.5 Lake-wide Hydroacoustic Assessment of Prey Fish

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

Hydroacoustic assessments of Lake Ontario prey fish have been conducted since 1991 with a standardized mid-summer hydroacoustic survey implemented in 1997. The survey is conducted jointly by the Ontario Ministry of Natural Resources and Forestry (OMNRF) and the New York State Department of Environmental Conservation (NYSDEC). Results from the hydroacoustic survey complement information obtained in spring bottom trawling surveys conducted in the U.S. waters of the lake, and provides whole-lake indices of abundance for Alewife, Rainbow Smelt, and *Mysis*. In addition the results 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. 1.5.1). Hydroacoustic data were collected beginning at approximately one hour after sunset from 10m depth on one shore and running to 10m of depth on the opposite shore at 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 100 m of water along the southern shore which has a much steeper slope than the northern shore. Temperature profiles and mysis hauls were conducted at multiple intervals along each

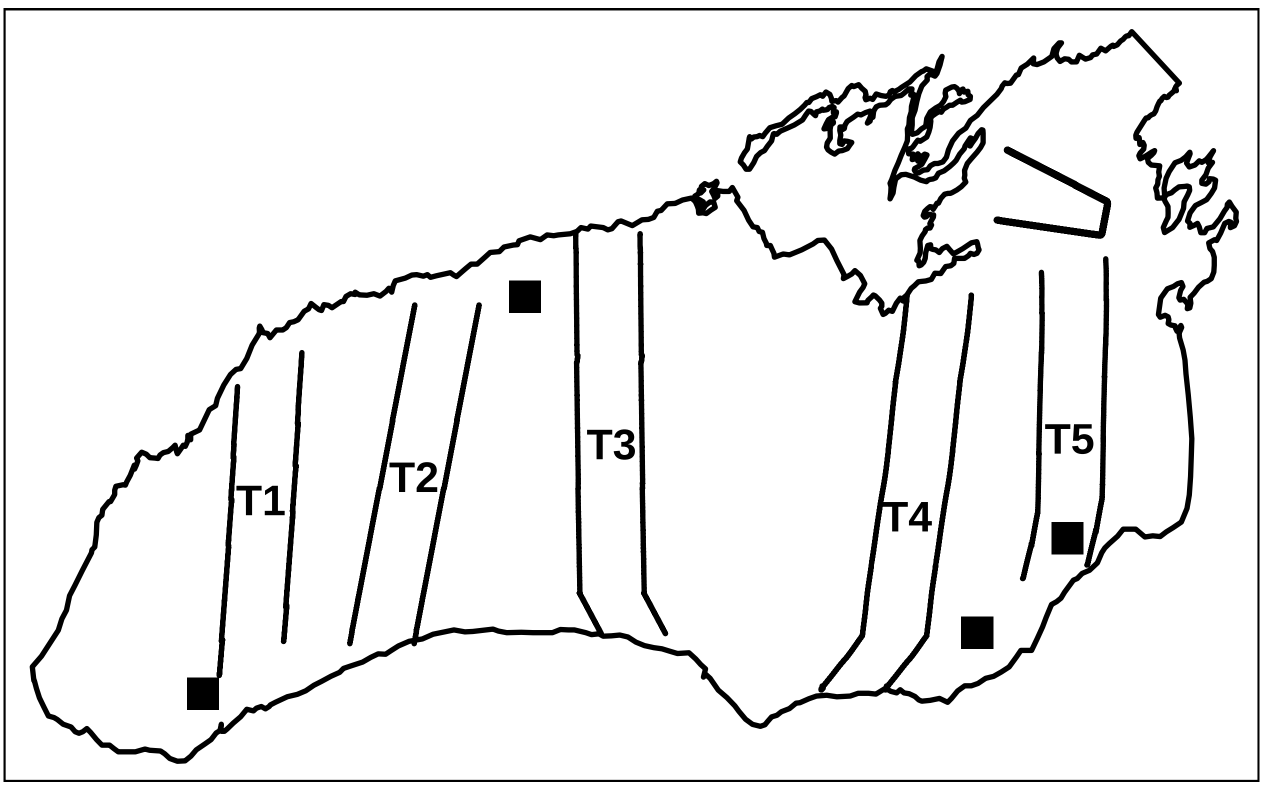


FIG. 1.5.1. The Lake Ontario Lake-wide prey fish survey uses cross-lake hydroacoustic transects. Transect corridors are logistically constrained but utilize a random starting point within the corridor for each annual survey. The filled squares represent additional transects that were used in 20143 for comparison of upward and downward looking acoustic methods.

transect. In the earlier years of the survey, mid-water trawls were conducted to collect fish for ground truthing vertical distribution of fish species and for estimating the average size of Alewife and Rainbow Smelt for calculating whole lake prey fish biomass, but in recent years floating vertical gillnets have been use more commonly to minimize effects of trawl net contamination.

The 2014 survey was conducted from July 20th to July 30th using two vessels, OMNRF's Ontario Explorer and NYSDEC's Seth Green. Acoustic data were 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. In addition to the six standard transects, four transects were added for comparisons between mobile down-looking and up-looking acoustics. Up-looking acoustic data collection was conducted with a BioSonics DT-X SUB echosounder system with a 120 kHz split-beam transducer on a tow-body attached to a trawl door towed at about 30 m depth facing towards the surface. Up-looking acoustics is part of an ongoing effort to address sampling issues arising from near-surface distribution of fish and vessel avoidance. Limnological and plankton sampling were also conducted at 5 stations (Fig. 1.5.2, Fig. 1.5.3) as a contribution to the Lake Ontario Biomonitoring Program which indexes phosphorus and plankton levels in the lake annually; and as an on-going partnership with Cornell University to investigate the potential for acoustic estimates of plankton biomass.

Data were processed with Echoview software (Myriax, version 6.1), using -64 dB volume backscattering strength and target strength thresholds. Abundance estimates are based on an area-weighted mean density estimates using echo integration.

The analytical methods for estimating density of Alewife and Rainbow Smelt have varied somewhat throughout the hydroacoustic program (1997-2014) but in general, hydroacoustic data was stratified by thermal layer and geographic zone. Prey fish-sized biomass in the upper layer (10°C depth to surface) are considered to be Alewife while prey fish-sized biomass in the lower layer (10°C to 100 m) is allocated as Rainbow Smelt. Past mid-water

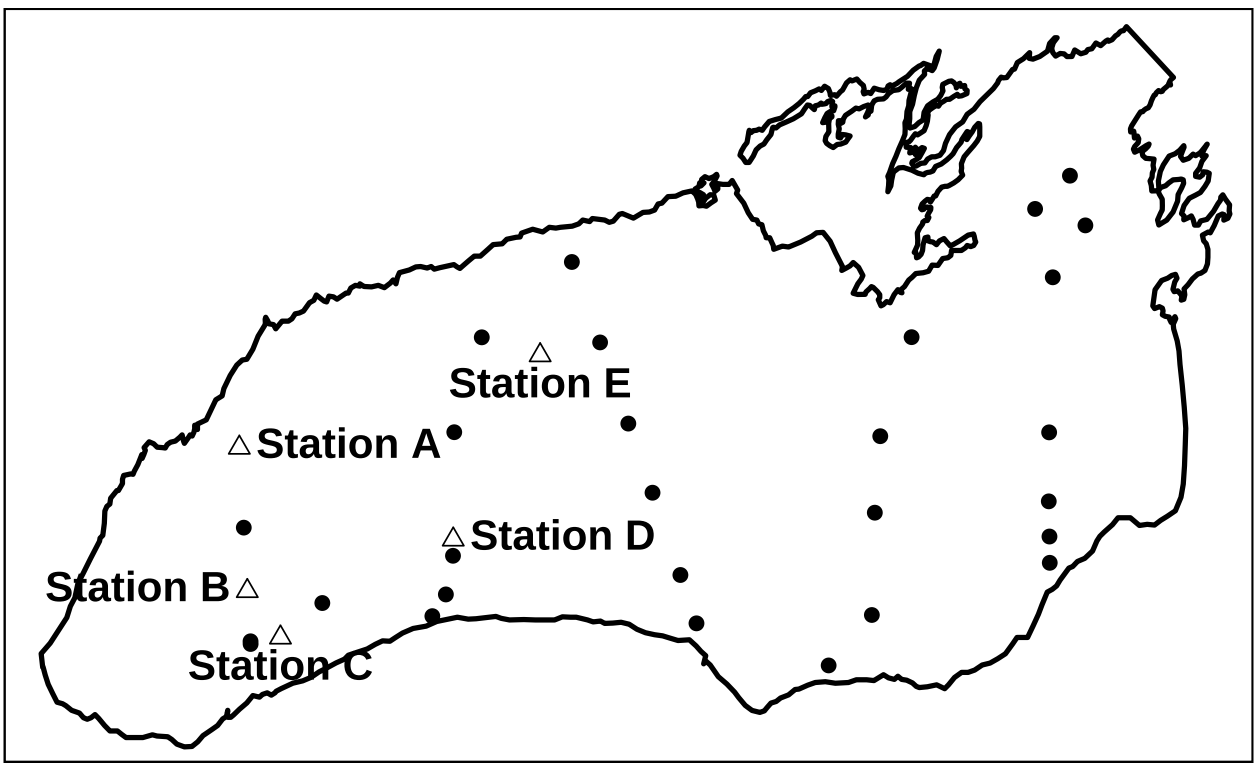


FIG. 1.5.2. Location of temperature profiles (filled circles), YSI and biological sampling stations (open triangles) to contribute to the Lake Ontario Biomonitoring Program.

trawling and vertical gillnetting during this survey and other independent surveys have demonstrated that Alewife and Rainbow Smelt are the two most abundant pelagic prey fish in these layers. Rainbow Smelt have traditionally been defined with acoustic target strengths between -55 and -28 decibels (dB). For Alewife, the scaled, integrated voltage estimates of total target abundance were split into 1 dB target strength (TS) bins according to results of single target analysis. The abundances of yearling and older fish (YAO) were apportioned from the resulting target strength histograms by fitting normal curves to the three modes of the histogram using a solver routine which minimizes the partial sums of squares, and then calculating the proportions of each curve relative to the total target strength frequency distribution. In the layer above 10°C, histograms were processed to identify the proportions of targets in the mode at or around -41.4 dB (+/- 3.8 dB), which were assumed to be YAO Alewife. The solver routine however is sensitive to the approximation of initial starting conditions and the distribution of non-fish targets,

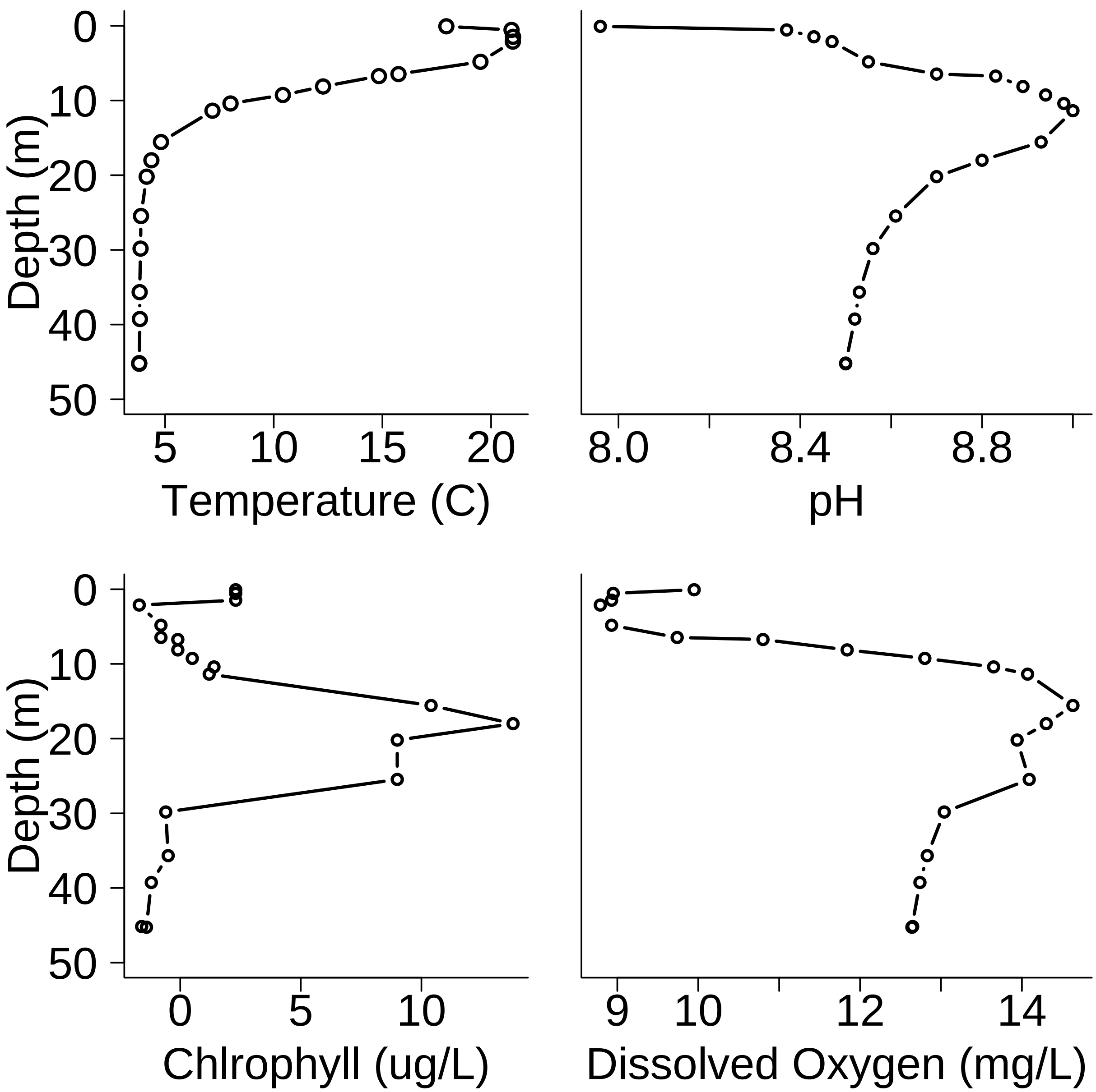


FIG. 1.5.3. A representative YSI profile of four parameters (temperature, pH, chlorophyll and dissolved oxygen) collected from Station D.

and the results can be affected by user judgment which makes it difficult to apply a standard method annually.

We are currently exploring alternative methods to analyze hydroacoustic data. For Rainbow Smelt changes under review include limiting the target strength range from -52 to -35 dB (rather than -55 to -28dB) which is a more realistic size distribution (60-250 mm, total length (TL)) for Rainbow Smelt observed in Lake Ontario. For Alewife, changes under review include 1) inclusion of target strengths as low -50 dB, as an alternative to the histogram method, since research has shown that in-situ alewife target strength can vary depending on the orientation of fish and the possibility that Alewife orientation is biased downward if Alewife are diving to avoid the vessel; 2) placing an upper limit on the target strength that we include in the density estimates to -35dB (rather than -28dB) which equals an Alewife that is about 240 mm (TL), a more realistic current maximum size of Alewife in Lake Ontario; and 3) using up-looking acoustics for estimating a correction factor to account for surface-oriented fish that may be missed by vessel avoidance and nearfield avoidance For both Rainbow Smelt and Alewife, we estimated a whole-lake mean density by bootstrapping the average target strengths and densities in 200 m surface intervals rather than 6 geographical zones (used in the traditional approach). The bootstrap approach provides 95% confidence intervals around the mean. Overall we are working towards standardization of analytical methods throughout the time series that can produce more automated, reproducible results that will allow us to modify future analysis throughout the time series as we refine methods for accurate estimates of total prey fish in the lake.

Here we present the results of the yearling and older (YAO) Rainbow smelt index using three different analyses: 1) the historical approach described above producing an area weighted estimate of all targets between -55 and -28 dB (HIS, open circles); 2) area weighted estimate of all targets between -52 and -39 dB (AW, filled circles) and; 3) bootstrap estimate method (BO, filled triangles) that used 200 m horizontal bins and the same target strength range as AW. Throughout the comparative time series (2006-2014) the HIS method has generally produced higher estimates (Fig. 1.5.4) as would be expected considering the broader target strength spectrum. BO produces estimates slightly higher than AW but the two estimates are highly correlated ($R = 0.96$, $p<0.001$). All three estimates show a decline in Rainbow Smelt abundance in 2014 and all three estimates are the lowest observed in the series (2006-2014, 1997-2014 for HIS). The HIS method produced the highest estimate (16.0 million fish) followed by BO (10.7 million) and AW was the lowest (9.6 million). Mean Rainbow Smelt weight is determined from the NYSDEC and U.S. Geological Survey (USGS) summer Rainbow Smelt bottom trawling program. Mean weight declined from 5.8 g to 3.7 g resulting in mean biomass estimates of 0.03 (HIS), 0.01 (AW), 0.02 kg/ha (BO) (Fig. 1.5.5). Rainbow Smelt distribution continues to be highest in the eastern areas of the lake (Fig. 1.5.6).

Three analytical approaches to estimate YAO Alewife were used in 2014 and back-casted as far back as 2006 for comparison purposes. The traditional method is based on the solver routine as described above (SR, open circles); the area weighted density method (AW, filled circles) used a target strength range between -50 and -35; and the bootstrap method (BO, filled triangles) used 200 m horizontal bins and the same target strength range as AW. Throughout the time series (2006-2014) estimates from BO are marginally different than AW but are highly correlated ($R = 0.95$, $p < 0.001$) and both tend to produce estimates that are higher than SR.

A decline in Alewife abundance in 2014 is observed using all three analysis methods however estimates vary between methods (Fig. 1.5.7). The SR estimates a decline of 70% abundance from 2013 to 2014 (682 million to 199 million). The AW and BO estimates (600 million, 753 million respectively) are more conservative in the decline (33%, 13% respectively). Mean Alewife size for biomass estimates is determined from the NYSDEC and USGS spring Alewife trawling program. Despite an increase in mean Alewife size from 20.6 g to 21.7g overall biomass estimates indicate a decline (SR = 70%, AR = 19%, BO = 9%) (Fig. 1.5.8).

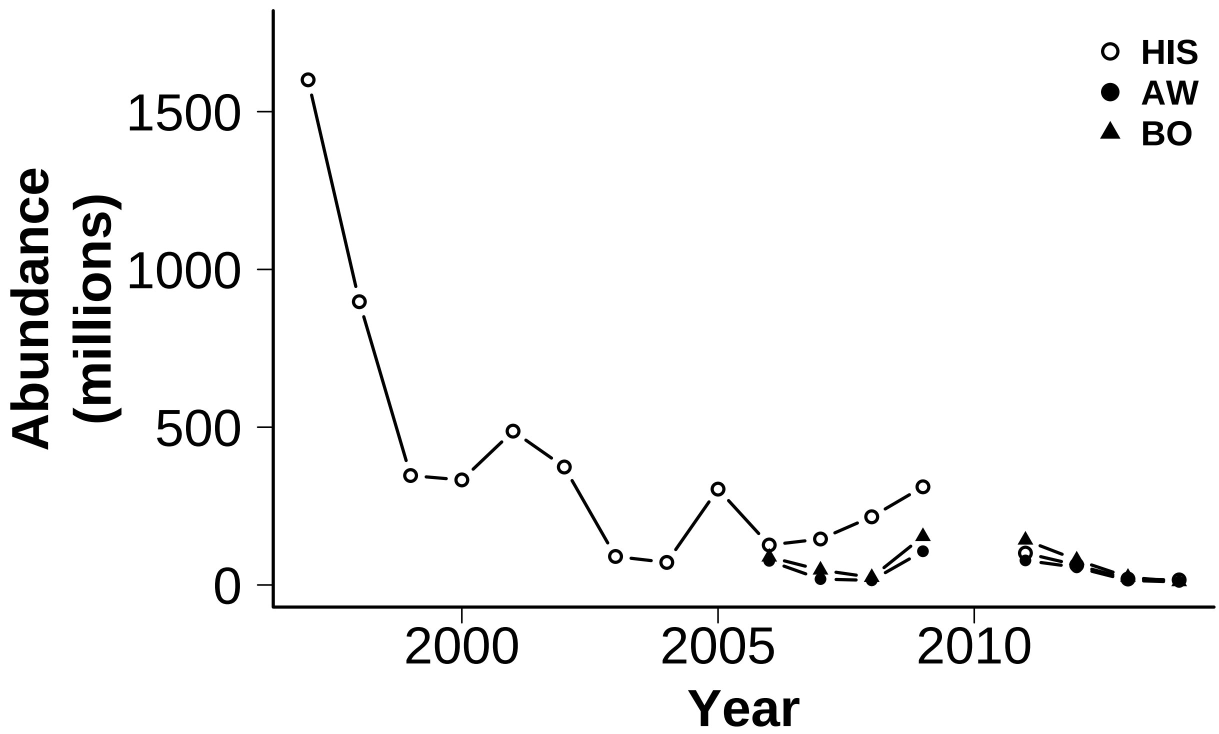


FIG. 1.5.4. Abundance (in millions of fish) of yearling-and-older Rainbow Smelt from 1997-2014. Abundance estimates are presented for three different methodologies: the traditional area-weighted abundance of targets between -55 and -28 dB (HIS, open circles); area-weighted abundance of targets between -52 and -39 dB (AW, filled circles) and a bootstrap approach using 200 m horizontal bins and targets between -52 and -39 dB (BO, filled triangles). Acoustic estimates were not conducted in 2010.

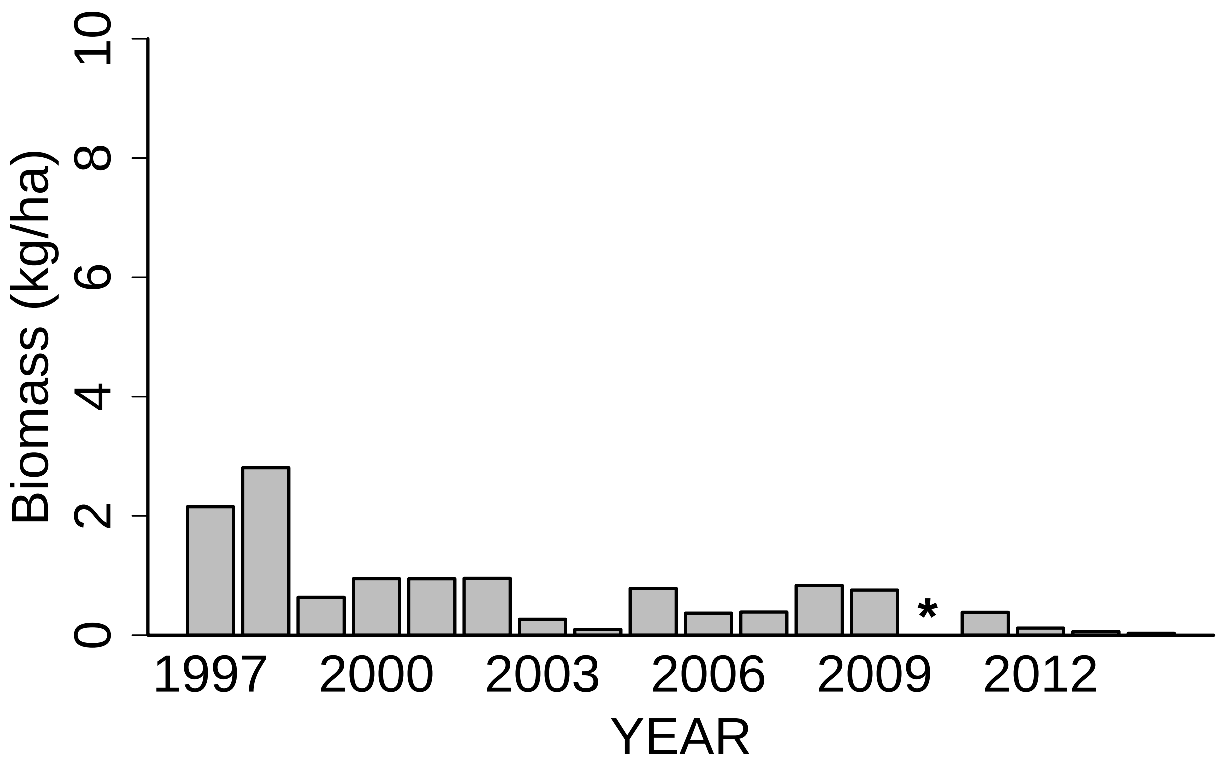


FIG. 1.5.5. Biomass (kg/ha) of Rainbow Smelt from 1997-2014. Biomass estimates were obtained by multiplying average weights of Rainbow Smelt measured during spring bottom trawling surveys for Rainbow Smelt by the area-weighted whole-lake hydroacoustic abundance estimates using targets between -55 and -28 dB. Acoustic estimates were not conducted in 2010.

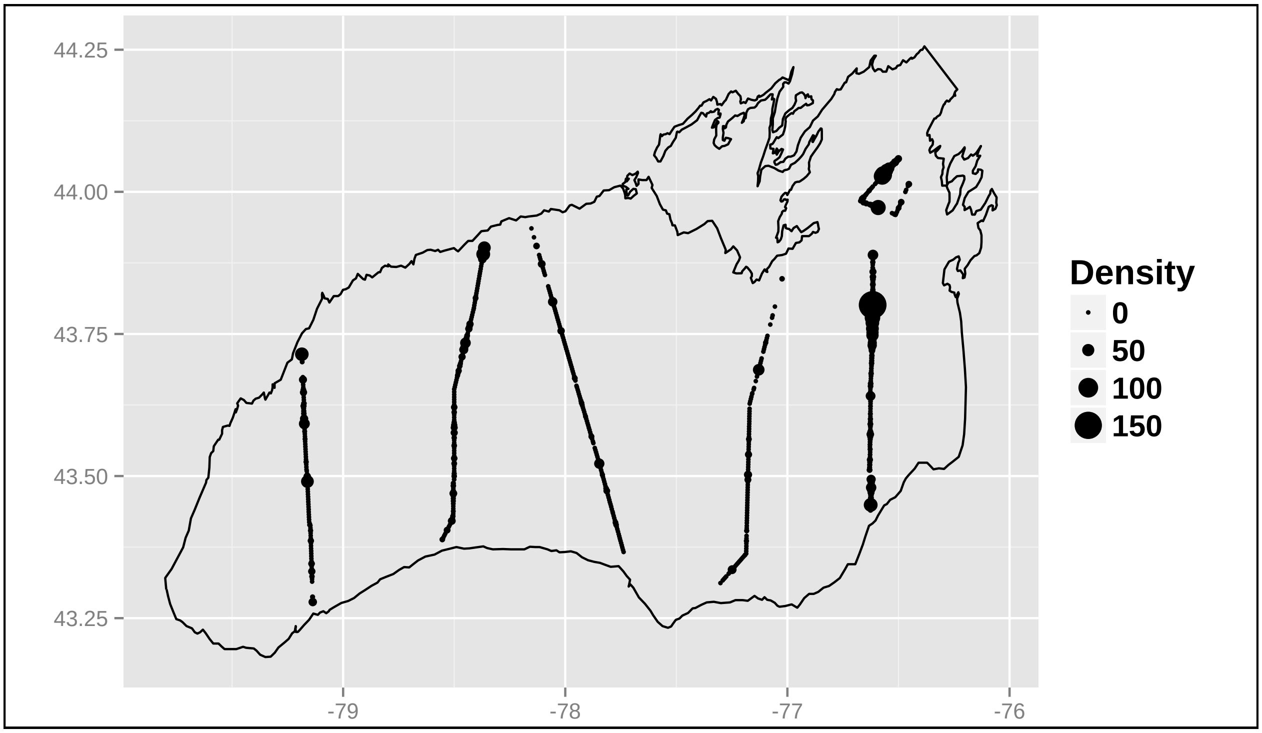


FIG. 1.5.6. Relative distribution of Rainbow Smelt (fish/ha) observed during the hydroacoustic survey in July 2014.

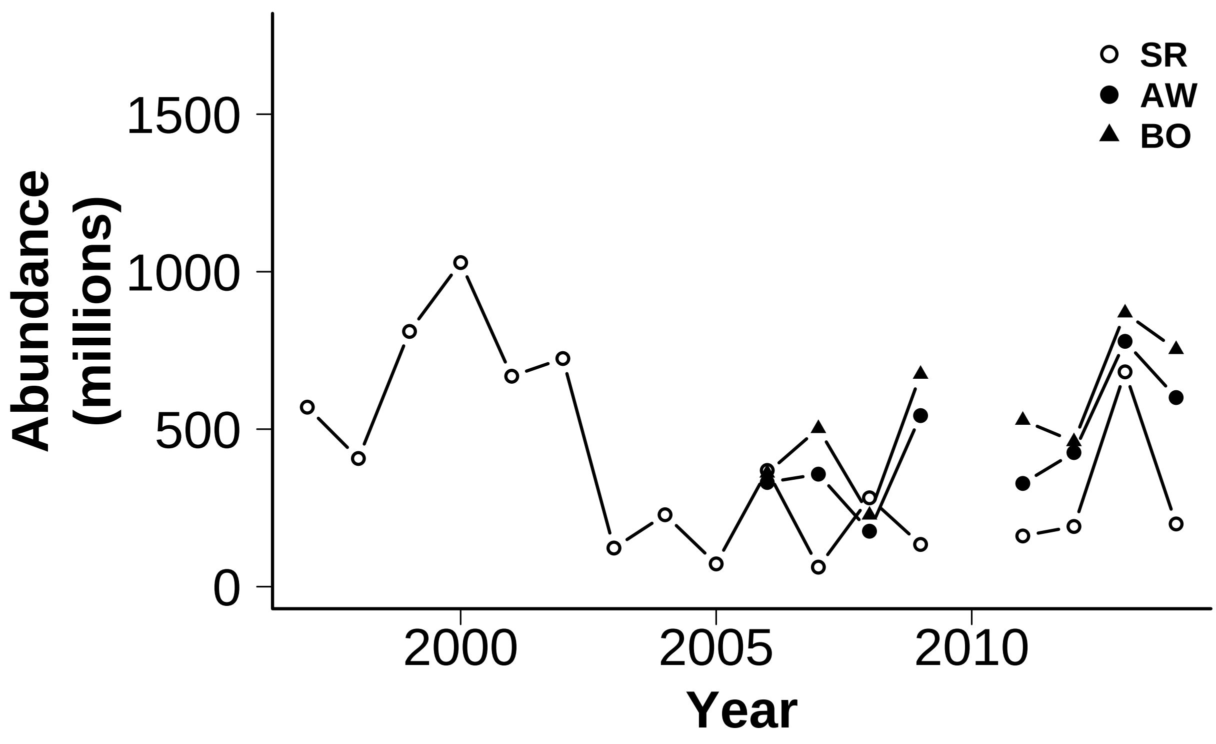


FIG. 1.5.7. Abundance (in millions of fish) of yearling-and-older Alewife from 1997-2014. Abundance estimates are presented for three different methodologies: area-weighted estimates using a solver routine to identify Alewife sized targets (SR, open circles); area-weighted abundance of targets between -50 and -35 dB (AW, filled circles) and a bootstrap approach using 200 m horizontal bins and targets between -50 and -35 dB (BO, filled triangles). Acoustic estimates were not conducted in 2010.

Alewife distribution during the survey period is presented in Fig. 1.5.9.

Comparison of Alewife acoustic biomass estimates to bottom trawl biomass estimates and energetic models suggest that acoustic estimates are biased low. One possible hypothesis is that acoustic estimates underestimate Alewife due to near surface schooling at night. Vertical gillnet data suggest that a significant portion of the biomass can be found in the surface to 4 m layer that is not sampled by traditional down-looking acoustics. Upward looking acoustics have been used to estimate the near-surface biomass not captured by traditional down-looking acoustics. Comparing target densities between up and down-looking echograms at 2m depth intervals during simultaneous pinging supports the hypothesis that a significant number of fish inhabit the 0-2 m and 2-4 m layers (Fig. 1.5.10). For the single transect represented in Fig. 1.5.10, traditional down-looking estimates would need to be corrected by a factor of 1.37 to account for targets in the 0-4 m layer identified by up-looking acoustics.

Hydroacoustics has been conducted in Lake Ontario since 1991 to provide an index of pelagic prey fish abundance, and like other assessment surveys, this survey has done that using a fairly consistent approach to provide trend through time data. Increasingly, however there is a strong interest by Great Lakes scientists in knowing the total abundance and biomass of prey fish (and predators). As with other assessment gears (e.g. gill nets, bottom trawls) making the transition from relative abundance to absolute densities requires rigorous testing of assumptions of gear catchability. Recent research has identified some challenges (e.g., surface blind spot and boat avoidance) to using the traditional down-looking hydroacoustic approach for achieving accurate, whole-lake estimates of Alewife however we are working with our partners to address these issues by employing vertical gill nets and up-looking acoustics to estimate correction factors for surface -oriented fish and conduct experiments to determine whether boat avoidance by Alewife is important (planned for 2015 by the USGS Lake Ontario Biological Station). Acoustic estimates of

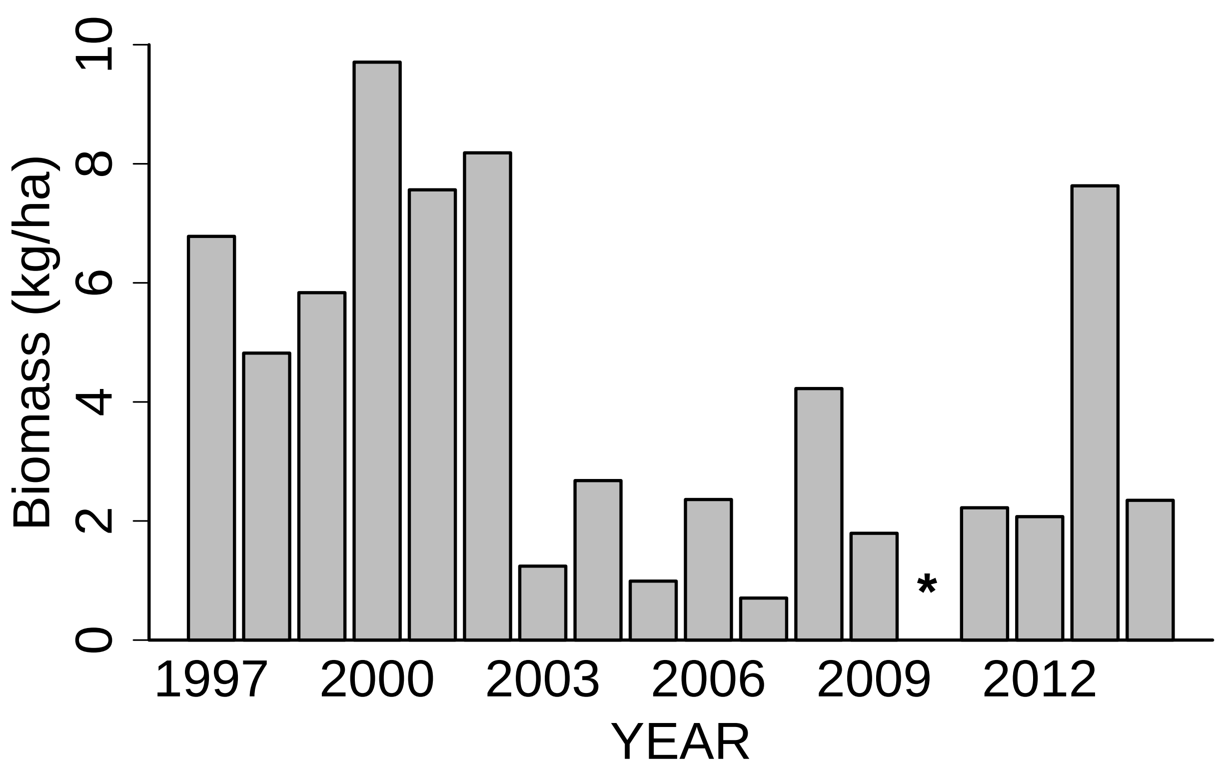


FIG. 1.5.8. Biomass (kg/ha) of Alewife from 1997-2014. Biomass estimates were obtained by multiplying average weights of Alewife measured during spring bottom trawling surveys for Alewife by the area-weighted whole-lake hydroacoustic abundance estimates of Alewife. Acoustic estimates were not conducted in 2010.

Rainbow Smelt biomass however are promising as preliminary research suggests a high degree of correlation with bottom trawl surveys. Research has also identified new opportunities including estimating the abundance of other important animals in the lake Ontario foodweb like Mysis and zooplankton. Comparisons between *Mysis* densities using nets and acoustics were very similar in 2005, 2006, and 2008, and acoustics provides continuous sampling and information about spatial horizontal and vertical distribution which would not otherwise be possible.

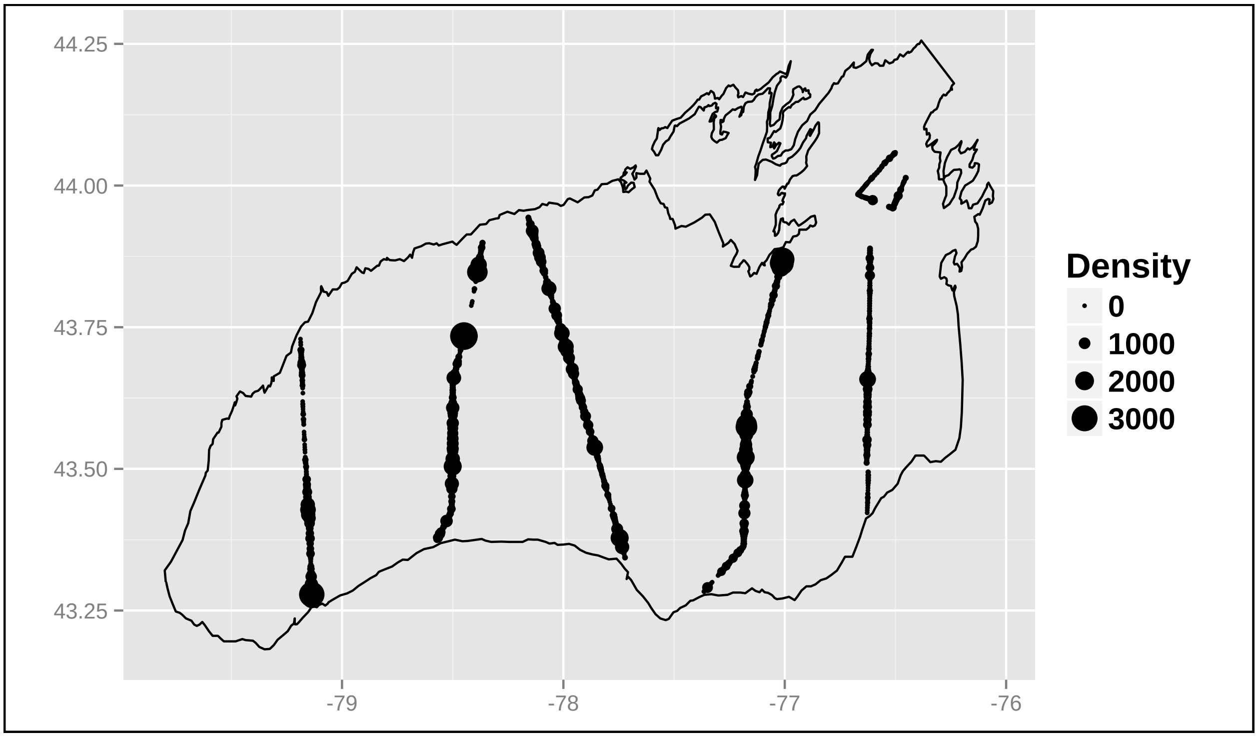


FIG. 1.5.9. Relative distribution of Alewife (fish/ha) observed during the hydroacoustic survey in July 2014.

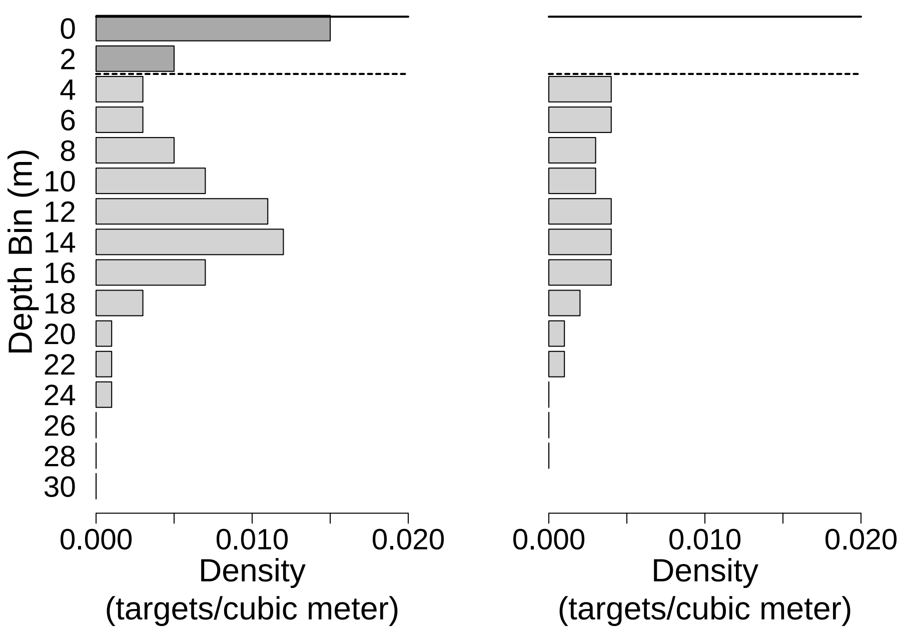


FIG. 1.5.10. Comparison depth stratified estimates of fish distribution from simultaneous towed up-looking and down-looking acoustics.

1.6 St. Lawrence River Fish Community Index Netting—Lake St. Francis

R. G. Green, Lake Ontario Management Unit

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

In 2014, the survey was conducted during the period of September 8-18. Thirty-six nets were deployed, using standard multi-panel gillnets with monofilament meshes ranging from 1 ½ to 6 inches at half-inch increments. The nets were fished for approximately 24 hours. In total, 832 fish were caught comprising 12 species (Table 1.6.1). The average number of fish per set was 23.1; down 23% from 2012. The number of fish per set continued to decline from the record high in 2008, and is now comparable to levels observed in the late 1990s (Fig. 1.6.1). The dominant species in the catch continued to be Yellow Perch (72.1% of the catch), followed by Rock Bass (12.9%; Fig. 1.6.2). Common White Sucker (5.4%), Smallmouth Bass (2.9%) and Walleye (3.5%) accounted for a slightly higher percentage of the catch compared to 2012 (Fig. 1.6.2). Despite 2012 exhibiting the highest observed catches of Largemouth Bass in the time series, no Largemouth Bass were caught in 2014.

Species Highlights

Catches of Yellow Perch continued to decline from peak levels seen previously in 2008 and 2010 (Fig. 1.6.3). Current Yellow Perch catch per net (16.67) is comparable to the 1984-2014 survey average (17.03; Table 1.6.1). An increase in the catch of large fish (>220 mm) observed in 2008 has been followed by continued decline from 2010 to 2014 (Fig 1.6.3). The catch per net of large fish (1.89) decreased in 2014 from 3.72 in 2012 (Fig 1.6.3). Yellow Perch catch in 2014 contained fish from age-2 to age-10 with the majority (86%) of individuals age-2 and 3 (Fig. 1.6.4). Yellow perch begin to be classified as large individuals (>220 mm) at age-4 and greater with the current growth rate (Fig. 1.6.4).

In 2014, catches of Northern Pike increased from 2012 but continued to remain at low levels overall (Fig. 1.6.4). Northern Pike encountered in 2014 were predominantly (55%) age-5 and older (Fig. 1.6.6). Catches of small fish (<=500 mm) continue to remain low, suggesting a recruitment problem with the population. A Northern Pike age -0 was encountered in 2014 (Fig. 1.6.6) for the first time since the sharp decline observed in 2002. Northern Pike age-1 and 2 were not encountered in 2012 however an individual of both age-1 and 2 were encountered in 2014 (Fig. 1.6.6). Northern Pike abundances declined sharply from 2000 to 2002. In general, abundances continued to decline and are presently 10% of levels observed in the 2000s.

Smallmouth Bass abundance increased slightly from 2012 (Fig. 1.6.7) but remains below the 1984-2014 catch per net average (0.74; Fig. 1.6.7). Walleye catches in 2014 were similar to 2012 catches and remained above the long term average (0.58; Fig. 1.6.7).

Catches of Brown Bullhead continued to decline in 2014. A single Muskellunge was encountered and no Largemouth were observed, both of which have not occurred since 2004 (Table 1.6.1).

TABLE 1.6.1. Summary of catches per standard gillnet set in the Lake St. Francis community index netting program, 1984-2014. All catches prior to 2002 were adjusted by a factor of 1.58 to be comparable to the new netting standard initiated in 2002. No survey was conducted in 1996.

	1984	1986	1988	1990	1992	1994	1998	2000	2002	2004	2006	2008	2010	2012	2014
Lake Sturgeon	-	-	-	-	-	-	-	0.04	-	0.03	-	0.03	-	-	-
Longnose Gar	-	0.23	0.09	-	0.66	0.26	0.14	0.13	0.4	-	0.06	-	-	0.22	-
Bowfin	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alewife	0.04	-	-	-	-	-	-	-	0.03	0.06	0.22	-	-	-	-
Salvelinus sp.	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-	-
Northern Pike	4.18	3.93	4.44	3.82	4.13	3.91	3.71	3.34	1.23	1.45	1.67	1.08	0.31	0.19	0.31
Muskellunge	-	-	0.04	-	-	-	-	-	-	0.03	-	-	-	-	0.03
White Sucker	1.71	2.17	1.01	1.71	1.41	1.67	1.99	1.63	0.74	1.06	0.97	1.94	1.56	1.17	1.25
Moxostoma sp.	-	-	0.04	0.18	0.04	0.09	0.18	0.09	-	-	0.11	0.19	0.14	0.33	0.08
Common Carp	0.13	-	-	0.09	-	-	-	-	0.09	-	0.25	0.03	-	-	-
Golden Shiner	-	-	-	-	-	0.04	-	-	0.03	-	-	-	-	-	-
Creek Chub	-	-	-	-	-	-	0.09	-	-	-	-	-	-	-	-
Fallfish	-	-	-	0.09	-	-	-	-	-	-	-	-	-	-	-
Brown Bullhead	1.14	1.27	0.62	0.4	0.7	0.44	0.95	3.25	0.54	1.38	2.81	1.97	0.56	0.25	0.14
Rock Bass	3.52	3.48	2.81	1.36	2.15	2.11	2.58	1.85	2.26	2.17	5.69	7.89	7.03	3.94	2.97
Pumpkinseed	4.97	1.72	0.84	0.75	1.49	1.76	1.54	1.06	0.41	0.41	0.89	1.5	0.06	0.33	0.17
Bluegill	-	-	-	-	-	-	0.05	0.04	0.1	-	-	-	0.06	-	-
Smallmouth Bass	0.88	0.63	0.26	0.26	0.62	0.62	1.4	0.44	1.02	0.59	1.17	1.67	0.44	0.47	0.67
Largemouth Bass	0.04	-	0.09	0.09	-	0.04	0.09	0.13	0.2	-	0.61	0.31	0.33	1.53	-
Black Crappie	0.04	0.09	0.04	0.04	0.09	0.13	-	0.09	0.07	-	-	-	-	-	-
Yellow Perch	21.45	16.32	20.88	16.57	15.83	13.72	11.89	9.36	6.49	7.45	16.36	31.03	30.83	20.64	16.67
Walleye	0.48	0.45	0.97	0.35	0.35	0.26	0.36	0.31	0.16	0.41	0.39	1.08	1.58	0.78	0.81
Freshwater Drum	-	-	-	-	-	-	-	-	0.04	-	-	-	-	-	-
All species	38.64	30.3	32.18	25.72	27.48	25.06	24.96	21.76	13.81	15.04	31.19	48.89	42.89	30.03	23.1
Count of species	13	10	14	13	11	13	13	14	16	11	14	13	12	14	12

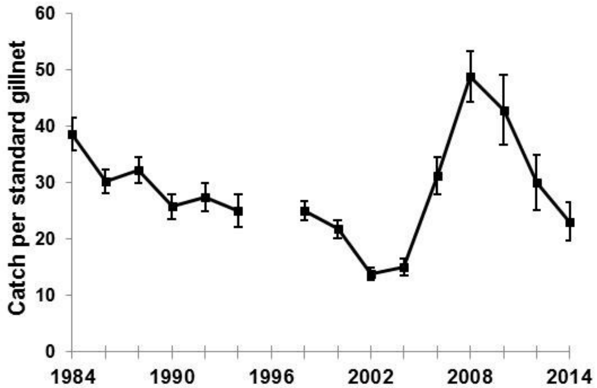


FIG. 1.6.1. Catches (±1SE) of all species combined, Lake St. Francis, 1984-2014.

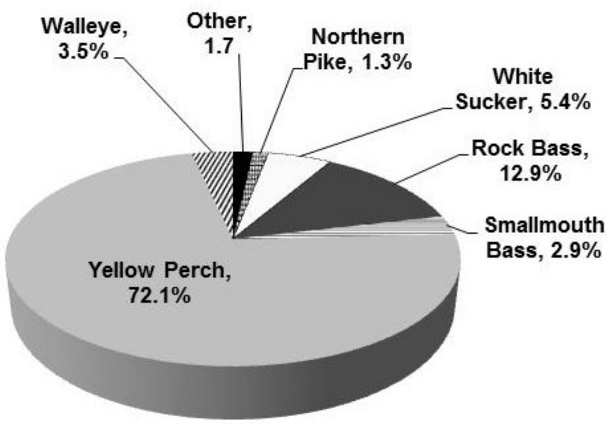


FIG. 1.6.2. Species composition in the 2014 Lake St. Francis community index netting program.

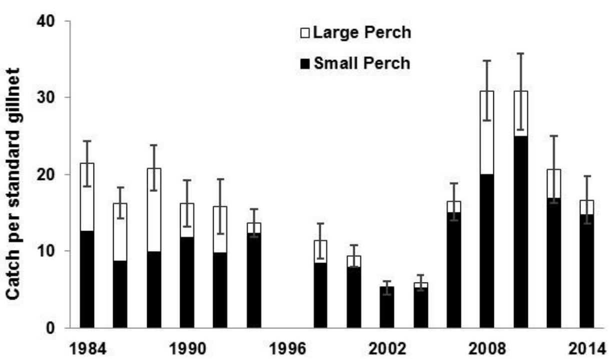


FIG. 1.6.3. Catches of small (<=220 mm total length) and large (>220 mm total length) Yellow Perch in the Lake St. Francis community index netting program, 1984-2014. Error bars (±1SE) apply to the total catch (small + large).

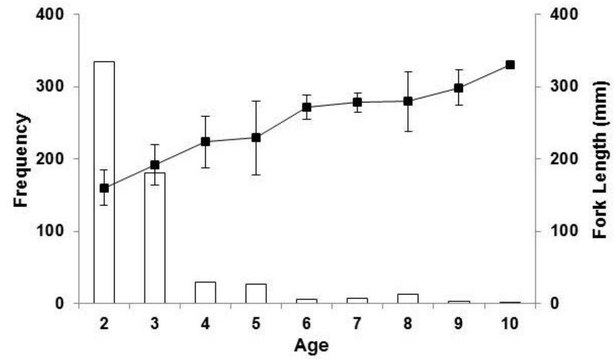


FIG. 1.6.4. Age distribution (open bars) and mean length at age (line; ± 1SD) of Yellow Perch caught in Lake St. Francis, 2014.

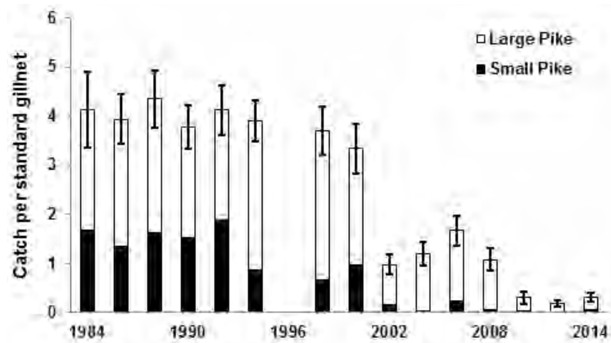


FIG. 1.6.5. Catches of small (<=500 mm total length) and large (>500 mm total length) Northern Pike in the Lake St. Francis community index netting program, 1984-2014. Error bars (±1SE) apply to the total catch (small + large).

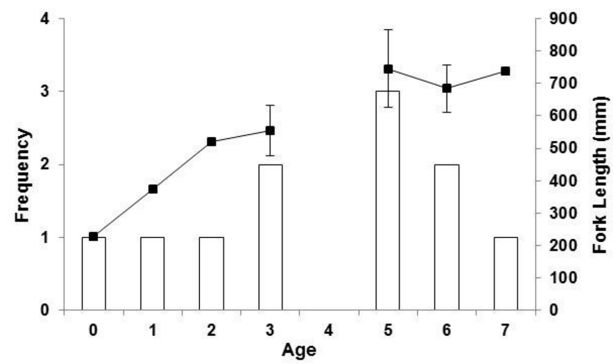


FIG. 1.6.6. Age distribution and mean length at age (± 1SD) of Northern Pike caught in Lake St. Francis, 2014.

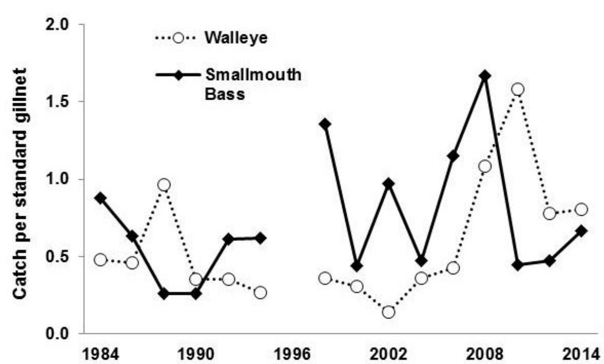


FIG. 1.6.7. Catches of Smallmouth Bass and Walleye in the Lake St. Francis community index gill netting program, 1984-2014.

1.7 Credit River Chinook Salmon Spawning Index

J. P. Holden, Lake Ontario Management Unit

The Credit River, below the Kraft dam in Streetsville, has been the long-term sampling 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. LOMU staff have utilized the spawn collections to index growth, condition, and lamprey marking of Chinook Salmon.

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

Samples for the 2014 Chinook index were taken on September 29th, 30th and October 2nd. Detailed sampling occurred on 315 Chinook Salmon, 150 fish were sampled for the representative length sample and 10 Chinook Salmon with fin clips were checked only for coded-wire tags.

In 2014, mean size of Chinook Salmon decreased in all sex and age classes (Fig. 1.7.1). The mean length of age-3 females (872 mm) and males (873 mm) are less than 5% below the long term average of 886 mm and 908 mm, respectively. Age-2 females (790 mm) were comparable to the long term mean of 795 mm. Age-2 males (762 mm) had the largest decline between years (10%, mean FL 2013 = 841 mm) but is still only marginally (5%) below the mean of 800 mm for the time series (1989-2014).

The estimated weight (based on a log-log regression) of a 900 mm (fork length) Chinook Salmon is used as an index of condition. In 2014, condition of both females and males declined (Fig. 1.7.2). Female (8410 g) and male (7893 g) condition are 5% and 6% (respectively), below the average condition between 2003 and 2014. While the current data reflect the lowest condition recorded in the time series, it should be noted that the absolute difference in conditions is within 500 g.

Lamprey scarring rates are highly variable throughout the time series. Both A1 (fresh wound with no healing) and A2 (wound with limited healing) wounding rates declined to low levels in 2014 (Fig. 1.7.3). As the clipped cohorts of Chinook Salmon (2008-2011) exit the system, clip rates and coded wire tag recoveries continue to decline. Of the 255 adipose clipped fish

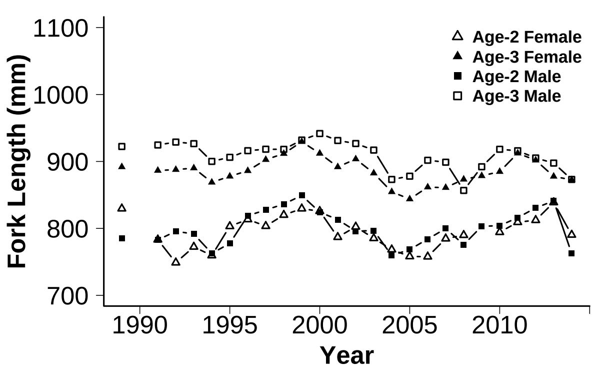


FIG. 1.7.1. Mean fork length of age-2 and age-3 Chinook Salmon by sex, caught for spawn collection in the Credit River during spawning run (approximately first week of October), 1989-2014.

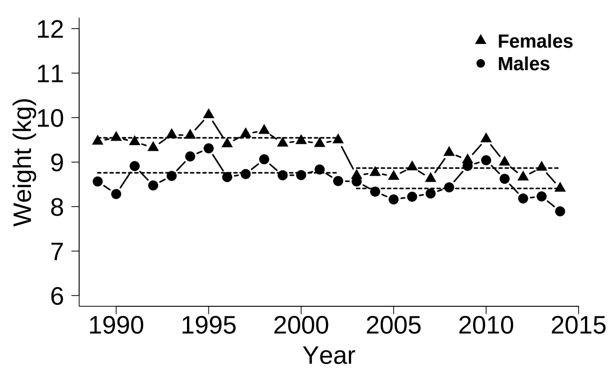


FIG. 1.7.2. Condition index as the mean weight of a 900 mm Chinook Salmon in the Credit River during the spawning run (approximately first week of October), 1989-2014.

observed, 14 had coded wire tags. Tag codes indicate 11 fish were stocked in 2011 in the Credit River at Norval Dam and three fish were stocked in 2011 in Bronte Creek (see Section 2.2: Chinook Salmon Mark and Tag Monitoring). Of the 117 age-3 and older fish observed, 68 fish (58%) were adipose clipped indicating hatchery origin.

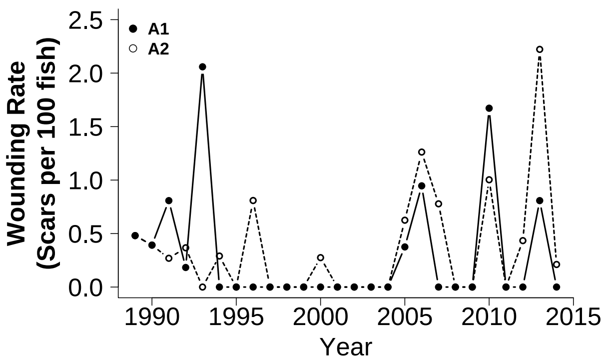


FIG. 1.7.3. . Lamprey scarring index (number of scars per 100 fish) observed during the spawning run at the Credit River (approximately the first week of October), 1989-2014. A1 (fresh wound with no healing) and A2 (wound with limited healing) refer to different classes of sea lamprey scars observed on Chinook Salmon

1.8 Juvenile Atlantic Salmon Parr Survey

J.N. Bowlby and C. Lake, Lake Ontario Management Unit

In 2014, Atlantic Salmon spring fingerlings (3.3 g) were stocked in the Credit River and its tributaries (Section 6) to restore self-sustaining populations (Section 8.2). The purpose of this survey was to evaluate growth and survival of Atlantic Salmon parr stocked as spring fingerlings and, in conjunction with smolt surveys (Section 1.9), to evaluate the relative contribution of each river reach to the smolt migration.

Atlantic Salmon parr were surveyed at 6 reaches in the Credit River and Black Creek (Table 1.8.1) during October 2014, after most of the year's growth was complete, and when fish size (>98 mm) indicates potential smolting. Atlantic Salmon were captured by electrofishing. Generally, other species were released upon capture and not recorded. Atlantic Salmon were individually tagged with half-duplex passive integrated transponder (PIT) tags at all sites. Two thousand, nine hundred and ninety-one (2,991) PIT tags were implanted into the body cavities of Atlantic Salmon parr (Table 1.8.2). Larger PIT tags (23 mm) were used on fish >108

TABLE 1.8.1. Geo-coordinates (downstream end) and dimensions of population sampling sites in the Credit River, 2014.

Reach	Latitude	Longitude	Sample length (m)	Stream width (m)	Days sampled
Meadow (Forks Prov. Park)	43° 48.75'	80° 00.87'	392	9.0	2
Stuck Truck (Forks Prov. Park)	43° 48.63'	80° 00.36'	274	9.9	2
Brimstone (Forks Prov. Park)	43° 48.17'	79° 59.70'	343	14.1	2
Ellies (Forks o' Credit Rd.)	43° 48.28'	79° 59.51'	271	14.8	1
West Credit Belfountain C.A.	43° 47.80'	80° 00.41'	353	9.8	2
Black Creek 6th Line	43° 37.83'	79° 56.88'	335	5.8	2

TABLE 1.8.2. Number of applied and recaptured PIT tags and VIE marks showing VIE colour and location by Atlantic Salmon age-group, 2014.

	Age 0					Age 1 and older		
Reach	Number of PIT tags	Number of VIE	VIE Colour	VIE Location	Not tagged	Number of PIT tags	Not tagged	Total number
Applied								
Meadow (Forks Prov. Park)	408				1	13		422
Stuck Truck (Forks Prov. Park)	346	134	Blue	Right Jaw	9	3		492
Brimstone (Forks Prov. Park)	822				3	31		856
Ellies (Forks o' Credit Rd.)	182				2	4		188
West Credit Belfountain C.A.	642				19	90	2	753
Black Creek 6th Line	444				5	26		475
Total Applied	2,844	134			39	167	2	3,186
*Recaptured**								0
Meadow (Forks Prov. Park)	19					1		20
Stuck Truck (Forks Prov. Park)	12							12
Brimstone (Forks Prov. Park)	38					6		44
Ellies (Forks o' Credit Rd.)	1							1
West Credit Belfountain C.A.	29					10		39
Black Creek 6th Line	47					6		53
Total Recaptured	146					23		169

* Includes recaptured fish tagged in 2013

mm. Smaller PIT tags (12 mm) were used on fish <108 and >68 mm. As well, another 134 Atlantic Salmon parr were marked using blue Visible Implant Elastomer (VIE) placed under the right jaw (Table 1.8.2). A piece of caudal or adipose fin was clipped from all Atlantic salmon for a genetic sample, and to provide a secondary mark. The smallest fish (<67 mm) were neither PIT-tagged nor VIE-marked but these fish could be recognized on recapture by the fin clip. One hundred and sixty-nine (169) tagged/marked Atlantic Salmon were recaptured generally at the same location (Table 1.8.2) as originally tagged. Most of these fish were tagged in 2014, except nine were tagged in 2013.

Growth of age-0 Atlantic Salmon (Table 1.8.3) declined at all three sites of the main Credit River above the forks in 2014 (mean 10.5 g) compared with 2013 (17.4 g). This was despite stocking larger fingerlings in spring 2014. The percentage of fish expected to smolt in 2015 declined from 83% at these sites in 2013 to 55%. Growth of age-0 Atlantic Salmon in the West Credit River was similar in 2014 and 2013. At Ellies (below the forks of the Credit River) and in Black Creek the growth of age-0 Atlantic Salmon increased, and accordingly, the percentage of fish expected to smolt in 2015 increased (Table 1.8.3).

In 2014 the density of age-0 Atlantic Salmon continued to meet or exceed the restoration target (0.05-0.5 m^{-2})[1] at all sites (Table 1.8.4). In the West Credit and Credit River at Stuck Truck we observed the highest density of age-0 Atlantic Salmon ever recorded in this program (1.8 fish m^{-2}). Density was also determined at the Meadow and Stuck Truck sites on the Credit River in 2013, and values increased 2-fold and 5-fold respectively in 2014. High densities in 2014 resulted from high survival of stocked fish which was likely related to stocking larger fish. The downside of higher fish density is that it likely caused lower growth, as we observed a strong negative correlation between age-0 Atlantic Salmon density and length (r=0.948). Further analysis is required to determine how to adjust stocking rates of fingerling Atlantic Salmon to optimize growth and smolt production.

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

TABLE 1.8.3. Mean fork length and weight of Atlantic Salmon by location and age group in 2014.

Reach	Age 0 Length (mm)	Age 0 Weight (g)	Expect to smolt in 2015	Age 1 and older Length (mm)	Age 1 and older Weight (g)
Meadow (Forks Prov. Park)	108.4	13.0	61%	155.9	35.0
Stuck Truck (Forks Prov. Park)	94.5	8.2	43%	148.0	32.3
Brimstone (Forks Prov. Park)	104.5	10.2	63%	150.7	38.5
Ellies (Forks o' Credit Rd.)	112.2	14.1	86%	147.3	30.5
West Credit Belfountain C.A.	92.6	8.0	33%	137.4	21.8
Black Creek 6th Line	110.1	13.4	87%	141.8	28.5

TABLE 2.8.4. Population estimates, density, and biomass of Age-0 Atlantic salmon in the Credit River and Black 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	938	338	1,845	0.70	5.72
	Age 0 ≥98	1,453	926	2,254	0.34	4.98
Stuck Truck (Forks Prov. Park)	Age 0 <98	2,806	1,503	5,012	1.03	6.81
	Age 0 ≥98	2,097	927	4,133	0.77	8.49
Brimstone (Forks Prov. Park)	Age 0 <98	1,491	881	2,469	0.31	1.87
	Age 0 ≥98	2,510	1,733	3,618	0.52	6.55
West Credit Belfountain C.A.	Age 0 <98	2,422	1,543	3,757	1.03	6.37
	Age 0 ≥98	1,181	698	1,955	0.77	9.26
Black Creek 6th Line	Age 0 <98	166	82	311	0.09	0.64
	Age 0 >98	1,095	812	1,474	0.56	8.06

1.9 Credit River Atlantic Salmon Smolt Survey

M. D. Desjardins, Lake Ontario Management Unit

Monitoring Atlantic Salmon throughout their life cycle is critical to the success of the Lake Ontario Atlantic Salmon Restoration Program. This information is necessary to choose '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 2014, the Lake Ontario Management Unit and Credit Valley Conservation conducted the fourth year of out-migrant sampling on the Credit River using a Rotary Screw Trap. The spring of 2014 was late and the spring melt happened quickly causing the deployment of the Rotary Screw Trap to be delayed until April 29th due to high and swift stream flows. Despite approximately a two week delay in sampling, catches and sampling effort were comparable to previous years. In 2014, 5696 fish representing 23 species were collected over a 51-day period (Table 1.9.1) and catches of Atlantic Salmon were relatively high despite the delayed sampling (Table 1.9.2).

TABLE 1.9.1. List of species collected using Rotary Screw Trap, 2014.

Species	Sum of catch
Chinook Salmon	4,230
Atlantic Salmon	351
Common Shiner	348
Coho Salmon	300
Rainbow Trout	128
Longnose Dace	110
Sea Lamprey	50
Fathead Minnow	45
Pumpkinseed	25
Hornyhead Chub	23
Brown Trout	16
Golden Shiner	16
Blacknose Dace	13
White Sucker	10
Rainbow Darter	9
Bluntnose Minnow	7
Stonecat	5
Brown Bullhead	2
Unid. Minnow	2
Creek Chub	2
Rock Bass	1
Northern Hog Sucker	1
Emerald Shiner	1
Central Mudminnow	1
Total	5,696

Tissues from 351 Atlantic Salmon were submitted to Trent University for genetic analysis to determine parentage and strain assignment. Parentage was confirmed for only 194 samples with a high number yielding ambiguous of unresolved classifications. Ambiguous designations represent fish that cannot be identified to strain whereas unresolved fish can be identified to strain but cannot be linked to hatchery parent crosses. The nature of these designations needs to be resolved as their proportion in the catch appears to be increasing (Table 1.9.2).

Parentage information from the confirmed 194 samples revealed some small changes in the composition of the catch (Table 1.9.3). Although the majority of the smolts continue to be mostly made up of Spring Fingerling stocked fish, the number of smolts that were stocked at the more advanced life stages (Fall Fingerlings and Spring Yearlings) appears to be increasing in the catch. For the yearlings, the small increase could be attributed to a change in the timing of stocking. In previous years, yearling stocking would have occurred in early to mid-March. However, in 2014 the late thaw and subsequent high flows delayed stocking until mid-April, which is closer to the onset of sampling. Higher catches resulting from later stocking times may indicate that these fish are exiting the stream soon after stocking resulting in artificially low catches when stocking and trapping times are not aligned.

Finally, the 2014 sampling period represents the first records of smolts that originated from Lac St. Jean strain stocking events. Reasonable catches of Fall Fingerling and Spring Yearling stocked fish were recorded. The Spring Fingerling life stage was unsurprisingly absent as we don't anticipate seeing smolts from that life stage until 2015. The 2015 sampling season will be the first year that all three life stages of all three strains are expected to be encountered in the gear.

TABLE 1.9.2. Sampling summary of Rotary Screw Trap operations 2011-2014 showing yearly Atlantic Salmon catch and the number of those fish with confirmed strain and parentage assignments and numbers with strain and / or parentage unresolved.

Year	Days sampled	Atlantic Salmon catch	Number with confirmed parentage	Unconfirmed parentage
2011	51	227	195	32
2012	82	308	219	89
2013	52	277	208	69
2014	51	351	194	151
Total	236	1163	816	341

TABLE 1.9.3. Break-down of the Rotary Screw Trap Catch from 2011–2014. Catch was partitioned by strain, life stage stocked, and age at time of smolting.

		Stocked Life Stage / Smolt Age						Total
		Fall Fingerling		Spring Fingerling		Spring Yearling		
Year	Strain	1	2	1	2	1	2	
2011	LaHave	2	16	106	44	7	20	195
	Sebago							
2012	LaHave	2		40	47	1	1	91
	Sebago	4		124				128
2013	LaHave		9	73	36	19	10	147
	Sebago	1	1	41	18			61
2014	LaHave	6	6	41	26	23	6	108
	Sebago		6	19	11	4		40
	Lac St.Jean	12				20		32
Total		27	38	444	182	74	37	802

1.10 Credit River Fishway

M. Heaton and Aaron Law, Aurora District, *R. G. Green,* Lake Ontario Management Unit

Management efforts continued in 2014 to restore Atlantic Salmon to Lake Ontario (Section 8.2), with three target high-quality cold water streams. The Credit River is the largest of the three streams selected to restore a self-sustaining wild population of Atlantic Salmon and receives annual stocking of multiple life stages (Section 6.1). Atlantic Salmon develop in stream habitats before smolting and out-migrating to Lake Ontario to spend at least one year feeding and growing until they mature and return to the Credit River to spawn. Fishways at Streetsville and Norval (Fig. 1.10.1) allow fish passage around barriers to gain access to quality spawning habitats and provide an excellent opportunity to count and sample returning adults.

The first barrier to adult Atlantic Salmon migrating upstream is the dam at Streetsville; located 15 km from Lake Ontario. This barrier was mitigated by a step-pool design fishway constructed in 1981 that provides selective passage for salmonid species. A screen can be placed at the top of the fishway to stop fish from passing through, effectively providing the ability to monitor adults in the step pools and the channel below. The step-pool design of the fishway provides passage for only jumping fish that are mainly mature adults. As the fish continue upstream from Streetsville, the next major barrier to migration is the dam at Norval located 40 km by river from Lake Ontario. A Denil fishway was constructed in 2011 to provide passage for all species and sizes of fish beyond the Norval dam. This fishway provides the opportunity to monitor fishes as they move upstream by method of lowering a cage into the fishway structure to detain moving fish.

Assessment of adult Atlantic Salmon moving up the Credit River through the two fishways occurred between June 3 and October 31, 2014 (Table 1.10.1). See Tables 1.10.2 and 1.10.3 for operational summaries of the Streetsville and Norval fishways, respectively.

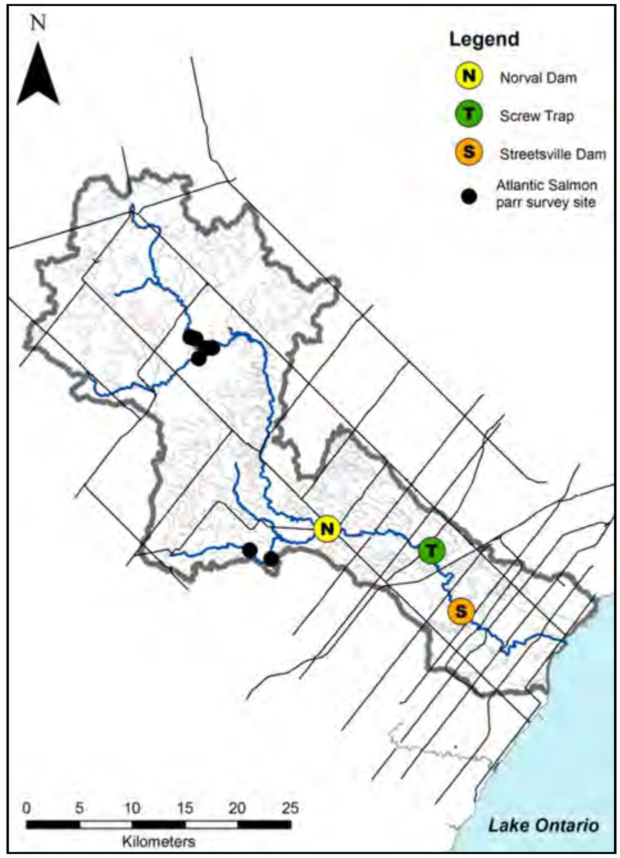


FIG. 1.10.1. Map of the Credit River, Lake Ontario showing locations of the fishways at Norval (N) and Streetsville (S) dams, the smolt screw trap (T) site (Section 1.9), and Atlantic Salmon parr assessment survey (●) sites (Section 1.8).

A total of 25 (including 5 recaptures) adult Atlantic Salmon were caught in the two Credit River fishways in 2014 (Table 1.10.1). 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 correctly. Adipose fins were clipped from individuals for genetic analysis, and to allow preliminary visual identification of recaptured individuals.

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

TABLE 1.10.1. Operational details of the Streetsville and Norval fishways 2011-2014.

Year	Fishway	Operational duration	Days operated	Adult Atlantic Salmon Captured (recaptures)
2011	Streetsville	Sep 8 - Nov 30	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
2014	Streetsville	Sep 12 - Oct 31	29	15
	Norval	Jun 3 - Oct 31	94	10 (5)
	Total		123	20 + 2*

* two individuals were caught electrofishing during Chinook and Coho egg collections.

TABLE 1.10.2. Numbers of trout and salmon caught (including recaptures) from Streetsville fishway in 2014.

Species	Life Stage	Number Caught
Atlantic Salmon	Adult	15
Brown Trout	Adult	42
Rainbow Trout	Adult	39
Coho Salmon	Adult	257
Chinook Salmon	Adult	963 (*unclipped*) 710 (*clipped*) 1912 (Total, 239 not sorted)

TABLE 1.10.3. Numbers of trout and salmon caught (including recaptures) from the Norval fishway in 2014.

Species	Life Stage	Number Caught
Atlantic Salmon	Adult	10
	Juvenile	92
Brown Trout	Adult	21
	Juvenile	22
Rainbow Trout	Adult	10
	Juvenile	300
Coho Salmon	Adult	1
	Juvenile	26
Chinook Salmon	Adult	2
	Juvenile	2

1.11 Duffins Creek Resistance Board Weir

T.J. Stewart, Lake Ontario Management Unit

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 stocked life-stages and genetic strains and it is important to capture these fish and determine their origin so that restoration efforts can be enhanced. 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. In 2013, with the support of the Great Lakes Fishery Commission (GLFC), the Ontario Ministry of Natural Resources and the Toronto Region Conservation Authority installed a Resistance Board Weir (RBW) in Duffins Creek. 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 high flow variation and debris. Here we report on the preliminary results of the 2014 weir operation.

Methods

The weir was installed at the same location as 2013 (on the main stem of Duffins Creek several kilometres upstream of Lake Ontario between Highway 401 and Highway 2) and was first set to capture fish on April 29th. The weir installation was completed in 2 days facilitated by a large crew (approximately 12 people) and made somewhat easier as the attachment rail installed in 2013 remained secured to the river bed overwinter. The weir was operated every month from May to November for a total of 112 sampling days (Table 1.11.1) representing an additional 45 days of sampling compared to 2013 operation. In addition, during October, when catches were very high, the weir was often checked and fish processed twice per day.

Based on the previous year experience with weir operation, several changes were made to the weir configuration. To reduce stress on captured fish the size of the weir capture cage was doubled by installing a second cage module. In the spring, resistance boards were removed from panels, except the entrance chute and two adjacent panels, to prevent the weir panels from riding too high in the water to reduce the number to drop back Rainbow Trout potentially being stranded on the weir panels. Fine tuning of the weir configuration was achieved by placement of sand bags on the top of the weir panels to adjust the level of the panels and further facilitate downstream passage of fish over the panels (Fig. 1.11.1). During the fall, the resistance boards were re-installed but when extreme high flow events were anticipated, every other resistance board was flipped over. Also baffles were installed in the capture cage to allow fish to rest in areas of reduced flows and a live well set up between the bank and the cage to allow for recovery of processed fish before final release.

On a typical sampling day the crew would arrive at the site in the morning to check the 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, except for Chinook salmon were measured for length and weight and hole punched in the caudal fin. All Chinook Salmon were measured for length, checked for an adipose fin clip, and if present, scanned for an implanted coded wire tag and every fifth fish weighed. All Atlantic Salmon were measured, weighed and photographed, had a small piece of tissue removed with a fin punch for

TABLE 1.11.1. Summary of sampling effort, catch by species and month and total mortalities, recaptures and gill parasites incidence by species observed during the operation of the resistance board weir during 2014. D.I.W. is the days in water —total days per month that the RBW was set up in the stream, D.O is days open—total days per month when the RBW was open and not catching fish and D.C./S. is days closed and sampling—total days per month when the RBW was closed and fish could be sampled. The April 29th sampling day results were included in the May summary. Multiple of 2013 is calculated as the value in 2014/value in 2013. Recaptures are fish previously marked as caught in the weir and released up-stream and recapture on a subsequent day.

Month	D.I.W.	D. O.	D.C./S	Atlantic Salmon	Rainbow Trout	Chinook Salmon	Coho Salmon	Brown Trout	Common White Sucker	Other
May	32	17	15	0	57	0	0	1	145	0
June	30	12	18	0	6	0	0	0	22	4
July	31	29	2	0	0	0	0	0	0	0
August	31	22	9	1	0	64	0	2	0	0
Sept	30	2	28	4	16	801	38	11	0	0
Oct	31	1	30	0	233	761	20	38	0	0
Nov	10	0	10	0	114	6	3	4	0	0
TOTAL	195	83	112	5	426	1632	61	56	167	4
Multiple of 2013	1.7	2.4	1.7	0.6	5.8	3.7	1.6	3.3	9.8	na
Recaptures				0	11	45	4	0	4	0
Mortalities in cage				0	0	23	1	0	1	0
Mortalities on/under panels				0	15	46	4	7	9	0
% with gill parasite				40.0	51.4	65.9	11.5	14.3	na	na

marking, preservation and genetic analysis, and released. All processing of the Atlantic salmon took place in the capture cage limiting the time the fish was out of the water to reduce handling stress. Atlantic salmon were also released well upstream of the weir in deeper calmer water to further aid recovery. Mortalities observed in the cage or dead fish observed on or under panels were also recorded. Beginning May 9th, the crew start tracking the presence of the gill parasite *Salmincola californiensis* (based on an identification of a U.S. specimen by Dr. Chris Whipps, SUNY Center for Applied Microbiology, Syracuse, NY) on all salmon and trout caught.

To attempt to measure weir catchability a couple of approaches were tried. The crew experimented with the insertion of streamer tags on Rainbow Trout to evaluate if the fish released up-stream might drop-back or be caught by anglers further upstream. Several volunteer anglers were solicited to record marked and unmarked angled fish. Streamer tags were applied to Rainbow Trout from May 6th to June 6th and beginning May 13th an RV punch was also applied to all tagged Rainbow Trout. Angler reports of marked and unmarked fish were only available from April 26th to May 13th. Also, counts of post-spawning Chinook Salmon carcasses were conducted on October 7, 9 and 20th in West Duffins Creek to determine what proportion of Chinook Salmon carcasses had previously been caught by weir and marked.

Results

The total number of fish captured by the weir was 2,351. This is over three times the number of fish caught in 2013 with a 67% increase in sampling days (Table 1.11.1). For species other than Atlantic Salmon, the increase in catches from 2013 to 2014 ranged from a multiple of 1.6 to 9.8 over the entire season. The catch of Atlantic Salmon dropped from 8 in 2013 to 5 in 2014 despite the increase in sampling effort. The Atlantic Salmon were caught later in the season (August-September) representing a summer/fall run fish. Even with changes to the weir configuration and larger cage we did observe some mortalities in the cage and on or under the panels (Table 1.11.1). Recaptures were observed indicating that some fish drifted or swam back down stream and re-entered the weir. Incidents of gill parasite ranged from a low of 11.5% on Coho Salmon to a high of 65.9 % on Chinook Salmon. Of the 217 fish caught and observed by volunteer anglers only 5 fish were caught after May 6th when streamer tags were being applied to weir caught Rainbow Trout and no streamer tags were observed on those fish. A total of 268 Chinook Salmon post-spawning carcasses were observed in the west branch of Duffins Creek and only 6 had upper caudal punches indicating that they had be captured and processed in the weir. Other species caught in the weir include three Longnose Suckers (*Catostomus catostomus*) and a Redhorse Sucker species (Moxostoma sp., only photographed and released so not identified to species; Fig. 1.11.2).

Discussion

Predicting the spawning time of multiple strain stocks of Atlantic Salmon introduced into a novel ecosystem is difficult. The increase in weir sampling effort in 2014 was to broaden the seasonal breadth of the sampling to ensure that any significant spring, summer or fall run of Atlantic Salmon was not missed. Unfortunately, the catches of Atlantic Salmon remained low. The weir needed to be open and not fishing on several days (Table 1.11.1), either to give staff time off or to deal with extreme flow events. During these times it is possible that significant runs of Atlantic Salmon were missed. Also, modifications to the weir to decrease drop-back mortality may have reduced the catch efficiency of the weir. However, all other species catches increased by a factor of 1.6 to 9.8 times and spring spawning species (Rainbow Trout and Common White Sucker) increased by a factor of 6 -9.8 times, suggesting that sampling effort and weir catchability should have been sufficient to capture Atlantic Salmon if they were ascending the stream in similar or greater numbers as 2013.

Dealing with the variable flow conditions remains a challenge. On the one hand, removing some resistance boards reduced the incident of drop-back mortality but could be reducing weir catchability during very high flow events. Regardless, flow conditions at times were so extreme that it was unlikely that any weir modification could be implemented safely to handle these flows. For example, on June 20th, 2014 a 30 minute intense rain event resulted in flows that buried half of the weir panels in sand and gravel and the other half was held down by a fallen tree (Fig. 1.11.3). Fish will move during these high flow events and can by-pass the weir. However, the weir remains in place and can be safely cleared and reconfigured when these flows subside. During less flashy events, debris accumulation is slower so the panels stay above the water and continue to block and direct fish to the capture cage.

The absence of a spring run of Atlantic Salmon in 2014, compared to 2013, despite a broader and more intensive spring sampling is intriguing. Genetic analysis, that would identify the strain and stocked life-stage origins of the 2014 sampled Atlantic Salmon, were not available. The Atlantic Salmon captured in 2013 were all stocked as spring fingerlings (1-3 months old) and five were LaHave strain and one was Sebago strain. The LaHave strain has a bi-modal spring/summer and fall spawning time, while Sebago stain is considered more of a fall spawning strain with a possible feeding runs in the spring (Diamond and Smitka 2005[1]). It is possible that the failure to observe a spring Atlantic Salmon spawning run in 2014 was due to poor survival of the LaHave cohort expected to return that year. The fall run observed in 2014 may be of Sebago strain origin.

One of the objectives of the weir project was to attempt to measure the catchability of the weir for Atlantic Salmon. The low catches of Atlantic Salmon do not allow this to be done and we explored the alternative of using Rainbow Trout and Chinook Salmon as surrogates to get some idea of catchability. Mark and recapture of Rainbow Trout using the weir and angler caught fish showed some promise but to be effective would require marking of a large number of fish below weir prior to the spawning run. The manpower required to do this is outside of the current project budget and it is unclear what method of capture below the weir would be effective. Similarly, the counts of weir-marked and un-marked Chinook Salmon carcasses resulted in very few weir marked Chinook being observed as post-spawning carcasses. This could be due to extremely low weir catchability (< 3% of the population) or more likely different behaviour, distribution, or spawning time, or mortality rate of weir caught fish versus unmarked fish that by-pass the weir. Also, many carcasses could have been washed out of the system during several high flow events prior to the carcass counts. More direct studies would be needed to figure this out. We have concluded that the RBW is a very effective, safe, and robust capture method. Low catches of Atlantic Salmon preclude developing measures of catchability for this species and determine the absolute size of the run. It suffices to say that the Atlantic Salmon run is smaller than any other salmonid species ascending Duffins Creek. For Rainbow Trout and Chinook Salmon it may be possible to estimate catchability but it would take further study and resources to develop and implement the appropriate methodology.

Acknowledgements

This work would not be possible without the dedication and hard work of Toronto Region Conservation staff especially Rick Portiss and his team, Katherine Hills, and Tim Rance. We also thank the volunteer anglers who helped with weir and provided mark-recapture information.

[1]Dimond, P., Smitka, J., 2005. Evaluation of selected strains of Atlantic Salmon as potential candidates for the restoration of Lake Ontario. Trout Unlimited Canada Technical Report ON-012, pp. 41.

1.12 Juvenile Chinook Assessment

J.N. Bowlby, Lake Ontario Management Unit

In recent years, the Lake Ontario Chinook Salmon Mass Marking Study indicated 40-60% of the Chinook Salmon in Lake Ontario were wild origin. Past electrofishing surveys determined that many wild Chinook Salmon were produced in Ontario tributaries. In 2014 a program was initiated to assess wild production of juvenile Chinook Salmon in Lake Ontario streams. This program was based on previous surveys during spring 1997-2000. From a broader list of streams, Wilmot Creek and Shelter Valley were chosen to survey in 2014, as past surveys indicated Wilmot Creek had the highest abundance of wild Chinook Salmon and Shelter Valley Creek had moderate abundance. Both Wilmot Creek and Shelter Valley were not stocked with Chinook or Coho Salmon, or Rainbow Trout.

During 2014 juvenile Chinook Salmon were surveyed by electrofishing in Shelter Valley Creek and Wilmot Creek, following the same methods and generally at the same randomly selected sites as surveyed in 1997-2007. In Shelter Valley Creek, nine sites were surveyed during May 20-22, 2014, completely covering the length of stream where Chinook Salmon spawned (Table 1.12.1). In addition, two of these sites were re-surveyed on June 5, 2014. In Wilmot Creek, seven sites in downstream reaches were sampled during May 26-29, 2014 (Table 1.12.1). Due to logistical constraints another nine sites planned for upstream reaches with potential Chinook Salmon spawning were not sampled.

In Shelter Valley Creek juvenile Rainbow Trout (age-1 and older) were the most abundant catch (23.2 fish/site) of fish (Table 1.12.2), and were followed closely by age-0 Chinook Salmon (19.9 fish/site). In Wilmot Creek age-0 Chinook Salmon catches (241.1 fish /site) were an order of magnitude higher than juvenile Rainbow Trout (32.3fish/site), and higher than Chinook Salmon in Shelter Valley Creek. The abundance of age-0 Chinook Salmon was about an order of magnitude higher in 2014 than 1997-2000 in both Shelter Valley Creek (Fig. 1.12.1) and Wilmot Creek. (Fig. 1.12.2).

Year to year variability in abundance of Chinook Salmon in Lake Ontario streams is still not well understood, but appears to be greater than for Rainbow Trout. Moreover, a widespread increase in Chinook Salmon abundance across streams may be consistent with ecosystem changes in Lake Ontario over the last 20 years. Assessment of wild Chinook Salmon production in streams should provide additional insights into wild fish production.

TABLE 1.12.1. . Location, sampling date site dimensions and abundance estimates (number, linear density (No./m) and biomass (g/m^2)) of age-0 salmon and trout in Shelter Valley Creek and Wilmot Creek in 2014. The abundance was estimated for each species at each site using: N = catch + catch /(1/(1-0.2617*(mean weight)0.27116)-1. The spatial coordinates are at the downstream end of each site. Sites are ordered in the table from downstream to upstream.

SITE	Latitude	Longitude	Date	Site width (m)	Site length (m)	Coho Salmon			Chinook Salmon			Rainbow Trout			Brown Trout		
						Estimated No.	No./m	g/m^2	Estimated No.	No./m	g/m^2	Estimated No.	No./m	g/m^3	Estimated No.	No./m	g/m^3
Shelter Valley Cr.																	
SE03	43° 58.50'	78° 00.23'	May 20	7.6	54.2	0.0	0.00	0.000	421.7	55.7	0.547	0.0	0.00	0.000	0.0	0.00	0.000
SE07	43° 59.12'	78° 00.10'	May 20	7.8	40.9	14.1	1.81	0.021	213.5	27.4	0.412	0.0	0.00	0.000	0.0	0.00	0.000
SE07	43° 59.12'	78° 00.10'	June 5	7.8	40.9	3.9	0.50	0.011	136.3	17.5	0.489	0.0	0.00	0.000	0.0	0.00	0.000
SE08	43° 59.83'	77° 59.93'	May 20	5.6	35.6	0.0	0.00	0.000	38.4	6.9	0.129	0.0	0.00	0.000	0.0	0.00	0.000
SE09	44° 00.04'	77° 59.70'	May 21	7.1	30.0	18.4	2.61	0.043	75.8	10.7	0.250	0.0	0.00	0.000	5.9	0.84	0.006
SE10	44° 00.59'	77° 59.15'	May 21	8.4	53.5	12.6	1.50	0.020	30.7	3.6	0.041	9.5	1.13	0.009	0.0	0.00	0.000
SE10	44° 00.59'	77° 59.15'	June 5	8.4	53.5	6.7	0.79	0.024	31.6	3.7	0.096	0.0	0.00	0.000	0.0	0.00	0.000
SE05	44° 01.03'	77° 59.37'	May 21	9.3	46.2	39.1	4.21	0.057	12.6	1.4	0.021	0.0	0.00	0.000	0.0	0.00	0.000
SE11	44° 01.99'	77° 59.73'	May 22	7.2	51.0	8.6	1.20	0.015	0.0	0.0	0.000	0.0	0.00	0.000	12.8	1.78	0.005
SE06	44° 02.57'	78° 00.07'	May 22	6.2	47.8	0.0	0.00	0.000	0.0	0.0	0.000	0.0	0.00	0.000	0.0	0.00	0.000
SE02	44° 02.71'	77° 59.47'	May 22	5.9	46.4	13.4	2.25	0.028	0.0	0.0	0.000	0.0	0.00	0.000	0.0	0.00	0.000
Wilmot Creek																	
WMA2	43° 54.17'	78° 36.04'	May 26	9.4	73.4	6.9	0.74	0.015	1,360.6	145.3	1.819	0.0	0.00	0.000	0.0	0.00	0.000
WMA8	43° 54.64'	78° 36.49'	May 26	8.4	60.0	4.1	0.48	0.006	466.5	55.6	0.698	0.0	0.00	0.000	0.0	0.00	0.000
WMA10	43° 54.81'	78° 36.60'	May 27	8.8	59.7	3.6	0.42	0.008	1,289.2	147.3	1.961	0.0	0.00	0.000	0.0	0.00	0.000
WMA11	43° 55.02'	78° 36.74'	May 28	7.5	50.0	7.4	0.99	0.023	768.6	102.9	1.701	4.2	0.56	0.008	4.2	0.56	0.008
WMA15	43° 55.68'	78° 37.10'	May 28	8.4	42.0	34.1	4.04	0.099	1,158.1	137.3	2.049	7.6	0.91	0.022	0.0	0.00	0.000
WMB1	43° 55.87'	78° 37.17'	May 29	7.8	57.8	18.6	2.40	0.046	463.7	59.7	0.821	4.1	0.52	0.007	10.6	1.36	0.007
WMB3	43° 56.22'	78° 36.96'	May 29	7.7	45.5	74.6	9.73	0.234	1,459.2	190.3	2.667	0.0	0.00	0.000	11.1	1.45	0.008

TABLE 1.12.2. Catch by species of fish in Lake Ontario tributaries during electrofishing surveys in 2014. "Other" Chinook salmon may be wild yearlings or stocked fish. Sites are ordered in the table from downstream to upstream.

Site	Date	Lamprey sp.	American Brook Lamprey	Sea Lamprey	Coho Salmon	Chinook Salmon		Rainbow Trout			Brown Trout			Brook Trout		White Sucker	Northern Redbelly Dace	Blacknose Shiner	Fathead Minnow	Blacknose Dace	Longnose Dace	Creek Chub	Brown Bullhead	Brook Stickleback	Pumpkinseed	Rainbow Darter	Johnny Darter	Logperch	Round Goby	Sculpin sp.	Mottled Sculpin
					Age-0	Age-0	Other	Age-0	1+	Adult	Age-0	1+	Adult	Age-0	1+																
Shelter Valley Cr.																															
SE03	May 20	1	0	0	0	93	0	0	2	1	0	0	0	0	0	1	0	2	2	6	0	0	0	0	0	0	0	0	0		12
SE07	May 20	0	14	0	3	49	0	0	8	1	0	0	0	0	0	0	0	0	2	16	0	0	0	0	0	0	0	0	0		22
SE08	May 20	0	0	0	0	9	0	0	15	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3
SE09	May 21	0	16	0	4	18	0	0	51	1	1	1	0	0	0	1	2	0	6	10	0	0	0	0	1	0	0	0	0	14	
SE10	May 21	5	0	0	3	7	0	2	43	0	0	2	0	0	0	0	1	0	0	3	0	0	0	0	4	0	0	0	0	19	
SE05	May 21	0	0	0	9	3	0	0	27	0	0	2	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	28	
SE11	May 22	0	0	0	2	0	0	0	29	1	2	4	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	12	
SE06	May 22	2	0	0	0	0	0	0	20	1	0	0	0	0	1	0	0	0	5	2	0	0	0	0	0	0	0	0	0	6	
SE02	May 22	6	0	0	3	0	0	0	14	0	0	1	0	3	2	0	1	0	13	0	0	1	0	0	0	0	0	0	0	3	
	Mean	**1.6**	**3.3**	**0.0**	**2.7**	**19.9**	**0.0**	**0.2**	**23.2**	**0.7**	**0.3**	**1.4**	**0.0**	**0.3**	**0.3**	**0.3**	**0.6**	**0.2**	**3.1**	**4.1**	**0.3**	**0.1**	**0.0**	**0.0**	**0.7**	**0.0**	**0.0**	**0.0**	**0.0**	**13.7**	**12.3**
SE07	June 5	3	0	0	1	37	0	0	25	0	0	0	0	0	0	0	0	0	0	13	1	0	0	0	0	0	0	0	0	12	
SE10	June 5	2	0	0	2	9	0	0	40	0	0	4	0	0	0	0	0	0	0	3	1	1	0	0	1	0	0	0	0	15	
Wilmot Creek																															
WMA2	May 26	2	2	0	2	348	0	0	64	0	0	2	2	0	0	19	0	0	1	10	1	0	0	0	0	2	1	2	25		17
WMA8	May 26	3	0	0	1	113	0	0	31	0	0	3	3	0	0	0	0	0	1	2	3	0	0	0	0	1	0	0	1		44
WMA10	May 27	0	0	0	1	317	0	0	5	0	0	0	4	0	0	0	0	0	0	1	9	1	1	1	0	1	0	0	0		29
WMA11	May 28	1	0	0	2	191	0	1	4	0	1	1	0	0	0	1	0	0	0	1	19	0	1	0	0	0	0	0	0	36	
WMA15	May 28	1	0	0	9	267	0	2	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58	
WMB1	May 29	0	0	0	5	114	0	1	11	0	2	5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	31	
WMB3	May 29	1	0	1	20	338	3	0	86	0	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	
	Mean	**1.1**	**0.3**	**0.1**	**5.7**	**241.1**	**0.4**	**0.6**	**32.3**	**0.0**	**0.7**	**1.7**	**1.3**	**0.0**	**0.1**	**2.9**	**0.0**	**0.0**	**0.4**	**2.0**	**4.6**	**0.1**	**0.3**	**0.1**	**0.0**	**0.6**	**0.1**	**0.3**	**3.7**	**41.5**	**30.0**

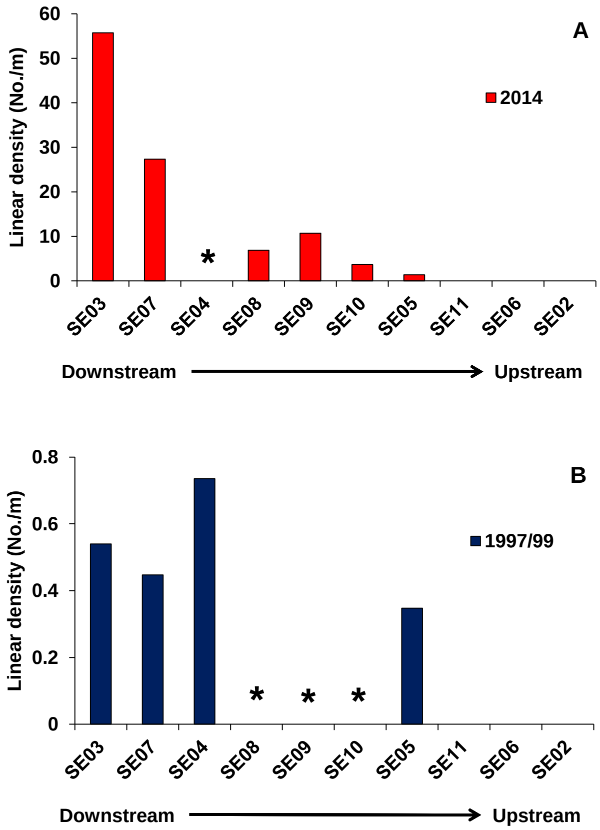


FIG. 1.12.1. Linear density (number/m) of Chinook Salmon at sites in Shelter Valley Creek. A – 2014; all sites except SE04 were surveyed in 2014. B – 1997 and 1999 combined; surveyed sites did not overlap between years, by design. Sites SE02 and SE03 were surveyed in 1997, and SE04-07 were surveyed in 1999. Unsurveyed sites are indicated with an asterisk (*).

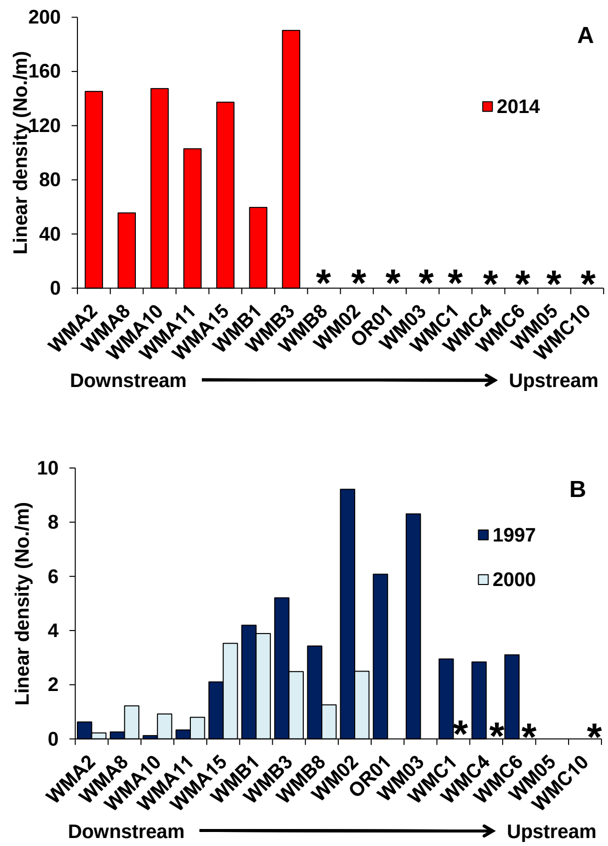


FIG. 1.12.2. Linear density (number/m) of Chinook Salmon at sites in Wilmot Creek. A – 2014; sites upstream of WMB3 were not sampled in 2014. B – 1997 and 2000; all sites were sampled in 1997. In 2000, a beaver dam upstream of WM02 prevented Chinook Salmon from gaining access. Unsurveyed sites are indicated with an asterisk (*).

2. Recreational Fishery

2.1 Fisheries Management Zone 20 Council (FMZ20)

M. D. Desjardins and C. Lake, Lake Ontario Management Unit

Fisheries Management Zone 20 (FMZ20) Council provides recommendations to the Lake Ontario Manager regarding the management of the recreational fishery. The FMZ 20 Council has spent many hours reviewing information, attending meetings, listening to issues, discussing options and providing advice. The Lake Ontario Management Unit would like to acknowledge their dedication and generous donation of time.

The council has been instrumental in advancing many regulatory and planning initiatives. In 2014 the two sub-councils (Eastern and Western Lake Ontario) helped draft a Stocking Plan for Lake Ontario. The purpose of the plan is to examine and optimize stocking activities to help achieve the recently revised Lake Ontario Fish Community Objectives. The stocking plan will guide stocking practices from 2015–2024 to help achieve both lake-wide and local fisheries management objectives. A key management challenge is to balance the short-term social, economic, and cultural needs of fishery stakeholders with the long-term goals of restoring native species while maintaining a balanced Lake Ontario fish community.

2.2 Chinook Salmon Mark and Tag Monitoring

M. J. Yuille, Lake Ontario Management Unit

NYSDEC and OMNRF are conducting a study of the origin (stocked or wild), distribution, and movement of Chinook Salmon in Lake Ontario using fin clips and coded wire tags (CWTs). Detailed results from OMNRF surveys are reported here. NYSDEC and OMNRF 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 CWTs to fish stocked in Lake Ontario. NYSDEC and OMNRF used this system to mark all Chinook Salmon stocked into Lake Ontario from 2008-2011 with an adipose fin clip. Some of these fish were tagged internally with a CWT in the nose to designate the agency and stocking location. Accordingly, all stocked Chinook Salmon ages 3 to 4 years-old observed in Lake Ontario in 2014 should be marked as a result of this program. Currently, only Chinook Salmon stocked into Lake Ontario through the U.S. net pen program are marked with an adipose fin clip.

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

Angling tournament and derby sampling was conducted from June 14th to September 1st, 2014. Salmon were measured, weighed, and examined for fin clips and CWTs. A subsample of Chinook Salmon otoliths and noses were collected for aging and for CWT extraction, respectively.

In the Lake Ontario Volunteer Angler Diary Program, anglers were asked to record any observed fin clips on landed Chinook Salmon (see Section 2.3). In 2014, 17% (141 of 829) of Chinook Salmon reported caught by volunteer anglers had fin clips.

Catch summary for fin clip by year-class of Chinook Salmon from community index gillnetting, angler surveys and angler diaries can be found in Table 2.2.1. The number of angler-caught Chinook Salmon with coded wire tags by stocking and capture location (Fig. 2.2.1) is summarized in Table 2.2.2. For mark and tag results on the Credit River Chinook Assessment Program, see Section 1.7.

TABLE 2.2.1. Catch of Chinook Salmon in index gillnets and angler surveys by fin clip and year class during 2008-2014, showing percent stocked origin. Angler Survey for 2014 consists of results from Angler Tournament and Derby sampling only. Fish length was not recorded in the 2014 Angler Diary Program, so these data are not included below.

		Gill nets							Angler surveys					Angler diaries					
Year-class	Fin Clip	2008	2009	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014	2011	2012	2013	2014	Total	Percent stocked
2008	No clip	-	1	1	-	-	-	-	42	35	-	-	-	124	-	-	-	203	67
	Adipose	3	2	1	1	-	-	-	53	76	-	-	-	281	-	-	-	417	
2009	No clip	-	2	12	1	1	-	-	56	106	147	8	-	315	355	3	-	1,006	53
	Adipose	-	-	18	3	-	-	-	102	142	114	2	-	430	328	1	-	1,140	
2010	No clip	-	-	7	43	1	1	1	3	72	263	288	1	465	515	149	-	1,809	40
	Adipose	-	-	3	14	-	-	-	-	48	176	118	4	326	412	83	-	1,184	
2011	No clip	-	-	-	3	4	4	2	-	3	61	104	24	-	195	47	-	447	57
	Adipose	-	-	-	11	4	1	-	-	-	116	79	19	-	315	57	-	602	
Total		3	5	42	76	10	6	3	256	482	877	599	48	1,941	2,120	340	-	6,808	

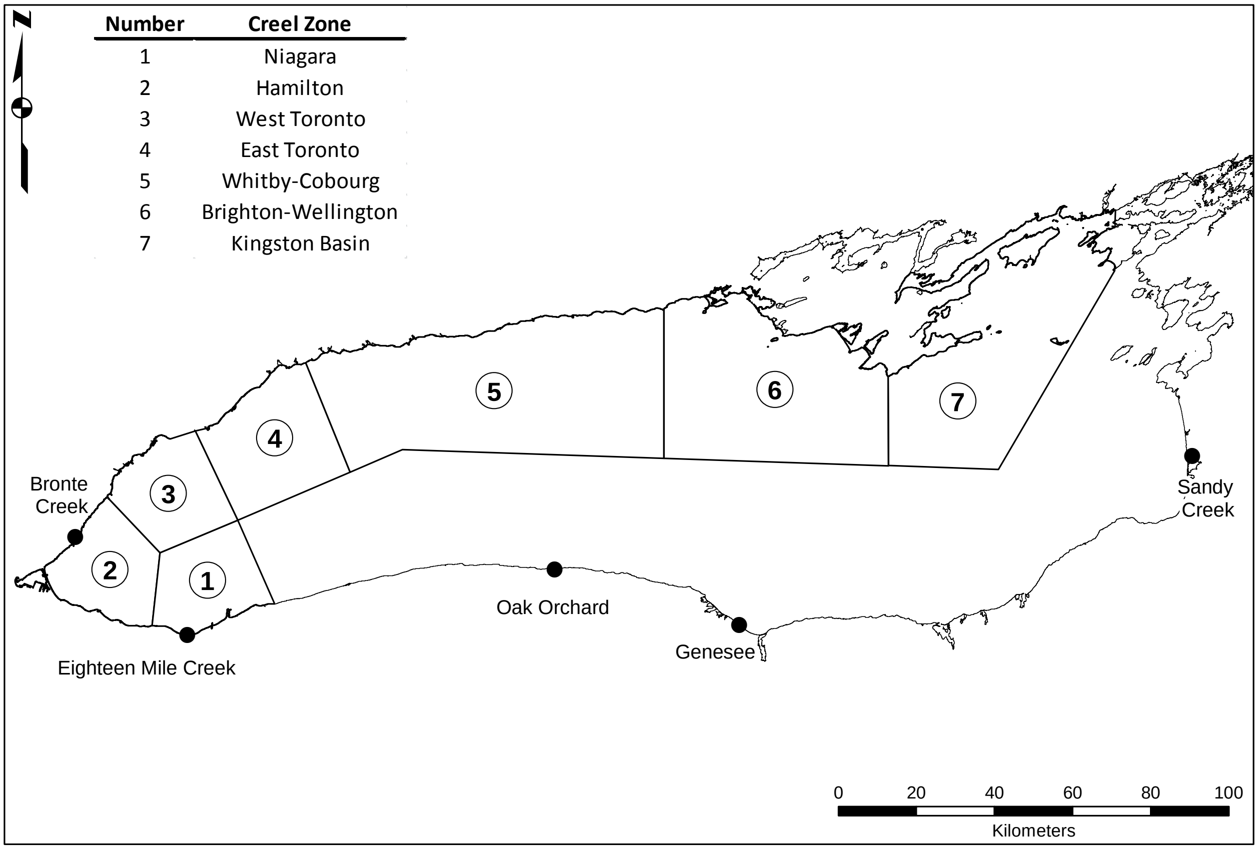


FIG. 2.2.1. Spatial stratification of OMNRF angler surveys in Lake Ontario. Filled circles indicate stocking locations for 2014 angler-caught Chinook Salmon with coded wire tags.

TABLE. 2.2.2. Number of angler-caught Chinook Salmon with coded wire tags in 2014 by stocking and capture locations (for a map of capture locations see Fig. 2.2.1).

		Capture Location					
Stocking Year	Stocking Location	Niagara	Hamilton	West Toronto	East Toronto	Whitby-Cobourg	Brighton-Wellington
2010	Genesee River			1			
	Oak Orchard		1				
2011	Bronte Creek					1	
	Eighteen Mile Creek	3	1	1		1	
	Genesee River					1	
	Oak Orchard					1	
	Sandy Creek	1					

2.3 Lake Ontario Volunteer Angler Diary Program

M. J. Yuille, Lake Ontario Management Unit

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

In 2014, 26 anglers (originating from Ontario and Québec, Fig. 2.3.1) participated in the program—an increase of five participants from 2013. Anglers participating in the diary program fished from March to September out of ports spanning from the Niagara River to Wellington, providing good temporal and spatial distribution of salmonid samples (see Fig. 2.2.1 in Section 2.2). Of all participants, 65% were affiliated with an angling club and 12% were charter boat operators. In 2014, anglers made 474 angling trips and recorded data on 2,238 Lake Ontario salmonids (Tables 2.3.1 and 2.3.2). Anglers were asked to record location (nearest port), fish disposition (kept or released), and examine every salmonid landed for fin clips.

Of the five salmonid species, Chinook Salmon were targeted most frequently and represented the highest catch in 2014 (Fig. 2.3.2

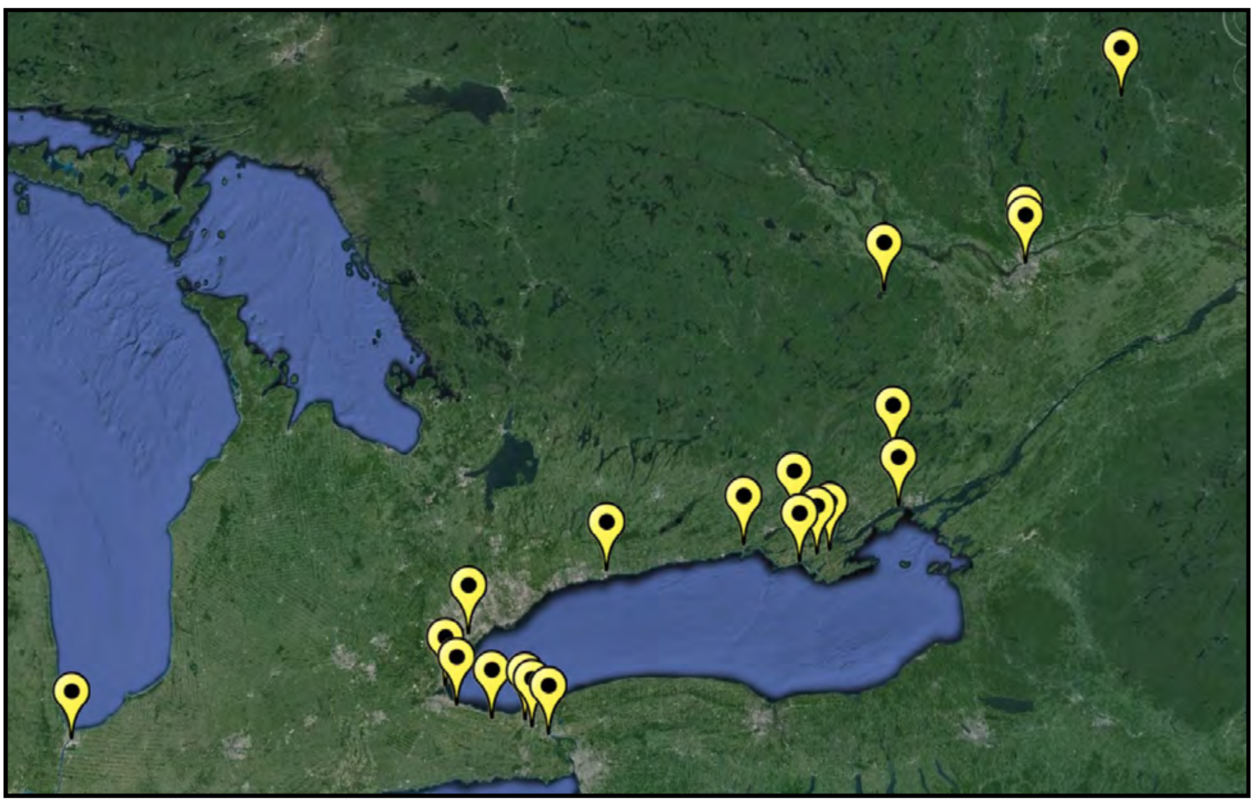


FIG. 2.3.1. Geographical distribution of participants in the 2014 Lake Ontario Volunteer Angler Diary program, ranging from Sarnia, ON (south western most point) to La Minerve, QC (north eastern most point). Image courtesy of Google Earth.

TABLE 2.3.1. Distribution of angler catches and targets (in brackets) for the six Lake Ontario salmonid species across seven months (March to September 2014) as reported in the 2014 Lake Ontario Angler Diary Program.

2014 Lake Ontario Angler Diary								
Month	Number of Trips	Coho Salmon	Chinook Salmon	Rainbow Trout	Atlantic Salmon	Brown Trout	Lake Trout	Total
March	1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (1)	6 (1)
April	40	10 (13)	25 (25)	4 (19)	1 (3)	42 (37)	86 (25)	168 (122)
May	111	47 (64)	222 (96)	34 (70)	5 (33)	25 (71)	222 (85)	555 (419)
June	59	24 (30)	50 (51)	65 (47)	3 (14)	3 (23)	131 (40)	276 (205)
July	127	30 (26)	191 (115)	84 (61)	1 (10)	7 (33)	180 (51)	493 (296)
August	112	58 (28)	268 (106)	155 (52)	5 (16)	7 (22)	93 (31)	586 (255)
September	24	3 (11)	73 (23)	56 (18)	0 (11)	1 (12)	21 (15)	154 (90)
Total	474	172 (172)	829 (416)	398 (267)	15 (87)	85 (198)	739 (248)	2238 (1388)

TABLE. 2.3.2. Distribution of angler catch and targets (in brackets) for the six Lake Ontario salmonid species across six sector locations as reported in the 2014 Lake Ontario Angler Diary Program. See Fig. 2.3.2 for a map of the six defined areas.

2014 Lake Ontario Angler Diary								
Sector	Number of Trips	Coho Salmon	Chinook Salmon	Rainbow Trout	Atlantic Salmon	Brown Trout	Lake Trout	Total
Brighton-Wellington	133	1 (4)	193 (91)	14 (16)	1 (2)	10 (40)	216 (46)	435 (199)
Whitby-Cobourg	27	0 (0)	38 (27)	2 (3)	0 (0)	0 (1)	5 (4)	45 (35)
East Toronto	6	5 (5)	4 (6)	8 (5)	0 (0)	0 (0)	0 (0)	17 (16)
West Toronto	28	80 (19)	32 (22)	168 (28)	5 (5)	0 (0)	2 (2)	287 (76)
Hamilton	128	52 (84)	183 (120)	148 (111)	5 (54)	20 (64)	277 (92)	685 (525)
Niagara	146	34 (60)	376 (144)	58 (100)	4 (26)	55 (93)	214 (101)	741 (524)
Other	6	0 (0)	3 (6)	0 (4)	0 (0)	0 (0)	25 (3)	28 (13)
Total	474	172 (172)	829 (416)	398 (267)	15 (87)	85 (198)	739 (248)	2238 (1388)

and Tables 2.3.1, 2.3.2 and 2.3.3). While Rainbow Trout were the second most frequently targeted species, Lake Trout were the second most frequently caught species (Fig. 2.3.2, Tables 2.3.1 and 2.3.2). Seventy-seven percent of trips targeted more than one species simultaneously. Approximately 20% of trips targeted solely Chinook Salmon, 15% targeted all species and 8% targeted both Chinook Salmon and Rainbow Trout at the same time (Fig. 2.3.3). Lake Trout and Rainbow Trout were the only other species targeted specifically on their own by anglers (3% and 0.7% of trips, respectively).

In 2014, Chinook Salmon had the highest percent harvest (34% of catch) followed by Coho Salmon and Brown Trout (28% each), Rainbow Trout (23%), Lake Trout (17%) and Atlantic Salmon (7%) (Fig. 2.3.4). No clips were observed on any Coho or Atlantic Salmon caught. Thirty-seven percent of Lake Trout, 17% of Chinook Salmon and 16% of both Rainbow and Brown Trout caught had fin clips (Fig. 2.3.5).

Seasonal and geographical catch summaries are provided in Tables 2.3.1 and 2.3.2 (respectively). Most angling trips were recorded in May, July and August (74% combined) and originated predominantly from Brighton-Wellington, Hamilton and Niagara sectors (86% of trips). Catches of Coho Salmon were concentrated in the West Toronto and Hamilton sectors (77% combined) and were generally equally distributed from May to August (Tables 2.3.1 and 2.3.2). Chinook Salmon were predominantly caught in May, July and August (82% of catch) and in the Niagara, Hamilton and Brighton-Wellington sectors (91% combined). Most Rainbow Trout were caught in July and August (60% combined) and in the West Toronto

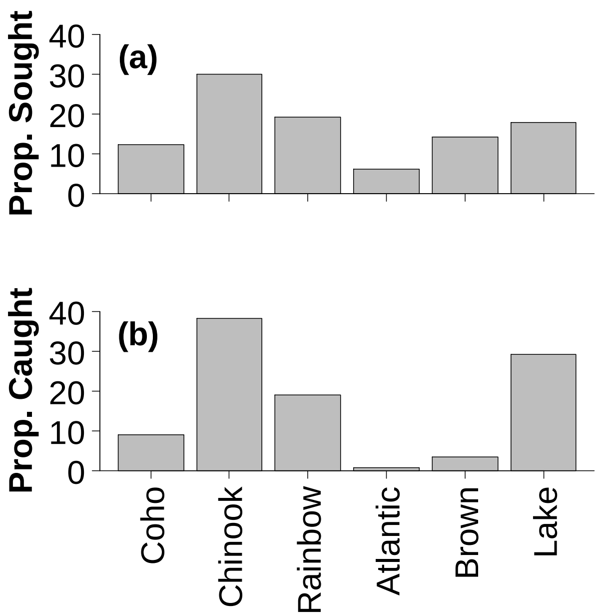


FIG. 2.3.2. Proportion of species sought (a) and caught (b) from all 474 trips recorded in the 26 Lake Ontario volunteer angler diaries submitted to the Lake Ontario Management Unit. Species labels include Coho Salmon (Coho), Chinook Salmon (Chinook), Rainbow Trout (Rainbow), Atlantic Salmon (Atlantic), Brown Trout (Brown) and Lake Trout (Lake).

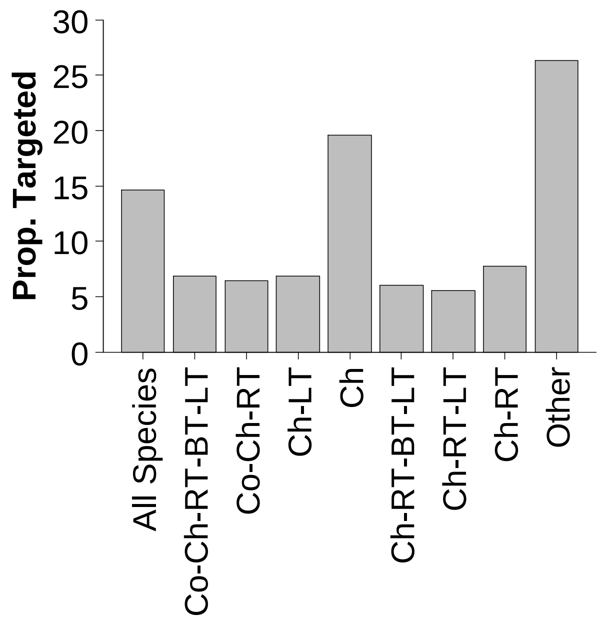


FIG. 2.3.3. Proportion of species combinations that were targeted by anglers in the 2014 Lake Ontario Angler Diary Program. All species represents all salmonid species were targeted (Coho Salmon (Co), Chinook Salmon (Ch), Rainbow Trout (RT), Atlantic Salmon, Brown Trout (BT) and Lake Trout (LT). Other represents the cumulative sum of proportions for targeted species combinations that were less than 5% frequency of occurrence.

TABLE 2.3.3. Annual angler participation and spatial distribution of Chinook Salmon captured in the Lake Ontario Volunteer Angler Diary Program, 2011-2014. See Figure 2.3.2 for a map of the six defined areas.

			Chinook Salmon Caught							
Survey Year	Number of Volunteer Anglers	Number of Trips	Niagara	Hamilton	West Toronto	East Toronto	Whitby-Cobourg	Brighton-Wellington	Undefined	Total Catch
2011	26	626	757	19	370	120	309	635	47	2257
2012	31	645	676	195	367	39	324	488	147	2236
2013	21	424	246	145	84	24	105	331	10	945
2014	26	474	376	183	32	4	38	193	3	829
Total	104	2169	2055	542	853	187	776	1647	207	6267

and Hamilton sectors (79% combined). Atlantic Salmon catches were evenly distributed through May to September; most fish were caught in the West Toronto, Hamilton and Niagara sectors (93% combined). The majority of Brown Trout were caught in April and May (79% combined) in the Hamilton and Niagara sectors (88% combined). Lastly, Lake Trout were predominantly caught from May to July (72% combined) and evenly distributed among the Brighton-Wellington, Hamilton and Niagara sectors (96% of catch).

We would like to thank all Lake Ontario Volunteer Angler Diary participants who generously volunteered their time to collect marking and biological information for this program.

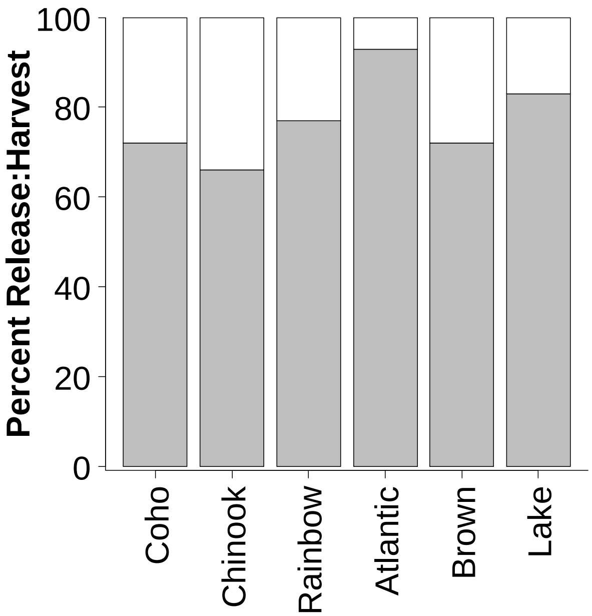


FIG. 2.3.4. Percent released (grey) and harvested (white) for each salmonid species (Coho Salmon (Coho), Chinook Salmon (Chinook), Rainbow Trout (Rainbow) Atlantic Salmon (Atlantic), Brown Trout (Brown) and Lake Trout (Lake)) reported in the 2014 Lake Ontario Angler Diary Program.

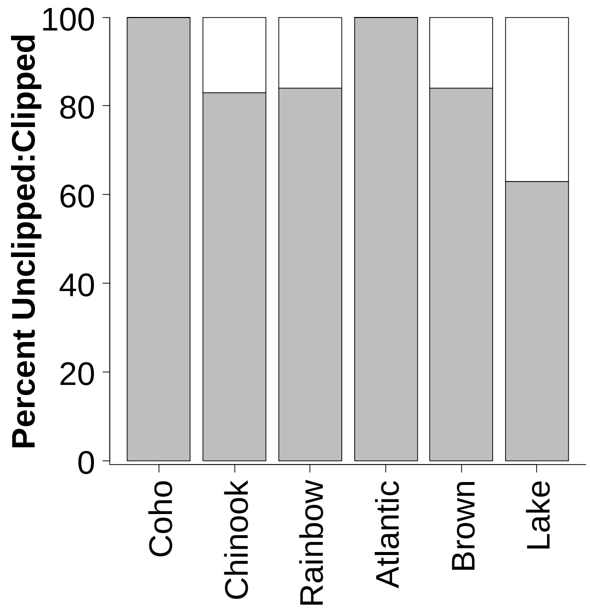


FIG. 2.3.5. Percent composition of unclipped (grey) vs clipped (white) for each salmonid species (Coho Salmon (Coho), Chinook Salmon (Chinook), Rainbow Trout (Rainbow) Atlantic Salmon (Atlantic), Brown Trout (Brown) and Lake Trout (Lake)) reported in the 2014 Lake Ontario Angler Diary Program..

2.4 Bay of Quinte Fish Ice Angling Survey

J. A. Hoyle, Lake Ontario Management Unit

Only the ice-fishing component of the Bay of Quinte recreational angling fishery was monitored in 2014; the open-water fishery was not surveyed. The ice-fishing survey was conducted from Trenton to just east of Glenora. The field survey began on Jan 3 and ran until Mar 1. 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 (four days per week; two weekday and two weekend days) provided information on hut occupancy rates, catch/harvest rates, and biological characteristics of the harvest. For the first time, portable huts were distinguished from permanent huts, and the use of electronics (flashers and cameras).

Ice conditions were generally quite good. For analysis, the angling season was considered to be Dec 16 (safe ice-conditions and observed angling effort) to March 1 (last day of Walleye angling open season) time-period. Seventeen aerial flights were conducted from Jan 3-Feb 28, 2014. The maximum number of ice-huts counted during aerial flights was 665 huts on February 15 (354 portable and 311 permanent huts); while the maximum number of on-ice anglers observed was 522 (also on February 15). A total of 1786 anglers were interviewed during 28 on-ice surveys. Thirty-three percent of anglers interviewed were local, 62% were from Ontario (outside the local area), 4% were from the US and 1% was from elsewhere in Canada.

The 2014 survey estimated a total of 203,952 hours of ice-fishing effort, 43% higher than in 2013 (146,304 hours). Of the total angling effort, Walleye anglers accounted for 202,409 hours. Walleye anglers caught 19,740 Walleye of which 14,044 were harvested (Table 2.4.1). Walleye fishing success rate (10 hours to catch a Walleye) this winter was average. The majority of angling effort, catch, harvest, and the highest catch rate (CUE = fish-per-hour) occured in portable huts. Also, anglers using electronics (e.g. portable flashers) had the highest CUE for Walleye (Fig. 2.4.1). The size distribution of Walleye harvested is shown in Fig. 2.4.2.

Fig. 2.4.3 and Table 2.4.2 summarize ice-fishing survey results for 1993-2014.

Anglers also caught an estimated 27,574 Yellow Perch of which 7,418 were harvested during the winter ice-fishery (Table 2.4.3). The size distribution of Yellow Perch harvested is shown in Fig. 2.4.4.

Other fish species observed caught included Cisco, Northern Pike and White Perch (Table 2.4.3).

TABLE 2.4.1. Walleye angling effort, catch, harvest, release rate and CUE (fish-per-hour) for on-ice, portable and permanent hut anglers, during the 2014 ice-fishery.

	Walleye Anglers				
	Effort (hours)	Catch	Harvest	Release Rate	CUE
On-ice anglers	70,655	5,539	5,083	8%	0.078
Portable hut anglers	109,847	13,338	8,270	38%	0.121
Permanent hut anglers	21,907	863	691	20%	0.039
Totals	**202,409**	19,740	14,044	29%	0.098

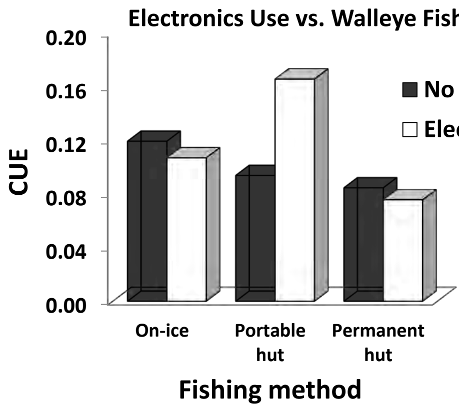


FIG. 2.4.1. Walleye angling catch rates (CUE) for on-ice, portable and permanent hut anglers with and without the use of electronics including flashers and cameras.

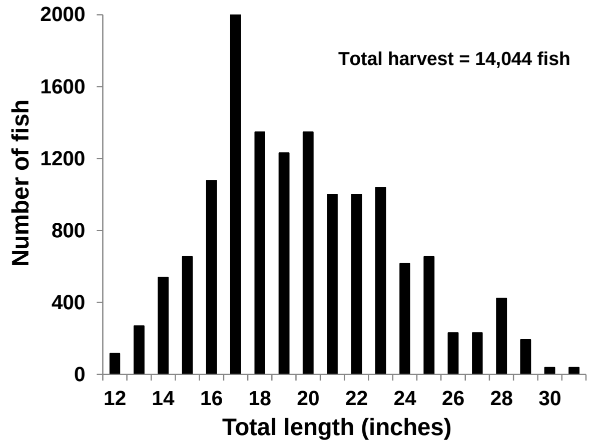


FIG. 2.4.2. Size (total length in inches) distribution of Walleye harvested during the 2014 winter ice-fishery based on measuring 365 fish.

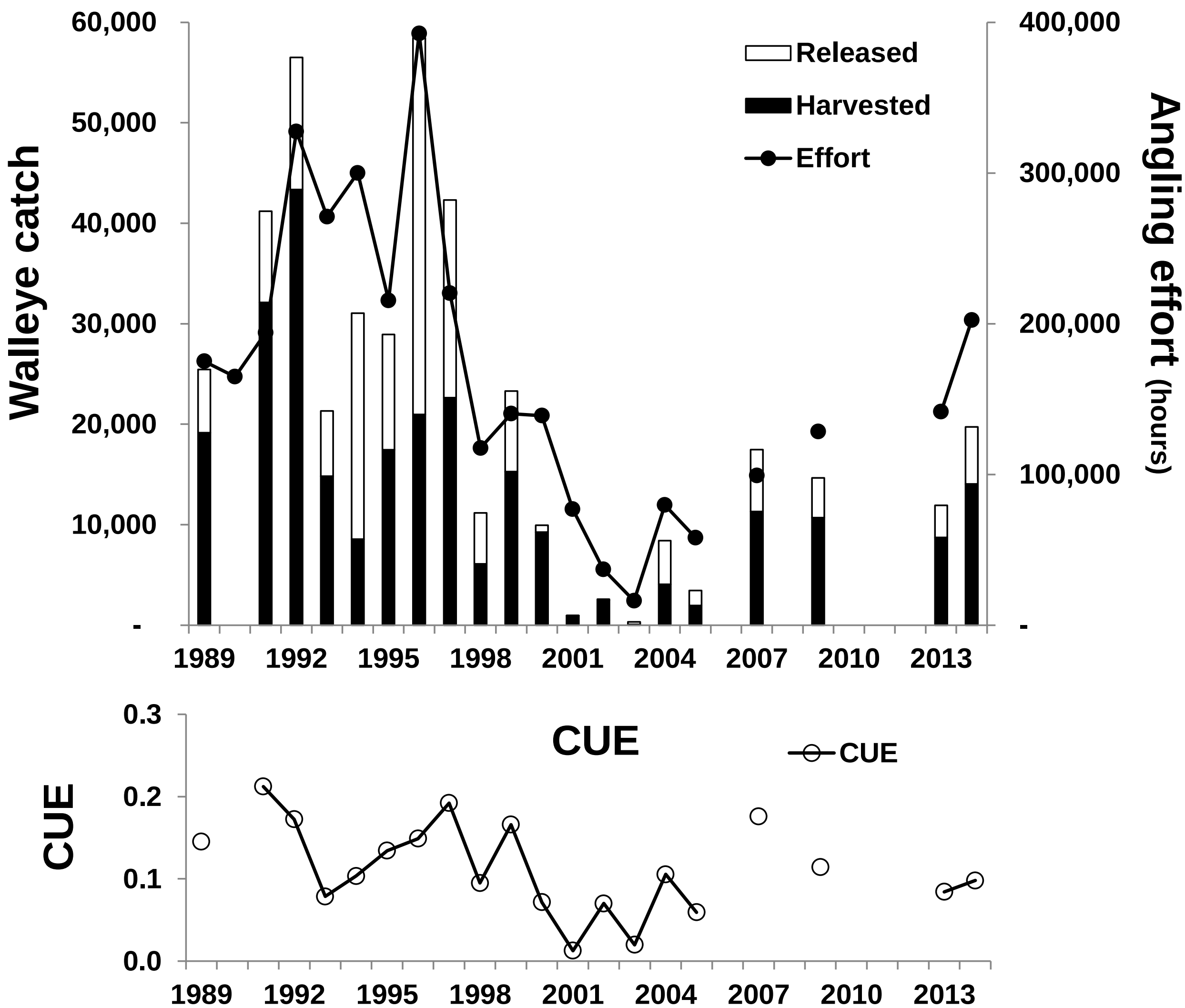


FIG. 2.4.3. Upper panel: fishing effort and walleye catch (released and harvested) during the winter ice-fishery, 1989-2014. No data for 2006, 2008, 2010, 2011 or 2012. Lower panel: Walleye catch-per-unit-effort (CUE) for same years as upper panel.

TABLE 2.4.2. Bay of Quinte ice angling fishery statistics, 1982-2014, 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
2014	202,409	0.098	0.069	19,740	14,044	1.439

TABLE 2.4.3. Species-specific catch and harvest by all anglers during the 2014 winter ice-fishery.

Species	Catch	Harvest	% kept
Cisco (Lake Herring)	27	27	100
Northern Pike	172	46	27
White Perch	96	38	40
Yellow Perch	27,574	7,418	27
Walleye	19,740	14,044	71

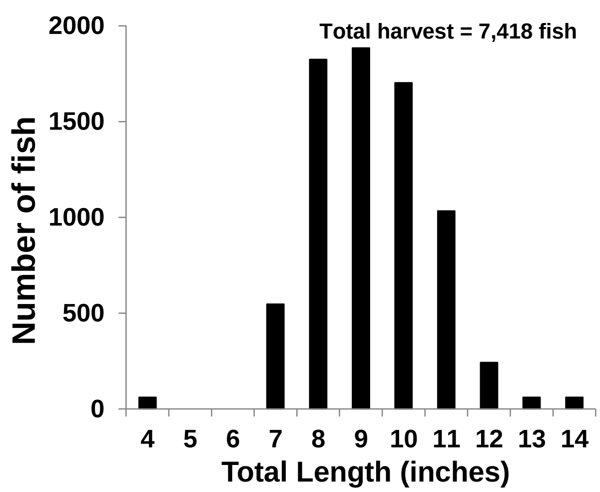


FIG. 2.4.4. Size (total length in inches) distribution of Yellow Perch harvested during the 2014 winter ice-fishery based on measuring 122 fish.

2.5 Bay of Quinte Volunteer Walleye Angler Diary Program

J. A. Hoyle, Lake Ontario Management Unit

A volunteer angler diary program was conducted during fall 2014 on the Bay of Quinte. The diary program focused on the popular fall recreational fishery for "trophy" Walleye, primarily on the middle and lower reaches of Bay of Quinte. This was the third year of the diary program. Anglers that volunteered to participate were given a personal diary and asked to record information about their daily fishing trips and catch (see Fig. 2.5.1). A total of 23 diaries were returned as of February 2015. We thank all volunteer anglers for participating in the program. A map showing the distribution of volunteer addresses of origin is shown in Fig. 2.5.2.

Objectives of the diary program included:

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

Three of the 23 returned diaries reported zero fishing trips. The number of fishing trips reported in each of the remaining 20 diaries

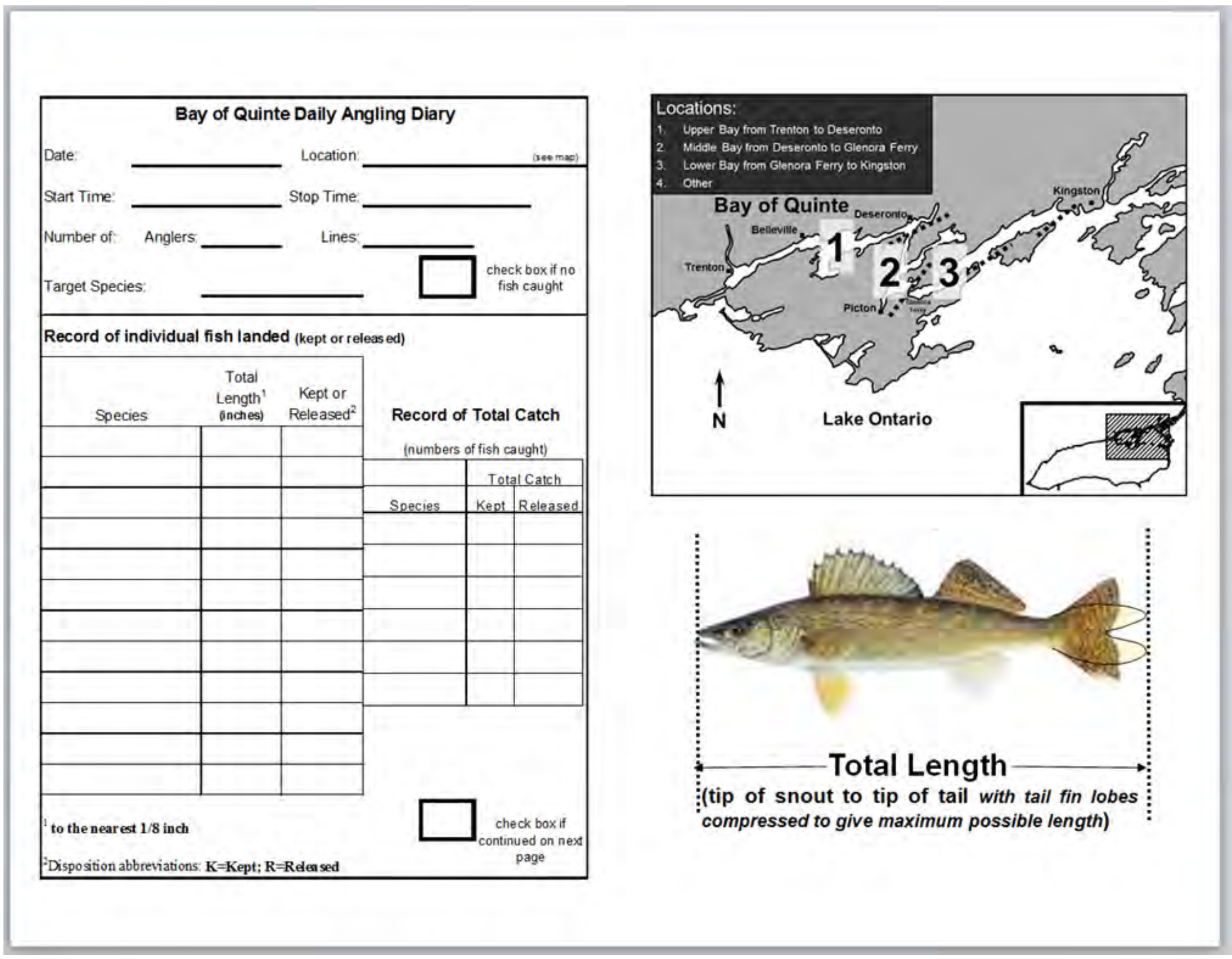


FIG. 2.5.1. Volunteer angler diary used to record information about daily fishing trips and catch.

FIG. 2.5.2. Map showing the distribution of volunteer addresses of origin.

Table 2.5.1. Reported total number of boat trips, average trip duration, and average number of anglers per trip for charter and non-charter Walleye fishing trips during fall 2012 and 2013 on the Bay of Quinte.

	2012		2013		2014	
	Charter	Non-charter	Charter	Non-charter	Charter	Non-charter
Total number of boat trips	121	137	72	83	123	87
Average trip duration (hours)	7.7	5.6	7.4	4.9	7.4	5.3
Average number of anglers per trip	4.4	2.3	4.0	2.1	4.4	2.3

ranged from one to 37 trips. Fishing trips were reported for 80 out of a possible 106 calendar days from Sep 1 to Dec 15. There were from one to fourteen volunteer angler boats fishing on each of the 80 days, and a total of 210 trip reports targeted at Walleye; 123 charter boat trips and 87 non-charter boat trips (Table 2.5.1). Of the 210 trips, 197 (94%) were made on Locations 2 and 3, the middle and lower reaches of the Bay of Quinte (see Fig. 2.5.1). The overall average fishing trip duration was 7.4 hours for charter boats and 5.3 hours for non-charter boats, and the average numbers of anglers per boat trip were 4.4 and 2.3 for charter and non-charter boats, respectively (Table 2.5.1). In Location 3, where two lines are permitted, most anglers used two lines (1.9 rods per angler on average).

Fishing Effort

A total of 5,164 angler hours of fishing effort was reported by volunteer anglers (Table 2.5.2). Reported fishing effort increased steadily from late September until late November and then declined rapidly (Fig. 2.5.3). Most (54%) fishing effort occurred in November followed by October (31%). Most fishing effort occurred in Locations 2 (63%; middle Bay) or 3 (35%; lower Bay) (Fig. 2.5.4).

Catch

Nine species and a total of 800 fish were reported caught by volunteer anglers. The number of Walleye caught was 688; 338 (49%) kept and 350 (51%) released (Table 2.5.3). The

Table 2.5.2. Reported total number of diaries (with at least one reported fishing trip), boat trips and effort, total angler effort, total number of Walleye caught, harvested, and released, average number of Walleye caught per boat fishing trip, average number of Walleye caught per boat hour, average number of Walleye caught per angler hour, and the "skunk" rate (percentage of trips with no Walleye catch) for Walleye fishing trips during fall 2012, 2013 and 2014 on the Bay of Quinte.

Year	2012	2013	2014
Number of diaries	22	19	20
Number of boat trips	258	155	210
Boat effort (hours)	1,694	941	1,375
Angler effort (hours)	5,915	3,093	5,164
Catch	542	574	682
Harvest	291	307	336
Released	251	267	346
Fish per boat trip	2.1	3.7	3.2
Fish per boat hour	0.305	0.557	0.463
Fish per angler hour	0.102	0.193	0.137
"Skunk" rate	36%	19%	27%

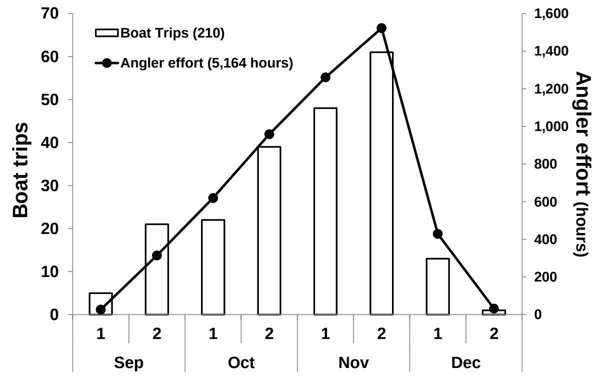


FIG. 2.5.3. Seasonal breakdown (summarized by first and second half of each month from the first half of Sep to the second half of Dec.) of fishing effort (boat trips and angler hours) reported by volunteer Walleye anglers during fall 2014 on the Bay of Quinte.

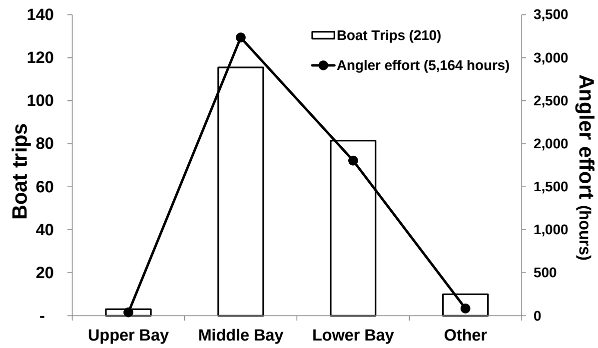


FIG. 2.5.4. Geographic breakdown (summarized by first and second half of each month from the first half of Sep to the second half of Dec.) of fishing effort (boat trips and angler hours) reported by volunteer Walleye anglers during fall 2014 on the Bay of Quinte.

TABLE 2.5.3. Number of fish, by species, reported caught (kept and released) by volunteer anglers during the fall Walleye diary program, 2012-2014.

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

next most abundant species caught was Freshwater Drum (54) followed by Northern Pike (38).

Fishing Success

The overall fishing success for Walleye in fall 2014 was 3.2 Walleye per boat trip or 0.137 fish per angler hour of fishing (Table 2.5.2). Fishing success in 2014 was lower than 2013 but higher than 2012. Seventy-three percent of all boat trips reported catching at least one Walleye ("skunk" rate 27%). Seasonal fishing success, for geographic Locations 2 and 3 combined, is shown in Fig. 2.4.5. Success was variable in September and October then showed an increasing trend in November through December. Fishing success was higher in location 2 (middle Bay; 4.1 Walleye per boat trip or 0.151 fish per angler hour) than in Location 3 (lower Bay; 2.6 Walleye per boat trip or 0.136 fish per angler hour).

Length Distribution of Walleye Caught

Harvested Walleye were smaller than released Walleye (mean total length 23.1 vs. 25.6 inches respectively; Fig. 2.5.6). The mean total length of Walleye caught (harvested and released fish) increased from September through early December (Fig. 2.5.7).

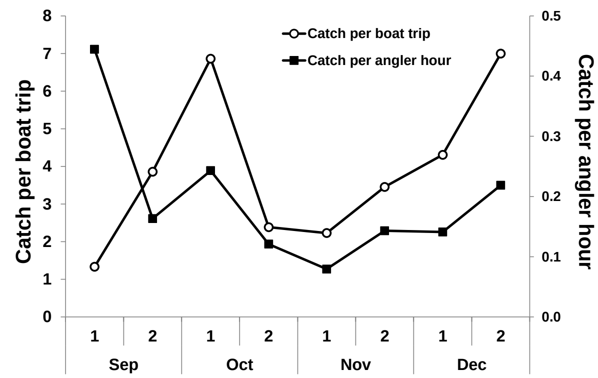


FIG. 2.5.5. Walleye fishing success (catch per boat trip and per angler hour) reported by volunteer Walleye anglers in areas 2 and 3 during fall 2014 on the Bay of Quinte (summarized by first and second half of each month from the first half of Sep to the second half of Dec).

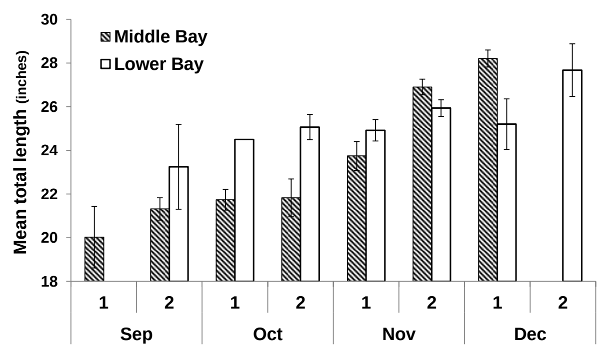


FIG. 2.5.7. Mean total length (inches) of Walleye caught by volunteer Walleye anglers during fall 2014 on the Bay of Quinte by location (summarized by first and second half of each month from the second half of Sep to the second half of Dec). Error bars are +-1SE.

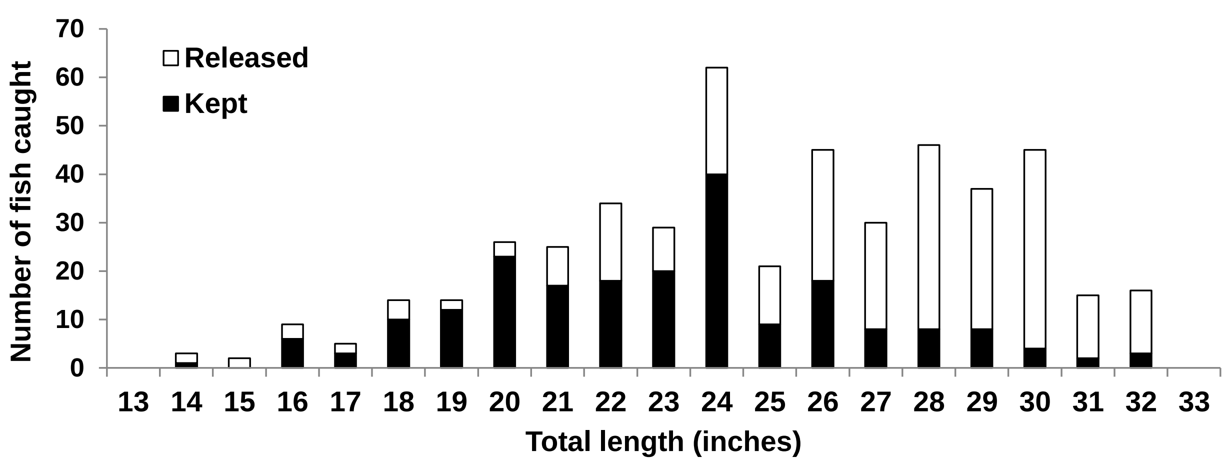


FIG. 2.5.6. Length distribution of Walleye caught (kept and released) by volunteer Walleye anglers during fall 2014 on the Bay of Quinte.

2.6 Lake Ontario Tributary Angling Survey

M. J. Yuille, Lake Ontario Management Unit

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

New York State Department of Environmental Conservation (NYSDEC) conducts a comprehensive tributary creel along the south shore of Lake Ontario on a three year cycle covering the fall, winter and spring tributary fishery (New York State Department of Environmental Conservation 2012[1]). NYSDEC has reported an increase in tributary effort (angler hours spent fishing) from 2005 to 2012; current estimates suggest angler effort in the NYS Lake Ontario tributary fishery (approximately 1.6 million hours) represents twice the effort reported in the U.S. Lake Ontario recreational boat fishery (approximately 900,000 hours) (New York State Department of Environmental Conservation 2012[1]). Based on these results, the Lake Ontario tributary fishery (Ontario and U.S.) could have ecological effects on the lake's fish community.

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

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

Starting in September 2014, the Lake Ontario Management Unit implemented the first comprehensive landscape scale Lake Ontario tributary creel. This survey includes 10 Lake Ontario tributaries across the north shore of Lake Ontario (Fig. 2.6.1). The value of this program is multi-facetted, providing critical information on angler effort, catch and harvest as well as characterising some of the behaviours and practices of tributary anglers. This program contributes to the understanding and management of Lake Ontario fisheries as a whole ecosystem as outlined in the 2013 Fish Community Objectives for Lake Ontario (http://www.glfc.org/lakecom/loc/LO-FCO-2013-Final.pdf).

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

From September 5 to December 31, 2014, there were a total of 134 survey days, 1,862 anglers interviewed and a total of 3,671 anglers counted (Table 2.6.1). In this survey period, 52% of anglers travelled alone and 94% of anglers traveled less than 1.5 hours by car to get to their angling location (Figs. 2.6.2 and 2.6.3, respectively). Ninety-nine percent of anglers interviewed were Ontario residents (40% local and 59% non-local; see Fig. 2.6.4). The most popular fishing method was drift fishing (77% of respondents) followed by still fishing (9%), fly (7%) and spin (6%) casting (Fig. 2.6.5). In the fall/winter tributary fishery, 55% of anglers targeted Rainbow Trout followed by Chinook Salmon (18%) and Brown Trout (17%, see Fig. 2.6.6).

The Lake Ontario Tributary Creel will continue until May 31, 2015. A full report on the results of this program will be compiled in the months following the program completion.

[1]*New York State Department of Environmental Conservation. 2013. 2012 Annual Report. Bureau of Fisheries Lake Ontario Unit and St. Lawrence River Unit to the Great Lakes Fishery Commission's Lake Ontario Committee. New York State Department of Environmental Conservation, Albany, New York, United States of America.*

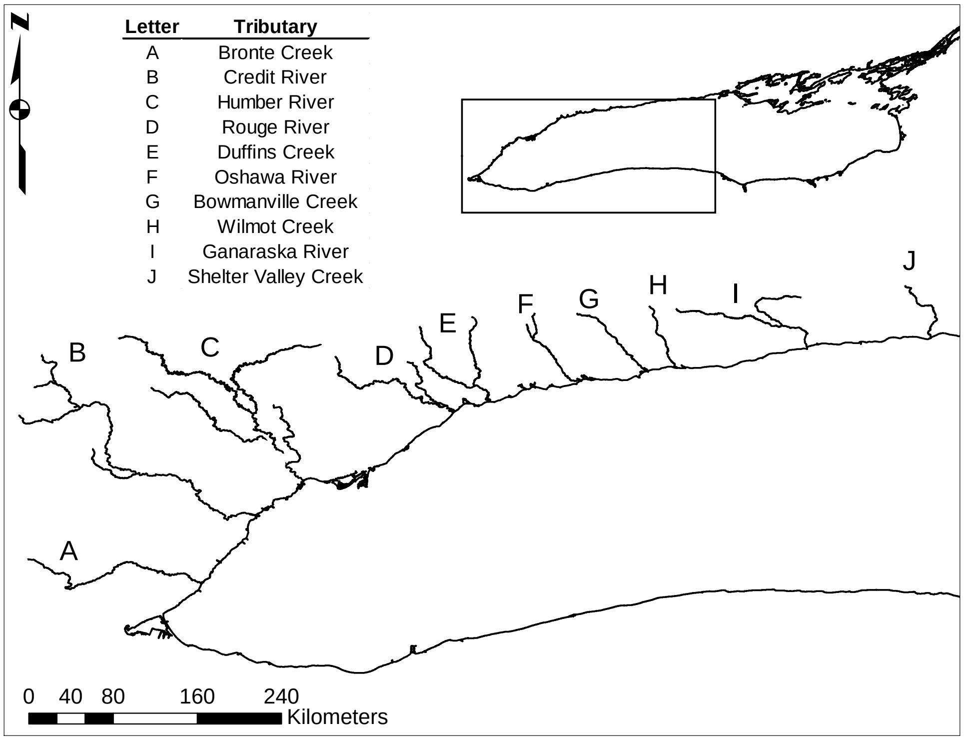


FIG. 2.6.1. Map of the 10 tributaries surveyed in the 2014-2015 Lake Ontario Tributary Angling Survey.

TABLE 2.6.1. Summary of field staff survey days (Survey Days), total count of anglers fishing (Anglers) and total number of interviews conducted by field staff from September 5-December 31, 2014.

Month	Survey Days	Anglers	Interviews
September	30	1209	505
October	32	1058	520
November	36	787	482
December	36	617	355
Total	134	3671	1862

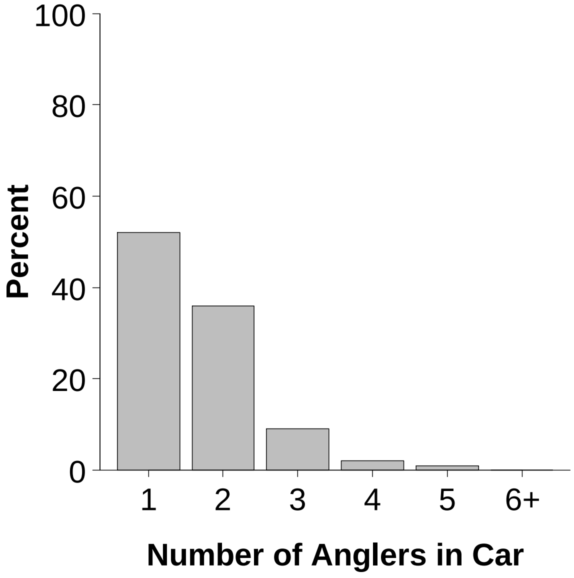


FIG. 2.6.2. Percent distribution of the number of anglers per vehicle for each trip between the period of September 5 and December 31, 2014. These data represent a total of 1,802 angler responses.

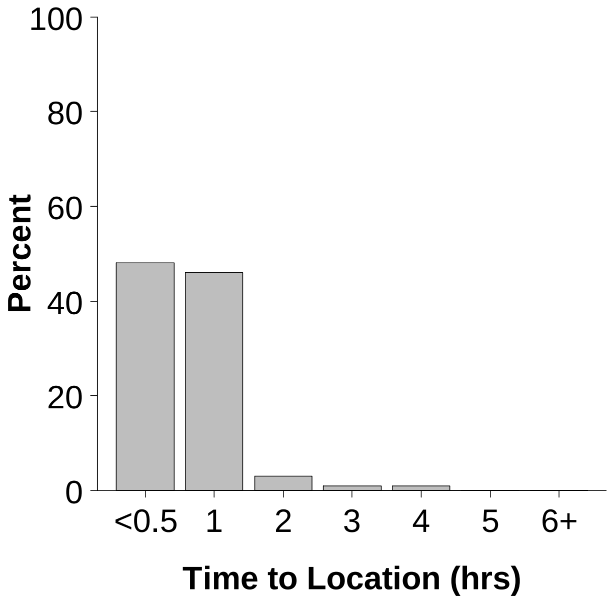


FIG. 2.6.3. Percent distribution of the time it took the angler to reach their fishing location between the period of September 5 and December 31, 2014. These data represent a total of 1,814 angler responses.

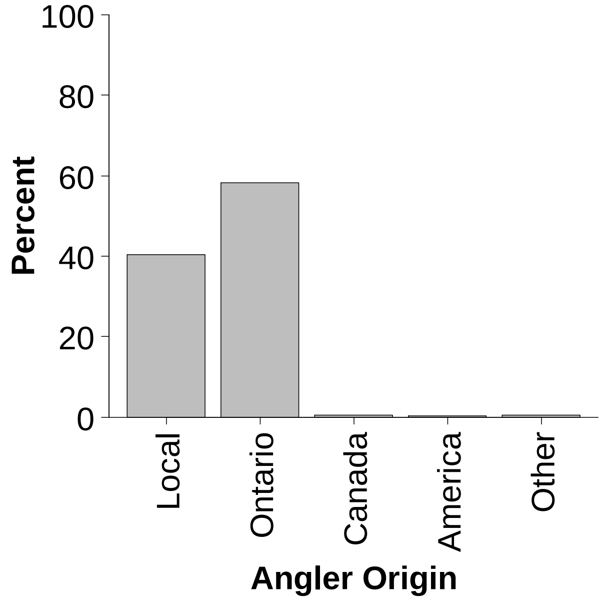


FIG. 2.6.4. Percent distribution of angler origin between the period of September 5 and December 31, 2014. Local represents anglers that live within 30 min of the fishing location, Ontario represents anglers that are Ontario residents but like more than 30 min away from their fishing location, Canada represents non-Ontario resident Canadians, America represents American anglers and Other captures anglers that do not fall within the aforementioned categories. These data represent a total of 1,857 angler responses.

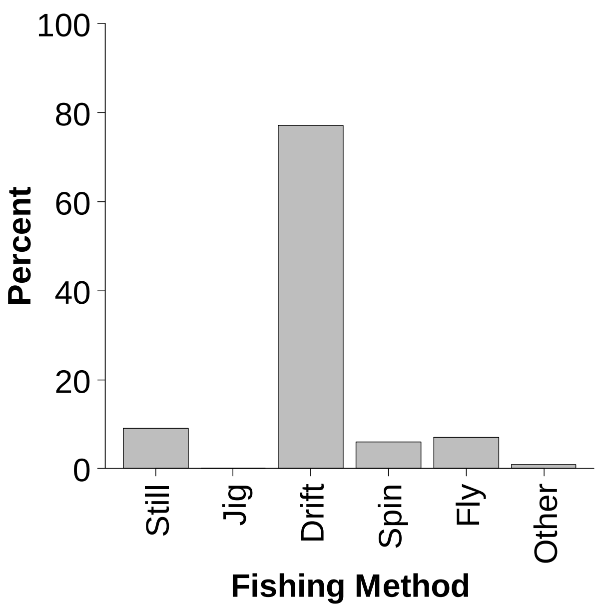


FIG. 2.6.5. Percent distribution of the fishing method used by anglers between the period of September 5 and December 31, 2014. Still = still fishing, Jig = casting with a jig, Drift = drift or float fishing/ bottom bouncing, Spin = spin casting or casting with lures, Fly = fly fishing, Other = any other method outside the previous five covered. These data represent a total of 1,857 angler responses.

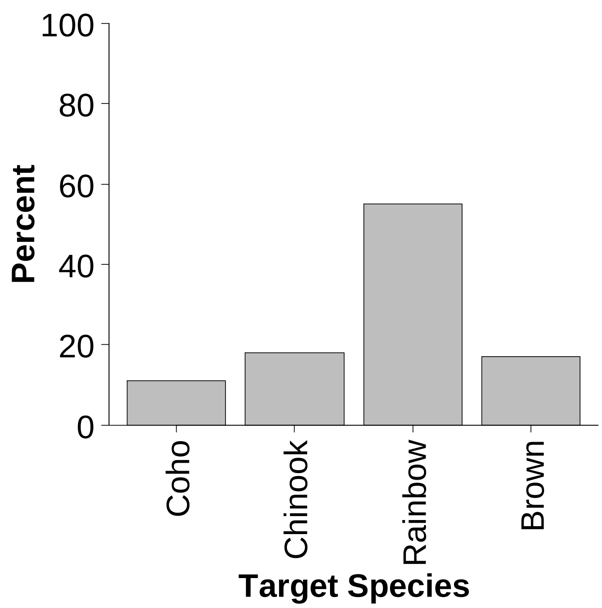


FIG. 2.6.6. Percent distribution of the migratory salmonid species targeted by anglers between the period of September 5 and December 31, 2014. Atlantic Salmon are not included in this figure as there is currently no open season for that species. These data represent a total of 1,862 angler responses.

3. Commercial Fishery

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

A. Mathers, Lake Ontario Management Unit

The Lake Ontario and St. Lawrence River Commercial Fishery Liaison Committee (LOLC) consists of Ontario Commercial Fishing License holders that are appointed to represent each of the quota zones, as well as representatives of the Ontario Commercial Fisheries' Association (OCFA), and MNR. 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.

The committee met three times during 2014. One of the topics of discussion during was bycatch of turtles in hoop nets (see Section 3.4). Other notable topics of discussion at the LOLC meetings included status of fish stocks, discussion of licence restrictions, quota and harvest levels for yellow perch, whitefish and walleye, invasion and efforts to control Water Chestnut at Wolfe Island, and the eel trap and transport program (Section 8.3).

3.2 Quota and Harvest Summary

J. A. Hoyle, Lake Ontario Management Unit

Lake Ontario supports a commercial fish industry; the commercial harvest comes primarily from the Canadian waters of Lake Ontario east of Brighton (including the Bay of Quinte, East and West Lakes) and the St. Lawrence River (Fig. 3.2.1). Commercial harvest statistics for 2014 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 2014, are shown in Tables 3.2.1 (base quota), 3.2.2 (issued quota), 3.2.3 (harvest) and 3.2.4 (landed value).

The total harvest of all species was 359,006 lb ($447,120) in 2014, down 136,005 lb (27%) from 2013. The harvest (landed value) for Lake Ontario, the St. Lawrence River, and East and West Lakes was 240,697 lb ($309,192), 92,679 lb ($107,990-), and 25,630 lb ($31,932), respectively (Fig. 3.2.2 and Fig. 3.2.3). Lake Whitefish, Yellow Perch and Walleye were the dominant species in the harvest for Lake Ontario. Yellow Perch was dominant in the St. Lawrence River. Sunfish was the dominant fish in East and West Lakes.

Major Fishery Trends

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

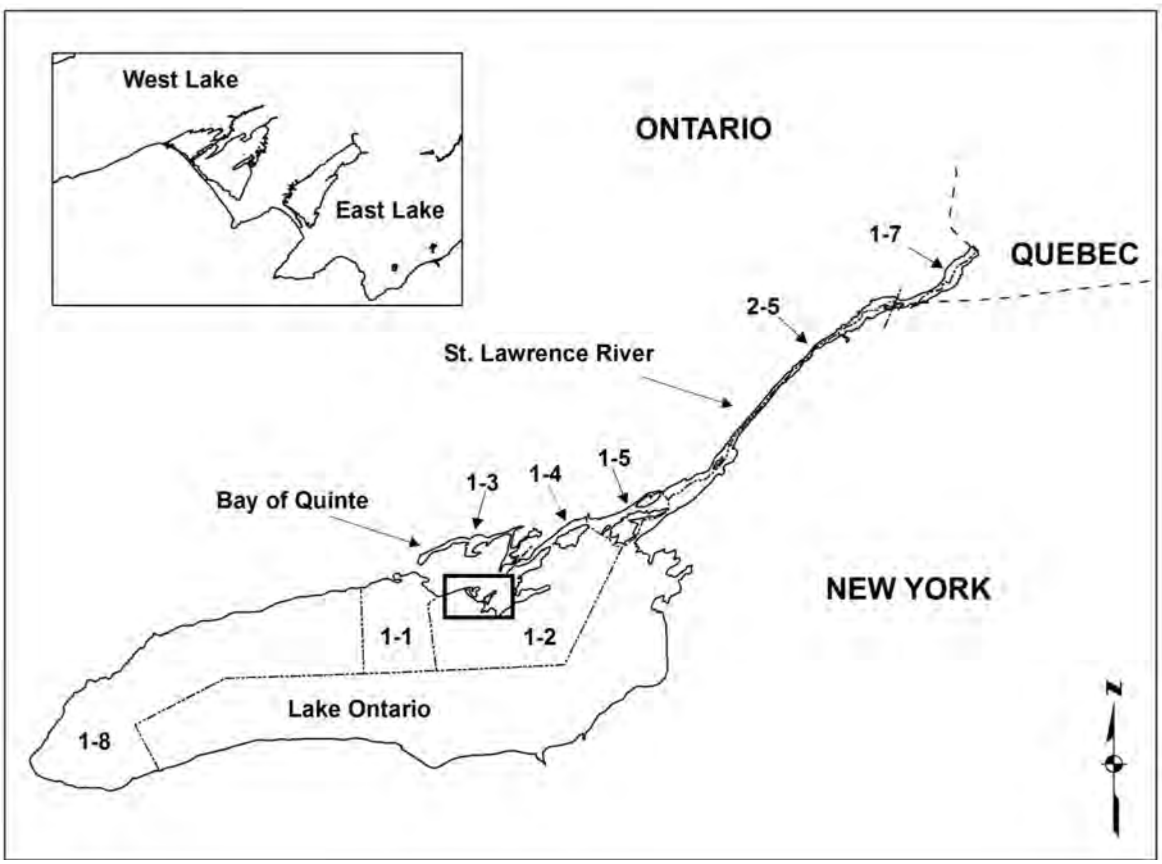


FIG. 3.2.1. Map of Lake Ontario and the St. Lawrence River showing commercial fishing quota zones in Canadian waters.

TABLE 3.2.1. Commercial fish **base quota** (lb), by quota zone, in the Canadian waters of Lake Ontario and the St. Lawrence River, East and West Lakes (two Lake Ontario embayments), 2014.

	Lake Ontario					St. Lawrence River			East Lake	West Lake	Base Quota by Waterbody		
Species	1-1	1-2	1-3	1-4	1-8	1-5	2-5	1-7	1	1	Lake Ontario	St. Lawrence River	Total
Black Crappie	4,540	3,000	14,824	1,100	2,800	14,170	17,590	4,840	3,100	9,850	26,264	36,600	75,814
Bowfin	0	0	0	0	500	0	0	0	0	0	500	0	500
Brown Bullhead	36,200	0	0	0	0	0	0	0	14,350	27,220	36,200	0	77,770
Lake Whitefish	7,275	76,023	13,675	20,313	208	0	0	0	0	0	117,494	0	117,494
Sunfish	28,130	0	0	0	0	0	0	0	14,600	18,080	28,130	0	60,810
Walleye	4,255	33,808	0	9,683	800	0	0	0	0	0	48,546	0	48,546
Yellow Perch	35,590	143,473	100,928	126,170	13,000	68,976	82,814	22,560	1,400	4,420	419,161	174,350	599,331
Total	115,990	256,304	129,427	157,266	17,308	83,146	100,404	27,400	33,450	59,570	676,295	210,950	980,265

TABLE 3.2.2. Commercial fish **issued quota** (lb), by quota zone, in the Canadian waters of Lake Ontario and the St. Lawrence River, East and West Lakes (two Lake Ontario embayments), 2014.

	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	14,824	600	1,400	10,870	8,795	4,840	3,100	9,850	20,594	24,505	58,049
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	369	113,531	6,108	9,356	104	0	0	0	0	0	129,468	0	129,468
Sunfish	14,065	0	0	0	0	0	0	0	14,600	18,080	14,065	0	46,745
Walleye	3,229	13,826	0	31,216	400	0	0	0	0	0	48,671	0	48,671
Yellow Perch	17,795	75,906	64,074	67,069	6,500	50,180	41,407	22,560	1,400	4,420	231,344	114,147	351,311
Total	55,828	204,763	85,006	108,241	8,904	61,050	50,202	27,400	33,450	59,570	462,742	138,652	694,414

TABLE 3.2.3. Commercial **harvest** (lb), by quota zone, for fish species harvested from the Canadian waters of Lake Ontario and the St. Lawrence River, East and West Lakes (two Lake Ontario embayments), 2014.

	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	28	0	7,775	30	0	3,712	1,851	763	7	3,118	7,833	6,326	17,284
Bowfin	34	0	2,580	0	0	3,982	1,378	182	184	623	2,614	5,542	8,963
Brown Bullhead	0	58	6,120	728	0	2,331	4,615	21,221	5	0	6,906	28,167	35,078
Common Carp	10	233	346	4,740	0	325	0	0	0	162	5,329	325	5,816
Freshwater Drum	0	822	10,464	18,954	0	0	0	0	0	0	30,240	0	30,240
Cisco	224	256	890	510	0	0	0	0	0	25	1,880	0	1,905
Lake Whitefish	158	62,576	3,754	476	0	0	0	0	0	0	66,964	0	66,964
Northern Pike	240	878	12,872	4,625	0	3,622	0	0	888	1,892	18,615	3,622	25,017
Rock Bass	66	1,693	2,729	935	0	467	304	223	900	700	5,423	994	8,017
Sunfish	107	2	15,219	171	0	2,486	2,353	1,268	10,112	5,466	15,499	6,107	37,184
Walleye	1,005	3,006	0	24,212	0	0	0	0	0	0	28,223	0	28,223
White Bass	0	139	352	2,167	0	0	0	0	0	0	2,658	0	2,658
White Perch	27	17	1,649	2,165	0	237	0	0	35	716	3,858	237	4,846
White Sucker	37	505	6,962	2,943	0	160	5	747	3	479	10,447	912	11,841
Yellow Perch	36	6,166	18,212	9,794	0	14,338	11,658	14,451	100	215	34,208	40,447	74,970
Total	1,972	76,351	89,924	72,450	0	31,660	22,164	38,855	12,234	13,396	240,697	92,679	359,006

TABLE 3.2.4. Commercial **harvest (lb), price per lb, and landed value** for fish species harvested from the Canadian waters of Lake Ontario and the St. Lawrence River, and the total for all waterbodies including East and West Lakes, 2014.

	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	7,833	$3.23	$25,323	6,326	$2.62	$16,553	17,284	$2.89	$49,971
Bowfin	2,614	$0.42	$1,109	5,542	$0.60	$3,299	8,963	$0.52	$4,656
Brown Bullhead	6,906	$0.19	$1,339	28,167	$0.40	$11,287	35,078	$0.35	$12,315
Common Carp	5,329	$0.11	$604	325	$0.30	$98	5,816	$0.13	$774
Freshwater Drum	30,240	$0.09	$2,705	0		$0	30,240	$0.09	$2,705
Cisco	1,880	$0.22	$405	0		$0	1,905	$0.21	$409
Lake Whitefish	66,964	$1.81	$120,968	0		$0	66,964	$1.81	$120,968
Northern Pike	18,615	$0.32	$6,019	3,622	$0.34	$1,238	25,017	$0.32	$7,964
Rock Bass	5,423	$0.50	$2,699	994	$0.65	$648	8,017	$0.54	$4,365
Sunfish	15,499	$1.32	$20,520	6,107	$1.22	$7,475	37,184	$1.27	$47,170
Walleye	28,223	$2.26	$63,841	0		$0	28,223	$2.26	$63,841
White Bass	2,658	$0.54	$1,436	0		$0	2,658	$0.54	$1,436
White Perch	3,858	$0.44	$1,713	237	$0.31	$72	4,846	$0.46	$2,226
White Sucker	10,447	$0.11	$1,133	912	$0.20	$178	11,841	$0.11	$1,308
Yellow Perch	34,208	$1.74	$59,378	40,447	$1.66	$67,142	74,970	$1.69	$127,014
Total	240,697		$309,192	92,679		$107,990	359,006		$447,120

(Fig. 3.2.4) and the St. Lawrence River (Fig. 3.2.5) respectively. However, in 2014, harvest declined again.

Major Species

For major species, commercial harvest relative to issued and base quota information, including annual trends, is shown in Fig. 3.2.6 to Fig. 3.2.17. 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 2014 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.6. Overall, only 13% (74,970 lb) of the Yellow Perch base quota was harvested in 2014. The highest Yellow Perch harvest came from quota zones 1-3, 1-7 and 1-5. A very small proportion of base quota was harvested in most quota zones.

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

Lake Whitefish

Lake Whitefish 2014 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.8. Overall, 57% (66,964 lb) of the Lake Whitefish base quota was harvested in 2014. The highest Lake Whitefish harvest came from quota zone 1-2. Lake Whitefish is managed as one fish

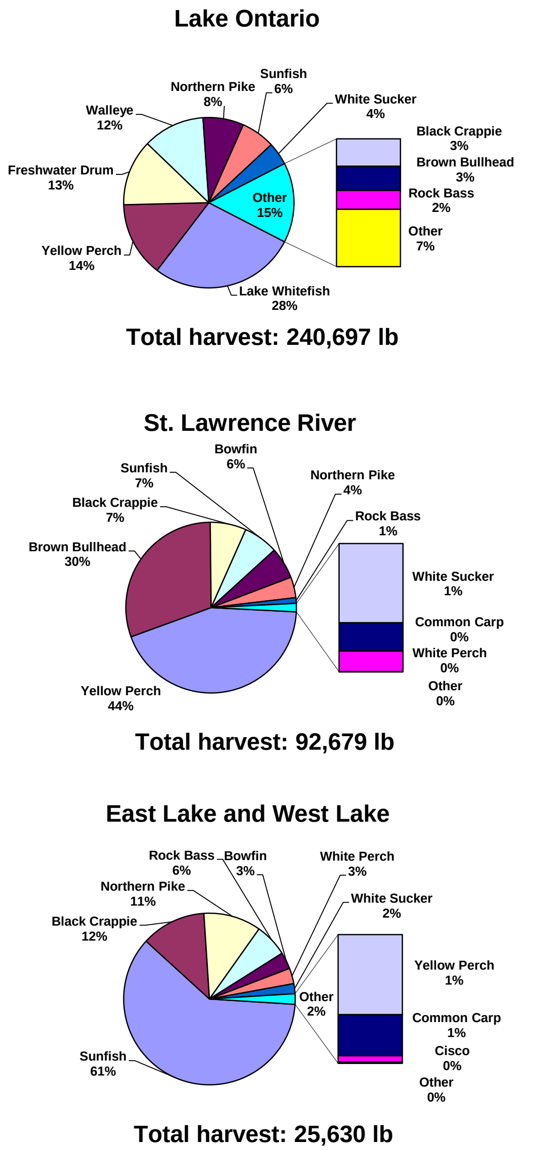


FIG. 3.2.2. Pie-charts showing breakdown of 2014 commercial harvest by species **(% by weight)** for Lake Ontario (quota zones 1-1, 1-2, 1-3, 1-4 and 1-8), the St. Lawrence River (quota zones 1-5, 2-5 and 1-7), and for East and West Lakes combined.

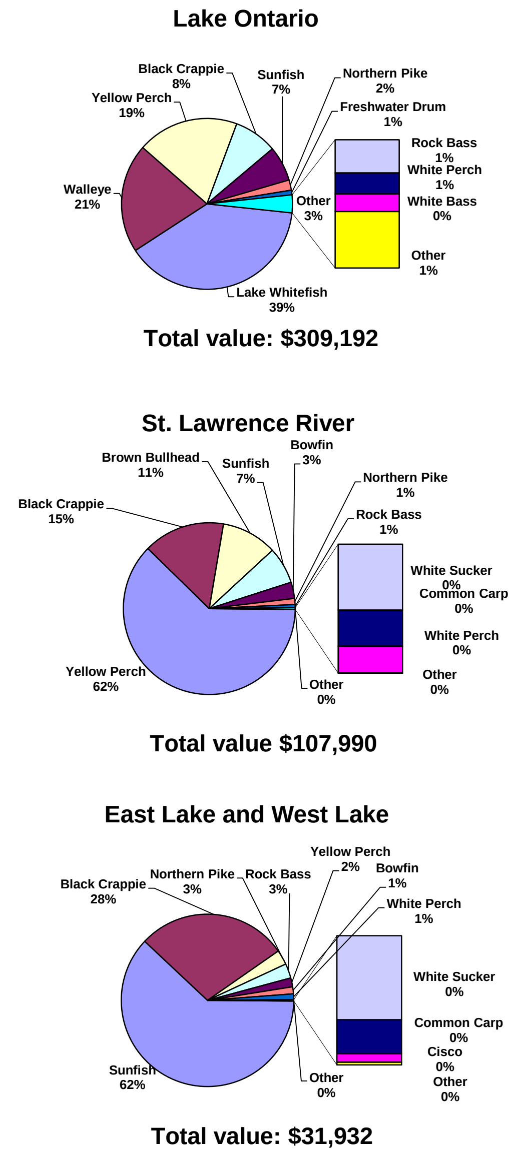


FIG. 3.2.3. Pie-charts showing breakdown of 2014 commercial harvest by species **(% by landed value**) for Lake Ontario (quota zones 1-1, 1-2, 1-3, 1-4 and 1-8), the St. Lawrence River (quota zones 1-5, 2-5 and 1-7), and for East and West Lakes combined.

population across quota zones. Therefore, quota can be transferred among quota zones. Issued quota and harvest was significantly higher than base quota in quota zone 1-2 (Fig. 3.2.8). Relatively small proportions of base quota were harvested in quota zones 1-1, 1-3 and 1-4.

Trends in Lake Whitefish quota (base), harvest and price-per-lb are shown Fig. 3.2.9. Base quota remained constant for the last four years (just under 120,000 lb for all quota zones combined). In 2014, an additional 10% of base quota was issued in early December after the fishery had harvested 40% of the based quota.

Seasonal whitefish harvest and biological attributes (e.g., size and age structure) information are reported in Section 3.3. Lake Whitefish price-per-lb increased significantly in 2014.

Walleye

Walleye 2014 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.10. Overall, 58% (28,223 lb) of the Walleye

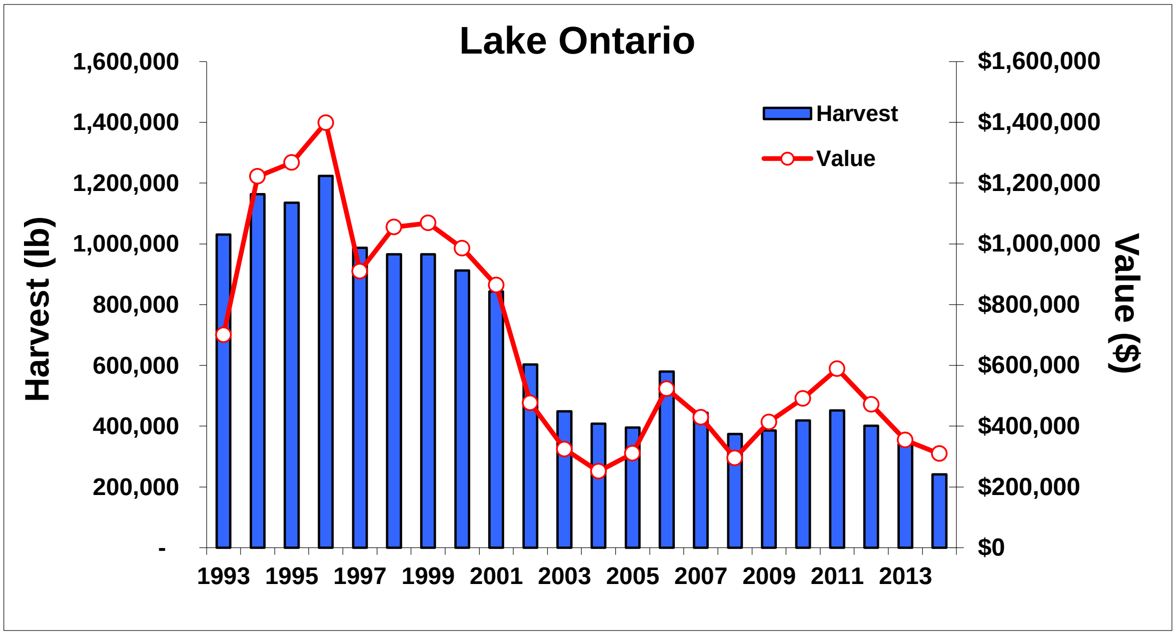


FIG. 3.2.4. Total commercial fishery harvest and value for **Lake Ontario** (Quota Zones 1-1, 1-2, 1-3 ,1-4 and 1-8) 1993-2014.

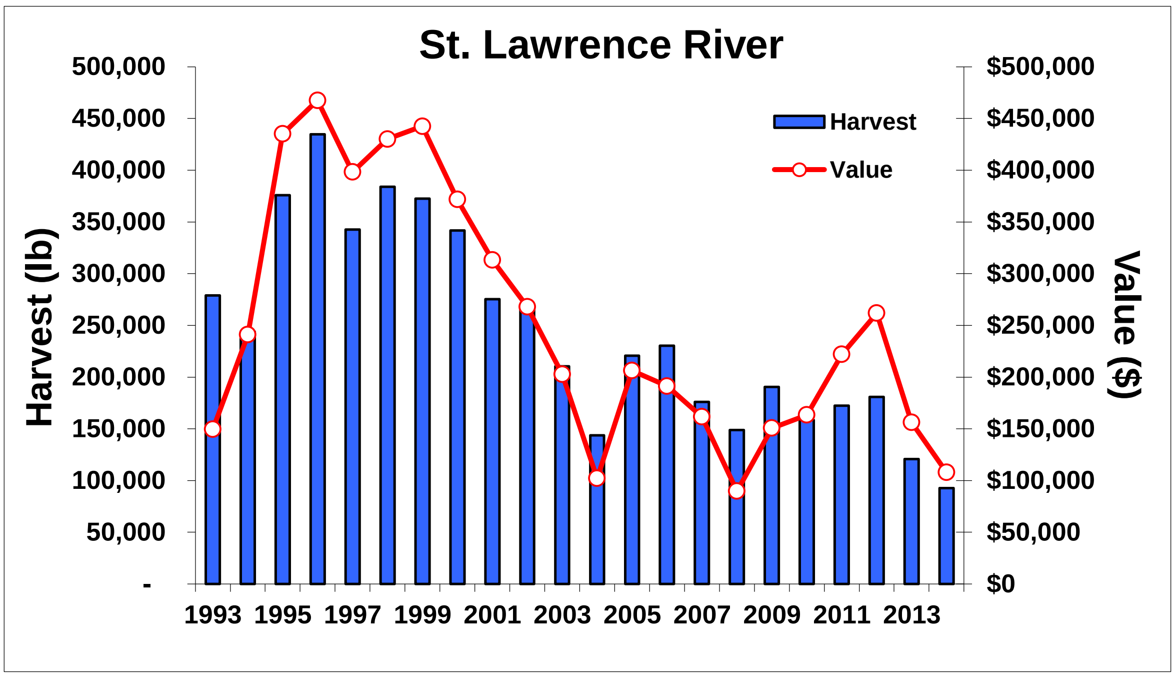


FIG. 3.2.5. Total commercial fishery harvest and value for the **St. Lawrence River** (Quota Zones 1-5, 2-5 and 1-7), 1993-2013.

base quota was harvested in 2014. 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 2014, this resulted in issued quota and harvest being considerably higher than base quota in quota zone 1-4 (Fig. 3.2.10).

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

Black Crappie

Black Crappie 2014 commercial harvest relative to issued and base quota by quota zone

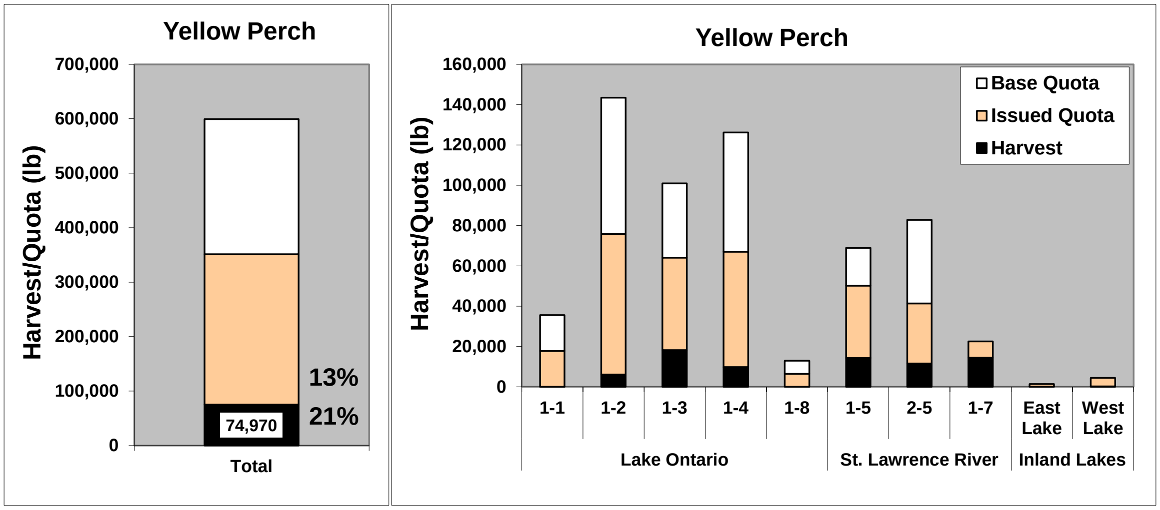


FIG. 3.2.6. **Yellow Perch** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2014.

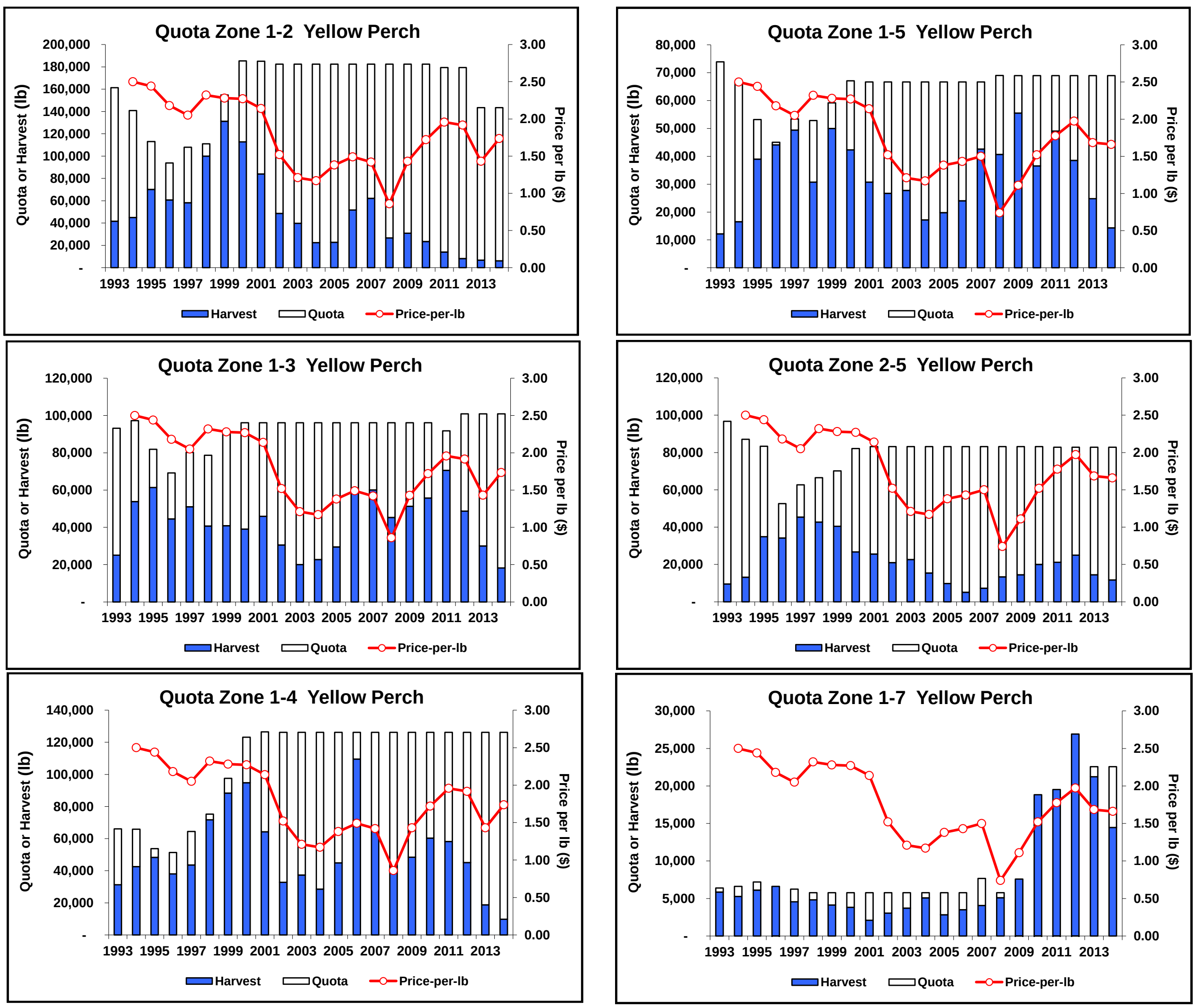


FIG. 3.2.7. Commercial base quota, harvest and price-per-lb for **Yellow Perch** in Quota Zones 1-2, 1-3, 1-4, 1-5, 2-5 and 1-7, 1993-2014.

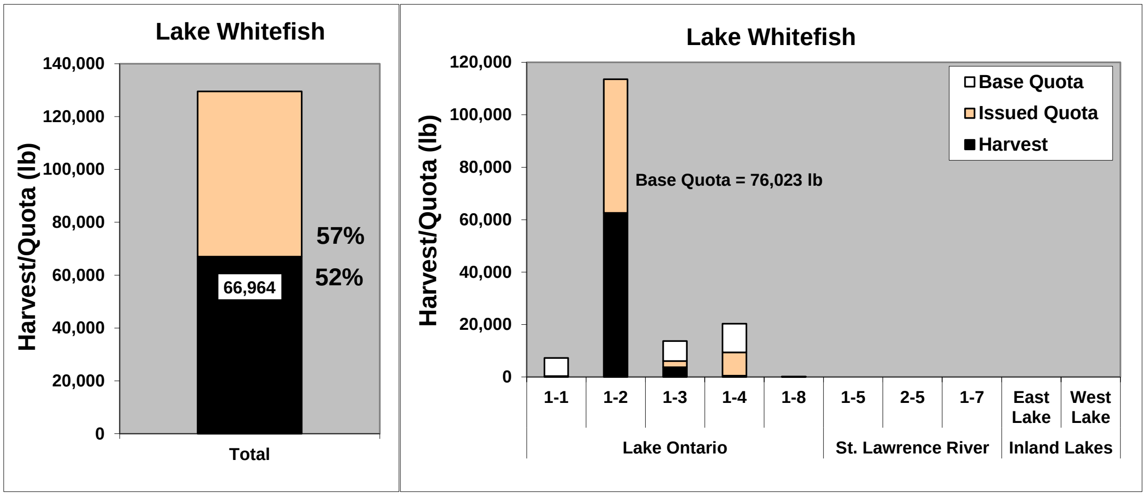


FIG. 3.2.8. **Lake Whitefish** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2014.

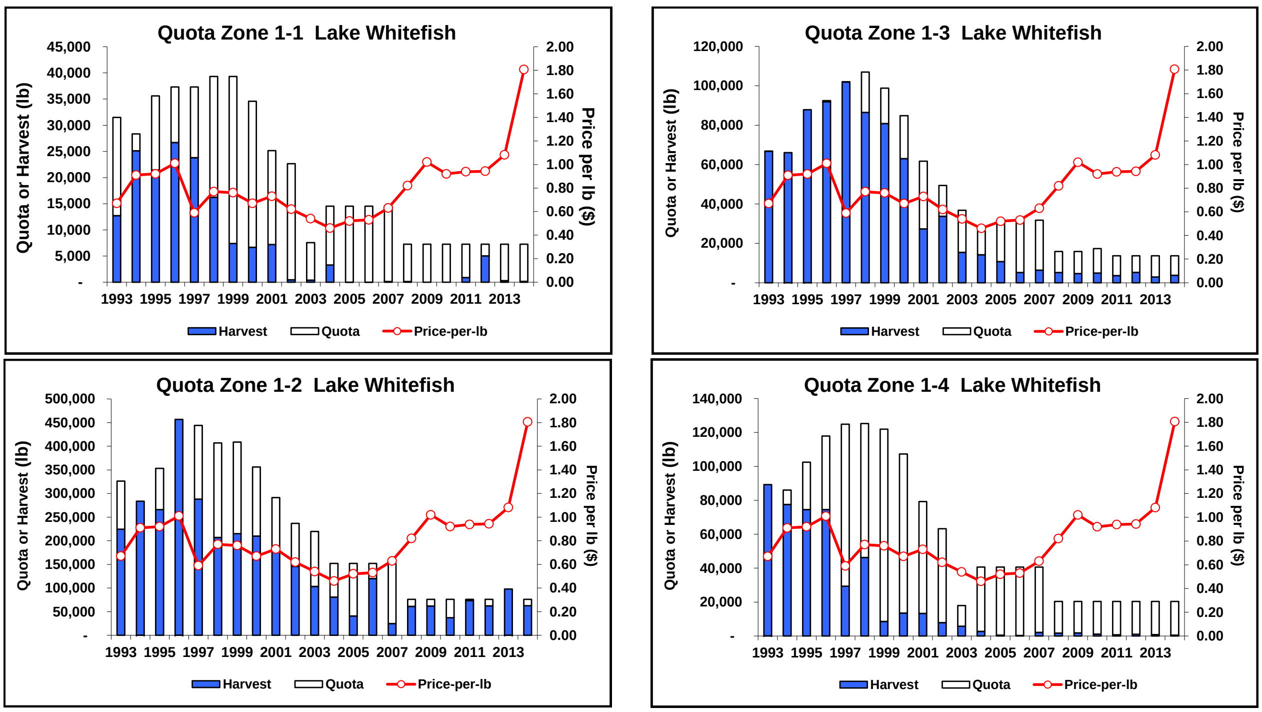


FIG. 3.2.9. Commercial base quota, harvest and price-per-lb for **Lake Whitefish** in Quota Zones 1-1, 1-2, 1-3 and 1-4, 1993-2014.

and total for all quota zones combined is shown in Fig. 3.2.12. Overall, only 23% (17,284 lb) of the Black Crappie base quota was harvested in 2013. The highest Black Crappie harvest came from quota zones 1-3, 1-5, West Lake, and 1-7. Only a very small proportion of base quota was harvested in other quota zones .

Trends in Black Crappie quota (base), harvest and price-per-lb are shown Fig. 3.2.13. Harvest increased in quota zone 1-7 and West Lake increased in 2014. Harvest declined in 1-3, 1-5 and 2-5. Black Crappie price-per-lb is currently high.

Sunfish

Sunfish 2014 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.14. Only quota zones 1-1 (embayment areas only), East Lake and West Lake have quotas for Sunfish; quota is unlimited in the other zones. Most Sunfish harvest comes from quota zone 1-3,

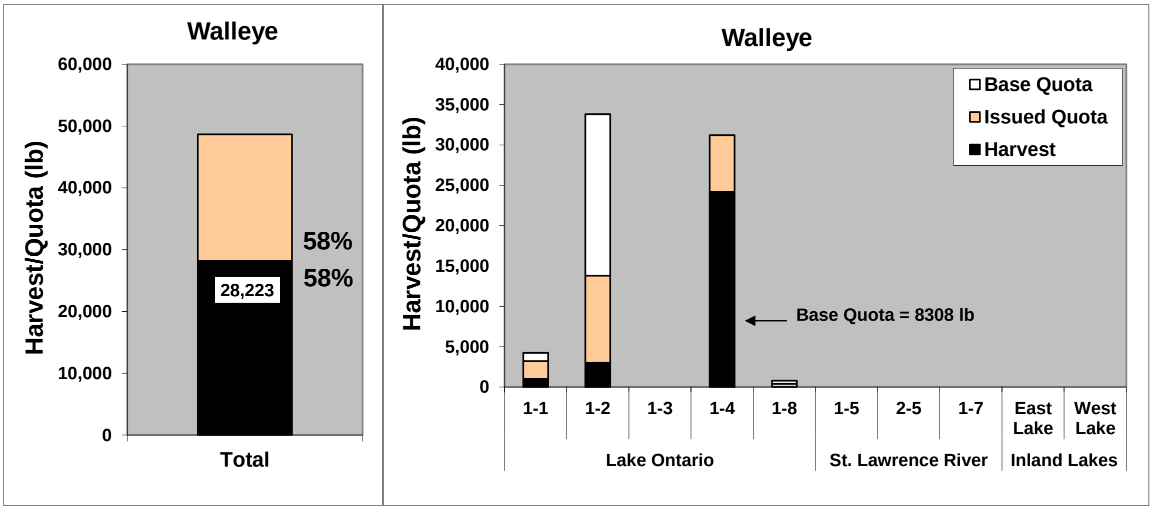
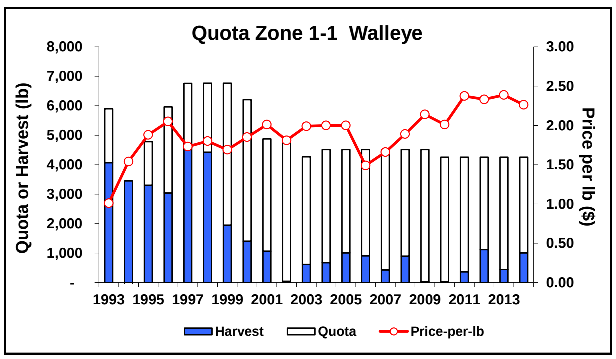
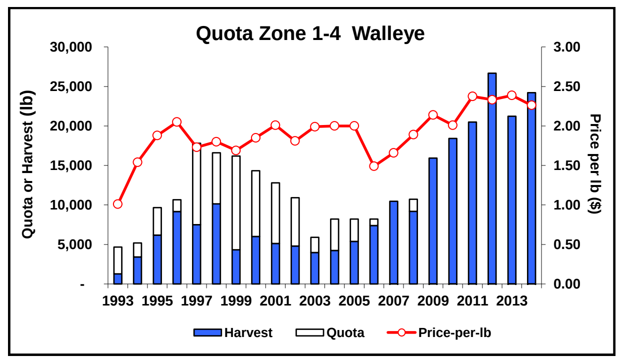


FIG. 3.2.10. **Walleye** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2014.





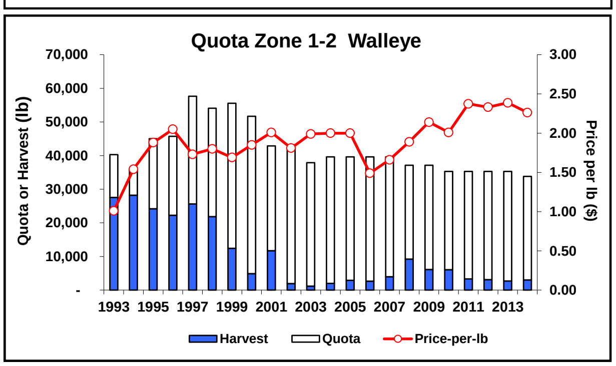


FIG. 3.2.11. Commercial base quota, harvest and price-per-lb for **Walleye** in Quota Zones 1-1, 1-2 and 1-4, 1993-2014.

East Lake and West Lake.

Trends in Sunfish quota (base), harvest and price-per-lb are shown Fig. 3.2.15. Harvest declined in all quota zones in 2014 except East Lake where it remained steady. Sunfish price-per -lb is currently high.

Brown Bullhead

Brown Bullhead 2014 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.16. Only quota zones 1-1 (embayments areas only), East Lake and West Lake have quotas for Brown Bullhead; quota is unlimited in the other zones. In the quota zones with quota restrictions, almost none of the quota was actually harvested. Highest Brown Bullhead harvest came from quota zone 1-7.

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

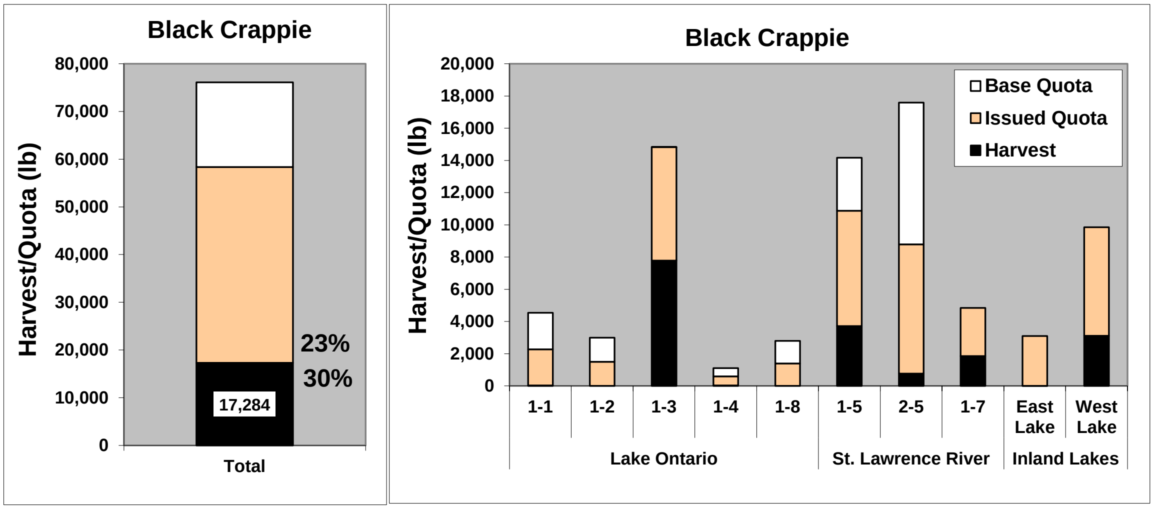


FIG. 3.2.12. **Black Crappie** commercial harvest relative to issued and base quota (total for all quota zones combined; left panel) and by quota zone (right panel), 2014.

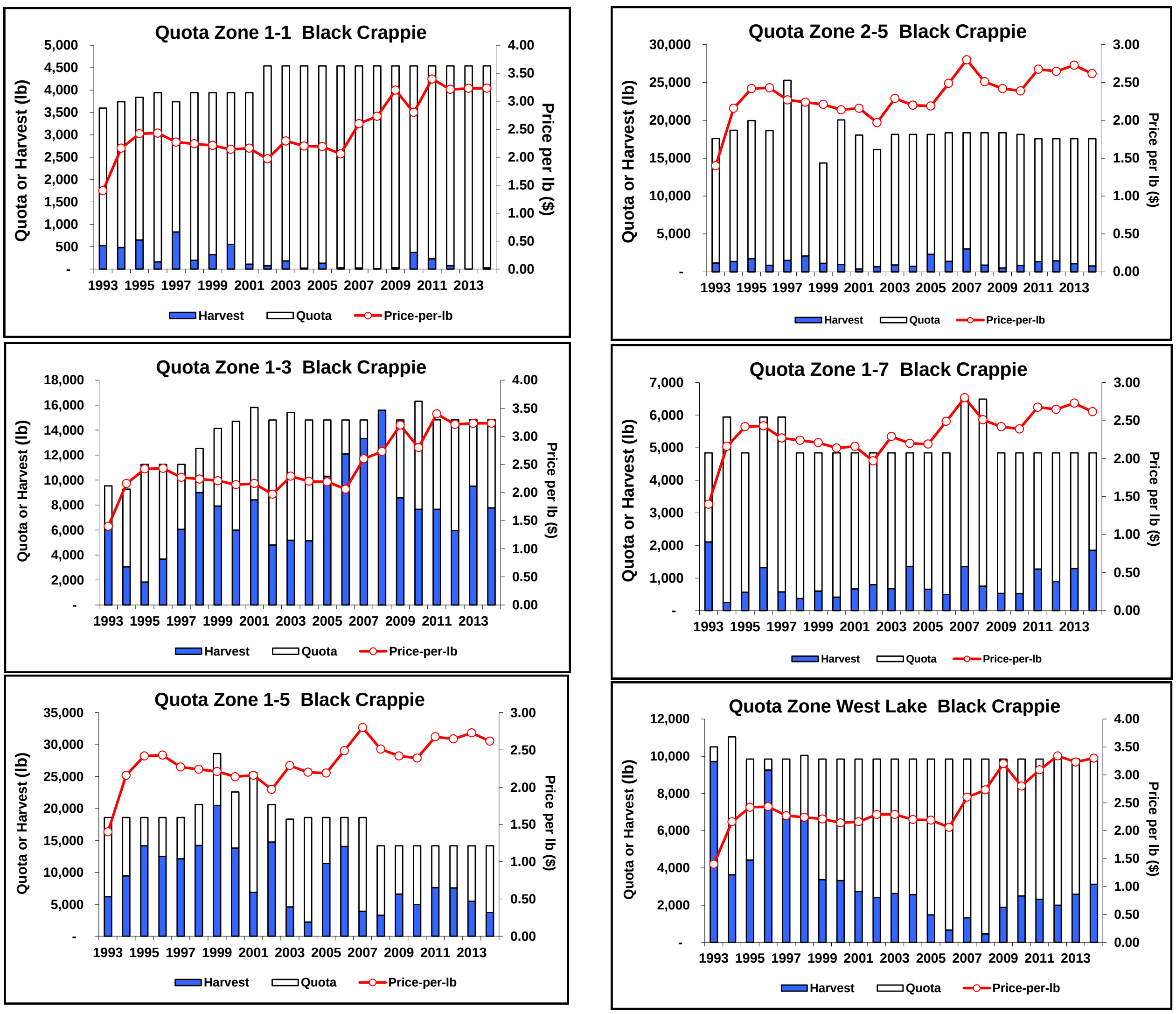


FIG. 3.2.13. Commercial base quota, harvest and price-per-lb for **Black Crappie** in Quota Zones 1-1, 1-3, 1-5, 2-5, 1-7 and West Lake, 1993-2014.

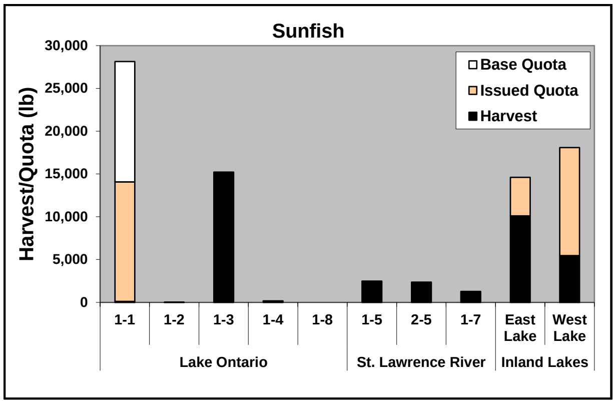


FIG. 3.2.14. **Sunfish** commercial harvest relative to issued and base quota for quota zones 1-1, East Lake and West Lake, 2014. The remaining quota zones have unlimited quota.

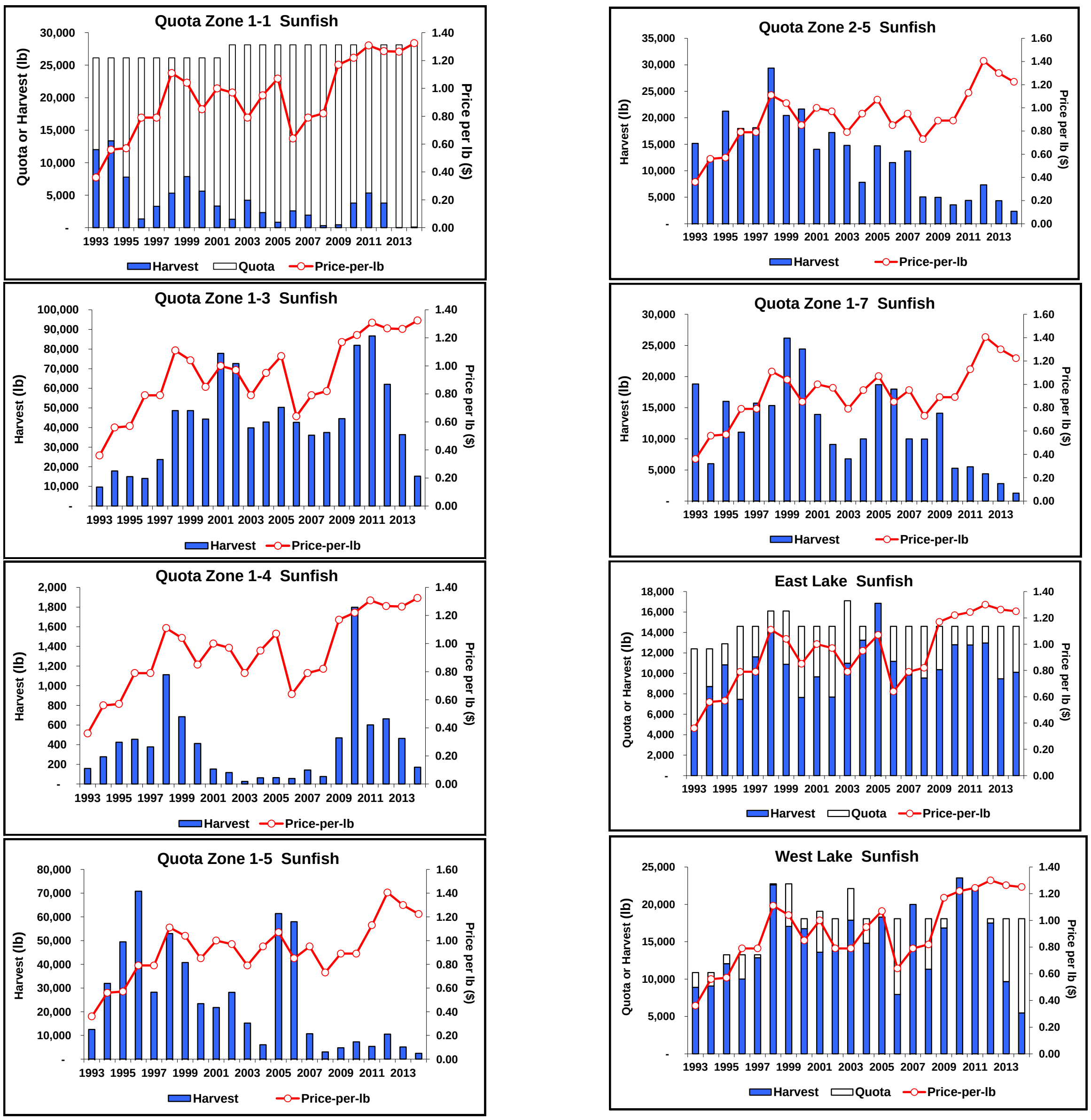


FIG. 3.2.15. Commercial base quota, harvest and price-per-lb for **Sunfish** in Quota Zones 1-1, 1-3, 1-4, 1-5, 2-5 and 1-7, East Lake and West Lake, 1993-2014.

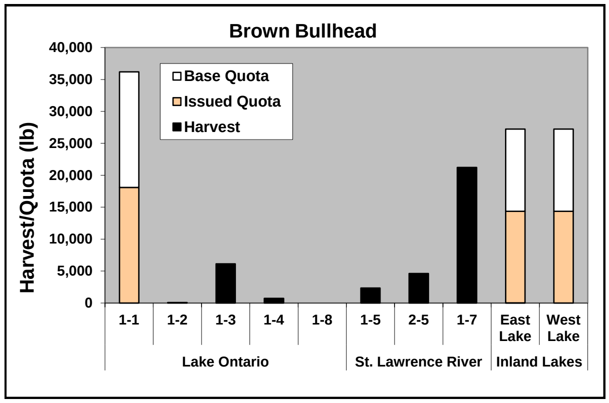


FIG. 3.2.16. **Brown Bullhead** commercial harvest relative to issued and base quota for quota zones 1-1, East Lake and West Lake, 2014. The remaining quota zones have unlimited quota.

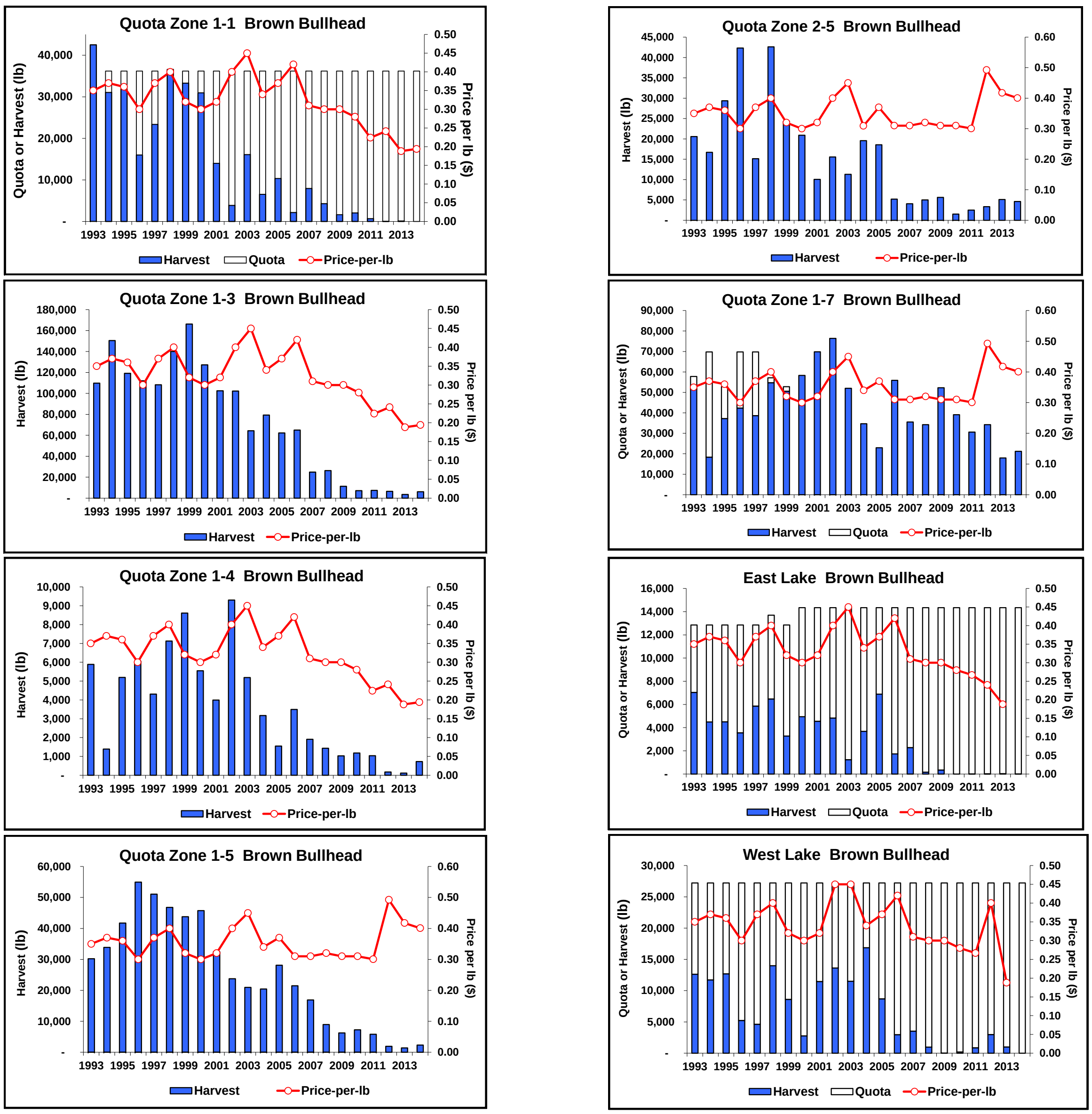


FIG. 3.2.17. Commercial base quota, harvest and price-per-lb for **Brown Bullhead** in Quota Zones 1-1, 1-3, 1-4, 1-5, 2-5 and 1-7, East Lake and West Lake, 1993-2014.

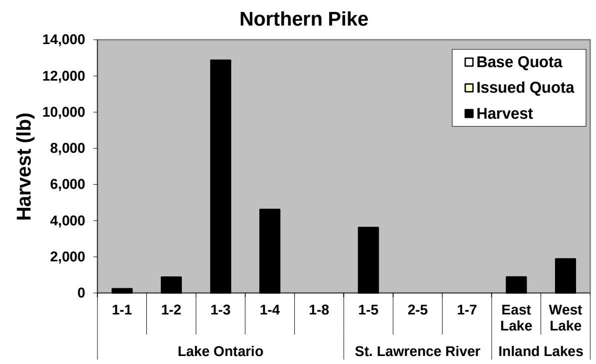
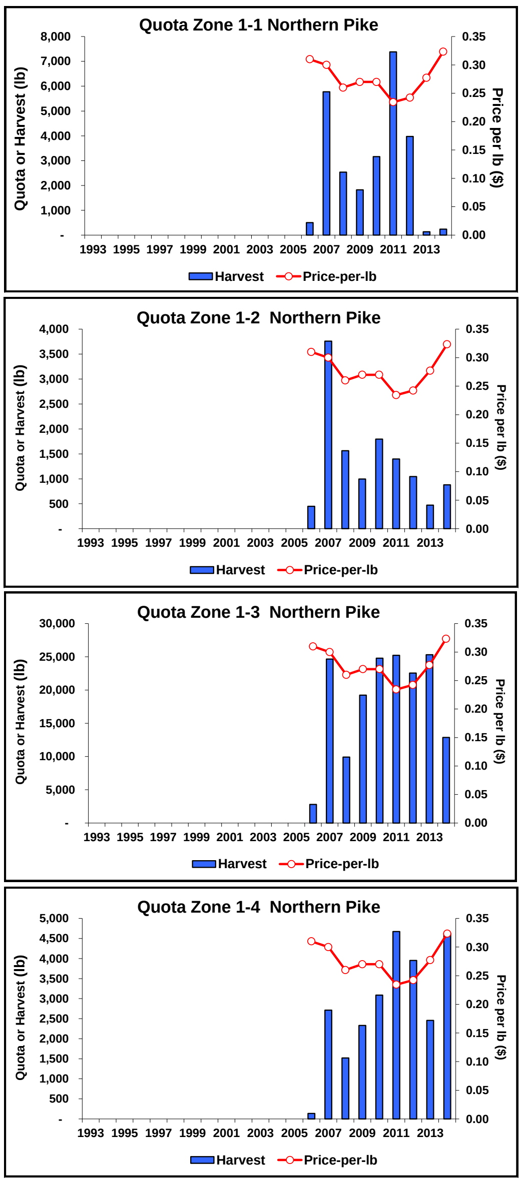


FIG. 3.2.18. **Northern Pike** commercial harvest by quota zone, 2014. In quota zones 2-5 and 1-7 no harvest is permitted; all other zones have unlimited quota.



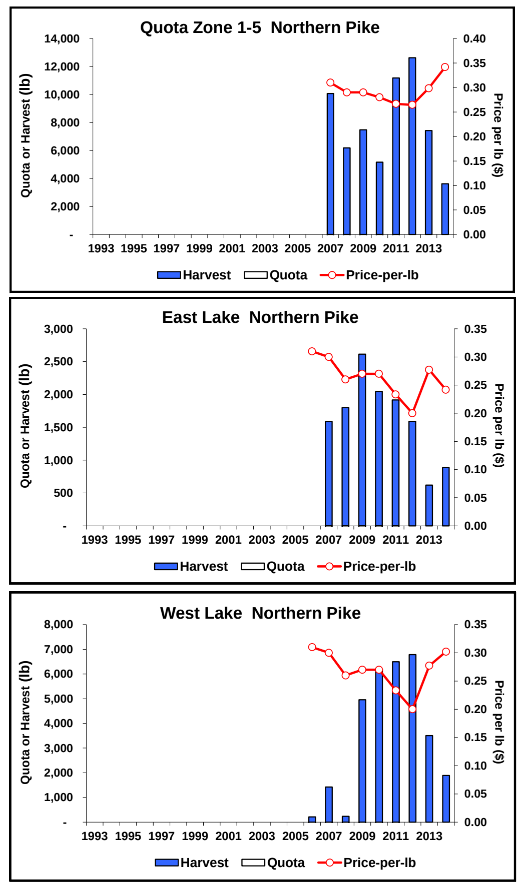


FIG. 3.2.19. Commercial base quota, harvest and price-per-lb for **Northern Pike** in Quota Zones 1-1, 1-2, 1-3, 1-4, and 1-5, East Lake and West Lake, 1993-2014.

Northern Pike

Northern Pike 2014 commercial harvest by quota zone is shown in Fig. 3.2.18. Highest pike harvest came from quota zones 1-3, 1-4 and 1-5.

Trends in Northern Pike harvest and price-per-lb are shown Fig. 3.2.19.

3.3 Lake Whitefish Commercial Catch Sampling

J. A. Hoyle, Lake Ontario Management Unit

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

Commercial Lake Whitefish harvest and fishing effort by gear type, month and quota zone for 2014 is reported in Table 3.3.1. Most of the harvest was taken in gillnets, 94% by weight; 6% of the harvest was taken in impoundment gear. Ninety-three percent of the gill net harvest occurred in quota zone 1-2. Fifty-seven 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 3.3.1).

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. 3.3.1 and Fig. 3.3.2). In total, fork length was measured for 4,210 fish and age was interpreted using otoliths for 350 fish (Table 3.3.2, Fig. 3.3.1 and 3.3.2).

TABLE 3.3.1. 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	Feb				57				920
	Mar				138				1,500
	Apr		268				4,360		
	May		1,747				21,555		
	Jun		4,986				17,600		
	Jul		6,628				42,280		
	Aug		7,006				31,600		
	Sep		3,447		203		20,400		2,800
	Oct		15		54		400		1,600
	Nov	158	***34,646***			3,000	***28,564***		
	Dec		3,834		10		9,000		200
Impoundment	Apr			16				58	
	May			5				23	
	Sep			11	6			32	2
	Oct			***1,014***	8			***123***	5
	Nov			***2,701***				***142***	

TABLE 3.3.2. Age-specific vital statistics of **Lake Whitefish** sampled and harvested including number aged, number measured for length, and proportion by number of fish sampled, harvest by number and weight (kg), and mean weight (kg) and fork length (mm) of the harvest for quota zones 1-2 and 1-3, 2014.

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	23	218	0.070	1,326	985	0.743	407	4	-	-	0.000	-	-		
5	5	83	0.027	509	435	0.855	429	5	5	43	0.039	49	48	0.982	438
6	10	354	0.114	2,155	2,110	0.979	446	6	24	167	0.149	188	168	0.891	429
7	5	150	0.048	913	1,086	1.189	482	7	23	146	0.131	165	180	1.090	454
8	26	793	0.256	4,834	6,260	1.295	458	8	13	98	0.088	111	116	1.041	447
9	19	517	0.167	3,149	4,005	1.272	486	9	11	67	0.060	76	90	1.183	466
10	18	350	0.113	2,130	2,898	1.361	497	10	9	50	0.045	56	81	1.441	503
11	19	309	0.100	1,886	2,892	1.534	506	11	27	147	0.131	166	217	1.305	487
12	1	11	0.004	66	107	1.602	507	12	5	24	0.021	27	43	1.602	511
13	-	-	0.000	-	-			13	1	2	0.002	3	5	1.788	542
14	1	10	0.003	60	89	1.479	504	14	3	10	0.009	12	19	1.690	518
15	5	99	0.032	603	905	1.500	510	15	6	24	0.022	28	55	1.991	602
16	-	-	0.000	-	-			16	2	12	0.010	13	20	1.506	526
17	-	-	0.000	-	-			17	2	7	0.006	8	17	2.128	558
18	2	39	0.013	237	426	1.796	548	18	4	21	0.019	24	30	1.260	495
19	2	7	0.002	42	79	1.897	558	19	3	14	0.012	16	29	1.872	557
20	5	22	0.007	131	236	1.795	540	20	4	21	0.019	23	44	1.883	552
21	9	58	0.019	355	732	2.059	576	21	4	27	0.024	31	59	1.919	554
22	4	25	0.008	150	239	1.593	529	22	12	74	0.066	84	153	1.834	550
23	5	32	0.010	194	388	2.000	575	23	19	129	0.115	146	253	1.738	534
24	2	5	0.001	28	51	1.834	525	24	7	33	0.030	38	75	2.000	550
25	1	10	0.003	61	142	2.326	585	25	-	-	0.000	-	-		
26	4	9	0.003	57	-			26	-	-	0.000	-	-		
27	-	-	0.000	-	-			27	-	-	0.000	-	-		
28	-	-	0.000	-	-			28	-	-	0.000	-	-		
29	-	-	0.000	-	-			29	-	-	0.000	-	-		
30	-	-	0.000	-	-			30	-	-	0.000	-	-		
Total	166	3,099	1	18,887	24,179			Total	184	1,116	1	1,263	1,703		
Weighted mean						**1.280**		Weighted mean						**1.349**	

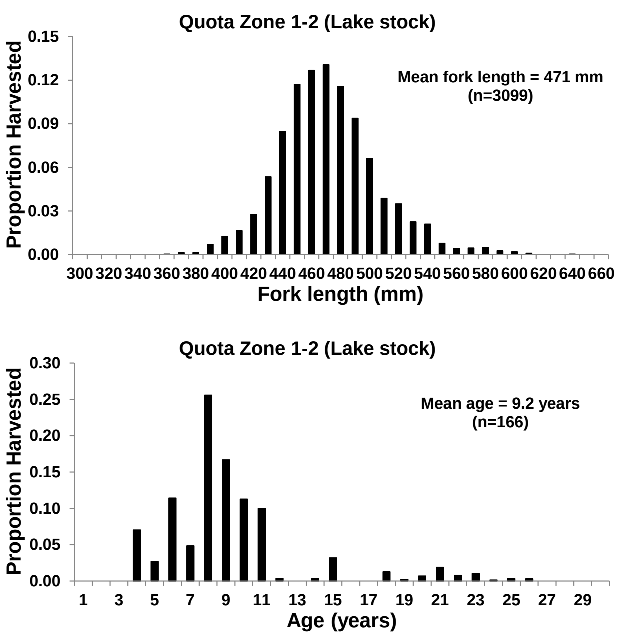


FIG. 3.3.1. Size and age distribution (by number) of **Lake Whitefish** sampled in quota zone 1-2 during the 2014 commercial catch sampling program.

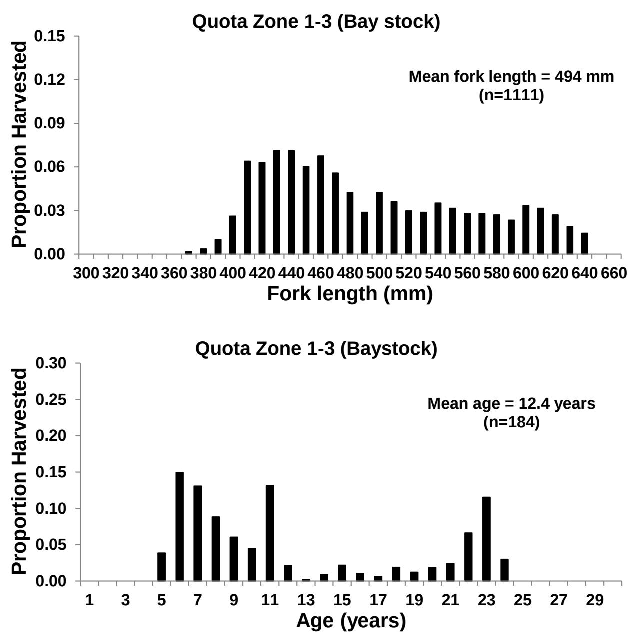


FIG. 3.3.2. Size and age distribution (by number) of **Lake Whitefish** sampled in quota zone 1-3 during the 2014 commercial catch sampling program.

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

The mean fork length and age of Lake Whitefish harvested during the gillnet fishery in quota zone 1-2 were 471 mm and 9.2 years respectively (Fig. 3.3.1). Fish ranged from ages 4 -26 years. The most abundant age-classes in the fishery were aged 6-11 years which together comprised 80% of the harvest by number (80% by weight).

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

Mean fork length and age were 494 mm and 12.4 years, respectively (Fig. 3.3.2). Fish ranged from ages 5-24 years. The most abundant age-classes in the fishery were aged 6-11 years which together comprised 60% of the harvest by number (50% 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 3.3.3. Condition declined markedly in 1994 and remained low.

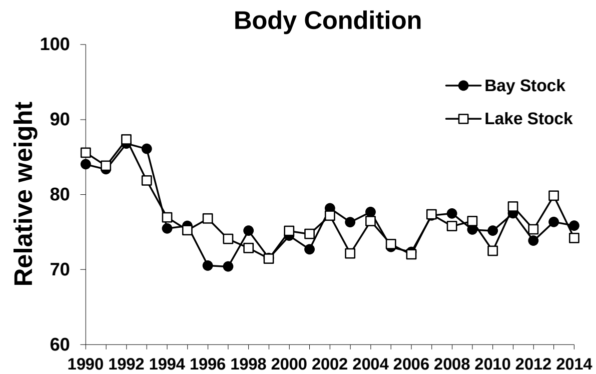


FIG. 3.3.3. **Lake Whitefish** (Lake Ontario and Bay of Quinte spawning stocks and sexes combined) relative weight (see [1]Rennie et al. 2008), 1990-2013.

[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.*

3.4 Turtle Bycatch in the Hoop Nets and Trap Nets

A. Mathers, Lake Ontario Management Unit

Almost 75% of the fish harvested in the Lake Ontario commercial fishery during 2014 were captured in hoop nets and trap nets (two types of impoundment gear). Trap nets are also frequently used by Lake Ontario Management Unit (LOMU) to assess nearshore fish populations in Lake Ontario (Section 1.4). In general, if a component of the catch in an impoundment gear is not targeted it can be released alive; however in recent years there have been concerns raised regarding mortality and sub-lethal stress of turtles incidentally caught in hoop nets used by the commercial fishery in Lake Ontario and the upper St. Lawrence River.

LOMU has been working with the Lake Ontario Commercial Fisheries Liaison Committee to investigate turtle bycatch. As part of this effort a workshop, which included commercial fishers, researchers from Carleton University and LOMU staff, was held during December 2012. At the workshop participants identified several techniques that could mitigate stress and mortality of turtles in hoop nets including placing floats in the cod end of the hoop net to provide air space for turtles to breath.

As a result of these discussions, the Lake Ontario Commercial Fishers Voluntary Biodiversity Protocol was introduced and unanimously accepted by all fishers during 2013. Under this protocol, hoop net operators that fished during May 20 to June 20 agreed to participate in the eel trap and transport program (Section 7.3) and had to use some type of turtle mitigation during fishing of impoundment gear. In addition, it was agreed that LOMU would conduct audits to evaluate the effectiveness of mitigation measures and diaries recording turtle observations were kept by fishermen.

LOMU staff audited 129 commercial hoop nets in Lake Ontario and the upper St. Lawrence River during the spring of 2013 and 2014. Audits were conducted during May 20 to June 20 at several locations in quota zones 1, 1.3, 1.5 and 1.7 (Fig. 3.2.1). These locations and time periods were chosen because they were felt to be periods/locations of both high turtle activity and high fishing activity. Audits documented environmental conditions, netting techniques, the presence of floats which could mitigate turtle mortality, and the presence of turtles. Water temperatures ranged from 14.2 to 22.6 ^{o}C (average 18.0 ^{o}C) during the audits. Water depth, at the opening of the net, ranged from 0.9 to 3.6 m (average 1.8 m). The nets and the contents of the nets were not touched by LOMU staff so the health of any turtles present could not be completely evaluated; however they were classified as either active or inactive.

Sixteen (12%) of the 129 hoop nets audited contained turtles. In total, 26 turtles were observed during the hoop net audits including 13 Eastern Musk Turtles (*Sternotherus odoratus*), 8 Northern Map Turtles (*Graptemys geographica*), 3 Painted Turtle (*Chrysemys picta*) and 2 Snapping Turtles (*Chelydra serpentina*). Of the nets audited, 28% included floats placed in the cod end. It should be noted that other turtle mortality mitigation techniques, such as moving nets to locations where they are less likely to capture turtles, may have been employed by the fishermen but we were not able to evaluate these techniques during our audits.

In the nine nets observed where floats were employed and turtles were present, all 15 of the turtles counted were active and behaved normally. In the seven nets where floats were not employed and turtles were present, six turtles were active and five turtles were inactive.

The influence of a variety of habitat features on the capture rate of turtles was explored. Data on the rate of turtle capture in trap nets set by LOMU as part of the nearshore fish community assessment project (NSCIN - Section 1.4) was included in this analysis to increase the number of samples. NSCIN data from 172 nets set in the upper Bay of Quinte, West Lake, East Lake, and Prince Edward Bay collected during 2012, 2013 and 2014 were examined. These locations were chosen to overlap with the locations of the bycatch audits. However, it should be noted that there are several differences between NSCIN and commercial hoop nets.

The incidence of turtles in both commercial hoop nets and NSCIN nets was strongly influenced by water depth (Fig. 3.4.1). The rate of capture was lower in hoop nets, however for both types of net, as the water depth increased the capture of turtles decreased. No turtles were observed in the 19 hoop nets set in depth of water greater than 2.2 m.

Water temperature appears to have a strong positive influence on the rate of capture of turtles in the NSCIN nets; however, the effect is not as strong in the commercial hoop nets (Fig. 3.4.2).

LOMU will continue to work with the industry on this important issue.

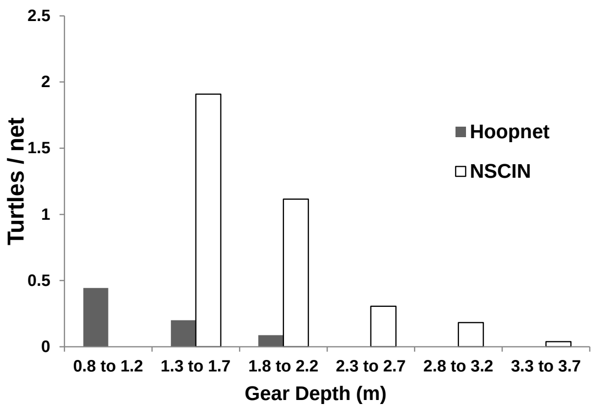


Fig. 3.4.1. Rate of observation of turtles in commercial hoop nets during the spring of 2013 and 2014 and during fall nearshore trap netting 2012, 2013, and 2014. The data are categorized by the water depth at the opening of the net.

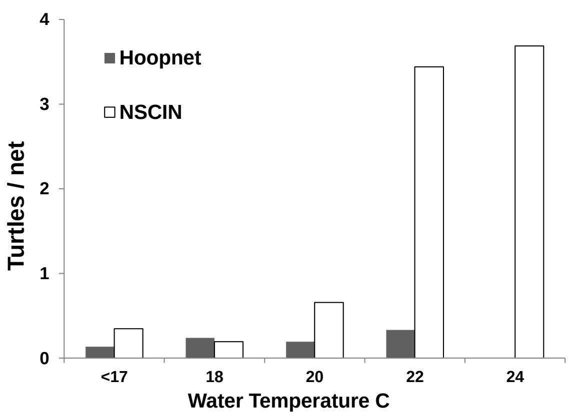


Fig. 3.4.2. Rate of observation of turtles in commercial hoop nets during the spring of 2013 and 2014 and during fall nearshore trap netting 2012, 2013, and 2014. The data categorized by the water temperature.

4. Age and Growth Summary

N. J. Jakobi and J. A. Hoyle, Lake Ontario Management Unit

Biological sampling of fish from Lake Ontario Management Unit (LOMU) 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 2014, a total of 2,341 structures were processed from 11 different field projects (Table 4.1) and interpreted from 18 different fish species (Table 4.2).

TABLE 4.1. Project-specific summary of age and growth structures interpreted for age (n= 2,341) in support of 11 different Lake Ontario Management Unit field projects, 2014 (CWT, Code Wire Tags).

Project	Species	Structure	n
Lake Ontario and Bay of Quinte Community Index Gillnetting			
	Deepwater Sculpin	Otoliths	17
	Northern Pike	Cleithra	16
	Smallmouth Bass	Scales	20
	Walleye	Otoliths	331
	Walleye	Scales	20
	Lake Trout	CWT	74
	Lake Whitefish	Otoliths	28
Lake Ontario and Bay of Quinte Community Index Trawling			
	Deepwater Sculpin	Otoliths	43
	Walleye	Otoliths	11
	Walleye	Scales	36
Chinook Salmon Mark/Tag Monitoring and Angling Survey			
	Chinook Salmon	CWT	13
Salmonid Ecology			
	Coho Salmon	Otoliths	8
	Coho Salmon	Scales	14
	Chinook Salmon	Otoliths	34
	Chinook Salmon	Scales	100
	Rainbow Trout	Otoliths	74
	Rainbow Trout	Scales	87
	Atlantic Salmon	Otoliths	19
	Atlantic Salmon	Scales	38
	Brown Trout	Otoliths	34
	Brown Trout	Scales	25
Hamilton Harbour Nearshore Community Index Netting			
	Northern Pike	Cleithra	6
	White Bass	Scales	18
	Pumpkinseed	Scales	20
	Bluegill	Scales	30
	Largemouth Bass	Scales	3
	Black Crappie	Scales	2
	Yellow Perch	Scales	25
	Walleye	Otoliths	30
Toronto Nearshore Community Index Netting			
	Northern Pike	Cleithra	19
	Pumpkinseed	Scales	23
	Bluegill	Scales	9
	Smallmouth Bass	Scales	2
	Largemouth Bass	Scales	14
	Black Crappie	Scales	15
	Yellow Perch	Scales	27
	Walleye	Otoliths	3
Upper Bay of Quinte Nearshore Community Index Netting			
	Northern Pike	Cleithra	10
	Pumpkinseed	Scales	30
	Bluegill	Scales	31
	Largemouth Bass	Scales	31
	Black Crappie	Scales	33
	Yellow Perch	Scales	31
	Walleye	Otoliths	23
St. Lawrence River Fish Community Index Netting - Lake St. Francis			
	Northern Pike	Cleithra	11
	Smallmouth Bass	Scales	24
	Yellow Perch	Scales	139
	Walleye	Otoliths	29
Credit River Chinook Assessment and Egg Collection			
	Chinook Salmon	Otoliths	169
	Chinook Salmon	CWT	14
Commercial Catch Sampling			
	Lake Whitefish	Otoliths	307
Round Whitefish Spawning Assessment			
	Round Whitefish	Otoliths	171
Total			2341

TABLE 4.2. Species-specific summery of age and growth structures interpreted for age (2,341) in 2014.

	Structure				
Species	Scales	Otoliths	Cleithra	Code Wire Tags	Total
Atlantic Salmon	38	19			57
Black Crappie	50				50
Bluegill	70				70
Brown Trout	25	34			59
Chinook Salmon	100	203		27	330
Coho Salmon	14	8			22
Deepwater Sculpin		60			60
Lake Trout				74	74
Lake Whitefish		335			335
Largemouth Bass	48				48
Northern Pike			62		62
Pumpkinseed	73				73
Rainbow Trout	87	74			161
Round Whitefish		171			171
Smallmouth Bass	46				46
Walleye	56	427			483
White Bass	18				18
Yellow Perch	222				222
Total	847	1331	62	101	2341

5. Contaminant Monitoring

N. J. Jakobi and J. A. Hoyle, Lake Ontario Management Unit

Lake Ontario Management Unit (LOMU) cooperates annually with several agencies to collect fish samples for contaminant testing. In 2014, 319 contaminant samples were collected for Ontario's Ministry of the Environment Sport Fish Monitoring program (Table 5.1). Samples were primarily collected using existing fisheries assessment programs on Lake Ontario, Bay of Quinte and the St. Lawrence.

A summary of the number of fish samples collected by species, for contaminant analysis by the Ministry of Environment 2000-2014 is shown in Table 5.2.

TABLE 5.1. Number of fish samples provided to Ministry of Environment for contaminant analysis, by region and species, 2014.

Region	Block	Species	Total
Hamilton Harbour	3	Black Crappie	2
		Channel Catfish	10
		Freshwater Drum	2
		Northern Pike	5
		Walleye	15
		White Perch	8
Toronto Offshore Area	4	Chinook Salmon	1
		Lake Trout	20
Toronto Waterfront Area	4a	Brown Bullhead	20
		Largemouth Bass	7
		Walleye	3
Northwestern Lake Ontario	6	Brown Trout	6
		Chinook Salmon	8
		Lake Trout	9
Northeastern Lake Ontario	8	Brown Trout	4
		Chinook Salmon	10
		Lake Trout	20
		Lake Whitefish	17
		Walleye	20
Upper Bay of Quinte	9	Brown Bullhead	30
Lake St. Francis	15	Brown Bullhead	3
		Northern Pike	11
		Smallmouth Bass	20
		Walleye	21
		White Sucker	25
		Yellow Perch	22
Total			319

TABLE 5.2. Summary of the number of fish samples collected, by species, for contaminant analysis by the Ministry of Environment, 2000-2014.

	Year														
Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Black Crappie			20	20	3	20		20		20	29			35	2
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	53
Brown Trout	40	3	20		31		22	6	29	34	34	12	20	6	10
Channel Catfish	20	20	7	23		17				8		15	20	4	10
Chinook Salmon	40	3	16		48		29	1	36		39	1	21	6	19
Coho Salmon		1	3												
Common Carp				7											
Freshwater Drum			43		16		13	2	32	20	37			42	2
Lake Trout			42		54		38	17	46	20	33	13	18	20	49
Lake Whitefish	20													20	17
Largemouth Bass		4	25	28	20	9	8	89	26	40	28	55	20	11	7
Northern Pike		53	39	60	22	40	22	94	35	28	31	20	34	47	16
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	20
Walleye		42	51	40	61	30	62	98	61	40	70	71	24	73	59
White Bass											20				
White Perch		40		40	40	14	21	20	35	20	7			40	8
White Sucker							1								25
Yellow Perch	20	60	66	58	75	40	86	90	60	91	80	20	44	81	22
Total	180	445	546	473	482	303	450	628	702	677	589	509	327	545	319

6. Stocking Program

6.1 Stocking Summary

C. Lake , Lake Ontario Management Unit

In 2014, OMNRF stocked approximately 2.3 million salmon and trout into Lake Ontario (Table 6.1; Fig. 6.1). This number of fish equaled nearly 38,000 kilograms of biomass added to the Lake (Fig. 6.1.b). Fig. 6.2 shows stocking trends in Ontario waters from 1968 to 2014. The New York State Department of Environmental Conservation (NYSDEC) also stocked about 4.24 million salmon and trout into the lake in 2014.

Approximately 650,000 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 165,000 (25% of total stocking) Chinook Salmon were held in pens at eight sites in Lake Ontario for a short period of time prior to stocking. This ongoing project is being done in partnership with local community groups. It is hoped that pen-imprinting will help improve returns of mature adults to these areas in the fall, thereby enhancing local nearshore and shore fishing opportunities.

Atlantic Salmon were stocked in support of an ongoing program to restore self-sustaining populations of this native species to the Lake

TABLE 6.1. Fish stocked into the Ontario waters of Lake Ontario for 2014, and targets for 2015.

Species	Life Stage	2014*	2015
Atlantic Salmon	Spring Fingerlings	498,055	400,000
	Fall Fingerlings	122,281	150,000
	Spring Yearlings	85,505	75,000
	Adult	26	-
		705,867	**625,000**
Brown Trout	Fall Fingerlings	40,000	40,000
	Spring Yearlings	162,098	140,000
		202,098	**180,000**
Chinook Salmon	Spring Fingerlings	657,887	600,000
Coho Salmon	Spring Fingerlings	56,460	80,000
Rainbow Trout	Fall Fingerlings	25,175	15,000
	Spring Yearlings	146,456	140,000
		171,631	**155,000**
Lake Trout	Spring Yearlings	462,482	500,000
Walleye	Fry	950,000	-
	Summer Fingerlings	-	100,000
Bloater	Sub-Adult	48,495	50,000
Grand Total**		**2,304,920**	**2,290,000**

* includes fish reared by MNRF and partners
** 2014 total does not include Walleye fry

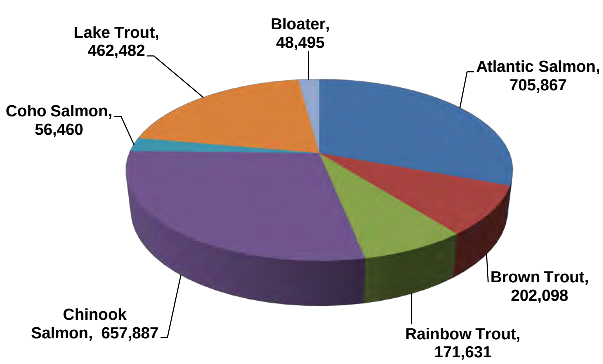


FIG. 6.1(a). Number of fish stocked into Ontario waters of Lake Ontario (excluding Walleye fry) in 2014. Total = 2,304,920.

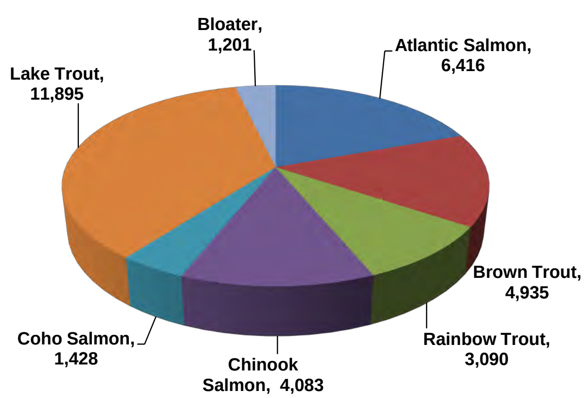


FIG. 6.1(b). Weight (kg) of fish stocked into Ontario waters of Lake Ontario (excluding Walleye fry) in 2014. For a small number of stocking events, total weight was not recorded, so the total weight should be considered an estimate only. Total = 33,048 kg.

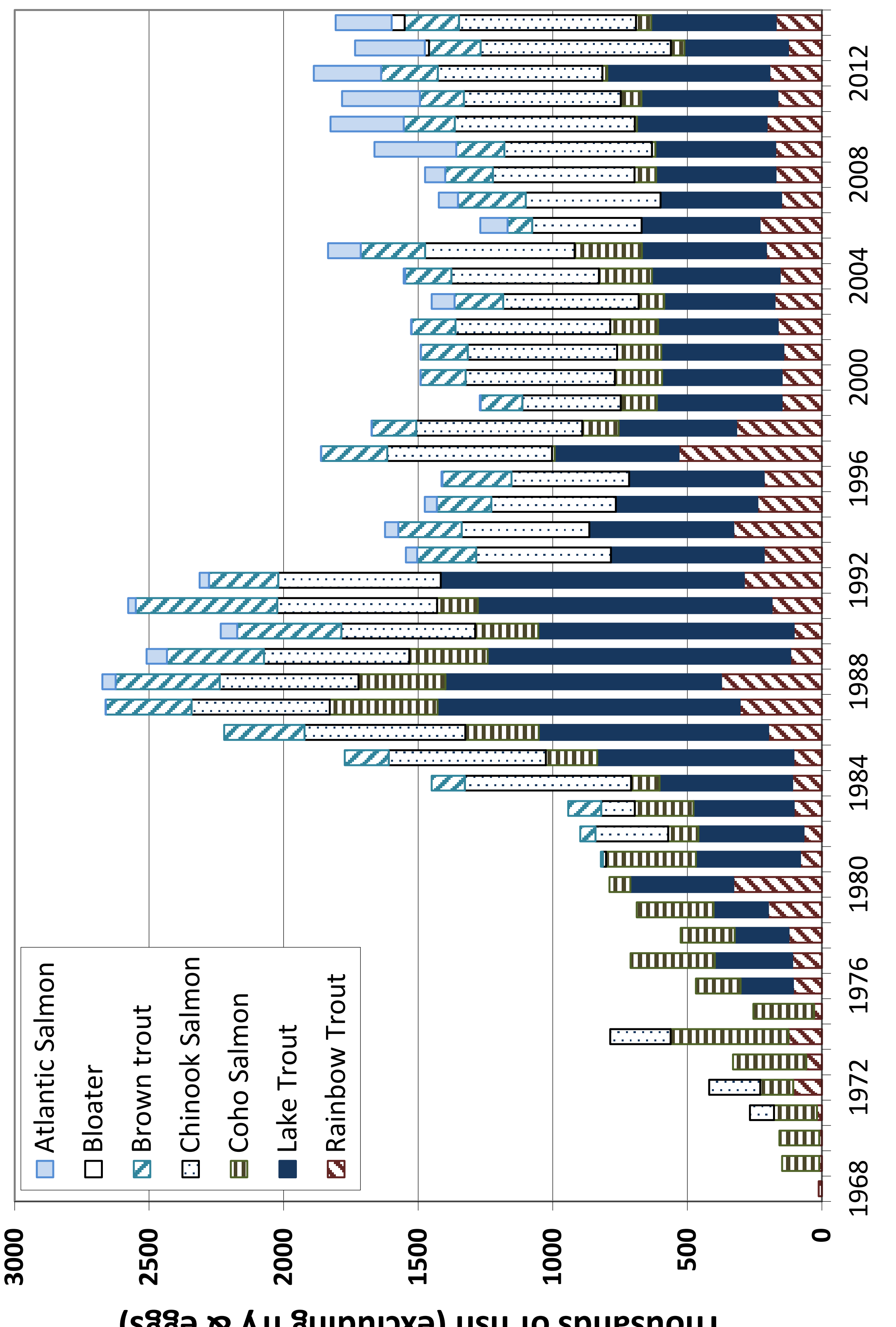


FIG. 6.1.2. Trends in salmon and trout stocking in Ontario waters of Lake Ontario, 1968-2014.

Ontario basin (Section 8.2). Approximately 700,000 Atlantic Salmon of various life stages were released into current restoration streams in 2014: Credit River, Duffins Creek and Cobourg Brook. OMNRF is working cooperatively with the Ontario Federation of Anglers and Hunters and a network of other partners to plan and deliver this phase of Atlantic Salmon restoration, including setting stocking targets to help meet program objectives. Atlantic Salmon are produced at both OMNRF and partner facilities. Three Atlantic Salmon brood stocks from different source populations in Nova Scotia, Quebec and Maine are currently housed at OMNRF's Harwood and Normandale Fish Culture Stations. All fish have been genotyped to facilitate follow-up assessment on stocked fish and their progeny in the wild.

Over 460,000 Lake Trout yearlings were stocked as part of an established, long-term rehabilitation program, and in support of the new Lake Trout Stocking Plan (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.

Nearly 50,000 Deepwater Cisco, or Bloater were stocked in 2014. This small relative of the Lake Whitefish was an important prey item for Lake Trout until the late-1950's when both species were extirpated. A coordinated program involving staff from the US and Canada resulted in the initial stocking of approximately 15,000 Bloater being stocked in 2013. Dedicated work by our US partners and MNRF Fish Culture Section staff have resulted in great advances each year in the complicated process of rearing Bloater. See section 8.4 for a detailed description of this restoration effort.

Rainbow Trout and Brown Trout were stocked at various locations to provide shore and boat fishing opportunities. Some of these stocking locations may change once the Stocking Plan (Section 6.3) is approved. Over 55,000 Coho Salmon were produced by stocking partner Metro East Anglers (51,000 fall fingerlings) and Credit River Anglers (5,460 spring fingerlings).

Continuing a new program started in 2012 (Section 8.7), 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; 950,000 Walleye fry were available in 2014. The Walleye were very young when stocked (48 hours old) and very small – future assessment will determine if this life stage is as successful as the summer fingerlings that were stocked in 2012. It is anticipated that 50,000 summer fingerlings will be available in 2015.

OMNR remains committed to providing diverse fisheries in Lake Ontario and its tributaries, based on wild and stocked fish, as appropriate. Detailed information about OMNRF's 2014 stocking activities is found in Tables 6.2 to 6.9.

TABLE 6.2 . Atlantic Salmon stocked in the Province of Ontario waters of Lake Ontario, 2014.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
				ATLANTIC SALMON - SPRING FINGERLINGS					
Cobourg Brook									
Dale Rd.	5	2013	Normandale FCS	Sebago Lake (HWC)	6	4.41	83.8	None	19,005
Dale Rd.	5	2013	Sir Sandford Fleming College	LaHave River (NMC)	5	1.6	31.1	None	19,446
Hie - McNichol Properties	5	2013	Normandale FCS	LaHave River (NMC)	6	1.97	49.3	None	25,006
McDougal Rd. Balls Mill	5	2013	Normandale FCS	Sebago Lake (HWC)	6	3.41	64.8	None	18,993
									82,450
Credit River									
Black Cr. - 15th Sideroad	5	2013	Normandale FCS	Sebago Lake (HWC)	6	3.94	78.8	None	20,001
Black Cr. - 6th Line	5	2013	Normandale FCS	Sebago Lake (HWC)	6	5.07	101.5	None	20,022
Forks of the Credit	5	2013	Normandale FCS	Sebago Lake (HWC)	6	3.32	66.4	None	19,999
Forks of the Credit	5	2013	Normandale FCS	Lac Saint-Jean, Quebec (HWC)	6	3.87	50.8	None	13,136
Forks of the Credit	5	2013	Normandale FCS	Sebago Lake (HWC)	6	3.42	41.0	None	11,997
Forks of the Credit	5	2013	Belfountain Community Hatchery	Sebago Lake (HWC)	5	0.22	2.4	None	10,924
Forks of the Credit - Meadow	5	2013	Normandale FCS	LaHave River (NMC)	6	2.55	25.5	None	10,003
Forks of the Credit - Meadow	5	2013	Normandale FCS	Sebago Lake (HWC)	6	2.84	28.4	None	9,996
Forks of the Credit - Meadow	5	2013	Normandale FCS	Lac Saint-Jean, Quebec (HWC)	6	3.92	39.2	None	9,997
Forks of the Credit - Stuck Truck	5	2013	Normandale FCS	Sebago Lake (HWC)	6	2.12	21.2	None	10,000
Forks of the Credit - Stuck Truck	5	2013	Normandale FCS	LaHave River (NMC)	6	2.12	21.2	None	10,001
Forks of the Credit - Stuck Truck	5	2013	Normandale FCS	Lac Saint-Jean, Quebec (HWC)	6	3.92	35.2	None	8,969
West Credit - Winston Churchill Blvd.	5	2013	Belfountain Community Hatchery	Sebago Lake (HWC)	5	0.22	2.2	None	10,017
West Credit - Belfountain	5	2013	Normandale FCS	LaHave River (NMC)	6	2.46	24.6	None	9,999
West Credit - Belfountain	5	2013	Normandale FCS	Sebago Lake (HWC)	6	3.71	37.1	None	9,995
									185,056
Duffins Creek									
Claremont	5	2013	Normandale FCS	Sebago Lake (HWC)	6	3.39	33.9	None	9,999
Claremont	5	2013	Normandale FCS	LaHave River (NMC)	6	2.22	22.2	None	9,999
Duffins Crk. - Sideline 32	5	2013	Normandale FCS	Sebago Lake (HWC)	6	3.02	30.2	None	10,000
Duffins Crk. - Sideline 32	5	2013	Normandale FCS	LaHave River (NMC)	6	2.15	21.5	None	9,985
E. Duffins Crk. - Durham Outdoor Centre	5	2013	Sir Sandford Fleming College	LaHave River (NMC)	5	1.3	32.5	None	25,000
Ganatsekiagon Cr.	5	2013	Sir Sandford Fleming College	LaHave River (NMC)	5	1.3	28.6	None	22,000
Greenwood	5	2013	Sir Sandford Fleming College	LaHave River (NMC)	5	1.5	33.8	None	22,531
Mitchell Crk. 8th Conc	5	2013	Normandale FCS	Lac Saint-Jean, Quebec (HWC)	6	3.92	39.2	None	9,997
Mitchell Crk. 8th Conc	5	2013	Normandale FCS	LaHave River (NMC)	6	2.15	21.5	None	9,994
Reesor Cr. - Sideline 34	5	2013	Sir Sandford Fleming College	LaHave River (NMC)	5	1.2	24.8	None	20,657
									150,162
Humber River									
Castelderg	5	2013	Normandale FCS	LaHave River (NMC)	6	2.47	61.7	None	24,995
Castelderg	5	2013	Normandale FCS	Sebago Lake (HWC)	6	2.77	14.0	None	5,044
Castelderg	5	2013	Normandale FCS	LaHave River (NMC)	6	2.24	11.4	None	5,103
Coffey Creek	4	2013	Islington Sportsman Club	Sebago Lake (HWC)	4	0.2	1.1	None	5,530
Coffey Creek - St. Francis Centre	4	2013	Islington Sportsman Club	Sebago Lake (HWC)	4	0.2	0.6	None	2,911
Coffey Creek - Finnerty Road	4	2013	Islington Sportsman Club	Sebago Lake (HWC)	4	0.15	1.1	None	7,054
Coffey Creek - Finnerty Road	4	2013	Islington Sportsman Club	Sebago Lake (HWC)	4	0.2	1.0	None	4,760
Duffy's Ln/Patterson	5	2013	Normandale FCS	LaHave River (NMC)	6	2.26	56.5	None	24,990
									80,387
						Spring Fingerling Total:	1,240		**498,055**

Continued on next page

TABLE 6.2 (continued) Atlantic Salmon stocked in the Province of Ontario waters of Lake Ontario, 2014.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
				ATLANTIC SALMON - FALL FINGERLINGS					
Cobourg Brook									
Danforth Rd.	10	2013	Normandale FCS	LaHave River (NMC)	10	22.6	452.0	None	19,998
Division St.	10	2013	Normandale FCS	Sebago Lake (HWC)	10	26.13	102.0	None	3,903
Division St.	10	2013	Normandale FCS	LaHave River (NMC)	10	18.97	34.3	None	1,808
Division St.	10	2013	Normandale FCS	Lac Saint-Jean, Quebec (HWC)	10	22.18	49.1	None	2,213
									27,922
Credit River									
Eldorado Park	10	2013	Normandale FCS	Sebago Lake (HWC)	10	19.19	195.0	None	10,161
Eldorado Park	10	2013	Normandale FCS	LaHave River (NMC)	10	18.76	190.0	None	10,126
Grange Sideroad	10	2013	Normandale FCS	LaHave River (NMC)	10	17.29	174.9	None	10,118
Grange Sideroad	10	2013	Normandale FCS	Sebago Lake (HWC)	10	23.78	240.0	None	10,091
McLaren Rd.	10	2013	Normandale FCS	LaHave River (NMC)	10	17.76	268.0	None	15,088
McLaughlin Road Bridge	10	2013	Normandale FCS	Sebago Lake (HWC)	10	22.64	59.0	None	2,605
McLaughlin Road Bridge	10	2013	Normandale FCS	Lac Saint-Jean, Quebec (HWC)	10	19.98	60.0	None	3,002
McLaughlin Road Bridge	10	2013	Normandale FCS	LaHave River (NMC)	10	21.61	65.0	None	3,007
									64,198
Duffins Creek									
5th Concession	10	2013	Normandale FCS	LaHave River (NMC)	10	18.4	369.8	None	20,097
Paulynn Park	10	2013	Normandale FCS	LaHave River (NMC)	10	18.9	190.2	None	10,064
									30,161
						Fall Fingerling Total:	2,449		**122,281**
				ATLANTIC SALMON - YEARLING					
Cobourg Brook									
Danforth Rd.	4	2012	Normandale FCS	Sebago Lake (HWC)	16	30.85	148.9	None	4,826
Danforth Rd.	4	2012	Normandale FCS	LaHave River (NMC)	16	21.91	239.4	None	10,927
Hie - McNichol Properties	5	2012	Sir Sandford Fleming College	LaHave River (NMC)		72	22.0	None	305
Hie - McNichol Properties	4	2012	Sir Sandford Fleming College	LaHave River (NMC)		82.6	621.2	None	7,521
Hie - McNichol Properties	4	2012	Sir Sandford Fleming College	LaHave River (NMC)		80.1	56.2	None	702
									24,281
Credit River									
Eldorado Park	4	2012	Normandale FCS	Lac Saint-Jean, Quebec (HWC)	16	26.44	342.6	None	12,956
Eldorado Park	4	2012	Normandale FCS	Sebago Lake (HWC)	16	37.27	445.5	None	11,953
Eldorado Park	4	2012	Normandale FCS	Sebago Lake (HWC)	16	32.08	17.6	None	549
Eldorado Park	4	2012	Normandale FCS	LaHave River (NMC)	16	21.41	206.5	None	9,646
Eldorado Park	4	2012	Normandale FCS	LaHave River (NMC)	16	25.13	82.6	None	3,287
Norval Nashville North	5	2012	Credit River Anglers Assoc.	LaHave River (NMC)	-	-	-	None	2,754
									41,145
Duffins Creek									
Brock Ridge Park	4	2012	Sir Sandford Fleming College	LaHave River (NMC)	0	79.1	23.7	None	300
Paulynn Park	4	2012	Normandale FCS	Lac Saint-Jean, Quebec (HWC)	16	25.31	76.2	None	3,010
Paulynn Park	4	2012	Normandale FCS	Sebago Lake (HWC)	16	30.57	223.4	None	7,307
Paulynn Park	4	2012	Normandale FCS	LaHave River (NMC)	16	23.4	221.4	None	9,462
									20,079
						Yearling Total:	2,727		**85,505**

Continued on next page

TABLE 6.2 (continued) Atlantic Salmon stocked in the Province of Ontario waters of Lake Ontario, 2014.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
			ATLANTIC SALMON - ADULT						
Lake Ontario									
Bond Head	4	-	Sir Sandford Fleming College	LaHave River (NMC)	-	-	-	None	**26**
						Spring Fingerling Total:	**1,240 kg.**		**498,055**
						Fall Fingerling Total:	**2,449 kg.**		**122,281**
						Yearling Total:	**2,727 kg.**		**85,505**
						Adult Total:	**-**		**26**
						Atlantic Salmon Total:	**6,416 kg.**		**705,867**

TABLE 6.3. Brown Trout stocked in the Province of Ontario waters of Lake Ontario, 2014.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
BROWN TROUT - FALL FINGERLINGS									
Lake Ontario									
Athol Bay	11	2013	Ringwood (OFAH 2006)	Ganaraska River (TTC)	10	22.0	220	None	10,000
CLOCA Ramp	11	2013	Ringwood (OFAH 2006)	Ganaraska River (TTC)	10	26.0	260	None	10,000
Frenchmans Bay	11	2013	Ringwood (OFAH 2006)	Ganaraska River (TTC)	10	28.0	140	None	5,000
Whitby Harbour	11	2013	Ringwood (OFAH 2006)	Ganaraska River (TTC)	10	26.0	260	None	10,000
									35,000
Rouge R.									
Rouge R.	11	2013	Ringwood (OFAH 2006)	Ganaraska River (TTC)	10	27.0	135	None	**5,000**
						Fall Fingerling Total:	1,015		**40,000**
BROWN TROUT - SPRING YEARLINGS									
Bronte Cr.									
Bronte Beach Park	3	2012	Chatsworth FCS	Ganaraska River (TTC)	14	23.5	360	None	**15,313**
Credit R.									
Norval Nashville North	5	-	Credit River Anglers Assoc. Hatchery	Ganaraska River (NMC)	-	-	-	None	**840**
Duffins Cr.									
401 Bridge	3	2012	Chatsworth FCS	Ganaraska River (TTC)	14	22.5	230	None	**10,229**
Lake Ontario									
Ashbridge's Bay	3	2012	Chatsworth FCS	Ganaraska River (TTC)	14	25.9	265	None	10,220
Bluffer's Park	4	2012	Chatsworth FCS	Ganaraska River (TTC)	14	25.9	660	None	25,453
Burlington Canal	3	2012	Chatsworth FCS	Ganaraska River (TTC)	14	21.9	335	None	15,332
Fifty Point CA	3	2012	Chatsworth FCS	Ganaraska River (TTC)	14	21.9	335	None	15,329
Humber Bay Park	3	2012	Chatsworth FCS	Ganaraska River (TTC)	14	26.1	400	None	15,325
Jordan Harbour	3	2012	Chatsworth FCS	Ganaraska River (TTC)	14	23.5	240	None	10,208
Oshawa Harbour	4	2012	Chatsworth FCS	Ganaraska River (TTC)	16	24.7	570	None	23,114
Port Dalhousie East	3	2012	Chatsworth FCS	Ganaraska River (TTC)	16	25.3	270	None	10,664
Wellington Channel	4	2012	Chatsworth FCS	Ganaraska River (TTC)	16	25.3	255	None	10,071
									135,716
						Spring Yearling Total:	3,920		**162,098**
						Brown Trout Total:	**4,935**		**202,098**

TABLE 6.4. Rainbow Trout stocked in the Province of Ontario waters of Lake Ontario, 2014.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
			RAINBOW TROUT - FALL FINGERLINGS						
Credit R.									
Norval Nashville North	11	-	Credit River Anglers Assoc. Hatchery	Wild Egg Collection	-	-	-	None	**5,175**
Lake Ontario									
Wellington Channel	10	2014	Springside Park Hatchery	Ganaraska River (TTC)	6	5.6	112	None	**20,000**
						Fall Fingerling Total:	112		**25,175**
			RAINBOW TROUT - SPRING YEARLINGS						
Bronte Cr.									
Lowville Park	4	2013	Normandale FCS	Ganaraska River (TTC)	12	16.9	60	None	3,545
2nd Side Road Bridge	4	2013	Normandale FCS	Ganaraska River (TTC)	12	21.2	255	None	12,006
Lowville Park	4	2013	Normandale FCS	Ganaraska River (TTC)	12	22.4	190	None	8,491
5th Side Road Bridge	5	2013	Harwood FCS	Ganaraska River (TTC)	15	27.1	312	None	11,500
									35,542
Credit R.									
Norval Nashville North	4	2013	Normandale FCS	Ganaraska River (TTC)	12	17.1	415	None	24,307
Huttonville	6	2013	Harwood FCS	Ganaraska River (TTC)	15	27.1	352	None	13,003
Norval Nashville North	5	-	Credit River Anglers Assoc. Hatchery	Ganaraska River (TTC)	-	-	-	None	687
									37,997
Humber R.									
East Branch Islington	4	2013	Normandale FCS	Ganaraska River (TTC)	12	12.5	119	None	9,517
King Vaughan Line	4	2013	Normandale FCS	Ganaraska River (TTC)	12	12.5	57	None	4,523
East Branch Islington	4	2013	Normandale FCS	Ganaraska River (TTC)	12	22.2	144	None	6,501
King Vaughan Line	4	2013	Normandale FCS	Ganaraska River (TTC)	12	23.7	290	None	12,254
									32,795
Lake Ontario									
Jordan Harbour	4	2013	Normandale FCS	Ganaraska River (TTC)	12	14.5	240	None	16,570
Port Dalhousie East	4	2013	Normandale FCS	Ganaraska River (TTC)	12	23.1	460	None	19,923
Beacon Inn	4	2013	Normandale FCS	Ganaraska River (TTC)	12	23.4	85	None	3,629
									40,122
						Spring Yearling Total:	2,978		**146,456**
						Rainbow Trout Total:	3,090		**171,631**

TABLE 6.5. Chinook Salmon stocked in the Province of Ontario waters of Lake Ontario, 2014.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
				CHINOOK SALMON - SPRING FINGERLINGS					
Bronte Cr.									
2nd Side Road Bridge	4	2013	Normandale FCS	Lake Ontario (Wild)	5	6.0	149.7	None	25,082
5th Side Road Bridge	4	2013	Normandale FCS	Lake Ontario (Wild)	5	6.0	149.6	None	25,051
									50,133
Credit R.									
Eldorado Park	5	2013	Normandale FCS	Lake Ontario (Wild)	5	6.7	211.3	None	31,772
Norval Nashville North	4	2013	Normandale FCS	Lake Ontario (Wild)	5	5.2	294.4	None	56,936
									88,708
Don R.									
East Don R Donalda Golf Club	5	2013	Normandale FCS	Lake Ontario (Wild)	5	5.6	282.7	None	**50,125**
Humber R.									
East Branch Islington	5	2013	Normandale FCS	Lake Ontario (Wild)	5	6.5	340.5	None	**52,540**
Lake Ontario									
Ashbridge's Bay	5	2013	Normandale FCS	Lake Ontario (Wild)	5	4.8	83.4	None	17,549
Bluffer's Park	5	2013	Normandale FCS	Lake Ontario (Wild)	5	4.6	92.5	None	20,201
Burlington Canal	5	2013	Normandale FCS	Lake Ontario (Wild)	5	5.7	226.8	None	39,999
CLOCA Ramp	5	2013	Normandale FCS	Lake Ontario (Wild)	5	5.9	74.2	None	12,484
Consecon Robinson Point	5	2013	Normandale FCS	Lake Ontario (Wild)	5	4.6	57.3	None	12,513
Jordan Harbour	5	2013	Normandale FCS	Lake Ontario (Wild)	5	5.0	125.5	None	25,006
Lakeport	5	2013	Normandale FCS	Lake Ontario (Wild)	5	4.6	68.7	None	15,000
Oshawa Harbour	5	2013	Normandale FCS	Lake Ontario (Wild)	5	6.0	75.0	None	12,494
Port Dalhousie East	4	2013	Normandale FCS	Lake Ontario (Wild)	5	5.5	384.9	None	70,489
Wellington Channel	5	2013	Normandale FCS	Lake Ontario (Wild)	5	4.6	57.3	None	12,512
Whitby Harbour	5	2013	Normandale FCS	Lake Ontario (Wild)	5	6.0	75.0	None	12,494
									250,741
Lake Ontario - Net Pens									
Bluffer's Park	5	2013	Net Pen - MEA	Lake Ontario (Wild)	6	9.5	238.0	None	25,057
Brighton - Gosport	5	2013	Net Pen - CLOSA	Lake Ontario (Wild)	6	8.9	160.3	None	18,008
Oshawa Harbour	5	2013	Net Pen - MEA	Lake Ontario (Wild)	6	8.5	127.3	None	15,030
Port Dalhousie East	5	2013	Net Pen - SCFGA	Lake Ontario (Wild)	6	5.9	292.9	None	49,986
Port Darlington	5	2013	Net Pen - MEA	Lake Ontario (Wild)	6	8.5	169.6	None	20,003
Pt. Credit Harbour	5	2013	Net Pen - PCSTA	Lake Ontario (Wild)	6	8.8	88.1	None	10,010
Wellington Channel	5	2013	Net Pen - CLOSA	Lake Ontario (Wild)	6	9.6	119.9	None	12,491
Whitby Harbour	5	2013	Net Pen - MEA	Lake Ontario (Wild)	6	9.2	138.5	None	15,055
									165,640
					Chinook Salmon Total:		4,083		**657,887**

TABLE 6.6. Coho Salmon stocked in the Province of Ontario waters of Lake Ontario, 2014.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
			COHO SALMON - SPRING FINGERLINGS						
Credit R.									
Norval Nashville North	5	2013	Credit River Anglers Assoc. Hatchery	Lake Ontario (Wild)	5	-	-	None	**5,460**
			COHO SALMON - FALL FINGERLINGS						
Credit R.									
Norval Nashville North	10	2013	Ringwood (OFAH 2006)	Lake Ontario (Wild)	10	28	1,428	None	**51,000**
						Coho Salmon Total:	1,428		**56,460**

TABLE 6.7. Lake Trout stocked in the Province of Ontario waters of Lake Ontario, 2014.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
				LAKE TROUT - SPRING YEARLINGS					
Lake Ontario									
Amherst Island	4	2012	Harwood FCS	Seneca Lake (TTC)	17	41.8	904	LPELV, AD	21,628
Amherst Island - K10 Buoy	4	2012	White Lake FCS	Slate Islands (DNC)	15	17	775	LPELV, AD	45,588
Brighton - Offshore	4	2012	Harwood FCS	Seneca Lake (TTC)	17	41.8	896	LPELV, AD	21,436
Brighton - Offshore	4	2012	Harwood FCS	Seneca Lake (TTC)	17	45.8	1019	LPELV, AD	22,254
Brighton - Offshore	5	2012	Harwood FCS	Seneca Lake (TTC)	17	45.8	960	LPELV, AD	20,970
Cobourg Harbour Pier	4	2012	North Bay FCS	Seneca Lake (TTC)	14	13.3	931	LPELV, AD	70,000
Fifty Point CA	4	2012	North Bay FCS	Seneca Lake (TTC)	14	13.3	676	LPELV, AD	50,800
Fifty Point CA	4	2012	North Bay FCS	Seneca Lake (TTC)	14	13.3	472	LPELV, AD	35,500
North of Main Duck Sill	5	2012	Harwood FCS	Seneca Lake (TTC)	18	44.4	160	LPELV, AD	3,610
North of Main Duck Sill	5	2012	Harwood FCS	Slate Islands (DNC)	17	29.3	621	LPELV, AD	21,194
Pigeon Island	5	2012	Harwood FCS	Seneca Lake (TTC)	18	40.8	513	LPELV, AD	12,581
Pt. Petre	4	2012	Harwood FCS	Michipicoten Island (DNC)	18	45.3	975	LPELV, AD	21,527
Scotch Bonnet Shoal	5	2012	North Bay FCS	Slate Islands (DNC)	14	4.8	240	LPELV, AD	50,085
Scotch Bonnet Shoal	4	2012	Harwood FCS	Seneca Lake (TTC)	17	41.8	945	LPELV, AD	22,606
Scotch Bonnet Shoal	5	2012	Harwood FCS	Michipicoten Island (DNC)	18	41.9	780	LPELV, AD	18,616
Scotch Bonnet Shoal	5	2012	Harwood FCS	Seneca Lake (TTC)	17	45.8	111	LPELV, AD	2,414
South of Long Point - Main Duck Isl.	5	2012	Harwood FCS	Michipicoten Island (DNC)	18	41.9	824	LPELV, AD	19,674
South of Long Point - Main Duck Isl.	5	2012	Harwood FCS	Seneca Lake (TTC)	17	45.8	92	LPELV, AD	1,999
						Lake Trout Total:	11,895		**462,482**

TABLE 6.8. Walleye stocked in Hamilton Harbour and Toronto Harbour, Lake Ontario, 2014.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
				WALLEYE - FRY					
Lake Ontario									
Hamilton Harbour	6	2014	White Lake FCS	Bay of Quinte (Wild)	~ 48 hrs.	-	-	None	**950,000**

TABLE 6.9. Bloater stocked in Hamilton Harbour and Toronto Harbour, Lake Ontario, 2014.

Waterbody / Site	Month Stocked	Year Spawned	Hatchery	Strain	Age (Months)	Mean Weight (g)	Total Weight (kg)	Marks	Number Stocked
				BLOATER - SUB-ADULT					
Lake Ontario									
Cobourg - 100	11	2013	White Lake FCS	Wild Egg Collection	19	19.3	411	None	21,368
Cobourg - 100	11	2013	White Lake FCS	Wild Egg Collection	19	16.7	162	None	9,701
Cobourg Harbour Pier	11	2013	Harwood FCS	Wild Egg Collection	19	36.0	477	None	13,256
Cobourg - 100	11	2013	Harwood FCS	Wild Egg Collection	19	36.0	150	None	4,170
						Bloater Total:	1,201		**48,495**

6.2 Net Pens

C. Lake, Lake Ontario Management Unit

Net Pen Use in Lake Ontario

Net pens have been used since 1998 in New York State, and more recently (since 2003) in Ontario. The net pen is a floating enclosure that is tied to a pier or other nearshore structure, and is used to temporarily house young salmonids (Chinook Salmon in Ontario, Chinook and Rainbow Trout in New York) prior to release into the lake. The net pens are managed by local angler groups, who ensure the health of the fish and feed them multiple times per day. The net pen fish are reared for approximately 4 weeks prior to release. Compared to fish released directly from the hatchery, net pen fish are larger, and may have a greater degree of site fidelity, or imprinting on the site. Once mature, these fish may return to the net pen site, providing for a near shore fall fishery.

New York State Net Pen Program

The first net pens in Lake Ontario were located in New York waters in 1998: Oswego Harbour (Rainbow Trout) and Oak Orchard Creek (Chinook Salmon and Rainbow Trout). The Oswego site was initiated in response to angler and stakeholder concerns over predation of newly -released fish by Double-Crested Cormorants, while the Oak Orchard site was established with the goal of increasing juvenile imprinting and subsequent returns of adult fish to the local fishery. In the first year, five net pens were used, and approximately 65,000 fish were reared. Now, over 400,000 fish on average are released annually, and the New York pen program has increased to 10 sites, with the number of pens used annually varying between 20-35, depending on acceptable water quality parameters (Fig. 6.2.1).

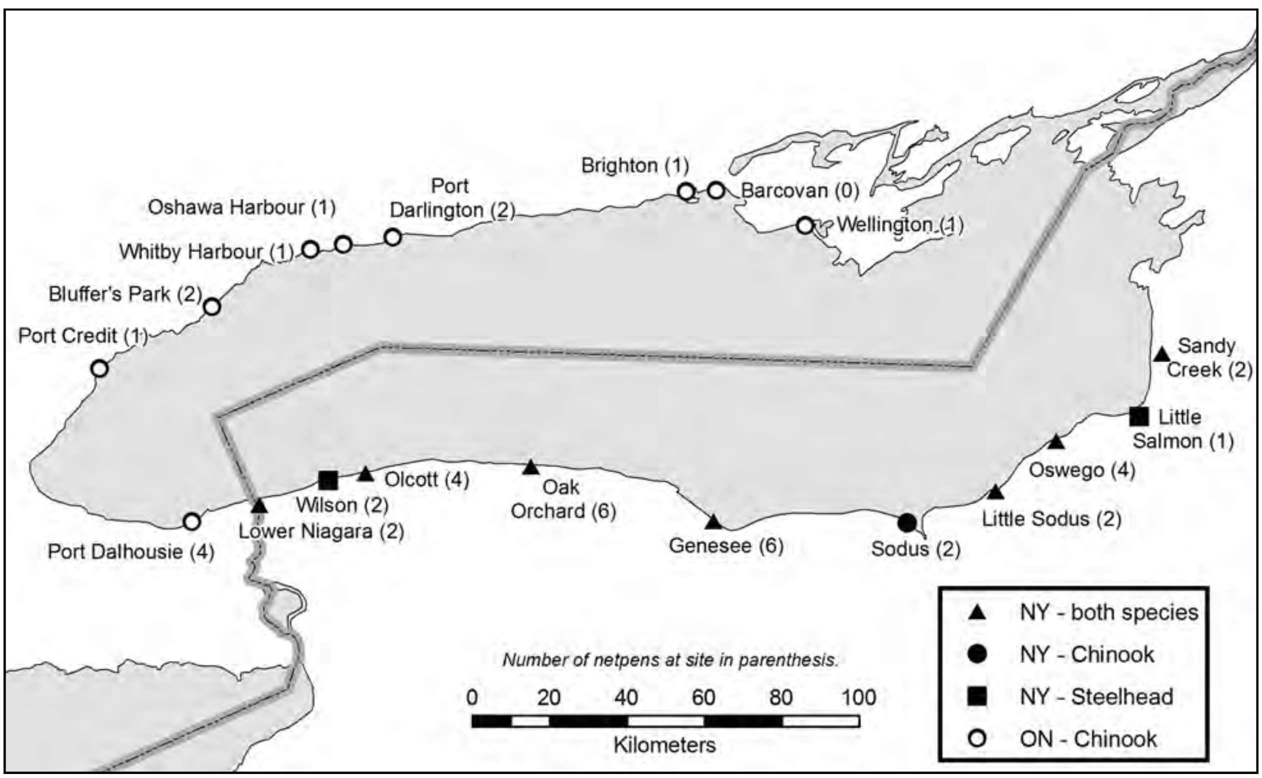


FIG. 6.2.1. Location of net pens used in Lake Ontario (Ontario and New York jurisdictions).

Ontario Net Pen Program

In August of 2002, a proposal was received by MNR from the Central Lake Ontario Sport Anglers (CLOSA), seeking approval for a pilot study to hold 10,000 Chinook Salmon in each of two eastern Lake Ontario locations (Barcovan and Wellington) for approximately 3 weeks prior to stocking. CLOSA's main objective was to determine whether a greater degree of imprinting would result in a more reliable fall fishery in this area. Since the use of net pens was new to the Ontario waters of Lake Ontario, the field protocol already in use by the New York State Department of Environmental Conservation (NYSDEC) was used to guide the early days of the project.

For five years (2003-2007), Barcovan and Wellington were the only two Ontario sites, releasing an average of just over 20,000 fish per year. In 2008, Whitby Harbour became the next site with a net pen, followed by Pt. Darlington and Pt. Dalhousie in 2009. In 2010, Bluffer's Park, Oshawa Harbour and Port Credit sites were added. In 2011 Barcovan was dropped in favour of Brighton. Fig. 6.2.1 illustrates the location of both Ontario and New York net pens. Table 6.2.1 and Fig. 6.2.2 show the numbers of fish released at each Ontario net pen site since the inception of the program.

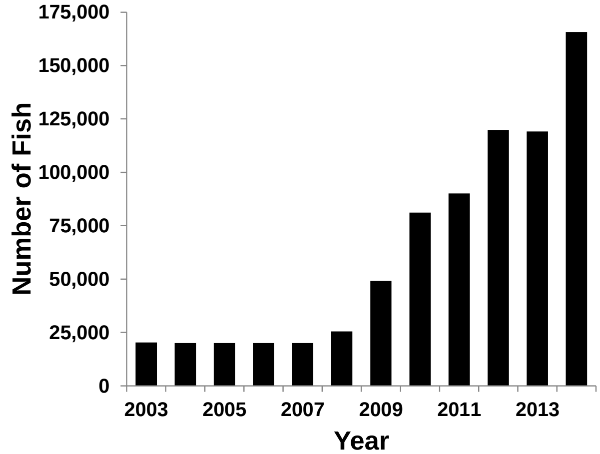


FIG. 6.2.2. Number of Chinook Salmon reared in net pens per year in the Ontario waters of Lake Ontario. Number of net pens: 2003-2007 = 2, 2008 = 3, 2009 = 9, 2010-2014 = 13.

2014 Net Pen Program

A total of 13 net pens were used at 8 sites in 2014. Table 6.2.2 shows site-specific details on fish size, duration of penning, and numbers released. Overall, fish growth and health was reported as good, with few mortalities. Fish were delivered to the pens at 3.6 g and weighed 8.6 g when released 32 days later (mean values across all pen sites).

TABLE. 6.2.1. List of net pen locations, years of operation, and average number of fish reared per year.

Site	Club sponsor*	Number pens at site	Years in operation	Total number fish released	Mean number fish released per year	Mean number fish per pen
Barcovan Beach	CLOSA	1	2003 - 2010 (8)	76,761	9,595	9,595
Bluffer's Park	MEA	2	2010 - current (5)	80,311	16,062	8,031
Brighton	CLOSA	1	2011 - current (4)	47,982	11,996	11,996
Oshawa Harbour	MEA	1	2010 - current (5)	49,665	9,933	9,933
Port Credit	PCSTA	1	2010 - current (5)	40,004	8,001	8,001
Port Dalhousie	SCFGC	4	2009 - current (6)	170,842	28,474	7,118
Port Darlington	MEA	2	2009 - current (6)	75,243	12,541	6,270
Wellington	CLOSA	1	2003 - current (12)	129,526	10,794	10,794
Whitby Harbour	MEA	1	2008 - current (7)	80,484	11,498	11,498

* CLOSA (Central Lake Ontario Salmon Anglers); MEA (Metro East Anglers); PCSTA (Port Credit Salmon & Trout Assoc.); SCFGC (St. Catherines Fish & Game Club).

TABLE 6.2.2. Results of 2014 Lake Ontario Chinook Salmon net pen rearing projects.

Pen Site	Organization	Number stocked (into pens)	Number of pens	Date stocked	Size at stocking (g)	Date released	Days held	Size at release (g)	Mortality (number of fish)	Mortality (%)	Number released
Brighton	CLOSA	18,008	1	Apr 09	3.4	May 14	35	8.9	0	0.0%	18,008
Bluffer's Park	MEA	25,071	2	Apr 05	3.7	May 14	39	9.5	14	0.1%	25,057
Oshawa Harbour	MEA	15,035	1	Apr 14	3.7	May 12	28	8.5	5	0.0%	15,030
Port Credit	PCSTA	10,022	1	Apr 12	3.7	May 12	30	8.8	12	0.0%	10,010
Port Dalhousie	SCFGC	50,014	4	Apr 08	3.5	May 08	30	5.9	28	0.1%	49,986
Port Darlington	MEA	20,005	2	Apr 14	3.7	May 07	23	8.5	2	0.0%	20,003
Wellington	CLOSA	12,559	1	Apr 09	3.4	May 12	33	9.6	68	0.5%	12,491
Whitby Harbour	MEA	15,055	1	Apr 05	3.7	May 12	37	9.2	0	0.0%	15,055
	Mean	20,721			3.6		32	8.6	16	0.1%	20,705
	Total	165,769	13						129		165,640

*CLOSA (Central Lake Ontario Salmon Anglers); MEA (Metro East Anglers); PCSTA (Port Credit Salmon & Trout Assoc.); SCFGC (St. Catherines Fish & Game Club).

Several clubs coordinated outreach events associated with the arrival and subsequent release of the fish, and report that public interest was very high. The net pen program continues to be very popular with the participating clubs, and we look forward to another successful year in 2015.

6.3 Lake Ontario Stocking Plan

C. Lake , Lake Ontario Management Unit

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

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

The purpose of the stocking plan is to examine current stocking activities and develop an updated plan to guide stocking practices from 2015–2024 to help achieve lake-wide and local fisheries management objectives. A key management challenge is to balance the short-term social, economic, and cultural needs of fishery stakeholders with the long-term goals of restoring native species while maintaining a balanced Lake Ontario fish community. The lake-wide OMNRF approved Fish Community Objectives 2013 guide the overall stocking program.

The proposed stocking plan provides important management context, presents proposed changes for 2015 and provides species-specific detail and rationale. The proposed plan will be on the Environmental Registry (ER) in early 2015 for public review and comment.

7. Stock Status

7.1 Chinook Salmon

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

Chinook salmon were stocked in Lake Ontario beginning in 1968 to suppress an over-abundant Alewife population, provide a recreational fishery and restore predator-prey balance to the fish community. At present Chinook Salmon are the most sought after species in the main basin recreational fishery, which is supported by a mix of stocked and wild fish. Salmon returning to rivers to spawn also support important shore and tributary fisheries.

In 2014, Chinook Salmon represented 29% of the total number of fish stocked and 11% of total biomass stocked into Lake Ontario by MNRF (Section 6). Ontario's Chinook Salmon stocking levels have remained relatively constant since 1985 (500,000 fish target; Fig. 7.1.1).

Chinook Salmon mark and tag monitoring data (Section 2.2) are reported from five Lake Ontario Management Unit (LOMU) surveys: i) Western Lake Ontario Boat Angling Survey (not conducted in 2014), ii) Chinook Salmon Angling Tournament and Derby Sampling, iii) Lake Ontario Volunteer Angler Diary Program (Section 2.3), iv) Eastern Lake Ontario and Bay of Quinte Fish Community Index Gill Netting (Section 1.2) and v) Credit River Chinook Salmon Spawning Index (Section 1.7). Gill nets caught small Chinook Salmon and complemented the angler programs that caught larger fish (Fig. 7.1.2). Coded wire tags (CWT) recovered from gill nets and angling programs show a mixed population of Chinook Salmon originating from geographically widespread stocking locations (Table 7.1.1 and Fig. 7.1.3), whereas Chinook Salmon returns to the Credit River tend to originate from fish stocked in the Credit River with a few strays from Bronte Creek stocking locations (Table 7.1.1 and Fig. 7.1.3). In 2014, there was no relationship between stocking and catch location suggesting adult Chinook Salmon utilize the entire lake during the summer months when the majority of the angling occurs. Return rates to the Credit River however suggests a strong relationship between stocking and spawning location.

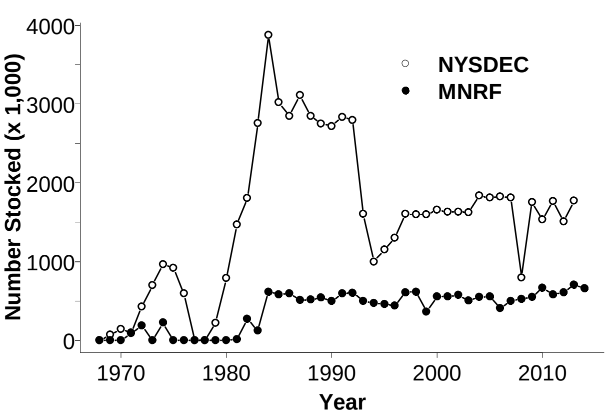


FIG 7.1.1. Number of Chinook Salmon stocked by New York State Department of Environmental Conservation (NYSDEC) and MNRF from 1968-2014 (Section 6).

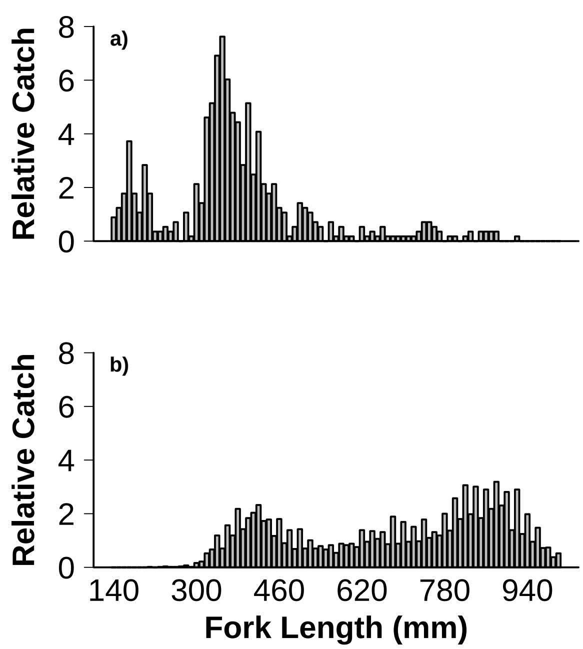


FIG. 7.1.2. Size selectivity (fork length, mm) of Chinook Salmon caught (a) in the Fish Community Index Gill Netting Program from 1992-2014 (Section 1.2) and (b) by anglers in the Western Lake Ontario Angler Survey from 1995-2013.

TABLE 7.1.1. Number of Chinook Salmon with coded wire tags caught in 2014 by anglers or through the Credit River Chinook Assessment Program (Section 1.7) organized by stocking and capture locations (for a map of capture locations see Fig. 7.1.3).

		Capture Location						Spawn Index
Stocking Year	Stocking Location	Niagara	Hamilton	West Toronto	East Toronto	Whitby-Cobourg	Brighton-Wellington	Credit River
2010	Genesee River			1				
	Oak Orchard		1					
2011	Bronte Creek					1		3
	Credit River							11
	Eighteen Mile Creek	3	1	1		1		
	Genesee River					1		
	Oak Orchard					1		
	Sandy Creek	1					1	

Catch per unit effort (CUE), total catch and total harvest is assessed by the Western Lake Ontario Boat Fishery and was not conducted in 2014. In 2013, total effort increased (Fig. 7.1.4 and Fig. 7.1.5) but total catch and harvest were 11% and 18% lower than the mean through 1997-2013 (Fig. 7.1.5). Release rates in both the Western Lake Ontario Boat Fishery and the Lake Ontario Volunteer Angler Program (Section 2.3) have increased through time (Fig. 7.1.6). In 2013, the release rates in the Western Lake Ontario Boat Fishery declined to 57% from the 2004-2013 average of 60%. In contrast, 2014 Chinook Salmon release rates reported in the Lake Ontario Volunteer Angler Program increased to 61% from the 2004-2014 average of 47%. From 2004-2008,

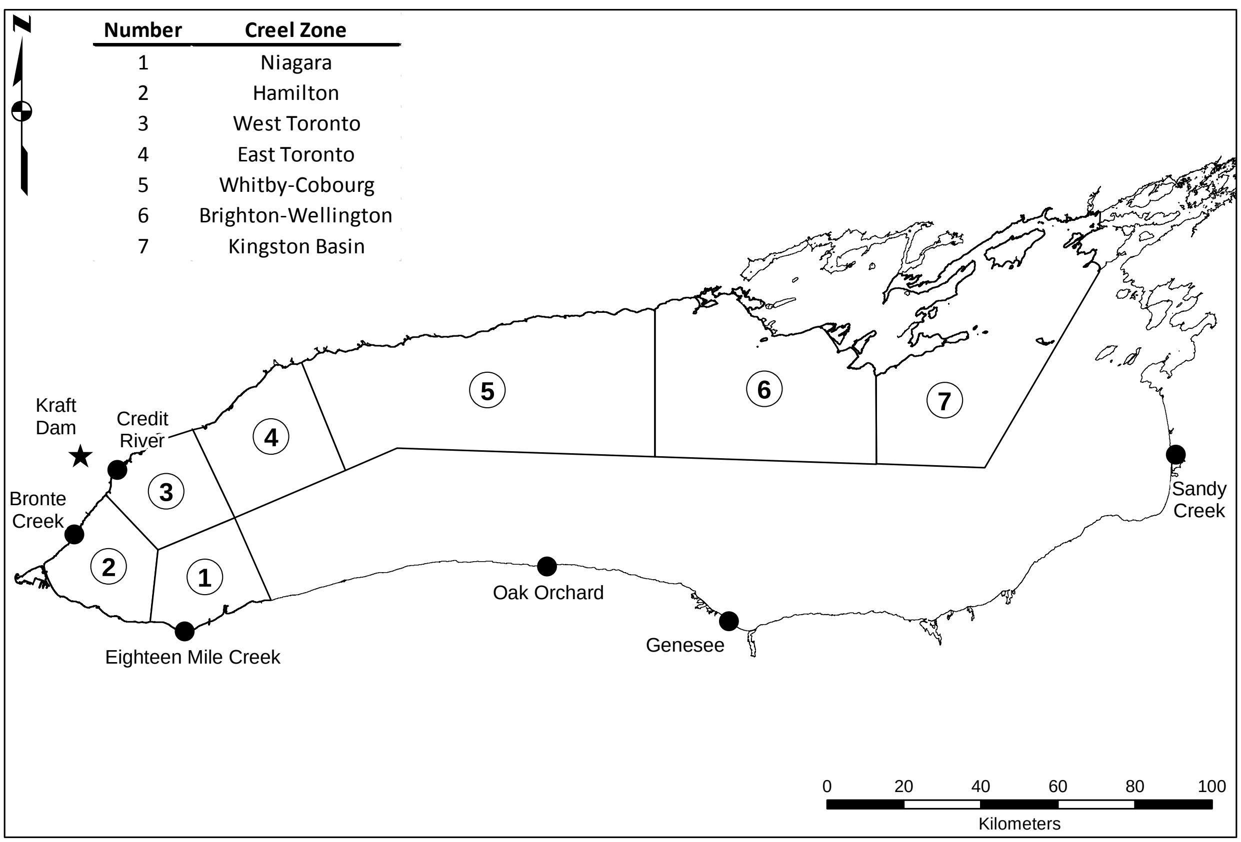


FIG 7.1.3. Spatial stratification of MNRF angler surveys in Lake Ontario. Filled circles indicate stocking locations for 2014 angler-caught Chinook Salmon with coded wire tags.

release rates in the Western Lake Ontario Boat Fishery were higher relative to the Volunteer Angler Program (63% vs 32%, respectively). From 2008 onward, Chinook Salmon release rates from both programs have been comparable (58% in Boat Fishery; 60% in the Volunteer Angler Program).

The condition of Lake Ontario Chinook Salmon was evaluated through three separate LOMU programs: i) Credit River Chinook Assessment (Section 1.7), ii) data collected for Chinook Salmon Mark and Tag Monitoring (Section 2.2) and iii) Western Lake Ontario Boat Fishery. Chinook Salmon in the Credit River index have a lower condition relative to fish sampled in the lake in mid-summer when condition should be at a maximum. Chinook Salmon condition, evaluated using data from the Credit River Chinook Assessment Program (Section 1.7) has declined since 1989 (Fig. 7.1.7). Condition of Chinook Salmon in 2014 from this program was the lowest since 1989. In contrast, these overall trends were not observed in either the Western Lake Ontario Boat Fishery or the tournament sampling (Fig. 7.1.7, Section 2.2). Despite the recent decline in Chinook Salmon condition from 2011-2013 in the Western Lake Ontario Boat Fishery, the 2013 condition index still remains above the long-term 1996-2013 average. A similar decline in condition was observed in Chinook Salmon sampled in tournaments; however this decline in condition is subtle relative to observations in the Credit River condition index (Fig. 7.1.7).

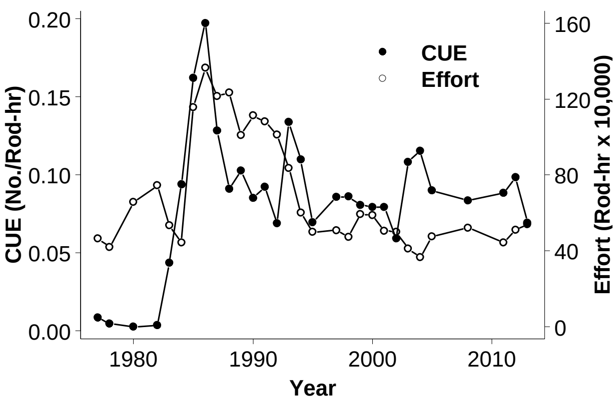


FIG 7.1.4. Catch rate (CUE) of Chinook Salmon and annual total effort (rod-hrs) in the Ontario waters of Lake Ontario (excluding the Eastern Basin), 1977-2013.

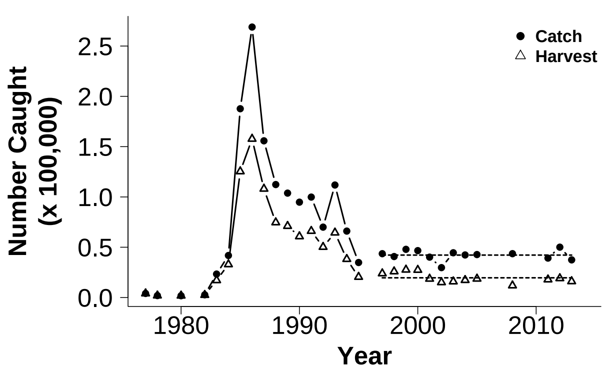


FIG. 7.1.5. Number of Chinook Salmon caught (circle) and harvested (triangle) annually in the Ontario waters of Lake Ontario (excluding he Eastern Basin), 1977-2013. Dashed line represents the mean catch and harvest from 1997-2013.

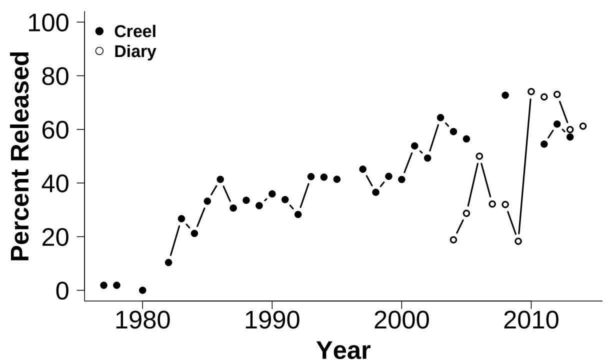


FIG. 7.1.6. Annual average of the proportion of Chinook Salmon released per trip from Lake Ontario Volunteer Angler Diary Program (open circle) and the Western Lake Ontario Angler Survey (closed circle). Data from the Western Lake Ontario Angler Survey are from 1977-2013 and do not include the Kingston Basin. Lake Ontario Volunteer Angler Diary data are from 2004-2014.

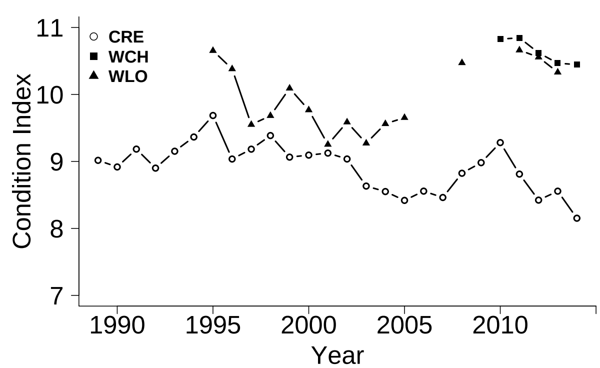


FIG. 7.1.7. Condition index of Chinook Salmon from Credit River Spawning Index (CRE), Tournament sampling (WCH) and the Western Lake Ontario Boat Angling Survey (WLO) from 1989-2014. Condition index is the predicted weight (based on a log-log regression) of a 900 mm Chinook Salmon.

7.2 Rainbow Trout

M. J. Yuille , Lake Ontario Management Unit

The Lake Ontario fish community is a mix of non-native and remaining native species. Rainbow Trout, a non-native species, was intentionally introduced to Lake Ontario in 1968 and has since become naturalized (naturally producing young, wild fish). Rainbow Trout are the primary target for tributary anglers, who take advantage of the seasonal staging and spawning runs of this species. In addition, Rainbow Trout are the second most sought-after species in the offshore salmonid fishery, making them not only ecologically important but recreationally and economically important as well.

The OMNRF stocks only *Ganaraska River* strain Rainbow Trout into Lake Ontario. Rainbow Trout represent less than 10% of all fish stocked (8% by weight, 7% by number) into Lake Ontario by the OMNRF (see Section 6). In 2014, approximately 172,000 Rainbow Trout were stocked, slightly below the 2000-2014 average of 173,000 (Fig. 7.2.1).

The spring spawning run of Rainbow Trout in the Ganaraska River has been estimated at the fishway at Port Hope since 1974 (see Section 1.1). The Rainbow Trout runs were late in 2014, and the fishway still contained ice in early April. A few Rainbow Trout may have gone through the fishway after counts were concluded in May. In 2014, the Rainbow Trout run in the Ganaraska River was estimated at 12,021 fish, the second largest run since 1992. Over the last four years, the Rainbow Trout run in the Ganaraska River has maintained a higher level than observed over the previous decade (Fig. 7.2.2).

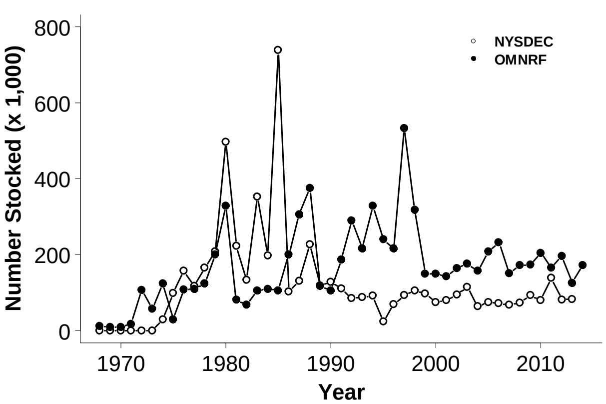


FIG 7.2.1. Number of Rainbow Trout stocked by New York State Department of Environmental Conservation (NYSDEC) and OMNRF, 1968-2014 (see Section 6).

The Lake Ontario ecosystem has changed dramatically during this time series (e.g., phosphorus abatement, dreissenid mussel invasion, Round Goby invasion). During this time period (1974-2013), Rainbow Trout condition has declined (Fig. 7.2.3a). With the exceptions of 1994 and 1996, the highest condition values occurred in the 1970s, prior to invasion of Zebra Mussels, Quagga Mussels and Round Goby. Condition declined through the 1980s to a low point in 1990. From 1990-2013, the long-term trend shows slight decline in relative weight. Data on Rainbow Trout condition since the latest significant ecosystem disruption (i.e., Round Goby invasion in 2003; see Section 1.3), are the most informative for current stocks (Fig. 7.2.3b). Rainbow Trout condition declined to a low in 2008 then increased up to 2013, the highest in the time-series since 1997.

After a sharp increase in catch per unit effort (CUE) from 1979-1984 (the highest in the 34 year time series), the CUE declined until 2004

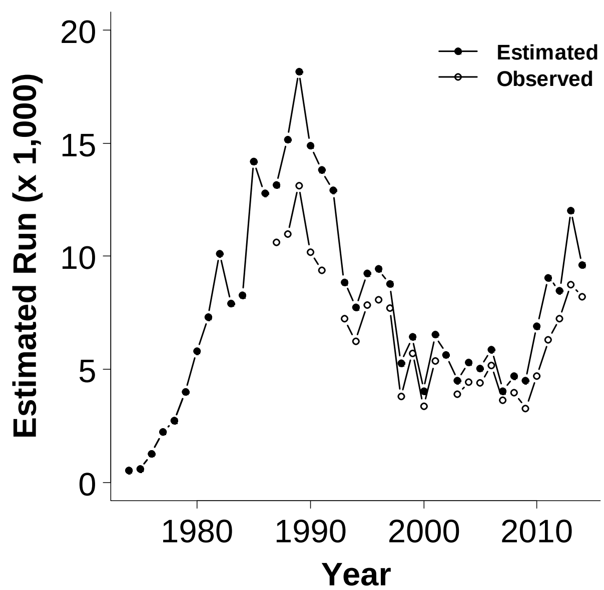


FIG 7.2.2. Estimated run of Rainbow Trout at the Ganaraska River fishway at Port Hope, Ontario, 1974-2014.

in the Western Lake Ontario Boat Fishery (Fig. 7.2.4). After 2004 (the lowest CUE since1982), the CUE steadily increased to 2013. Effort in this fishery has remained fairly stable since 1994 (Fig. 7.2.4). Total numbers of Rainbow Trout caught and harvested in the Western Lake Ontario Boat Fishery naturally followed the same trends found in CUE with total harvest generally lower than total catch (Fig. 7.2.5).

Lastly, annual release rates (mean percent of total catch released per trip) for Rainbow Trout have remained stable since the mid-1980s (Fig 7.2.6). The lowest release rates were observed in 1978 and 1980 (0.6% and 0.2%, respectively).

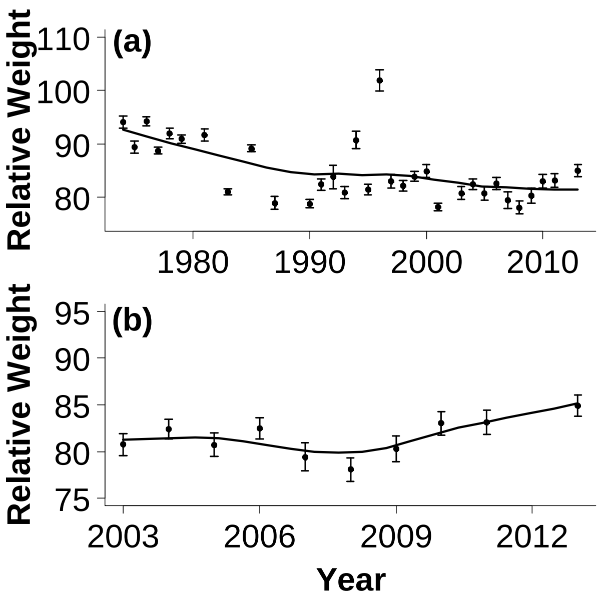


FIG 7.2.3. Relative weight of Rainbow Trout sampled at the Ganaraska River fishway at Port Hope, Ontario for (a) the whole time series 1974-2013 and (b) since the first observation of Round Goby Lake Ontario Trawls (2003-2013; see Section 1.3).

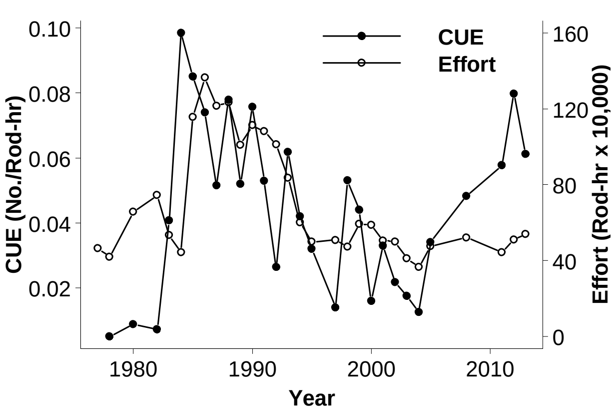


FIG 7.2.4. Catch rate (CUE) of Rainbow Trout and annual total effort (rod-hrs) in the Ontario waters of Lake Ontario (excluding Eastern Basin), 1977-2013.

Release rates were variable from year to year, but slowly climbed over a 21 year period from 1982 (24.1%) to 2003 (38.1%; Fig 7.2.6). They declined to 3.0% in 2005 (Western Lake Ontario Boat Fishery) and 0% in 2006 (Lake Ontario Volunteer Angler Diary; see Section 2.3). Since this time, release rates in the Western Lake Ontario Boat Fishery increased to 30.0% in 2013, similar to the long-term average 1978-2013 of 27.6%. In the Lake Ontario Volunteer Angler Program release rates increased from 2006 to 2014 (Fig. 7.2.6, see Section 2.3). In 2014, release rates were the highest in this program (72.4%).

Overall, the combination of increased run size (Fig. 7.2.2) as well as recent increases in body condition from the Ganaraska River fishway (Fig. 7.2.3) and CUE in the Western Lake Ontario Boat Fishery, suggests that Rainbow Trout stocks in Lake Ontario are doing well.

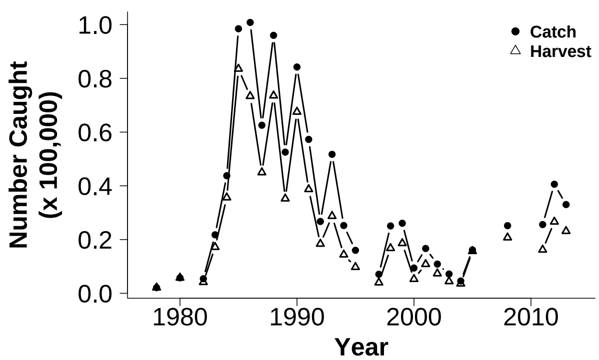


FIG 7.2.5. Number of Rainbow Trout caught (circle) and harvested (triangle) annually in the Ontario waters of Lake Ontario (excluding Eastern Basin), 1978-2013.

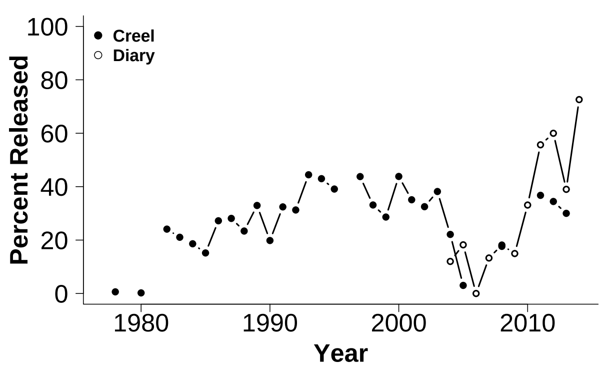


FIG 7.2.6. Annual average of the proportion of Rainbow Trout released per trip from Lake Ontario Volunteer Angler Diary Program (open circle) and the Western Lake Ontario Angler Survey (closed circle). Data from the Western Lake Ontario Angler Survey are from 1977-2013 and do not include the Eastern Basin. Lake Ontario Volunteer Angler Diary data are from 2004-2014.

7.3 Lake Whitefish

J. A. Hoyle, Lake Ontario Management Unit

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

Commercial Fishery

Lake Whitefish commercial quota and harvest increased from the mid-1980s through the mid-1990s, declined through to the mid-2000s then stabilized at a relatively low level (Fig. 7.3.1). Quota and harvest averaged 119,000 lb and 70,000 respectively, over the 2008-2014 time -period. Most of the harvest occurs in quota zone 1-2, eastern lake Ontario (Fig. 7.3.2). Here, most of the harvest occurs at spawning time in November and early December (Fig. 7.3.3). Although harvest at other times of the year is less than at spawning time, considerable gill net fishing effort does occur. Highest harvest rates (HUE) occur at spawning time.

The age distribution of Lake Whitefish harvested is comprised of many age-classes (Fig. 7.3.4). Most fish are age-4 to age-11 but very old fish are commonly harvested, especially in quota zone 1-3 (Bay of Quinte spawning stock).

A*bundance*

Lake Whitefish abundance is assessed in a number of programs. Summer gill net sampling is used to assess relative abundance of juvenile and adult in eastern Lake Ontario (Fig. 7.3.5, and see

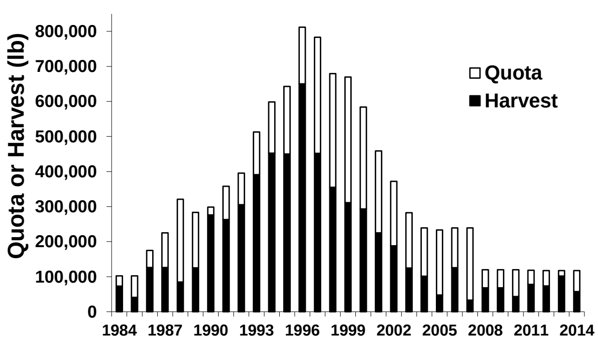


Fig. 7.3.1. Lake Whitefish commercial quota and harvest, 1984-2014.

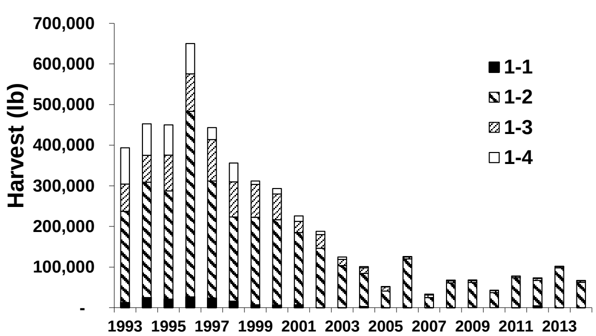


Fig. 7.3.2. Lake Whitefish commercial harvest by quota zone, 1993-2014.

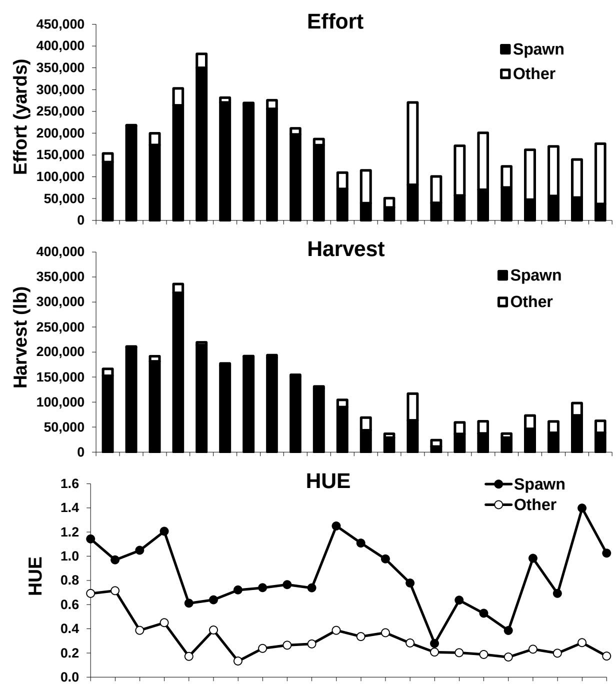


Fig. 7.3.3. Commercial Lake Whitefish gill net fishing effort (top panel), harvest (middle panel), and harvest-per-unit-effort (HUE; bottom panel) in quota zone 1-2, 1993-2014. "Spawn" includes November and December, and "Other" includes January through October.

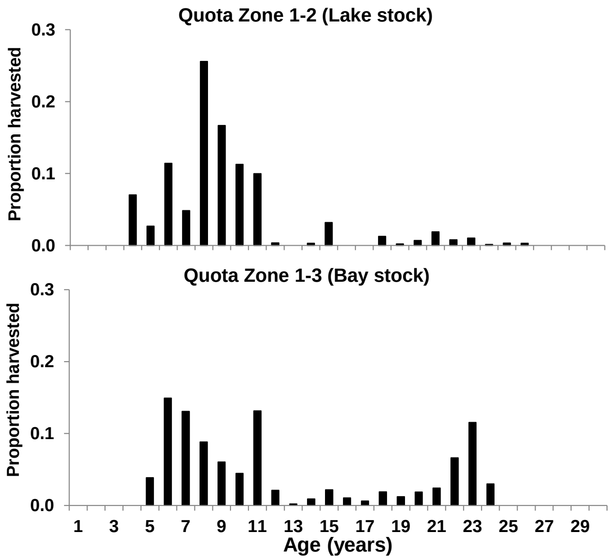


Fig. 7.3.4. Lake Whitefish age distributions (by number) in the 2014 quota zones 1-2 (upper panel) and 1-3 (lower panel) fall commercial fisheries.

Section 1.2). Young-of-the-year (YOY) abundance is assessed in bottom trawls at Conway (lower Bay of Quinte) and Timber Island (EB03 in eastern Lake Ontario (Fig. 7.3.5). Lake Whitefish abundance, like commercial harvest, has been stable at a relatively low level for the last decade. Young-of-the-year catches have been variable.

Growth

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

Condition

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

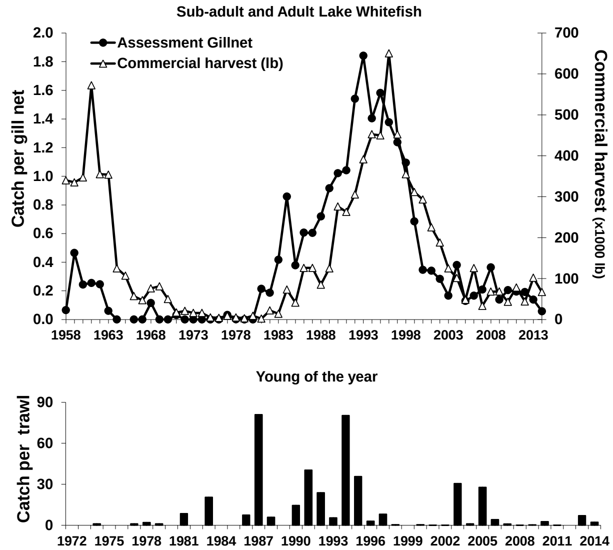


Fig. 7.3.5. Abundance of Lake Whitefish abundance in eastern Lake Ontario assessment gill nets, 1958-2014 (sub-adult and adult; upper panel) and bottom trawls, 1972-2014 (young-of-the-year; lower panel). Lake Whitefish commercial harvest is also shown in the upper panel.

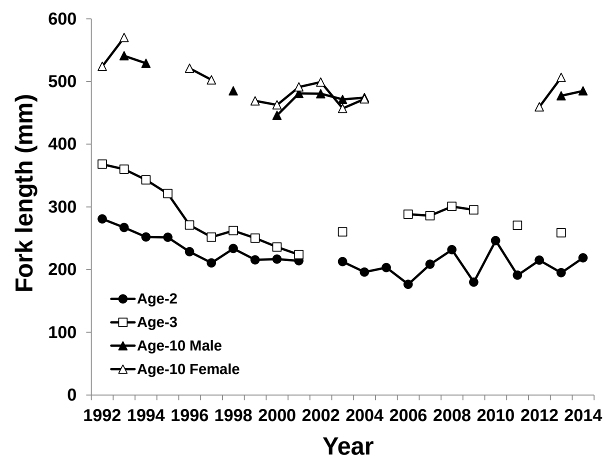


Fig. 7.3.6. Trends in Lake Whitefish fork length-at-age for age-2, age-3, age-10 males and females, caught in summer assessment gill nets, 1992-2014.

Overall Status

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

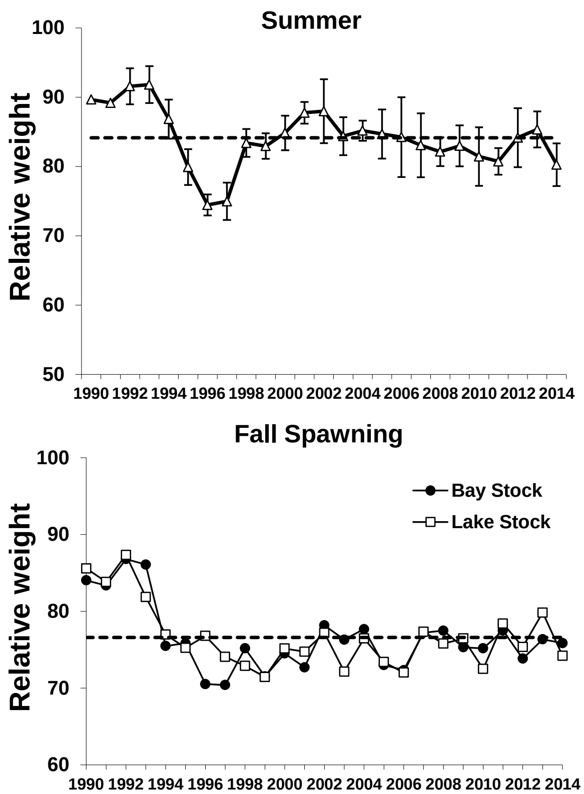


Fig. 7.3.7. Condition (relative weight) of Lake Whitefish sampled during summer assessment gill net surveys in eastern Lake Ontario (upper panel' error bars ±2SE) and fall commercial catch sampling in the Bay of Quinte ("Bay Stock") and the south shore Prince Edward County ("Lake Stock"), 1990-2014

7.4 Walleye

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

Walleye is the Bay of Quinte fish community's primary top piscivore and of major interest to both commercial and recreational fisheries. The Walleye population in the Bay of Quinte and eastern Lake Ontario is managed as a single large stock. The Walleye's life history-specific movement and migration patterns between the bay and the lake determines the seasonal distribution patterns of the fisheries. Understanding Walleye distribution is also crucial to interpret summer assessment netting results. After spawning in April, mature Walleye migrate from the Bay of Quinte toward eastern Lake Ontario to spend the summer months. These mature fish return back "up" the bay in the fall to over-winter. Immature Walleye remain in the bay year-round.

Recreational Fishery

Walleye harvest by the recreational fishery occurs primarily in the upper and middle reaches of the Bay of Quinte during the winter ice-fishery (Fig. 7.4.1; see Section 2.4) and the spring/early summer open-water fishery. All sizes of fish are caught during winter while mostly juvenile fish (age-2 and age-3) are caught during spring and summer. A popular "trophy" Walleye fishery occurs each fall based on the large, migrating fish in the middle and lower reaches of the Bay of Quinte at that time (see Section 2.5). Trends in the open-water fishery are shown in Fig. 7.4.2. Annual Walleye angling effort and catch (ice and open-water fisheries combined) has been relatively stable averaging about 320,000 hours and 57,000 fish during the last decade.

Commercial Fishery

Walleye harvest by the commercial fishery is highly regulated and restricted. No commercial Walleye is permitted in the upper and middle reaches of the bay (Trenton to Glenora). A relatively modest Walleye commercial quota (48,546 lbs; Fig. 7.4.3)) is allocated in the lower Bay of Quinte and Lake Ontario with additional

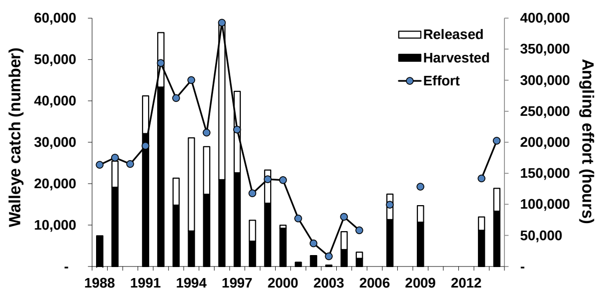


FIG. 7.4.1. Bay of Quinte recreational angling effort and walleye catch (released and harvested) during the winter ice-fishery, 1988-2014. No data for 2006, 2008, 2010-2012.

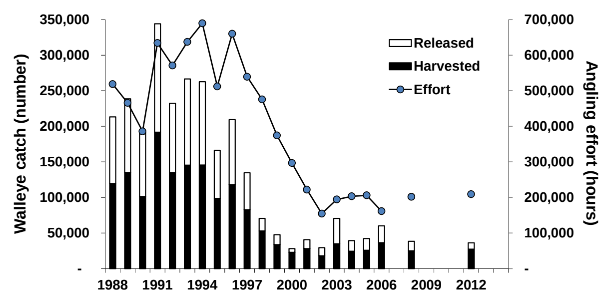


FIG. 7.4.2. Bay of Quinte recreational angling effort and walleye catch (released and harvested) during the open-water fishery, 1988-2014. No data for 2007, 2009-2011, or 2013-2014.

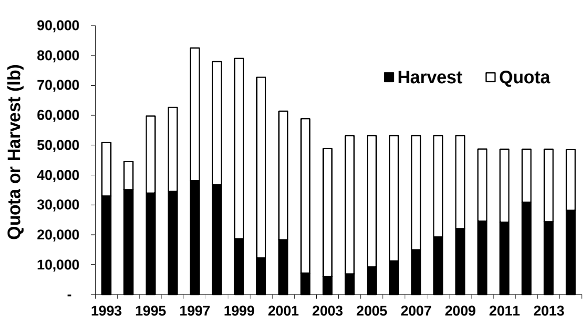


FIG. 7.4.3. Walleye commercial quota and harvest, 1993-2014.

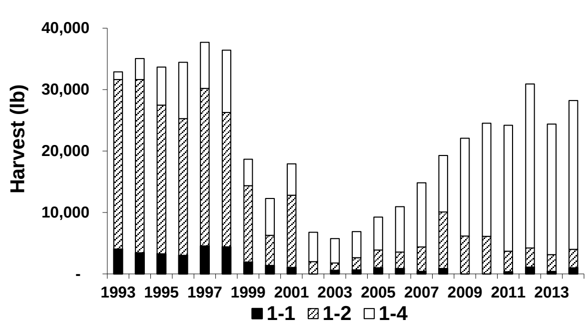


FIG. 7.4.4. Walleye commercial harvest by quota zone, 1993-2014.

seasonal, gear, and fish-size restrictions. The commercial harvest (27,400 lbs in 2014; Fig. 7.4.4) consists primarily of mature Walleye (age-4 and older) that migrate from the upper/middle regions of the Bay of Quinte to the lower bay (quota zone 1-4) and eastern Lake Ontario (quota zone 1-2) for the summer months.

Annual Harvest

Total annual Walleye harvest in the recreational and commercial fisheries (by number and weight) over the last decade (2005-2014) is given in Table 7.4.1. The recreational fishery takes about 80% of the annual harvest with the open-water component of the recreational fishery making up over 60% (by number) of total annual harvest.

Abundance

Walleye abundance is assessed in a number of programs. Summer gill net sampling (Section 1.2) is used to assess relative abundance of juvenile (Bay of Quinte) and adult (eastern Lake Ontario) abundance (Fig. 7.4.5). Fig. 7.4.6 shows the 2014 Walleye age distribution in these two geographic areas. Young-of-the-year (YOY) abundance is assessed in Bay of Quinte bottom trawls (Fig. 7.4.7; Section 1.3).

Except for an unusually high catch in 2013, juvenile abundance in the Bay of Quinte has been relatively stable since 2001 (Fig. 7.4.5). In eastern Lake Ontario index gill nets, after an unusually low catch in 2013, Walleye abundance in eastern Lake Ontario increased to a level similar to that observed in the previous few years (Fig. 7.4.5). The 2014 catch of YOY Walleye in bottom trawls was the highest since 1994 (Fig. 7.4.7) and foreshadows continued stability in the Walleye population and fisheries.

TABLE 7.4.1. Mean annual Walleye harvest by major fishery over the last decade (2005-2014).

	Walleye harvest			
	Number of fish	lbs	% by number	% by weight
Recreational				
ice-fishery	9,205	29,594	20%	28%
open-water fishery	28,573	54,595	62%	52%
Commercial	8,367	20,917	18%	20%
Total	46,145	105,106	100%	100%

Growth

Walleye length-at-age for age-2 and age-3 juvenile fish and age-10 mature fish (males and females separated) is shown in Fig. 7.4.8. Length

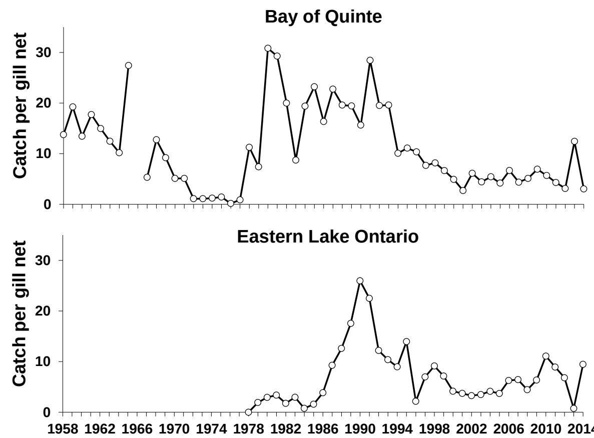


FIG. 7.4.5. Walleye abundance in summer gill nets in the Bay of Quinte, 1958-2014 (upper panel) and eastern Lake Ontario, 1978-2014 (lower panel).

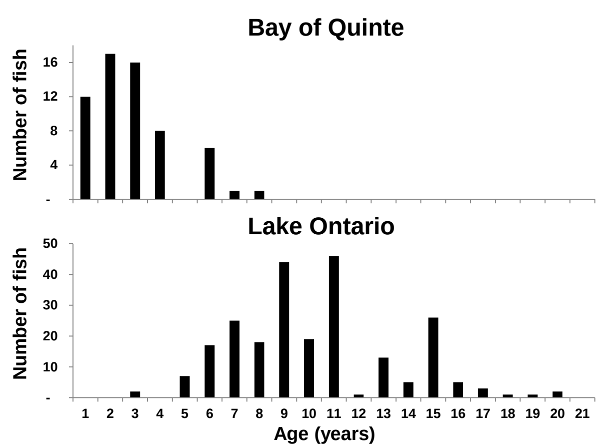


FIG. 7.4.6. Walleye age distribution in 2014 summer gill nets in the Bay of Quinte (upper panel) and eastern Lake Ontario (lower panel).

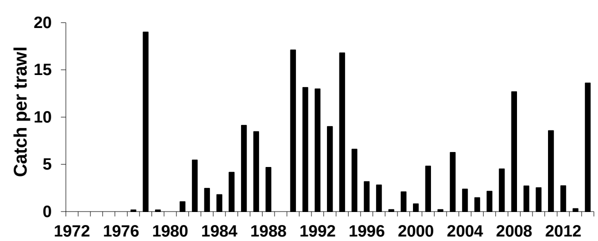


FIG. 7.4.7. Young-of-the-year Walleye catch per trawl in the Bay of Quinte, 1972-2014.

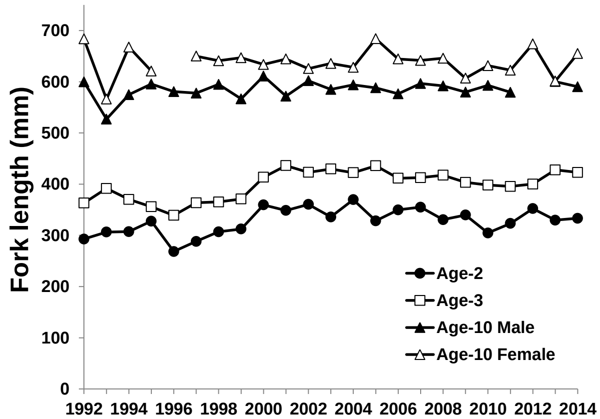


FIG. 7.4.8. Trends in Walleye fork length-at-age for age-2, age-3, age-10 males and females, caught in summer assessment gill nets, 1992-2014.

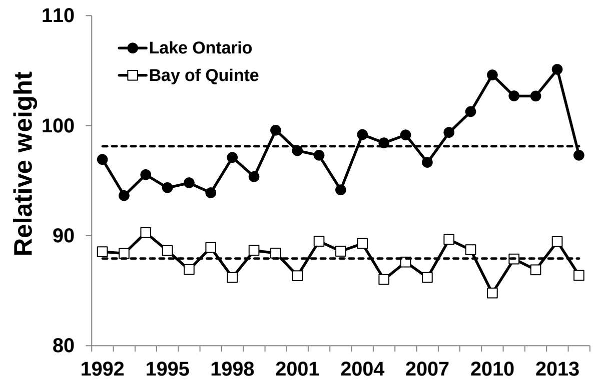


FIG. 7.4.9. Trends in Walleye condition (relative weight), 1992-2014 caught in summer assessment gill nets, 1992-2014.

-at-age increased for juvenile (age-2 and 3) fish in 2000 and remained stable since. For mature fish (age-10), length-at-age has remained stable with females larger than males.

Condition

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

Other Walleye Populations

The Bay of Quinte/eastern Lake Ontario Walleye population is the largest on Lake Ontario smaller populations exist in other nearshore areas of the lake and St. Lawrence River. Walleye in these other areas are regularly assessed with a standard trap net program (Nearshore Community Index Netting; see Section 1.4). Mean (2006-2014) Walleye trap net catches in 12 geographic nearshore areas are shown in Fig. 7.4.10. Highest Walleye abundance occurs in the Bay of Quinte, Weller's Bay, East Lake and West Lake. Walleye abundance increased in Hamilton Harbour following 2012 Walleye stocking efforts (see Section 8.7).

Overall Status

The overall status of Lake Ontario Walleye is good. The Bay of Quinte/eastern Lake Ontario population declined during the 1990s but stabilized at levels that still supports a high quality fishery.

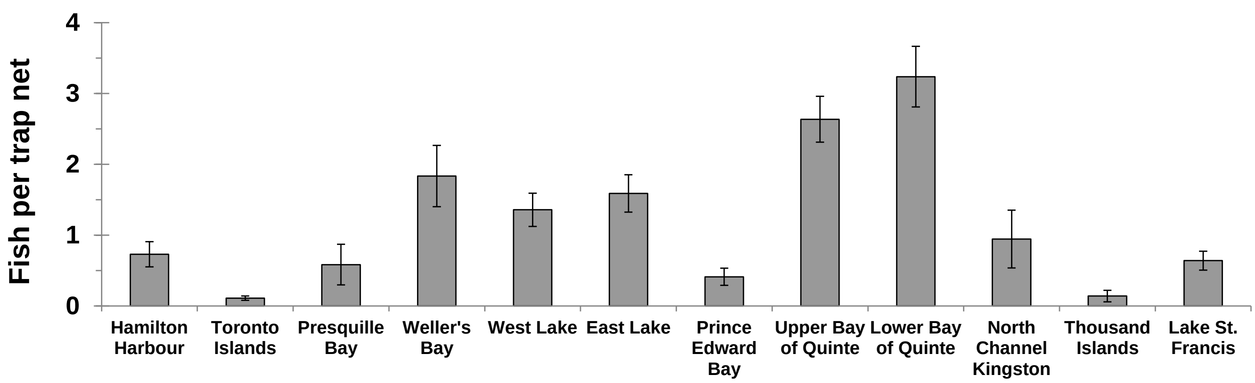


Fig. 7.4.10. Walleye abundance (mean number of fish per trap net) in 12 geographic nearshore areas of Lake Ontario and the St. Lawrence River arranged from west (Hamilton Harbour to east Lake St. Francis). Catches are means for all sampling from 2006-2014 with individual areas having been sampled from one to eight years over the nine year time-period. Error bars are ± 1 SE.

7.5 Prey Fish

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

Alewife

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

The stock status of Alewife as it relates to predator-prey balance in Lake Ontario requires a whole-lake assessment. Acoustic estimates (Section 1.7) are used in conjunction with estimates derived from the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Geological Survey (USGS) spring bottom trawl program conducted in the U.S. portion of Lake Ontario to track Alewife abundance. The fish community index gill netting (Section 1.2) and bottom trawling (Section 1.3) programs provide localized trends but may not reflect whole lake abundance trends due to the relatively restricted geographical area of these surveys. A comparison of these three programs shows little synchrony in abundance trends (Fig. 7.5.1). Trawls in the Bay of Quinte tend to catch a higher proportion of small Alewife compared to the Eastern Basin trawls (Fig. 7.5.2). Fish community index trawls in the Bay of Quinte do capture significant numbers of age-0 Alewife (Fig 7.5.3). The utility of this survey to predict cohort success to age-1 requires further investigation to understand over-wintering success and the relationship between the Bay of Quinte/Eastern Basin to the main basin of Lake Ontario.

Acoustic estimates of Alewife have been conducted since 1997 using a standard survey methodology however analytical methods continue to evolve along with the technology. Three different analytical approaches were compared in 2014 based on a subset of the time series (2006-2014; Fig. 7.5.4). All three approaches show a decline in Alewife abundance in 2014 however the magnitude of the decline varies between analytical approaches. The historical approach produced the lowest estimate (199 million fish), which is 25% lower than the 2006-2013 average but only 13% lower than the 10-year 2003-2013 average. The two new

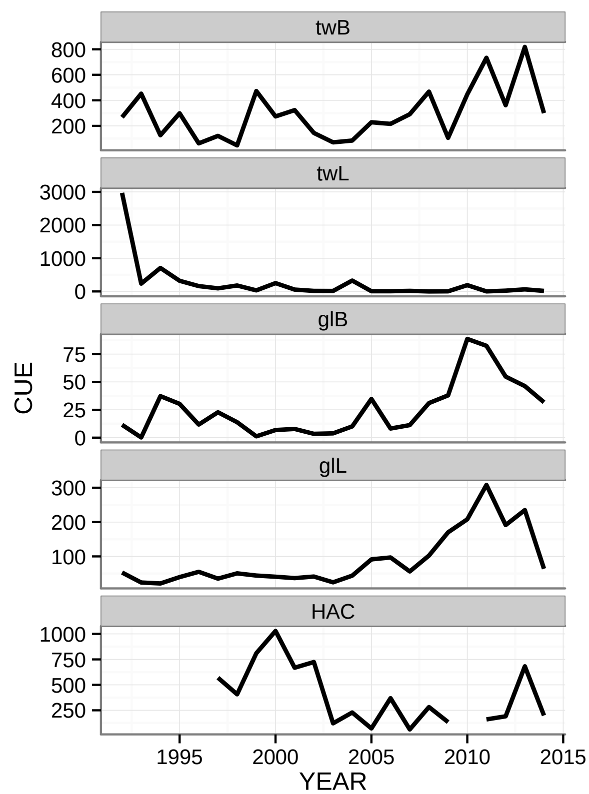


Fig. 7.5.1. Alewife abundance through time in the Bay of Quinte, Eastern Basin and as a whole lake index. Bay of Quinte sites were assessed using bottom trawls (twB) and gill nets (glB). The Eastern Basin was assessed using bottom trawls (twL) and gill nets (glL). Whole lake assessments are conducted with hydroacoustics (HAC).

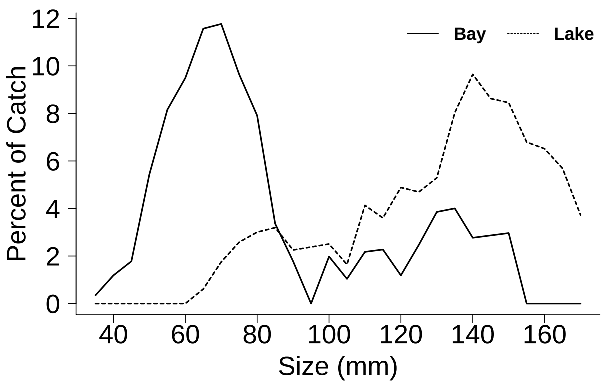


Fig. 7.5.2. Fish community index trawls in Bay of Quinte (Bay) and in the Eastern Basin (Lake) size distributions of Alewife catches (1992 – 2014).

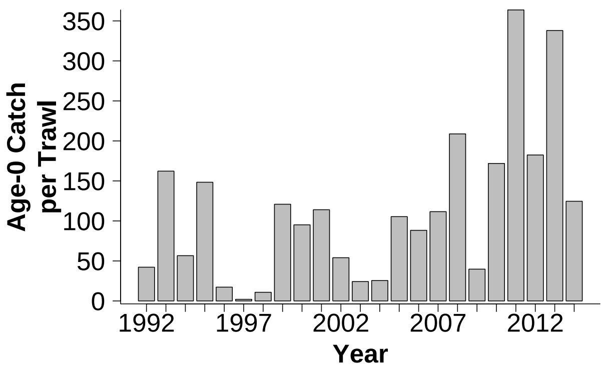


Fig. 7.5.3. Mean age-0 Alewife catch per trawl in the fish community index Bay of Quinte sites (1992-2014).

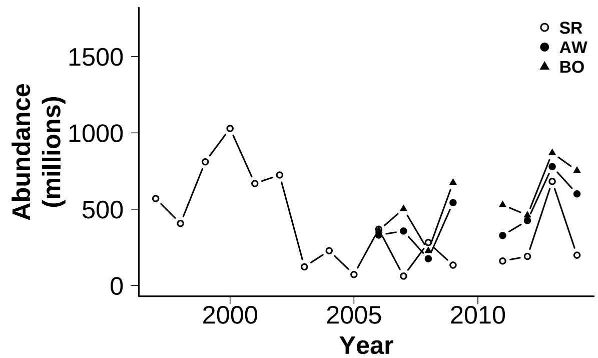


Fig. 7.5.4. Abundance (in millions of fish) of yearling-and-older Alewife from 1997-2014. Abundance estimates are presented for three different methodologies: area-weighted estimates using a solver routine to identify Alewife-sized targets (SR, open circles); area-weighted abundance of targets between -50 and -35 dB (AW, filled circles) and a bootstrap approach using 200 m horizontal bins and targets between -50 and -35 dB (BO, filled triangles). Acoustic estimates were not conducted in 2010.

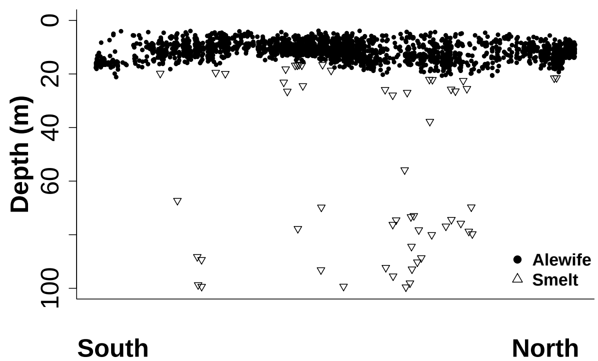


Fig. 7.5.5. A representation of Alewife (solid circles) and Rainbow Smelt (open triangles) distribution along a transect between Rochester, NY (south) and Pointe Petre, ON (north). Target density based on single target detection and not corrected for beam volume.

approaches, which tend to produce higher estimates throughout the time series, suggest a much larger population (600 and 753 million fish), despite the decline observed in 2014, and suggest populations are 43 and 45% higher than the 2006-2013 average.

The acoustic survey provides midsummer Alewife distribution (horizontal and vertical), which is a unique product not possible with traditional assessment gear. The cross-lake transect depicted in Fig. 7.5.5 shows how Alewife depth and spatial distribution can change across the lake. Distribution across Lake Ontario is highly variable among years (Fig. 7.5.6) with no clear geographic trend detectable based on an analysis of 2006-2013 data. Alewife distribution is potentially influenced by wind patterns, prey availability and/or thermal conditions. Further investigation in to the factors affecting Alewife distribution is on-going.

Lake wide Alewife condition, measured as the predicted weight (based on a log-log regression) of a 165 mm (TL) Alewife, is tracked through the NYSDEC and USGS spring bottom trawl program (Fig. 7.5.7). Fish community index trawls from the Eastern Basin and Bay of Quinte (refer to Section 1.3 for site locations) occur later in the season but provide catches of similar sized Alewife. While the fish community index trawl estimates are generally lower and more variable, the two indices are correlated (R^2 = 0.51, p = 0.02). Both indices show a decline in Alewife condition in 2014 and are marginally below the mean for the time period (1992-2014).

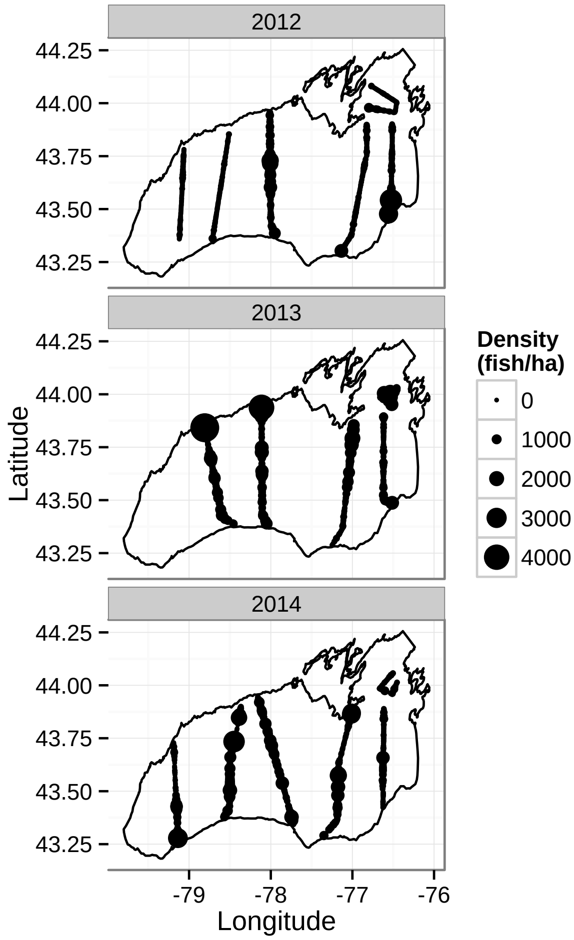


Fig. 7.5.6. Variability of Alewife density (fish/ha) measured through acoustic transects from 2012-2014.

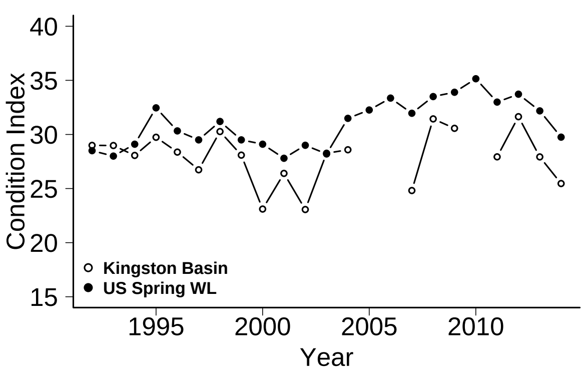


Fig. 7.5.7. Alewife condition, represented as the predicted weight (g, based on a log-log regression) of a 165 mm (total length) Alewife from the fish community index trawls (open circles) conducted in mid-summer and through New York State Department of Environmental Conservation and U.S. Geological Survey spring bottom trawl program.

Rainbow Smelt

Rainbow Smelt are the second most abundant pelagic prey species in Lake Ontario. Alewife however, contributes the majority of fish biomass in predator diets even during high periods of Rainbow Smelt abundance. High abundance of Rainbow Smelt has been thought to negatively impact native species. For example, the decline of the native cisco population in the 1940s coincided with high abundance of Rainbow Smelt.

Acoustic estimates (Section 1.7) are used in conjunction with estimates derived from the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Geological Survey (USGS) bottom trawl program conducted in the U.S. portion of Lake Ontario to track Rainbow Smelt abundance. The fish community index trawling program (Section 1.3) provides an index of abundance within the Eastern Basin.

Both the acoustic estimates and trawl based estimates show a dramatic decline of Rainbow Smelt since the 1990s (Fig. 7.5.8). Trawl based estimates of Eastern Basin Rainbow Smelt density peaked at 1882 fish/ha with an average density 861 fish/ha between 1992 and 1997 Rainbow Smelt have declined through time with only marginal increases (e.g. 2010) to an estimated 9 fish/ha in 2014. The whole lake acoustic estimate of Rainbow Smelt from 1997 to present show a similar trend to the Eastern Basin trawls. Acoustic estimates of Rainbow Smelt density was estimated to be 870 fish/ha in 1997 and have declined to 8 fish/ha.

The spatial distribution provided by the acoustic survey suggests a slightly higher density within the Eastern Basin compared to whole lake density estimates (Fig. 7.5.9). The single Eastern Basin acoustic transect provides comparable acoustic estimates to the Eastern Basin trawls. This has not been a standard analysis throughout the survey, but recent efforts to standardize the analysis allow comparisons from 2006 to present (exclusive of 2010 when the full acoustic survey could not be completed). While trawl and acoustic estimates for the Eastern Basin vary

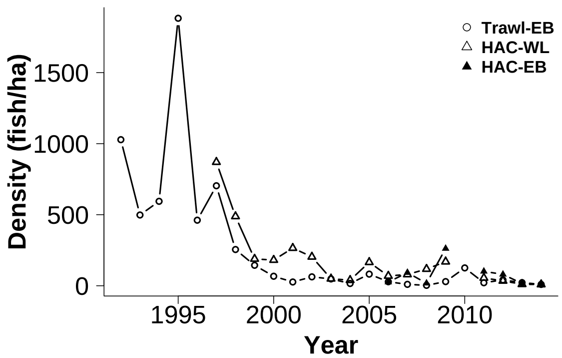


Fig. 7.5.8. Density (fish/ha) of yearling-and-older Rainbow Smelt from 1997-2014 from fish community index trawls in the Eastern Basin (open circle, Trawl-EB), whole lake acoustic estimate (open triangle, HAC-WL), Eastern Basin only acoustic estimates (filled triangles, HAC-EB).

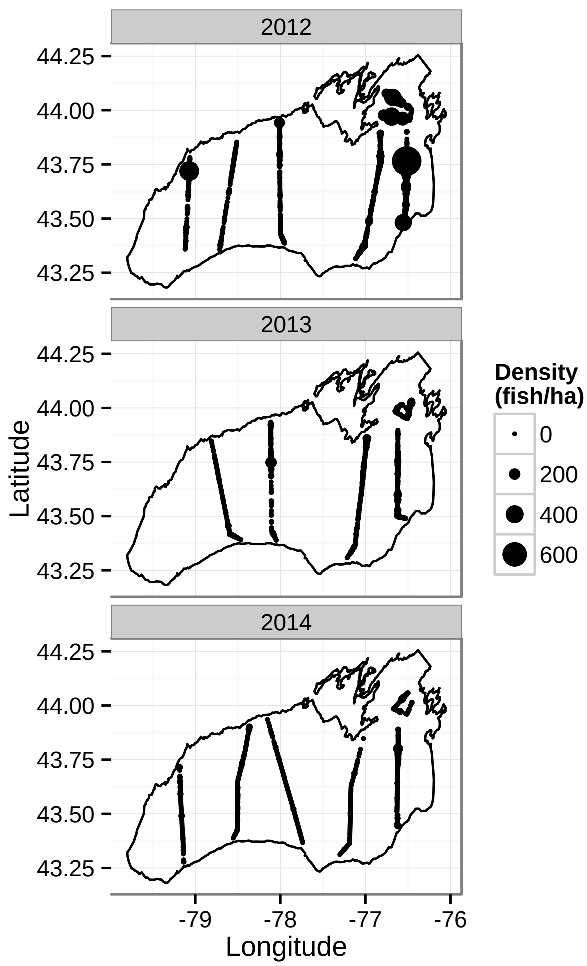


Fig. 7.5.9. Variability of Rainbow Smelt density (fish/ha) measure through acoustic transects from 2012-2014.

throughout the time series, they both show a general declining trend through the period. The 2014 density estimates are 9 and 13 fish/ha from trawls and acoustic surveys respectively. In general, a comparison of Eastern Basin and whole lake trends in Rainbow Smelt abundance show that the Eastern Basin has an average density 30% greater than the main lake.

Round Goby

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

In fish community index trawls, Round Goby density and biomass increased slightly from 2013 levels (Fig. 7.5.10a, Section 1.3). Round Goby density and biomass peaked in 2010, followed by steep decline to 2014 (67% and 75% decline in density and biomass from 2010, respectively). Despite a 10 year decline between 2003 and 2013, in 2014 average total length for Round Goby caught in Lake Ontario trawls was the highest in the time series (Fig. 7.5.11). In general, Round Goby caught in the Lake Ontario trawls were larger than Round Goby caught in the Bay of Quinte trawls (Fig. 7.5.11).

In the Bay of Quinte, Round Goby density and biomass peaked in 2003 (Fig. 7.5.10b). After 2003, Round Goby biomass sharply declined to 2005 levels where it has remained stable for the remainder of the time series. Average total length of Round Goby in the Bay of Quinte trawls has been variable through the time series. Total length peaked in 2002 and then declined to the lowest

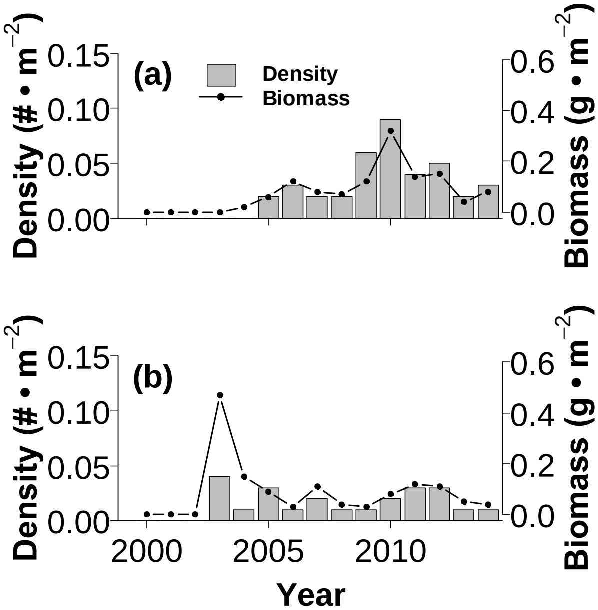


Fig. 7.5.10. Round Goby density and biomass based on bottom trawls conducted by the Ontario Ministry of Natural Resources and Forestry in the Ontario waters of Lake Ontario shoreward of the 90-m bottom contour (a) and the Bay of Quinte (b), 2000–2014. No Round Goby were caught in Lake Ontario (a) prior to 2003 and in the Bay of Quinte (b) prior to 2001. All trawls were conducted during July and August and data have been standardized to a 12-min (½ mi) trawl. Round Goby density and biomass for Lake Ontario was calculated using Rocky Point 60 and 100, EB02, EB03 and EB06 trawling sites. Round Goby density and biomass for Bay of Quinte was calculated using Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton trawling sites (see Section 1.3).

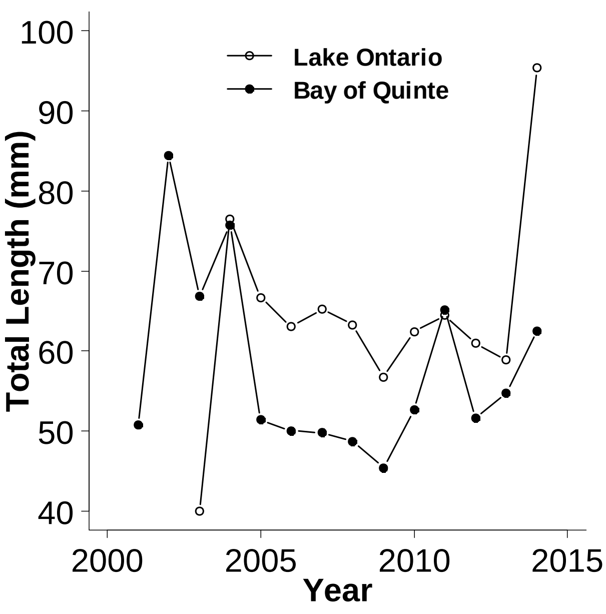


Fig. 7.5.11. Average total length (mm) of all Round Goby caught in Lake Ontario and Bay of Quinte (open and closed circles, respectively) index trawling from 2001 to 2014. Round Goby average length for Lake Ontario was calculated using catches from Rocky Point 60 and 100, EB02, EB03 and EB06 trawling sites. Round Goby average length for Bay of Quinte was calculated using catches from Conway, Hay Bay, Deseronto, Big Bay, Belleville and Trenton trawling sites (see Section 1.3).

point in 2009 (Fig. 7.5.11). Average total length increased from 2009 to 2011, declined in 2012 and has been increasing to 2014.

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

Deepwater Sculpin

Deepwater Sculpin were once abundant in the main basin of Lake Ontario. By the 1970s, Lake Ontario's native fish stocks, including Deepwater Sculpin, had been pushed to near extinction. After 1972, Deepwater Sculpin had not been detected in Lake Ontario until 1996, when one was caught in the fish community index trawling program (Fig. 7.5.12a; Section 1.3).

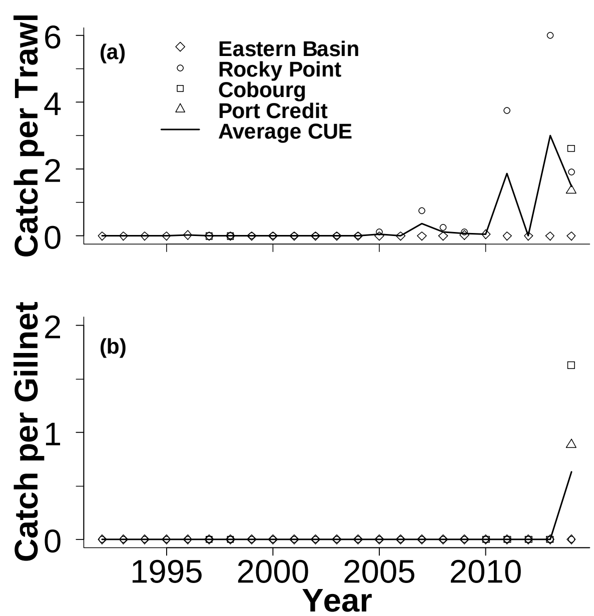


Fig. 7.5.12. Catch per unit effort of Deepwater Sculpin in fish community index trawling (a) and fish community index gill netting (b) at Eastern Basin (diamond), Rocky Point (circle), Cobourg (square) and Port Credit (triangle) sites, 1992-2014. The solid line represents the average catch per unit effort from all sites sampled per year. Not all locations were sampled every year (see Sections 1.2 and 1.3).

Since 1996, no Deepwater Sculpin were collected in fish community index programs until 2005, where they were collected in the trawls at Rocky Point (Fig. 7.5.12a). In the trawls, Deepwater Sculpin were most abundant at Rocky Point where abundances increased to a maximum in 2013 followed by a moderate decline in 2014. In 2014, both trawls and gill nets were fished at Cobourg and Port Credit (Sections 1.2 and 1.3). Both gear types caught Deepwater Sculpin at these locations (Fig. 7.5.12). With the exception of 1996, Deepwater Sculpin have not been found in the trawls or gillnets at Eastern Basin sites from 1992-2014 (Fig. 7.5.12). As a result, only Rocky Point, Cobourg and Port Credit sites are discussed below.

A total length (mm) by round weight (g) plot of all Deepwater Sculpin caught at Rocky Point, Cobourg and Port Credit in 2014 illustrates the size distribution of these fish at each site but also showcases the size selectivity of the two gear types (Fig. 7.5.13). In general, the fish community index trawls caught mainly small fish, while the gill nets captured larger fish. Cobourg had the largest distribution of Deepwater Sculpin sizes and ages (Fig. 7.5.13, 7.5.14 and 7.5.15). Deepwater Sculpin from Rocky Point were smaller and younger relative to sculpin from both Cobourg and Port Credit. In contrast, Deepwater Sculpin from Port Credit were larger and older (on average) relative to Rocky Point and Cobourg (Fig. 7.5.13, 7.5.14 and 7.5.15). In 2014, Deepwater Sculpin ages ranged from 1-9 years with both the youngest and oldest fish coming from Cobourg (Fig. 7.5.14 and 7.5.15).

Considering catches from both the trawling and gill netting gears, there appears to be an east to west gradient of Deepwater Sculpin captured, with small/young fish caught in the east (Rocky Point), large/older fish caught in the west (Port Credit) and a combination caught centrally (Cobourg). With only one year of sampling conducted at Cobourg and Port Credit, it is unclear whether this size and age geographical distribution is real or a sampling artifact. Both fish community index trawling and gill netting will continue at Eastern Basin, Rocky Point, Cobourg and Port Credit sites in 2015. The increased frequency of occurrence of Deepwater Sculpin in both index trawling and gill netting programs is promising for this species—once considered extirpated from Lake Ontario.

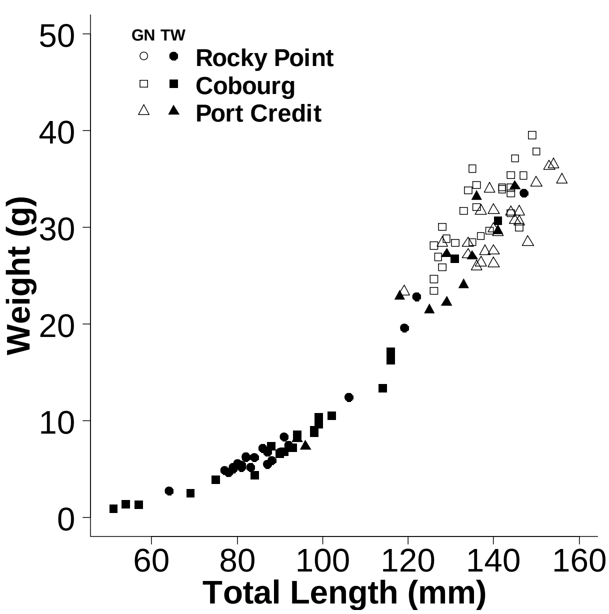


Fig. 7.5.13. Total length (mm) and weight (g) of all Deepwater Sculpin caught in the 2014 Fish Community Index Gillnetting Program (filled shapes, see Section 1.2) and the 2014 Fish Community Index Trawling Program (open shapes, see Section 1.3) for three sites: Rocky Point (circle), Cobourg (square) and Port Credit (triangle).

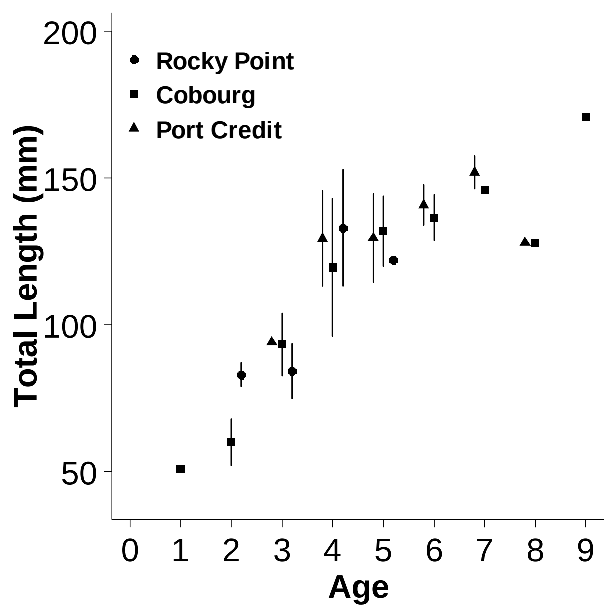


Fig. 7.5.14. Length at age for Deepwater Sculpin caught in the Fish Community Index Gillnetting and Trawling Programs at Rocky Point (circle), Cobourg (square) and Port Credit (triangle). Error bars represent one standard deviation.

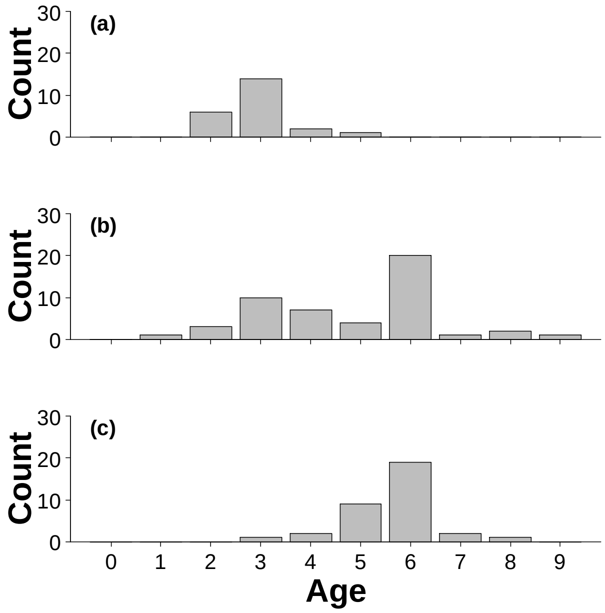


Fig. 7.5.15. Age distribution for Deepwater Sculpin caught at (a) Rocky Point, (b) Cobourg and (c) Port Credit in the 2014 fish community index gill netting and trawling program.

8. Species Rehabilitation

8.1 Introduction

A. Mathers, Lake Ontario Management Unit

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

The sections below describe the planning and efforts to restore Atlantic Salmon, Bloater, Lake Trout, American Eel, Walleye and Round Whitefish. Some of these species have been extirpated while others were once common but are now considered rare, at least in some locations in the lake. Successful restoration of these native species would be a significant milestone in improving Ontario's biodiversity.

8.2 Atlantic Salmon Restoration

C. Lake and T.J. Stewart, Lake Ontario Management Unit

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 Ontario Ministry of Natural Resources and Forestry (OMNRF) and the Ontario Federation of Anglers and Hunters (OFAH) and a strong network of partners and sponsors.

Program partners recognize the generous support of Phase I lead sponsor, Australia's Banrock Station Wines, and welcome Phase II lead sponsor, Ontario Power Generation. Many other sponsors, conservation organizations, corporations, community groups and individuals are contributing to the success of this program. Funding and in-kind support from all partners have contributed to enhanced fish production, habitat rehabilitation and stewardship initiatives, 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.

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 OMNRF's Harwood and Normandale Fish Culture Stations. 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 2014, approximately 63,000 Lac St-Jean salmon of various life stages were stocked.

The performances of all three strains are being 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 1.8 and 1.9). These projects use conventional electro-fishing assessment, as well as a rotary screw trap, the only example of this technology currently being used on the Great Lakes. Upstream migration is monitored at the Norval fishway, allowing us to enumerate adult Atlantic Salmon (and other species) as they migrate, as well as collect important biological data on individual fish (Section 1.10). In 2013, we implemented another innovative program designed to monitor upstream migration. A resistance board weir was installed on Duffins Creek made possible through a grant from the Great Lakes Fishery Commission. This is a highly specialized piece of fisheries assessment gear, originally developed to assess West Coast salmonid migration. Never used on the Great Lakes before, it has allowed us to monitor the upstream migration of adult Atlantic Salmon and other migrating species (Section 1.11).

With funding support from the Great Lakes Fishery Commission, a science review of the Atlantic salmon restoration program was completed in 2014. The focus of the review was the first 5-year phase of the enhanced restoration program (2006-2010). A three day workshop was held in February and was attended by 38 people including resource managers, fisheries biologists, scientists, and fish culturist. Invited Atlantic Salmon restoration specialists from other jurisdictions in United States and Canada also shared their experiences and advice. The workshop report includes 25 extended abstracts and facilitated discussion summaries. A synthesis of the major findings, hypotheses-of-effect, and management implications is provided at the beginning of the report. The report can be downloaded at www.bringbackthesalmon.ca. The findings and management implications are being considered in the development of an updated five-year program plan for Atlantic salmon restoration.

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

8.3 American Eel Restoration

A. Mathers, Lake Ontario Management Unit

Historically, the American Eel was an important predator in the nearshore fish community of Lake Ontario and the upper St. Lawrence River (LO-SLR). In addition, eel were an important component of the LO-SLR commercial fishery during the latter part of the 20th century and are highly valued by aboriginal peoples. American Eel abundance declined in the LO-SLR system as a result of the cumulative effects of eel mortality during downstream migration due to hydro-electric turbines, reduced access to habitat imposed by man-made barriers to upstream migration, commercial harvesting, contaminants, and loss of habitat.

By 2004, eel abundance had declined to levels that warranted closure of all commercial and recreational fisheries for American Eel in Ontario to protect those that remained. In 2007, American Eel was identified as Endangered under Ontario's Endangered Species Act. 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 the American Eel. This section describes the current status of American Eel in LO-SLR as well as actions taken by the Lake Ontario Management Unit and its partners to reverse the decline of American Eel populations.

The Moses-Saunders Dam located on the upper St. Lawrence River between Cornwall, Ontario and Massena, New York, is an impediment to both upstream and downstream migration of eels in the LO-SLR system. From 1974 to 2007, OMNRF 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 Hydroelectric Dam). Since 2007, OPG has assumed full responsibility for ladder operation. In 2014, the Saunders eel ladder was opened June 15 and closed October 15 (122 days). During this time, a total of 14,266 eels successfully exited the eel ladder (Fig. 8.3.1). A second ladder (Moses ladder) located on the New York portion of the

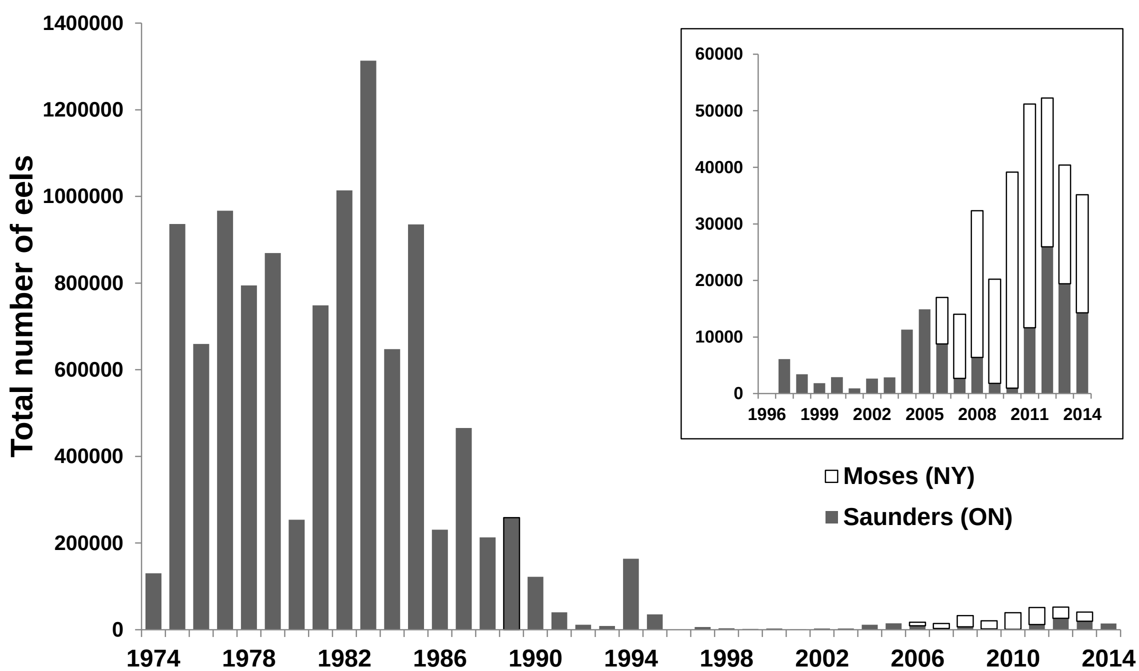


FIG. 8.3.1. Total number of eels ascending the eel ladder(s) at the Moses-Saunders Dam, Cornwall, Ontario from 1974-2014. During 1996, the ladder operated however no counts were made.

dam, has been operated since 2006 by the New York Power Authority (NYPA). In 2014, 20,908 eels exited the Moses ladder. The combined number (35,174 eels) was the lowest since 2010, but overall combined eel numbers exiting both ladders have increased since 2001. However, the numbers migrating upstream last year are still less than 4% of the numbers identified as a long-term indicator of Lake Ontario Fish Community Objectives (Fig. 8.3.1, FCO 1.3 Progress indicator – increasing levels of recruitment to the upper St. Lawrence River/Lake Ontario as measured at the Moses-Saunders Dam eel ladders with a long term target of at least one million eels ascending the ladders annually).

Sub-samples of eels were collected from the OPG ladder and biological characteristics were measured during 2014. The average length (382.2 ± 69.9 mm, n=747, range 114-678 mm) was similar to what has been observed in recent years with some minor variations. Age distribution of the eels sampled ranged from 4-15 years (mean 6.52±1.94, n=49). All eels from the sub-sample were determined to be female and an oxytetracycline mark was present on 5 of the 102 eels examined indicating that some eels were stocked.

The abundance of larger 'yellow' eels in the LO-SLR was measured with several assessment programs. Bottom trawling in the Bay of Quinte has been conducted since 1972 as part of the fish community index program (Fig. 1.3.1 and Tables 1.3.8 to 1.3.13). The average catch of American Eel in 511 trawls conducted (June-September at sites upstream of Glenora) between 1972 and 1996 was 2.00 eels per trawl. No eels were captured in the 360 trawls conducted between 2003 and 2011 and one eel was captured during the 40 trawls conducted during both 2012 and 2013. No eels were observed during the 40 trawls conducted during 2014.

Nearshore trap netting was conducted using the NSCIN fish community index protocol (see Section 1.4). During 2014, ten eels were captured in 36 net sets in the upper Bay of Quinte, two eels were captured in 24 nets set in Hamilton Harbour and two eels were captured in 24 nets set in Toronto Harbour (Fig. 1.4.2 and Table 1.4.5).

Systematic surveys to collect and examine dead and injured eels were conducted by both NYPA and OPG in the tail-waters of the Moses-Saunders Dam. In these studies, investigators travelled approximately 10 km by boat along a standardized survey route searching for dead and injured American Eel along the shoreline from the Moses-Saunders Dam downstream to the end of Cornwall Island. Surveys were conducted on Tuesdays and Fridays each week from June 17-October 3, 2014. During 2014, OPG observed an average of 2.3 eels per day, while NYPA observed 0.7 per day (Fig. 8.3.2). The average length of whole eels (n=18) collected by OPG was approximately 869 ± 117 mm (mean ± SD). Eel abundance was greatest in September and most eels (95%) were collected when water temperatures were greater than or equal to 18.0˚C. These results have been consistent since 2008, however the numbers of eels collected in 2014 is much lower than those observed in earlier years of the survey.

In 2006, Fisheries and Oceans Canada (DFO), OMNRF and OPG developed an Action Plan for Offsetting Turbine Mortality of American Eel for the Saunders Generating Station. A second five year American Eel Action Plan took effect in 2014 and includes conducting trap and transport activities, monitoring stocked eels, operation of the eel ladder, tail-water surveys and research into downstream passage options using behavioural guidance. The Action Plan is being implemented using an adaptive

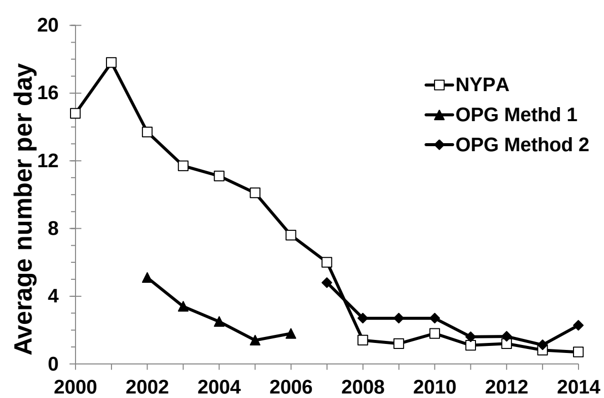


FIG. 8.3.2. Average number of eels observed per day in the tail-waters of the Moses-Saunders Dam 2000-2014. Note that the OPG sampling methodology and route changed in 2007.

management strategy, which will allow modifications to be made based upon findings that emerge.

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

DFO and OPG have collaborated to evaluate the effectiveness of American Eel stocking using spring boat electrofishing surveys. The monitoring of eel density continues through pre-established electrofishing transects on the St. Lawrence River (Jones Creek, Grenadier Island, and Rockport) and Bay of Quinte (Deseronto, Big Bay, and Hay Bay). In addition to examine for dispersal outside of the Bay of Quinte, transects in Prince Edward Bay were sampled.

This monitoring program has shown that stocked eels have survived over an eight year period; however the survival rate remains unknown. The number counted and number captured were the lowest on record since the first year of the survey in 2009 (Fig. 8.3.3). Spring density estimates declined by just over 50% in the upper St. Lawrence River, and over 66% in the Bay of Quinte. The decline in American Eel density was expected as increasing numbers of stocked eels were observed as out-migrants in the Québec silver eel fishery and no eels have been stocked in the LO-SLR system since 2010. All eels evaluated were females.

Recently, commercial fishermen in the Bay of Quinte have reported increasing numbers of American Eel in their fall entrapment gear (Fig. 8.3.4). LOMU collected 61 eels from commercial catches in early October, 2014. The average length of sampled fish was 806 mm (range 687-965 mm) and average weight was 1,226 g (range 752-1,929 g). The fish were 4-8 years old, which overlaps completely with the timing of eel stocking. In addition, the presence of oxytetracycline marks confirms all these fish were stocked. All fish were female and were of relatively high stage of maturity. The growth pattern of these fish suggests a rapid growth rate (Fig. 8.3.5) consistent with the idea that some of the larger and older fish have emigrated from the system.

Safe downstream passage past hydro turbines during the eel's spawning migration is an

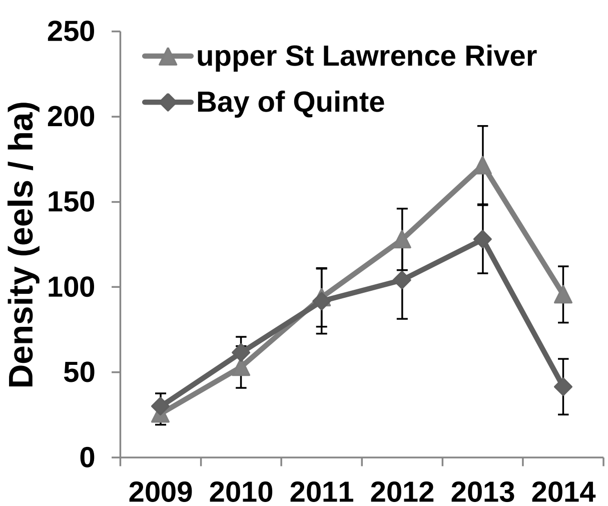


FIG. 8.3.3. The relative abundance of stocked American eel enumerated in spring transects, as estimated by mean density per hectare, from the stocking locations in the upper St. Lawrence River and the Bay of Quinte.

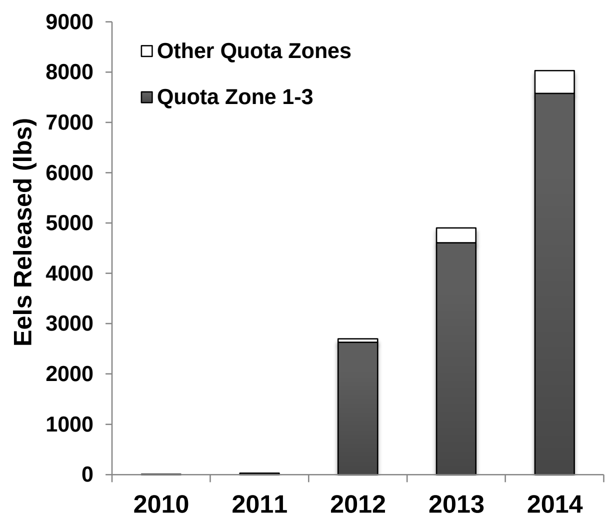


FIG. 8.3.4. American Eel reported as released (lbs) during the fall commercial entrapment gear fishery in the Bay of Quinte (Quota Zone 1-3) and other locations in Lake Ontario and the upper St. Lawrence River.

obstacle to restoration of eel that is identified in the OPG Action Plan. LOMU staff assisted in the capture and transport of large yellow eels from LO-SLR 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 of this technique as an alternative for mitigating turbine mortality at the Saunders Hydroelectric Dam. The project also involved local commercial fishers and the Association des Pêcheurs d’anguilles du Québec (APAQ).

A total of 1,589 large yellow eels (1,382 from Lake St. Francis and 207 from above the dam) were released in Lac St. Louis immediately downstream of the Beauharnois Hydroelectric Dam. During release, all “Trap and Transport” eels were observed to be in good health and swam away from the release site. The mortality rate during capture, holding and transport was 0.25%. APAQ staff sampled 10,068 eels (87.3% of the total catch) from the silver eel fishery in the St. Lawrence River estuary during the fall of 2014 to assess the survival, condition, maturation and migration of the transported yellow eels. APAQ staff detected seven (7) PIT tagged eels from the trap and transport program (one tagged in 2009 and six tagged in 2011). Eels have not been PIT tagged in the trap and transport program since 2011.

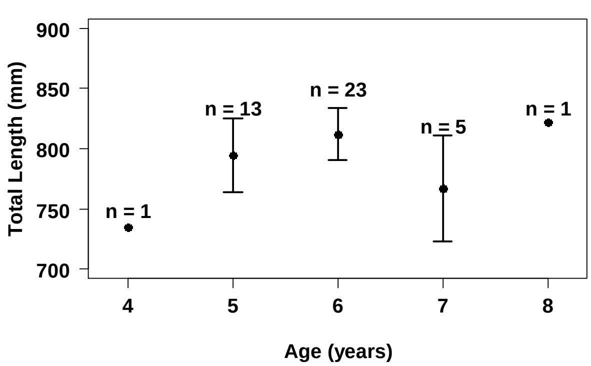


FIG. 8.3.5. Mean length at age, and 95% confidence intervals, of American Eel sampled from the Bay of Quinte commercial entrapment gear fishery during October 2014.

The 2014 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. Results suggest that after four years, 75% of the transported eels have migrated towards the spawning grounds.

Since 2013, the Eel Passage Research Center (EPRC) has conducted a research based program to evaluate potential techniques to concentrate adult eels for downstream transport around turbines at Moses-Saunders and Beauharnois Hydroelectric Dams to mitigate turbine mortality. EPRC is coordinated by Electric Power Research Institute and primary funders of the research include OPG, Hydro Québec and the United States Fish and Wildlife Service, through a funding arrangement from NYPA. Two research projects were funded in 2014:

1) Assessment of Downstream Migrating American Eel Behavior: Reduced-scale Field and Laboratory Studies of Eel Behavior in Response to Various Behavioral Cues. The project occurred in the 3rd and 4th quarter of 2014 and a final report is expected by 2nd quarter of 2015; and
2) White Paper Investigation of Recent Research on the Effect of Light on Out-migrating Eels and Recent Advancements in Lighting Technology. A draft report was received in 2014, with a final expected in the 1st quarter of 2015.

Restoration of American Eel in LO-SLR has been identified as a Fish Community Objective for Lake Ontario. The abundance of eels moving into the system via the ladders at the Moses-Saunders Dam has increased and the mortality rate of eels migrating downstream towards the spawning grounds has decreased as a result of the trap and transport project. In addition, a collaborative effort to develop methods of reducing mortality of eels during their downstream migration has been initiated.

8.4 Deepwater Cisco Restoration

T.J. Stewart and C. Lake, Lake Ontario Management Unit

Prior to the mid-1950s, Lake Ontario was home to a very diverse assemblage of deepwater ciscoes including Bloater (*Coregonus hoyi*), Kiyi (*C. kiyi*), 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 and Forestry (OMNRF), the New York State Department of Environmental Conservation (NYSDEC), the U.S. Fish and Wildlife Service (USFWS), the U.S. Geological Survey (USGS) and the Great Lakes Fishery Commission (GLFC). The Lake Ontario Committee has set a goal to establish a self-sustaining population of deepwater cisco in Lake Ontario within 25 years. The objectives and strategies for the establishment of deepwater cisco are specified in a draft strategic plan, which is currently under review. The plan addresses: sources of gametes, culture facilities, culture capacity, stocking, detection of wild fish, increasing our understanding of ecological consequences, research needs, and public education.

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

During January and February of 2014, fertilized Bloater eggs were obtained from Lake Michigan with the help of local commercial fisherman and personnel from the USFWS. Eggs were transferred to quarantined facilities at the OMNRF (White Lake and Normandale Fish Culture Stations) and the USGS Tunison Laboratory of Aquatic Science at Cortland, New York. The White Lake and Normandale facilities received just over 367,000 and 34,000 eggs, respectively; the Tunison laboratory received approximately 97,000 eggs.

In November of 2014, the OMNRF successfully released over 48,000 Bloater (19 months old, mean weight 26.9 g., mean total length 147 mm). The Bloater were released offshore of Cobourg in 100 m of water (Fig 8.4.1). Cobourg was chosen in part to determine the operational feasibility of mid-lake stocking, so that in the future when Bloater production targets are being met, biologists may have the choice of multiple stocking sites. In November 2014 the USGS and New York State Department of Environment Conservation released 20,000 fall fingerling bloater (mean weight 8.7 g, mean total length 97 mm) off of Oswego, NY.

OMNRF staff sampled 156 fish from the 2014 Cobourg stocking events. Length, weight and sex were recorded for all individuals. Of the 156 individuals retained, 63 were male, 62 were female, and the sex of 31 fish was not able to be determined (these fish were generally relatively small). There was not a statistically significant difference in the length-weight relationship based on sex, so all fish were pooled for analysis. The resultant length-weight relationship is illustrated in Fig 8.4.2. The mean length and weight of the sampled fish was 126.2 mm and 21.2 g.

The re-introduction of Bloater to Lake Ontario is consistent with bi-national commitments to diversify the offshore prey fish community, increase and restore native fish biodiversity and restore historical ecosystems structures and functions. Continued collection of eggs from the wild and development of a cultured brood stock will result in more fish being stocked in future years. A key restoration goal with this program is to be able to stock 500,000 fish per year by 2015. To help achieve this goal, broodstock development continues at White Lake FCS, and attempts are being this season to add to the egg inventory by spawning the first maturing brood stock fish.

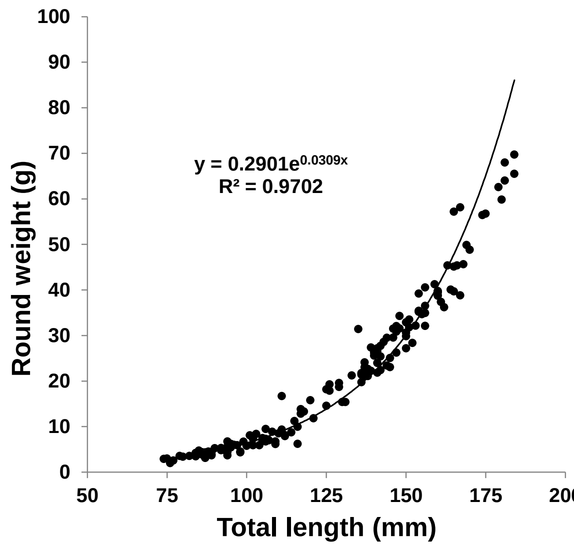


FIG. 8.4.2. Length-weight relationship of retained Bloater, all sexes pooled (n=156, mean total length = 126.2 mm; mean weight = 21.2 g).

FIG. 8.4.1. A load of Bloater onboard the *Ontario Explorer*, awaiting release offshore of Cobourg, November 2014.

8.5 Lake Trout Restoration

J. P. Holden, Lake Ontario Management Unit

Lake Trout were extirpated in Lake Ontario in the 1950s. The loss of this top predator and valued commercial species caused both ecological and economic damage. Rehabilitation of Lake Trout in Lake Ontario began in the 1970s with Sea Lamprey control, and stocking of hatchery fish. The first joint Canada/U.S. plan outlining the objectives and strategies for the rehabilitation efforts was formulated in 1983 (referred to henceforth as 'the strategy'), and revisions in 1990, 1998 and most recently in 2014 were made to evaluate the methodology and the progress of rehabilitation. The two objectives of the strategy are: 1) increase abundance of stocked adult lake trout to a level allowing for significant natural reproduction and 2) improve production of wild offspring and their recruitment to adult stock.

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

Lake Trout abundance experienced a significant period of decline that began in the early 1990s and reached a low point in 2005 (Fig. 8.5.1). Since 2005, there has been a gradual increase in the relative abundance of adult Lake Trout although catches are still well below those seen in the 1990s. Abundance increased in the Kingston Basin and Lake while the Deep Main Lake declined from 2013 catches. The strategy specifically identifies female Lake Trout greater than 4000 g as an important indicator of a spawning stock that has historically reference point for a detectable level of wild recruits. The current catch per unit effort (CUE, number per 24 hr gill net set) is on an increasing trend since 2005, however CUE (0.48 fish/net) remains well below the target of 1.1 fish per standard assessment gill net (Fig. 8.5.2).

Survival of juvenile Lake Trout was identified as one factor contributing to the decline in abundance. Catches of age-3 fish per half million fish stocked is used as an index of juvenile survival. Survival to age-3 of the 2011 cohort declined to levels observed in the early 2000s following the high level of survival observed in 2013 (Fig. 8.5.3). The current survival index (0.39) is well below the target of

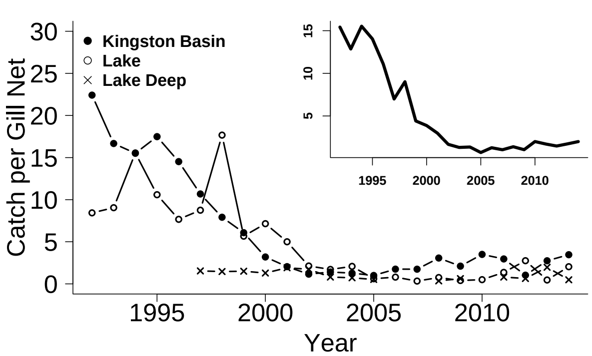


FIG. 8.5.1. Catch per unit effort of mature Lake Trout by area. Inset shows mean trend of the three areas combined.

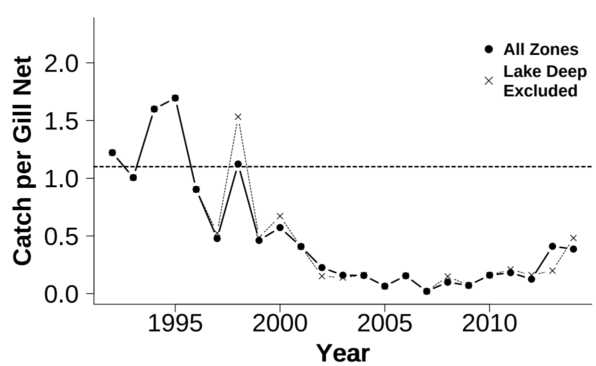


FIG. 8.5.2. Relative abundance of mature female Lake Trout greater than 4000 g. Trend is present with and without Lake Deep sites as they were not conducted in all years.

1.5 identified in the strategy.

As a measure of improved production of wild offspring and recruitment to adult, the strategy sets a target of wild fish to levels greater than observed between 1994 and 2011 (Ontario target = 0.84 wild fish per 100 standard gill net sets). The occurrence of wild Lake Trout is measured through catches of fish that do not bear hatchery fin clips (i.e. unclipped). Stable isotope analysis has shown that more than 90% of unclipped fish are of wild origin. Catches of wild Lake Trout increased marginally in 2014 over 2013 (0.36 and 0.32, respectively), however catches are below the mean CUE of the 1994 to 2011 target window (Fig. 8.5.4). Catches of small Lake Trout in the Community Index Trawling Program (Section 1.3) are generally low but can provide some additional insight on wild recruitment. Small numbers of wild young-of-year (YOY) fish were caught in 2010, 2012 and 2013 (Fig. 8.5.5). No wild YOY were captured in 2014, however one wild yearling was captured.

Sea Lamprey control is monitored through the number of A1 wounds (fresh with no healing) observed on Lake Trout. The strategy sets a target of less than two A1 wounds per 100 Lake Trout. The target has been consistently met since 1996 with the exception of 2012 (Fig. 8.5.6). Wounding rates were below target again in 2014 (0.0 wounds/100 Lake Trout) and only 0.3 A2 wounds (wound with limited healing)/100 Lake Trout.

The strategy calls for Ontario to continue stocking 500,000 Lake Trout yearlings annually to increase adult biomass to levels that would facilitate natural reproduction. Ontario stocks three strains of Lake Trout to maximize genetic diversity and develop a strain that is well adapted to present conditions in Lake Ontario. In 2014, a total of 462,482 Lake Trout yearlings were stocked at four different areas across the lake. A

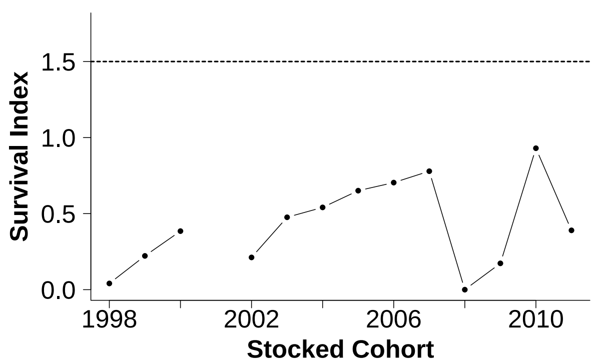


FIG. 8.5.3. Catch per unit effort (CUE) of age-3 Lake Trout standardized to 500,000 stocked. Dotted line indicates the Lake Trout Management Strategy target (CUE = 1.5).

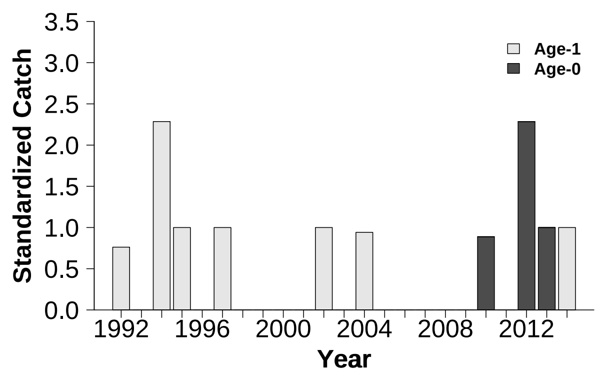


FIG. 8.5.5. Catches of age-0 and age-1 Lake Trout in the Community Index Trawling. Catches standardized to a 100 trawl program.

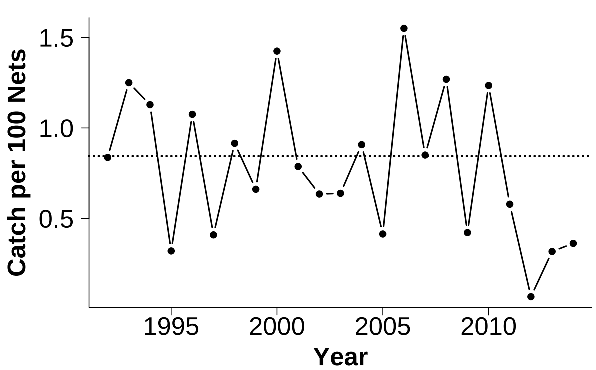


FIG. 8.5.4. Catch of unclipped Lake Trout per 100 standardized nets. Dotted line indicates Lake Trout Management Strategy target of 1.1.

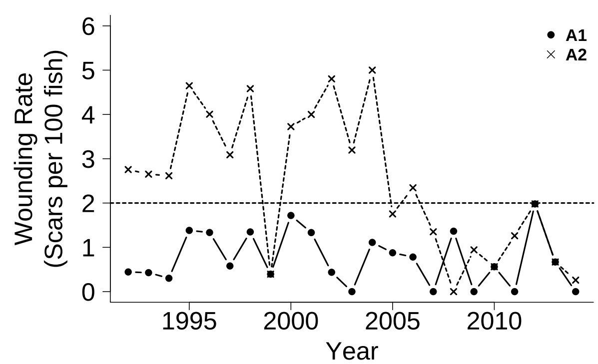


FIG. 8.5.6. Sea Lamprey scarring rate. Dotted line indicates the Lake Trout Management Strategy target of a maximum of two A1 wounds (fresh with no healing) per 100 Lake Trout.

breakdown of Lake Trout stocking numbers, locations and strains is included in Section 6.1.7.

The body condition of Lake Trout is reported as the predicted weight, based on a log-log regression, of a 680 mm (fork length) Lake Trout. The condition index remains high (4655 g) and is the fifth highest in the time series (1992-2014; Fig. 8.5.7).

Catch and harvest of Lake Trout in the recreational fishery is assessed through the Western Lake Ontario Boat Angling Survey. When last conducted in 2013, the total catch of Lake Trout had increased to levels observed in the 1980s and 1990s (Fig. 8.5.8), however harvest remains low as anglers chose to release most (96% in 2013) of the Lake Trout caught (Fig. 8.5.9). The estimate of 532 harvested Lake Trout, which does not take in to account harvest from the Kingston Basin or commercial by-catch, is below the maximum recommended harvest of 5000 fish from Ontario waters. From direct interviews, Lake Trout was the fourth most caught species behind Chinook Salmon, Rainbow Trout and Largemouth Bass although the majority of the catch (95%) is isolated in the western end of Lake Ontario (Niagara and Hamilton Areas, see Section 2.2 for map of angler survey areas). Of the Lake Trout sampled by creel technicians, it was determined that the majority of fish were of hatchery origin (93%) and 78% were stocked in U.S. waters (based on coded-wire tag data). In contrast, no U.S. stocked fish were captured in 2014 in the Community Index Gill Netting Program; and less than 5% of the Lake Trout sampled between 2004 and 2014 have originated from U.S. waters. This may be a reflection of Ontario's stocking and assessment effort being focused in the eastern portion of Lake Ontario.

The Lake Ontario Volunteer Angler Diary Program (Section 2.3) provides additional information on the recreational fishery for Lake

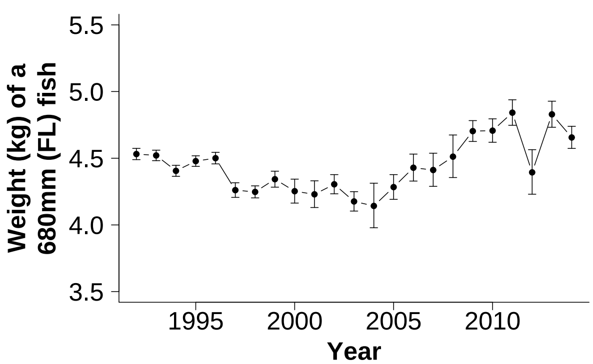


FIG. 8.5.6. Sea Lamprey scarring rate. Dotted line indicates the Lake Trout Management Strategy target of a maximum of two A1 wounds (fresh with no healing) per 100 Lake Trout.

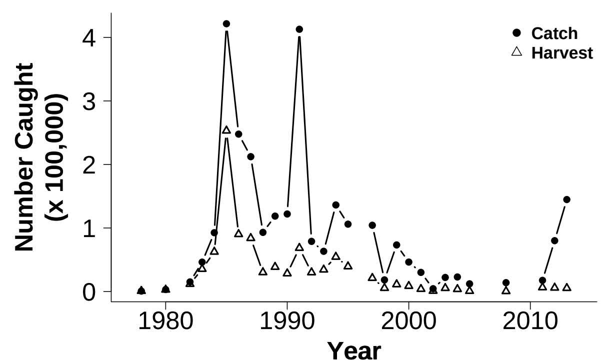


FIG. 8.5.8. Estimated catch and harvest of Lake Trout in the Western Lake Ontario Boat Angling Fishery survey. The survey was not conducted in 2014.

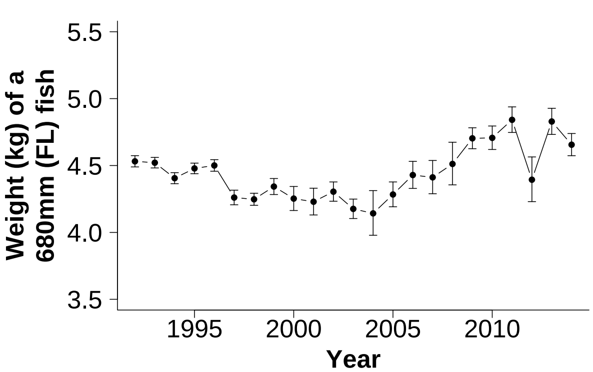


FIG. 8.5.7. Lake Trout Condition Index is the predicted weight of a 680 mm (fork length) Lake Trout. Error bar indicate the 95% confidence intervals.

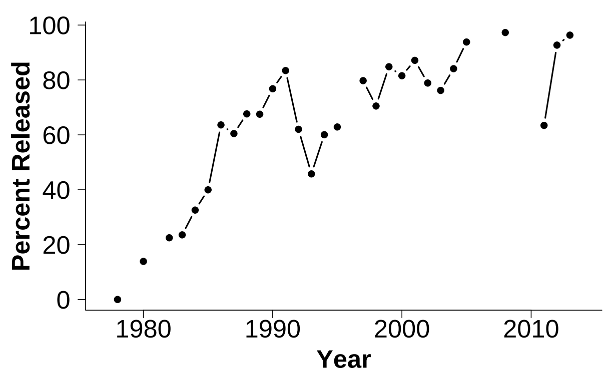


FIG. 8.5.9. Percentage of Lake Trout released in the Western Lake Ontario Boat Angling Fishery. The survey was not conducted in 2014.

Trout. Diaries were submitted from 26 anglers in 2014. A total of 474 trips were recorded and 248 (52%) were reported as targeting Lake Trout. Anglers reported catching 739 Lake Trout, which was the second most abundant species after Chinook Salmon in the 2014 catch. Consistent with the Western Lake Ontario Boat Angling Survey, diary anglers reported releasing a large proportion (85%) of the Lake Trout caught.

There is currently no quota for the commercial harvest of Lake Trout, however some fisheries (primarily the gill net fishery) do capture Lake Trout as by-catch (non-target captures). Commercial fishers are required to report by-catch on their Daily Catch Record. A total of 3,488 lbs (1,582 kg) of Lake Trout were reported as by-catch in 2014 (Fig. 8.5.10). This is lower than the previous two years and is the median for the time series (2004-2014). Quota Zone 1-2 (see Section 3.2 for description of Quota Zones) makes up the largest proportion (86%) of the reported by-catch.

The expanded transects in the Community Index Gill Netting and Trawling Programs (Sections 1.2 and 1.3 respectively) provide an opportunity to contrast new sites with the established index sites. Comparisons between bottom trawls were not possible as no Lake Trout were captured in western bottom trawl sites. Overall, the size distribution of Lake Trout captured at western sites was similar to the traditional index sites (Fig. 8.5.11). Gill net CUE of Lake Trout was lowest in the western sites (Table 8.5.1) but had catches of mature males and large mature females (> 4000 g) comparable to other areas. Only a small proportion (5%) of the catch was unclipped (Table 8.5.2).

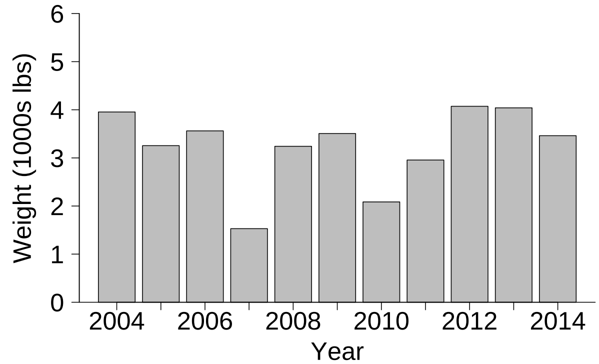


FIG. 8.5.10. By-catch of Lake Trout in the gill net fishery reported by commercial fishers on Daily Catch Records.

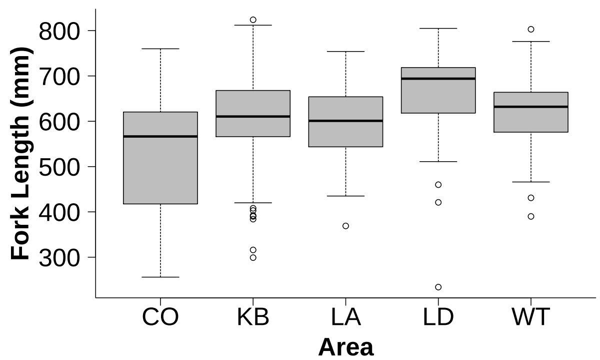


FIG. 8.5.11. Comparison of size distribution of Lake Trout between traditional eastern areas (CO = Conway, KB = Kingston Basin, LA = Lake, LD = Lake Deep) and the 2014 western areas combined (WT). Median value is indicated by the solid line. Boxes and whiskers capture 50% and 95%, respectively, of the values. Values beyond the 95% quantile are represented individually as open circles.

TABLE 8.5.2. Clipped to unclipped ratio of Lake Trout captured in the 2014 Community Index Gill Netting Program across five geographic areas. Isotope studies have shown that more than 90% of unclipped fish are of wild origin.

Area	Unclipped	Clipped	% Unclipped
Conway	0	56	0.0
Kingston Basin	10	300	3.3
Lake	0	59	0.0
Deep Lake	2	33	6.1
West	2	40	5.0

TABLE 8.5.1. Comparison of 2014 Community Index Gill Netting Program catches (CUE) between areas within the five areas sampled based on sex and maturity.

Area	CUE	Immature	Mature Females (< 4000 g)	Mature Females (≥ 4000 g)	Mature Males
Conway	2.75	0.95	0.1	0.15	1.55
Kingston Basin	2.86	0.14	0.43	0.56	1.73
Lake	0.98	0.03	0.2	0.3	0.45
Deep Lake	1.46	0.12	0.58	0.17	0.58
West	0.78	0.02	0.13	0.17	0.46

8.6 Round Whitefish Spawning Population Study

J. A. Hoyle, Lake Ontario Management Unit

An exploratory Round Whitefish (*Prosopium cylindraceum*) spawning population assessment project was conducted along the north central shoreline of Lake Ontario during early December, 2013. Building on the 2013 work, in 2014 gill net sampling was conducted at three locations (Pickering, Darlington and Peter Rock; Fig. 8.6.1) during late November and early December. These sites were selected based on both their spatial distribution across the Lake Ontario Round Whitefish range, and proximity to ports that can provide boat access during late fall. The objective of the netting was to collect 30-50 individual Round Whitefish, from each location, to obtain detailed biological attribute information from the spawning population of fish. The 2014 gill netting was a partnership project between Ontario Power Generation (OPG) and the Lake Ontario Management Unit (LOMU). An OPG consultant (EcoMetrix Incorporated, Mississauga, ON) conducted netting at Pickering and Darlington locations and LOMU conducted netting at the Peter Rock location. LOMU sampled all Round Whitefish for biological attributes.

A total of 53 gill net sets were made at the three locations from 26 Nov to 15 Dec (Table 8.6.1). Most number of sets occurred at Peter Rock (n=40). Each set consisted of a 500 ft gang

FIG. 8.6.1. Map of Lake Ontario showing locations (Pickering, Darlington, and Peter Rock) of Round Whitefish spawning population assessment gill netting, 2014.

TABLE. 8.6.1. Dates, number of gill net sets, mean and range of water depths, mean and range of water temperature, and the number of Round Whitefish caught, by location, during the 2014 Round Whitefish spawning population assessment.

	Location		
	Pickering	Darlington	Peter Rock
Date range	26 Nov - 28 Nov	1 Dec - 5 Dec	26 Nov - 15 Dec
Number of sets	8	5	40
Mean depth (m)	7.6	8.7	8.8
Depth range (m)	6.0 - 9.8	7.7 - 9.9	5.5 - 14.0
Mean water temperature (^{o}C)	5.6	4.6	3.4
Water temperature range (^{o}C)	4.8 - 8.6	3.9 - 5.2	2.1 - 4.8
Number of Round Whitefish Caught	49	93	30

of net comprised of a graded series of five mesh sizes from 2 to 4 inch (½ inch increments) stretched mesh gill net panels. The range of depths sampled was 6-14 m. The range of water temperatures sampled was 2.1-8.6 °C. A total of 172 Round Whitefish were caught.

A total of eight species and 254 individual fish were caught (Table 8.6.2). Round Whitefish were the most numerous species (n=172) followed by Brown Trout (n=40), White Sucker (n=26), and Rainbow Trout (n=11).

Round Whitefish gonad condition suggested that the netting dates bracketed peak spawning time (Table 8.6.3). Mean length at age increased for fish aged 4-9 years then plateaued at about 450 mm fork length for older fish (Fig. 8.6.2). Round Whitefish ranged in age from 3-26 years-old (Table 8.6.4). Age-classes with more than five fish sampled included ages 4-7 and ages 14-22 years. Fish between ages 7 and 14 were less numerous. Fifty-five percent of the fish caught were male.

Tissue samples (muscle and fin) were collected from all Round Whitefish for genetic analysis. The ultimate goal of a genetic analysis would be to test the null hypothesis that individual Round Whitefish across the spawning distributional range comprise a single panmictic population, and the alternative hypothesis that each of the three spawning location samples comprise reproductively discrete populations.

Results of the Round Whitefish spawning population study will help inform ongoing management of the species.

TABLE 8.6.2. Species specific total catches, by location, during the 2014 Round Whitefish spawning population assessment. Number of species and gill net sets are indicated.

	Location			
Species	Pickering	Darlington	Peter Rock	Totals
Rainbow trout			11	11
Brown trout	8		32	40
Lake trout			1	1
Lake whitefish	2			2
Round whitefish	49	93	30	172
White sucker	3	2	21	26
White perch	1			1
Walleye		1		1
Total catch	63	96	95	254
Number of species	5	3	5	8
Number of net sets	8	5	40	53

TABLE 8.6.3. Round Whitefish gonad condition by sex for fish observed during the 2014 spawning population assessment.

	Sex	
Gonad condition	Male	Female
Gonad developing	1	
Maximum gonad size	31	23
Spawning	60	35
Spent	1	19

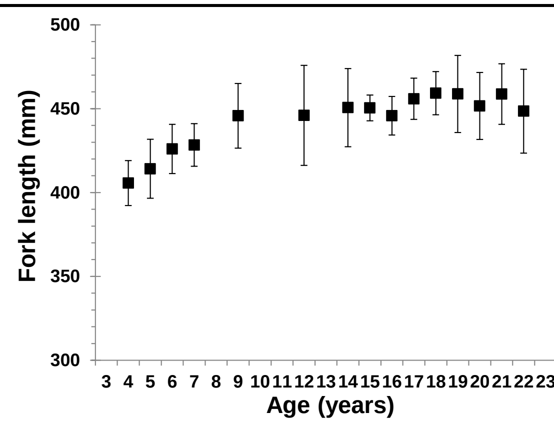


FIG. 8.6.2. Fork length at age for Round Whitefish caught during the 2014 spawning population assessment.

TABLE 8.6.3. Age distribution of 171 Round Whitefish, by location and overall), sampled during the 2014 spawning population assessment. Also shown are mean fork length, total length, weight, and GSI (females), and proportion of males, by afe and overall. GSI = gonadal somatic index calculated for females only as log10(gonad weight + 1)/log10(weight).

	Age/year-class																								
	3	4	5	6	7	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Overall	Total
Location	2011	2010	2009	2008	2007	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	means	numbers
Pickering		5	13	2	1			1			2	2	3	2	1	2	7	5	2	1				14.6	49
Darlington	1	6	9	6	3	3	1		2	1	5	4	4	6	7	3	11	11	7		1	1	1	12.7	93
Peter Rock		1	2		2	1			2		1	1	2		1	4	5	4	3					16.1	29
Totals	1	12	24	8	6	4	1	1	4	1	8	7	9	8	9	9	23	20	12	1	1	1	1	14.3	171
Mean fork length (mm)	400	406	414	426	428	446	440	477	446	442	451	450	446	456	459	459	452	459	449	420	464	458	462	442	
Mean total length (mm)	430	440	447	459	461	481	476	515	481	472	484	483	480	489	495	494	485	495	487	454	496	483	499	476	
Mean weight (g)	755	869	916	949	1053	1269	1233	1339	1117	1056	1149	1151	1144	1042	1238	1162	1119	1151	1127	748	1152	1104	1015	1075	
Proportion male	1.00	0.25	0.58	0.25	0.20	0.50	0.00	0.00	0.50	1.00	0.63	0.57	0.75	0.63	0.56	0.44	0.70	0.50	0.67	1.00	0.00	1.00	1.00	0.55	
Mean GSI (females)		0.68	0.67	0.50	0.63	0.73	0.71	0.60	0.72		0.74	0.76	0.59	0.53	0.66	0.63	0.69	0.66	0.70		0.73				

8.7 Hamilton Harbour Walleye Reintroduction

J. A. Hoyle, Lake Ontario Management Unit

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

Walleye stocking commenced again in 2012 (Table 8.7.1) with 100,000 summer fingerlings stocked in July that year. In addition, 74 adult Walleye (approximately 10-years-old hatchery brood stock) were stocked in November 2012. In 2013, 10,000 summer fingerlings were stocked, and in 2014, 950,000 day-old swim-up fry were stocked on June 13. Early results of the 2012 Walleye stocking were very promising. Fisheries and Oceans Canada electrofishing assessments began to capture Walleye shortly after the 2012 stocking. Growth rate of the fish was very fast and this fast growth rate appears to have continued.

Nearshore fish community index trap netting (NSCIN) was conducted on Hamilton Harbour in August 2014 (see Section 1.4). A mean catch of 2.5 Walleye per trap net was observed (Fig. 8.7.1). This meets the target of 2 fish per net established prior to commencement of the 2012 Walleye stocking initiative. The mean catch of 2.5 fish per net also compares favourably to that from other Lake Ontario and St. Lawrence River nearshore areas (see Section 1.4 and Section 7.4). Seventeen of the 24 trap net sets in

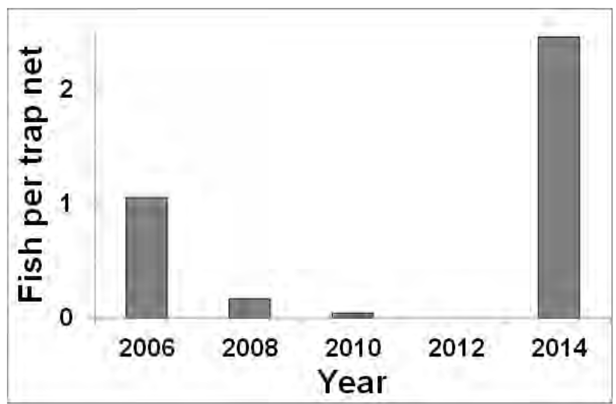


FIG. 8.7.1. Walleye catch (number of fish per trap net lift) for years indicated. Of the 59 Walleye caught in 2014, 55 were age-2 years and (by inference) originated from the 100,000 summer fingerlings stocked in 2012.

TABLE 8.71. Walleye stocked into Hamilton Harbour, 1993-2014.

Year	Month	Life-Stage	Mean weight (g)	Number of fish	Source
1993	October	adult	600	185	transferred from Bay of Quinte
1994	October	adult	1500	129	transferred from Bay of Quinte
1997	October	adult	8900	130	transferred from Bay of Quinte
1998	September	adult	1364	120	transferred from Bay of Quinte
1999	July	3-months	0.5	6,000	White Lake FCS (Bay of Quinte strain)
2012	July	3-months	1	100,000	White Lake FCS (Bay of Quinte strain)
2012	November	adult	1500	74	White Lake FCS (Bay of Quinte strain)
2013	July	3-months	0.5	10,000	White Lake FCS (Bay of Quinte strain)
2014	June	Swim-up fry	n/a	950,000	White Lake FCS (Bay of Quinte strain)

Hamilton Harbour caught at least one Walleye (Fig. 8.7.2). Walleye were captured throughout Hamilton Harbour where suitable trap net sampling locations were located; including the west, north and northeast shorelines. Highest Walleye catches occurred in the extreme southwest corner of the harbour. A total of 59 Walleye were caught in the August netting and 55 of these fish were 2-year-olds from the 2012 stocking event. These 2-year-old fish ranged in size from 360-440 mm fork length (mean 417 mm; Fig. 8.7.3). The four other Walleye caught were much larger, ranging in size from 590-690 mm, and were released.

Information from prior years' surveys indicated that six of nineteen Walleye caught in 2006 were aged (using otoliths) 3-years-old and ranged in length from 440-510 mm (Fig. 8.7.3). All other Walleye caught in years prior to 2014 were larger than 570 mm.

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

FIG. 8.7.2. Map of Hamilton Harbour showing number of Walleye caught, in August 2014, at each trap net location. A total of 59 Walleye were captured.

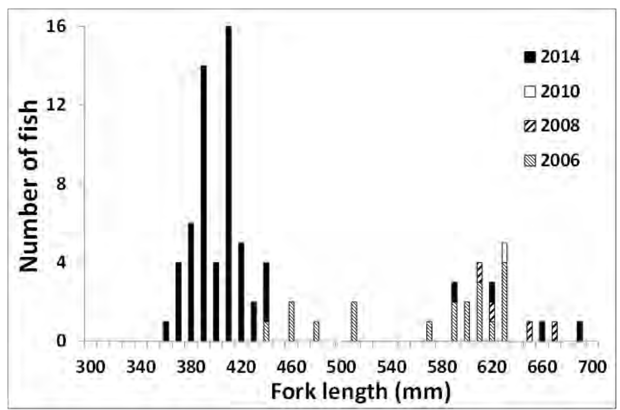


FIG. 8.7.3. Size distribution of Walleye caught during NSCIN trap net surveys conducted in 2006, 2008, 2010 (no Walleye caught in 2012) and 2014. Walleye caught in 2014 that ranged in size from 360-440 mm are inferred to originate from the 2012 stocked fish.

9. Research Activities

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

Project leads: Aaron Fisk & Steve Kessel (Great Lakes Institute for Environmental Research), Tim Johnson (OMNR-ARMS), Tom Stewart (OMNR-LOMU)

Contributors: Jana Lantry (NYSDEC)

Funding: OMNRF Fish & Wildlife Special Purposes Account, Natural Sciences and Engineering Research Council of Canada, Great Lakes Fishery Commission Fishery Research Program

Lake Ontario contains a diverse salmonid community. With six species overlapping their distributions to varying extents, there is potential for inter-species competition for resources. Highly valued recreational fisheries for Chinook Salmon *Oncorhynchus tshawytscha* and Rainbow Trout *Oncorhynchus mykiss* (see Section 7.1) are sometimes perceived to be in conflict with efforts to rehabilitate Atlantic Salmon *Salmo salar* and Lake Trout *Salvelinus namaycush* (see sections 8.2 and 8.5) owing to concerns about competition for food. Understanding the movement and distribution of these species in a large and ever-changing ecosystem like Lake Ontario is not an easy task. Pop-off data storage tags (pDST) became available for freshwater fish for the first time in 2013 and provide an ideal tool for collecting information on depth and temperature of fishes over an extended period of time. These pDST record data at specified time intervals and then release from the fish on a programmed date, floating to the surface where they can be recovered. During a pilot study in August 2013, we released 100 dummy pDSTs in offshore salmon fishing areas in central Lake Ontario. Recovery and return rate of dummy tags by the general public was 83%. Bolstered by this ability to recover the tags (and their data), we tagged 22 fish in the spring (Lake Trout, Brown Trout) and fall (Chinook Salmon, Rainbow Trout) of 2014 with pDST tags. While programmed to release from the fish one year after tagging, two of the tagged fish were caught by anglers and the pDST returned (a reward was offered as an incentive). The first fish, a Brown Trout tagged near the mouth of Oswego River (NY) in April, was caught by an angler just a few kilometres away in late June. The second fish, a Rainbow Trout tagged in Port Credit (ON) in September, was caught by an angler near the mouth of the Salmon River (NY) 3 weeks after tagging—a straight-line distance of over 270 km. Both fish were reported to be in excellent condition by the anglers.

The Rainbow Trout occupied a broad range of temperatures associated with regular movements between surface and deeper waters until the end of September (Fig. 9.1.1). Commencing October 1, the fish occupied a much narrower range of temperatures, and generally remained in shallower water, possibly representing its arrival to stage off the Salmon River. When we examined the movements of the Rainbow Trout at hourly intervals (Fig. 9.1.2), we saw a distinct daily pattern of the fish occupying constant depth (and temperature) through the night (the first half of the daily record), followed by a much more dynamic movement to both shallower and deeper water during the day. During the first two days of this record, the fish tended to move to shallower and warmer water, while the final five days tended to show movement to deeper and cooler water. We interpret this dynamic behaviour as the period of feeding, and the two different patterns may be related to pursuit of different prey species. Depth and temperature data recorded every five seconds will enable us to make inferences about foraging behaviour. More detailed analysis will relate the fish behaviour to environmental conditions and will allow us to test this feeding hypothesis.

With the support of the Great Lakes Fishery Commission`s Fishery Research Program, this study will continue in 2015 with the objective of tagging 30 Atlantic Salmon, 30 Lake Trout, and 30 Chinook Salmon and recording their depth and thermal distribution for an entire year. This information will be combined with agency derived diet and growth rate information to explore questions of energetic optimisation related to the depth and temperature preferences of each species. Collaborators on this research project include Drs. Christina Semeniuk, Trevor Pitcher and Nigel Hussey (all University of Windsor) in addition to the project leads and contributors listed above.

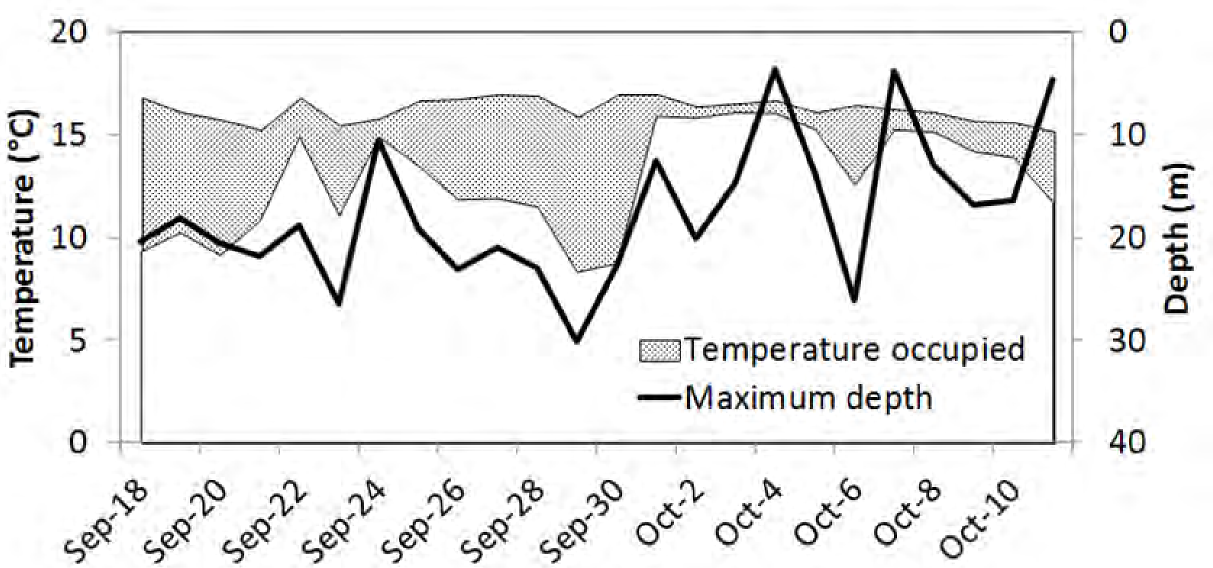


FIG. 9.1.1. Range of temperatures occupied (°C) and maximum daily depth (m) for a 610 mm Rainbow Trout tagged at Port Credit, Ontario on Sept 17, 2014 and captured by an angler near the mouth of the Salmon River, New York on Oct 11, 2014.

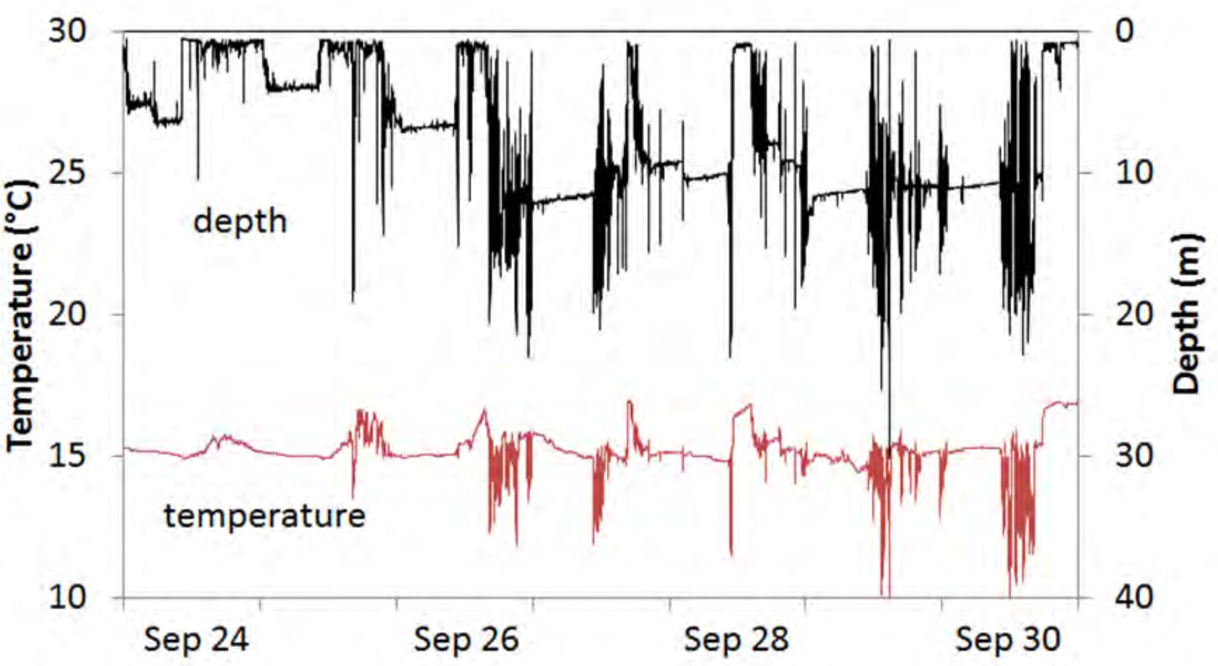


FIG. 9.1.2.Hourly records of temperature (°C) and depth (m) occupied by the same 610 mm Rainbow Trout for the period Sept 24, 2014 through Sept 30, 2014.

9.2 Has the feeding behaviour of Lake Trout (*Salvelinus namaycush*) changed in response to shifts in prey fish community composition?

Project leads: Brent Metcalfe, Tim Johnson, Jim Hoyle
Funding: OMNRF-ARMS Base

Lake Ontario Lake Trout (*Salvelinus namaycush*) have faced many challenges over the past century. Once abundant, Lake Trout populations were severely reduced by the early-1950s, became the focus of rehabilitation efforts in the late-1960s, and presently exist at lower than desired abundance levels. Over the same time period, prey fish communities have undergone wide swings in abundance and species composition. Historically abundant and native Lake Herring (*Coregonus artedi*) and sculpins (*Cottus cognatus* and *Myoxocephalus thompsonii*) persist at low abundances, while non-native Alewife (*Alosa pseudoharengus*) and Rainbow Smelt (*Osmerus mordax*), dominant through the latter half of the past century, experienced dramatic declines in abundance in the mid-1990s (Fig. 9.2.1). Round Goby (*Neogobius melanostomus*) invaded Lake Ontario in the early 2000s and now account for a significant portion of the prey fish community biomass (Fig. 9.2.1). Changes in the forage fish community can directly impact Lake Trout by affecting the availability of their food resources. Understanding Lake Trout diet can help us better understand Lake Trout ecology, productive capacity, and ultimately rehabilitation potential. To characterize Lake Trout feeding ecology we examined the contents of almost 12,000 Lake Ontario Lake Trout stomachs collected annually between 1992 and 2014 by OMNRF. Stomach contents were identified, measured, and wet weights of individual prey items estimated. Lake Trout diets were dominated throughout the entire time series by Alewife (ranging from 50-85% by mass; Fig. 9.2.2). Rainbow Smelt were present throughout the time series, making up a much smaller proportion of Lake Trout diet (ranging from 5-20%). Benthic fishes also made up a significant proportion of Lake Trout diet (ranging from 5-35%), with Sculpin species being replaced by Round Goby in the latter half of the time series (i.e., following the establishment of Round Goby

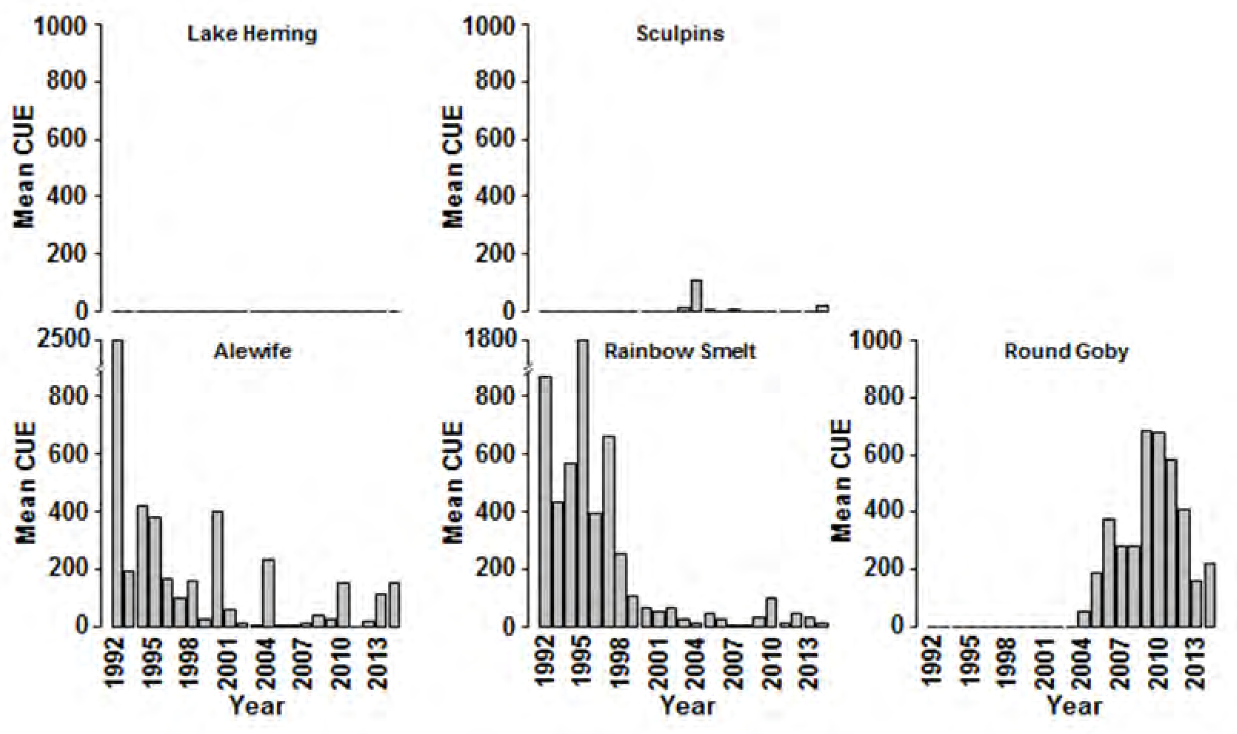


FIG. 9.2.1. Mean catch-per-unit-effort (CUE) for select Lake Ontario prey fish species from benthic trawls, 1992-2014.

in the early 2000s; Fig. 9.2.2). When Lake Trout catches were separated into pre- and post-Round Goby invasion time periods, there was no evidence Lake Trout had moved nearer to shore in the post-Goby time period (and may have actually moved more offshore). Additionally, in the post-invasion time period, frequency of empty stomachs was lower, ration size became more variable, and size of prey consumed was also more variable. Continued analyses will explore the bioenergetic consequences of these shifts, not only in terms of prey composition, but also implications of foraging costs and growth rate potential that may be associated with changes in the quality, as well as quantity, of the consumed prey. Such analyses can provide valuable information to scientists and managers about the productive capacity and rehabilitation potential of this native apex predator in Lake Ontario.

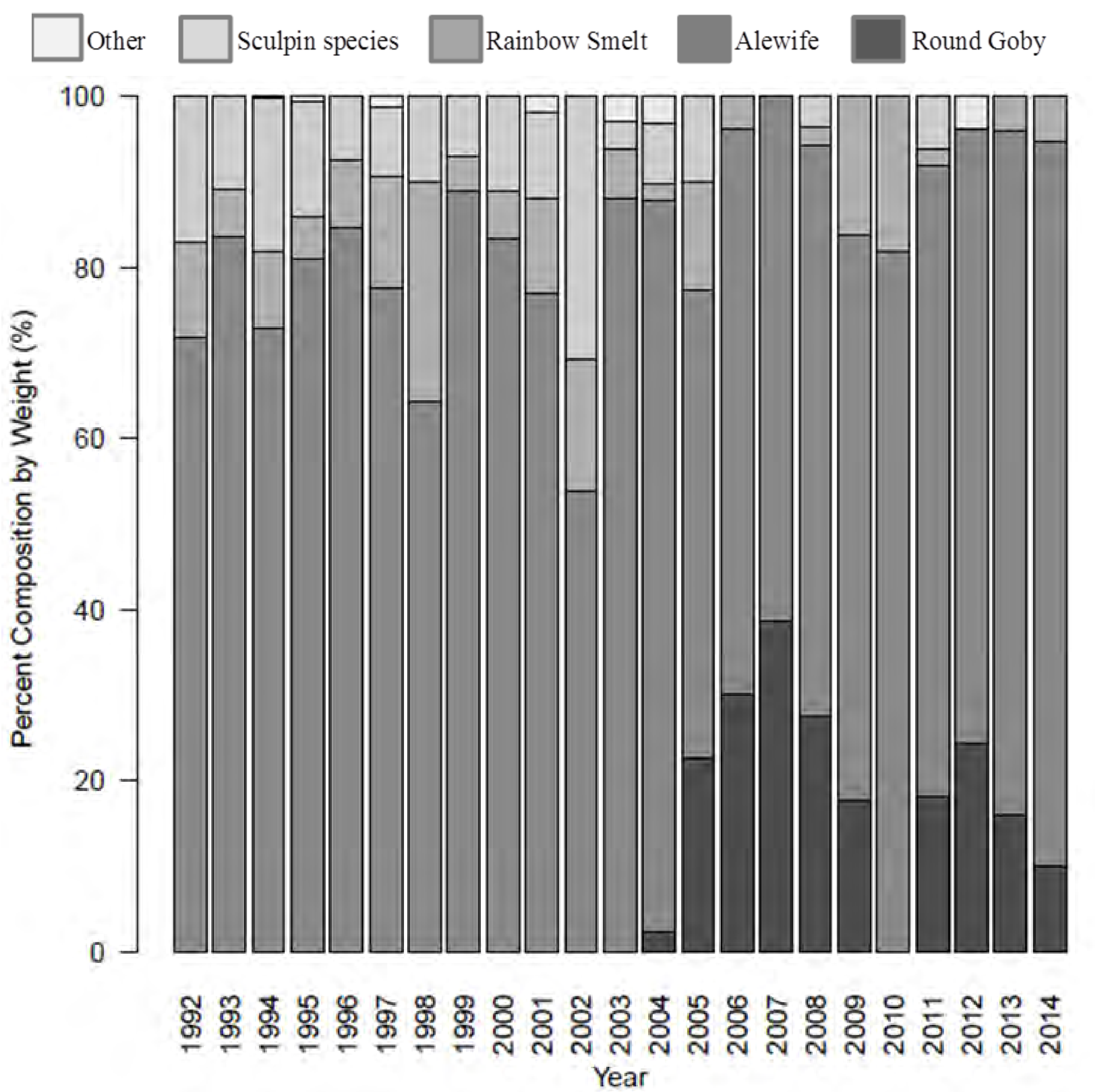


FIG. 9.2.2. Lake Ontario Lake Trout diet composition by prey fish species, 1992-2014.

9.3 Investigating salmon and trout habitat use and diet

Project leads: James Mumby, M.Sc. candidate, University of Windsor (co-advised by Tim Johnson, Tom Stewart OMNRF, and Aaron Fisk (Great Lakes Institute for Environmental Research))
Contributors: Jana Lantry (NYSDEC), Brian Weidel & Maureen Walsh (USGS), and John Fitzsimons (DFO - retired)
Funding: COA, OMNRF-ARMS base funds, NSERC

Lake Ontario has a number of native (Lake Trout *Salvelinus namaycush* and Atlantic Salmon *Salmo salar*) and non-native (Chinook Salmon *Oncorhynchus tshawytscha*, Coho Salmon *O. kisutch*, Rainbow Trout *O. mykiss,* and Brown Trout *Salmo trutta*) salmonids maintained largely by stocking. Management goals to maintain both highly-valued recreational fisheries while also striving to restore native salmonids raise concerns about the potential for prey resource limitation among salmonids. The objectives of this study were to 1) quantify Lake Ontario salmonid habitat use (niche) using stable isotopes of carbon and nitrogen, and 2) describe diet using both stomach contents and stable isotopes.

To understand habitat use, we first needed to understand how much of the variation in species stable isotope signature is due to spatial (across Lake Ontario) and temporal (i.e. seasonal) differences in fish location. If isotopic signatures for all species were strongly overlapping we would infer similar habitat and feeding behaviour. However, differences in relative size, orientation, and overlap in isotopic signatures among species provides critical information for understanding how these species partition or share the available food and habitat in the lake. A circle or ellipse drawn around the individual species data represents what ecologists refer to as the species niche (in this case, representing what they eat, their habitat and trophic position in the food web). Using samples collected from six different species of adult (>300 mm) trout and salmon caught in Lake Ontario in 2013 (n = 680) we can begin to see how similar (or different) these species are from one another (Fig. 9.3.1). Some species have larger ellipses than others which may indicate greater variation in prey species consumed or more varied habitat occupied (i.e., using both nearshore and offshore resources as opposed to being more restricted to one or the other). This can be seen in the ellipse size of a particular species. For example, Chinook Salmon have the smallest ellipse (0.6‰^{2}) indicating a specialized diet (fewer different types of prey), while Brown Trout have a larger ellipse (1.2‰^{2}) indicating a more general diet. In addition, the relative position of each ellipse can help us understand what and where the species is feeding on in the food web. For example, Lake Trout feed at the highest position in the food web amongst the Salmonids while a portion of the Rainbow Trout population feed at lower trophic levels than the other species (Fig. 9.3.1). Rainbow Trout consume a more diverse suite of prey, including nearshore invertebrates as well as fish, resulting in a larger, and vertically oriented ellipse relative to the other species (1.4‰^{2}). Lake Trout feed at the highest trophic position because they consume prey (e.g., sculpins) more associated with deeper nearshore and offshore (>30 m) regions. Being able to quantify differences in Salmonid diet and niche can help researchers and managers understand the potential competition for prey sources which when combined with estimates of prey density can support decisions around stocking rates, rehabilitation potential, and productive potential of the fisheries of Lake Ontario.

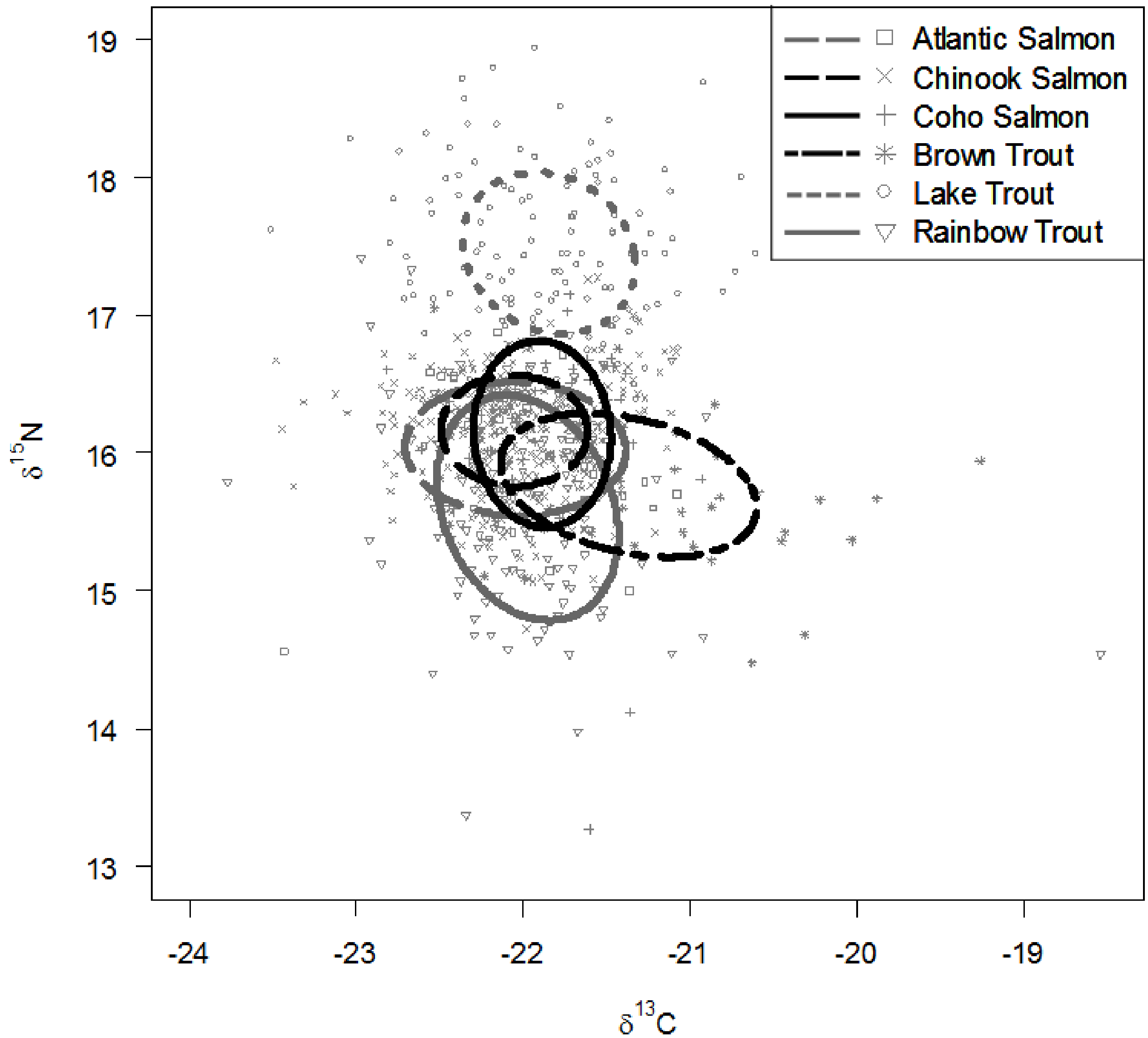


FIG. 9.3.1. Stable isotope bi-plot of the isotopic niche of Lake Ontario Atlantic Salmon, Chinook Salmon, Coho Salmon, Brown Trout, Lake Trout, and Rainbow Trout collected in 2013 (Atlantic Salmon collected from 2008-2013). Thick circles enclose standard (40%) ellipse areas (*SEA*$_c$) for all species with Atlantic Salmon represented by a *long dashed grey* line, Chinook Salmon by a *long dashed black* line, Coho Salmon by a *solid black* line, Brown Trout by a *two dashed black* line, Lake Trout by a *dotted grey* line, and Rainbow Trout by a *solid grey* line. Individual data points (*light grey*) are represented by *squares* for Atlantic Salmon, *x's* for Chinook Salmon, *crosses* for Coho Salmon, *stars* for Brown Trout, *circles* for Lake Trout, and an *upside triangle* for Rainbow Trout.

9.4 Using stable isotopes to understand shifts in ecology among Lake Ontario salmonid life stages

Project leads: Nick Kelly, Tim Johnson, Mike Yuille (OMNR- ARMS), Tom Stewart (OMNR-LOMU), Aaron Fisk (University of Windsor)
Funding: Canada Ontario Agreement

The Lake Ontario fish community includes multiple species of salmonids, including native species such as Lake Trout (*Salvelinus namaycush*) and Atlantic Salmon (*Salmo salar*) and introduced species like Chinook Salmon (*Oncorhynchus tshawytscha*), Rainbow Trout (*O. mykiss*) and Brown Trout (*Salmo trutta*). Despite their ecological and economic importance to the Lake Ontario ecosystem, we have a relatively poor understanding of how their behaviour and ecological role changes across life stages. Determining shifts in habitat and prey resources as fish age is critical in order to determine the limits to growth and production in these populations.

Stable isotope analysis is a useful tool for quantifying habitat and resource use within and among species and life stages. A fish's isotopic signature reflects both the source ($\delta^{13}C$) and trophic level ($\delta^{15}N$) of the predator relative to its prey. Nearshore food sources tend to be enriched in the heavy carbon isotope (more positive $\delta^{13}C$ values) relative to offshore food sources, thus $\delta^{13}C$ is typically used to estimate the source of the carbon in an organism's diet. The $\delta^{15}N$ of a consumer is typically enriched by 3.4‰ relative to that of its diet. Therefore, $\delta^{15}N$ can be used to estimate a fish's trophic position or the types of prey it has been feeding on (e.g. invertebrates versus fish). Combined, $\delta^{15}N$ and $\delta^{13}C$ can indirectly infer the types of prey salmonid life stages are feeding on and where they are foraging. Using data from 2012 and 2013, we investigated the relationship between body size and both $\delta^{15}N$ and $\delta^{13}C$ for Lake Ontario salmonid species. As Chinook Salmon, Rainbow Trout and Brown Trout increase in weight there was a significant increase in $\delta^{15}N$ (Fig. 9.4.1A) and a significant decrease in $\delta^{13}C$ (Fig. 9.4.1B) in their muscle tissue. Together, these results suggest that as these fish grow they are feeding on organisms from higher trophic levels (more fish vs. invertebrates) and are foraging further offshore. The slopes of these relationships for Chinook Salmon were significantly lower than for Rainbow Trout and Brown Trout, suggesting that juvenile Chinook Salmon might depend more on fish (as opposed to invertebrate prey) and forage further offshore than juvenile Rainbow Trout and Brown Trout. These relationships provide important insight into the ecology and behaviour of salmonid life stages in the nearshore and offshore environment of Lake Ontario.

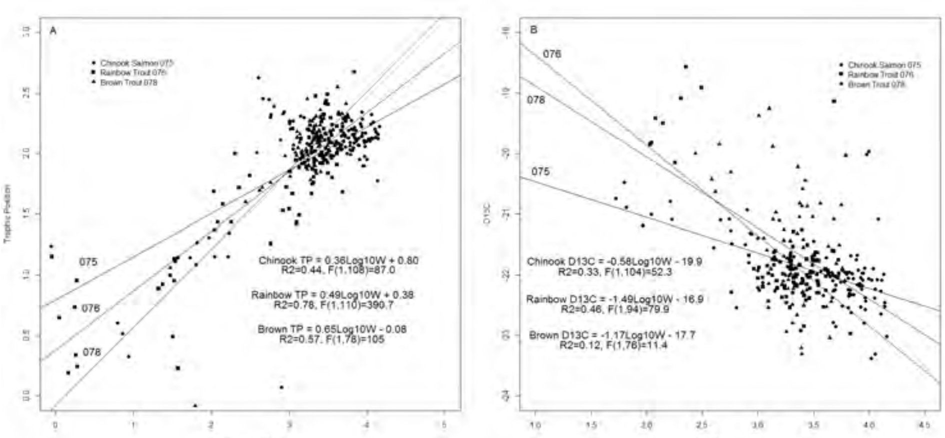


FIG. 9.4.1. The relationship between Weight (g) and (A) Trophic Position (TP) and (B) $D^{13}C$ for Chinook Salmon, Rainbow Trout and Brown Trout in Lake Ontario. All data are from 2012 and 2013. Trophic position is calculated as follows: $TP = \lambda + (D^{15}N_{consumer} - D^{15}N_{base})/\Delta_n$, where λ is the trophic position of the organism used to estimate $D^{15}N_{base}$, the $D^{15}N$ of base of the food web (dreissenids), $D^{15}N_{consumer}$ is the $D^{15}N$ value for the consumer and Δ_n is the trophic enrichment factor.

Stable isotope data can also be used to infer the degree of overlap in resource use among salmonid species. We calculated standard ellipse areas (SEAc) for adult Chinook Salmon, Rainbow Trout, Brown Trout and Lake Trout, corrected for sample size. These ellipses represent the amount of variation in the stable isotope data around the average $\delta^{13}C$ and $\delta^{15}N$ values. The SEAc of Lake Trout and Rainbow Trout are two- to six-fold greater than that of Chinook Salmon and Brown Trout (Table 9.4.1), indicating that the former have a broader foraging base than the latter. In addition, there is significant overlap in the SEAc among salmonid species. For example, the SEAc of Rainbow Trout overlaps by 86.94% and 96.91% with that of Chinook Salmon and Brown Trout, respectively (Table 9.4.1). This indicates a high degree of resource sharing among these species. In contrast, Lake Trout have the lowest degree of overlap with the other salmonid species (Table 9.4.1).

Combining stable isotope and stomach content data from Lake Ontario salmonid species can provide valuable information about their ecology, habitat and resource use and how this changes across life stages. In 2014, our field efforts have focused on collecting all life stages of salmonids, from fry in the tributaries through smolts and sub-adults in the lake. Stable isotope and stomach content data from these samples will allow us to infer the diets and important prey sources for the younger life stages, as well as where they are obtaining these resources (i.e. nearshore versus offshore). This will inform bioenergetics models to determine the ecological factors that limit the growth and production of juvenile salmonids in Lake Ontario.

TABLE 9.4.1. Standard Ellipse Area corrected for sample size (SEAc) and percent overlap for Lake Ontario salmonid species. Values represent stable ^{13}C and ^{15}N isotope data from 2012 and 2013 combined. To interpret table, read in the left to right direction: e.g. the SEA_c of Chinook Salmon overlaps 15.34% of the Rainbow Trout SEA_c.

Species	SEA_c (‰^{2})	Ellipse Percent Overlap (%)			
		Chinook Salmon	Rainbow Trout	Brown Trout	Lake Trout
Chinook Salmon	1.19	-------	15.34	37.83	17.83
Rainbow Trout	6.72	86.41	-------	96.91	14.96
Brown Trout	2.74	86.94	39.52	-------	20.51
Lake Trout	4.89	73.22	20.53	36.64	-------

9.5 Seasonal and ontogenetic energy dynamics in Lake Ontario salmonids

Project leads: Tim Johnson, Vanessa Bourne, Jaclyn Brown (OMNR- ARMS), Tom Stewart (OMNR-LOMU)
Funding: Canada-Ontario Agreement

The energy content (kJ·g^{-1}) of a fish reflects the amount of stored energy derived from past feeding events and available for vital processes such as metabolism, growth, and reproduction. Smaller fish tend to have lower energy density relative to larger fish as most of energy consumed, once metabolic requirements have been met, is directed into growth. Larger fish on the other hand, tend to store energy for seasonal processes such as reproduction. As part of a larger study to investigate the sources of energy supporting salmonid production in Lake Ontario, we collected a wide range of sizes and species of salmonids from different locations throughout the year to compare the size-dependent patterns of energy density. Preliminary results of samples analysed to date suggest a strong positive relationship between fish size and energy density (Fig. 9.5.1). Differences exist among species (e.g., Atlantic Salmon *Salmo salar* tend to have higher energy density than Coho Salmon *Oncorhynchus kisutch*) but the slope of the relationships is similar suggesting similar underlying physiology. Differences could be due to factors such as prey type consumed (varying energetic “quality” of prey), prey quantity (more prey per unit effort to catch the prey), or habitat utilized (higher metabolic expenditures such as might be associated with warmer habitats). These hypotheses will be investigated when the energy data are combined with stable isotope (see sections 9.3 and 9.4) and diet collected from these same fish. There were no significant differences among fish of the same species collected from our three study locations (Port Credit, Duffins Creek, Cobourg Creek). A very strong, negative relationship existing between energy content and water content of the fish (similar analyses described in Section 10.6 of the 2013 Lake Ontario Annual Report) confirming we can use water content as a reliable proxy for estimating energy content in our salmonid species. Further, the water-to-energy density relationship did not differ by species, fish size, location, or season providing us with a very robust estimator of fish energy density (R^2= 0.85, $F_{(1,173)}$=994.6, p<0.001). Describing ontogenetic, seasonal and spatial patterns in energy dynamics, diet, and habitat use are essential to understanding the ecology of these species that will be used to inform whole lake ecosystem models (see Section 9.9).

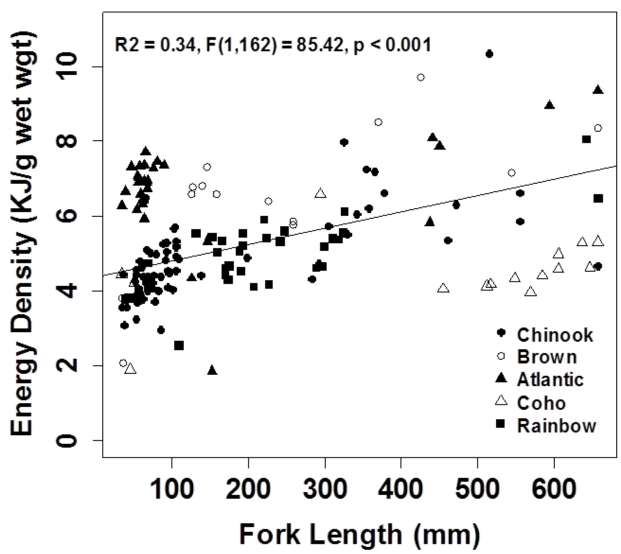


FIG. 9.5.1. Size dependent energy density (kJ·g-1) of different salmonid species captured in Lake Ontario in 2014.

9.6 Bloater rehabilitation: Can we estimate post-stocking survival and behaviour?

Project leads: Tom Stewart (OMNR-LOMU), Tim Johnson (OMNR-ARMS), Aaron Fisk & Eddie Halfyard (Great Lakes Institute for Environmental Research, University of Windsor)
Collaborators: George Bluett and Tim Drew (OMNR- White Lake Fish Culture Station)
Funding: NSERC, OMNR base funds

Historically, a very diverse assemblage of deepwater ciscoes (5 species), including bloater (*Coregonus hoyi*), inhabited Lake Ontario. Since that time, only the shallow water form (*C. artedi*) remains. OMNRF and New York State Department of Environmental Conservation have jointly developed a plan to re-establish a self-sustaining deepwater cisco (bloater) population with a target to stock 500,000 juvenile bloater annually (see Section 8.4). One question requiring investigation is what will happen to the stocked fish after introduction. Do hatchery fish survive in the wild and how does that change over time? Do they quickly disperse or do they stay close to their stocking site? Do they school closely together and move as group? What is their seasonal habitat use and occupied depth and temperature? Answering these questions using acoustic telemetry is the focus of this research. Bloater are generally considered to be a fragile fish not well suited for handling and stressful manipulation and acoustic telemetry may not be feasible with this species. To address this concern, we have initiated a series of trials examining the risk to bloater subjected to tagging and the appropriateness of assuming that bloater behaviour, survival and movements are not affected by the presence of a transmitter. To date, we have successfully surgically implanted 50 dummy acoustic transmitters in three tag sizes (total=150), another 50 bloater have been subjected to sham treatment (i.e. surgery without the insertion of a tag) and we have handled a population of controls (no surgery but subject to the same handling procedures). Since the initial surgery in November 2014 (3 months at the time of writing of this report), all of the tagged fish have survived. All fish appear healthy with no evidence of tag shedding or loss. Due to the cold temperatures the fish are held at in the hatchery (~2.5°C) fish are not actively feeding. Over the first 45 days of observation, the fish grew on average 0.2 cm (1.2%) but lost 1.3 g (2.3%). For both length and weight, all treatments were significantly different from the control, but none of the treatments were different from one another. These differences are very small, and given the lack of feeding were are not concerned but we will continue to monitor these trial fish for a total of 6 months.

A next step in our preparation is to undertake acoustic range testing which involves assessing environmental effects (depth, temperature, turbulence, wave activity, etc.) on the distance different sized tags can be detected from a receiver. Such information is critical in designing an effective acoustic receiver array to ensure all acoustic targets are detected, while also optimising configuration and spacing of receivers to maximise spatial extent of coverage relative to the number of receivers deployed. If funded (pending GLFC pilot Fishery Research Program project) this work would commence in June of 2015.

Research proposals to investigate the post-release behaviour, dispersal, habitat use and survival of hatchery-reared bloater using acoustic telemetry have been prepared for the US Fish and Wildlife Service Restoration Program and the Great Lakes fishery Commission Fishery Research Program. If supported, these funds will enable us to implant acoustic tags into stocked bloater, possibly as early as the fall of 2015. Information from that work would provide invaluable advice to scientists and managers to advance efforts to re-establish bloater in Lake Ontario and represent an exciting new method for evaluating the success and fate of stocked fish in the Great Lakes.

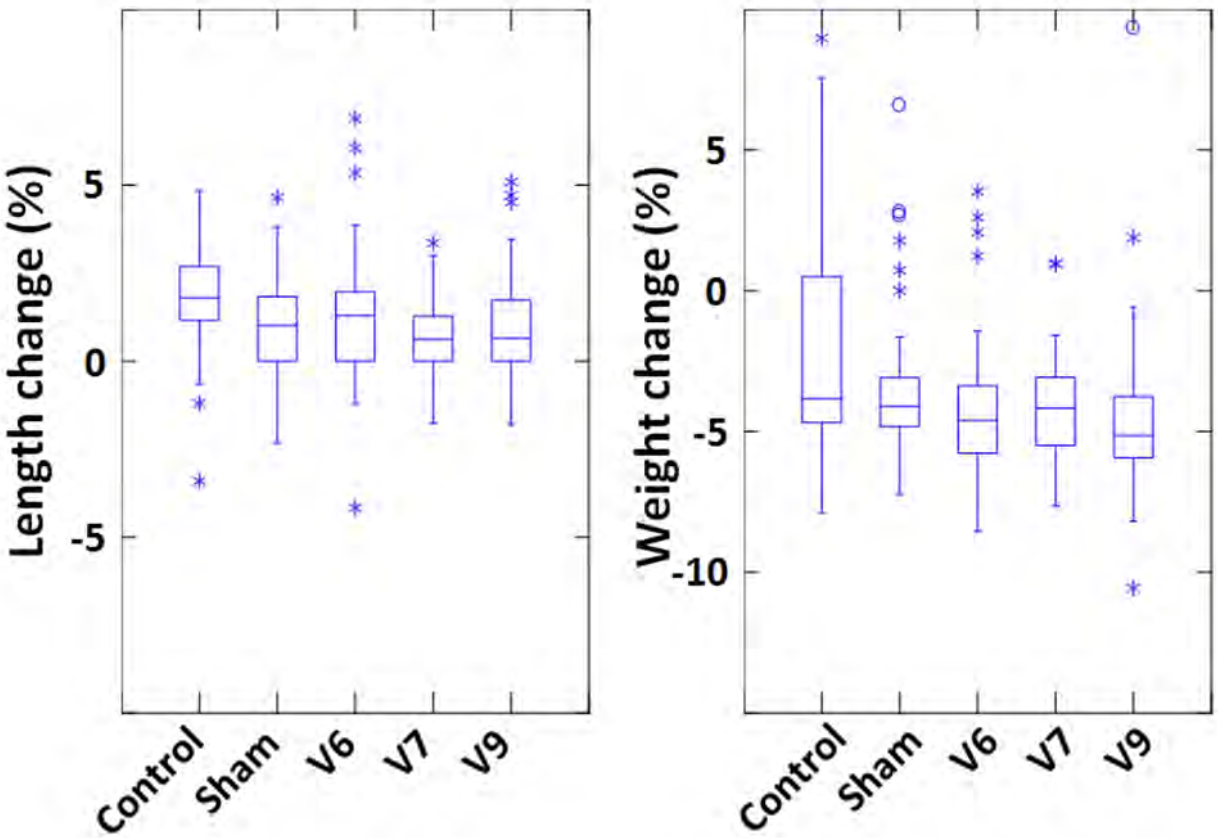


FIG. 9.6.1. Change in length and weight in relation to the size of the fish on the day of the surgery for the 5 different treatments. These results reflect the weight change 46 days following the surgeries. Differences are statistically different (Arcsine transformed length: $F_{4, 264}$=3.78, P<0.005; Arcsine transformed weight: $F_{4, 264}$=6.87, P<0.001) with the differences occurring between the control and all other treatments. Tag weights and average tag:fish weight ratio are: V6: 1.0g, 2%; V7: 1.6 g, 3.2 %; V9: 2.9g, 4.7%. The V6 tags are 180 kHz while the V7 and V9 are 69 kHz.

9.7 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: OMNRF-ARMS Base

In 2014, the Ontario Ministry of Natural Resources and Forestry's (OMNRF) 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; 38m 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; Fig. 9.7.1), primary production (e.g., algal and microbial composition and abundance), and secondary production (e.g., zooplankton and benthic invertebrates). This long-term monitoring program documented a dramatic decline in seasonal mean epilimnetic zooplankton densities in the late 2000s (relative to the 1980s and 1990s), and significant changes in zooplankton community composition (e.g., greater than 90% declines in some native plankton, while the community as a whole is increasingly dominated by invasive dreissenid mussel veligers).

In 2014, samples were collected from the station 12 times, from May 12th to October 27th. Thermal stratification began to establish in mid-June, and remained until mid-October. Secchi depth ranged from 5-20 m throughout the sampling season with no consistent trend.

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

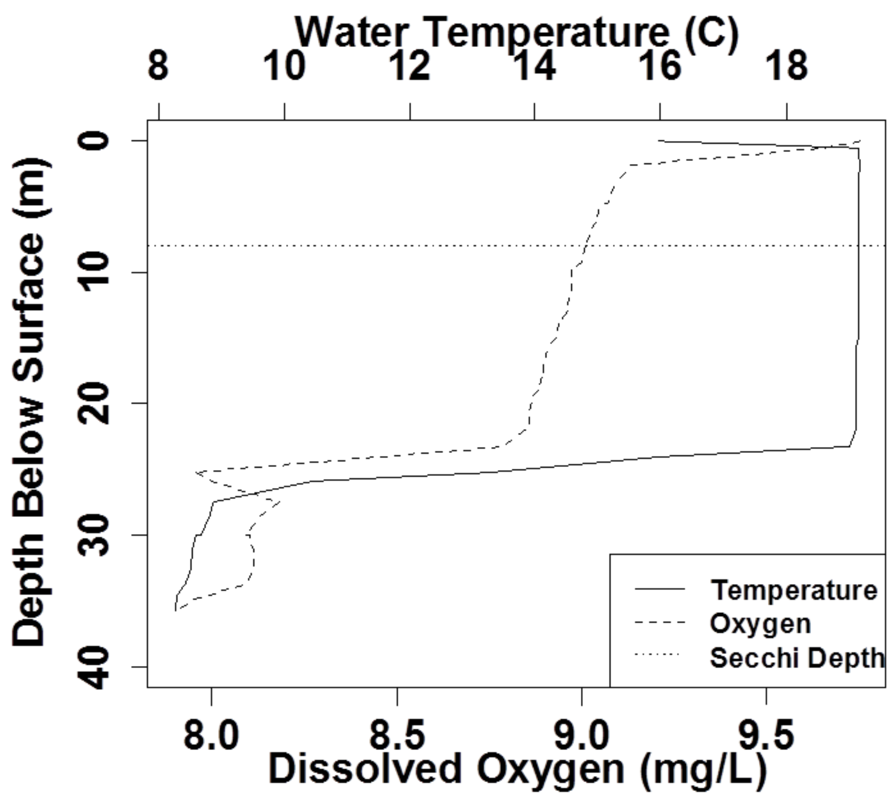


FIG. 9.7.1. Water temperature, dissolved oxygen, and Secchi depth measured in mid-September, in the eastern basin of Lake Ontario.

9.8 Spatial and temporal patterns in zooplankton community composition in north-eastern Lake Ontario

Project Leads: Julie Munro and Tim Johnson, Aquatic Research and Monitoring Section
Partners: Kelly Bowen (Fisheries and Oceans Canada)
Funding: Canada-Ontario Agreement

In 2013, OMNRF, in partnership with numerous other Canadian and U.S. agencies and universities, undertook an intensive, lakewide, seasonal, multi-trophic level sampling of Lake Ontario during the ice-free season (see 2013 Annual Report of the Lake Ontario Management Unit). On-going sample processing will see this collaborative work bring together lakewide datasets to provide a more comprehensive picture and interpretation of the current state and dominant drivers of the Lake Ontario ecosystem. Herein, we provide a preliminary look at some of the zooplankton data collected in the northeast and north-central portions of Lake Ontario by OMNRF. The objective of the analysis was to determine whether there were more and / or different zooplankton communities in different seasons, and / or in nearshore vs. offshore areas of the lake. Future analyses will compare alewife diet, the dominant planktivorous prey fish, with that of the resident zooplankton community to understand feeding preferences and other ecological associations between these two trophic levels.

This preliminary analysis uses data from three transects reflecting northeast [(Flatt Point (FP) and Rocky Point (RP)] and north central [(Cobourg (CB)] open Lake Ontario, exclusive of the Bay of Quinte. Zooplankton community demographics including population density (number·m^{-3}), biomass (mg·m^{-3}), and organism size (mean length in mm) were analyzed for monthly sampling events at discrete depths, and by major groups of zooplankton. The same attributes will be analyzed for the 2013 alewife diet data, and the results will be compared.

Population densities (number·m^{-3}) of major zooplankton groups observed in June 2013 at six sampling locations were compared (Fig. 9.8.1). Samples were collected during daylight hours from the whole water column with a 64-µm plankton net. Samples have been analyzed for six of the eight locations that were sampled that month. Considerable variability in zooplankton density was observed among zooplankton groups and sampling locations. At all sites, copepods dominated the community with near equal representation of cyclopoid and calanoid species. Dreissenid veligers were only observed at Rocky Point sampling locations, and were at low densities. Non-predatory cladocerans were observed at most locations except for the shallow nearshore site at Flatt Point (FP-5). Predatory cladocerans were only observed at the deepest offshore location at Rocky Point (RP-100), and at very low densities. Similar patterns were observed for mean zooplankton length and biomass among plankton groups at the different sites, although the importance of cladocerans and calanoid copepods increased relative to the other groups owing to their larger relative size. Once counting and quality checks are completed on the respective zooplankton sample sets, efforts will continue to consolidate the data with our other Canadian and U.S. partners to provide a more comprehensive, lakewide description of spatial and temporal dynamics of the Lake Ontario zooplankton community.

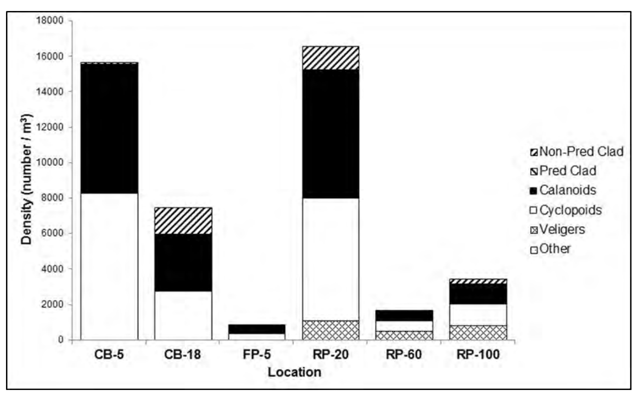


FIG. 9.8.1. Density of major zooplankton groups at different sampling locations collected during daylight hours from the whole water column with a 64 µm plankton net in June 2013. Locations: CB-5 = Cobourg 5m, CB-18 = Cobourg 18m, FP = Flatt Point 5m, RP-20 = Rocky Point 20m, RP-60 = Rocky Point 60m, RP-100 = Rocky Point 100m. Legend: Non-Pred Clad = non-predatory cladocerans, Pred Clad = predatory cladocerans, Calanoids = calanoid copepods, Cyclopoids = cyclopoid copepods, Veligers = Dreissenid veligers, Other = other zooplankton groups.

9.9 Modelling the Lake Ontario food web

Project leads: Tom Stewart and Tim Johnson
Partners: Monir Hossain (Department of Fisheries and Oceans; DFO), Marten Koops (DFO), Mohi Munawar (DFO), Robert Randall (DFO), Ed Rutherford (National Oceanic and Atmospheric Administration; NOAA), Brian Weidel (United States Geological Survey; USGS) and Hongyan Zhang (NOAA)
Funding: Canada-Ontario Agreement

The Lake Ontario Coordinated Science and Monitoring Initiative (CSMI) was initiated in 2013 and is now entering the analysis and synthesis phase. Of interest to bi-national investigators was understanding the structure and function of the Lake Ontario nearshore and offshore food webs and quantifying trophic energy flows. Herein, we describe the topology of linked nearshore and offshore contemporary Lake Ontario food webs. A unique feature of this model is the linking of nearshore and offshore trophic processes. Developing a better understanding of these linkages was one the investigative themes of the 2013 CSMI. This approach requires explicit modelling of separate nearshore and offshore food webs and identifying links between them. To our knowledge this approach has yet to be applied in Great Lakes food web studies. One advantage to this approach is that it allows important nearshore fish species (e.g., Walleye *Sander vitreus*, bass *Micropterus* species, Yellow Perch *Perca flavescens*) to have the same prominence in the models as offshore salmon and trout, even though they occupy a relatively much smaller habitat area.

The model defines the nearshore as waters with a depth ≤ 25 m and includes sheltered embayments and exposed coastal zones (Minns and Whichert 2005). The food web consists of seven major species-group categories; primary producers (pelagic pico plankton <2 um, pelagic nanoplankton 2-20 um, pelagic macroplankton > 20 um, benthic algae and macrophytes), detrital pools (particulate organic carbon, sedimentary detritus, dissolved organic carbon), zooplankton (including protozoans, bacteria, and dreisssenid veligers), benthos, *Mysis*, fish and cormorants (Table 9.9.1). Diet information was used to describe the species topology (i.e., who eats whom) and trophic linkages between nearshore and offshore species-groups were proposed (Fig. 9.9.1). The two food webs are represented by 62 species-groups and 283 trophic flows, of which 10 are trophic flows between the nearshore and offshore food webs.

The specification of the spatial zonation is conceptual but necessary in application to properly scale biomasses and trophic flows when modelling the two zones together and quantifying trophic exchanges. For modelling purposes, the area of the nearshore zone (≤ 25 m depth) represents approximately 18% of total lake area and this has to be taken into account when material flows are quantified and balanced between the two food webs. It also important to accept that assigning a species-group to a zone is a simplification and is intended to represent the spatial zone where most of the biomass is found during the time when most of the growth occurs for that species-group (examples provided below). To better communicate and foster an appreciation for food web flows, we have “looked under the hood” at a few sub-components of the model flows, including adult Walleye diets, adult Chinook Salmon *Oncorhynchus tshawytscha*, and adult Bass *Micropterus* species.

Adult Walleye diet information is represented as flows from prey species-groups to adult Walleye (Fig. 9.9.2). Adult Walleye age-5 and older emigrate from embayments such as the Bay of Quinte and reside in Lake Ontario nearshore and offshore (as defined here) zones. In the model they are assigned to the offshore zone with flows from the nearshore. The major flows are based on the observation that Walleye feed primarily on Alewife *Alosa pseudoharengus*, Round Goby *Neogobius melanostomus*, White Perch *Morone americana* (represented in the omnivore nearshore species-group; OMN) and Yellow Perch (Bowlby et al. 2010).

The model can also be applied to illustrate sources of energy and trophic flows required to support the growth of adult Chinook Salmon (Fig. 9.9.3). The diet of Chinook Salmon is assigned to the offshore zone with diet flows from nearshore

TABLE 9.9.1. Lake Ontario nearshore and offshore food web species-groups and acronyms.

Group	Offshore Acronym	Species-Group	Nearshore Acronym	Notes
Primary Producers	oNAN	Nano Plankton (> 2um < 20 um)	nNAN	
	oNET	Macro Plankton (> 20 um)	nNET	
	oPIC	Pico Plankton (2 um)	nPIC	
		Benthic Algae and Macrophytes	BEN	
Organic Carbon	oDOC	Dissolved Organic Carbon	nDOC	
	oPOC	Particulate Organic Carbon	nPOC	
	oSDT	Sedimentary detritus	nSDT	
Benthos	DIP	Diporeia		
	oOB	Other Benthos	nOB	includes crayfish
	oDRE	Dreissenids	nDRE	
Zooplankton	oBAC	Bacteria	nBAC	
	oPRT	Protozoans	nPRT	
	oROT	Rotifers	nROT	
	oVEL	Veligers	nVEL	
	oCAL	Calanoid Copepods	nCAL	
	oCYC	Cyclopoid Copepods	nCYC	
	oSC	Small Cladocerans	nSC	
	oPZ	Predatory Zooplankton	nPZ	Bythotrephes, Cercopagis, Leptodora
	oLC	Other Large Cladocerans	nLC	
Mysis	MYS	Mysis		
Fish	JSM	Juvenile smelt		
	OSM	Older Smelt		
	ASC	Adult sculpin		
	JSC	Juvenile sculpin		
	ACH	Adult Chinook		
	ALT	Adult Lake Trout		
	AOS	Adult Other Salmonids		rainbow trout, coho
	WAL	Adult Walleye		ages 5 and older, leave the Bay of Quinte and feed offshore
	oAGB	Adult Round Gobies	nAGB	
	oJGB	Juvenile Round Gobies	nJGB	
	oY&OAL	Yearling and Older Alewife	nY&OAL	
	oYOYAL	YOY Alewife	nYOYAL	
		Juvenile Salmonids	JSL	
		Yearling and Older yellow perch	Y&OYP	
		YOY Yellow Perch	YOYYP	
		Adult Bass	BAS	
		Immature walleye	IWAL	Walleye age 0+ to 4- Includes other nearshore piscivores (e.g. northern pike)
		Nearshore Benthivores	nBTH	suckers, trout perch
		Nearshore Omnivores	OMN	carp, drum, white perch,brown trout, juvenile bass, sunfishes, cyprinids
Cormorants		Cormorants	COR	

and offshore yearling and older Alewife (nY&OAL, oY&OAL). Growth of these prey species require flows from a diverse range of zooplankton species-groups, *Mysis relicta,* and *Diporeia hoyi* (now very rare). Further down the food web the model shows that adult Chinook Salmon growth requires flows from primary producers, organic carbon, and bacteria to support zooplankton species-groups, *Mysis*, and *Diporeia*. Sources of energy and trophic flows are even more complex for adult bass (Fig. 9.9.4). In this case the model is simplified by combining Smallmouth Bass (*Micropterus dolomieu*) and Largemouth Bass (*Micropterus salmoides*) into one bass species-group. There are no links identified for trophic flows from offshore species-groups. Many similar lower-trophic level groups that support adult Chinook Salmon also support adult bass but in different habitats (offshore for Chinook Salmon, nearshore for adult bass). The importance of the nearshore to many juvenile species and their role in supporting adult bass is illustrated as is the importance of both juvenile and adult Round Goby.

The model structure is the first step towards mass-balance food web modeling applications and simulations such as ECOPATH / ECOSM and LIM (Christensen et al. 2005, Van Oevelen et al. 2010) and further development will depend on finding resources to synthesize the data and support the modelling. The model structure and

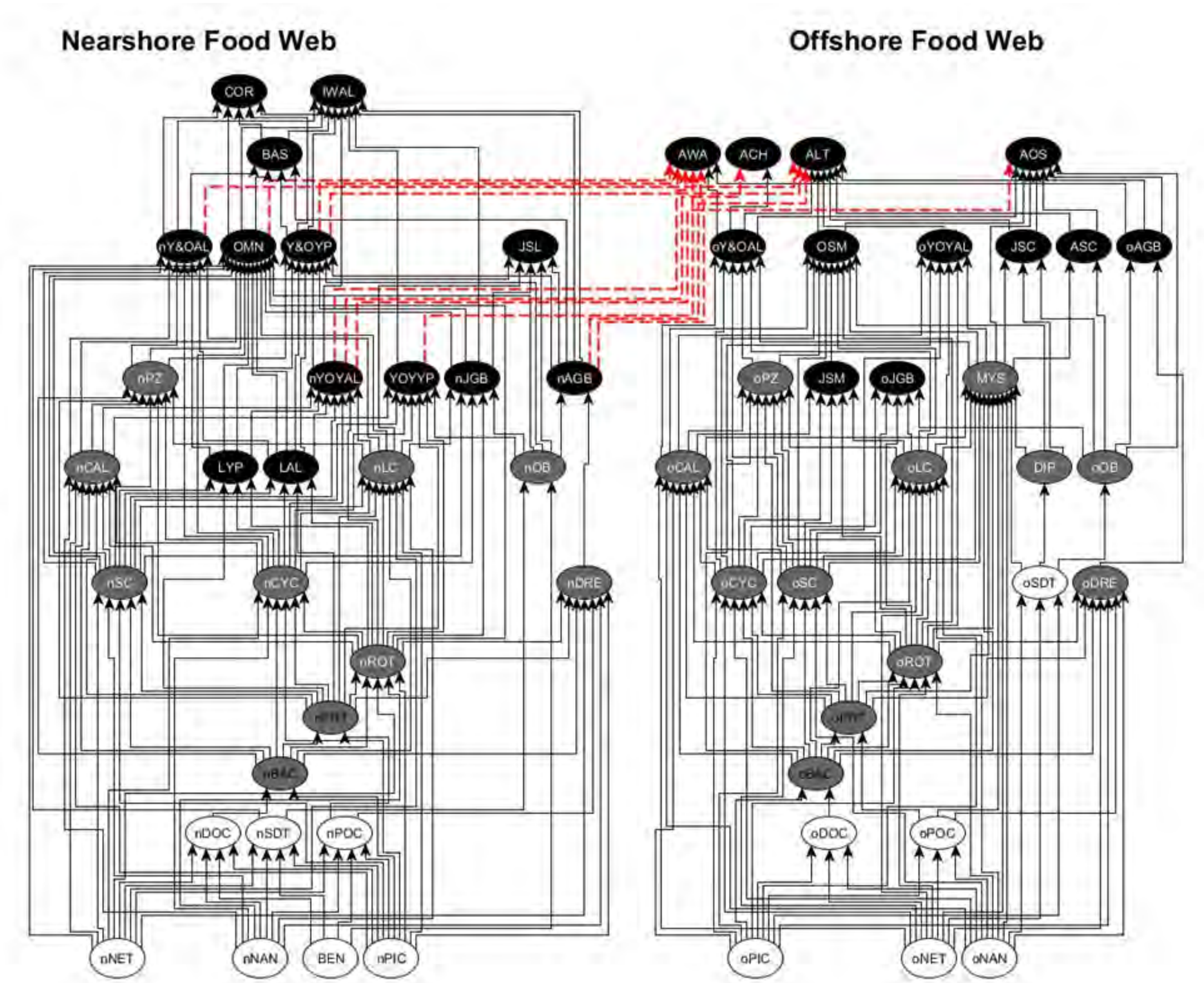


FIG. 9.9.1. Lake Ontario nearshore and offshore food web. See Table (9.9.1) for species-group acronyms. The white coloured groups are primary producers and carbon sources, the grey coloured groups are zooplankton, *Mysis* and benthos the black coloured groups are fish. Dotted lines represent flows from nearshore groups to offshore groups.

components capture the major trophic linkages in Lake Ontario but, as for any model, required simplification of the structure and grouping of individual species with similar trophic function. Further simplification may be possible depending on the model application.

Bowlby, J. N., Hoyle, J. A.,Lantry, and Morrison, B. J. 2010 Status of Walleye in Lake Ontario 1988-2006. In Status of walleye in the Great Lakes: proceedings of the 2006 Symposium. Great Lakes Fish.Comm. Tech. Rep. 69. pp. 1-14.

Christensen, V., Walters, C. J., Pauly, D. (Eds.), 2005. Ecopath with Ecosim, A user's guide. Fisheries Centre, University of British Columbia, Canada.

Van Oevelen, D., Van Den Meersche, K., Meysman, F.J.R., Soetaert, K., Middelburg, J.J., and Vezina, A.F. 2010. Quantifying food web flows using linear inverse models. Ecosystems 13: 32-45.

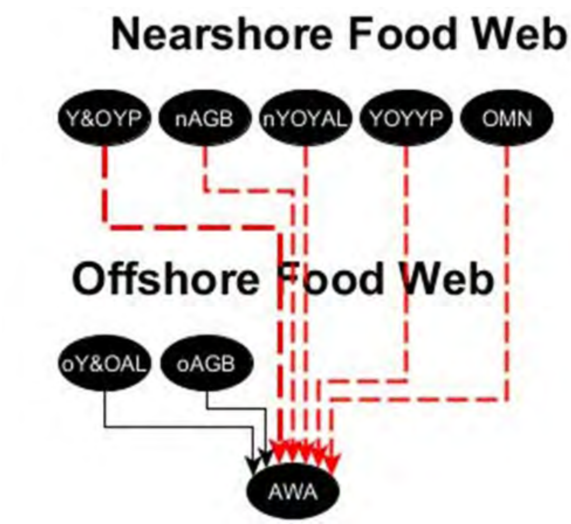


FIG. 9.9.2. Food sources for adult Walleye (AWA). The dotted lines indicate flows from the nearshore food web to the offshore food web. See Table 9.9.1 for species-group legend.

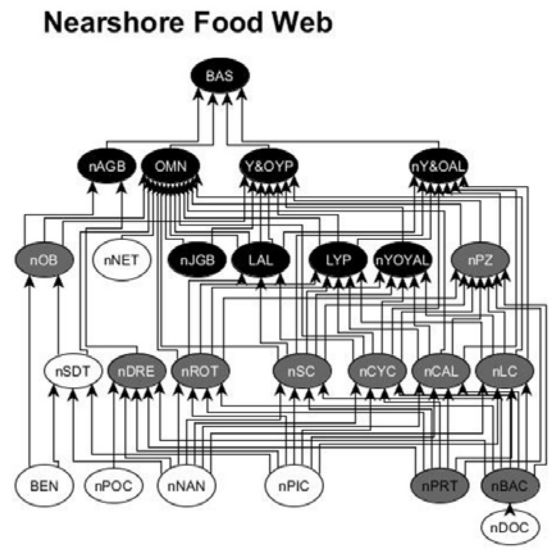


FIG. 9.9.3. The trophic flows that support adult Chinook Salmon (ACH) growth. The dotted line indicates a nearshore flow from yearling and older Alewife. See Table 9.9.2 for species-group legend.

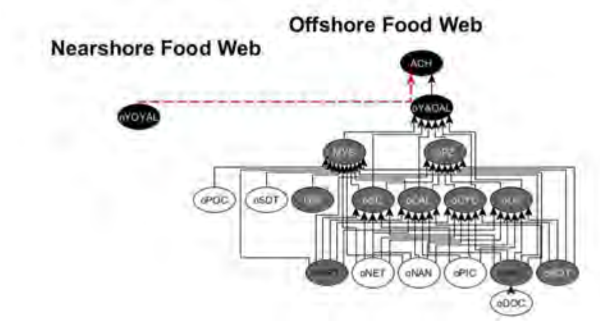


FIG. 9.9.4. The trophic flows that support adult bass (BAS) growth. See Table 9.9.1 for species-group legend.

9.10 Bioenergetics modelling to assess aquatic invasive species impact

Project leads: Nickolas Kosmenko, M.Sc. candidate, University of Windsor (co-advised by Tim Johnson, OMNRF, Ken Drouillard and Christina Semeniuk, Great Lakes Institute for Environmental Research)
Funding: Canadian Aquatic Invasive Species Network (CAISN); OMNRF-ARMS Base funds; Ontario Graduate Scholarship

Estimating the impacts of invasive fish before or shortly following their arrival is a tremendous challenge for scientists and resource managers. While the type and magnitude of impacts can vary, our analysis focuses on the trophic impacts or the relative consumption of food resources. In order to grow and survive, an organism must consume food (energy) resources, and the amount of energy it consumes can be estimated from bioenergetic principles, which are mathematical relationships describing how much energy is needed to support vital functions such as metabolism, activity, digestion, and growth. Most of the consumed energy is needed to support metabolism (typically estimated by the amount of oxygen consumed under specified conditions). We compiled information on how much energy is required for routine (normal activity) metabolism for 73 north-temperate freshwater fish species (Fig. 9.10.1). Measuring the routine metabolism of a fish is a very time-consuming process, requiring special equipment and controlled environmental conditions and has therefore only been measured in a small number of fish species (there are over 14,000 freshwater fishes worldwide). Our analyses seek to be able to predict routine metabolic rate from easily measured or observed fish traits (how they look and act). If we can determine an easy way to estimate metabolic rate, we may be able to estimate potential trophic impact and provide a straight-forward way for resource managers and scientists to gauge the relative risks of invading species.

Data relating to 31 different fish traits were collected from various sources for the 73 species of fish being analyzed. Currently, statistical procedures are being used to determine which of the 31 traits are most important in explaining how each fish is different from one another. The data remaining after this procedure will be analyzed to see how traits are related to the amount of energy fish use for routine metabolism. The resulting predictive tool will be validated, and if it proves accurate, will be used to predict trophic impact of fish species posing potential threat to Canadian waters and to identify additional fish species that could have a high trophic impact were they to invade. Preliminary results suggest fish with a small head have a higher metabolic rate and therefore pose a greater risk of trophic impact.

New organisms continue to invade the fresh waters of Canada and while some have large impact on their new environments, others do not. Relating fish traits to how much energy an organism requires to survive will give managers the ability to understand potential impact and therefore where best to invest limited management resources.

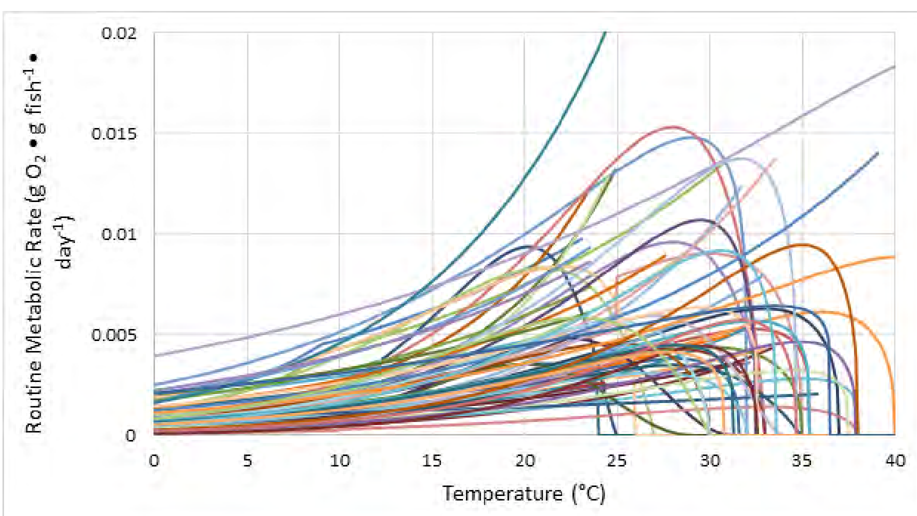


FIG. 9.10.1. Temperature dependence curves for routine metabolic rates of 74 north-temperate, freshwater fish species comprising the dataset being analysed for relationships between morphometric, physiological, ecological, and behavioural traits against routine metabolic rate as part of CAISN Project 4.1.

9.11 Predicting the impacts of climate change on the spread of aquatic invasive species

Project leads: Shannon Fera, Andrew Drake (University of Toronto), Len Hunt and Tim Johnson
Funding: Canada-Ontario Agreement -Climate Change program

Climate change and invasive species are two of the greatest threats to Ontario's aquatic resources. We are investigating how changes in temperature, as predicted by climate models, may alter the amount of suitable habitat for a given species. Previous analyses suggest warmer waters may be more hospitable to non-native species allowing their distribution to expand into Ontario, or for established species to shift northward. However, even if the climate is suitable, a species will only gain access to a new waterbody if there is a connection or pathway to facilitate its arrival. Physical connections (i.e., rivers & canals) allow species to move from one lake to another; however, the distances and rate of movement tend to be small and slow. In contrast, the movement of humans across the landscape in pursuit of recreational opportunities (boating and fishing), and any associated "hitchhiker species" occurs over much greater distance and connects formerly unconnected water bodies. For this study, we are performing a vulnerability assessment of invasive species spread across the province and the Great Lakes region, based on two components: (a) identifying which water bodies in Ontario a species could live within, based on a temperature match with the thermal requirements, and (b) identifying which waterbodies are more likely to be recipients of new species, based on human movement patterns that are defined by the distance each waterbody is from human populations (i.e. towns and cities) and the 'attractiveness' of that waterbody for recreational activities.

Using the Intergovernmental Panel on Climate Change's suite of climate models predicting temperatures over the next 100 years, we matched the province's temperature projections with a given species thermal requirements for survival (temperatures must be less than the species' thermal maximum), reproduction (temperatures must reach the appropriate temperatures for spawning and egg development), and growth. We combined this potential habitat map for the species with predictions of lake accessibility and attractiveness (risk of introduction) to create projections of the likelihood of spread for species already present in the Great Lakes (e.g., Round Goby, Fig. 9.10.1) and the likelihood of arrival and establishment of species of concern (e.g., Asian carps, Northern Snakehead). We have also developed models for general categories of cold, cool, and warm water fish to allow us to understand the vulnerability for all possible invaders. Results of our analyses will help resource managers and planners identify areas of high risk for establishment of invasive fishes, and in understanding the relative importance of climate vs human facilitated transport in contributing to the rate and range for these species.

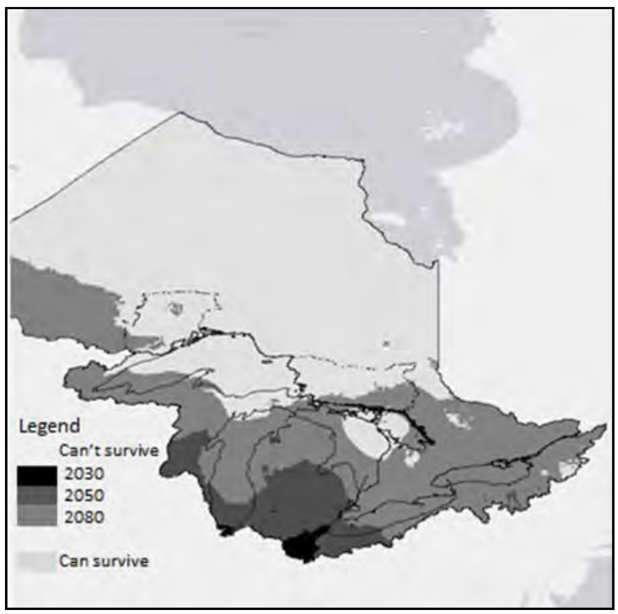


FIG. 9.11.1. Potential range of Round Goby *Neogobius melanostomus* in Ontario under different climate change projections. Based on thermal criteria alone, the entire province could be colonised by Round Goby (light grey). This range will actually become reduced along the southern boundary as projected temperatures become too warm to allow Round Goby to flourish.

9.12 Coastal Wetland Survey of Muskrat Houses

J.P. Holden, Lake Ontario Management Unit
J. Bowman, and *C. Sadowski*, Wildlife Research and Monitoring Section, MNRF

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 and as a result are often considered an indicator of ecosystem health. The objectives of this survey are to assess the muskrat populations and their relationship to water levels in selected wetlands along the north shore of Lake Ontario and in the Bay of Quinte.

During the winter of 2014, a total of 47 wetlands were surveyed by Central Lake Ontario Conservation Authority, Quinte Conservation, Cataraqui Region Conservation Authority, Wildlife Research and Monitoring Section (WRMS, MNRF) and Lake Ontario Management Unit. Wetlands were assessed through a survey of 10 one-hectare plots randomly assigned within a wetland. This provided 470 hectares of wetland intensively surveyed for muskrat houses as well as descriptions of wetland habitat characteristics including identification of invasive plant species such as Phragmites. Additional houses encountered within the wetland were inventoried but were not included in the water level analysis. Detailed measurements of size and construction material were made on 160 muskrat houses and 67 feeding pop ups.

In addition to the field survey, aerial photography was obtained for 30 wetlands. Imagery was obtained as part of a three phase project to evaluate the optimal season and photo resolution for image acquisition and compare effectiveness of ground versus aerial inventory. Image interpretation and analysis is ongoing in partnership with WRMS.

Muskrat house density was calculated based on only houses observed within the 10 hectare random survey area of each wetland (Fig. 9.12.2). The highest density of muskrat houses observed was 2.4 houses per hectare found in Cranberry Marsh. The next highest was Westside Marsh with 1.2 houses per hectare. Only 17 wetlands had houses that were found within the random study plots and there were 22 wetlands where no houses were incidentally observed or found within the random plots.

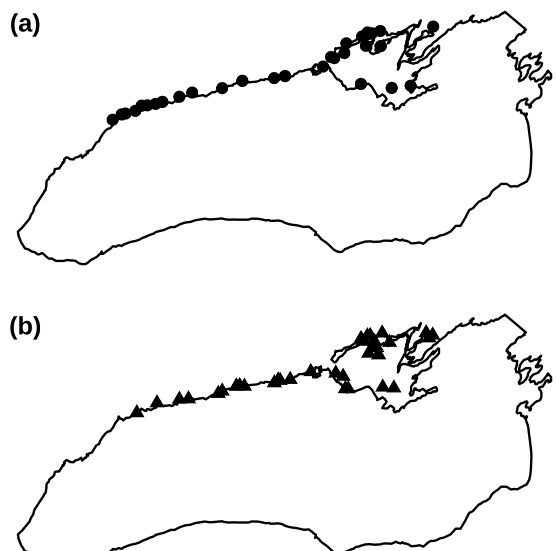


FIG. 9.12.1. . Lake Ontario coastal wetlands that were surveyed during the winter of 2014 using ground surveys (Panel A) and by aerial photography (Panel B).

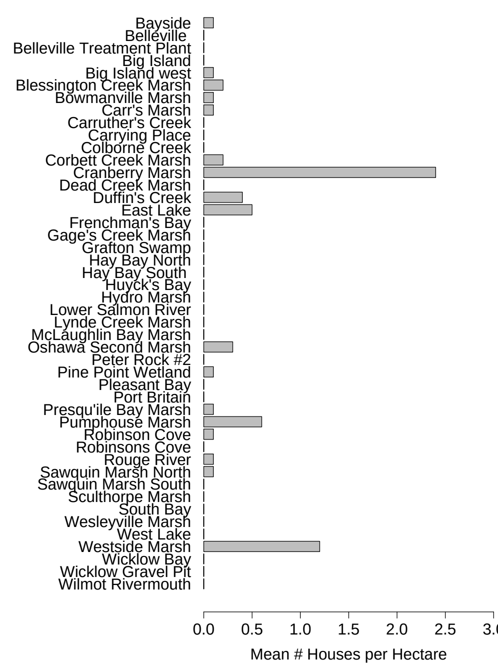


FIG. 9.12.2. Muskrat house density (houses/hectare) across selected Lake Ontario coastal wetlands based on a survey of 10 random one hectare quadrats per site.

10. Partnerships

10.1 Walleye Spawn Collection

J.A. Hoyle, Lake Ontario Management Unit

In April 2014 the Lake Ontario Management Unit worked in conjunction with MNRF's White Lake Fish Culture Station (FCS) to collect Walleye gametes. A similar project was conducted in spring 2013. In 2014, a combination of NSCIN trap nets (6 ft nets) and two larger trap nets (10 ft and 12 ft) were used. Trap nets were set shortly after ice-out in shoreline areas thought to be inhabited by Walleye staging to spawn (Fig. 10.1.1). Netting took place from April 14-24. Water temperature ranged from 1.6-6.0 over this time period. Walleye, in spawning condition, were brought, by boat, to the Glenora Fisheries Station. White Lake FCS staff collected gametes from 56 Walleye pairs. A total of 6.4 million eggs were collected.

Walleye gametes collected in 2014 will be used to help re-fresh the captive Walleye broodstock at the White Lake FCS, and to supply walleye fingerlings for stocking in inland lakes. The 2014 spawn collection will also provide wild gametes for restoration Walleye stocking in Hamilton Harbour.

Eighteen species and a total of 1,127 fish including 601 Walleye were caught (Table 10.1.1). Other commonly caught species included: White Sucker (183), Yellow Perch (93), White Perch (48), Cisco (36), Freshwater Drum (35), Northern Pike (26), and Lake Whitefish (24).

The size distribution of 438 Walleye measured for fork length is shown in Fig. 10.1.2.

Walleye sex (male, female, immature) and state of maturity information is shown in Table 10.1.2.

FIG. 10.1.1. Walleye egg collections trap net site locations, 2014

TABLE 10.1.1. Summary of fish captured (18 species) during Walleye egg collection , April 2014.

Species	Total catch
Longnose gar	6
Bowfin	8
Rainbow trout	1
Lake whitefish	24
Cisco (Lake herring)	36
Northern pike	26
White sucker	183
Brown bullhead	22
Channel catfish	19
American eel	1
White perch	48
Rock bass	7
Pumpkinseed	3
Largemouth bass	6
Black crappie	8
Yellow perch	93
Walleye	601
Freshwater drum	35
Total catch	1,127

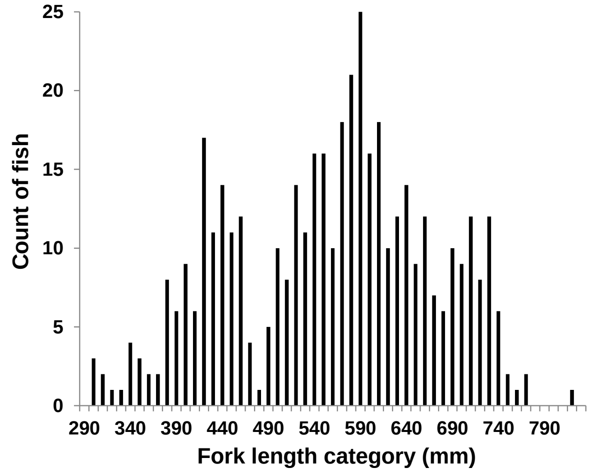


FIG. 10.1.2. Size distribution (10 mm fork length categories) of 438 Walleye caught during the egg collection program, April 2014.

TABLE 10.1.2. Sex and gonad classification (based on external characteristics) for 438 Walleye observed during the 2014 Walleye egg collection program.

Gonad condition	Sex			Total
	Male	Female	Unknown	
Immature	1	15	75	91
Green	-	81	-	81
Ripe	89	100	-	189
Spent	7	70	-	77
Total	97	266	75	438

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

C. Lake, Lake Ontario Management Unit

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

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

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

In 2014, Banded Killifish (*Fundulus diaphanus*), Yellow Perch (*Perca flavescens*) and Blackchin Shiner (*Notropis heterodon*) were the most abundant species encountered during the survey, collectively making up 68% of the total catch. Six YOY Muskellunge were captured in 2014, just below the long-term annual average for this program (Table 10.2.1).

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

TABLE 10.2.1. Summary statistics of the St. Lawrence River seining program, 1989-2014.

Year	Muskellunge Captured	Species Captured	Number of Fish Captured	Number of Seines	Catch per Seine
1989	6	19	4,756	26	183
1990	16	16	3,842	58	66
1991	2	30	4,559	31	147
1992	11	32	4,151	21	198
1993	4	27	5,907	22	269
1994	6	21	3,102	15	207
1995	15	26	3,427	16	214
-----	-----	-----	-----	-----	-----
2005	13	27	8,624	122	71
2006	2	27	4,874	55	89
2007	7	28	4,836	45	107
2008	8	36	6,558	57	115
2009	8	34	6,690	41	163
2010	5	33	7,083	53	134
2011	5	32	8,445	50	169
2012	2	33	5,452	45	121
2013	1	29	3,827	31	123
2014	6	36	7,162	25	286
Mean	7	29	5,488	42	157
Total	117	-	93,295	713	-

11. Staff 2014

PROVINCIAL SERVICES DIVISION

Fish and Wildlife Service Branch
Lake Ontario Management Unit

Andy Todd	Lake Manager
Dawn Young	Administrative Assistant (Acting)
Alastair Mathers	Assessment Supervisor (Acting)
Dr. 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
Jeremy Holden	Assessment Biologist
Mike Yuille	Research Biologist, Assessment Biologist (Acting)
Marc Desjardins	Management Biologist
Evan Hall	Lake Ontario Aquatic Ecologist Intern
Ron Green	Great Lakes Fisheries Technician/ Lake Ontario Aquatic Ecologist Intern
Dale Dewey (retired)	Operations Supervisor (Acting)
Steve McNevin	Operations Coordinator (Acting)
Kelly Sarley	Support Services/Data Technician
Sonya McMillian	Senior Technician Base Operations
Ben Maynard	Great Lakes Technician
Jon Chicoine	Vessel Master
Nina Jakobi	Great Lakes Technician
Alan McIntosh	Boat Captain
Gord Meadows (LOA)	Great Lakes Fisheries Technician
Tim Dale	Great Lakes Fisheries Technician
Amy McPherson	Great Lakes Fisheries Technician
Trent Haggarty	Great Lakes Fisheries Technician
Callie Moore	Great Lakes Fisheries Technician
Daniel Jang	Great Lakes Fisheries Technician
Tyson Scholz	Great Lakes Fisheries Technician
Megan Smith	Great Lakes Fisheries Technician
Mary Hanley	Student Biologist, Great Lakes Fisheries Technician
Aaron Law	Great Lakes Fisheries Technician (Aurora District)
Kurtis Plourde-Rideout	Great Lakes Fisheries Technician (Aurora District)
Grant Fortin	Great Lakes Fisheries Technician (Aurora District)
Kody Adams	Student Fisheries Technician/ Great Lakes Fisheries Technician
Tysan Dowdle	Student Fisheries Technician
Scott Brown	Student Fisheries Technician
Colleen Burliuk	Student Fisheries Technician
Alex Bowlby	Coop Student

Enforcement Branch

Kyle Cachagee	Enforcement Manager, Peterborough District
Jeff Fabian	Conservation Officer

Science and Research Branch
Aquatic Research and Monitoring Section

Dr. Tim Johnson	Research Scientist
Brent Metcalfe	Research Biologist
Shannon Fera	Research Biologist (Invasive Species)
Nick Kelly	Research Biologist (Salmonid Ecology)
Julie Munro	Research Biologist (Food Web Ecology)
Jaclyn Brown	Research Technician
Vanessa Bourne	Research Technician
Megan Murphy	Co-op Student/Research Technician
Amanda Boyd	Volunteer
Les Stanfield	Senior Research Biologist

12. Operational Field and Lab Schedule, 2014

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

Field and Lab Projects	Dates	Species Assessed, Monitored or Stocked	Project Lead	Operational Lead	Funding source
Bay of Quinte Ice Angling Survey	Jan-Feb	Walleye and Perch	Hoyle	McNevin	SPA
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	Dale	OPG
Chinook Salmon Mark/Tag Monitoring	Apr-Sep	Salmon and Trout	Bowlby	Hall	SPA
Juvenile Chinook Assessment	May	Juvenile Chinook Salmon	Bowlby	Smith	SPA
Duffins Creek Weir (adult atlantic salmon Assessment)	May-Nov	Adult Atlantic Salmon	Stewart	Portiss	TRCA/GLFC
Entrapment Gear Turtle Monitoring	May-June	Turtles / Fishing Gear	Mathers	Hanley	SPA
Credit River Fishway	June-Nov	Adult Atlantic Salmon	Heaton	Heaton	COA
Salmonid Ecology Project	May-Oct	Salmon and Trout	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
Hamilton Harbour Nearshore Community Index Netting	Aug	Nearshore Fish Community	Hoyle	Dale	COA
Upper Bay of Quinte Nearshore Community Index Netting	Sep	Nearshore Fish Community	Hoyle	Dale	COA
Toronto Harbour Nearshore Community Index Netting	Sep	Nearshore Fish Community	Hoyle	Maynard	COA
St. Lawrence River Fish Community Index Netting - Lake St. Francis	Sep	Fish Community	Hoyle	Jakobi	COA
Lake Ontario Tributary Angling Survey	Sep-Dec	Salmon and Trout	Yuille	McNevin	SPA
Credit River Chinook Assessment and Egg Collection	Oct	Chinook Salmon	Bowlby	McNevin	SPA
Credit River Juvenile Atlantic Salmon Electrofishing	Oct	Juvenile Atlantic Salmon	Bowlby	Maynard	COA
Deepwater Cisco Stocking	Nov	Deepwater Cisco	Lake	Chicoine	SPA
Commercial Catch Sampling	Oct-Nov	Lake Whitefish	Hoyle	Jakobi	SPA
Round Whitefish Spawning Location Identification	Nov-Dec	Round Whitefish	Hoyle/Desjardins	McNevin	SPA
Age and Growth	Year-round	Multiple Species	Multiple	McNevin	SPA/COA

13. Primary Publications of Glenora Fisheries Station Staff[1] in 2014

Carreon-Martinez, L.B., Wellband, K.W., **Johnson, T.B.**, Ludsin, S. A., Heath, D.D. 2014. Novel molecular approach demonstrates that turbid river plumes reduce predation mortality on larval fish. Mole. Ecol. 23: 5366-5377.

Chaput, G., Pratt, T.C., Cairns, D.K., Clarke, K.D., Bradford, R.G., **Mathers, A.**, and Verreault, G. 2014. Recovery Potential Assessment for the American Eel (*Anguilla rostrata*) for eastern Canada: description and quantification of threats. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/135. vi + 90 p.

Hebert, C.E., Chao, J., Crump, D., **Johnson, T.B.,** Rudy, M.D., Sverko, E., Williams, K., Zaruk, D., Arts, M.D. 2014. Ecological tracers track changes in bird diets and possible routes of exposure to Type E Botulism. J. Great Lakes Res. 40: 64-70.

Muir, A.M., Sutton, T.M., Koops, M.A., **Johnson, T.B.**, Krueger, C.C., Arts, M.T.. 2014. Reproductive life-history strategies in lake whitefish. Can. J. Fish. Aquat. Sci. 71: 1256-1269.

Paterson, G., Rush, S.A., Arts, MT., Drouillard, K.G., Haffner, G.D., **Johnson, T.B.**, Lantry, B.F., Hebert, C.E., McGoldrick, D.J., Backus, S.M., and Fisk, A.T. 2014. Ecological tracers reveal resource convergence among prey fish species in a large lake ecosystem. Freshwat. Biol. 59: 2150-2161.

Pratt, T.C., Bradford, R.G., Cairns, D.K., Castonguay, M., Chaput, G., Clarke, K.D., and **Mathers, A.** 2014. Recovery Potential Assessment for the American Eel (*Anguilla rostrata*) in eastern Canada: functional description of habitat. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/132. v + 49 p.

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

50968
(0.2 k P.R., 15 03 21)
ISSN 1201-8449