LAKE ONTARIO FISH COMMUNITIES AND FISHERIES:

2010 ANNUAL REPORT OF THE LAKE ONTARIO MANAGEMENT UNIT

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Lake Ontario Fish Communities and Fisheries: 2010 Annual Report of the Lake Ontario Management Unit

Foreword

The Lake Ontario Management Unit (LOMU) is pleased to release its Annual Report of assessment and management activities carried out during 2010.

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 management today requires a pragmatic approach that recognizes the changes that have occurred and the current state of the ecosystem. Managers must 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.

Despite dramatic changes, the Lake Ontario ecosystem is resilient and continues to support an important and world-class fishery valued at over $100 million. In 2010, the Lake Ontario recreational fishery produced Chinook salmon up to 40 lb, and anglers reported excellent catches of rainbow trout, Coho salmon and brown trout. Atlantic salmon, once native to Lake Ontario but now locally extinct, are being reintroduced in an effort to improve native biodiversity and ecosystem health. The Bay of Quinte and the St. Lawrence River are famous for walleye, perch and other pan-fish, bass, and muskellunge. The subsistence fishery is culturally important and provides a traditional food source for several communities. The commercial fishery has declined in recent years; however, it continues to help support the local economy and provides a wholesome local food source. The Lake Ontario and St. Lawrence River commercial fishery harvested over 600,000 lb of locally caught fish with a landed value of over $700,000.

LOMU continues to work closely with Canadian federal agencies, First Nations, provincial governments, various U.S. federal and state agencies, and non-government partners to develop and implement plans to protect and restore native species and to maintain sustainable commercial and recreational fisheries.

We express our sincere appreciation to the many partners and volunteers who contributed to the successful delivery of LOMU initiatives. 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 OFAH, the Metro East Anglers and many other volunteers, and the anglers that participated in the diary and assessment programs.

Our team of skilled and committed staff 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 2010.

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1. Status of Major Species

The following is an overview of the status of major species in Ontario waters of Lake Ontario for 2010. The overview draws largely upon information presented in the chapters and sections that follow in this report. The fish communities of Lake Ontario continue to respond to changes in the ecosystem attributed to the effects of dreissenid mussels and other stresses.

1.1 Chinook Salmon

Growth and condition of age-2 and age-3 Chinook salmon in the Credit River increased in 2010 and were generally as high as or higher than long term averages since 1989 (see Section 2.8). Estimates of wild production of Chinook salmon in Lake Ontario were consistent in index gillnets and angler catches (44% and 35% for the 2008 and 2009 year classes, respectively, see Section 3.1) based on mass fin clipping of all stocked fish since 2008. Wild Chinook salmon production in the Credit River was considerably lower (17% and 9% for the 2008 and 2009 year classes, respectively; see Section 2.8). Lamprey marking on Chinook salmon was elevated compared with the past three decades but still remains low compared with the 1970s (see Section 2.8). Although current prey fish populations support increased growth of Chinook salmon at densities elevated by natural reproduction, declining alewife production puts the long term stability of the fish community in question.

1.2 Rainbow Trout

Counts of wild rainbow trout at the Ganaraska River fishway have been stable since 1998, with a slight increase in 2010. This increase is consistent with higher catches of rainbow trout in recent New York and Ontario angler surveys, and may be related to size restrictions on angler harvest of rainbow trout in New York waters of Lake Ontario and to increased predation of salmon and trout on round gobies in recent years. Condition of rainbow trout in the Ganaraska River in 2010 increased from the previous 3 years and is close to the long term average (see Section 2.1). Lamprey marks on rainbow trout continue to be a concern as they remain comparable with levels observed in the 1970s before lamprey control (see Section 2.1).

1.3 Lake Trout

The abundance of adult lake trout remains low, however, after several years of improved early-life survival of stocked fish, there are signs of improvement in the adult population (see Section 2.2).

1.4 Lake Whitefish

Abundance of lake whitefish in assessment gillnets is very low (see Section 2.2). Many strong year-classes produced in the late 1980s and early 1990s are aging and declining in both assessment gillnets (see Section 2.2) and commercial gear (see Section 4.2). Reproductive success was very low after the mid 1990s until a strong year-class was produced in 2003 (see Section 2.3). Growth of these young fish is very slow and age-at-maturity is delayed by at about two years. The condition of lake whitefish caught in summer assessment gillnets improved after the mid to late 1990s but condition of fish caught during the fall remained low. Commercial lake whitefish harvest in 2010 (43,236 lb) was down compared to 2009 due primarily to decreased fishing effort (see Section 4.1 and 4.2).

1.5 Northern Pike

Northern pike, while not abundant in the open waters of Lake Ontario are common in many embayment and nearshore areas (see Sections 2.2, 2.3 and 2.5). There has been a further decrease in the abundance of northern pike in Lake St. Francis (see Section 2.6).

1.6 Muskellunge

The muskellunge is an important native species and top predator in the St. Lawrence River ecosystem. A significant mortality event in the spring of 2005 and 2006, related to viral hemorrhagic septicemia (VHS), has caused concern over the status of St. Lawrence River muskellunge . MNR is examining muskellunge management options with the

FMZ20 Council which may include increased minimum size limits, to protect large spawning fish, and public education. MNR is continuing to work with partners to identify and protect muskellunge spawning and nursery habitats in the St. Lawrence River (see Section 11.1)

1.7 American Eel

The total number of eel migrating upstream at the ladders, located at the Moses-Saunders Hydroelectric Dam on the St. Lawrence River has been increasing since 2001; however, the number is still less than 3% of the migrations observed during the 1970s and 1980s. Even with the closure of the commercial fishery (2004), the abundance of large yellow eels in the Lake Ontario/upper St. Lawrence River ecosystem remains low. Ontario Power Generation (OPG) stocked eels into the upper St. Lawrence River and the Bay of Quinte (see Sections 8.1 and 8.2) and initial results suggest that stocked eels are surviving well, growing quickly and that they are dispersing from stocking sites. Some stocked eels are maturing into males and migrating at a small size; this has not been observed before. Ontario is continuing to work with other management agencies and stakeholders to encourage the safe passage of eels around hydro dams. OPG conducted a pilot project to trap large yellow eels and release them below all barriers to downstream migration. Preliminary results of this project suggest that some of the transported eels do migrate towards the spawning grounds which should contribute to the global spawning stock. Sustainable management practices throughout the range of this panmictic species will be required to restore eel abundance in North America (see Section 8.2).

1.8 Smallmouth Bass

Assessment gillnet and nearshore trapnet indices indicate that smallmouth bass remain at low to moderate abundance levels in the nearshore areas of Lake Ontario (see Section 2.2 and Section 2.5). The smallmouth bass population in Lake St. Francis decreased in 2010 (see Section 2.6).

1.9 Largemouth Bass

Assessment trapnet information indicates that largemouth bass abundance increased in the Bay of Quinte following increases in water transparency and aquatic vegetation in the late 1990s. Their current level of abundance exceeds that of walleye in upper Bay of Quinte nearshore areas. Largemouth bass are moderately abundant in other embayment areas of Lake Ontario (see Section 2.5).

1.10 Panfish

Panfish, particularly pumpkinseed, bluegill and black crappie, increased after re-establishment of submerged aquatic macrophytes in the Bay of Quinte (see Sections 2.2 and 2.3). These events were associated with post-dreissenid mussel invasion in the 1990s. Panfish are also common in other Lake Ontario embayments and nearshore areas (see Section 2.5). Together, these panfish species now form a significant component of the commercial fishery; second only to yellow perch in terms of dollar value (see Section 4.1).

1.11 Yellow Perch

Yellow perch is one of the most common species in the nearshore areas. Current perch abundance in Lake Ontario is low to moderate compared to past levels (see Section 2.2). Abundance is relatively high in the Bay of Quinte (see Sections 2.2 and 2.3). Abundance of yellow perch in Lake St. Francis remains high (see Section 2.6). Yellow perch commercial harvest in 2010 was similar to that for 2009 in Lake Ontario and the St. Lawrence River (see Section 4.1). Yellow perch are currently the most valuable species in the commercial fishery.

1.12 Walleye

The eastern Lake Ontario/Bay of Quinte walleye population has been stable since 2001 (Section 2.2 and 2.3). Assessment gillnet abundance indices for juvenile (age-1 to age 4) and mature walleye indicate that the walleye population has stabilized or increased slightly following their steady decline throughout the 1990s. Recruitment indices, based on young of year catch in bottom trawls, indicate that a strong year-class was produced in 2003, and that above average (i.e. average for the last ten years) year-classes were produced in 2007 and 2008. Catches at

age-1 in assessment gillnets suggest that the 2004 year-class is weaker and the 2005 year-class stronger than first indicated by the trawls. The 2003, 2005, 2007 and 2008 year-classes also figure prominently in most assessments. The 2009 and 2010 year-classes are of moderate abundance. Based on these recent recruitment levels, the walleye population should remain stable or increase, at least through the next few years. The walleye population in Lake St. Francis continues to improve (see Section 2.6).

1.13 Prey Fish

The hydroacoustic survey of prey fish was not conducted in 2010 due to weather and scheduling problems.

1.14 Round Goby

Round goby invaded Lake Ontario in the late 1990s and first appeared in routine Bay of Quinte assessment bottom trawls in 2001 and gillnets in 2002. Goby distribution expanded to include all areas of eastern Lake Ontario and the Bay of Quinte to depths of at least 36 m by 2006. Goby abundance appears to have peaked and declined in the Bay of Quinte. In Lake Ontario, abundance has remained high and stable or increased over the last three years (see Sections 2.2 and 2.3).

2. Index Fishing Projects

2.1 Ganaraska Fishway Rainbow Trout Assessment

The fishway on the Ganaraska River at Port Hope has been in operation since 1974. Prior to 1987 counts of rainbow trout were complete, based on hand lift and visual counts. Since 1987 fish counts were made with a Pulsar Model 550 conductivity type fish counter. Estimates of fish missed by the counter were made through calibration with visual counts. In 2010 a significant number of rainbow trout were observed entering the fishway prior to installation of the fish counter on March 18. Estimates of the run prior to installation of the counter were made by modelling the relationship of rainbow trout counts with maximum air temperature and stream flow. This model is still under development and the estimates were conservative by design. The count of rainbow trout in the spring run has been stable since 1998, and in 2010 was 6,923 fish (Table 2.1.1), the highest value since 1997 (Fig. 2.1.1).

Rainbow trout were measured and weighed during the spawning run. Rainbow trout body condition was determined as the estimated weight of a 635 mm (25 in) fish at the Ganaraska River. In 2010, the weights of male (3,072 g) and female (3,139 g) rainbow trout were significantly greater (P<0.05) than in 2007, 2008 or, 2009, and were close to the long-term average for the data (Table 2.1.2).

In 2010, lamprey marks on rainbow trout in the Ganaraska River declined 17% to 0.528 marks/fish (Table 2.1.3), and still remained more than three times higher than the average for 1990-2003 (Fig. 2.1.2). The marking rates from 2004-2010 were similar to levels in the 1970s (Fig. 2.1.2). A high incidence of A1 and B1 marks[1] since 2004 indicated very recent attacks relative to rainbow trout migrating into the Ganaraska River (Table 2.1.4).

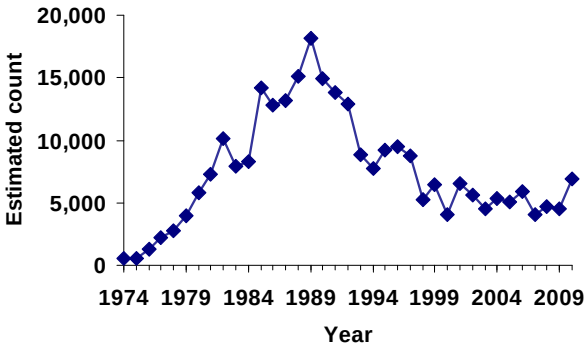

FIG. 2.1.1. Estimated upstream counts of rainbow trout at the Ganaraska River fishway at Port Hope, Ontario during spring, 1974 to 2010. Estimates for 1980, 1982, 1984, 1986, 1992, and 2002 were determined from adjacent years with virtual population analysis.

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

TABLE 2.1.1. Observed and estimated upstream counts of rainbow trout at the Ganaraska River fishway at Port Hope, Ontario during spring, 1974-2010. Observed counts are the sum of hand lifted fish and visual or electronic counts. As electronic counts are biased low, they were scaled based on simultaneous visual and electronic counts to obtain estimated counts.

Year	Observed count	Estimated count
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

TABLE 2.1.2. Estimated weight of a 635 mm (25 in) rainbow trout at the Ganaraska River fishway at Port Hope, Ontario during spring, 1974-2010.

	Male		Female	
Year	Weight (g)	Sample size	Weight (g)	Sample size
1974	3,069	173	3,214	231
1975	2,971	183	3,070	279
1976	3,171	411	3,326	588
1977	2,978	635	3,166	979
1978	3,183	255	3,341	512
1979	3,221	344	3,337	626
1981	3,176	252	3,360	468
1983	2,879	308	3,032	132
1984			3,178	120
1985	3,171	410	3,205	154
1987	2,643	66	3,046	74
1990	2,868	259	3,071	197
1991	2,851	126	3,087	289
1992	2,998	138	3,113	165
1993	2,952	84	3,135	166
1994	3,247	109	3,357	178
1995	2,960	146	3,077	154
1997	3,143	140	3,269	127
1998	3,035	96	3,195	222
1999	3,063	173	3,226	290
2000	3,120	121	3,241	226
2001	2,919	295	3,040	290
2003	3,034	92	3,151	144
2004	3,054	143	3,184	248
2005	2,985	142	3,109	173
2006	3,024	101	3,137	217
2007	2,922	75	3,006	132
2008	2,889	125	3,012	148
2009	2,905	74	3,017	209
2010	3,072	72	3,139	156
Average	3,017		3,161	

TABLE 2.1.3. Lamprey marks on rainbow trout in spring, 1974-2010, at the Ganaraska River fishway, in Port Hope, Ontario. Since 1990, A1 and A2 marks[1] were called wounds and the remainder of marks was called scars to fit with historical classification.

Year	Wounds per fish	Scars per fish	Marks per fish	% with wounds	% with scars	% with marks	N
1974	0.083	0.676	0.759	7.0	33.2	36.8	527
1975	0.095	0.725	0.820	8.0	37.2	40.2	599
1976	0.090	0.355	0.445	6.6	23.3	28.1	1280
1977	0.076	0.178	0.254	6.4	13.5	18.2	2242
1978	0.097	0.380	0.476	8.1	28.4	33.7	2722
1979	0.122	0.312	0.434	10.3	22.8	29.8	3926
1981			0.516			36.2	5489
1983	0.113	0.456	0.569	9.7	33.4	38.8	833
1985	0.040	0.154	0.193	3.7	11.5	14.5	1256
1990	0.015	0.087	0.102	0.0	0.1	0.1	470
1991	0.012	0.091	0.103	1.2	7.4	8.4	419
1992	0.035	0.162	0.197	2.9	14.3	16.5	315
1993	0.034	0.165	0.199	3.1	15.3	17.2	261
1994	0.027	0.156	0.183	0.0	0.1	0.2	301
1995	0.017	0.046	0.063	1.7	4.3	5.9	303
1996	0.023	0.030	0.053	2.3	3.0	5.3	397
1997	0.017	0.158	0.175	1.7	12.7	13.7	291
1998	0.035	0.162	0.197	0.0	0.1	0.2	340
1999	0.015	0.199	0.214	0.0	0.2	0.2	477
2000	0.005	0.272	0.278	0.5	23.2	23.5	371
2001	0.028	0.229	0.257	2.5	17.8	18.8	608
2003	0.017	0.176	0.193	1.7	14.3	15.1	238
2004	0.079	0.464	0.543	6.9	33.7	37.5	392
2005	0.084	0.579	0.664	6.9	39.6	41.4	321
2006	0.088	0.577	0.665	6.9	40.1	44.5	319
2007	0.068	0.665	0.733	5.3	46.6	49.0	206
2008	0.113	0.843	0.956	8.8	48.5	51.5	274
2009	0.142	0.491	0.633	12.5	36.3	42.2	289
2010	0.048	0.481	0.528	3.0	36.4	38.1	231

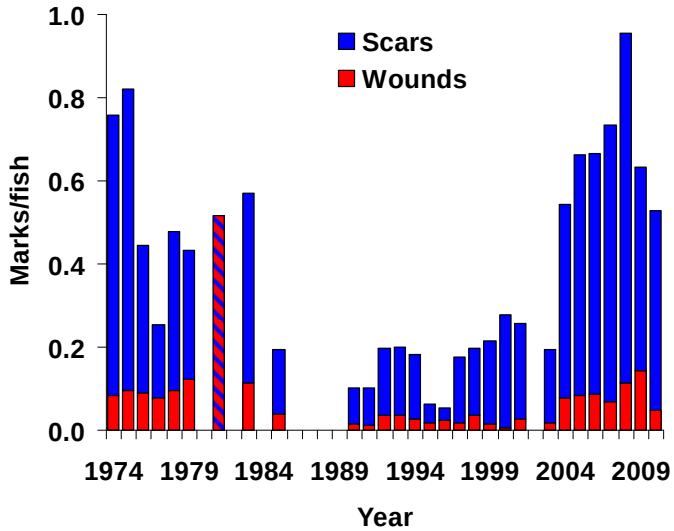

FIG. 2.1.2. Lamprey mark trends on rainbow trout in spring, 1974-2010, at the Ganaraska River fishway, in Port Hope, Ontario. Since 1990, A1 and A2 marks[1] were called wounds and the remainder of marks were called scars to fit with historical classification. Scars and wounds were combined in 1981.

TABLE 2.1.4. Classification of lamprey marks[1] on rainbow trout in spring, 1990-2010, at the Ganaraska River fishway, in Port Hope, Ontario.

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

2.2 Eastern Lake Ontario and Bay of Quinte Fish Community Index Gillnetting

Bottom set gillnets have been used at fixed index netting sites (Fig. 2.2.1) in eastern Lake Ontario (ranging in depth from 2.5-140 m) and the Bay of Quinte (ranging in depth from 5-45 m) annually beginning with the Hay Bay site, in the Bay of Quinte, in 1958. Gillnets are multi-paneled with mesh sizes ranging from 1½-6 inch (½ inch increments) stretched mesh. Monofilament mesh replaced multifilament in 1992. The gillnetting program is used to monitor the abundance of a variety of warm, cool and cold-water

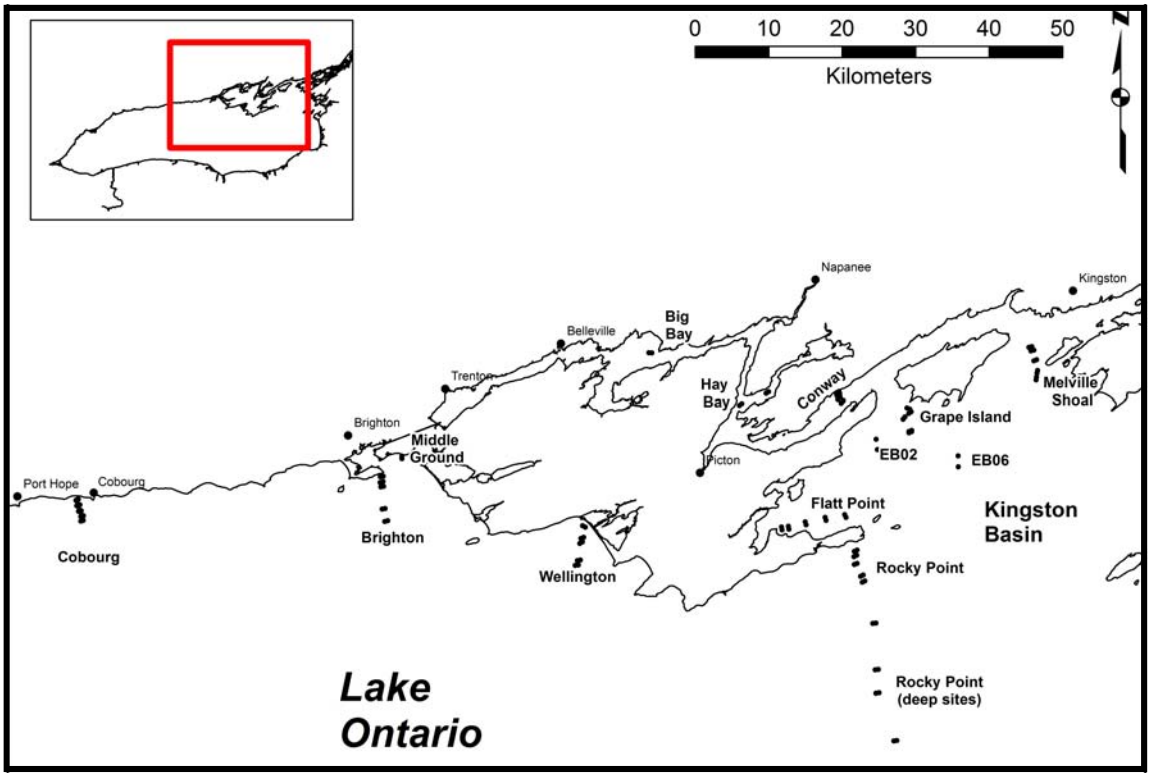

FIG. 2.2.1. Map of northeastern Lake Ontario. Shown are eastern Lake Ontario and Bay of Quinte fish community index gillnetting sites.

fish species in the eastern Lake Ontario and Bay of Quinte.

Species-specific catches in the gillnetting program are shown by geographic region in Tables 2.2.1-2.2.8 for 1992-2010. Each gillnet catch was standardized to represent the total number of fish in 100 m of each mesh size and summed across the ten mesh sizes from 1½-6 inch. Twenty-five different species and over thirty-four thousand individual fish were caught in 2010. About 89% of the catch was alewife.

Some biological information is also presented below for selected species including lake whitefish, walleye, round goby, lake herring and lake trout.

Lake Ontario

Cobourg

Ten species were caught at Cobourg in 2010. The most abundant species was alewife. Coldwater species, including Chinook salmon, rainbow trout, brown trout, lake trout and round whitefish figured prominently in the catch (Table 2.2.1).

TABLE 2.2.1. Species-specific catch per gillnet set at Cobourg, Lake Ontario, 2010. June and August catches are averages for 2 gillnet gangs set at each of 5 depths (range 7.5-27.5 m) during each of 2 (June) of 1 (August) visits. The total number of species caught and gillnets set each month are indicated.

	Month	
Species	June	August
Alewife	3,206.4	533.8
Chinook salmon	0.7	12.0
Rainbow trout	-	10.1
Brown trout	-	2.6
Lake trout	3.6	-
Round whitefish	0.3	0.7
White sucker	-	2.0
Yellow perch	1.1	4.3
Walleye	-	0.7
Round goby	16.3	10.9
Total catch	3,228	577
Number of species	6	9
Number of sets	20	10

Middle Ground

Eight species were caught at Middle Ground in 2010. The most abundant species were yellow perch, white

TABLE 2.2.2. Species-specific catch per gillnet set at **Middle Ground**, 1992-2010. Annual catches are averages for 1-3 gillnet gangs set at a single depth (5 m) during each of 2-3 visits to a single site (Middle Ground). The number of species caught and gillnets set each year are indicated.

		Year										
	1992-2000											**2001-2010**
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**
Longnose gar	**-**	-	-	1.6	-	-	-	-	-	-	-	**0.2**
Alewife	**23.7**	5.4	5.4	-	-	-	-	-	5.4	54.3	21.7	**16.5**
Gizzard shad	**2.6**	-	-	-	-	3.3	-	1.6	-	-	1.6	**1.6**
Brown trout	**0.7**	-	-	-	-	-	1.6	-	1.6	3.3	1.6	**0.8**
Lake trout	**5.9**	-	-	-	-	-	1.6	-	-	-	-	**3.0**
Northern pike	**2.3**	-	-	3.3	-	1.6	1.6	9.9	6.6	8.2	1.6	**2.8**
White sucker	**9.2**	9.9	20.2	-	13.7	4.9	8.2	26.3	14.8	6.6	38.3	**11.7**
Common carp	**2.7**	3.3	-	4.9	3.3	-	-	-	-	-	-	**1.9**
Brown bullhead	**9.3**	13.2	3.3	14.2	1.6	10.4	5.4	4.9	1.6	-	-	**7.4**
White perch	**0.5**	-	-	-	-	-	-	-	-	-	-	**0.3**
Rock bass	**9.7**	7.1	1.6	3.3	4.9	3.3	-	7.1	-	-	1.6	**6.3**
Pumpkinseed	**1.2**	-	-	-	-	-	-	-	-	-	-	**0.6**
Bluegill	**0.4**	-	-	-	-	-	-	-	-	-	-	**0.2**
Smallmouth bass	**0.1**	-	-	-	1.6	-	-	1.6	-	-	-	**0.2**
Largemouth bass	**0.4**	-	-	-	-	-	-	-	-	-	-	**0.2**
Yellow perch	**372.9**	285.4	400.7	170.1	448.2	193.0	695.6	192.5	291.8	149.0	89.7	**332.3**
Walleye	**16.0**	1.6	3.3	6.6	3.3	4.9	8.2	23.0	4.9	4.9	1.6	**11.1**
Freshwater drum	**3.8**	-	1.6	-	19.7	1.6	-	3.3	-	3.3	-	**3.4**
Total catch	**461**	326	436	204	496	223	722	270	327	230	158	**400**
Number of species	**8**	7	7	7	8	8	7	9	7	7	8	**8**
Number of sets		4	4	4	4	4	4	4	4	4	4	

TABLE 2.2.3. Species-specific catch per gillnet set in **Northeastern Lake Ontario**, 1992-2010. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (range 7.5-27.5 m) during each of 2-3 visits to each of 3 sites (Brighton, Wellington and Rocky Point shallow sites). The total number of species caught and gillnets set each year are indicated.

		Year										
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**
Alewife	**423.0**	385.6	657.0	396.9	474.0	916.2	773.4	307.9	877.1	1,829.3	2,073.0	**869.0**
Gizzard shad	**1.0**	-	-	-	-	-	-	-	-	-	0.3	**0.0**
Coho salmon	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
Chinook salmon	**2.7**	0.4	1.4	4.1	4.8	1.5	1.5	2.3	2.0	0.1	3.3	**2.1**
Rainbow trout	**-**	-	-	-	-	-	0.1	-	-	-	0.1	**0.0**
Atlantic salmon	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
Brown trout	**0.7**	0.3	3.3	1.2	1.9	1.0	1.3	0.7	2.6	1.3	7.9	**2.1**
Lake trout	**40.4**	11.8	8.9	3.0	7.5	1.3	3.2	1.1	0.7	0.8	1.1	**3.9**
Lake whitefish	**3.8**	0.4	0.1	0.8	0.2	0.1	0.2	0.1	0.5	1.0	-	**0.4**
Cisco (Lake herring)	**0.6**	-	-	0.1	-	0.2	0.3	0.1	0.5	0.2	0.1	**0.2**
Round whitefish	**2.7**	-	0.5	0.1	0.1	-	-	-	-	-	-	**0.1**
Chub	**-**	0.4	-	-	-	-	-	-	-	-	-	**0.0**
Rainbow smelt	**0.5**	-	-	-	-	-	-	-	0.5	0.2	0.6	**0.1**
Northern pike	**0.2**	-	-	0.2	-	0.2	-	0.4	0.1	0.1	-	**0.1**
White sucker	**1.0**	0.1	0.2	-	0.5	0.3	0.1	0.4	-	-	0.1	**0.2**
Greater redhorse	**-**	-	-	0.1	-	-	-	-	-	-	-	**0.0**
Lake chub	**0.3**	-	0.4	-	-	-	-	0.1	-	-	-	**0.0**
Common carp	**0.3**	-	-	0.1	0.2	0.2	-	-	-	-	-	**0.1**
Brown bullhead	**0.2**	1.2	0.7	1.9	0.8	1.1	-	0.5	0.5	0.1	-	**0.7**
Channel catfish	**0.0**	-	-	-	-	-	-	-	-	0.1	-	**0.0**
Stonecat	**0.0**	1.5	0.4	0.1	-	0.2	0.1	0.6	-	-	-	**0.3**
American eel	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
Burbot	**1.3**	0.7	1.3	0.3	0.2	0.7	0.3	0.1	0.1	-	0.2	**0.4**
White perch	**0.1**	-	-	-	-	-	-	-	-	-	-	**-**
Rock bass	**3.3**	1.1	1.9	4.4	2.0	1.6	1.5	2.1	4.9	1.4	2.6	**2.3**
Pumpkinseed	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
Smallmouth bass	**2.7**	1.5	1.4	1.5	1.7	0.9	0.9	1.1	1.2	0.3	1.2	**1.2**
Yellow perch	**96.5**	27.8	14.7	40.5	23.3	34.7	24.2	56.9	49.8	57.8	35.1	**36.5**
Walleye	**3.3**	-	1.1	1.2	3.4	4.4	1.8	3.7	1.6	0.3	1.3	**1.9**
Round goby	**-**	-	-	1.1	2.5	71.3	63.3	162.1	49.8	67.4	52.3	**47.0**
Freshwater drum	**1.4**	0.2	0.2	0.4	1.0	0.1	0.3	0.1	0.4	0.3	0.3	**0.4**
Total catch	**586**	433	693	458	524	1,036	873	540	992	1,961	2,180	**969**
Number of species	**17**	14	16	19	16	18	16	18	17	16	16	**17**
Number of sets		60	60	60	60	60	60	60	60	60	60	

sucker and alewife (Table 2.2.2). Other species caught included gizzard shad, brown trout, northern pike, rock bass and walleye. Yellow perch catches were the lowest on record at Middle Ground. Alewife, a species that was moderately abundant in the early to mid-1990s but not been caught from 2003-2007, reappeared in 2008 and, in 2009 and 2010, returned to the early 1990 levels of abundance.

Northeast (Brighton, Wellington and Rocky Point shallow sites)

Sixteen species were caught in the Northeast Lake Ontario gillnets in 2010. The most abundant species were alewife, round goby, yellow perch, and brown trout (Table 2.2.3). Of these species, alewife, and brown trout were more abundant in 2010 than the 2009 average while round goby and yellow perch were less abundant. The cold-water benthic species, lake trout, lake whitefish and round whitefish, declined markedly over the 1992-2010 time-period. Round goby, caught for the first time in 2003 is now, along with alewife and yellow perch, one of the most abundant species in the northeast region.

Rocky Point—Deep Sites

Netting operations were not completed at the Rocky Point deep sites in 2010 because our vessel was not compliant with Transport Canada Regulations; the sites were too far offshore. With our new vessel, this issue will be resolved for 2011.

TABLE 2.2.4. Species-specific catch per gillnet set in the **Kingston Basin Lake Ontario (nearshore sites)**, 1992-2010. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (range 7.5-27.5 m) during each of 2-3 visits to each of 3 sites (Flatt Point, Grape Island and Melville Shoal). The total number of species caught and gillnets set each year are indicated.

		Year										
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**
Lake sturgeon	**0.1**	0.1	-	0.2	-	-	-	-	-	-	-	**0.0**
Alewife	**574.1**	530.6	130.3	151.0	497.0	1,195.1	1,700.5	825.8	1,734.7	2,295.7	4,301.7	**1,336.2**
Gizzard shad	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
Chinook salmon	**0.5**	-	-	-	0.8	0.4	-	0.4	-	-	0.1	**0.2**
Rainbow trout	**-**	-	-	-	-	-	-	0.1	-	-	-	**0.0**
Brown trout	**0.1**	0.2	-	-	0.1	0.1	0.5	-	0.4	0.1	0.7	**0.2**
Lake trout	**47.5**	6.3	3.0	3.8	2.5	2.3	1.1	4.0	2.6	6.3	3.0	**3.5**
Lake whitefish	**18.9**	10.7	6.8	2.9	6.1	1.4	0.7	3.4	1.9	0.5	0.8	**3.5**
Cisco (Lake herring)	**2.4**	-	-	0.2	-	0.1	-	-	-	-	0.8	**0.1**
Round whitefish	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
Coregonus sp.	**0.1**	0.1	-	-	-	-	-	-	-	-	-	**0.0**
Rainbow smelt	**0.7**	-	-	-	-	-	0.1	-	0.5	0.1	0.3	**0.1**
Northern pike	**0.3**	0.4	0.2	0.1	0.1	0.3	0.1	0.2	0.8	0.5	0.4	**0.3**
White sucker	**2.4**	1.1	1.0	1.8	2.2	1.3	0.8	0.5	1.2	0.1	0.4	**1.0**
Silver redhorse	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
Greater redhorse	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
Moxostoma sp.	**0.1**	-	-	-	-	-	-	-	-	-	-	**-**
Common carp	**0.0**	-	-	0.1	0.2	-	-	-	0.1	-	-	**0.0**
Brown bullhead	**0.1**	-	0.1	0.4	0.5	0.1	0.1	0.1	-	-	-	**0.1**
Channel catfish	**0.4**	-	-	0.2	-	-	-	-	-	-	-	**0.0**
Stonecat	**0.2**	0.8	1.4	0.9	0.7	1.1	-	-	-	-	-	**0.5**
Burbot	**0.6**	0.2	0.2	0.1	0.1	-	-	-	-	-	-	**0.1**
Threespine stickleback	**0.1**	-	-	-	-	-	-	-	-	-	-	**-**
White perch	**0.6**	-	-	0.4	0.2	0.1	-	-	-	-	-	**0.1**
Rock bass	**9.1**	7.7	2.4	4.6	6.1	4.4	6.3	6.4	9.7	2.8	3.6	**5.4**
Pumpkinseed	**-**	0.4	-	-	-	-	-	-	-	-	-	**0.0**
Smallmouth bass	**2.8**	1.2	1.8	2.0	1.6	0.4	1.6	1.6	2.3	1.2	1.9	**1.6**
Yellow perch	**146.9**	46.8	112.5	103.9	298.5	127.5	250.7	164.7	71.1	47.8	98.8	**132.2**
Walleye	**25.7**	11.3	8.8	9.4	11.9	10.3	17.2	17.2	12.5	17.1	30.2	**14.6**
Round goby	**-**	-	-	2.9	129.9	42.2	56.9	46.0	10.9	3.6	10.9	**30.3**
Freshwater drum	**0.9**	0.2	-	0.5	-	-	0.1	0.5	0.1	-	0.3	**0.2**
Total catch	**834**	618	268	286	959	1,387	2,037	1,071	1,849	2,376	4,454	**1,530.4**
Number of species	**16**	16	12	19	17	16	14	14	14	12	15	**15**
Number of sets		60	60	60	60	60	60	60	60	60	60	

Kingston Basin—Nearshore Sites (Melville Shoal, Grape Island and Flatt Point)

Fifteen species were caught in Kingston Basin nearshore gillnets in 2010. The most abundant species were alewife, yellow perch, walleye, round goby and rock bass (Table 2.2.4). Alewife abundance has increased dramatically over the last three years.

Kingston Basin—Deep Sites (EB02 and EB06)

Ten species were caught in Kingston Basin deep gillnets in 2010. The most abundant species were alewife, lake trout and lake whitefish (Table 2.2.5). The catches of each of these species was higher, particularly for alewife, in 2010 than in 2009.

Bay of Quinte

Big Bay

Twelve species were caught in Big Bay gillnets in 2010. The most abundant species were yellow perch, white perch, walleye, bluegill, and longnose gar (Table 2.2.6). Of these species, white perch catches were similar to past years, yellow perch catches were lower and walleye catches were somewhat higher in 2010. Brown bullhead, which have shown a steady decrease in abundance since 2001, were absent from the 2010 catch. Round goby, first caught here in 2003, have not been caught since 2005.

TABLE 2.2.5. Species-specific catch per gillnet set in the **Kingston Basin Lake Ontario (deep sites)**, 1992-2010. Annual catches are averages for 4-8 gillnet gangs set at a single depth (approx. 30 m) during each of 3 visits to each of 2 sites (EB02 and EB06). The total number of species caught and gillnets set each year are indicated.

		Year										
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**
Sea lamprey	**0.1**	-	-	-	-	-	-	-	-	-	-	**-**
Lake sturgeon	**0.1**	-	-	-	-	-	-	-	-	-	-	**-**
Alewife	**225.4**	110.2	2.7	3.4	37.7	11.9	22.9	31.9	46.6	28.8	766.0	**106.2**
Chinook salmon	**0.2**	0.8	-	0.1	0.1	0.3	-	0.1	0.1	0.4	0.3	**0.2**
Rainbow trout	**-**	-	-	-	-	-	-	0.1	-	-	-	**0.0**
Atlantic salmon	**-**	-	-	-	-	-	-	-	0.1	-	-	**0.0**
Brown trout	**0.1**	0.3	0.3	-	-	0.1	-	0.3	0.3	0.1	0.8	**0.2**
Lake trout	**139.9**	10.4	10.1	11.8	12.1	8.1	13.0	15.5	22.9	17.4	21.7	**14.3**
Lake whitefish	**33.2**	2.7	2.7	1.1	8.9	1.0	1.9	1.9	7.4	1.8	3.2	**3.3**
Cisco (Lake herring)	**0.8**	-	-	-	0.1	-	-	-	-	-	0.7	**0.1**
Rainbow smelt	**3.6**	-	-	-	0.1	0.1	0.4	0.1	-	0.7	0.5	**0.2**
Common carp	**-**	-	-	-	0.1	-	-	-	-	-	-	**0.0**
American eel	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
Burbot	**0.6**	0.8	0.3	0.1	0.1	-	-	-	-	-	-	**0.1**
Trout-perch	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
White perch	**0.1**	-	-	0.1	-	-	-	-	-	-	-	**0.0**
Rock bass	**-**	-	-	-	-	-	-	-	-	-	0.1	**0.0**
Smallmouth bass	**-**	-	-	-	-	-	-	-	-	0.1	-	**0.0**
Yellow perch	**0.3**	-	0.9	0.3	9.6	1.6	2.3	0.5	2.1	0.4	0.8	**1.9**
Walleye	**0.2**	-	-	-	0.1	-	0.1	-	0.1	-	-	**0.0**
Round goby	**-**	-	-	-	0.4	0.3	1.0	1.1	-	-	0.4	**0.3**
Freshwater drum	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
Sculpin sp.	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
Total catch	**404**	125	17	17	69	23	42	52	80	50	795	**127**
Number of species	**8**	6	6	7	11	8	7	9	8	8	10	**8**
Number of sets		24	24	48	48	48	48	48	48	48	48	

Hay Bay

Nine species were caught in Hay Bay gillnets in 2010. The most abundant species were yellow perch, alewife, cisco (lake herring) and white sucker (Table 2.2.7). The catch of each of these species was greater than previous years. Brown bullhead were absent from the 2009 and 2010 catches. Round goby, having been caught each year from 2002-2005, were absent from the 2006-2010 catches.

Conway

Sixteen species were caught in Conway gillnets in 2010. The most abundant species were alewife, yellow perch, walleye, rock bass and freshwater drum (Table 2.2.8). Alewife catches were very high. Round goby, which were caught for the first time in 2002 and which had increased to a high abundance level by 2004, have subsequently declined to very low abundance levels.

Species Highlights

Lake Whitefish

Thirty-four lake whitefish were caught in the 2010 index gillnets. Fifteen were from the 2003 year-class and five were from 2008, the next most common year-class. Age-7 fish averaged of 445 mm fork length, 1046 g in weight, and all females were mature (Table 2.2.9 and Fig. 2.2.2 and Fig. 2.2.3). Lake whitefish condition appears to have stabilized at a level lower than that observed in the early 1990s but significantly higher than that in 1996 and 1997 (Fig. 2.3.4).

Walleye

The age distribution of walleye (Table 2.2.10) showed a broad range of age-classes from age-1 to age-22. Generally speaking, during the summer index

TABLE 2.2.6. Species-specific catch per gillnet set at **Big Bay, Bay of Quinte**, 1992-2010. Annual catches are averages for 2-4 gillnet gangs set at a single depth (5 m) during each of 2-4 visits (summer). The total number of species caught and gillnets set each year are indicated.

		Year										
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**
Lake sturgeon	**0.1**	-	-	-	-	-	-	-	-	-	-	**-**
Longnose gar	**9.1**	6.6	6.6	1.1	6.6	9.9	19.7	2.2	16.4	24.8	42.8	**13.7**
Alewife	**4.6**	-	5.8	11.0	20.8	-	4.9	-	6.6	17.5	6.6	**7.3**
Gizzard shad	**47.6**	14.0	43.6	13.2	1.1	277.4	1.6	6.6	24.1	-	21.9	**40.4**
Northern pike	**4.4**	0.8	0.8	-	1.1	1.1	3.3	1.1	-	-	-	**0.8**
Mooneye	**0.2**	-	-	-	-	-	-	-	-	-	-	**-**
White sucker	**48.0**	23.0	60.9	15.4	35.1	16.4	32.9	16.4	28.5	21.9	24.1	**27.5**
Silver redhorse	**-**	-	-	-	-	-	-	-	-	-	1.1	**0.1**
Moxostoma sp.	**0.2**	0.8	-	1.1	-	-	-	-	-	-	-	**0.2**
Common carp	**1.9**	-	-	1.1	1.1	-	-	-	-	-	-	**0.2**
Brown bullhead	**44.2**	44.4	36.2	12.1	15.4	5.5	13.2	5.5	4.4	4.4	-	**14.1**
Channel catfish	**2.4**	-	0.8	-	1.1	-	1.6	-	-	1.1	-	**0.5**
Burbot	**0.2**	-	-	-	-	-	-	-	-	-	-	**-**
White perch	**592.9**	144.7	239.3	393.6	858.6	523.0	1,294.4	782.9	838.8	810.3	605.3	**649.1**
White bass	**0.5**	-	0.8	-	-	-	-	1.1	1.1	-	-	**0.3**
Rock bass	**1.7**	-	-	-	-	1.1	-	-	-	-	-	**0.1**
Pumpkinseed	**26.1**	111.8	54.3	5.5	28.5	2.2	21.4	3.3	6.6	4.4	1.1	**23.9**
Bluegill	**3.8**	46.9	24.7	3.3	2.2	16.4	42.8	35.1	20.8	36.5	43.9	**27.3**
Smallmouth bass	**7.3**	3.3	-	-	-	-	3.3	-	-	1.1	-	**0.8**
Largemouth bass	**0.1**	-	-	-	-	-	1.6	-	-	-	1.1	**0.3**
Black crappie	**0.7**	1.6	2.5	2.2	1.1	1.1	14.8	6.6	2.2	-	-	**3.2**
Yellow perch	**912.2**	1,254.1	1,203.1	758.8	721.5	677.6	782.9	108.6	414.5	852.3	284.0	**705.7**
Walleye	**111.1**	29.6	50.2	42.8	52.6	38.4	70.7	35.1	60.3	52.6	71.3	**50.4**
Round goby	**-**	-	-	2.2	2.2	3.3	-	-	-	-	-	**0.8**
Freshwater drum	**102.0**	139.8	48.5	48.2	48.2	62.5	129.9	74.6	42.8	57.0	31.8	**68.3**
Total catch	**1,922**	1,822	1,778	1,311	1,797	1,636	2,439	1,079	1,467	1,884	1,135	**1,635**
Number of species	**14**	14	15	15	16	14	16	13	13	12	12	**14**
Number of sets		8	8	6	6	6	4	6	6	6	6	

gillnetting program young walleye were found in the Bay of Quinte (e.g., age-1 to age-5 fish comprised 92% of the Bay of Quinte walleye catch) while older walleye were present in eastern Lake Ontario (e.g., age-6 and older fish comprised 86% of the catches in the Kingston Basin). Among young walleye, all ages were quite common indicating that year-class strength has been relatively strong and consistent in recent years. Older walleye, from many strong year-classes, were also abundant in eastern Lake Ontario. The 2003 year-class appears particularly strong in Lake Ontario. Female walleye begin to mature for the first time during the summer at age-4 to presumably spawn the following spring at age-5.

Round Goby

Only large round goby are susceptible to capture in assessments gillnets. Round goby first appeared in assessment gillnets in the northeast and Bay of Quinte in 2002, Kingston Basin nearshore sites in 2003 (depth range 7.5 to 27.5 m), and in Kingston Basin deep sites (depth about 30 m) in 2004. No round goby were captured to date at Middle Ground or the Rocky Point deep sites. In the Bay of Quinte, round goby abundance initially increased, peaked in 2004, and then decreased substantially. In Lake Ontario, goby abundance increased until 2007, declined in 2008 and remained stable in 2009 and 2010.

Lake Herring

The age distribution of lake herring caught in the 2010 index gillnets is shown in Table 2.2.11. The 2003, 2006 and 2007 year-classes are all relatively common.

Lake Trout

The abundance of adult lake trout remains low, but there are signs of improvement in recent years (Fig. 2.2.5). The recent low levels were reached around the year 2002, after a period of decline that began in the

TABLE 2.2.7. Species-specific catch per gillnet set at **Hay Bay, Bay of Quinte**, 1992-2010. Annual catches are averages for 1-3 gillnet gangs set at each of 2 depths (7.5 and 12.5 m) during each of 1-2 visits (summer). The total number of species caught and gillnets set each year are indicated.

		Year										
Species	**1992-2000 mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**2001-2010 mean**
Sea lamprey	**-**	-	-	-	-	-	-	-	0.8	-	-	**0.1**
Lake sturgeon	**0.1**	-	-	-	-	-	-	-	-	-	-	**-**
Longnose gar	**-**	-	-	-	-	-	-	0.8	-	-	-	**0.1**
Alewife	**54.8**	126.6	53.5	-	8.2	1.6	49.3	24.7	0.8	64.1	189.1	**51.8**
Gizzard shad	**4.7**	-	1.6	-	-	-	3.3	0.8	0.8	-	-	**0.7**
Chinook salmon	**0.2**	-	-	-	-	-	-	-	-	-	-	**-**
Brown trout	**0.1**	-	-	-	-	-	-	-	-	-	-	**-**
Lake trout	**0.8**	-	-	1.6	-	-	-	-	-	-	-	**0.2**
Lake whitefish	**0.4**	0.8	-	-	-	-	-	-	-	-	-	**0.1**
Cisco (Lake herring)	**24.9**	6.6	0.8	-	0.8	-	-	0.8	-	0.8	67.4	**7.7**
Coregonus sp.	**0.3**	-	-	-	-	-	-	-	0.8	-	-	**0.1**
Rainbow smelt	**1.2**	-	1.6	-	-	-	0.8	-	-	2.5	-	**0.5**
Northern pike	**6.6**	5.8	0.8	2.5	-	3.3	2.5	7.4	6.6	3.3	19.7	**5.2**
White sucker	**40.2**	37.0	18.9	14.8	40.3	9.9	11.5	9.0	16.4	28.0	57.6	**24.3**
River redhorse	**-**	-	-	-	-	-	-	0.8	-	-	-	**0.1**
Common carp	**1.5**	-	-	-	-	-	-	-	-	-	-	**-**
Spottail shiner	**0.1**	-	-	-	-	-	-	0.8	-	-	-	**0.1**
Brown bullhead	**6.2**	5.8	0.8	1.6	1.6	2.5	5.8	2.5	3.3	-	-	**2.4**
Channel catfish	**0.1**	-	-	0.8	0.8	-	-	-	-	-	-	**0.2**
Burbot	**0.3**	-	-	-	-	-	-	-	-	-	-	**-**
White perch	**72.3**	3.3	35.4	55.1	95.4	0.8	198.2	106.9	136.5	61.7	11.5	**70.5**
Rock bass	**0.2**	-	-	-	-	-	-	-	0.8	-	-	**0.1**
Pumpkinseed	**5.6**	7.4	6.6	4.1	14.0	2.5	4.1	4.9	4.9	4.9	4.9	**5.8**
Smallmouth bass	**0.7**	0.8	0.8	-	-	-	-	-	-	-	-	**0.2**
Yellow perch	**1,013.7**	948.2	737.7	727.0	565.8	939.1	421.1	671.1	650.5	537.0	1,381.6	**757.9**
Walleye	**28.9**	16.4	24.7	18.1	14.0	5.8	11.5	16.4	7.4	18.1	13.2	**14.6**
Round goby	**-**	-	1.6	1.6	1.6	0.8	-	-	-	-	-	**0.6**
Freshwater drum	**7.1**	1.6	20.6	8.2	43.6	16.4	54.3	6.6	5.8	6.6	4.9	**16.9**
Total catch	**1,271**	1,160	905	836	786	983	762	854	836	727	1,750	**960**
Number of species	**14**	12	14	11	11	10	11	14	13	10	9	**12**
Number of sets		8	8	8	8	8	8	8	8	8	4	

early 1990s, and which was attributed to reduced stocking levels combined with a decline in early survival of the stocked fish. The current increase in numbers of adults appears to be due to increased early-life survival of stocked fish (Fig. 2.2.6), and it should result in further increases in adults at least for the next few years. The condition of adult fish has also improved in recent years (Fig. 2.2.7), perhaps due to inclusion of round gobies in the diet. Lamprey wounding rates remain under target levels (Fig. 2.2.8), suggesting that lamprey mortality is at acceptably low levels.

TABLE 2.2.8. Species-specific catch per gillnet set at **Conway, Bay of Quinte**, 1993-2010. Annual catches are averages for 1-2 gillnet gangs set at each of 5 depths (range 5-40 m) during each of 2 visits (summer). The total number of species caught and gillnets set each year are indicated.

		Year										
	1992-2000											**2001-2010**
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**
Sea lamprey	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
Lake sturgeon	**0.0**	-	-	-	-	-	-	-	-	-	-	**-**
Longnose gar	**0.0**	0.3	-	-	-	-	-	-	-	-	-	**0.0**
Alewife	**307.5**	54.3	19.1	39.5	106.6	456.9	76.0	127.3	467.1	493.1	1,153.6	**299.3**
Gizzard shad	**0.1**	-	-	-	0.3	-	-	1.3	0.7	-	-	**0.2**
Chinook salmon	**0.2**	0.3	-	0.3	0.7	-	-	0.7	0.7	0.7	0.3	**0.4**
Rainbow trout	**-**	-	-	-	-	0.3	-	-	-	-	-	**0.0**
Atlantic salmon	**0.1**	-	-	-	-	-	-	-	-	-	-	**-**
Brown trout	**1.9**	0.7	0.3	2.3	0.7	1.6	1.6	1.0	3.0	1.0	0.3	**1.3**
Lake trout	**13.3**	4.9	15.1	11.5	13.5	18.1	7.6	8.9	6.3	0.7	1.0	**8.8**
Lake whitefish	**6.3**	3.0	1.6	4.9	0.7	3.9	2.0	1.6	1.3	0.3	1.3	**2.1**
Cisco (Lake herring)	**1.2**	1.3	-	-	-	-	0.3	-	0.7	0.3	1.0	**0.4**
Coregonus sp.	**0.0**	-	-	-	0.3	-	-	-	-	-	-	**0.0**
Rainbow smelt	**0.5**	1.3	-	-	0.3	1.3	0.3	-	2.3	0.7	1.0	**0.7**
Northern pike	**0.2**	0.3	-	0.3	-	-	-	0.3	0.3	-	0.3	**0.2**
White sucker	**15.5**	21.7	17.1	14.1	6.9	3.9	3.0	9.5	3.6	2.0	1.3	**8.3**
Silver redhorse	**0.1**	-	-	-	-	-	-	-	-	-	-	**-**
Moxostoma sp.	**0.1**	-	-	-	-	-	-	-	-	-	-	**-**
Common carp	**0.2**	-	-	-	-	-	-	0.3	-	-	-	**0.0**
Brown bullhead	**0.3**	0.3	-	0.7	1.3	1.0	5.9	2.3	-	-	-	**1.2**
Channel catfish	**0.1**	0.3	0.3	-	-	0.3	-	-	-	-	-	**0.1**
Stonecat	**-**	0.3	0.3	-	-	-	-	-	-	-	-	**0.1**
Burbot	**0.1**	-	-	-	-	-	-	-	-	-	-	**-**
Trout-perch	**0.1**	-	-	-	-	-	-	-	-	-	-	**-**
White perch	**12.8**	-	0.3	5.6	17.4	-	5.6	8.2	7.6	1.0	0.3	**4.6**
Rock bass	**14.4**	3.0	5.9	1.0	1.0	3.3	6.3	25.3	13.5	1.3	6.3	**6.7**
Pumpkinseed	**0.2**	0.3	0.3	0.3	-	-	-	0.3	-	-	-	**0.1**
Smallmouth bass	**2.1**	0.3	-	-	-	0.3	1.0	1.0	0.3	-	1.0	**0.4**
Yellow perch	**554.3**	430.9	509.9	320.1	218.1	184.2	376.6	119.7	171.7	76.3	106.9	**251.4**
Walleye	**54.1**	6.6	9.5	17.8	6.9	8.2	12.5	16.4	10.5	9.2	8.2	**10.6**
Round goby	**-**	-	6.6	72.4	204.3	5.3	1.0	0.7	1.6	-	0.3	**29.2**
Freshwater drum	**3.5**	0.3	0.7	1.0	4.3	3.3	7.9	8.9	4.9	2.6	4.9	**3.9**
Total catch	**990**	531	587	492	583	692	508	334	696	589	1,288	**630**
Number of species	**15.5**	19	14	15	16	15	15	18	17	13	16	**15.8**
Number of sets		20	20	20	20	20	20	20	20	20	20	

TABLE 2.2.9. Age distribution of **34 lake whitefish** sampled from summer index gillnets, by region, 2010. 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). A GSI greater than approximately 0.25 indicates a mature female.

	Age (years) / Yesr class									
	1	2	4	5	6	7	8	11	16	Total
Region	2009	2008	2006	2005	2004	2003	2002	1999	1994	
Bay of Quinte	2	1	0	0	0	0	0	1	0	4
Kingston Basin (deep)	0	2	2	3	1	11	2	1	1	23
Kingston Basin (nearshore)	0	2	1	0	0	4	0	0	0	7
Total	2	5	3	3	1	15	2	2	1	34
Mean fork length (mm)	178	246	378	409	432	445	434	480	540	
Mean weight (g)	51	164	640	780	862	1046	1162	1328	1555	
Mean GSI (females)			0.21	0.58		0.51	0.55	0.60	0.45	
% Mature (females)		0%	0%	100%		100%	100%	100%	100%	

TABLE 2.2.10. Age distribution of **387 walleye** sampled from summer index gillnets, by region, 2010. 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).

	Age (years) / Year-class																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Total
Region	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	
Bay of Quinte	9	50	25	4	2	1	1	0	1	0	0	0	1	0	1	0	2	1	0	0	0	0	98
Kingston Basin (nearshore)	1	8	1	6	22	19	57	1	27	11	29	17	3	7	12	16	11	6	15	2	3	1	275
Middle Ground	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Northeast	0	0	1	0	1	0	3	0	1	1	1	2	0	0	0	0	1	0	0	1	0	0	12
Western	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	10	59	27	10	25	20	62	1	29	12	30	19	4	7	13	16	14	7	15	3	3	1	387
Mean fork length (mm)	223	308	398	469	527	548	576	566	594	602	621	631	590	618	661	654	642	651	648	642	694	630	
Mean weight (g)	110	316	793	1345	1951	2269	2774	2330	2958	3168	3440	3607	2939	3244	4022	3962	3564	3761	3746	3543	4512	3033	
Mean GSI (females)	0.04	0.09	0.20	0.32	0.33	0.36	0.40		0.36	0.39	0.42	0.44	0.46	0.48	0.47	0.43	0.46	0.47	0.50	0.48	0.48		
% Mature (females)	0%	0%	7%	100%	81%	90%	94%		80%	100%	93%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		

TABLE 2.2.11. Age distribution of 54 **lake herring** sampled from summer index gillnets, by region, 2010. Also shown are mean fork length and mean weight.

	Age (years) / Year-class										
	2	3	4	5	6	7	8	9	12	14	Total
Region	2008	2007	2006	2005	2004	2003	2002	2001	1998	1996	
Bay of Quinte	3	15	12	2	1	5	2	1	0	0	41
Kingston Basin (nearshore)	0	0	1	0	1	2	2	0	1	0	7
Kingston Basin (deep)	0	0	0	1	0	3	0	0	0	1	5
Northeast	0	0	0	0	0	0	0	1	0	0	1
Total	3	15	13	3	2	10	4	2	1	1	54
Mean fork length (mm)	226	279	302	313	355	362	378	384	348	398	
Mean weight (g)	143	265	343	406	622	675	784	827	529	896	

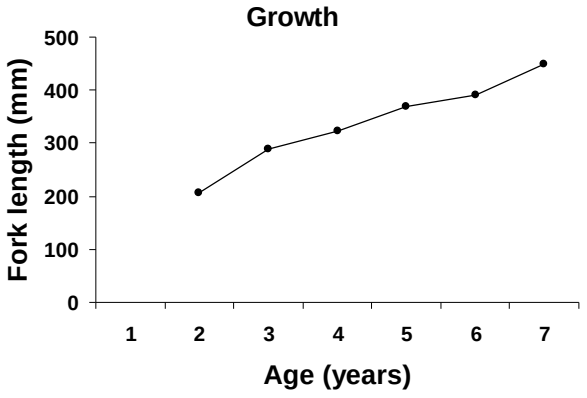

FIG. 2.2.2. Lake whitefish mean fork length-at-age for the 2003 year-class.

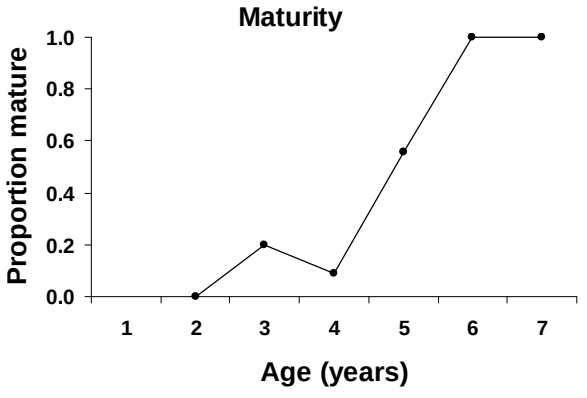

FIG. 2.2.3. Proportion of mature lake whitefish (females) by age for the 2003 year-class.

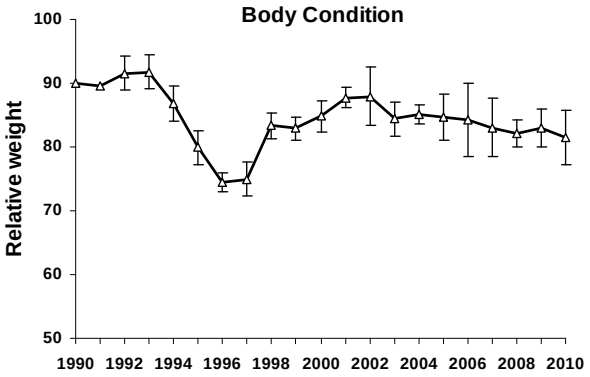

FIG. 2.2.4. Lake whitefish relative weight (see Rennie and Verdon, 2008) for fish caught in summer index gillnets, 1990-2010.

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.

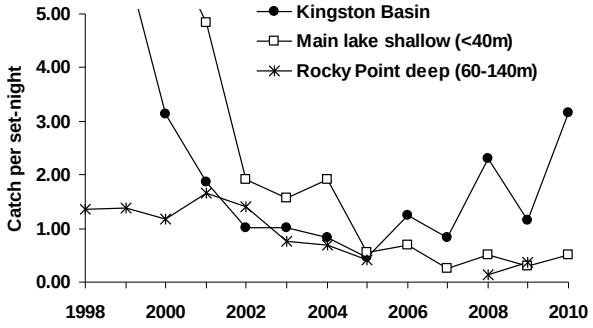

FIG. 2.2.5. Catch per unit effort of adult lake trout in bottom-set gillnets in three areas of eastern lake Ontario. Deep sets off Rocky Point were not fished in 2006, 2007, and 2010.

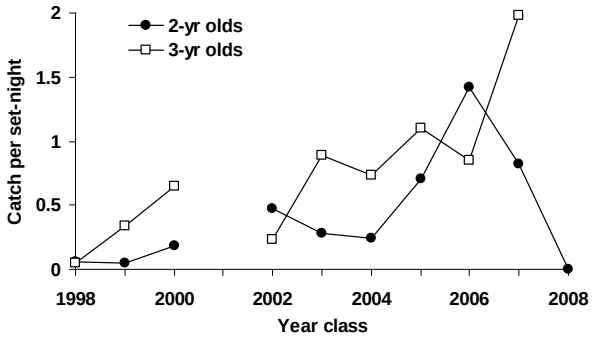

FIG. 2.2.6. Lake trout relative survival to ages 2 and 3. The survival index is the catch per unit effort of 2 and 3 year-old fish, corrected for number stocked 2 or 3 years earlier; age determination is based on year-specific fin clip information combined with the size of the fish. The low catches of 2-year old fish in 2010 do not necessarily indicate decreased survival, but are more likely due to a combination of small size of stocked yearlings in 2009, and unusually warm temperatures in 2010, both of which would result in lower vulnerability of these fish to index gillnets.

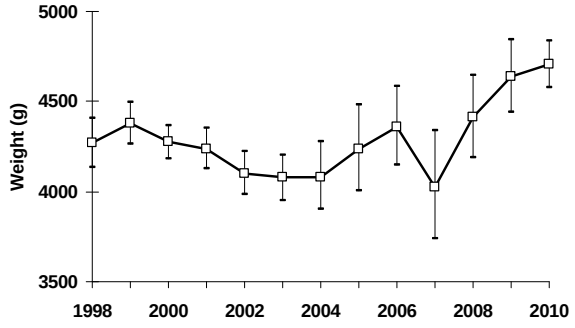

FIG. 2.2.7. Condition of adult lake trout expressed as the predicted weight of a 680 mm fork length fish. The predictions are based on yearly length-weight regressions, and 95% confidence intervals for the predictions are shown.

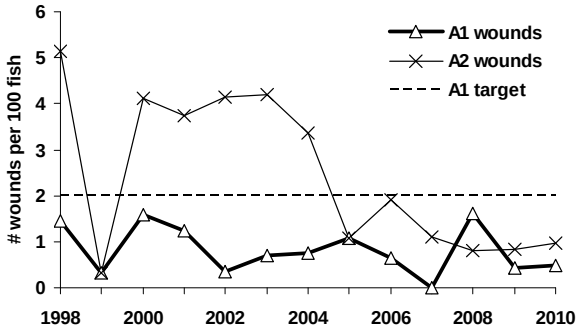

FIG. 2.2.8. Frequency of A1 (fresh) and A2 (partially healed) lamprey wounds observed on lake trout. The lamprey control target is 2.0 A1 wounds per 100 fish.

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

Bottom trawling at fixed sites (Fig. 2.3.1) in eastern Lake Ontario (ranging in depth from 21-100 m) and the Bay of Quinte (ranging in depth from 4 to 23 m) has occurred annually since 1972 (except 1989). Typically, ½ mile trawl drags using a three-quarter "Yankee Standard" No. 35 bottom trawl are made at Lake Ontario sites while ¼ mile drags using a three-quarter "Western" bottom trawl are made at Bay of Quinte sites. At the deep Rocky Point trawl site (100 m) the trawling distance is 1 mile. Bottom trawling is used primarily to monitor the abundance of small fish species and the young (e.g. age-0) of larger species. Species-specific catches in the 2009 trawling program are shown in Tables 2.3.1-2.3.9. Twenty-eight species and over 75,000 fish were caught in 88 bottom trawls in 2010. Round goby (35%), alewife (26%), yellow perch (12%), gizzard shad (7%), sunfish (6%), rainbow smelt (5%) and white perch (4%) collectively made up 94% of the catch by number.

Lake Ontario Sites

EB02

Six species, alewife, round goby, rainbow smelt, lake trout, yellow perch and walleye were caught at EB02 in 2010 (Table 2.3.1). Alewife catches were high relative to the last decade. Threespine stickleback, having risen to high levels of abundance in the late 1990s, declined rapidly after 2003 and has been absent in the EB02 catches for the last four years.

EB03

Seven species were caught at EB03 in 2010. The most abundant species were round goby and rainbow smelt. Rainbow smelt abundance was high relative to the last decade. 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 four years. Trout-perch and slimy sculpin have also been absent from the catches for the last few years (Table 2.3.2).

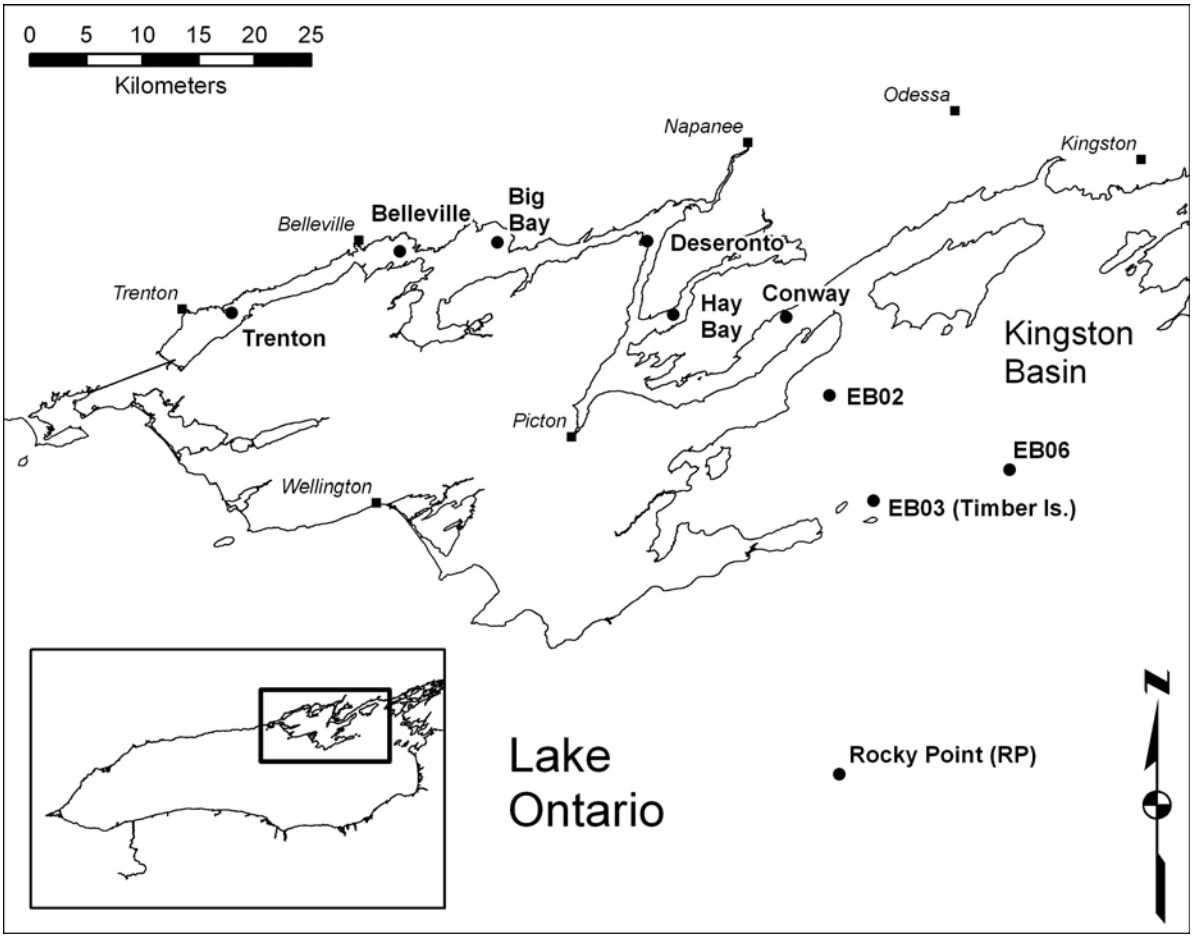

FIG. 2.3.1. Map of northeastern Lake Ontario. Shown are eastern Lake Ontario and Bay of Quinte fish community index bottom trawling site locations.

TABLE 2.3.1. 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.

		Year										
	1992-2000											**2001-2010**
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**
Alewife	**1220.305**	203.333	20.917	19.500	27.100	0.000	0.417	11.000	0.667	72.425	463.950	**81.931**
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**
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**
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**
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**
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**
Rainbow smelt	**440.899**	29.667	7.917	0.917	5.000	19.750	28.750	3.583	5.667	114.408	14.667	**23.033**
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**
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**
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**
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**
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**
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**
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**
Round goby	**0.000**	0.000	0.000	0.083	250.100	24.833	40.083	119.750	26.667	169.900	143.924	**77.534**
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**
Deepwater sculpin	**0.046**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Total catch	**1685**	253	64	115	365	56	70	135	34	357	623	**207**
Number of species	**9**	6	5	8	8	7	7	5	4	4	6	**6**
Number of trawls		12	12	12	12	12	12	12	12	12	12	

TABLE 2.3.2. 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										
	1992-2000											**2001-2010**
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**
Alewife	**704.382**	57.375	21.375	8.000	168.375	14.833	15.250	33.917	156.325	0.000	0.250	**47.570**
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**
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**
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**
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**
Cisco (Lake herring)	**0.292**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Rainbow smelt	**517.345**	20.000	207.488	109.231	1.917	25.667	20.625	21.500	0.250	11.583	217.933	**63.619**
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**
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**
Spottail shiner	**42.449**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.250	0.083	**0.033**
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**
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**
Threespine stickleback	**32.894**	67.375	680.138	459.275	2781.625	116.083	8.500	0.000	0.000	0.000	0.000	**411.300**
Trout-perch	**689.067**	175.000	592.200	56.294	255.083	3.417	3.750	0.417	0.000	0.000	0.000	**108.616**
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**
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**
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**
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**
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**
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**
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**
Round goby	**0.000**	0.000	0.000	0.000	0.333	732.358	850.325	910.133	1100.163	2551.917	1079.833	**722.506**
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**
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**
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**
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**
Total catch	**2004**	320	1501	695	3254	943	902	968	1257	2564	1303	**1371**
Number of species	**10**	4	5	10	10	9	9	9	5	6	7	**7**
Number of trawls		8	8	16	12	12	8	12	8	12	12	

EB06

Six species were caught at EB06 in 2010. Round goby and rainbow smelt were the most abundant species caught (Table 2.3.3). Round goby abundance was very high relative to previous years. Of particular significance is the capture of two deepwater sculpin; a species of special concern (see Section 8.1).

Rocky Point

Netting operations were not completed at the Rocky Point deep trawl site in 2010 because our vessel was not compliant with Transport Canada Regulations; the sites were too far offshore. With our new vessel, this issue will be resolved for 2011.

Bay of Quinte Sites

Trenton

Twenty-one species were caught at Trenton in 2010. The most abundant species were yellow perch, spottail shiner, gizzard shad, pumpkinseed, alewife and white perch. White perch abundance was particularly low in 2010 (Table 2.3.4).

Belleville

Twenty species were caught at Belleville in 2010. Gizzard shad, yellow perch, sunfish, and white perch were the most abundant species in the catch. Catches of gizzard shad, yellow perch and sunfish were high while white perch catch was relatively low relative to previous years (Table 2.3.5).

Big Bay

Eighteen species were caught at Big Bay in 2010. The most abundant species were alewife, white perch, yellow perch and sunfish. Alewife and gizzard shad catches were relatively high while white perch catches were low compared to previous years (Table 2.3.6).

Deseronto

Twenty-one species were caught at Deseronto in 2010. The most abundant species were alewife, yellow perch, white perch, gizzard shad, spottail shiner and pumpkinseed. Alewife catches were high while yellow perch and white perch catches were relatively low compared to previous years (Table 2.3.7).

Hay Bay

Eighteen species were caught at Hay Bay in 2010. The most abundant species were alewife and yellow perch. White perch catches were low compared with prior years (Table 2.3.8).

Conway

Only eight species were caught at Conway in 2010. The most abundant species were round goby, yellow perch and cisco (lake herring) (Table 2.3.9).

TABLE 2.3.3. Species-specific catch per trawl (12 min duration; 1/2 mile) by year in the fish community index bottom trawling program during summer at **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**
Alewife	**85.619**	5.583	0.250	0.083	1.250	0.417	8.000	0.917	0.667	10.833	1.083	**2.908**
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**
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**
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**
Rainbow smelt	**743.666**	21.417	6.750	0.250	25.083	142.583	23.917	0.583	1.000	3.500	73.167	**29.825**
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**
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**
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**
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**
Round goby	**0.000**	0.000	0.000	0.000	0.000	0.000	5.000	82.925	1.667	8.667	877.767	**97.603**
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**
Slimy sculpin	**0.083**	0.083	0.000	3.583	399.158	15.750	0.250	0.000	0.000	0.500	1.500	**42.083**
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**
Total catch	**843**	30	55	16	434	173	38	85	3	24	954	**181**
Number of species	**6**	5	5	6	7	4	5	4	3	5	6	**5**
Number of trawls		12	12	12	12	12	12	12	12	12	12	

TABLE 2.3.4. 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 at each site 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**
Alewife	**66.908**	149.288	98.600	174.113	8.625	508.825	126.625	24.500	8.750	112.363	26.875	**123.856**
Gizzard shad	**165.272**	4.125	6.375	22.250	0.000	30.375	23.375	1.375	38.500	5.750	84.225	**21.635**
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**
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**
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**
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**
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**
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**
Spottail shiner	**88.467**	217.400	60.875	60.875	1.250	24.500	41.750	0.000	76.000	148.400	120.050	**75.110**
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**
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**
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**
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**
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**
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**
White perch	**321.078**	54.250	19.875	240.000	80.775	278.988	388.213	29.875	33.750	669.275	16.250	**181.125**
White bass	**0.403**	0.000	0.125	0.000	0.000	0.000	1.250	0.125	0.000	0.875	0.125	**0.250**
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**
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**
Pumpkinseed	**86.344**	84.750	32.250	88.875	56.788	46.750	20.000	77.513	143.775	66.250	62.250	**67.920**
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**
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**
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**
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**
Lepomis sp.	**0.764**	0.000	64.788	0.000	0.000	59.750	10.250	0.000	17.000	0.625	7.125	**15.954**
Yellow perch	**317.754**	200.625	239.000	544.613	186.375	340.825	130.125	584.738	769.538	1095.063	335.263	**442.616**
Walleye	**9.764**	9.625	3.625	10.500	1.500	1.875	0.750	4.750	7.375	6.125	2.125	**4.825**
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**
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**
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**
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**
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**
Total catch	**1155**	781	547	1203	353	1380	781	751	1145	2186	688	**981**
Number of species	**20**	20	19	19	15	19	20	15	19	19	21	**19**
Number of trawls		8	8	8	8	8	8	8	8	8	8	

Species Highlights

Catches of age-0 fish in 2010 for selected species and locations are shown in Tables 2.3.10-2.3.13 for lake whitefish, lake herring, yellow perch and walleye respectively. Age-0 lake whitefish catches were low at Conway and low to moderate at Timber Island in 2010 (Table 2.3.10). Age-0 lake herring catches at Conway were relatively high in 2010 (Table 2.3.11). Age-0 catches of yellow perch were relatively high (Table 2.3.12). Age-0 walleye catches were moderate (Table 2.3.13).

Age-0, age-1 and age-2 walleye were all common in the 2010 Bay of Quinte trawls (Table 2.3.14).

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. Round goby catches in the Kingston Basin remained very high at EB02 and EB03 and increased significantly at EB06 in 2010.

Two deepwater sculpin, a species of special concern, were caught in 2010, both at EB06 (35 m depth). The fish, one female and one male, were 74 and 89 mm total length and weighed 3.27 and 5.60 g respectively.

TABLE 2.3.5. 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 at each site 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**
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**
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**
Alewife	**92.032**	0.250	82.375	0.125	11.500	13.875	9.750	0.125	34.875	78.775	59.813	**29.146**
Gizzard shad	**266.406**	99.200	234.363	46.025	581.775	50.563	88.325	73.313	326.875	321.425	500.788	**232.265**
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**
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**
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**
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**
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**
Spottail shiner	**71.583**	10.625	21.500	4.750	3.875	13.250	23.875	3.750	17.375	33.375	8.125	**14.050**
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**
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**
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**
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**
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**
White perch	**306.882**	6.625	154.625	165.013	1929.950	475.900	880.563	338.925	845.013	1601.363	104.275	**650.225**
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**
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**
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**
Pumpkinseed	**26.421**	21.750	5.125	1.875	4.125	1.750	1.125	0.875	0.500	0.250	0.375	**3.775**
Bluegill	**13.429**	0.250	0.500	0.125	0.000	0.375	1.250	1.875	0.000	0.000	0.625	**0.500**
Smallmouth bass	**0.296**	0.125	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.025**
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**
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**
Lepomis sp.	**0.014**	0.000	88.375	0.000	2.375	409.700	0.250	5.125	9.000	17.875	293.888	**82.659**
Yellow perch	**116.481**	37.875	53.250	14.250	66.250	47.375	14.625	78.750	214.725	44.375	300.438	**87.191**
Walleye	**13.352**	5.375	0.750	8.500	2.625	2.000	2.750	8.625	18.125	3.500	10.375	**6.263**
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**
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**
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**
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**
Freshwater drum	**23.412**	163.750	58.250	20.875	4.375	214.763	87.000	830.063	25.000	31.000	53.375	**148.845**
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**
Total catch	**1042**	453	724	365	2691	1318	1161	1421	1570	2213	1385	**1330**
Number of species	**19**	20	22	20	17	19	19	19	19	17	20	**19**
Number of trawls		8	8	8	8	8	8	8	8	8	8	

TABLE 2.3.6. 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 at each site 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**
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**
Alewife	**33.495**	0.000	224.938	0.000	407.363	35.750	13.000	0.375	190.263	37.875	332.700	**124.226**
Gizzard shad	**228.178**	0.000	52.250	23.250	58.375	25.875	2.250	2.250	68.738	0.000	66.213	**29.920**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
White perch	**446.613**	18.250	793.025	145.125	1498.975	554.588	1252.238	363.425	456.700	1116.888	190.763	**638.998**
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**
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**
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**
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**
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**
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**
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**
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**
Lepomis sp.	**0.000**	0.000	66.625	0.000	0.000	1060.175	0.000	4.125	56.475	41.500	170.450	**139.935**
Yellow perch	**62.998**	381.125	153.463	107.650	200.250	90.613	99.388	33.750	660.600	197.775	184.238	**210.885**
Walleye	**10.485**	7.500	6.125	19.250	16.875	6.500	8.125	8.750	28.125	10.750	7.250	**11.925**
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**
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**
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**
Round goby	**0.000**	0.000	0.125	1.375	15.750	9.500	4.750	50.413	1.125	0.625	0.375	**8.404**
Freshwater drum	**10.894**	21.750	24.375	9.000	15.625	125.500	178.450	139.350	14.625	11.625	51.500	**59.180**
Total catch	**891**	721	1511	442	2300	2017	1699	661	1586	1543	1109	**1359**
Number of species	**18**	18	23	15	17	18	20	19	20	17	18	**19**
Number of trawls		8	8	8	8	8	8	8	8	8	8	

TABLE 2.3.7. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Deseronto** (5 m depth), Bay of Quinte. Catches are the mean number of fish observed at each site for the number of trawls indicated. Total catch and number of species caught are indicated.

		Year										
	1992-2000											**2001-2010**
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**
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**
Alewife	**120.567**	180.063	47.625	277.350	55.375	54.213	106.263	1037.375	217.088	16.250	447.013	**243.861**
Gizzard shad	**54.322**	32.000	20.875	11.875	1.375	22.000	62.100	29.250	109.375	47.538	20.500	**35.689**
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**
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**
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**
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**
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**
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**
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**
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**
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**
Trout-perch	**35.125**	4.750	7.500	0.125	4.500	6.000	12.375	18.375	550.213	226.813	1.750	**83.240**
White perch	**273.129**	10.250	194.863	306.238	3075.588	237.588	793.925	226.200	298.113	811.600	25.250	**597.961**
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**
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**
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**
Pumpkinseed	**15.042**	118.088	17.500	67.500	19.500	14.750	15.500	19.125	11.500	30.500	11.000	**32.496**
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**
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**
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**
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**
Lepomis sp.	**0.000**	0.000	0.000	0.000	0.000	483.675	0.000	1.000	0.250	0.000	1.875	**48.680**
Yellow perch	**320.919**	412.700	555.388	683.425	152.138	1030.913	638.313	1087.100	531.750	219.300	66.225	**537.725**
Walleye	**17.486**	12.500	2.875	7.500	15.125	5.000	5.250	9.875	19.875	15.875	1.875	**9.575**
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**
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**
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**
Round goby	**0.000**	1.250	11.500	16.125	20.625	117.300	4.625	4.250	4.500	2.750	1.625	**18.455**
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**
Total catch	**904**	887	900	1451	3403	2021	1738	2510	1863	1457	605	**1683**
Number of species	**16**	20	19	19	16	22	20	17	16	19	21	**19**
Number of trawls		8	8	8	8	8	8	8	8	8	8	

TABLE 2.3.8. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Hay Bay** (7 m depth), Bay of Quinte. Catches are the mean number of fish observed at each site 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**
Alewife	**204.132**	565.963	21.125	1.750	67.063	72.088	394.425	695.188	631.613	713.000	967.788	**413.000**
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**
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**
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**
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**
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**
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**
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**
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**
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**
Spottail shiner	**32.120**	63.513	54.000	53.250	64.375	79.113	133.950	188.575	47.750	46.500	53.375	**78.440**
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**
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**
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**
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**
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**
White perch	**94.664**	9.250	132.563	14.750	495.163	24.625	504.113	27.500	163.738	167.700	54.875	**159.428**
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**
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**
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**
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**
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**
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**
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**
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**
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**
Yellow perch	**372.581**	726.475	856.588	119.200	551.850	278.638	580.700	906.500	138.063	146.038	206.663	**451.071**
Walleye	**7.333**	7.125	3.250	1.750	3.125	4.125	7.125	8.500	13.375	5.000	8.500	**6.188**
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**
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**
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**
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**
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**
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**
Total catch	**824**	1443	1109	232	1297	545	1732	1937	1043	1096	1338	**1177**
Number of species	**15**	16	15	13	15	15	17	17	18	18	18	**16**
Number of trawls		8	8	8	8	8	8	8	8	8	8	

TABLE 2.3.9. Species-specific catch per trawl (6 min duration; 1/4 mile) by year in the fish community index bottom trawling program at **Conway** (24 m depth), Bay of Quinte. Catches are the mean number of fish observed at each site for the number of trawls indicated. Total catch and number of species caught are indicated.

		Year										
	1992-2000											**2001-2010**
Species	**mean**	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**
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**
Alewife	**121.966**	0.000	0.000	2.250	1.917	0.417	9.667	0.083	214.558	1.583	0.333	**23.081**
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**
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**
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**
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**
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**
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**
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**
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**
White sucker	**4.412**	134.825	28.750	6.667	7.417	4.750	3.167	11.250	0.500	0.000	0.167	**19.749**
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**
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**
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**
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**
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**
Trout-perch	**132.800**	139.438	58.225	53.667	43.333	12.250	0.500	1.000	13.000	0.083	0.000	**32.150**
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**
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**
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**
Yellow perch	**12.597**	134.700	181.238	178.133	58.667	53.750	146.567	20.000	108.975	8.250	56.950	**94.723**
Walleye	**2.764**	1.250	0.000	0.250	1.000	0.083	0.417	0.417	0.083	0.000	0.333	**0.383**
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**
Round goby	**0.000**	0.000	0.500	282.225	79.167	127.208	40.833	173.192	89.717	80.767	146.975	**102.058**
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**
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**
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**
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**
Total catch	**403**	412	310	545	197	216	215	238	428	91	212	**286**
Number of species	**9**	8	9	13	12	11	14	9	10	7	8	**10**
Number of trawls		8	8	12	12	12	12	12	12	12	12	

TABLE 2.3.10. 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, 1992-2010. 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

TABLE 2.3.11. Mean catch-per-trawl of **age-0 lake herring** at Conway in the lower Bay of Quinte, 1992-2010. 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	6.33	12

TABLE 2.3.12. Mean catch-per-trawl of **age-0 yellow perch** at six Bay of Quinte sites, 1992-2010. 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

TABLE 2.3.13. Mean catch-per-trawl of **age-0 walleye** at six Bay of Quinte sites, 1992-2010. 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

TABLE 2.3.14. Age distribution of 246 **walleye** sampled from summer bottom trawls, Bay of Quinte, 2010. Also shown are mean fork length and mean weight. Fish of less than 160 mm fork length were assigned an age of 0, fish between 160 and 225 mm were aged using scales; and those over 225 mm fork length were aged using otoliths.

	Age (years) / Year class												
	0	1	2	3	4	5	6	7	8	9	10	11	
	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	Total
Bay of Quinte	120	47	59	14	3	1	0	0	1	0	0	1	246
Mean fork length (mm)	143	239	323	431	425	470			578			618	
Mean weight (g)	29	139	359	890	904	988			2351			3057	

2.4 Lake-wide Hydroacoustic Assessment of Prey Fish

The hydroacoustic survey of prey fish was not conducted in 2010 due to weather and scheduling problems.

2.5 Nearshore Community Index Netting

The provincial standard nearshore community index netting program (NSCIN) was initiated on the upper Bay of Quinte (Trenton to Deseronto) in 2001, and was expanded to include the lower Bay of Quinte (Deseronto to Lake Ontario) in 2002. Both upper and lower Bay of Quinte were sampled from 2002-2005. In 2006, the NSCIN program was conducted on Hamilton Harbour and the Toronto waterfront area thanks to partnerships developed with the Department of Fisheries and Oceans Canada and the Toronto Region Conservation Authority. In 2007, NSCIN was conducted in five areas: Lake St. Francis (St. Lawrence River), the upper Bay of Quinte, East and West Lakes (two Lake Ontario embayments on the southwest side of Prince Edward County), and the Toronto waterfront area. In 2008, NSCIN was conducted in five areas: Lake St. Francis (St. Lawrence River), the upper Bay of Quinte, Weller's Bay, Presqu'ile Bay, and Hamilton Harbour. In 2009, five areas were completed: upper Bay of Quinte, lower Bay of Quinte, Prince Edward Bay, North Channel/Kingston, and the Thousand Islands. In 2010, three areas were completed: Hamilton Harbour, the Toronto Waterfront, and the upper Bay of Quinte (Fig. 2.5.1).

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

Twenty-four trap net sites were sampled on Hamilton Harbour from 3 Aug-12 Sep with water temperatures ranging from 21.5-25.4 ^{o}C (Table 2.5.1). More than 14,000 fish comprising 22 species were caught (Table 2.5.2). The most abundant species by number were brown bullhead (11,584), white perch (2,025), bluegill (218), channel catfish (192), and yellow perch (100). Of note was the capture of a spotted gar, a species listed as threatened both Provincially and Federally (see Section 8.1). Although the total number of fish and species caught are relatively high in Hamilton Harbour, the species evenness and composition appears to reflect degraded environmental conditions. For example, the high turbidity tolerant ictalurids (brown bullhead and channel catfish) comprise over 80% of the fish community by number. Also a large component of the fish community is comprised of non-native species such as white perch, goldfish, and carp.

Toronto Waterfront

Twenty-four trap net sites were sampled on the Toronto Waterfront from 30 Aug-10 Sep with water temperatures ranging from 11.1-24.5 ^{o}C (Table 2.5.1). Just over 300 fish comprising 20 species were caught (Table 2.5.2). The most abundant species by number were brown bullhead (202), pumpkinseed (184), common carp (114), yellow perch (63), and rock bass (62). The most abundant piscivores were northern pike (33) and largemouth bass (33). Overall catches were low at the Toronto Waterfront. Catches were likely impacted by cold water intrusions from Lake Ontario. One-half of the trap net sets experienced water temperatures less than 18 ^{o}C while the other half of the sets were all greater than or equal to 23 ^{o}C. Common carp abundance is relatively high.

Upper Bay of Quinte

Thirty-six trap net sites were sampled on the upper Bay of Quinte from 30 Aug-17 Sep with water temperatures ranging from 16.0-24.0 ^{o}C (Table 2.5.1). More than 4,800 fish comprising 21 species were captured (Table 2.5.2). The most abundant species by number were bluegill (2,214), pumpkinseed (1,047), brown bullhead (380), black crappie (271), yellow perch (220), and largemouth bass (153). Two species of redhorse were caught silver (16) and shorthead (2).

Piscivore Biomass

Trophic structure is an indicator of general health of a fish community. A proportion of the fish community assemblage comprised of piscivores greater than 0.20 (biomass) reflects a healthy trophic structure. The proportion of piscivore biomass was 0.06, 0.15 and

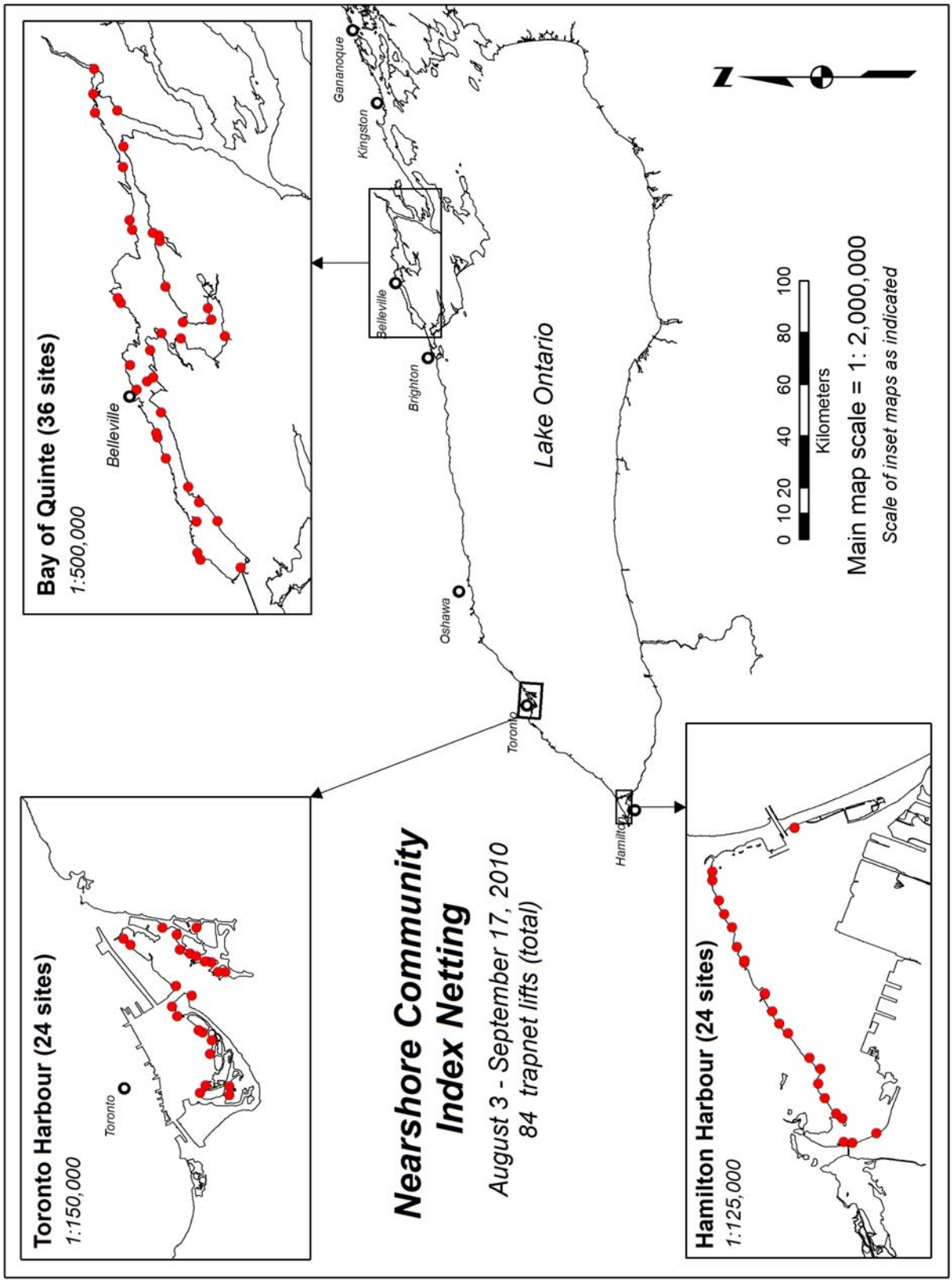

FIG. 2.5.1. Map of Lake Ontario and the St. Lawrence River indicating NSCIN trapnet locations for 2010.

TABLE 2.5.1. Survey information for the 2010 NSCIN trap net program on Hamilton Harbour, the Toronto Waterfront, and the upper Bay of Quinte.

		Hamilton Harbour	Toronto Waterfront	Upper Bay of Quinte
Survey dates		3 Aug-12 Sep	30 Aug-10 Sep	30 Aug-17 Sep
Water temperature (^{o}C)		21.5-25.4 ^{o}C	11.1-24.5^{o}C	16.0-24.0 ^{o}C
No. of trapnet lifts		24	24	36
No. sites by depth (m):				
	Target (2-2.5 m)	5	8	12
	> Target	1	11	11
	< Target	18	5	13
No. sites by substrate:				
	Hard	5	6	17
	Soft	19	18	19
No. sites by cover:				
	None	1	2	1
	1-25%	8	9	14
	25-75%	15	13	12
	>75%	0	0	9

0.30 in Hamilton Harbour, the Toronto Waterfront and the upper Bay of Quinte, respectively (Fig. 2.5.2).

Status of Selected Species

Northern pike

Northern pike were most abundant in the Toronto Waterfront and least abundant in the upper Bay of Quinte (Table 2.5.2). Age-2 pike were abundant in Hamilton Harbour (Table 2.5.3). Year-class strength appears to be consistent at the Toronto Waterfront. The oldest pike were found on the Bay of Quinte.

Pumpkinseed

Pumpkinseed were most abundant in the upper Bay of Quinte and least abundant in Hamilton Harbour (Table 2.5.2). The oldest pumpkinseed and the most year-classes of pumpkinseed were found on the upper Bay of Quinte (Table 2.5.4).

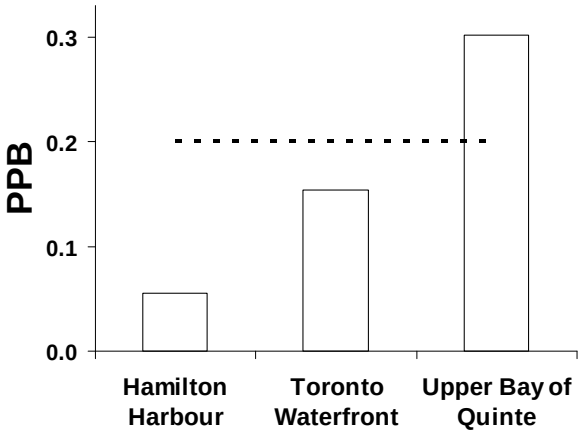

FIG. 2.5.2. Proportion of total fish community biomass represented by piscivore species (**PPB**) in the nearshore trap net surveys of Hamilton Harbour, the Toronto Waterfront and the upper Bay of Quinte. A PPB>0.20 is indicative of a balanced trophic structure (depicted by a dashed line). Piscivore species included longnose gar, bowfin, northern pike, smallmouth bass, largemouth bass, and walleye.

TABLE 2.5.2. Species-specific catch in the 2010 NSCIN trap net program on Hamilton Harbour, the Toronto Waterfront, 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 (for species with a forked tail) or total length (mm). A total of 26 species was caught.

	Hamilton Harbour				Toronto Waterfront				Upper Bay of Quinte			
	Arithmetic mean CUE	Geometric mean CUE	RSE (%)	Mean length (mm)	Arithmetic mean CUE	Geometric mean CUE	RSE (%)	Mean length (mm)	Arithmetic mean CUE	Geometric mean CUE	RSE (%)	Mean length (mm)
Longnose gar	0.280	0.187	42	733					1.556	0.478	35	782
Spotted gar	0.042	0.029	100	500								
Bowfin	2.417	1.527	17	592	0.458	0.266	40	565	0.806	0.525	22	562
Alewife					0.417	0.221	49	137				
Gizzard shad	2.375	0.738	33	148	0.042	0.029	100	430	0.639	0.363	28	187
Rainbow trout					0.042	0.029	100	290				
Northern pike	1.083	0.697	24	629	1.375	0.686	30	686	0.833	0.559	20	586
White sucker	0.458	0.238	46	356	2.292	0.992	27	475	0.444	0.339	22	416
Silver redhorse									0.444	0.226	39	475
Shorthead redhorse	0.250	0.119	70	492					0.056	0.039	70	370
Goldfish	2.708	1.609	19	393	0.042	0.029	100	400				
Common carp	2.200	1.298	19	625	4.750	2.494	16	643	0.333	0.184	41	603
Golden shiner									0.056	0.039	70	145
Brown bullhead	482.667	66.050	9	254	8.417	3.604	17	290	10.556	4.669	11	278
Channel catfish	8.000	2.153	24	473	0.167	0.091	73	623	0.528	0.333	28	598
White perch	84.375	40.172	7	184	0.250	0.175	42	232	1.694	0.600	30	223
White bass	1.458	0.481	42	255	0.042	0.029	100	260				
Rock bass	1.480	0.804	25	189	2.583	1.348	21	164	2.444	1.148	19	177
Pumpkinseed	3.333	1.256	25	126	7.667	2.343	23	113	29.083	9.191	10	156
Bluegill	9.080	3.450	18	156	1.125	0.359	51	163	61.500	42.837	4	150
Smallmouth bass	0.125	0.091	55	310	0.083	0.047	100	475	0.444	0.151	57	258
Largemouth bass	0.333	0.245	33	255	1.375	0.505	39	220	4.250	2.579	12	236
Black crappie	0.417	0.303	31	210	0.125	0.091	55	227	7.528	5.126	8	209
Yellow perch	4.160	0.982	34	209	2.625	1.304	23	178	6.111	3.267	12	205
Walleye	0.042	0.029	100	650					2.528	1.506	15	429
Freshwater drum	1.240	0.608	30	499	0.833	0.452	34	593	1.972	0.961	21	435
Total CUE	609				35				134			
Number of species	22				20				21			
Number of nets	24				24				36			
Total catch	14,605				833				4,817			

Bluegill

Bluegill were abundant in the upper Bay of Quinte and Hamilton Harbour but relatively uncommon at the Toronto Waterfront (Table 2.5.2). Bluegill ranges in age from 1-7 years with age-4 and 5 being relatively common (Table 2.5.5).

Smallmouth bass

Smallmouth bass were uncommon in all areas (Table 2.5.2). Of note was the two large age-8 fish caught at the Toronto Waterfront (Table 2.5.6).

Largemouth bass

Largemouth bass were most abundant in the upper Bay of Quinte and of low abundance in Hamilton Harbour (Table 2.5.2). Fish of age-0 to 11 years were caught with age-1 fish from the 2009 year-class particularly common in all geographic areas (Table 2.5.7).

Black crappie

Black crappie were most abundant in the upper Bay of Quinte and relatively uncommon in Hamilton Harbour and the Toronto Waterfront (Table 2.5.2). Black crappie ranged in age from age-1 to 7. Age-2 and 3 fish were most common (Table 2.5.8)

Yellow perch

Yellow perch were common in all three geographic areas (Table 2.5.2). The perch ranged in age from age-1 to 6 years (Table 2.5.9). The widest range in ages and the oldest perch were found on the upper Bay of Quinte.

TABLE 2.5.3. Age distribution and mean length and weight of 59 **northern pike** sampled from NSCIN trap nets in three geographic areas. Ages were interpreted using cleithra.

Age (years)	0	1	2	3	4	5	6	7	8	9	10
Year-class	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Hamilton Harbour											
Number		1	12	3	1	1					
Mean fork length (mm)		446	565	634	644	602					
Mean weight (g)		727	1533	2019	1948	1413					
Toronto Waterfront											
Number	2	2	2	2	3	2	2				
Mean fork length (mm)	355	531	524	597	689	798	749				
Mean weight (g)	377	1259	1244	1728	2674	4133	3426				
Upper Bay of Quinte											
Number		7	7	6	1		2	1		1	1
Mean fork length (mm)		448	524	598	754		744	676		850	747
Mean weight (g)		826	1113	1681	2930		3128	2131		3418	2594

TABLE 2.5.4. Age distribution and mean length and weight of 80 **pumpkinseed** sampled from NSCIN trap nets in three geographic areas. Ages were interpreted using scales.

Age (years)	0	1	2	3	4	5	6	7
Year-class	2010	2009	2008	2007	2006	2005	2004	2003
Hamilton Harbour								
Number		6	8	11		2		
Mean fork length (mm)		103	120	125		171		
Mean weight (g)		28	51	55		141		
Toronto Waterfront								
Number			10	11	1			
Mean fork length (mm)			112	120	139			
Mean weight (g)			38	48	73			
Upper Bay of Quinte								
Number			1	9	9	8	2	2
Mean fork length (mm)			129	146	151	156	173	162
Mean weight (g)			55	88	98	105	144	127

Walleye

Walleye were most abundant in the upper Bay of Quinte. No walleye were caught at the Toronto Waterfront and only a single fish was caught in Hamilton Harbour (Table 2.5.2). The most common ages were 2, 3, 5 and 7 years from the 2008, 2007, 2005 and 2003 year-classes, respectively (Table 2.5.10).

TABLE 2.5.5. Age distribution and mean length and weight of 70 **bluegill** sampled from NSCIN trap nets in three geographic areas. Ages were interpreted using scales.

Age (years)	0	1	2	3	4	5	6	7
Year-class	2010	2009	2008	2007	2006	2005	2004	2003
Hamilton Harbour								
Number		1	3	4	11	4	5	2
Mean fork length (mm)		130	136	158	165	171	177	178
Mean weight (g)		62	66	110	122	134	161	149
Toronto Waterfront								
Number		1		2		5	2	1
Mean fork length (mm)		103		142		183	201	218
Mean weight (g)		28		78		189	221	308
Upper Bay of Quinte								
Number			3	4	4	16	1	1
Mean fork length (mm)			121	136	155	169	172	193
Mean weight (g)			39	57	100	121	135	201

TABLE 2.5.6. Age distribution and mean length and weight of 9 **smallmouth bass** sampled from NSCIN trap nets in three geographic areas. Ages were interpreted using scales.

Age (years)	0	1	2	3	4	5	6	7	8
Year-class	2010	2009	2008	2007	2006	2005	2004	2003	2002
Hamilton Harbour									
Number			1	1					
Mean fork length (mm)			196	278					
Mean weight (g)			140	415					
Toronto Waterfront									
Number									2
Mean fork length (mm)									455
Mean weight (g)									2087
Upper Bay of Quinte									
Number			1			2	1		1
Mean fork length (mm)			244			413	415		419
Mean weight (g)			206			1658	1306		1544

TABLE 2.5.7. Age distribution and mean length and weight of 56 **largemouth bass** sampled from NSCIN trap nets in three geographic areas. Ages were interpreted using scales.

Age (years)	0	1	2	3	4	5	6	7	8	9	10	11
Year-class	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999
Hamilton Harbour												
Number		5			1	1			1			
Mean fork length (mm)		170			345	390			424			
Mean weight (g)		92			881	1321			1544			
Toronto Waterfront												
Number		13	3				1					2
Mean fork length (mm)		200	271				294					478
Mean weight (g)		152	367				490					2366
Upper Bay of Quinte												
Number	1	15	3	3	4		2		1			
Mean fork length (mm)	152	205	280	304	337		348		420			
Mean weight (g)	65	166	454	545	764		807		1145			

TABLE 2.5.8. Age distribution and mean length and weight of 43 **black crappie** sampled from NSCIN trap nets in three geographic areas. Ages were interpreted using scales.

Age (years)	0	1	2	3	4	5	6	7
Year-class	2010	2009	2008	2007	2006	2005	2004	2003
Hamilton Harbour								
Number			7	1	1			
Mean fork length (mm)			191	230	262			
Mean weight (g)			138	255	375			
Toronto Waterfront								
Number				1	2			
Mean fork length (mm)				188	240			
Mean weight (g)				119	249			
Upper Bay of Quinte								
Number		6	8	13	2	1		1
Mean fork length (mm)		179	218	250	281	272		315
Mean weight (g)		115	202	341	444	427		650

TABLE 2.5.9. Age distribution and mean length and weight of 30 **yellow perch** sampled from NSCIN trap nets in three geographic areas. Ages were interpreted using scales.

Age (years)	0	1	2	3	4	5	6
Year-class	2010	2009	2008	2007	2006	2005	2004
Hamilton Harbour							
Number			16	7	2		
Mean fork length (mm)			200	221	245		
Mean weight (g)			121	166	204		
Toronto Waterfront							
Number		5	20	4			
Mean fork length (mm)		144	186	204			
Mean weight (g)		46	93	123			
Upper Bay of Quinte							
Number			4	11	9	5	3
Mean fork length (mm)			179	203	214	253	256
Mean weight (g)			86	128	160	273	278

TABLE 2.5.10. Age distribution and mean length and weight of 30 **walleye** sampled from NSCIN trap nets in three geographic areas. Ages were interpreted using scales.

Age (years)	0	1	2	3	4	5	6	7	8	9	10	11	14
Year-class	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1996
Hamilton Harbour													
Number								1					
Mean fork length (mm)								627					
Mean weight (g)								3737					
Toronto Waterfront													
Number													
Mean fork length (mm)													
Mean weight (g)													
Upper Bay of Quinte													
Number			10	10		5		3					1
Mean fork length (mm)			363	439		516		528					554
Mean weight (g)			533	976		1705		1832					1383

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

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 abundance, measure biological attributes, and to collect age structures, stomach contents and tissues for pathological examination for selected species. This 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), and it is coordinated with the New York State Department of Environmental Conservation (NYSDEC) to provide river-wide coverage of fisheries resources.

In 2010 the survey was conducted during the period of September 13-23. Thirty six sets were made, using standard multi-panel gillnets with monofilament meshes ranging from 1.5 to 6 inches at half-inch increments. The nets were fished for approximately 24 hours. The overall catch was 1,544 fish comprising 12 species (summary in Table 2.6.1). The average number of fish per set was 42.9, a slight decrease from the record high level in 2008, and still more than three times the low levels observed in 2002 (Fig. 2.6.1). The dominant species in the catch by far were yellow perch (71.9% of the catch), followed by rock bass (16.4%), walleye (3.7%), white sucker (3.6%), and brown bullhead (1.3%) (Fig. 2.6.2).

Species Highlights

Yellow perch continued to be abundant in 2010 (Fig. 2.6.3). Over the history of the netting program, there was a decline in the abundance of yellow perch between the start of the series in 1984, and 2002. The decline was especially evident in large perch (>220 mm) indicating increased mortality of older fish. The trend was reversed in 2006, when large number of small perch was caught, followed by record high catches in 2008 with both small and large perch abundant. The 2010 catches were similar to 2008, but fewer large and more small perch were caught. The decrease in large perch is consistent with increased commercial exploitation since 2009, while the increase

TABLE 2.6.1. Summary of catches per standard gillnet set in the Lake St. Francis community index netting program, 1984-2010. 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
Lake Sturgeon	-	-	-	-	-	-	-	0.04	-	0.03	-	0.03	-
Longnose Gar	-	0.23	0.09	-	0.66	0.26	0.14	0.13	0.40	-	0.06	-	-
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
Muskellunge	-	-	0.04	-	-	-	-	-	-	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
Moxostoma sp.	-	-	0.04	0.18	0.04	0.09	0.18	0.09	-	-	0.11	0.19	0.14
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	0.40	0.70	0.44	0.95	3.25	0.54	1.38	2.81	1.97	0.56
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
Pumpkinseed	4.97	1.72	0.84	0.75	1.49	1.76	1.54	1.06	0.41	0.41	0.89	1.50	0.06
Bluegill	-	-	-	-	-	-	0.05	0.04	0.10	-	-	-	0.06
Smallmouth Bass	0.88	0.63	0.26	0.26	0.62	0.62	1.40	0.44	1.02	0.59	1.17	1.67	0.44
Largemouth Bass	0.04	-	0.09	0.09	-	0.04	0.09	0.13	0.20	-	0.61	0.31	0.33
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
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
Freshwater Drum	-	-	-	-	-	-	-	-	0.04	-	-	0.03	-
All species	38.64	30.30	32.18	25.72	27.48	25.06	24.96	21.76	13.81	15.04	31.19	48.89	42.89
Count of species	13	10	14	13	11	13	13	14	16	11	14	13	12

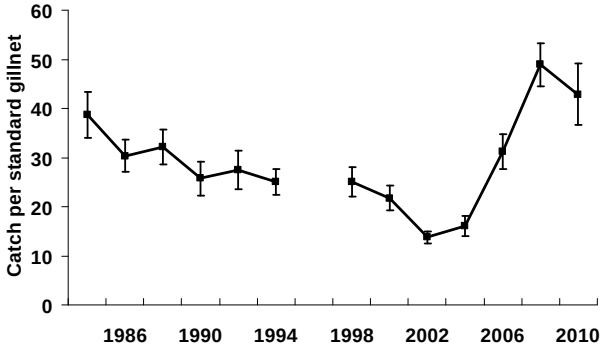

FIG. 2.6.1. Catches (±1SE) of all species combined, Lake St. Francis, 1984-2010.

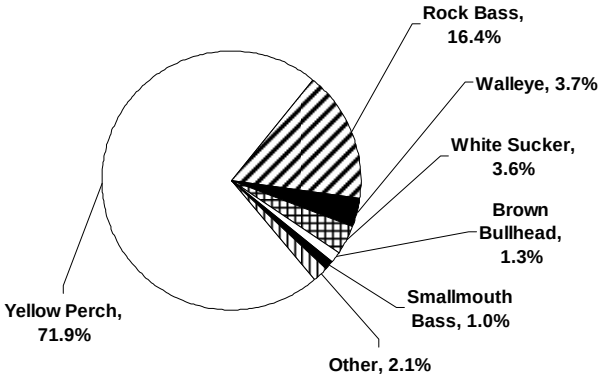

FIG. 2.6.2. Species composition in the 2010 Lake St. Francis community index netting program.

in small fish suggests continued recruitment.

Northern pike catches were the lowest since the start of index netting in 1984 (Fig. 2.6.4). A decline in abundance of small fish (<500 mm) was first observed in 1994, followed by a sharp decline in abundance of all sizes in 2002. This pattern is the opposite of the one observed in yellow perch, and it suggests a recruitment problem. The catches since 2002 remained low, with few small fish, and the 2010 catches suggest a further drop in abundance, down to less than one tenth of the 1980s levels.

Smallmouth bass abundance declined since the previous survey (Fig. 2.6.5). The abundance of smallmouth bass fluctuated considerably since the mid-1990s, and was generally higher than in the earlier years of the netting program. The low 2010 catches suggest a significant drop from record high abundance observed just two years earlier

Walleye catches in 2010 were the highest in the history of the netting program, This marks the second survey in a row with record high catches, roughly three times the levels observed in the 1984-2006 period.

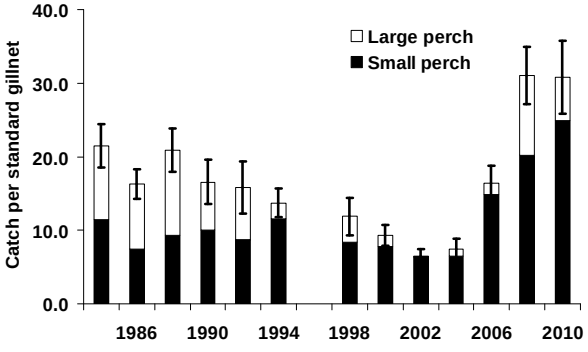

FIG. 2.6.3. Catches of small (<=220mm total length) and large (>220 mm total length) yellow perch in the Lake St. Francis community index netting program, 1984-2010. Error bars (±1SE) apply to the total catch (small + large).

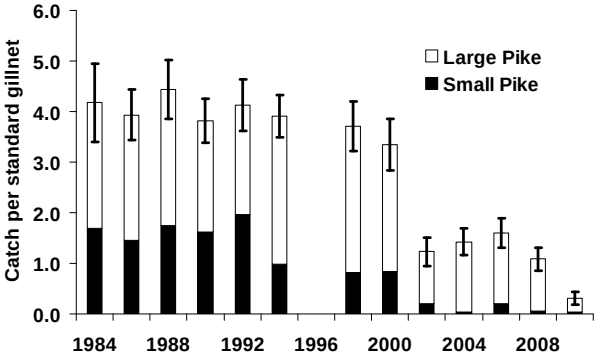

FIG. 2.6.4. Catches of small (<=500 mm total length) and large (>500 mm total length) northern pike in the Lake St. Francis community index netting program, 1984-2010. Error bars (± 1SE) apply to the total catch (small + large).

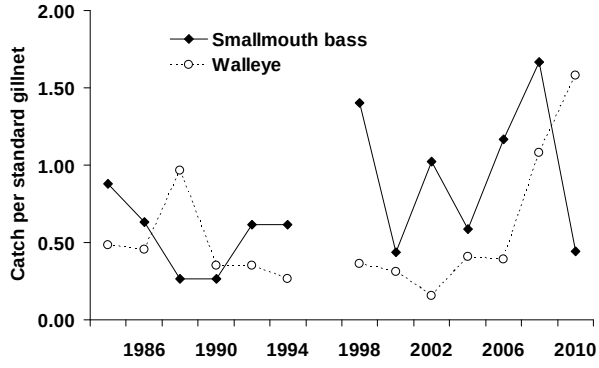

FIG. 2.6.5. Catches of smallmouth bass and walleye in the Lake St. Francis community index netting program, 1984-2010.

2.7 Juvenile Atlantic Salmon Parr Survey

In 2010, Atlantic salmon spring fingerlings (~1 g) were stocked in the Credit River and its tributaries to restore self-sustaining populations (Table 2.7.1). The purpose of this assessment was to evaluate growth and survival of Atlantic salmon parr stocked as spring fingerlings, and in conjunction with smolt surveys, to evaluate the relative contribution of each reach to the smolt migration. Atlantic salmon populations were estimated at 5 reaches, and another reach downstream from the spring fingerling stocking was sampled to determine the presence of yearling parr stocked in 2009 (Table 2.7.2, Fig. 2.7.1). Two smaller reaches on Black Creek were also stocked but not sampled.

Atlantic salmon parr populations were estimated using marks and recapture. Parr were captured by electrofishing and marked in October 2010, after most of the year's growth was complete, and when fish size indicates potential smolting. Marking and recapture sessions were about one week apart. Other species were released upon capture, and were not generally recorded. Parr were marked (3,186) using orange, blue, or black Visible Implant Elastomer (VIE) marks placed behind the eye or under the jaw in combination to discriminate each reach, and age 0 from age 1 and older fish (Table 2.7.3). During recapture sessions parr were marked for smolt assessment. Petersen population estimates were stratified by size due to size-dependent catchability, and to estimate the population of groups

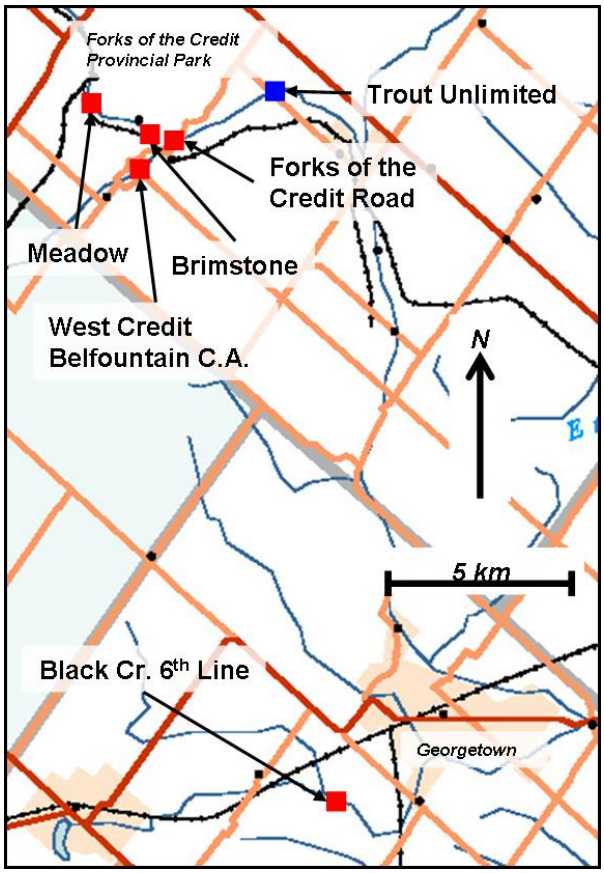

FIG. 2.7.1. Location of reaches sampled for Atlantic salmon in the Credit River in 2010. Red and blue boxes indicate mark-recapture sites and marking only, respectively.

TABLE 2.7.1. Number of Atlantic salmon stocked at study reaches in the Credit River and Black Creek in 2010.

Reach	Number	Mean weight (g)	Date	Length of reach (m)	Stream width (m)	Density (No. m-2)
Meadow (Forks Prov. Park)	47,369	1.2	May 4	707	9	7.53
Brimstone (Forks Prov. Park)	40,575	1.1	May 6	511	12	6.56
Forks of the Credit Road	39,266	1.7	May 25	409	16	6.11
West Credit Belfountain C.A.	39,196	1.2	May 20	800	10	5.00
Black Creek 6th Line	40,116	1.1	May 5	1,005	7	5.79

TABLE 2.7.2. Geo-coordinates (downstream end) and dimensions electrofishing sample in 2010.

Reach	Latitude	Longitude	Sample length (m)	Stream width (m)
Meadow (Forks Prov. Park)	43° 48.76	80° 00.87	359	9
Brimstone (Forks Prov. Park)	43° 48.18	79° 59.70	331	12
Forks of the Credit Road	43° 48.29	79° 59.48	274	16
West Credit Belfountain C.A.	43° 47.82	80° 00.41	377	10
Black Creek 6th Line	43° 37.78	79° 56.88	438	7
Trout Unlimited (lower)	43° 48.94	79° 57.58	1,066	12
Trout Unlimited (upper)	43° 48.85	79° 57.00	399	13

TABLE 2.7.3. Number of Atlantic salmon marked and VIE colour and location by age group in 2010.

Reach	Age 0			Age 1 and older			Total number
	Number	Colour	Location	Number	Colour	Location	
Meadow (Forks Prov. Park)	573	Black	Left jaw	72	Black	Right jaw	645
Brimstone (Forks Prov. Park)	707	Orange	Left jaw	90	Blue	Left jaw	797
Forks of the Credit Road	456	Orange	Left jaw	45	Blue	Left jaw	501
West Credit Belfountain C.A.	458	Orange	Right jaw	126	Blue	Right jaw	584
Black Creek 6th Line	524	Orange	Left eye	84	Blue	Left eye	608
Trout Unlimited	18	Orange	Right eye	33	Blue	Right eye	51
Total	2,736			450			3,186

of parr with differing size-dependent life history strategies.

Atlantic salmon parr exhibited two distinct growth patterns in the Credit River. Parr were smaller at the West Credit and Black Creek than at the main branch reaches (Fig. 2.7.2). The size differences were not explained by density-dependent growth related to stocking (Table 2.7.1).

The population, density, and biomass estimates of Atlantic salmon parr in the Credit River are in Table 2.7.4. From a total of 206,523 spring fingerlings stocked at these 5 reaches in 2010, an estimated 32,955 parr have survived. Of these 9,724 parr may be large enough (≥ 98 mm) to smolt in 2011, along with 2,717 age-1 parr. Assuming survival to smolt of 0.677[1] we expect 8,423 smolts from these reaches in 2011. Similarly, of the remaining 23,231 age-0 parr, we expect 8,059 smolts in 2012.

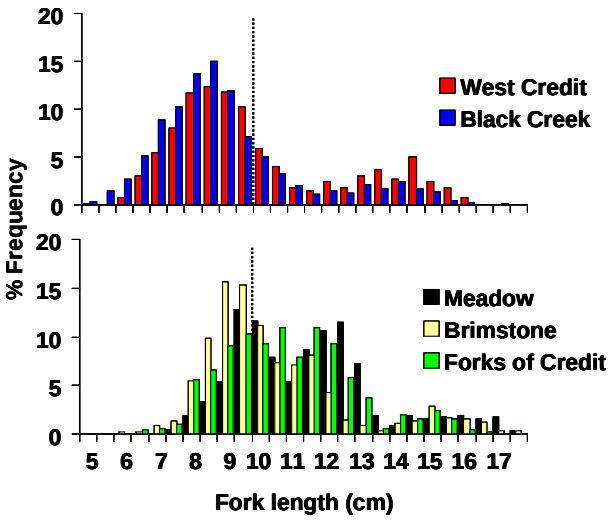

FIG. 2.7.2. Fork length distributions of Atlantic salmon parr in the Credit River in 2010. The dotted line indicates the 97.5 mm division, above which parr are expected to smolt in 2011.

TABLE. 2.7.4. Population, density, and biomass of Atlantic salmon by age/size groups in the Credit River during electrofishing surveys in 2010. Atlantic salmon >98 mm fork length are expected to smolt in 2011.

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	998	495	1,871	0.31	2.94
	Age 0 ≥98	1,119	826	1,510	0.35	6.16
	Age 1 ≥138	176	94	314	0.05	2.36
Brimstone (Forks Prov. Park)	Age 0 <98	2,306	1,452	3,618	0.58	4.59
	Age 0 ≥98	1,091	743	1,594	0.27	3.77
	Age 1 ≥138	314	147	604	0.08	3.21
Forks of the Credit Road	Age 0 <98	3,594	1,073	6,260	0.84	6.40
	Age 0 ≥98	2,697	1,395	4,930	0.63	9.21
	Age 1 ≥138	458[1]	-	-	0.11	3.76
West Credit Belfountain C.A.	Age 0 <98	1,948	1,270	2,963	0.53	2.42
	Age 0 ≥98	487	229	937	0.13	1.64
	Age 1 ≥128	308	178	519	0.08	2.60
Black Creek 6th Line	Age 0 <98	3,473	2,413	4,975	1.18	5.43
	Age 0 ≥98	330	191	556	0.11	1.40
	Age 1 ≥128	233	124	417	0.08	2.48

[1] Population estimate based on catchability of Age 0 ≥98 mm

The target density[2] (0.05-0.5 m^{-2}) of age-0 parr was exceeded at all reaches, and survival from stocking to October (9-24%, Fig. 2.7.3) was low compared with published values[1]. The lowest parr survival corresponded with the highest stocking density at the Meadow reach, suggesting density-dependent effects. Stocking densities in Ontario are relatively high compared with Atlantic salmon restoration programs, elsewhere (e.g. Connecticut, New York State).

[1] based on: Robertson, C.T. 2005. Conservation of endangered Atlantic salmon in Maine. M.Sc. Thesis. University of Toronto. 143 pp.

[2] 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.

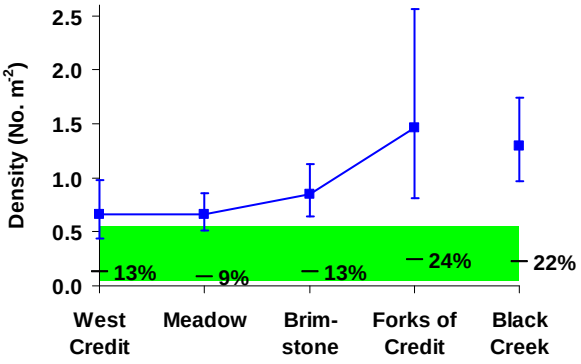

FIG. 2.7.3. Density with 95% CI and % survival of age-0 Atlantic salmon parr in the Credit River in 2010. The shaded zone indicates the target for density.

2.8 Credit River Chinook Assessment

Growth, condition, and lamprey marking of Chinook salmon were monitored during the fall spawning run (approximately October 1) in the Credit River at the Kraft dam in Streetsville. Chinook salmon were electrofished in the Credit River for spawn collection by the Ringwood Fish Culture Station. LOMU staff measured fork length and weight and collected otoliths, for ageing, from a sample of these fish. Prior to 2004, ages of Chinook salmon were based on the length distributions. This method was validated for ages 1 to 3 as accurate based on fin clipped (known age) fish stocked in 1989. Since 2005, Chinook salmon have been aged by counting annuli on thin sectioned otoliths. Mean length-at-age reported since 2005 have been recalculated as a weighted mean based on the unsorted sample and are presented here for the first time. In addition the mean length-at age of female Chinook salmon in 1995 was revised based on a re-examination of the data. The body condition was estimated for each sex as the weight of a 900 mm fish based on a general linear model.

Length of age-2 males (804 mm) and females (794 mm) and age-3 females (885 mm) increased slightly (<1%) from the previous year, but the length of age-3 males (918 mm) increased by almost 3% (Fig. 2.8.1). Length of both ages and sexes of Chinook salmon in the Credit River in 2010, was slightly above (<1%) the mean for 1991-2009 (Fig. 2.8.1).

The condition of female Chinook salmon in the Credit River in 2010 increased significantly ($P > 0.05$) over the previous seven years, and was not significantly different ($P < 0.05$) than in 1999-2002 (Fig. 2.8.2). The condition of the male Chinook salmon was not significantly different from 2009, and most years from 1989-2003, but was significantly higher than in 2004-2008.

All Chinook salmon stocked into the Credit River and other Lake Ontario locations in 2008 and 2009 were marked with an adipose fin clip. Unclipped fish observed in the Credit River spawning run were presumed to be wild. Of age-2 (2008 year class) and age-1 (2009 year class) Chinook salmon, 83% (N=67) and 91% (N=39), respectively, were stocked. The estimated numbers of wild Chinook salmon smolts were 14,201 and 8,481 in 2008 and 2009, respectively.

Lamprey marks on Chinook salmon in the Credit River increased from zero in 2009 to 0.2 marks/fish in 2010 (Fig. 2.8.3). Although low compared with the 1970s, this value was the second highest, only to 2007, in the last 30 years. B4 lamprey scars dominated the marks (Table 2.8.1) and fresh wounds (A1 and A2) comprised 25% of the marks (Fig. 2.8.3).

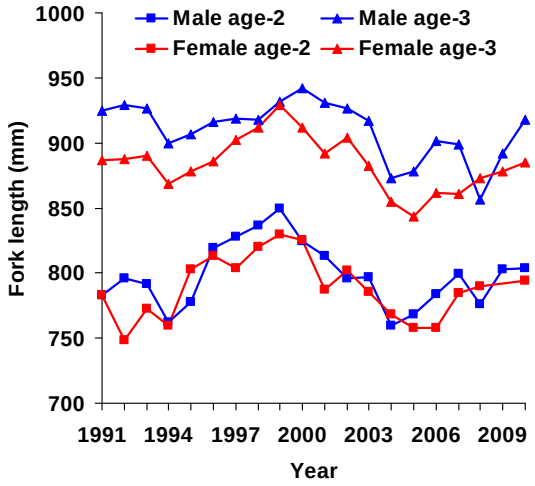

FIG. 2.8.1. Fork length of age-2 and age-3 Chinook salmon by sex during the spawning run in the Credit River, 1991-2010.

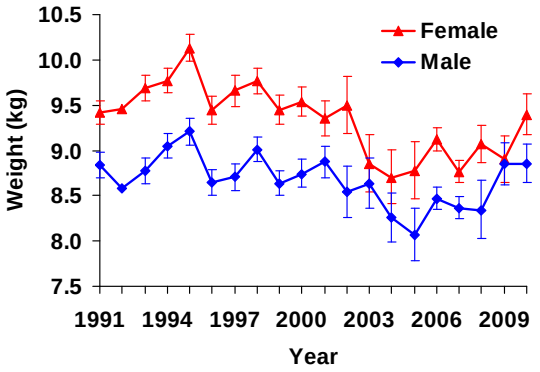

FIG. 2.8.2. Mean weight (± 95%) of a 900 mm (35.4 inch) Chinook salmon during the spawning run in the Credit River, 1991-2010.

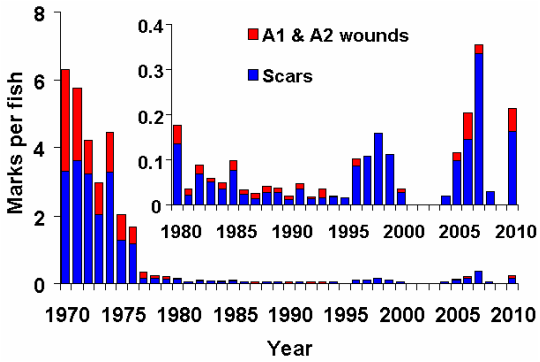

FIG. 2.8.3. Lamprey marking on Chinook salmon and coho salmon in the Credit River, Ontario during fall 1970-2010. Since 1990, A1 and A2 marks[1] were called wounds and the remainder of marks were called scars to fit with historical classification.

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

Table 2.8.1. Classification of lamprey marks (King and Edsall 1979) on Chinook salmon in the Credit River, 1990-2010.

Year	Marks/fish							
	A1	A2	A3	A4	B1	B2	B3	B4
1990	0.004	0.004	0.000	0.004	0.000	0.000	0.004	0.004
1991	0.014	0.005	0.005	0.009	0.021	0.000	0.002	0.007
1992	0.003	0.003	0.010	0.005	0.000	0.000	0.000	0.003
1993	0.021	0.000	0.003	0.000	0.003	0.000	0.006	0.003
1994	0.000	0.003	0.009	0.006	0.000	0.000	0.000	0.003
1995	0.000	0.000	0.006	0.000	0.000	0.000	0.003	0.006
1996	0.000	0.012	0.029	0.003	0.000	0.012	0.018	0.012
1997	0.000	0.000	0.006	0.102	0.000	0.000	0.000	0.000
1998	0.000	0.000	0.000	0.069	0.000	0.010	0.003	0.075
1999	0.000	0.000	0.005	0.051	0.005	0.000	0.000	0.051
2000	0.000	0.013	0.000	0.000	0.000	0.000	0.000	0.000
2001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2004	0.000	0.000	0.000	0.000	0.003	0.005	0.013	0.000
2005	0.007	0.011	0.020	0.011	0.009	0.013	0.020	0.029
2006	0.026	0.034	0.017	0.034	0.009	0.009	0.009	0.068
2007	0.000	0.009	0.028	0.121	0.000	0.009	0.047	0.084
2008	0.000	0.000	0.015	0.007	0.000	0.000	0.000	0.007
2009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2010	0.034	0.020	0.020	0.013	0.020	0.013	0.034	0.060

3. Recreational Fishing Surveys

3.1 Chinook Salmon Mark and Tag Monitoring

This is the first year of assessment for a Chinook salmon mark and tag project to determine the ratio of stocked vs. wild fish, as well as to examine fish distribution and movement. It will take a few years of assessment to get an understanding of fish production and movement around the lake. While both NYSDEC and MNR are working together on this project, only the methods and results from the 2010 Ontario assessment are provided here. In the future, as more data is collected, a joint report will be provided based on combined data from both NYSDEC and OMNR.

In 2008, NYSDEC acquired an AutoFish System from Northwest Marine Technology to apply fin clips and coded wire tags (CWTs) to fish stocked in Lake Ontario. This system is in a mobile trailer, and has since been used by NYSDEC and OMNR to mark all Chinook salmon stocked into Lake Ontario with an adipose fin clip, and some of these fish have been tagged internally with a CWT in the nose to designate the agency and stocking location.

Angler-caught Chinook salmon were sampled from June 25 to September 4, 2010 at selected high-effort boat ramps and marinas. Chinook salmon were measured, weighed, and examined for fin clips and CWTs. A subsample of Chinook salmon otoliths and noses were collected for age interpretation and CWT extraction, respectively. Ages were obtained by counting annuli on 204 thin sectioned otoliths from Chinook salmon with fork length <900 mm. Age distributions on the remaining Chinook salmon were obtained with monthly stratified age-length keys. For fish greater than 900 mm an age-length keys were based on Credit River samples (Section 2.8).

We sampled 404 angler-caught Chinook salmon, and most of these samples were from Port Credit, Bluffers, and Whitby where angling effort was higher. A greater proportion of unclipped Chinook salmon was observed at Port Credit, Whitby, and Port Darlington due to greater catches of 3 year-olds that mostly were not clipped before stocking in 2007. Most of the angler-caught Chinook salmon (380) were ages 1-3, and almost all of the fish with adipose fin clips (155) were ages 1 or 2 (Table 3.1.1). One age-3 Chinook salmon with an adipose fin clip was observed at Port Darlington, and had been stocked in 2007 as part of pen-rearing project at Barcovan or Wellington by the Central Lake Ontario Sport Anglers.

Stocked Chinook salmon were more abundant and larger than wild. A small majority of age-1 and age-2 Chinook salmon (65% and 56%, respectively) had fin clips, indicating they were stocked (Table 3.1.1). Age-1 and age-2 Chinook salmon with fin clips were both 45 mm longer on average than those with no clip (Table 3.1.2 and Fig. 3.1.1). Stream studies (OMNR unpublished data) show that stocked age-0 Chinook salmon are larger before they smolt than wild salmon, and that growth advantage may be maintained up to age 1 and 2.

Chinook salmon with NY CWTs (27) outnumbered Ontario CWTs (18). However, NYSDEC stocked 3.5 times more tagged Chinook salmon than OMNR (Table 3.1.3). NY CWTs were observed at all locations, but more (37%) were seen at Bluffers. CWTs from fish stocked in the Credit River in 2008 were observed widely dispersed from Port Credit to Port Darlington (Table 3.1.3). In contrast, CWTs from fish stocked in 2009 tended to be closer to the stocking location. Although sample sizes are small, this is consistent with increased dispersal from the stocking location with age.

TABLE. 3.1.1. Age distribution of angler-caught Chinook salmon by fin clip in 2010, and estimated percent stocked. Three age-1 Chinook salmon were captured with a CWT and no clip, were included with the Adipose clip category.

Fin clip	Age				
	0	1	2	3	4
No clip	3	56	42	126	21
Adipose	0	102	53	1	0
% stocked	0	65	56	-	-

TABLE. 3.1.2. Average fork length (+SD) in millimeters of angler-caught Chinook salmon by age and month in 2010. Samples from June 25 and September 4 were grouped with July and August, respectively.

Fin clip	Month	Age		
		0	1	2
No clip	July	-	439±68.9	709±79.7
	August	283±5.6	433±73.8	694±62.6
Adipose	July	-	449±54.7	738±85.4
	August	-	541±71.9	769±65.1

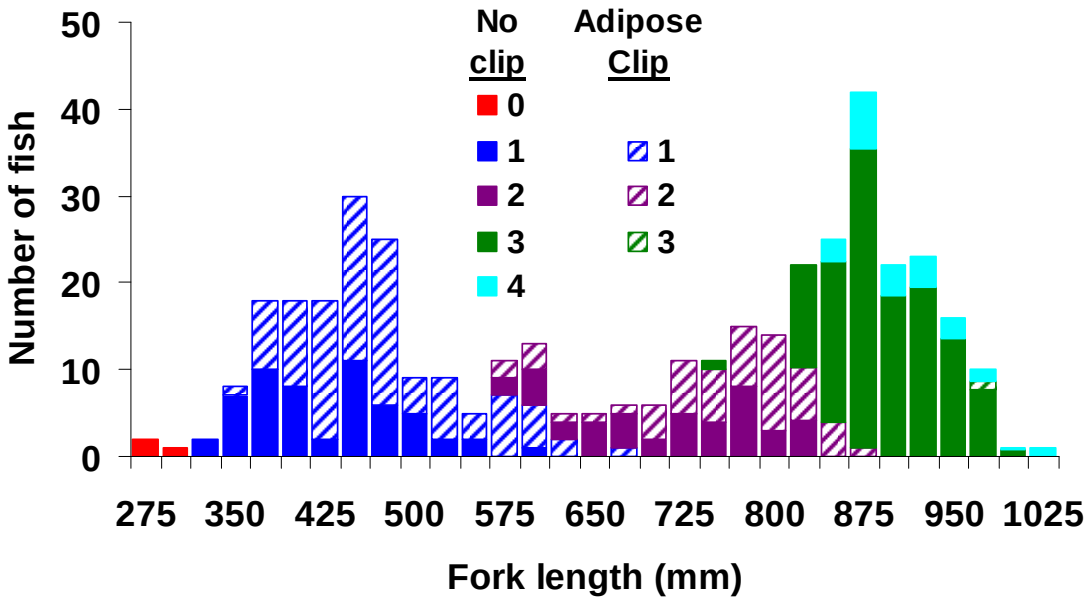

FIG. 3.1.1. Length distribution of angler-caught Chinook salmon by age and fin clip in 2010.

TABLE. 3.1.3. Number of angler-caught Chinook salmon recaptured with coded wire tags in 2010 by stocking and recapture locations and years, and number stocked. Coincidental stocking and recapture locations are shaded.

Location recaptured in 2010	Year and location stocked							
	2008 & 2009	2008	2009					
	NY	Credit River	Port Dalhousie	Burlington Canal	Bronte Creek	Credit River	Bluffer's Park	Bowmanville Creek
Hamilton	1	0	0	1	0	1	0	0
Port Credit	6	3	0	0	0	2	1	0
Bluffers	10	1	1	1	0	0	1	1
Whitby	1	3	0	0	0	0	0	0
Pt Darlington	3	1	0	0	0	0	0	0
Port Hope	5	0	0	0	0	0	0	0
Wellington	1	0	0	0	0	0	0	1
Total	27	8	1	2	0	3	2	2
Number stocked	715,510	85,000	20,205	20,220	20,201	20,255	20,199	20,403

4. Commercial Fishery

4.1 Quota and Harvest Summary

Lake Ontario supports a locally important commercial fish industry. The commercial harvest comes primarily from the Canadian waters of Lake Ontario east of Brighton (including the Bay of Quinte) and the St. Lawrence River (Fig. 4.1.1). Commercial harvest statistics for 2010 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 and the St. Lawrence River for 2010 are shown in Tables 4.1.1 (base quota), 4.1.2 (issued quota), 4.1.3 (harvest) and 4.1.4 (landed value).

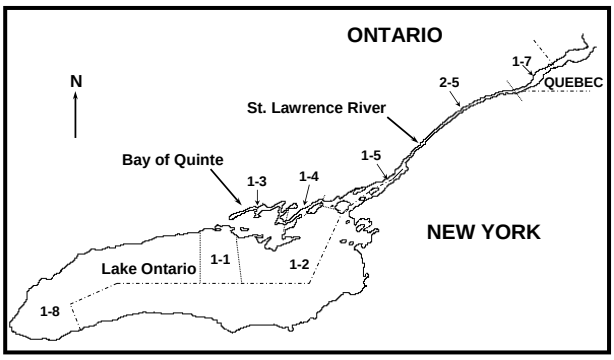

FIG. 4.1.1. Map of Lake Ontario and the St. Lawrence River showing commercial fishing quota zones in Canadian waters.

Lake Ontario

The total harvest of all species was 418,804 lb ($491,089) in 2010, up 33,085 lb (9%) from 2009 (Fig. 4.1.2, Table 4.1.5).

Lake whitefish
Lake whitefish harvest was 43,236 lb, 36% of base quota, and down over 25,000 lb from last year's harvest. Seasonal whitefish harvest and biological attributes (e.g., size and age structure) information are reported in Section 4.2.

Yellow perch
Yellow perch harvest was 140,207 lb, 31% of the base quota, and an increase of 9,027 lb (7%) from the previous year.

Walleye
Walleye harvest was 24,540 lb, 50% of the base quota, and an increase of 2,445 lb (11%) from the previous year.

TABLE 4.1.1. Commercial fish **base quota** (lb) in the Canadian waters of Lake Ontario, 2010. See Fig. 4.1.1 for a map of the quota zones. Although there is also American eel base quota, commercial fishing for this species is currently closed, due to conservation considerations, and base quotas are not shown here.

	Lake Ontario					St. Lawrence River			East Lake	West Lake	Base quota by waterbody (lb)		
	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	2,500	16,310	800	2,800	14,170	18,140	4,840	3,100	9,850	26,950	37,150	77,050
Bowfin					500						500		500
Brown bullhead	36,200								14,350	27,220	36,200		77,770
Common carp			1,000								1,000		1,000
Lake whitefish	7,275	76,023	17,364	20,313	208						121,183		121,183
Sunfish	28,130								14,600	18,080	28,130		60,810
Walleye	4,255	35,310		8,308	800						48,673		48,673
Yellow perch	35,590	182,508	96,128	126,170	13,000	68,976	83,174	16,200	1,400	4,420	453,396	168,350	627,566
Total	115,990	296,341	130,802	155,591	17,308	83,146	101,314	21,040	33,450	59,570	716,032	205,500	1,014,552

TABLE 4.1.2. Commercial fish **issued quota** (lb) in the Canadian waters of Lake Ontario, 2010. See Fig. 4.4.1 for a map of the quota zones.

	Lake Ontario					St. Lawrence River			East Lake	West Lake	Issued quota by waterbody (lb)		
	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	2,500	1,250	15,370	400	1,400	10,995	2,420	8,795	2,725	6,775	20,920	22,210	52,630
Bowfin					250				-	-	250	-	250
Brown bullhead	18,100								12,175	13,610	18,100	-	43,885
Common carp											-	-	-
Lake whitefish	2,300	74,745	12,434	10,162	104						99,745	-	99,745
Sunfish	17,000								16,100	28,000	17,000	-	61,100
Walleye	627	17,755		27,904	400						46,686	-	46,686
Yellow perch	12,185	105,385	94,234	120,708	6,500	58,244	19,200	45,697	1,200	2,660	339,012	123,141	466,013
Total	52,712	199,135	122,038	159,174	8,654	69,239	21,620	54,492	32,200	51,045	541,713	145,351	770,309

TABLE 4.1.3. 2010 commercial **harvest** (lb) for fish species harvested from the Canadian waters of Lake Ontario and the St. Lawrence River, East and West Lakes (two Lake Ontario embayments).

	Lake Ontario				St. Lawrence River			East Lake	West Lake	Total harvest (lb)		
Species	1-1	1-2	1-3	1-4	1-5	2-5	1-7	1	1	Lake Ontario	St. Lawrence River	All waterbodies
Black crappie	372	2	7,660	25	4,967	844	521	40	2,501	8,058	6,332	16,931
Bowfin	2,628	-	1,602	-	2,430	1,233	374	305	61	4,230	4,037	8,633
Brown bullhead	2,080	161	7,085	1,181	7,262	1,510	39,065	-	200	10,506	47,836	58,543
Channel catfish	-	-	12	-	-	-	-	-	-	12	-	12
Common carp	31	135	1,954	72	932	-	-	60	-	2,192	932	3,184
Freshwater drum	-	1,238	11,975	7,763	7	-	-	-	39	20,976	7	21,022
Lake herring (cisco)	49	193	1,845	1,292	-	-	-	-	148	3,379	-	3,527
Lake whitefish	-	37,223	4,890	1,124	-	-	-	-	-	43,236	-	43,236
Northern pike	3,163	1,796	24,784	3,088	5,169	-	-	2,047	6,193	32,831	5,169	46,240
Rock bass	1,432	2,441	6,706	2,276	1,146	-	-	1,972	3,200	12,855	1,146	19,173
Sunfish	3,795	10	81,905	1,798	7,268	3,571	5,267	12,797	23,544	87,509	16,106	139,955
Walleye	33	6,083	-	18,424	-	-	-	-	-	24,540	-	24,540
White bass	-	39	-	181	-	-	-	-	-	220	-	220
White perch	58	103	11,085	9,790	187	-	-	18	4,328	21,037	187	25,570
White sucker	42	604	5,235	1,138	1,352	-	-	-	-	7,017	1,352	8,369
Yellow perch	755	23,399	55,709	60,344	36,575	20,064	18,832	174	914	140,207	75,471	216,765
Total	14,437	73,426	222,446	108,495	67,294	27,222	64,059	17,413	41,126	418,804	158,575	635,918

TABLE 4.1.4. 2010 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.

	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	8,058	$2.80	$22,547	6,332	$ 2.39	$15,159	16,931	$ 2.67	$45,269
Bowfin	4,230	$0.31	$1,302	4,037	$ 0.49	$1,969	8,633	$ 0.40	$3,448
Brown bullhead	10,506	$0.28	$2,952	47,836	$ 0.31	$14,809	58,543	$ 0.29	$17,213
Common carp	2,192	$0.24	$526	932	$ 0.22	$205	3,184	$ 0.23	$737
Freshwater drum	20,976	$0.09	$1,829	7	$ 0.05	$0	21,022	$ 0.09	$1,833
Lake herring (cisco)	3,379	$0.26	$879	0			3,527	$ 0.26	$917
Lake whitefish	43,236	$0.92	$39,709	0			43,236	$ 0.92	$39,709
Northern pike	32,831	$0.27	$8,726	5,169	$ 0.28	$1,454	46,240	$ 0.27	$12,345
Rock bass	12,855	$0.44	$5,658	1,146	$ 0.44	$508	19,173	$ 0.44	$8,487
Sunfish	87,509	$1.22	$106,858	16,106	$ 0.89	$14,376	139,955	$ 1.22	$170,087
Walleye	24,540	$2.01	$49,280	0			24,540	$ 2.01	$49,280
White bass	220	$0.65	$143	0			220	$ 0.65	$143
White perch	21,037	$0.41	$8,610	187	$ 0.28	$52	25,570	$ 0.44	$11,312
White sucker	7,017	$0.11	$751	1,352	$ 0.10	$140	8,369	$ 0.11	$891
Yellow perch	140,207	$1.72	$241,320	75,471	$ 1.52	$114,884	216,765	$ 1.65	$358,002
Total	418,792		$491,089	158,575		$163,556	635,906	12	$719,673

St. Lawrence River

The total harvest of all species was 158,575 lb ($163,556) in 2010 (Fig. 4.1.3, Table 4.1.6).

Yellow perch

Yellow perch harvest was 75,471 lb, 45% of base quota, a decrease of 2,113 lb (3%) from the previous year.

TABLE 4.1.5. Commercial harvest (lb; 1960-2010) and landed value ($; 1985-2010) trends for the Canadian waters of Lake Ontario, including the Bay of Quinte.

	Harvest (lb)		Harvest (lb)	Value ($)
1960	1,834,000	1985	1,497,000	$ 906,879
1961	2,026,000	1986	1,759,000	$ 1,577,086
1962	1,620,000	1987	756,000	$ 993,609
1963	1,847,000	1988	1,190,000	$ 896,481
1964	1,814,000	1989	1,211,000	$ 989,563
1965	2,226,000	1990	1,165,000	$ 907,409
1966	1,347,000	1991	1,210,000	$ 1,003,909
1967	1,617,000	1992	1,191,000	$ 1,039,892
1968	1,829,000	1993	1,103,000	$ 746,892
1969	2,130,000	1994	1,243,097	$ 1,277,262
1970	2,798,000	1995	1,218,508	$ 1,322,557
1971	2,804,000	1996	1,284,022	$ 1,456,736
1972	2,455,000	1997	1,078,250	$ 996,383
1973	2,279,000	1998	973,006	$ 1,059,212
1974	2,299,000	1999	964,743	$ 1,067,904
1975	2,664,000	2000	914,014	$ 990,544
1976	2,935,000	2001	840,557	$ 861,978
1977	2,456,000	2002	602,338	$ 475,262
1978	2,469,000	2003	447,633	$ 324,320
1979	2,042,000	2004	404,236	$ 249,444
1980	1,982,000	2005	395,365	$ 310,084
1981	2,387,000	2006	579,738	$ 521,910
1982	1,999,000	2007	443,691	$ 429,171
1983	2,263,000	2008	373,917	$ 294,331
1984	2,050,000	2009	385,719	$ 413,580
		2010	418,804	$ 491,089

TABLE 4.1.6. Commercial harvest (lb; 1988-2010) and landed value ($; 1989-1994 and 1996-2010) trends for the Canadian waters of the St. Lawrence River.

	Harvest (lb)	Value ($)
1988	318,000	
1989	273,800	$217,000
1990	305,100	$237,000
1991	247,600	$328,100
1992	292,700	$257,300
1993	237,000	$171,900
1994	262,240	$257,900
1995	375,763	
1996	445,052	$399,856
1997	353,838	$397,494
1998	378,729	$424,111
1999	368,035	$438,581
2000	341,672	$407,647
2001	272,523	$352,551
2002	266,817	$241,817
2003	211,254	$203,710
2004	143,845	$102,646
2005	221,294	$206,479
2006	230,201	$190,819
2007	175,951	$161,484
2008	148,963	$ 89,954
2009	190,472	$150,716
2010	158,575	$163,556

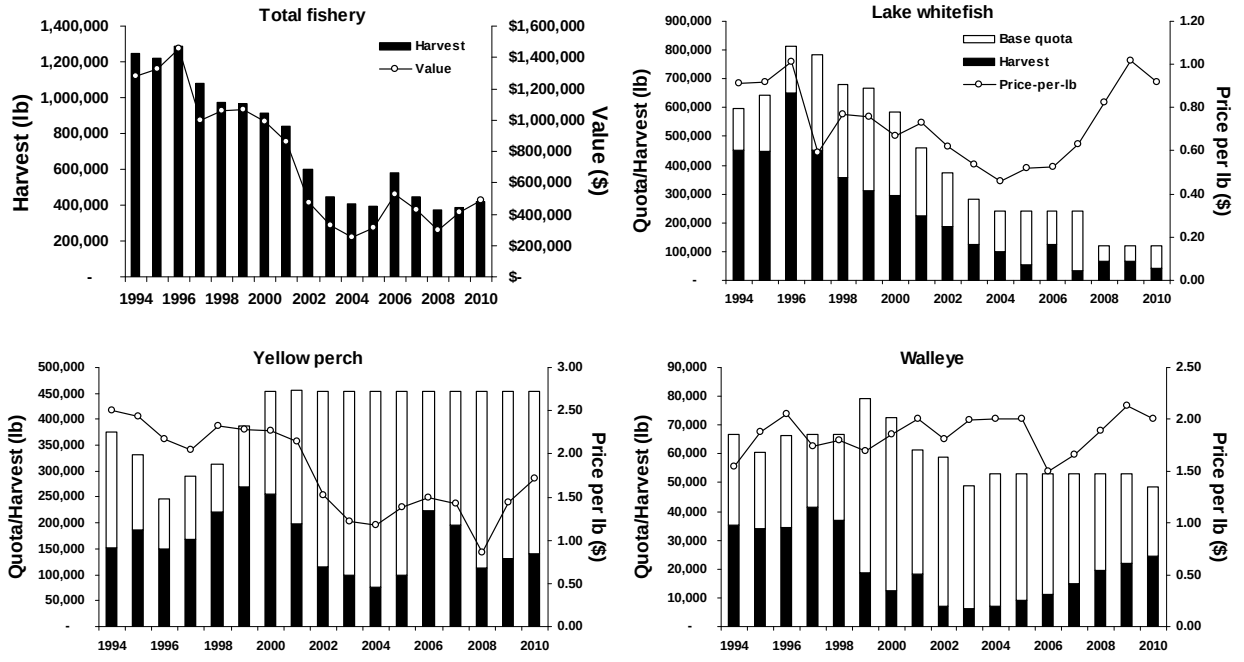

FIG. 4.1.2. Total harvest and value for the Lake Ontario commercial fishery and quota, harvest and price-per-lb for lake whitefish, yellow perch and walleye, 1994-2010.

Fishery Performance

Commercial harvest relative to quota, both quota issued and potential base quota, is shown for selected species in Fig. 4.1.4. Fisheries are performing efficiently and at full capacity when harvest approaches issued and base quota. This appears to be the case, for example, for sunfish in East and West Lakes. Many fisheries are performing well below current quota.

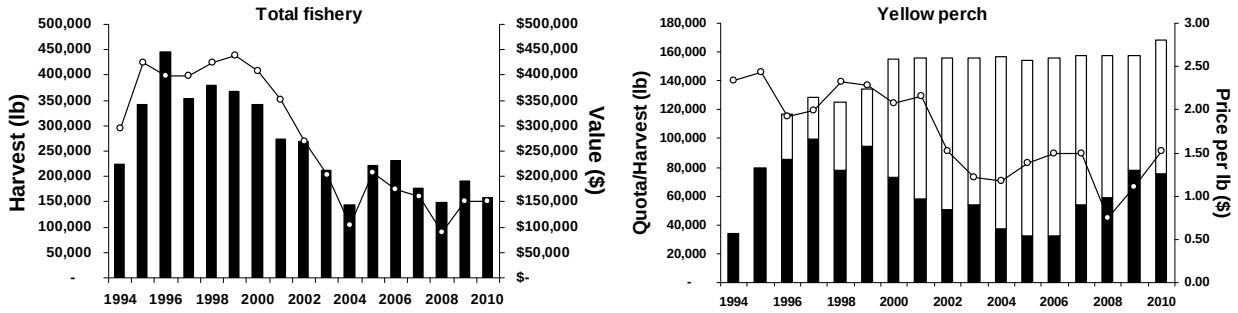

FIG. 4.1.3. Total harvest and value for the St. Lawrence River commercial fishery and quota, harvest and price-per-lb for yellow perch, 1994-2010.

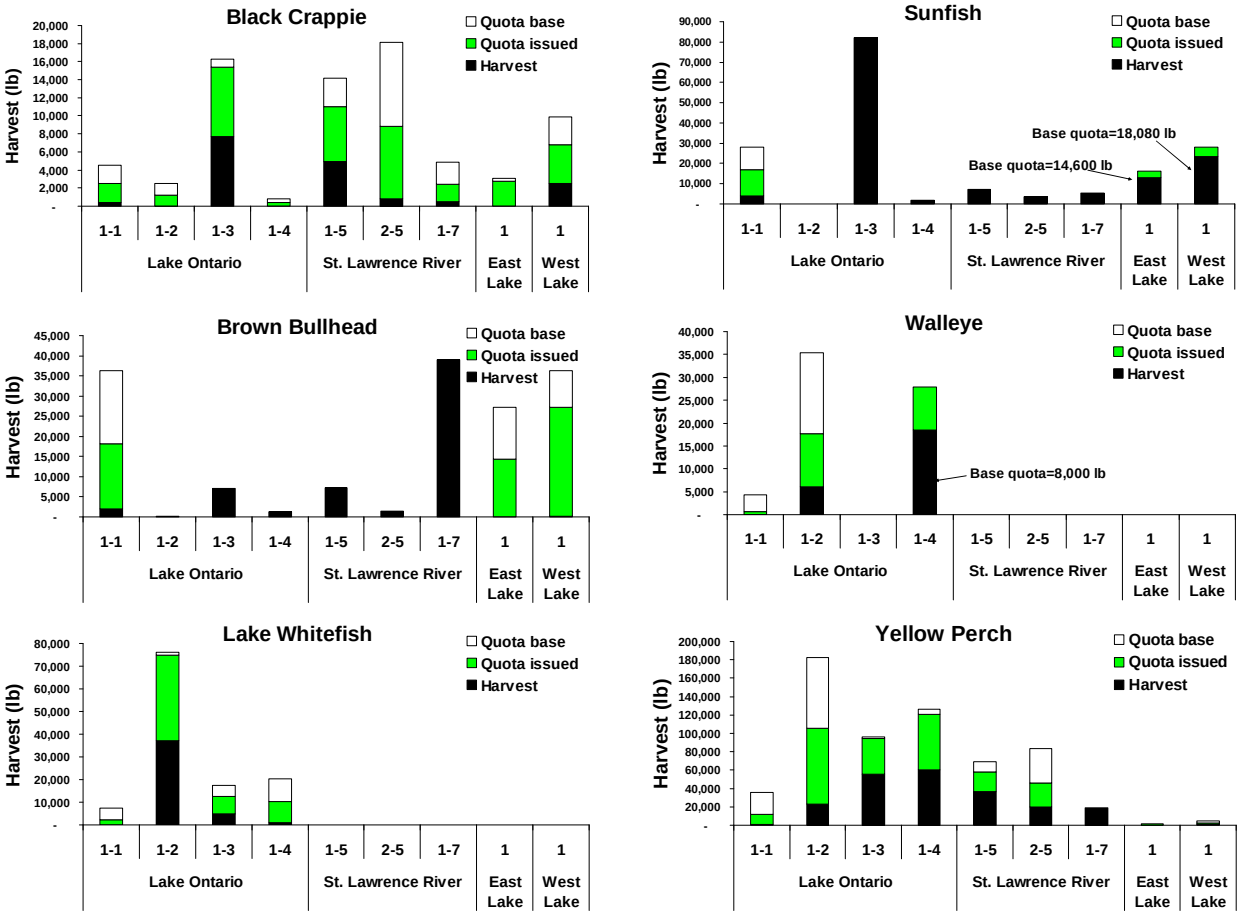

FIG. 4.1.4. Commercial harvest relative to issued and base quota for selected species by quota zone.

4.2 Lake Whitefish Commercial Catch Sampling

Sampling of commercially harvested lake whitefish for biological attribute information occurs annually. While total lake whitefish harvest can be determined from commercial fish Daily Catch Reports (DCRs; see section 4.1), biological sampling of the catch is necessary to breakdown total harvest into size and age-specific harvest. Age-specific harvest data can then be used in catch-age modeling to estimate population size and mortality schedule.

Commercial lake whitefish harvest and fishing effort by gear type, month and quota zone (QZ) for 2010 is reported in Table 4.2.1. Most of the harvest was taken in gillnets (88% by weight); 12% of the harvest was taken in impoundment gear. Gillnet fishing during November in QZ 1-2 accounted for 63% of the total harvest, for this gear type, and 45% of the effort. Most impoundment gear harvest and effort occurred in October and November in QZ 1-3 (Table 4.2.1).

Biological sampling focused on the November spawning-time gillnet fishery on the south shore of Prince Edward County (QZ 1-2), and the October/ November spawning-time impoundment gear fishery in the Bay of Quinte (QZ 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. Whitefish length and age distribution information is presented in (Fig. 4.2.1 and Fig. 4.2.2). In total, fork length was measured for 1,838 fish and age was interpreted using otoliths for 307 fish (Table 4.2.2, Fig. 4.2.1 and 4.2.2).

Lake Ontario Gillnet Fishery (QZ 1-2)

The mean fork length and age of lake whitefish harvested during the gillnet fishery in Quota Zone 1-2 were 481 and 10.8 years respectively (Fig. 4.2.1). Fish ranged from ages 4-23 years. The most abundant age-class in the fishery was age-7 (30% of the harvest by number). The 1992 and 1991 year-classes, at ages-18 and 19 years, represented 15% of the harvest.

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

Mean fork length and age were 476 mm and 10.4 years, respectively (Fig. 4.2.2). Fish ranged from ages 5 to 26 years. The most abundant age-class in the fishery was age-7 from the 2003 year-class. The 1991 year-class, at age-19, represented 8% by number of the total harvest.

Condition

Lake whitefish (Lake Ontario and Bay of Quinte

TABLE 4.2.1. Lake whitefish harvest (lb) and fishing effort (yards of gillnet or number of impoundment nets) by gear type, month and quota zone. Harvest and effort value in ***bold italic*** represent months and quota zones where whitefish biological samples were collected.

		Harvest (lb)				Effort (yards or number of nets)		
Gear type	Month	1-2	1-3	1-4	Month	1-2	1-3	1-4
Gillnet	Jan			77	Jan			1,112
	Feb			85	Feb			1,172
	Mar	149		42	Mar	1,100		320
	Apr	1,399			Apr	7,700		
	May	706		3	May	6,800		800
	Jun	2,144			Jun	13,000		
	Jul	1,802			Jul	13,020		
	Aug	1,046			Aug	5,780		
	Sep	753		63	Sep	3,080		740
	Oct	9		162	Oct	400		3,600
	Nov	***27,168***		405	Nov	***63,040***		3,420
	Dec	1,895		284	Dec	12,400		3,500
Impoundment	Mar		128		Mar		169	
	Apr	34	33	7	Apr	2	78	3
	May	112	3		May	9	1	
	Jun	22			Jun	2		
	Sep		80		Sep		123	
	Oct		***1,948***		Oct		***347***	
	Nov		***2,692***	3	Nov		***213***	2

TABLE 4.2.2. Age-specific vital statistics of lake whitefish sampled and harvested including number aged, number lengthed, 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.

	Quota zone 1-2								Quota zone 1-3							
	Sampled			Havested					Sampled			Havested				
Age (years)	Number aged	Number lengthed	Prop.	Number	Weight (kg)	Mean weight (kg)	Mean length (mm)	Age (years)	Number aged	Number lengthed	Prop.	Number	Weight (kg)	Mean weight (kg)	Mean length (mm)	
1	-	-	0.000	-	-			1	-	-	0.000	-	-			
2	-	-	0.000	-	-			2	-	-	0.000	-	-			
3	-	-	0.000	-	-			3	-	-	0.000	-	-			
4	-	-	0.000	-	-			4	-	-	0.000	-	-			
5	11	39	0.020	430	276	0.643	392	5	2	7	0.011	19	13	0.681	402	
6	28	308	0.160	3,424	3,112	0.909	435	6	25	87	0.143	235	190	0.809	412	
7	26	407	0.211	4,518	4,450	0.985	447	7	43	149	0.246	403	366	0.908	436	
8	17	244	0.127	2,708	2,923	1.080	453	8	8	28	0.046	75	74	0.985	443	
9	2	30	0.016	335	472	1.408	483	9	7	24	0.040	66	68	1.033	453	
10	5	80	0.042	890	1,215	1.365	486	10	6	21	0.034	56	60	1.059	459	
11	3	69	0.036	770	1,040	1.350	481	11	9	31	0.051	84	125	1.482	498	
12	1	14	0.008	161	214	1.334	482	12	3	10	0.017	28	40	1.406	497	
13	-	-	0.000	-	-			13	4	14	0.023	38	62	1.658	524	
14	3	26	0.013	286	557	1.948	534	14	7	24	0.040	66	87	1.326	486	
15	5	74	0.038	822	1,146	1.394	507	15	7	24	0.040	66	104	1.586	506	
16	1	1	0.001	15	31	2.081	572	16	5	17	0.029	47	92	1.954	556	
17	28	261	0.136	2,904	5,099	1.756	536	17	7	24	0.040	66	111	1.691	521	
18	14	172	0.089	1,913	3,179	1.662	530	18	27	93	0.154	253	451	1.781	546	
19	8	65	0.034	726	1,305	1.796	545	19	6	21	0.034	56	107	1.898	565	
20	11	96	0.050	1,068	2,078	1.946	551	20	3	10	0.017	28	41	1.452	513	
21	4	31	0.016	346	709	2.052	546	21	1	3	0.006	9	18	1.900	594	
22	-	-	0.000	-	-			22	2	7	0.011	19	34	1.816	568	
23	-	-	0.000	-	-			23	3	10	0.017	28	57	2.024	560	
24	1	6	0.003	63	123	1.950	547	24	-	-	0.000	-	-			
Total	168	1,925	1.000	21,379	27,930			Total	175	606	1.000	1,642	2,099			
Weighted mean						**1.306**		Weighted mean						**1.278**		

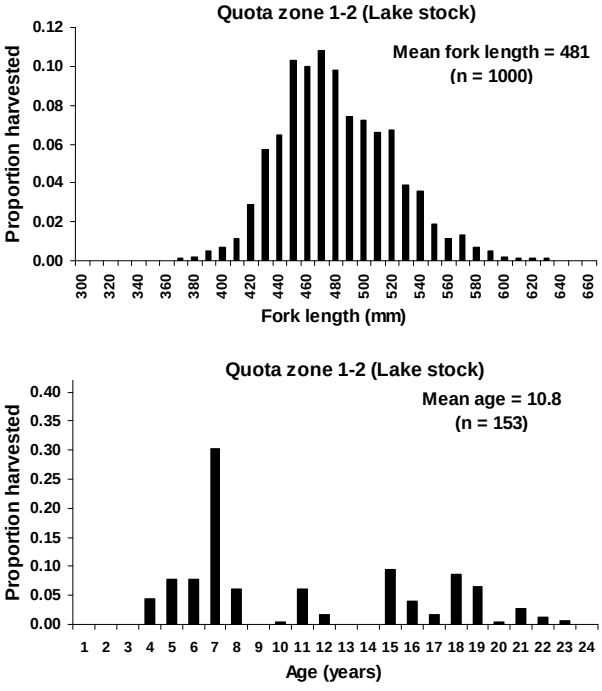

FIG. 4.2.1. Size and age distribution (by number) of lake whitefish sampled in QZ 1-2 during the 2010 commercial catch sampling program.

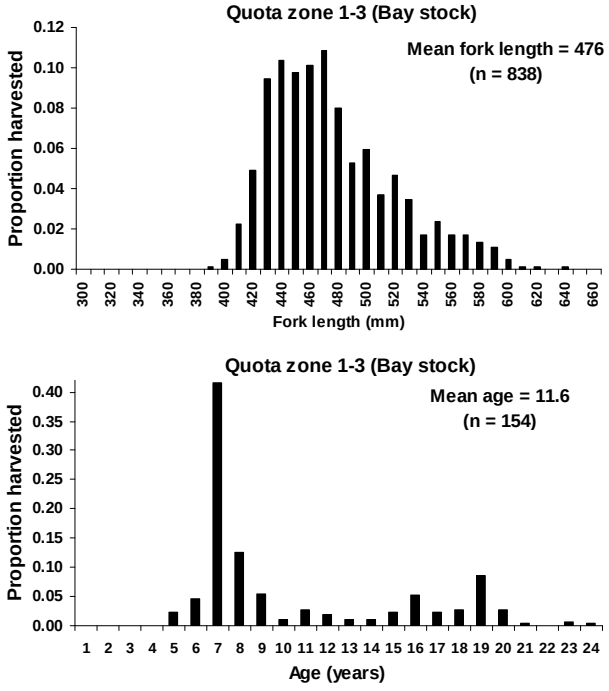

FIG. 4.2.2. Size and age distribution (by number) of lake whitefish sampled in QZ 1-3 during the 2010 commercial catch sampling program.

spawning stocks and sexes combined) relative weight (see Rennie et al. 2008) is shown in Figure 4.2.3. Condition declined markedly in 1994 and has remained low.

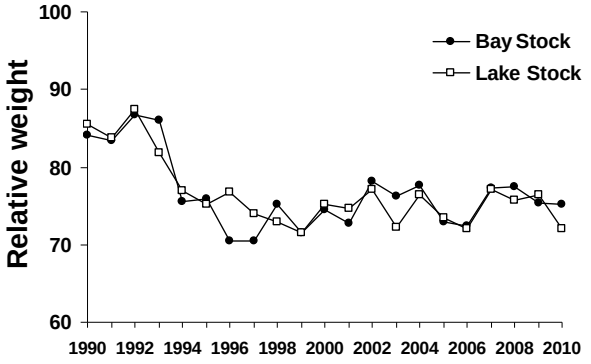

FIG. 4.2.3. Lake whitefish (Lake Ontario and Bay of Quinte spawning stocks and sexes combined) relative weight (see Rennie et al. 2008), 1990-2010.

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

4.3 Northern Pike Commercial Catch Sampling

Commercial catch sampling of northern pike was conducted during the spring of 2010. The primary objective of determining basic biological characteristics of the harvest. Pike have been commercially harvested, on an experimental basis since part way through the 2006 fishing season. In 2010, pike were sampled from the April hoop net fishery in several quota zones; harvest in this component of the pike fishery had been the largest previous years (2007-2009). The 2010 harvest is summarized in Table 4.3.1.

Sampling was conducted on 10 days in quota zones 1-3, 1-5, East Lake, and West Lake from 25 March to 9 April, 2010. A total of 820 pike were lengthed and 320 pike were measured for more detailed biological characteristics including age (Table 4.3.2). Over 70% percent of the pike sampled were female, and the mean weight of all pike sampled was 2.7 lb. Pike ranged in age from age-2 to age-10 years. The oldest pike were females; all fish over age-6 were females. Size and age distributions for pike sampled are shown in Fig. 4.3.1 to 4.3.4 for quota zones 1-3, 1-5, East Lake and West Lake, respectively.

TABLE 4.3.1. Northern pike 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 gear type, months and quota zones where pike biological information was collected. No pike harvest was permitted in quota zones 2-5 or 1-7.

		Harvest (lb)								Effort (yards or number of nets)						
Gear	Month	1-1	1-2	1-3	1-4	1-5	East L.	West L.	Month	1-1	1-2	1-3	1-4	1-5	East L.	West L.
Gillnet	Jan				102				Jan				2,788			
	Feb				116				Feb				3,456			
	Mar		9		744				Mar		400		24,468			
	Apr		42		553				Apr		7,900		34,524			
	May		36		118				May		3,560		9,000			
	Jun		208		94				Jun		4,950		5,820			
	Jul		296						Jul		11,175					
	Aug		178						Aug		8,175					
	Sep		67		58				Sep		10,400		11,880			
	Oct		30		254				Oct		1,700		35,545			
	Nov		242		570				Nov		24,200		25,610			
	Dec		39		101				Dec		6,400		7,000			
Impoundment	Jan	106							Jan	5						
	Feb			10		63			Feb			8		12		
	Mar	977		***12,347***		***2,270***	***953***	***2,851***	***Mar***	71		653		278	57	71
	Apr	738	355	***5,251***	149	***2,446***	***1,072***	***1,534***	***Apr***	88	32	1,439	10	786	224	151
	May	132	163	480	29	357	22	126	May	41	34	390	4	240	18	45
	Jun	49	24	10					Jun	20	10	8				
	Jul		6						Jul		3					
	Aug				92				Aug				19			
	Sep	122	105	1,538	86			202	Sep	84	44	546	13			104
	Oct	264		1,827	18			266	Oct	118		1,109	3			132
	Nov	709		1,226	6			900	Nov	87		411	2			59
	Dec	67		72				314	Dec	10		9				6

TABLE 4.3.2. Results of the 2010 sampling for northern pike commercial harvest.

Quota zone	Number sampling days	Number fish lengthed	Number of fish biologically sampled	Mean length (mm)	Mean age
1-3	4	266	123	578	3.9
1-5	2	127	82	494	3.0
East Lake	2	166	0	510	
West Lake	2	261	115	551	4.3
Total	10	820	320		

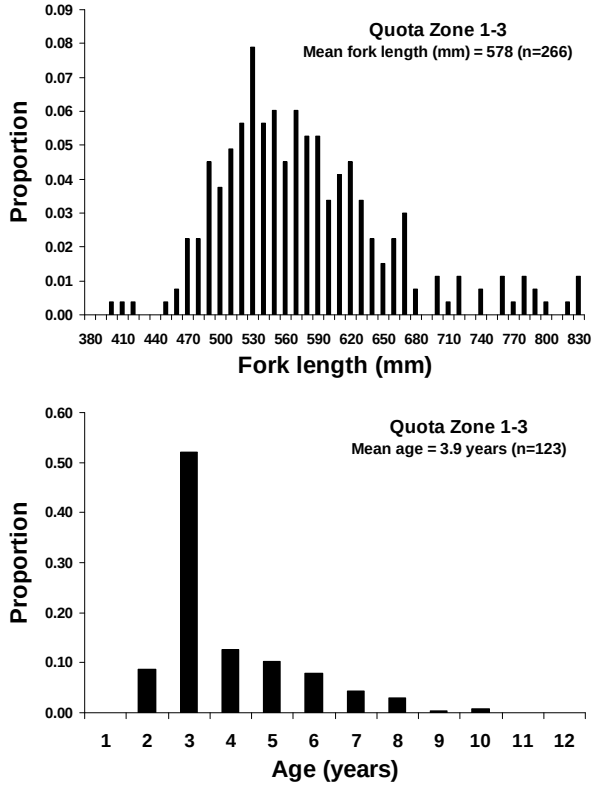

FIG. 4.3.1. Size and age distribution (by number) of northern pike sampled in QZ 1-3 during the 2010 commercial catch sampling program.

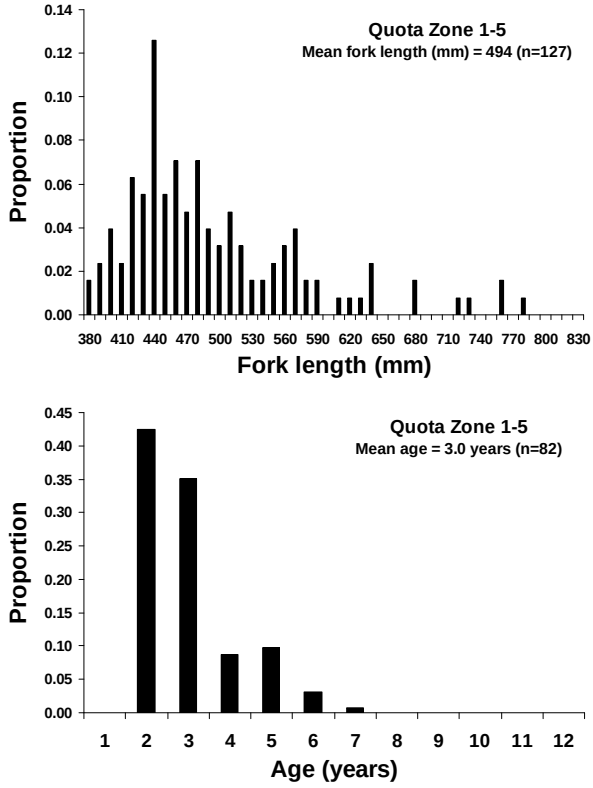

FIG. 4.3.2. Size and age distribution (by number) of northern pike sampled in QZ 1-5 during the 2010 commercial catch sampling program.

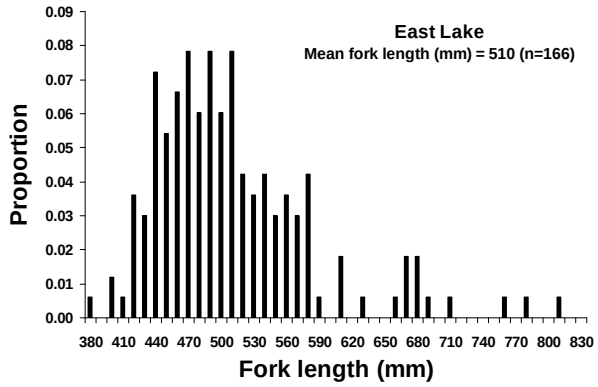

FIG. 4.3.3. Size distribution (by number) of northern pike sampled in East Lake during the 2010 commercial catch sampling program.

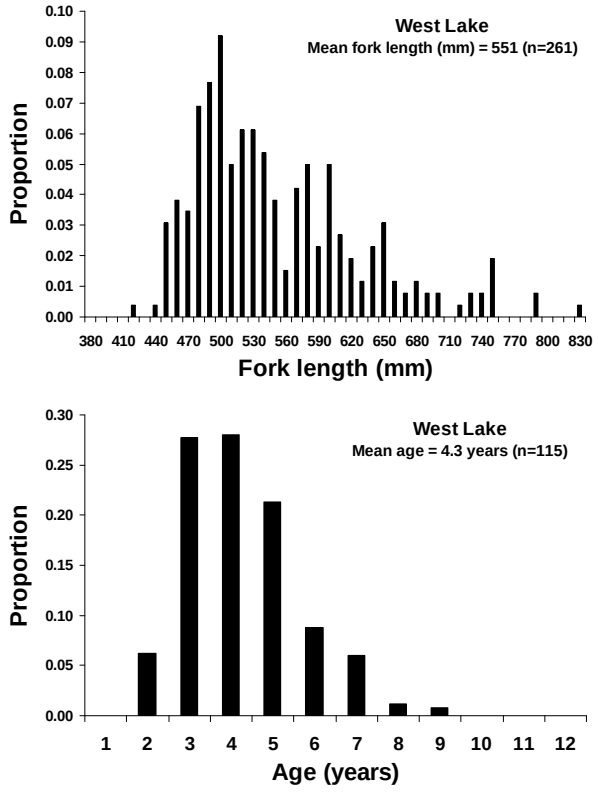

FIG. 4.3.4. Size and age distribution (by number) of northern pike sampled in West Lake during the 2010 commercial catch sampling program.

5. Age and Growth Summary

Biological sampling of fish from Lake Ontario Management Unit field projects routinely involves collecting and archiving structures used for such purposes as age interpretation and validation, origin determination (e.g. stocked versus wild), life history characteristics and other features of fish growth. In 2010, a total of 8,927 structures were collected and 3,539 were processed for age interpretation from 29 different fish species and 11 different field projects (Table 5.1) .

TABLE 5.1. Species-specific summary of age and growth structures collected/archived (n = 8,927) and interpreted for age (3,539) in support of 11 different Lake Ontario Management Unit field projects, 2010.

	Scales		Otoliths		Cleithra		Opercula		Spines	
Species	Collected	Interpreted for age	Collected	Interpreted for age	Collected	Interpreted for age	Collected	Interpreted for age	Collected	Interpreted for age
Alewife	-	-	161	-	-	-	-	-	-	-
Gizzard shad	18	-	-	-	-	-	-	-	-	-
Chinook salmon	442	-	489	278	-	-	-	-	-	-
Rainbow trout	245	100	34	-	-	-	-	-	-	-
Atlantic salmon	39	-	4	-	-	-	-	-	-	-
Brown trout	90	-	88	-	-	-	-	-	-	-
Lake trout	207	-	206	-	-	-	-	-	-	-
Lake whitefish	367	-	365	338	-	-	-	-	-	-
Cisco (Lake herring)	78	-	83	57	-	-	1	-	-	-
Round whitefish	2	-	2	-	-	-	-	-	-	-
Rainbow smelt	-	-	189	-	-	-	-	-	-	-
Northern pike	415	-	-	-	406	406	-	-	-	-
White sucker	15	-	-	-	-	-	145	-	1	-
Silver redhorse	-	-	-	-	-	-	1	-	-	-
Brown bullhead	-	-	-	-	-	-	-	-	19	-
Burbot	-	-	2	-	-	-	-	-	-	-
White perch	243	-	-	-	-	-	-	-	-	-
White bass	52	-	-	-	-	-	-	-	-	-
Rock bass	139	-	-	-	-	-	-	-	-	-
Pumpkinseed	272	160	-	-	-	-	-	-	-	-
Bluegill	179	140	-	-	-	-	-	-	-	-
Smallmouth bass	56	56	1	-	-	-	-	-	-	-
Largemouth bass	183	112	-	-	-	-	-	-	-	-
Black crappie	44	44	-	-	-	-	-	-	-	-
Yellow perch	1,339	874	297	149	-	-	-	-	-	-
Walleye	726	60	720	597	-	-	-	-	-	-
Freshwater drum	238	-	319	-	-	-	-	-	-	-
Slimy sculpin	-	-	4	-	-	-	-	-	-	-
Deepwater sculpin	-	-	1	-	-	-	-	-	-	-
Total	5,389	1,546	2,965	1,419	406	406	147	-	20	-

6. Contaminant Monitoring

Lake Ontario Management Unit cooperates annually with several agencies to collect fish samples for contaminant testing. In 2010, 571 contaminant samples were collected for Ontario's Ministry of the Environment Sport Fish Monitoring program (Table 6.1). Samples were primarily collected using existing fisheries assessment programs on Lake Ontario, Bay of Quinte and the St. Lawrence River.

A summary of the number of fish samples collected, by species, for contaminant analysis by the Ministry of Environment, 2001-2010 is shown in Table 6.2.

TABLE 6.1. Number of fish samples collected, by region and species, for contaminant analysis by the Ministry of Environment, 2010.

Region	Block	Species	Total
Hamilton Harbour	3	White bass	20
	3	Black crappie	9
Northwestern Lake	6	Chinook salmon	20
Ontario		Rainbow trout	12
		Brown trout	4
		Lake trout	6
Ganaraska River	7	Rainbow trout	20
Northeastern Lake	8	Chinook salmon	17
Ontario		Rainbow trout	1
		Brown trout	20
		Lake trout	7
		Rock bass	6
		Yellow perch	20
		Walleye	10
Upper Bay of Quinte	9	Brown bullhead	36
Middle Bay of Quinte	10	Northern pike	16
		Brown bullhead	20
		White perch	7
		Rock bass	16
		Pumpkinseed	18
		Largemouth bass	20
		Black crappie	20
		Yellow perch	20
		Walleye	20
		Freshwater drum	20
Lower Bay of	11	Chinook salmon	2
Quinte/Eastern Lake		Brown trout	10
		Lake trout	20
		Northern pike	4
		Rock bass	20
		Smallmouth bass	15
		Yellow perch	20
		Walleye	20
		Freshwater drum	17
Lake St. Francis	15	Northern pike	11
		Pumpkinseed	1
		Smallmouth bass	16
		Largemouth bass	8
		Yellow perch	20
		Walleye	20
Total			589

TABLE 6.2. Summary of the number of fish samples collected, by species, for contaminant analysis by the Ministry of Environment, 2001-2010.

	Year										
Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Black crappie			20	20	3	20		20		20	29
Bluegill		26		20	10	23			102	88	
Brown bullhead		40	44	40	25	30	33	40	68	63	56
Brown trout	40	3	20		31		22	6	29	34	34
Channel catfish	20	20	7	23		17				8	
Chinook salmon	40	3	16		48		29	1	36		39
Coho salmon		1	3								
Common carp				7							
Freshwater drum			43		16		13	2	32	20	37
Lake trout			42		54		38	17	46	20	33
Lake whitefish	20										
Largemouth bass		4	25	28	20	9	8	89	26	40	28
Northern pike		53	39	60	22	40	22	94	35	28	31
Pumpkinseed		60	25	57	8	11	23	78	92	105	19
Rainbow trout	40	37	28	20	37	20	29	20	21	20	33
Rock bass		36	30	38	11	21	27	30	20	40	42
Silver redhorse							1				
Smallmouth bass		20	87	22	21	28	35	23	39	40	31
Walleye		42	51	40	61	30	62	98	61	40	70
White bass											20
White perch		40		40	40	14	21	20	35	20	7
White sucker							1				
Yellow perch	20	60	66	58	75	40	86	90	60	91	80
Total	180	445	546	473	482	303	450	628	702	677	589

7. Stocking Program

In 2010, OMNR stocked about 2.7 million salmon and trout into Lake Ontario (Table 7.1). Figure 7.1 shows stocking trends in Ontario waters from 1968-2010. The New York State Department of Environmental Conservation (NYSDEC) also stocked 3.6 million salmon and trout into the lake in 2010.

Almost 670,000 Chinook salmon spring fingerlings were stocked at various locations to provide put-grow-and-take fishing opportunities. A surplus of 130,000 fish was produced in 2010. About 75% of the surplus was stocked in the Niagara area to help offset a shortfall in New York State. All Chinook for the Lake Ontario program are produced at Ringwood Fish Culture Station, currently operated by the Ontario Federation of Anglers and Hunters, under agreement with OMNR. Volunteers from host club, Metro East Anglers, provide thousands of hours of technical support at this hatchery. About 80,000 Chinook 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. All Chinook salmon stocked from 2008 to 2010 were marked with a coded wire tag and/or an adipose fin clip. This was done using Northwest Marine Technology's AutoFish, a unique, highly automated clipping and tagging system. Marking will help us determine levels of natural reproduction of Chinook salmon in Lake Ontario and evaluate the effectiveness of our stocking program. The study is being done cooperatively between New York and Ontario. Anglers will continue to see adipose-clipped Chinook in the fishery in 2011 and beyond. OMNR and NYSDEC will continue to sample marked fish, collect snouts and recover tags from the recreational fisheries and other sources. In 2010, anglers contributed to the collection of data on marked Chinook through a volunteer diary program. Nineteen diaries were completed, with over 1,200 Chinook observed.

TABLE 7.1. American eel, salmon and trout stocked into Province of Ontario waters of Lake Ontario, 2010, and target for 2011.

		Number Stocked	
Species		**2010**	**2011**
American eel		**142,042**	-
Atlantic salmon	Eggs	223,653	10,000
	Fry	639,992	639,500
	Fall fingerlings	177,598	189,800
	Spring yearlings	94,369	94,750
		1,135,612	**934,050**
Brown trout	Spring yearlings	**190,040**	**165,000**
Chinook salmon	Spring fingerlings	**669,452**	**540,000**
Coho salmon	Fall fingerlings	**8,415**	**50,000**
Lake trout	Spring yearlings	478,125	440,000
	Sub-adults	3,772	-
		481,897	**440,000**
Rainbow trout	Spring yearlings	172,226	140,000
	Fall yearlings	23,420	-
	Sub-adults	9,220	-
		204,866	**140,000**
Stocking totals		**2,832,324**	**2,269,050**

Atlantic salmon were stocked in support of an ongoing program to restore self-sustaining populations of this native species to the Lake Ontario basin (see Section 8.2). Over one million Atlantic salmon of various life stages were released into current restoration streams: Credit River, Duffins Creek and Cobourg Brook. OMNR is working cooperatively with a network of partners to plan and deliver this phase of Atlantic salmon restoration, including setting stocking targets to help meet program objectives. Atlantic salmon are produced at both OMNR and partner facilities. Three Atlantic salmon broodstocks, from different source populations in Nova Scotia, Quebec and Maine, are currently housed at OMNR's Harwood Fish Culture Station.

About 482,000 lake trout yearlings were also stocked as part of an established, long-term rehabilitation program. Lake trout stocking is focused in eastern Lake Ontario where most of the historic spawning shoals are found. Our annual target of 440,000 fish is comprised of Seneca Lake, Slate Islands and Michipicoten strains. In 2010, we stocked an additional 42,000 lake trout of Lake Simcoe origin. These fish were surplus to the Lake Simcoe management program. Increasing genetic variation in the lake trout population may increase prospects for successful rehabilitation of this native species to Lake Ontario. These fish were marked with coded wire tags so they can be easily identified during follow-up assessment.

Rainbow trout and brown trout were stocked at various locations to provide shore and boat fishing opportunities. A portion of the rainbow trout target is stocked into streams with a potential to establish wild populations. About 8,000 coho fall fingerlings were

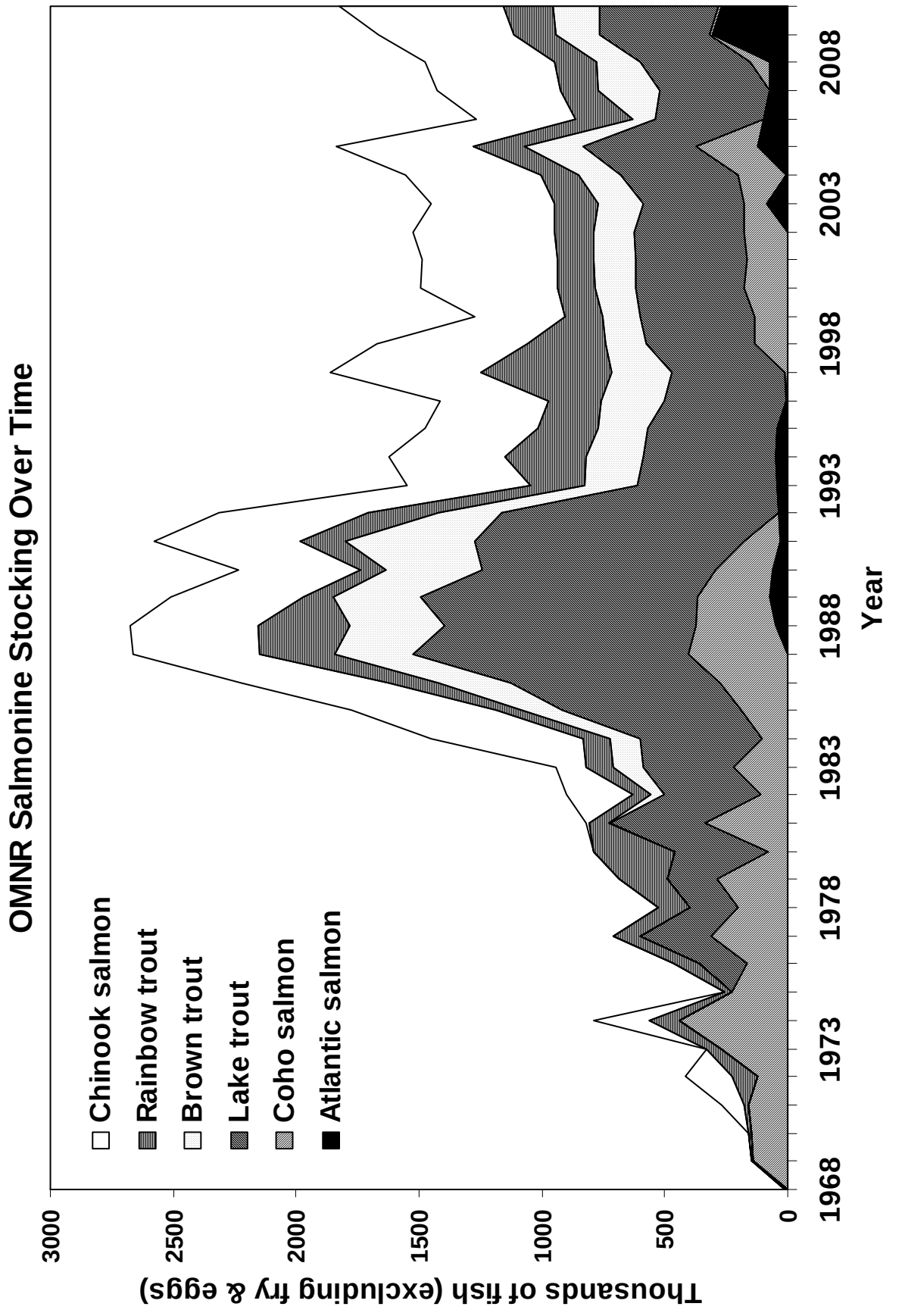

FIG. 7.1. Trends in salmon and trout stocking in Ontario waters of Lake Ontario, 1968-2010.

produced at Ringwood Fish Culture Station by the Ontario Federation of Anglers and Hunters and host club, Metro East Anglers.

Over 142,000 young American eel (elvers) were stocked into the upper St. Lawrence River, as a short-term measure to offset mortalities experienced in hydro electric generation turbines during downstream migration. This is part of a broad, bi-national, multi-agency effort to reverse the serious decline in abundance of this globally significant species. Federal research scientists from Quebec recently recovered a small number of stocked eel in the St. Lawrence Estuary. These fish were part of a larger group of wild silver eels migrating downstream, enroute to the Sargasso Sea to spawn.

OMNR remains committed to providing diverse fisheries (and the associated benefits) in Lake Ontario and its tributaries, based on wild and stocked fish, as appropriate. OMNR is committed also to restoration of native species and supports efforts to maintain / restore healthy, stable Lake Ontario fish communities.

Detailed information about OMNR's 2010 stocking activities is found in Tables 7.2-7.8.

TABLE 7.2. Atlantic salmon stocked in the Province of Ontario waters of Lake Ontario, 2010.

SITE NAME	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN/ EGG SOURCE	AGE (MONTHS)	MEAN WT (G)	MARKS	NUMBER STOCKED
ATLANTIC SALMON - EGGS / SAC FRY								
CREDIT RIVER								
Belfountain	1	2009	Belfountain	LaHave/Harwood			None	25,682
East Credit R. - site N/A	1	2009	Harwood	LaHave/Harwood			None	25,801
								51,483
DUFFINS CREEK								
East Duffins Cr. - Uxbridge/Pickering Townline	1	2009	Harwood	LaHave/Harwood			None	65,910
	11	2010	Fleming College	LaHave/Harwood			None	700
	11	2010	Fleming College	Sebago/Harwood			None	700
	11	2010	Fleming College	Lac St-Jean/Harwood			None	65
West Duffins Cr. - 30th Sideline	1	2009	Harwood	LaHave/Harwood			None	43,895
								111,270
HUMBER RIVER								
Castlederg Road	1	2009	Ontario Streams	LaHave/Harwood			None	25,000
Chicco's	1	2009	Ontario Streams	LaHave/Harwood			None	30,000
Coffey Cr. - Galloway Property	2	2009	Ontario Streams	LaHave/Harwood				900
Humber Station Road	1	2009	Ontario Streams	LaHave/Harwood			None	5,000
								60,900
ATLANTIC SALMON - ADVANCED FRY								
COBOURG BROOK								
Ball's Mill	5	2009	Fleming College	LaHave/Harwood	5	0.7	None	11,793
	5	2009	Normandale	LaHave/Harwood	5	1.1	None	15,223
Crossen Road	5	2009	Fleming College	LaHave/Harwood	5	1.7	None	17,564
	5	2009	Fleming College	Sebago/Harwood	5	1.2	None	8,457
Dale Rd.	5	2009	Fleming College	LaHave/Harwood	5	1.3	None	34,607
	5	2009	Normandale	LaHave/Harwood	5	1.2	None	10,149
Hie / McNichol Properties	5	2009	Fleming College	LaHave/Harwood	5	1.3	None	24,800
								122,593
CREDIT RIVER								
Belfountain C.A.	5	2009	Normandale	LaHave/Harwood	5	1.2	None	39,196
Black Cr. - 6th Line	5	2009	Normandale	LaHave/Harwood	5	1.1	None	40,116
Black Cr. - 15th Sideroad	5	2009	Normandale	LaHave/Harwood	5	1.4	None	14,990
Black Cr. - 17th Sideroad	5	2009	Normandale	LaHave/Harwood	5	1.4	None	24,688
Ellie's Ice Cream Parlour	5	2009	Normandale	LaHave/Harwood	5	1.7	None	39,266
Forks of the Credit - Dominion St.	5	2009	Normandale	LaHave/Harwood	5	1.1	None	40,575
Forks of the Credit Prov. Park - "meadow"	5	2009	Normandale	LaHave/Harwood	5	1.2	None	47,369
Forks of the Credit Prov. Park - "stuck truck"						1.6	None	28,565
West Credit R. - Belfountain	4	2009	Belfountain	LaHave/Harwood		0.2	None	46,793
								321,558

Continued on next page

TABLE 7.2 (continued) Atlantic salmon stocked in the Province of Ontario waters of Lake Ontario, 2010.

SITE NAME	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN/ EGG SOURCE	AGE (MONTHS)	MEAN WT (G)	MARKS	NUMBER STOCKED
DUFFINS CREEK								
East Duffins Cr. - Claremont Field Centre	5	2009	Normandale	LaHave/Harwood	5	1.6	None	19,990
East Duffins Cr. - Durham Board of Education Outdoor Centre	5	2009	Normandale	LaHave/Harwood	5	1.6	None	11,675
East Duffins Cr. - Michell Cr., 8th Conc.	5	2009	Normandale	LaHave/Harwood	5	1.3	None	22,990
East Duffins Cr. - Pickering Museum	5	2009	Normandale	LaHave/Harwood	5	1.6	None	30,575
Ganatsekiagon Cr. - Tillings Rd.	5		Normandale	LaHave/Harwood	5	1.3	None	9,974
West Duffins Cr. - Sideline 32	5	2009	Normandale	LaHave/Harwood	5	1.1	None	25,880
West Duffins Cr. - Sideline 34	5	2009	Normandale	LaHave/Harwood	5	1.1	None	10,896
	5	2009	Harwood	LaHave/Harwood	3	1.0	None	39,618
								171,598
HUMBER RIVER								
Cold Cr.	4	2009	Ontario Streams	LaHave/Harwood			None	209
Private property	4	2009	Ontario Streams	LaHave/Harwood			None	24,034
								24,243
ATLANTIC SALMON - FALL FINGERLINGS								
COBOURG BROOK								
Danforth Rd.	11	2009	Normandale	LaHave/Harwood	10	9.0	None	22,396
West Branch - Telephone Road	10	2009	Fleming College	LaHave/Harwood	10	31.3	None	26,515
								48,911
CREDIT RIVER								
Grange Sideroad	11	2009	Normandale	LaHave/Harwood	10	9.3	None	20,625
Inglewood	11	2009	Normandale	LaHave/Harwood	10	9.6	None	21,084
McLaren Rd.	10	2009	Normandale	LaHave/Harwood	9	7.8	None	25,033
McLaughlin Rd.	10	2009	Normandale	LaHave/Harwood	9	8.4	None	25,072
								91,814
DUFFINS CREEK								
East Duffins Cr. - 5th Concession	10	2009	Normandale	Lac St-Jean/Harwood	11	13.3	None	5,911
	12	2009	Normandale	Lac St-Jean/Harwood	13	16.4	None	796
East Duffins Cr. - Paulynn Park	10	2009	Pine Valley Springs	Sebago/Harwood		23.0	None	53
West Duffins Cr. - Wixon Cr.	10	2009	Normandale	LaHave/Harwood	9	7.7	None	30,113
								36,873
ATLANTIC SALMON - SPRING YEARLINGS								
COBOURG BROOK								
Danforth Rd.	3	2008	Normandale	LaHave/Harwood	14	15.7	None	14,571
	4	2008	Harwood	LaHave/Harwood	16	25.7	None	744
	6	2008	Normandale	Sebago Lake/Harwood	18	82.7	None	656
Hie / McNichol Properties	4	2008	Fleming College	LaHave/Harwood	15	92.8	None	9,976
								25,947
CREDIT RIVER								
Glen Williams	3	2008	Normandale	LaHave/Harwood	14	16.1	None	11,749
Inglewood	3	2008	Normandale	LaHave/Harwood	14	15.2	None	15,540
Paper Mill Dam (Georgetown)	3	2008	CRAA	LaHave/Harwood	16	22.0	None	304
Terra Cotta	3	2008	Normandale	LaHave/Harwood	14	15.1	None	15,547
								43,140
DUFFINS CREEK								
East Duffins Cr. - 5th Concession	3	2008	Normandale	LaHave/Harwood	14	15.9	None	7,656
	3	2008	Normandale	Lac St-Jean/Harwood	16	19.9	None	4,756
	5	2008	Normandale	Lac St-Jean/Harwood	18	42.2	None	770
East Duffins Cr. - Paulynn Park	3	2008	Normandale	LaHave/Harwood	14	15.3	None	12,100
								25,282
TOTAL - ATLANTIC SALMON EGGS / SAC FRY								**223,653**
TOTAL - ATLANTIC SALMON ADVANCED FRY								**639,992**
TOTAL - ATLANTIC SALMON FALL FINGERLINGS								**177,598**
TOTAL - ATLANTIC SALMON SPRING YEARLINGS								**94,369**
TOTAL - ATLANTIC SALMON								**1,135,612**

TABLE 7.3. Brown trout stocked in the Province of Ontario waters of Lake Ontario, 2010.

SITE NAME	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN/ EGG SOURCE	AGE (MONTHS)	MEAN WT (G)	MARKS	NUMBER STOCKED
BROWN TROUT - SPRING YEARLINGS								
BRONTE CREEK								
Bronte Beach Park	3	2008	Chatsworth	Ganaraska/Tarentorus	15	28.1	Ad	**14,972**
DUFFINS CREEK								
401 Bridge	3	2008	Chatsworth	Ganaraska/Tarentorus	15	23.9	Ad	**10,025**
LAKE ONTARIO								
Ashbridge's Bay Ramp	3	2008	Chatsworth	Ganaraska/Tarentorus	15	28.1	Ad	15,007
Athol Bay	3	2008	Chatsworth	Ganaraska/Tarentorus	15	23.9	Ad	25,063
Bluffer's Park	3	2008	Chatsworth	Ganaraska/Tarentorus	15	23.9	Ad	15,038
Burlington Canal	3	2008	Chatsworth	Ganaraska/Tarentorus	15	25.0	Ad	25,000
Fifty Point CA	3	2008	Chatsworth	Ganaraska/Tarentorus	15	25.0	Ad	15,000
Jordan Harbour	3	2008	Chatsworth	Ganaraska/Tarentorus	15	24.8	Ad	10,073
Lakefront Promenade	3	2008	Chatsworth	Ganaraska/Tarentorus	15	28.1	Ad	10,028
Millhaven Wharf	3	2008	Chatsworth	Ganaraska/Tarentorus	15	23.9	Ad	14,829
Oshawa Harbour	3	2008	Chatsworth	Ganaraska/Tarentorus	15	23.9	Ad	10,025
Port Dalhousie East	3	2008	Chatsworth	Ganaraska/Tarentorus	15	24.8	Ad	24,980
								165,043
TOTAL - BROWN TROUT								**190,040**

TABLE 7.4. Chinook salmon stocked in the Province of Ontario waters of Lake Ontario, 2010.

SITE NAME	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN/ EGG SOURCE	AGE (MONTHS)	MEAN WT (G)	MARKS	NUMBER STOCKED
CHINOOK - SPRING FINGERLINGS**								
BOWMANVILLE CREEK								
Mouth	5	2009	Ringwood	Wild - Credit R.	6	4.6	Ad	1,882
	5	2009	Ringwood	Wild - Credit R.	6	4.6	Ad/CWT	21,136
Port Darlington	5	2009	Ringwood*	Wild - Credit R.	6	10.1	Ad	10,239
								33,257
BRONTE CREEK								
2nd Side Road Bridge	5	2009	Ringwood	Wild - Credit R.	6	5.4	Ad	16,322
	5	2009	Ringwood	Wild - Credit R.	6	5.4	Ad/CWT	10,972
5th Side Road Bridge	5	2009	Ringwood	Wild - Credit R.	6	5.4	Ad	15,577
	5	2009	Ringwood	Wild - Credit R.	6	5.4	Ad/CWT	10,472
								53,343
CREDIT RIVER								
Eldorado Park	4	2009	Ringwood	Wild - Credit R.	5	4.3	Ad	15,208
	4	2009	Ringwood	Wild - Credit R.	5	4.3	Ad/CWT	12,799
Huttonville	4	2009	Ringwood	Wild - Credit R.	5	4.4	Ad	19,804
	4	2009	Ringwood	Wild - Credit R.	5	4.3	Ad/CWT	8,213
Norval	4	2009	Ringwood	Wild - Credit R.	5	4.4	Ad	30,135
								86,159
DON RIVER								
Donalda Golf Club	4	2009	Ringwood	Wild - Credit R.	5	4.2	Ad	**14,932**
HIGHLAND CREEK								
Colonel Danforth Park	4	2009	Ringwood	Wild - Credit R.	5	4.2	Ad	**14,932**
HUMBER RIVER								
East Branch Islington	4	2009	Ringwood	Wild - Credit R.	5	4.2	Ad	**15,366**
LAKE ONTARIO								
Ashbridge's Bay Ramp	4	2009	Ringwood	Wild - Credit R.	5	3.5	Ad	10,919
Barcovan	4	2009	Ringwood*	Wild - Credit R.	5	3.6	Ad	7,508
Beacon Inn	4	2009	Ringwood	Wild - Credit R.	5	4.4	Ad	24,849
Bluffer's Park	5	2009	Ringwood	Wild - Credit R.	6	5.5	Ad	7,417
	5	2009	Ringwood*	Wild - Credit R.	6	11.9	Ad	10,252
	5	2009	Ringwood	Wild - Credit R.	6	5.5	Ad/CWT	20,787
Burlington Canal	5	2009	Ringwood	Wild - Credit R.	6	5.1	Ad	31,317
	5	2009	Ringwood	Wild - Credit R.	6	5.1	Ad/CWT	20,737
Consecon Robinson Pt	4	2009	Ringwood	Wild - Credit R.	5	4.1	Ad	20,000
Lakeport	4	2009	Ringwood	Wild - Credit R.	5	4.1	Ad	15,067
Oshawa Harbour	4	2009	Ringwood	Wild - Credit R.	5	4.1	Ad	20,089
	5	2009	Ringwood*	Wild - Credit R.	6	6.3	Ad	4,977
Port Dalhousie East	4	2009	Ringwood	Wild - Credit R.	5	4.4	Ad	30,326
	5	2009	Ringwood	Wild - Credit R.	6	5.4	Ad	33,592
	5	2009	Ringwood*	Wild - Credit R.	6	9.0	Ad	20,231
	5	2009	Ringwood	Wild - Credit R.	6	5.4	Ad/CWT	21,155
Port Credit Marina	5	2009	Ringwood*	Wild - Credit R.	6	7.3	Ad	4,985
Wellington Channel	4	2009	Ringwood	Wild - Credit R.	5	4.1	Ad	15,098
	5	2009	Ringwood*	Wild - Credit R.	6	10.1	Ad	10,236
Whitby Harbour	4	2009	Ringwood	Wild - Credit R.	5	4.1	Ad	12,555
	5	2009	Ringwood*	Wild - Credit R.	6	9.2	Ad	12,713
								354,810
NIAGARA RIVER								
Queenston	5	2009	Ringwood	Wild - Credit R.	6	5.8	Ad/CWT	**96,653**
TOTAL - CHINOOK SALMON								**669,452**

* Pen-imprinted

**All fish produced at Ringwood FCS by the Ontario Federation of Anglers and Hunters and volunteers from Metro East Anglers

TABLE 7.5. Coho salmon stocked in the Province of Ontario waters of Lake Ontario, 2010.

SITE NAME	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN/ EGG SOURCE	AGE (MONTHS)	MEAN WT (G)	MARKS	NUMBER STOCKED
COHO - FALL FINGERLINGS								
CREDIT RIVER								
Norval Nashville North	9	2009	Ringwood*	Wild - Credit River / Cobourg Ck	9	27.5	None	8,415
TOTAL - COHO SALMON								**8,415**

* following the hatchery name indicates a partnership hatchery

Ringwood - all fish at Ringwood FCS are produced by the Ontario Federation of Anglers and Hunters and volunteers from Metro East Anglers

TABLE 7.6. Lake trout stocked in the Province of Ontario waters of Lake Ontario, 2010.

SITE NAME	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN/ EGG SOURCE	AGE (MONTHS)	MEAN WT (G)	MARKS	NUMBER STOCKED
LAKE TROUT - SPRING YEARLINGS								
LAKE ONTARIO								
Cobourg Harbour Pier	4	2008	Harwood	Seneca Lake/Tarentorus	16	24.2	AdLV	19,692
	5	2008	Harwood	Seneca Lake/Tarentorus	17	34.7	AdLV	22,102
Fifty Point CA	4	2008	Harwood	Seneca Lake/Tarentorus	16	27.9	AdLV	20,888
	5	2008	Chatsworth	Lake Simcoe (Wild)	17	31.1	Ad/CWT	41,815
	5	2008	Harwood	Seneca Lake/Tarentorus	17	35.0	AdLV	41,277
	5	2008	Harwood	Slate Islands/Dorion	17	41.4	AdLV	15,066
North of Main Duck Sill	4	2008	White Lake	Seneca Lake/Tarentorus	15	34.0	AdLV	10,859
	4	2008	Harwood	Seneca Lake/Tarentorus	16	29.0	AdLV	12,168
	4	2008	White Lake	Slate Islands/Dorion	16	22.8	AdLV	86,822
	4	2008	Harwood	Michipicoten Island/Dorion	17	35.6	AdLV	32,222
Pigeon Island	4	2008	White Lake	Slate Islands/Dorion	16	35.8	AdLV	11,429
South of Long Point	4	2008	White Lake	Seneca Lake/Tarentorus	15	33.9	AdLV	131,192
	4	2008	White Lake	Slate Islands/Dorion	16	35.0	AdLV	11,403
	4	2008	Harwood	Michipicoten Island/Dorion	17	32.5	AdLV	21,190
								478,125
LAKE TROUT - SUB-ADULTS								
LAKE ONTARIO								
Fifty Point CA	10	2008	Chatsworth	Michipicoten Island (Wild)	22	216.8	Ad/CWT	**3,772**
TOTAL - LAKE TROUT SPRING YEARLINGS								**478,125**
TOTAL - LAKE TROUT SUB-ADULTS								**3,772**
TOTAL - LAKE TROUT								**481,897**

TABLE 7.7. Rainbow trout stocked in the Province of Ontario waters of Lake Ontario, 2010.

SITE NAME	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN/ EGG SOURCE	AGE (MONTHS)	MEAN WT (G)	MARKS	NUMBER STOCKED
RAINBOW TROUT - SPRING YEARLINGS								
BRONTE CREEK								
Lowville Park	4	2009	Normandale	Ganaraska/Tarentorus	12	15.6	RV	11,873
2nd Side Road Bridge	4	2009	Normandale	Ganaraska/Tarentorus	12	15.6	RV	12,033
								23,906
CREDIT RIVER								
Norval Nashville North	4	2009	Normandale	Ganaraska/Tarentorus	12	20.7	RV	11,752
Huttonville	4	2009	Normandale	Ganaraska/Tarentorus	12	19.1	RV	12,025
								23,777
HUMBER RIVER								
King Vaughan Line	4	2009	Normandale	Ganaraska/Tarentorus	12	17.7	RV	16,077
East Branch Islington	5	2009	Harwood	Ganaraska/Tarentorus	14	11.2	RV	32,228
								48,305
LAKE ONTARIO								
Jordan Harbour	4	2009	Normandale	Ganaraska/Tarentorus	12	15.9	RV	20,009
Port Dalhousie East	4	2009	Normandale	Ganaraska/Tarentorus	12	18.8	RV	20,002
North of Main Duck Sill	4	2009	Harwood	Ganaraska/Tarentorus	14	11.8	RV	5,005
Millhaven Wharf	5	2009	Harwood	Ganaraska/Tarentorus	14	11.0	RV	8,011
Glenora	5	2009	Harwood	Ganaraska/Tarentorus	14	11.0	RV	7,628
								60,655
ROUGE RIVER								
Bruce Creek	3	2009	Ringwood*	Wild (Rouge)	10	22.5	None	5,000
Little Rouge at steeles	3	2009	Ringwood*	Wild (Rouge)	10	22.5	None	5,583
Rouge at16th avenue	3	2009	Ringwood*	Wild (Rouge)	10	22.5	None	5,000
								15,583
RAINBOW TROUT - FALL YEARLINGS								
CREDIT RIVER								
Norval-Carter Farm	9	2009	CRAHH*	Wild Credit R.	17	45.0	Dorsal clip	**23,420**
RAINBOW TROUT - SUB ADULTS								
CREDIT RIVER								
Norval-Carter Farm	4	2008	CRAHH*	Wild Credit R.	24	67.0	Dorsal clip	**9,220**

TOTAL - RAINBOW TROUT SPRING YEARLINGS	**172,226**
TOTAL - RAINBOW TROUT YEARLINGS	**23,420**
TOTAL - RAINBOW TROUT SUB ADULTS	**9,220**
TOTAL - RAINBOW TROUT	**204,866**

* following the hatchery name indicates a partnership hatchery

CRAAH - Credit River Anglers Association Hatchery

Ringwood - all fish at Ringwood FCS are produced by the Ontario Federation of Anglers and Hunters and volunteers from Metro East Anglers

TABLE 7.8. American eel stocked in the Province of Ontario waters of Lake Ontario, 2010.

SITE NAME	MONTH STOCKED	YEAR SPAWNED	HATCHERY	STRAIN / EGG SOURCE	AGE (months)	MEAN WT (g)	MARKS	NUMBER STOCKED
AMERICAN EEL - ELVERS								
Bay of Quinte, Lake Ontario (Hay Bay area)								
Hay Bay - north shore	6	2009	private	Wild collection of 4.296 kg of glass eels from the Sissiboo River in Nova Scotia	16	0.1	Tetracycline	29,730
Hay Bay - Ram Island	6	2009	private	Wild collection of 5.403 kg of glass eels from the Sissiboo River in Nova Scotia	16	0.1	Tetracycline	37,391
								67,121
ST. LAWRENCE RIVER (Mallorytown Landing area)								
Squaw Island	6	2009	private	Wild collection of 1.055 kg of glass eels from the Sissiboo River in Nova Scotia	16	0.1	Tetracycline	7,301
Squaw Island	6	2009	private	Wild collection of 0.809 kg of glass eels from the Sissiboo River in Nova Scotia	16	0.1	Tetracycline	5,599
North end of Grenadier Island	6	2009	private	Wild collection of 0.801 kg of glass eels from the Sissiboo River in Nova Scotia	16	0.1	Tetracycline	5,543
North end of Grenadier Island	6	2009	private	Wild collection of 0.748 kg of glass eels from the Sissiboo River in Nova Scotia	16	0.1	Tetracycline	5,176
North end of Grenadier Island	6	2009	private	Wild collection of 0.809 kg of glass eels from the Sissiboo River in Nova Scotia	16	0.1	Tetracycline	5,599
Jones Creek	6	2009	private	Wild collection of 0.759 kg of glass eels from the Sissiboo River in Nova Scotia	16	0.1	Tetracycline	5,253
Jones Creek	6	2009	private	Wild collection of 0.824 kg of glass eels from the Sissiboo River in Nova Scotia	16	0.1	Tetracycline	5,702
Savage Island	6	2009	private	Wild collection of 0.812 kg of glass eels from the Sissiboo River in Nova Scotia	16	0.1	Tetracycline	5,619
Butternut Bay	6	2009	private	Wild collection of 0.832 kg of glass eels from the Sissiboo River in Nova Scotia	16	0.1	Tetracycline	5,758
Butternut Bay	6	2009	private	Wild collection of 0.877 kg of glass eels from the Sissiboo River in Nova Scotia	16	0.1	Tetracycline	6,069
Landon's Bay east	7	2009	private	Wild collection of 1.25 kg of glass eels from the Sissiboo River in Nova Scotia	17	0.1	Tetracycline	8,651
Landon's Bay west	7	2009	private	Wild collection of 1.25 kg of glass eels from the Sissiboo River in Nova Scotia	17	0.1	Tetracycline	8,651
								74,921
TOTAL - AMERICAN EEL								**142,042**

8. Biological Diversity of Lake Ontario's Fish Species

8.1. Introduction

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

A number of native fish species have been lost or persist in low numbers in the Lake Ontario basin. Table 8.1.1 lists twenty-three fish species that formerly occurred or are currently 'rare' in the Lake Ontario basin. The blackfin cisco (note that there is debate about historic existence of blackfin cisco in Lake Ontario), the Lake Ontario Kiyi, and blue pike (a subspecies of walleye) are thought to be extinct. Four species, Atlantic salmon, lake trout, bloater, and shortnose cisco have been extirpated (i.e. local extinction) from the Lake Ontario basin. Four species, American eel, burbot, deepwater sculpin and lake sturgeon that were once very common in the basin are now rare. The remaining species on this list were either uncommon historically or their historic status is uncertain. In addition, we acknowledge that there may be other species (small cyprinids for example) that may have been present historically but were lost prior to their documentation of their presence in the basin.

Section 8.2 following describes the planning and efforts to restore Atlantic salmon, American eel and deepwater Ciscoes. Success restoring these native species would be a significant milestone in improving Ontario's biodiversity. Observations of other rare fish species in Lake Ontario and its tributaries during 2010 included:

Burbot: 2 specimens observed, one at Rocky Point and one at Wellington, see Section 2.2;

Deepwater Sculpin: 2 specimens captured in eastern Lake Ontario, see Section 2.2;

Round Whitefish: 2 specimens captured in Lake Ontario near Cobourg, see Section 2.2;

Spotted Gar: 1 specimen captured in Hamilton Harbour, see Section 2.5;

Grass pickerel: 1 specimen captured in upper St. Lawrence River, see Section 11.1;

Pugnose shiner: 20 specimens captured at 6 sites in upper St. Lawrence River, see Section 11.1.

Section 8.3 provides an update on the status of the two most recent non-native fish species to invade Lake Ontario, Round Goby and Chain Pickerel.

8.2 Native Species Restoration

Atlantic Salmon—Lake Ontario Atlantic Salmon Restoration Program (LOASRP)

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 a valued resource for aboriginal communities and early Ontario settlers. As such, Atlantic salmon are recognized as an important part Ontario's natural and cultural heritage.

A unique partnership has been established to help bring back wild, self-sustaining populations of Atlantic salmon to Lake Ontario. This partnership, launched in 2006, brings together the Ministry of Natural Resources and the Ontario Federation of Anglers and Hunters (OFAH) and a strong network of partners and sponsors.

Australia's Banrock Station is lead sponsor for this initiative and committed $1.25 million to LOASRP during the first 5-year phase of the program (Phase I). Banrock Station is a world leader in their corporate commitment to the environment, supporting conservation projects world-wide. LOASRP is the largest project they have supported outside of Australia.

The LCBO adopted Atlantic salmon as the "flagship" species for its Natural Heritage Fund and committed $250,000 to LOASRP during Phase I.

Many other conservation organizations, corporations, community groups and individuals are contributing to this program.

TABLE 8.1.1. Status of 'rare' fishes in the Lake Ontario basin and their designation (as of December 31, 2010) under the Ontario Endangered Species Act (ESA) and the Canadian Species at Risk Act (SARA).

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

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 in Phase I have been focused on three "best-bet" streams – the Credit River, Duffins Creek and Cobourg Brook. These systems offer good quality spawning and nursery habitat for Atlantic salmon and community support is strong. Demonstrated success in these systems will pave the way for restoration of Atlantic salmon to other suitable streams in future phases of the program.

Three broodstocks from different source populations in Nova Scotia, Quebec and Maine have been established and are currently housed at OMNR's Harwood Fish Culture Station. The performance of all three strains will be evaluated in the Lake Ontario environment.

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.

More than 2.6 million Atlantic salmon, of various life stages, were stocked during Phase I. Significant returns of adults to the Credit River were observed in 2008, 2009 and 2010. Measures continue to be taken to improve access to upstream spawning habitat through the removal or modification of barriers and installation of fishways.

Thousands of students from schools and outdoor education centres have participated in a classroom hatchery program designed to actively involve youth in local restoration efforts. Thousands of staff, partner and volunteer hours have been logged on almost 100 stream habitat protection and enhancement projects.

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

American Eel

American eel is identified as an *Endangered* species under Ontario's Endangered Species Act (ESA). In addition, the Committee on the Status of Endangered Wildlife in Canada recommended that American eel be identified as a species of *Special Concern* under the Canadian Species at Risk Act (Table 8.1.1). These designations have lead to additional efforts to protect American eel in Ontario. Several actions were taken by MNR's partners and the Lake Ontario Management Unit during 2010 to address the low abundance of eel.

MNR and Ontario Power Generation (OPG) have collaborated on the operation of the eel ladder at the R.H. Saunders Hydroelectric Dam since 1974. During 2009, OPG made major modifications to the Saunders eel ladder. An extension pipe was built between the original exit of the eel ladder, on the fore-bay deck of the generating station, and extended to a site located 300 m upstream from the station where the new exit of the eel passage facility is located. In addition, the climbing substrate of the eel ladder was replaced by a moulded plastic substrate with studs similar to the ones installed at the other eel ladders in the St. Lawrence River. The new substrate and ladder was also covered with aluminium covers to shade the eels during passage and prevent access by potential predators.

The Saunders eel ladder was opened on Jun 15 and closed on Oct 25, 2010 (132 days). Continuous counts of eel migration activity were obtained by a photoelectric counter at the top of the ladder (Fig. 8.2.1) with the exception of the period between Sep 21 and Oct 15 when the counter was out of operation and manual counts were made. The electronic counts were compared to manual counts at least once a week throughout the migration season. The overall error of the electronic counter compared to manual counts was 0.9% for the entire 2010 season. During 2009 and 2008, the error rate was 0.4% and 2.1%, respectively. Ninety-eight percent of the eels exited the facility between 23:00 h and 6:00 h – a dramatic change from previous years when eels were observed at all hours of the day. The average travel time of tagged eels traveling the entire facility during 2009 and 2010 was around 2 to 3 hrs. The average time to travel the eel ladder (without extension and new climbing substrate) reported in previous studies conducted from 1997 – 2001 varied between 15.1 and 24.2 hrs.

A sub-sample of 142 eels were collected from the ladder and sampled for biological characteristics during 2010. The average length (366 mm, range 245-572 mm, Fig. 8.2.2) was the one of the smallest observed since the ladder opened in 1974 and continued the trend of declining size that started in 2004. Age distribution of the eels samples ranged from 2 to 9 years (mean 4.95 ± 1.5 yrs). All eels from the sub-sample were determined to be female and an oxytetracycline mark was present on two of the eels indicating that these fish were from a stocking program.

A total of 961 eels successfully exited the eel passage facility (Fig. 8.2.3). The first record during 2010 occurred on Jun 15 and the last one on Oct 15. The 31-day peak period of eel activity was Jul 3 – Aug 2 (23.9 eels / day, 77% of total) with the highest daily count (172 eels) occurring on Jul 21st. The total number in 2010 is the second lowest abundance recorded. Adjustments required to optimize the operation of the modified ladder may have contributed to the low number and size of eels during 2009 and 2010, however the numbers of eels climbing the new ladder on the Moses portion of the dam should be considered.

The numbers of eels moving up the ladders located at the Moses (38,173 eels) which is the highest number recorded since this ladder opened during 2006.

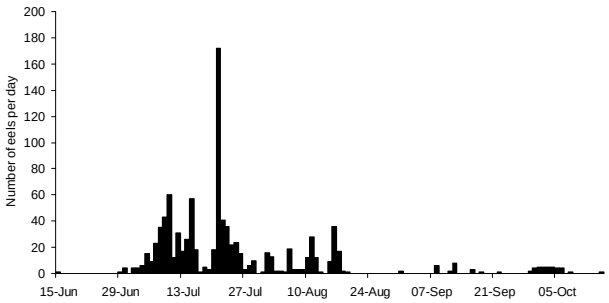

FIG. 8.2.1. The numbers of eel counted at the top of the eel ladder located at the R.H. Saunders Hydroelectric Dam during 2010.

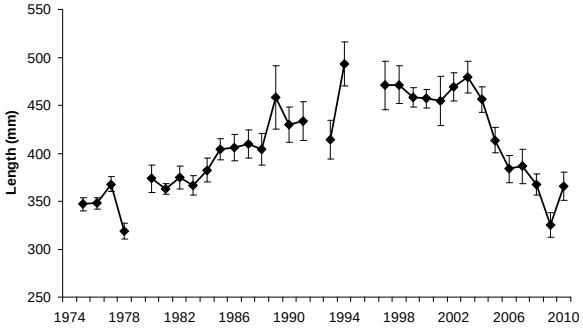

FIG. 8.2.2. Length (error bars are 95% confidence limits) of eel migrating upstream through the eel ladder located at the R.H. Saunders Hydroelectric Dam, 1975-2010.

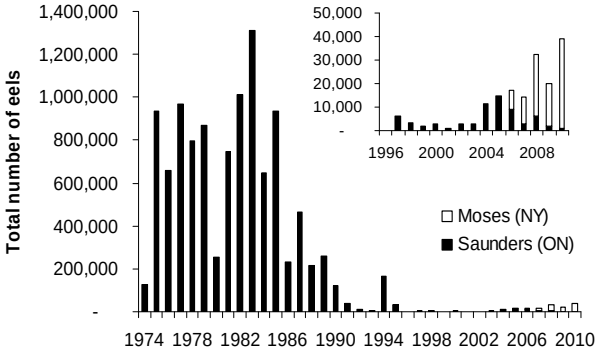

FIG. 8.2.3. Total number of eels ascending the eel ladder(s) at the Moses-Saunders Dam, Cornwall, Ontario for 1974-2010. No counts are available for 1996.

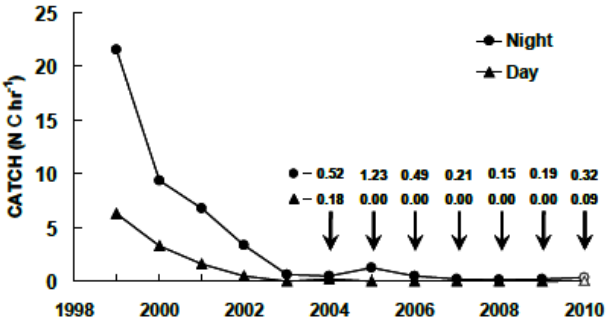

FIG. 8.2.4. Electrofishing catch in numbers caught per hr in the vicinity of Main Duck Island in eastern Lake Ontario, separated by day and night for a recent period of declining abundance, 1999-2010.

Combined, 39,134 eels passed the two ladders located at the Moses-Saunders Dam during 2010. This number was the largest observed since 1994 (163,518 eels), and continues the general trend of increasing numbers since 2001. However, the numbers migrating upstream last year are still less than 3% of the numbers of eel observed during the early years of the ladder's operation (Fig. 8.2.3, over 600,000 eels per year during the 1970s and 1980s).

The abundance of larger 'yellow' eels in the upper St. Lawrence River (USLR) and eastern Lake Ontario (ELO) was measured with three assessment programs during 2010. Bottom trawling in the Bay of Quinte has been conducted since 1972 as part of the fish community index program (see Section 2.3). The average catch of American eel in 372 trawls conducted between 1972 and 1996 was 1.68 eels per trawl; however, no eels were captured in the 416 trawls conducted between 2003 and 2010.

Quantitative electrofishing was conducted during 2010 in the Mallorytown area (USLR) and Main Duck Island - Yorkshire Bar area (ELO) by Dr. J. Casselman and L. Marcogliese of Queens University with the financial support provided by the Ontario Ministry of Natural Resources. Eel abundance in the USLR was 1.598 ± 1.297 eels/hr during daytime surveys and 8.836 ± 4.840 eels/hr during night-time surveys. In the ELO, 0.086 ± 0.103 eels/hr were observed during daytime and 0.321 ± 0.468 eels/hr during night-time (Fig. 8.2.4). Based on the size of eels captured, it appears that fish that originated from stocking programs were observed at both locations.

Nearshore trapnetting was conducted in the upper Bay of Quinte, Hamilton Harbour and Toronto Harbour using the NSCIN fish community index protocol during 2010 (see Section 2.5). All of these areas are within the historical range of the eel and this gear has been shown to be effective for larger eels; however no eel were captured in the total of 84 net sets.

Lake Ontario Management Unit staff participated in the development of a Recovery Strategy for the American Eel in Ontario. In addition, staff assisted OPG and Fisheries and Oceans Canada in the implement the OPG Action Plan to improve eel abundance in ELO and USLR and improve passage of eel around hydroelectric generating facilities in the St. Lawrence River.

In one component of the OPG plan, staff assisted in health assessment and stocking of a total of 142 thousand glass eel into the USLR and ELO during 2010 (see Section 7.1). All stocked eels were purchased from commercial fisheries in Nova Scotia and were marked with a fluorescent dye to distinguish them from naturally migrating eels. This brings the total number of eels stocked since 2006 to 4.0 million fish. Prior to all stocking, health screening was conducted at the Atlantic Veterinary College, and the testing results for a wide variety of fish pathogens (including *Anguillicoloides crassus*) were all negative for stocked fish.

Fisheries and Oceans Canada conducted electrofishing surveys during the spring and the fall of 2010 near the USLR and Bay of Quinte stocking sites to evaluate the success of eel stocking. During the 154 transect surveyed during the spring average densities of 53.1 (+/- 12.3) and 61.5 (+/- 9.3) eels/ha were observed in the USLR and Bay of Quinte sites respectively. These densities were more than doubled those observed in 2009, reflecting the relatively large numbers of eels stocked in 2009. The 173 transects surveyed during the fall revealed densities of 83.7 (+/- 23.5) and 90.5 (+/-13.2) eels/ha at the USLR and Bay of Quinte sites respectively. The patterns in fall density estimates were less consistent; there was a 60% increase in the number

of eels enumerated at the upper St. Lawrence River transects, but a decrease was observed at the Bay of Quinte stocking location. The observed decrease in the Bay of Quinte is likely explained by two factors. First, very few eels were stocked in 2010, and age-0 eels usually make up a high proportion of the catch, and second, additional areas (Hay Bay, Big Bay) were included in the fall sampling estimates for the first time. These surveys suggest that eels are surviving well at stocking sites and some sites nearby.

While no targeted efforts were made toward assessing dispersal in 2010, reports of stocked American eel occurrence continue to be made by other agencies. Fisheries and Oceans Canada Sea Lamprey Control Program captured small, presumably stocked American eel in Cobourg Brook and the Rouge River for the second consecutive year and in the Humber River for the first time. Small, presumably stocked American eel were captured above the first barrier in a number of Bay of Quinte tributaries (Trent, Salmon and Napanee rivers) during Ontario Ministry of Natural Resources research surveys. As well, Royal Botanical Garden staff captured an American eel in the Hamilton Harbour fishway, and Ministry of Natural Resources staff captured an eel in Lake Simcoe. Both of these eels were large enough that they could have been natural migrants.

Eels from each of the five year classes stocked (2006–2010) were sampled by Fisheries and Oceans Canada during their electrofishing surveys, and length and weight at age, and biomass per hectare were calculated. Growth rates were very high, approximately 100 mm / yr, even for newly stocked eels recaptured in the autumn. Biomass estimates continue to increase as the stocked fish grow. Gender assessment confirmed the presence of stocked male American eel in Lake Ontario for the second year in a row, though the proportion of males declined from 2009. All of the eels aged by otolith showed the fluorescent oxytetracycline mark indicative of stocking.

In the autumn of 2009 and 2010, for the first time in living memory, fishermen from the silver eel fishery in the St. Lawrence River estuary reported the capture of very small silver eels to the Quebec Ministère des Ressources Naturelles et de la Faune (MRNF). Both mature female eels (about 65 cm length) and mature male eels (about 30 cm) were observed. The majority of these fish had oxytetracycline marks proving that they were stocked fish. Since eels from the Lake Ontario – St. Lawrence River system usually do not mature until about age 20, this early maturation is difficult to explain. It may be due to extremely rapid growth rate by young stocked eel in an environment that had never been previously colonized by very young eel and where there is limited intra-specific competition. Some have also hypothesized that it may be due to some unknown mechanism of stock differentiation between stocked Maritime eel and natural migrants to this system.

In a second component of the OPG Action Plan, MNR staff assisted in the capture, tagging and transport of large yellow eels from the USLR, ELO and Lake St. Francis (LSF) to Lac St. Louis (a section of the St. Lawrence River below all barriers to downstream migration). This study is a continuation of the project conducted in 2008 and 2009 which was undertaken by OPG as a pilot project to investigate the economics and practical feasibility of this alternative for mitigating turbine mortality at the Saunders GS during the downstream migration of mature silver eels. The project also involved local commercial fish harvesters, Akwesasne First Nation and Quebec MRNF.

A total of 234 large eels (minimum size > 80 cm or approximately 2.5 lb) were taken by 15 license holders from mid April-Jun 20 as a by-catch in the existing spring hoop and trap net fisheries in USLR and ELO (upstream of the Moses-Saunders Dam). The LSF fish harvesters (2 licences) also participated in the spring fishery and captured 1,485 eels. The catch rates in the USLR-ELO and LSF were 0.03 and 0.71 eels/net night, respectively. This suggests, as observed in previous studies, that yellow eel abundance is much higher in LSF than in the USLR-ELO. Eels from USLR-ELO were transported to holding facilities at the MNR's Glenora Research Station. In the case of eels from LSF, eels were transferred to a facility at Bainsville, Ontario. At both locations a passive integrated transponder (PIT) tag was implanted in each eel for subsequent identification and morphometric data were collected.

In 2010, 751 large yellow eels from LSF and 234 from the USLR-LO were released from shore at four locations in Lac St. Louis immediately downstream of the Beauharnois GS. Another 734 eels collected from LSF were returned to LSF as a reference sample. During the release program, all the eels were observed to be in good health. The mortality rate during capture and holding was 5 eels (0.3 % of catch) including 4 eels from LSF and 1 eel from the USLR-LO.

To monitor the long-term survival, condition, maturation and migration of the transported yellow eels, biologists from Quebec MRNF attempted to recover tagged eels in the silver eel fishery in the St. Lawrence River estuary. In 2010, detection of marked eels occurred from August 15 to November 12.

MRNF sampled all 13 fish harvesters and scanned about 85.2 % of the total harvest (13,725 silver eels) about the same number as in 2009. Ninety-eight PIT tags from the OPG trap and transport study were detected and another 128 PIT tags came from previous studies conducted near Moses-Saunders GSs from 1997 to 2001.

The trap and transport project has been successful in demonstrating that most large yellow eels can be held in captivity, tagged, transported and released without obvious detrimental effects. In addition, longer term effects of trap and transport on eels can likely be evaluated by monitoring transported eels in the silver eel fishery in the St. Lawrence estuary. Lastly it appears that transported eels migrate at higher rate in the first year of transport when compared to reference eels. However, two years after their release the percentage of reference vs. transported eels migrating through the St. Lawrence Estuary from the trap and transport program is similar.

Deepwater Ciscoes

Until the mid 1950's, Lake Ontario was home to a very diverse assemblage of deepwater ciscoes including bloater (*Coregonus hoyi)* kiyi (*C. kiyi*), shortnose cisco (*C. reighardi*) and possibly blackfin cisco (*C. nigripinnis*). Currently, only the shallow-water form of lake herring (*C. artedi*) remains in Lake Ontario. The Lake Ontario Committee's goal is to establish a self-sustaining population of deepwater cisco in Lake Ontario within 25 years. Objectives and associated strategies are specified in a draft strategic plan currently under review. The plan addresses sources of gametes, culture facilities, culture capacity, stocking targets, detection of wild fish, increasing our understanding of ecological consequences, research needs, and public education. Potential benefits of restoring deepwater cisco include increasing the diversity and resilience of the food web, increasing wild production of salmon and trout by reducing thiaminase impacts of a diet based on alewife and rainbow smelt, supporting a small commercial fishery, restoring historical food web structures and function and increasing trophic transfer efficiency. Potential risks 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.

In 2010, approximately 117,000 fertilized bloater eggs were collected from Lake Michigan with the help of local commercial fisherman and personnel from the United States Fish and Wildlife Service and transferred to New York State Department of Environmental culture facilities in Cape Vincent, NY. All adults used for gamete collection were free of disease. Fertilization rates were approximately 30% and only approximately 5,000 fish hatched. The surviving hatched fish reached a maximum size of approximately 13 mm, but hatched larvae did not feed well on commercially available fish food and none survived to be stocked into Lake Ontario. Plans are to continue to collect eggs from Lake Michigan and explore collection opportunities in Lakes Huron and Superior, improve culture facilities and procedures at Cape Vincent, and bring additional culture facilities on line at United States Geological Survey Laboratory at Tunison, New York and at the Ontario Ministry of Natural Resources Facility at White Lake, Ontario.

8.3. Non-native Species

Round Goby

Round Goby invaded western Lake Ontario in 1998 and were first reported in the Bay of Quinte in 1999 and first captured in routine Bay of Quinte assessment bottom trawls in 2001 and gillnets in 2002. Goby distribution expanded to include all areas of eastern Lake Ontario and the Bay of Quinte to depths of at least 36 m by 2006.

Goby abundance was high in offshore areas of the Bay or Quinte by 2003, declined rapidly after 2004 in gill net catches but stabilized at relatively high levels in the bottom trawls (see Sections 2.2 and 2.3). This observation suggests that while large Round Goby, vulnerable to gill net gear, were included in the goby size structure soon after goby invasion, after 2004 the goby size structure included primarily smaller individuals. Goby also appeared in the diet of many piscivores in the Bay of Quinte in 2003.

In Lake Ontario, Round Goby abundance in gillnets increased until 2007, declined in 2008 and remained stable in 2009 and 2010. (see Sections 2.2 and 2.3). In bottom trawls, Round Goby catches in the Kingston Basin remained very high or increased in 2010.

Chain Pickerel

The Chain Pickerel (*Esox niger*) is a small to medium-sized member of the pike family (Esocidae). The species prefers warm water, usually inhabits sluggish streams and heavily vegetated lakes, and is a top predator in the fish community. Its native range is primarily the Atlantic coastal plain on the east side of the Allegheny-Appalachian Mountains in the eastern United States. Introductions and range expansions have resulted in a distribution that now extends west of the Allegheny-Appalachian Mountains. The Canadian distribution of Chain Pickerel includes Quebec (south of the St. Lawrence River and east of Montreal), southern New Brunswick and Nova Scotia. Their status is Not At Risk in Canada. The species is not native to New Brunswick or Nova Scotia and its native status in Quebec seems uncertain.

The first Chain Pickerel collected in Ontario and the first on the northwest side of the St. Lawrence River in Canada was caught by a local commercial fisherman in April 2008. Since 2008, five additional specimens were caught: three in 2009 and three more in 2010. All were captured in the eastern Lake Ontario and Thousand Islands area of the St. Lawrence River. All individuals were mature adults in robust condition. The appearance of Chain Pickerel in these Ontario waters may signal a range expansion of this species from New York State waters where the species appears to have increased in abundance in recent years. While not yet a major species locally, the potential future impact of this species on the nearshore ecosystem is not known.

9. Management Planning

9.1 Fisheries Advisory Council for Zone 20 (Lake Ontario / St. Lawrence River)

The Zone 20 Fisheries Advisory Council provides recommendations to the Lake Ontario Manager regarding the recreational fishery. In 2010 the zone 20 council began operating under a new geographically based structure. The former zone–wide council was split to form two new sub-councils with one representing the east end of Lake Ontario and the St. Lawrence River and the second representing the western basin of Lake Ontario. This restructuring led to the addition of four new committee members. Ultimately, the reorganization has allowed for more focussed discussions on regional interests.

The two sub-councils met a total of 10 times in 2010. Issues discussed included pen imprinting of Chinook salmon, the development of a stocking strategy for Lake Ontario, the development of new fish community objectives for Lake Ontario, and the review of regulations for Common Carp, Muskellunge, and Rainbow Trout. A rainbow trout harvest regulation proposal has been developed and is currently open for public comment. In addition, the council provided significant assistance with the collection of data in support of the Lake Ontario Chinook salmon mass marking study.

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

The Lake Ontario and St. Lawrence River Commercial Fishing Liaison Committee (LC) provides recommendations to the Lake Ontario Manager regarding their concerns and issues and in response to MNR's proposed actions. Members represent fishers in different management zones, buyers/processors, and the Ontario Commercial Fisheries' Association (OCFA). The LC provides a unique forum for dialogue between the Lake Unit and the commercial industry.

Management actions were presented to all licensed commercial fishers at the Annual General Meeting during April 2010. The Ontario Commercial Fishery Policy review was also presented at this time and updates were provided during subsequent meetings of the LC. The LC met five times during 2010. Action items discussed included the revision of some license conditions; the eel trap, truck and transfer project; a proposal by MNR about set duration times; and the revision of quotas in response to reduced catch per unit effort in both commercial and MNR fishing gear. Issues related to the harvest of fish with special restrictions related to contaminants were also discussed. Most issues were deferred pending the outcome of the Commercial Fishery Policy review.

9.3 Fisheries Management Plans

The Bay of Quinte Fisheries Management Plan and the Hamilton Harbour and Watershed Fisheries Management Plan were recently approved as fisheries management policy. The purpose of these plans is to guide the sustainable management and use of the fish resources of the respective waterbodies and watershed. The goal of the Bay of Quinte Fisheries Management Plan is to identify and resolve fisheries issues, manage the resource in a sustainable manner, and encourage communication between government and stakeholders. The goal of the Hamilton Harbour and Watershed Fisheries Management Plan is to support diverse, well-balanced, and healthy aquatic ecosystems that provide sustainable benefits to meet society's present and future needs.

Copies of these fisheries management plans are available at: **http://www.mnr.gov.on.ca/en/Business/LetsFish/2ColumnSubPage/251350.html**.

10. Research Activities

10.1 *Hemimysis*

Hemimysis – *the bloody red shrimp in Lake Ontario*

Collaborators: Michael Yuille (M.Sc. candidate), Liang Zhang (post-doctoral fellow), Michelle Campbell (Hon. B.Sc. candidate), Shelley Arnott and Linda Campbell, Queen's University, in partnership with Fisheries and Oceans Canada, University of Windsor, St. Lawrence River Institute, University of Waterloo, Cornell University and the U.S. Geological Survey.

Aquatic invasive species are second only to habitat loss as a threat to the long-term sustainability of the recreational and commercial fisheries of the Great Lakes. Over 180 aquatic invasive species preceded *Hemimysis anomala* (hereafter *Hemimysis*) in establishing populations in the Great Lakes, with an estimated annual impact of tens to hundreds of millions of dollars. *Hemimysis* is a small, nearshore, shrimp native to eastern Europe that likely arrived via ballast water around 2006. No native organism shares a similar ecological role to *Hemimysis*, making the impacts both uncertain and potentially of great magnitude. Our research, started in 2008, has shown *Hemimysis* can reach high densities (>1,800 / m^2), resulting in part from their production of 3 generations per year. *Hemimysis* consume a variety of prey at the base of the food web including algae and zooplankton (tiny animals that young fish eat), which has affected both water quality and fish production in invaded European lakes. In the past 2 years, we have examined over 3,000 fish stomachs across a gradient of density of *Hemimysis* and found little evidence of fish consuming this invasive prey (less than 1% of the total stomachs examined contained *Hemimysis*). Laboratory feeding preference experiments have shown yellow perch, an abundant and economically important fish, do consume *Hemimysis* and actually select it over a common prey item (amphipods) especially in rocky habitats. Further laboratory experiments revealed that the digestion rate for *Hemimysis* is extremely rapid, less than 1-2 hours at normal water temperatures, so we may simply be unable to detect their presence using traditional methods. A DNA-based screening tool is being developed in partnership with the University of Windsor (Lucia Carreon-Martinez and Daniel Heath) to find evidence of *Hemimysis* in fish stomachs even after the prey item has been digested. In addition, through the use of stable isotopes (chemical tracers naturally occurring in the environment), we have found evidence of shifts in feeding pathways suggesting higher incorporation of *Hemimysis* in plankton-eating fish diets (alewife & yellow perch) at sites with higher density of *Hemimysis*, coinciding with areas where *Hemimysis* have been in the food web longer (> 3 years). Collectively these results (Fig. 10.1.1) suggest that *Hemimysis* are becoming incorporated into the

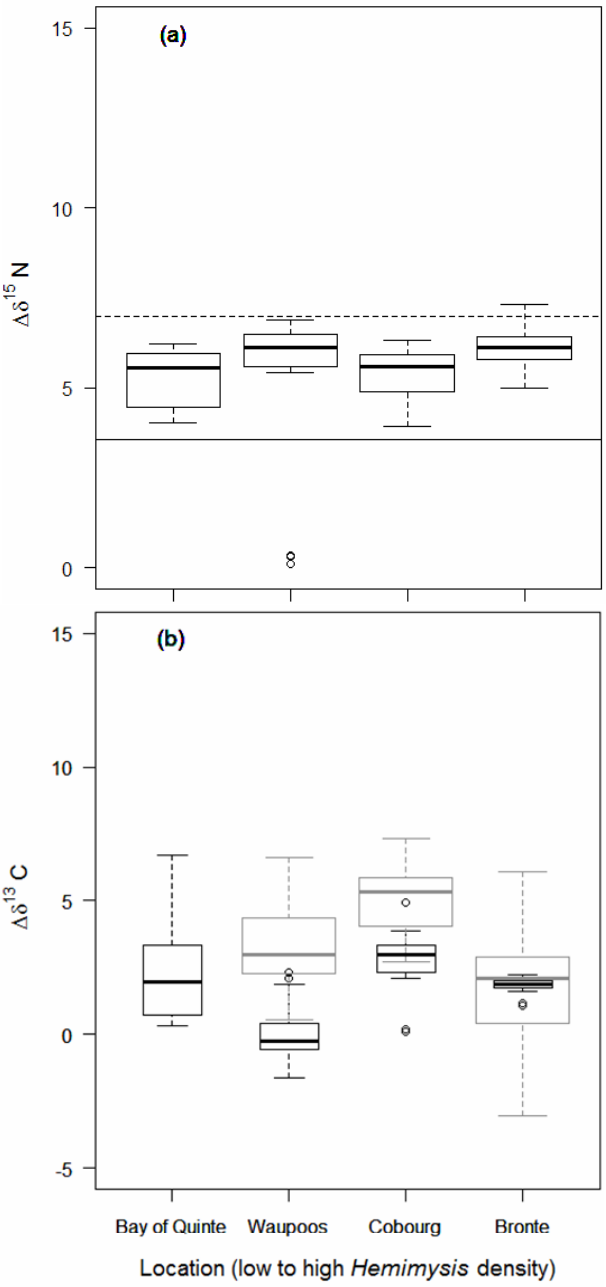

Fig. 10.1.1. $\Delta\delta^{15}$N and $\Delta\delta^{13}$C of alewife (*Alosa pseudoharengus*) (a and b, respectively) relative to the $\Delta\delta^{15}$N and $\Delta\delta^{13}$C of *Hemimysis anomala* (solid line and grey boxplots, respectively). The dashed line in (a) represents a 3.4 ‰ ^{15}N trophic enrichment of *Hemimysis*. Boxes in (a) that are close to the dashed lines indicate alewife are consuming prey similar to *Hemimysis*. Black boxes in (b) that overlap the grey boxes indicate alewife are consuming prey similar to *Hemimysis*. Combining (a) and (b) suggests alewife from Bronte are consuming *Hemimysis*.

food web. Two questions then arise: 1) are *Hemimysis* impacting lower trophic levels such that water quality or food resources may be compromised? and 2) will *Hemimysis* increase energy and contaminant flow to higher trophic levels, possibly resulting in increased loads of contaminants? Collaborating researchers at Fisheries & Oceans Canada, University of Waterloo, and Cornell University are investigating the first question about lower trophic level impacts while our team is exploring the contaminant bioaccumulation question. Preliminary results suggest *Hemimysis* have not increased the biomagnification potential (how quickly contaminants accumulate in the food web), in part because of our perceived low incorporation of *Hemimysis* in fish diets. The stable isotope results noted above, including the time-delay before *Hemimysis* become incorporated in the fish diets, warrant our continued investigation and modelling to better forecast the potential effects of *Hemimysis* on Great Lakes food webs as this invasive organism continues to expand it's population size and distribution.

10.2 Impediments to Lake Trout Rehabilitation

Consequences of Changing Prey Base on Lake Trout Growth and Survival

Collaborators: Scott Rush (post-doctoral), Ken Drouillard, Aaron Fisk, Doug Haffner, Gord Paterson (U Windsor), Michael Arts, Craig Hebert, Daryl McGoldrick (Environment Canada), Brian Lantry (US Geological Survey), John Fitzsimons (Fisheries and Oceans Canada), Ted Schaner (OMNR), Jana Lantry (New York Department of Environmental Conservation).

As an apex predator native to the great lakes, lake trout (*Salvelinus namaycush*) historically influenced the distribution of some prey fish species and cycled energy between offshore benthic and pelagic zones. Over the last three decades however, multiple factors have reduced prey fish abundance in the Laurentian Great Lakes. Subsequently, Lake trout have experienced significant changes in reproduction, survival and distribution and have inspired conservation efforts for this species. Efforts to maintain populations of this important predator however necessitate a thorough understanding of this species trophodynamics (diet and energy requirements), relationships that can vary across an organisms' lifetime. Our work employs naturally occurring chemical tracers (stable isotopes of carbon and nitrogen ($\delta^{13}C$ and $\delta^{15}N$) and fatty acids to explore trophic relationships of lake trout (*Salvelinus namaycush*) and major prey species (alewife: *Alosa pseudoharengus*; Mysis: *Mysis diluviana*; rainbow smelt: *Osmerus mordax*; round goby: *Noegobius melanostomus*; and slimy sculpin: *Cottus cognatus*) within the Great Lakes. Result of our recent work, focused on fish collected from Lake Ontario during 2008, suggests that younger lake trout no longer feed predominately on native prey fish but incorporate higher proportions of the introduced fish, the round goby, in their diets (Fig. 10.2.1). This finding has important implications for understanding the impacts of introduced species, predator-prey dynamics and the ecology of large lake systems. In particular, if the change in habitat use and inclusion of round goby in the lake trout's diet represents a substantial shift in this species' bioenergetics, then this change can have long-

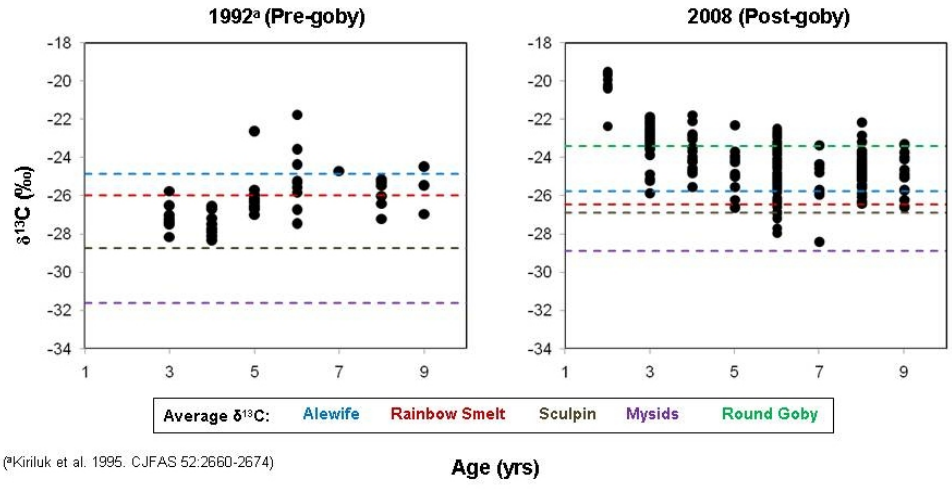

Fig. 10.2.1. $\delta^{13}C$ of various ages of Lake Ontario lake trout (circles) relative to prey items (horizontal lines). Since 1992, Lake trout carbon isotope signatures have become more positive indicating an increased importance of nearshore/littoral production pathways. Isotopic signature much more representative of the round goby than traditional pelagic prey resources including alewife, smelt and sculpin.

term implications for the lake trout's health, reproduction and population stability. Our ongoing work will help broaden our understanding of these trophic interactions, the structure of these lake communities, and the forces that shape them.

10.3 Fish Health

Metabolic costs of sub-lethal contaminant exposure

Collaborators: Todd A. Leadley (Ph.D. candidate) and Ken Drouillard, Great Lake Institute for Environmental Research, University of Windsor

Aquatic ecosystems show remarkable resiliency to perturbation and stress, although short-term laboratory and field measurements of stress response tend to predict more catastrophic outcomes. A prime example of population resilience is the response of fish populations to high levels of contaminant exposure: lab toxicity trials using field levels of contaminants lead us to expect substantial mortality in the field, but fish populations persist in heavily contaminated waters. Such observations suggest an adaptive response in the resident fauna: either short-term physiological change (acclimation) or genetic change driven by selection (evolution), or both. Acclimation carries a high energetic cost that could compromise survival or reproductive success suggesting population evolution is necessary for population persistence. As part of a larger project to quantify and integrate stress response measures we will combine intermittent flow respirometry with bioenergetic modelling to partition the toxicological stress response into physiological and genetic adaptive components. More specifically, this study will quantify metabolic costs resulting from long term exposure of an organism to a contaminated environment and whether field metabolic demands can be quantified through respirometry techniques.

Brown bullhead (*Ameiurus nebulosus*) populations in the Detroit River vary in the degree of exposure to in-situ organic contaminants. Previous studies on the these fish populations have demonstrated higher incidences of tumours in brown bullheads from Trenton Channel (lower Detroit River) compared to brown bullheads from less contaminated sites in the Detroit River (e.g. Peche Island). Oxygen consumption, a surrogate for metabolic rate, was measured in bullheads from both locations across a range of body sizes and temperatures (Fig. 10.3.1). If differences are detected in the standard metabolic rates (SMR) between the two bullhead populations, further respirometry trials will be conducted on both populations following acclimation in clean ponds for approximately one year. These studies will determine if the standard metabolic rate differences between the two populations are retained over time. Further to the above acclimation trials, the SMR of the F_1 generation from both populations will also be determined investigating whether the SMR is an inheritable trait in brown bullheads.

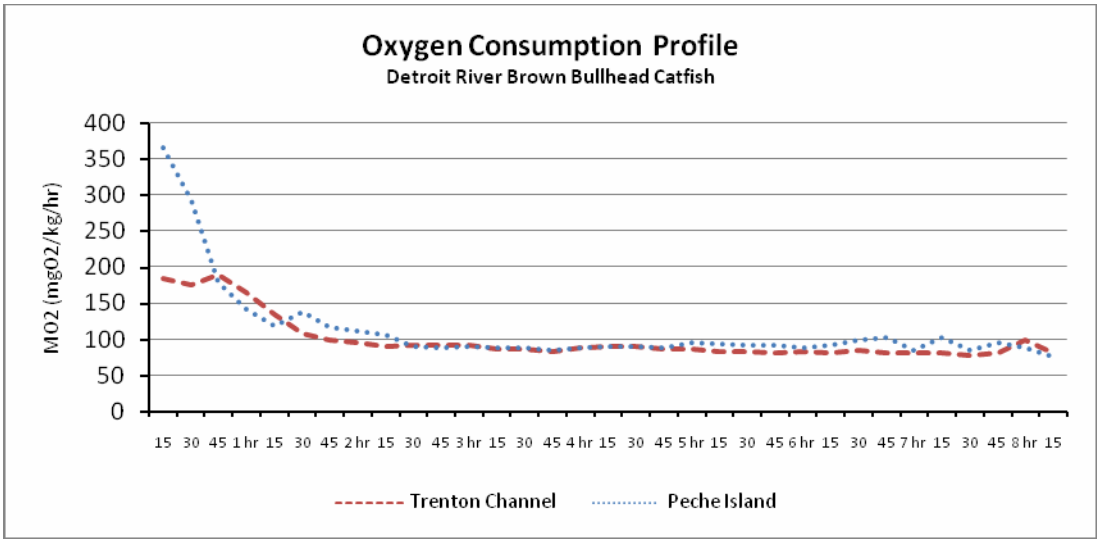

Fig. 10.3.1. An example of an 8 hour oxygen consumption profile of two brown bullhead (*Ameiurus nebulosus*) populations: Trenton Channel (352 g) and Peche Island (180 g).

10.4 Habitat Effects on Food Web Structure

Spatial and Seasonal Variability in Diet of an Invasive Fish Species in Nearshore Habitats of Eastern Lake Ontario

Collaborators: Jaclyn Brush (M.Sc. candidate) and Aaron Fisk, University of Windsor.

Aquatic invasive species (AIS) have been a particular concern in the Laurentian Great Lakes where valuable fisheries and water quality are important ecosystem services. The success of these invaders has been linked to their broad physiological and environmental tolerances, rapid reproduction, and similarity between natal and introduced habitats. Where AIS have successfully established, they have had detrimental impacts on local aquatic food webs.

Food web ecology, the study of feeding relationships among species, has helped ecologists and fisheries managers understand how invasive species act as predators, competitors, or prey, thereby quantifying how these species may alter aquatic food webs. Because lake habitats may differ in temperature, nutrient inputs, or species composition, how these invasive species impact food webs in different areas of a single lake is of particular interest.

The benthic feeding round goby (*Neogobius melanostomus*) has been regarded as the fastest advancing and one of the furthest spreading of all AIS to establish within the Great Lakes. Round goby likely arrived through ballast-water from the Black and Caspian Sea region in the early 1990's. This small fish has been the cause of a number of ecological and economic problems, including declines in benthic invertebrate abundance, mediating changes in fish community composition through predation and competition, and altering predator feeding behaviour. Several studies have attributed the rapid success of the round goby to its ability to consume zebra and quagga mussels in an otherwise diverse diet, its broad environmental tolerance, aggressive behaviour, and repeat spawning events. These characteristics, along with the small home range of the round goby make it an ideal model species to understand spatial and seasonal trends in diet of an invasive species within different habitats of a single lake system.

We examined spatial and seasonal trends in stomach contents and stable isotopes (naturally occurring compounds that change in predictable ways in food webs) of round goby in two eastern Lake Ontario habitats: warm, productive, and ecological stressed Bay of Quinte (a listed Area of Concern) and the cooler and less productive Kingston Basin. Stomach contents and stable isotopes (Fig. 10.4.1) were variable across site and season, however within a site, stable carbon isotope values indicated that round goby had high site-fidelity. At both sites, benthic invertebrates comprised the bulk of the diet, and reliance on Dreissenid mussels increased from spring to fall. Despite similar diets, stable isotopes indicated different production sources, with greater terrestrial inputs in the Bay of Quinte and more pelagic inputs in the Kingston Basin. The influence of pelagic carbon on round goby $\delta^{13}C$ increased with size, resulting from increased consumption of filter-feeding Dreissenid mussels. round goby $\delta^{15}N$, or trophic position, increased with consumer size and was higher in the cooler, oligotrophic lake site. Both seasonal and spatial effects must be considered when evaluating feeding behaviour of fishes, especially when considering the impacts of invasive organisms on fish communities.

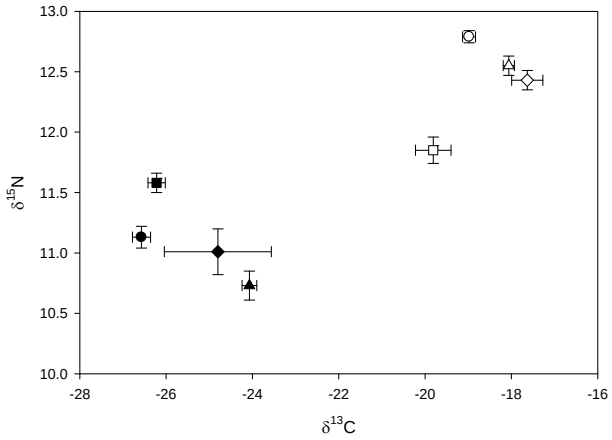

Fig. 10.4.1. Plot of Bay of Quinte (filled) and Kingston Basin (open) $\delta^{13}C$ and $\delta^{15}N$ values for round goby in 2009 Summer (square), 2010 Spring (circle), 2010 Summer (triangle) and 2010 Fall (diamond).

10.5 Project Quinte

Ecosystem Health and Recovery of the Bay of Quinte, Lake Ontario

Project Quinte is a co-operative, multi-agency, research and monitoring project between the federal (Department of Fisheries and Oceans) and provincial governments (Ontario Ministry of Natural Resources) that has investigated the long-term effects of the reduction in point-source phosphorus loadings, food-chain influences and zebra mussel colonization on the trophic dynamics of the entire Bay of Quinte ecosystem. In 2010, the members of Project Quinte held a focused session at IAGLR's 53rd Annual Conference at the University of Toronto (May 17-21)

entitled “Ecosystem Health and Recovery of the Bay of Quinte, Lake Ontario”. The main objective of the symposium was to assess the current status of the bay and its recovery in response to the remedial actions undertaken towards delisting. The project Quinte members plan to publish their findings in two special issues of the journal “Aquatic Ecosystem Health and Management”. Lake Ontario Management Unit personnel participated in the following contributions.

Bowlby, J. N. and J. A. Hoyle. Distribution and Movement of Walleye in the Bay of Quinte and Eastern Lake Ontario.

Brousseau, C.M., R.G. Randall, J.A. Hoyle, and C.K. Minns. Fish Community Indices of Ecosystem Health: Are Index of Biotic Integrity Values at Bay of Quinte Relatively High Compared to other coastal sites in Lake Ontario?

Hoyle, J.A., O.E. Johannsson, and K.L. Bowen. Larval Lake Whitefish Abundance, Diet and Prey Availability during a Period of Ecosystem change on the Bay of Quinte, Lake Ontario.

Hoyle J.A., J.N. Bowlby, C.M. Brousseau, T.B. Johnson, B.J. Morrison, and R.G. Randall. Fish Community Structure in the Bay of Quinte, Lake Ontario: The Influence of Nutrient Levels and Invasive Species.

Johnson, T.B. and J.A. Hoyle. Fish response to aquatic ecosystem change in the Bay of Quinte, Lake Ontario.

Randall, R.G., C.M. Brousseau, and J.A. Hoyle. Effect of macrophyte density on spatial variability in the abundance and growth of littoral fishes in bays of Prince Edward County, Lake Ontario.

11. Partnerships

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

The "Update of the Strategic Plan for Management of the St. Lawrence River Muskellunge Population and Sport Fishery Phase III: 2003-2010" includes the objective of protection of muskellunge spawning and nursery habitats. These habitats are not well documented or identified within the St. Lawrence River. OMNR conducted a young of-the-year seining program from 1989-1995 in an effort to identify nursery sites within the Canadian waters of the St. Lawrence River. Efforts were discontinued following this period. During 2005-2010, efforts to identify muskellunge nursery habitats were renewed through a partnership between Muskies Canada Inc. (MCI – Gananoque Chapter), Parks Canada (St. Lawrence Islands National Park), Kemptville District MNR, Fisheries and Oceans Canada (Prescott), and the Lake Ontario Management Unit (LOMU).

Fifty-three seining hauls were completed over a period from August 3-28, 2010. A total of 7,083 fish, comprising 33 species were captured during this program. Among the most abundant species captured were Yellow Perch (38%), Round Goby (25%), Pumpkinseed (11%), Largemouth Bass (6%), Rock Bass (5%), Bluntnose Mminnow (5%), Blackchin Shiner (2%), Banded Killifish (2%), Spotfin Shiner (2%), Brook Silverside (1%), and Bluegill (1%). Pugnose shiner (*Notropis anogenus*), listed as 'endangered' under both the Ontario ESA and Canadian SARA legislation (see Section 8), were captured at 6 sites. Additionally, Grass Pickerel (*Esox americanus vermiculatus* – listed as 'special concern' under both the Ontario ESA and Canadian SARA legislations) was captured at 1 site. These important observations highlight the importance of seining programs to the identification of biological diversity of the St. Lawrence River.

During 2010, 5 muskellunge were captured at 5 sites. Three of the muskellunge were captured at sites which were not previously confirmed as a muskellunge nursery area, while the remaining 2 were captured at previously confirmed sites. These data are being incorporated into NRVIS mapping of muskellunge nursery habitats by MNR – Kemptville District Office and shared with partner agencies.

11.2 Nearshore Community Index Netting (NSCIN)

Nearshore community index netting (NSCIN), a provincially standardized trapnet program designed originally on inland lakes to evaluate littoral zone fish communities, was initiated on Lake Ontario in the Bay of Quinte from 2001-2005. In 2006, the NSCIN program was conducted on Hamilton Harbour and the Toronto Waterfront area with partnerships involving Ontario Ministry Natural Resources, Fisheries and Oceans Canada, and Toronto Region Conservation Authority. The Ministry of Natural Resources' Lake Ontario Management Unit (LOMU) provided equipment and expertise with the NSCIN program while partners provided experienced staff with local knowledge. The partnerships proved very successful.

The Canada-Ontario Agreement (COA) provided funding for the past four years (2007-2010) of NSCIN projects on a variety of nearshore and embayment location including Hamilton Harbour, the Toronto waterfront area, Presq'ile Bay, Weller's Bay, West Lake, East Lake, Prince Edward Bay, lower and upper Bay of Quinte, Long Reach and Kingston, Thousand Islands, and Lake St. Francis (see Section 2.5 for NSCIN projects completed in 2010). Partnerships are a key delivery mechanism for these field projects. Partnerships to date (2007, 2008 and 2010 field seasons) have included Fisheries and Oceans Canada (2008 and 2010), the Toronto Region Conservation Authority (2007 and 2010), the Raison Region Conservation Authority (2007 and 2008), and local commercial fishers (2007).

Some of the NSCIN project locations are Areas of Concern (AOC) with ongoing Remedial Action Plans (RAP). Fisheries Management Plans (FMP) have been or are being prepared for these AOCs and NSCIN is one of the methods used for setting and evaluating the success of fish community targets. NSCIN projects on non-AOC areas provide the necessary reference sites to help evaluate the status of fish communities/ populations in AOC areas. Other important benefits of the NSCIN projects include commercial fish harvest management and a source of fish for MOEE contaminant sampling.

12. Staff 2010

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13. Operational Staff Field and Lab Schedule

Field or lab project	Dates	Species assessed, monitored or stocked	Length of data series (yrs)	Lead biologist	Funding source
Ganaraska Fishway Rainbow Trout Assessment	Mar 29 - Apr 16	Adult rainbow trout	37	Bowlby	
Lake Trout Tug Stocking	Apr 19 - May 7	Juvenile lake trout	n/a	Daniels	
Commercial Catch Sampling	Seasonal	Lake whitefish	25	Hoyle	
American eel trap and transfer	May - June	American eel	4	Mathers	
Moses Saunders Eel Ladder Monitoring	May - Oct	Migrating American eel	37	Mathers	COA
Chinook Salmon Mark and Tag Monitoring	Jun 25 - Sep 4	Chinook salmon	1	Bowlby	
Eastern Lake Ontario and Bay of Quinte Community Index Netting	Jun 28 - Sep 10	Eastern Lake Ontario and the Bay of Quinte fish community	53	Hoyle	
St. Lawrence River Fish Community Index Netting - Lake St. Francis	Sep 13 - Sep 24	Walleye, yellow perch, northern pike	26	Schaner	COA
Hamilton Harbour Nearshore Community Index Netting	Aug 3 - Aug 13	Nearshore fish community	3	Hoyle	COA
Upper Bay of Quinte Nearshore Community Index Netting	Aug 30 - Sep 17	Nearshore fish community	9	Hoyle	COA
Toronto Harbour Nearshore Community Index Netting	Aug 30 - Sep 10	Nearshore fish community	3	Hoyle	COA
Credit River Chinook Assessment	Sep 27 - Oct 1	Adult Chinook salmon	41	Bowlby	
Atlantic Salmon Parr Survey	Oct 4 - Oct 22	Juvenile Atlantic salmon	4	Bowlby	COA
Age and Growth	Year-round	Multiple species	n/a	Multiple	

14. Primary Publications 2010

Blukacz, E.A. and 11 co-authors. 2010. Linking lake whitefish (*Coregonus clupeaformis*) condition with male gamete quality and quantity. J. Great Lakes Res. 36 (Suppl. 1): 78-83.

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Brenden, T.O., and 8 co-authors. 2010. Assessing the health of lake whitefish populations in the Laurentian Great Lakes: Lessons learned and research recommendations. J. Great Lakes Res. 36 (Suppl. 1): 135-139.

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Johnson, J.H., Ross, R.M., McCullough, R.D., **Mathers, A.** 2010. Diet shift of double-crested cormorants in eastern Lake Ontario associated with the expansion of the invasive round goby. J. Great Lakes Res. 36: 242–247.

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Stewart, T.J., Johannsson, O., Holeck, K., Sprules, W.G., and O'Gorman, R. 2010. The Lake Ontario zooplankton community before (1987-1991) and after (2001-2005) invasion-induced ecosystem change. J. Great Lakes Res. 36: 596-605.

Stewart, T.J., O'Gorman, R., Sprules, W.G., and Lantry, B.F. 2010. The bioenergetic consequences of invasive-induced food web disruption to alewives. N. Am. J. Fish. Manag. 30: 1485-1504.

Taraborelli, A.C., Fox, M.G., **Johnson, T.B.**, and **Schaner, T.** 2010. Round goby (*Neogobius melanostomus*) population structure, biomass, prey consumption and mortality from predation in the Bay of Quinte, Lake Ontario. J. Great Lakes Res. 36: 625-632.

Walsh, M.G., Lantry, B.F., Boscarino, B., Bowen, K., Gerlofsma, J., **Schaner, T.,** Back, R., Questel, J., Smythe, A.G., Cap, R., Goehle M., Young, B., Chalupnicki, M., Johnson, J.H., and McKenna Jr., J.E. 2010. Early observations on an emerging Great Lakes invader *Hemimysis anomala* in Lake Ontario. J. Great Lakes Res. 36: 499-504.

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