Inland Seas Angler

GREAT LAKES BASIN REPORT©

Special Report – Lake Ontario

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Highlights of the Annual Lake Committee Meetings

Great Lakes Fishery Commission proceedings, Ypsilanti, Michigan

This last of a series of annual special reports is an extensive summary of Great Lakes Region-wide activities. These lake committee reports are from the annual Lake Committee meetings hosted by the Great Lakes Fishery Commission in March 2019. We encourage reproduction with appropriate credit to the GLSFC and the agencies involved. Our thanks to the USFWS for their contributions to these science documents. Thanks also to the Great Lakes Fishery Commission, its staff, Bob Lamb & Marc Gaden, for their efforts in again convening and hosting the Lake Committee meetings in Ypsilanti, MI.

Lake Ontario

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Key:

CPH = Catch per hectare
CPUE = Catch per unit effort
CWT = Coded Wire Tag
DEC = NY Dept. of Environment Conservation
DFO = Dept. of Fisheries and Oceans
LOC = Lake Ontario Committee
LOMU = Lake Ontario Management Unit
ODNR = Ohio Dept. of National Resources
OMNR = ON Ministry Natural Resources
USFWS = U.S. Fish and Wildlife Service
USGS = U.S. Geological Service
YAO = Age 1 and older
YOY = Young of the year (age 0)
1 kg = 2.205 lbs
Kt = kilotonnes
1 kiloton (kt) = 1000 metric tons

Highlights

The age-1 and older Alewife index for 2018 is 1.97 billion fish down from 4.48 billion fish in 2017

The 2018 Alewife Bottom Trawl Survey USGS

- The Lake Ontario alewife population is assessed by the USGS, DEC, and OMNRF using a collaborative survey design that provides a whole lake estimate of alewife abundance.

- The alewife population is assessed with bottom trawls in early spring, largely before alewife leave their over-wintering habitat (near bottom in deep water).

- Alewife were not distributed evenly around the lake in spring 2018, with more alewife in Ontario than in NY waters (**Figs 1 & 2; larger circles=larger catches**).

- Growth and condition of alewife declined across all age classes, meaning less energy transferred to predators for every alewife eaten.

- The relative numbers of alewife at a given size and age (color) in 2018 are presented in **Figure 3**. Please note that each color represents the same "year class" in all three graphs. A year class is those fish produced in a given year, and they will always belong to that year class. For example: the 2015 year class is yellow when measured at age 1 in the top graph of Figure 3, and remains yellow as age 2 fish in 2017 (middle graph) and as age 3 fish in 2018 (bottom graph).

- A large number of alewife were produced in 2016 and first measured as age 1 fish in 2017 (2016 year class; green bars in middle graph of **Figure 3**). This was great news and a good start towards population recovery. Their abundance at age 2 in 2018 (green bars in bottom graph), however, indicates a marked decline in their numbers, likely due to heavy predation.

- A below average year class was produced in 2017 (age 1 fish in 2018; dark blue bars in bottom graph in Figure 3). Their numbers will likely decline markedly by spring 2019.

- In 2018, "larger" size alewife that support both alewife spawning and food for large Chinook salmon are primarily composed of age-2 (2016 year class, green bars), age 3 (2015 year class, yellow bars), and age 6 fish (2012 year class, black bars). Alewife numbers in these year classes will decline markedly by spring 2019.

- As expected, catches of age 4 (2014 year class; red bars) and age 5 (2013 year class; light-blue bars) alewife were poor. The extremely long, cold winters of 2013/2014 and 2014/2015 contributed to the poor 2013 and 2014 year classes, and these poor year classes will continue to affect the overall stability of Lake Ontario's alewife population for several more years.

- The adult alewife population in 2019 will be composed primarily of alewife ages 2, 3, and 4, and will likely experience additional stress over the next several years. The Lake Ontario Committee (LOC) remains committed to maintaining a high-quality Chinook salmon fishery. While there is hope that a relatively strong 2018 alewife year class will be detected in 2019, concerns regarding instability in the adult alewife population have increased.

Table 1- Anticipated NYSDEC 2019 stocking targets for Lake Ontario.

Species	Life Stage	Stocking policy 2019
Chinook Salmon*	**Spring Yearlings**	**1,056,960**
Lake Trout	**Yearling equivalents**	**400,000**
Rainbow Trout	**Spring Yearlings**	**615,700**
Brown Trout	**Spring Yearlings**	**400,000**
Atlantic Salmon	**Spring Yearlings**	**50,000**
Coho Salmon	**Fall Fingerlings**	**155,000**
	Spring Yearlings	**90,000**
		2,767,660

Fig 1-Maps showing adult (Age 2+ = 2 and older) Alewife bottom trawling sites and catch level for 2016, 2017 and 2018. Larger circles represent larger catches of Alewife; "X" = no Alewife caught at that trawl site.

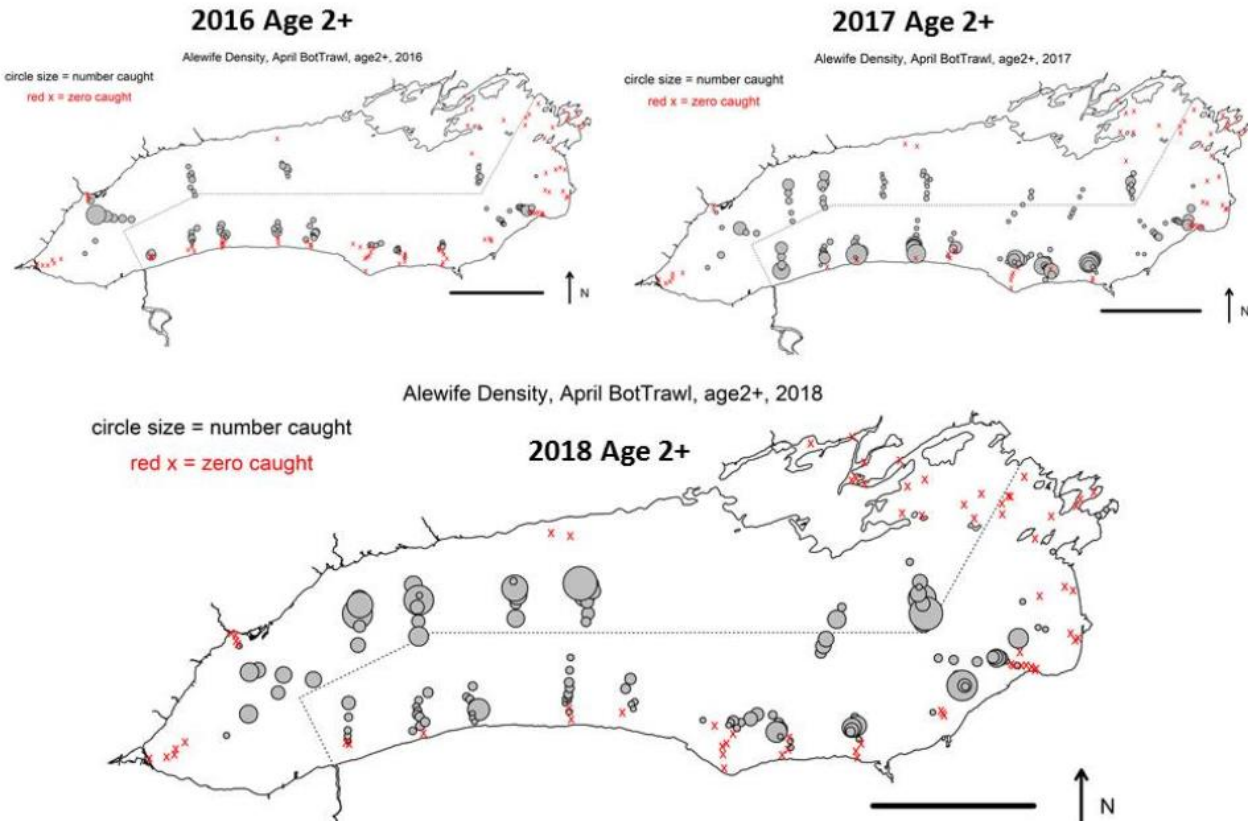


Fig 2- Maps showing Age 1 Alewife bottom trawling sites and catch level for 2016, 2017 and 2018. Larger circles represent larger catches of Alewife; "X" = no Alewife caught at that trawl site.

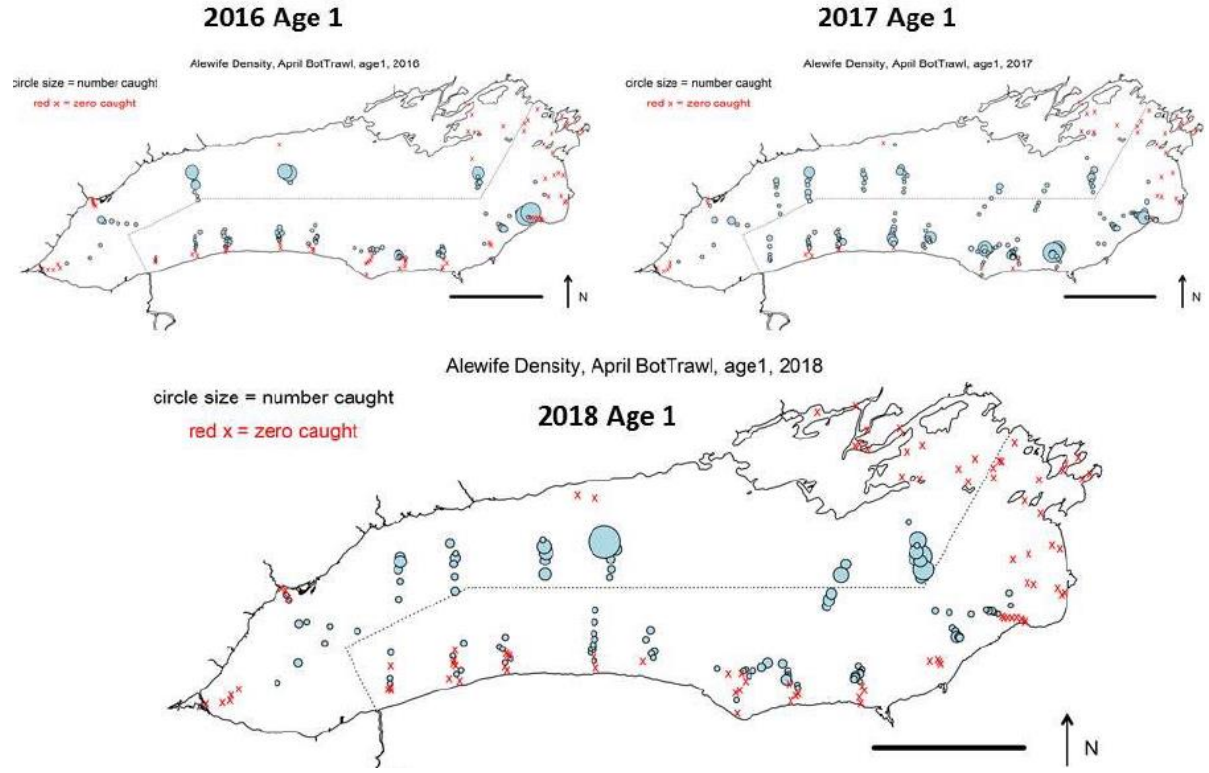
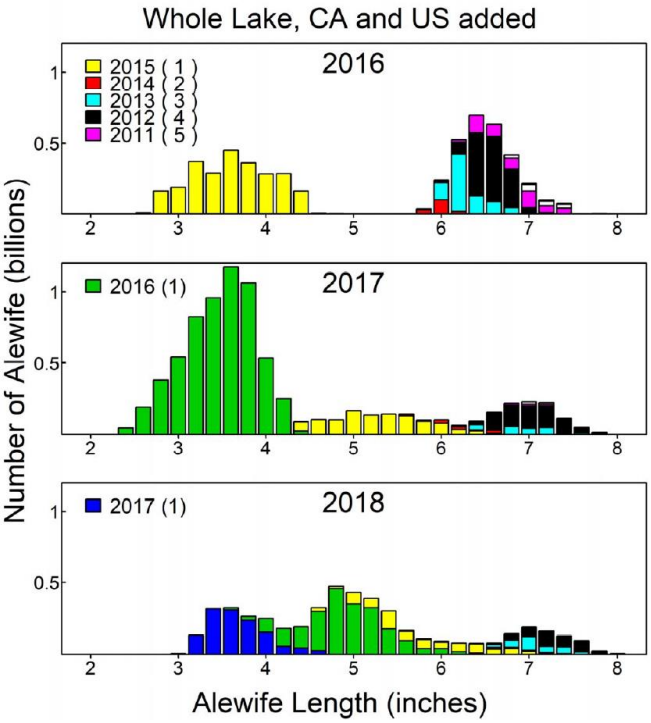


Fig 3-Lake-wide age structure of Alewife for 2016, 2017 and 2018. Higher bar height = more fish of that size. The color representing an alewife year class remains the same in succesive years. For example the 2015 year class is yellow in 2016 when they were age 1 (top graph), and remains yellow as age 2 in 2017 (middle graph) and age 3 in 2018 (bottom graph.



Trout & Salmon fishing remains excellent in Lake Ontario

Preliminary results of the 2018 Lake Ontario boat survey indicate that fishing for trout and salmon remains excellent in the lake. Anglers caught 5.3 trout and salmon per boat, the highest catch rate ever recorded on the lake. Both charter and non-charter boats experienced outstanding fishing. Fishing quality in 2018 was particularly good for Chinook salmon and brown trout.

Status of Lake Ontario Alewife

In 2016, Lake Ontario fisheries management agencies were concerned about declining numbers of adult alewife in future years due to consecutive, poor alewife reproduction in 2013 and 2014.

Alewife in the Great lakes are at the northern extreme of their tolerance for cold temperatures, and young alewife have difficulty surviving long, cold winters. The severe winters of 2013/14 and 2014/15 negatively impacted survival of alewife produced in those years. In 2016, the alewife produced in 2013 and 2014 should have dominated the adult alewife population at ages 3 and 2, respectively, however, these ages are poorly represented in the population.

It is important to note that this situation is not the same as the alewife population collapse in Lake Huron, or the continuing alewife decline in Lake Michigan. Reduced nutrients leading to less alewife food and fewer alewife, combined with too many predators, are thought to be key factors leading to predator-prey imbalance in the upper lakes. In Lake Ontario, for now, we have sufficient nutrients to support alewife and their food. The current issue appears related to poor alewife reproduction in 2013 and 2014, combined with high predator demand for alewife.

These poor year classes will continue to affect the overall stability of Lake Ontario's alewife population for several more years.

In 2016, the Lake Ontario Committee (New York State Department of Environmental Conservation [DEC] and the Ontario Ministry of Natural Resources and Forestry [OMNRF]) announced that stocking levels for Chinook salmon and lake trout would be adjusted down 20% in 2017 to reduce predator demand on adult alewife in order to protect the valuable fishery.

Chinook salmon and lake trout stocking targets remained at the 20% reduced level for 2018.

DEC and OMNRF remain committed to maintaining the ecological, recreational, and economic benefits of Lake Ontario's sportfishery, and in particular, the Chinook salmon fishery. Any future management actions will be based on the results of 2017 alewife population assessments, as well as changes in Chinook salmon growth. In the event that further management actions are deemed necessary, the Department will consult with stakeholder groups and the public.

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NY continues request with Coho Salmon Head Collection

The New York State Department of Environmental Conservation (NYSDEC) and Ontario Ministry of Natural Resources and Forestry (OMNRF) requests your help with recovering heads from Coho Salmon caught in Lake Ontarioagain this year. Each year, NYSDEC stocks Coho Salmon as fall fingerlings at six sites along the New York shoreline and as spring yearlings at the Salmon River; and Metro East Anglers in cooperation with OMNRF, stock Coho fall fingerlings at the Credit River. As part of a continuing effort to evaluate the effectiveness of stocking programs, we are comparing Coho Salmon stocking strategies by mass marking and/or tagging all stocked Coho Salmon in 2016-2018. Tags are 1 mm long pieces of coded wire inserted into the snouts of fish prior to stocking. Tags are invisible to the naked eye, and undetectable without specialized equipment; therefore we need to collect the heads to retrieve the tags.

Some portion of the Coho Salmon caught in Lake Ontario may also come from natural reproduction instead of hatcheries. Although some streams are known to produce wild Coho smolts, the relative contribution of wild and hatchery Coho Salmon to the Lake Ontario fishery is unknown. This information is important for fisheries managers to understand trends in Coho Salmon catch rates. To determine the proportion of wild Coho Salmon in the Lake Ontario fishery, the adipose fin of all Coho Salmon stocked by NYSDEC and OMNRF will be clipped in 2016-2018, including the fall fingerlings stocked by Metro East Anglers at the Credit River. Anglers can help by noting whether their Coho is clipped or not and include that data with the head along with noting collection date, location, and fish length on a label. See attached instructions. Recovery of mark and tag data is ongoing until 2022.

We are asking volunteers to collect heads and data from Coho Salmon harvested in Lake Ontario and tributaries and place them in freezers located at sites from the Niagara River to Oswego (see below). Bags and labels will be available at freezer locations, and instructions for collections are provided below. We would like your help. Please be on the lookout for Coho Salmon when fishing. For all harvested Coho Salmon, please cut off its head, toss it in a bag, label, and put it in a freezer. If you are willing to collect Coho Salmon heads and store them in your personal freezer, we will happily come pick them up. Arrangements can be made by emailing **fwfishlo@dec.ny.gov.**

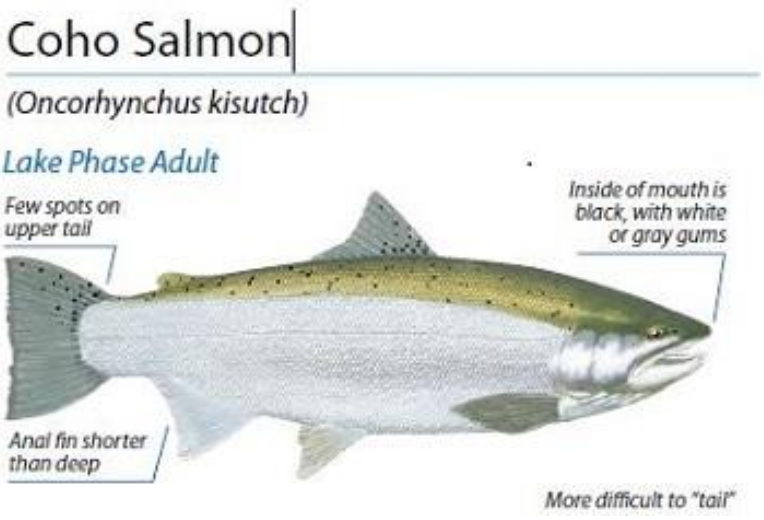
Each year, NYSDEC and OMNRF relies on the cooperation of anglers like you for collecting valuable data used to inform fisheries management and science in Lake Ontario. If you have any questions regarding collection instructions or the mass marking program, please contact Michael Connerton at 315-654-2147 or **fwfishlo@dec.ny.gov** by email.

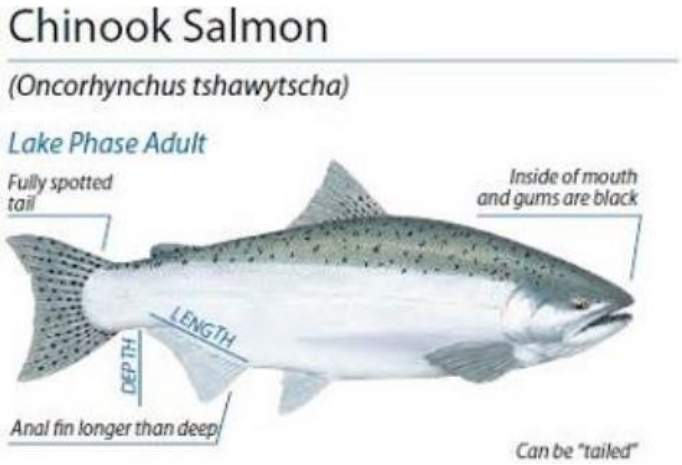
Freezer Locations for Depositing Coho Salmon Heads (starting April 1, 2019)

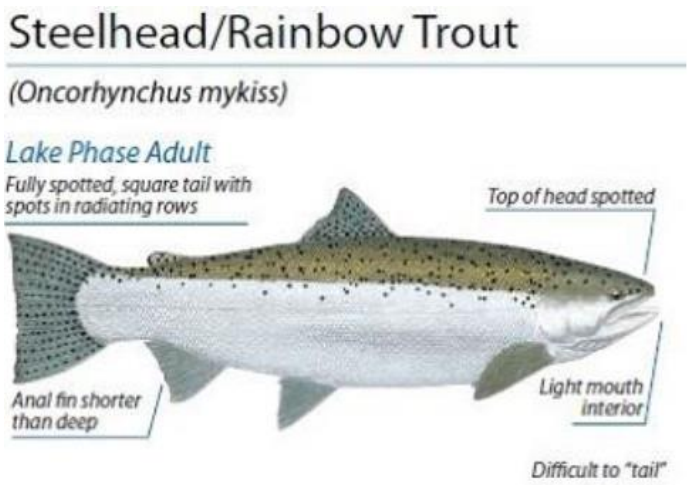
Location
Fort Niagara State Park Cleaning Station
Bootleggers Marina (Freezer)
Wilson Boat Yard (Freezer available only in April/ May at this location)
Town of Newfane Marina Cleaning Station, Olcott
* Lake Breeze Marina near launch, Point Breeze
Shumway Marina Gas Dock, Rochester
Bayside Marina Cleaning Station, Fairhaven
* Wrights Landing Cleaning Station, Oswego 43° 27.724'N, 76° 31.071'W

Instructions for Coho Salmon Sample Collection

Cut the whole head off and place it in a bag. Note capture location, date, whether it has an adipose clip (Yes/No), fish length and the collector's name on the bag label. Note: If you did not note the presence of a clip or its length at capture, please leave that data blank. Use pencil if possible. **Labels and bags are available at the freezers.**







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Salmon River Fisheries Management Plan

New York's Salmon River is a unique and world famous fishery. It is one of the most highly used fisheries resources in the State, visited by anglers from across the country and around the globe who seek to catch the trophy-sized trout and salmon that run from Lake Ontario.

Salmon River flows have been altered since the early 1900s by the construction and operation of two hydroelectric dams. For decades river flows were regulated to maximize power production revenue, resulting in daily flow fluctuations ranging from negligible flow up to 2,000 cubic feet per second (cfs). In t h e 1990s, s i g n i f i c a n t changes in both daily and seasonal water release protocols were negotiated between the hydroelectric utility (Niagara Mohawk), DEC, U.S. Fish and Wildlife Service, and other interested parties, as part of the Federal Energy Regulatory Commission (FERC) hydropower licensing process.

The FERC license established seasonal minimum or "base" flow requirements of 185 cfs from May 1st – August 31st, 335 cfs from September 1st – December 31st, and 285 cfs from January 1st – April 30th. These negotiated base flows, which went into effect in 1996, were selected to ensure suitable habitat for year-round survival of indigenous and introduced fish species and to enhance year-round recreational fisheries. In addition to base flow requirements, any daily flow modifications are now implemented incrementally (ramped) and generally occur during the night or early morning hours when anglers are not on the river. These modifications were implemented to protect anglers and other river users, and enhance the fishery (aquatic habitat) downstream of the lowermost reservoir/power plant (Lighthouse Hill).

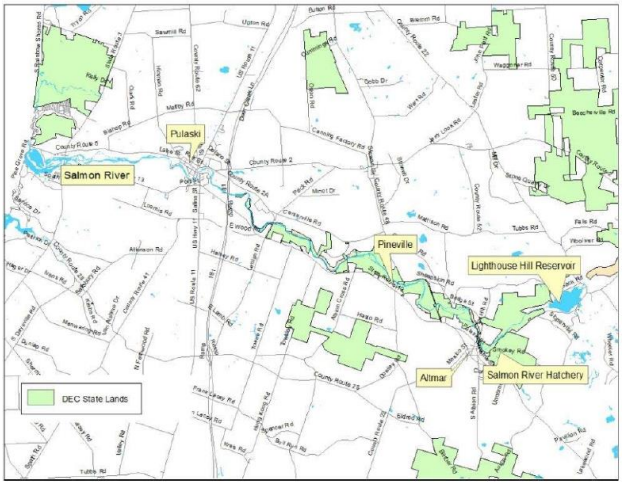

Fig 1-Salmon River from Lake Ontario to Lighthouse Hill Reservoir

The new flow regime resulted in significant improvements to the river's aquatic ecosystem as well as the fishing opportunities it supports. The trout and salmon fisheries of the Salmon River have generally flourished since the changes went into effect. The Salmon River has supported sportfishing effort exceeding one million angler hours, surpassing the open-lake boat angler effort in some years. This tremendous angler effort, which occurs in a relatively short length of river, presents several significant fisheries management and social challenges.

Current Fisheries

The River supports year-round sportfishing opportunities and qualities that are rare, if not unique, in the continental United States. This world class fishery not only offers salmonid

angling opportunities almost every month of the year, but also affords the potential to catch trophy or even record-sized fish. Like the diversity of the River's lake run salmonids, the desires of anglers frequenting the River also vary greatly.

Public access to the River is unique as well. In total, DEC currently provides permanent angler access on one or both banks of approximately 14 miles of the river. Most of the remaining sections of river where DEC does not have public fishing access are owned and managed by businesses or individuals that charge anglers a fee to access the river.

The River experiences a tremendous amount of fishing effort, typically ranking in the top five of waters statewide in total annual effort. From Sept. 1, 2011 through May 15, 2012 estimated angler effort exceeded a million hours which surpassed the Lake Ontario New York boat fishing effort during the 2011 season. DEC has regularly monitored angler effort and catch on the river and more summary information about the data collected can be found in a report by Prindle and Bishop (2017).

Fall

The greatest angling effort occurs in fall with the Chinook salmon spawning run, drawing large numbers of anglers who are largely focused on harvesting fish. The coho salmon run also occurs in fall, but it is smaller in comparison and these fish ascend the River more rapidly than Chinooks. Small numbers of Washington strain steelhead also enter the River in fall, however, most ascend the River in late fall/winter (see "Winter/Spring" section). Atlantic salmon, brown trout, and Skamania strain steelhead are less frequently caught in the fall, but trophy-sized fish are not uncommon. The chances of catching these three species are greater in the summer and early fall.

Chinook Salmon

The Chinook fishery is supported by a combination of wild and stocked fish. The annual Chinook salmon stocking target for the Salmon River system is 352,000 fish. A portion of these fish are stocked just below the Salmon River Hatchery (Hatchery) in Beaverdam Brook, while the remainder are stocked into the lower River at the NYS Route 3 bridge. Additionally, while numbers vary from year to year, millions of wild Chinook smolts are produced annually as a result of natural reproduction in the River. In one study, Everitt (2006) estimated that well over 5 million wild Chinook salmon parr were produced in the River in a single year. A tagging study conducted by DEC from 2008 - 2011 revealed that approximately 58% of the Chinooks in the fall spawning run are wild fish. Despite this significant wild contribution to the River fishery, only about 12% of Chinook salmon entering the Hatchery's fish ladder are wild fish. Consequently, current Chinook stocking numbers in the River must be maintained to support the River's fall Chinook salmon fishery, and to ensure that enough adults return to the Hatchery to meet NY lake-wide Chinook stocking targets.

Adult Chinook salmon returning from Lake Ontario generally begin to enter the River in late August. Adult returns typically increase throughout September, generally peaking with heightened spawning activity during the first two weeks of October. Some fish remain in the river into November, but the run and associated spawning activity is generally completed by mid-October. Both Chinook and coho salmon die after spawning. Salmon River angler demographics during the fall salmon fishery differ somewhat from those of the remainder of the year. Out-of-state anglers comprise 65% of the total during the fall fishery, compared to 54% during the winter and spring fishery (Prindle and Bishop, 2017). Angling effort during the fall fishery is predominantly shore based, with boat angling only accounting for a small percentage of the effort. The roughly 2.5-month-long Chinook salmon season generally accounts for half of the annual fishing effort at the River.

Coho Salmon

Approximately 90,000 yearling coho salmon are stocked annually from the Hatchery directly into Beaverdam Brook. Adult coho salmon generally return to the River during the same time period as Chinooks. Hatchery stocked coho comprise nearly the entire run of adults to the Hatchery because the River does not, in general, provide summer temperatures necessary for survival of wild juveniles. Unlike Chinook salmon that migrate to the Lake within months of hatching, young cohos require a year in the river before migrating.

The coho spawning run is smaller in size and duration than the Chinook run but provides a significant complimentary fishery. In addition to lower stocking numbers, fish migrate upstream very quickly, typically overnight, and this rapid ascent means that any given individual is only available to be caught by anglers for a short time.

Winter/Spring
Steelhead Rainbow Trout

The winter/spring fishery predominantly focuses on steelhead rainbow trout (steelhead). Both Washington strain and Skamania strain steelhead are present in the River and its tributaries, with 120,000 and 43,000 yearlings, respectively, stocked annually. Washington strain steelhead are a "winter run" variety, with adults generally initiating migration back to stocking sites/natal streams during late fall/winter. This run continues through the winter, and into early spring when they spawn. Unlike Chinook and coho salmon which die after one spawning, steelhead can spawn several times. Stocked Washington strain steelhead support most of the winter and spring fishery in the River and its tributaries. Skamania strain steelhead are stocked with the intent of providing a summer run fishery and are described in the next section. Fish returning to the Hatchery provide the eggs and milt for all the steelhead stocked in both lakes Ontario and Erie.

Summer

The River summer fishery offers a surprisingly diverse assemblage of trout and salmon species for anglers to pursue. Skamania steelhead have traditionally been the primary draw of the summer fishery with the highest concentrations being present in early August. However, over the past decade, and particularly since about 2011, the number of Landlocked Atlantic salmon (Atlantics) in the river appears to have increased. Angler catches of Atlantics frequently start during the early summer, immediately following the end of the winter/spring steelhead fishery, and typically increase throughout the summer. Atlantics now appear to be more abundant than Skamania during most summers. The third species that anglers can expect to catch during the summer are non-migratory, stocked domestic brown trout. Further discussion of these species follows.

Steelhead Rainbow Trout

Skamania strain steelhead are considered a "summer run" variety since many individuals migrate into the river during the summer, sometimes nearly a year before they will spawn. The Skamania strain was introduced to the River in the 1980's to create a summer and early fall fishery. While the program was fairly successful for many years, the advent of more stringent fish disease prevention protocols at DEC hatcheries, following an outbreak of Viral Hemorrhagic Septicemia in Lake Ontario in 2006, changed how the Skamania egg-take takes place. Because early run (summer and fall) fish could no longer be sorted and held inside the hatchery due to disease concerns, these fish could not be selectively used during the spring eggtake. Since those changes went into effect, the summer Skamania fishery has declined, with only occasional reports from anglers in recent years. While good numbers still return to the Hatchery each spring, very few return to the river during the summer as intended. The Skamania life history pattern now seems to mirror that of the "winter run" Washington strain steelhead.

Atlantic Salmon

The DEC's Adirondack Hatchery annually rears and stocks 50,000 yearling Atlantic salmon for the Salmon River Additionally, the US Geological Survey (USGS) Tunison Laboratory of Aquatic Sciences (TLAS) has reared and stocked as many as 32,000 Atlantic salmon annually into the Salmon River system in recent years in support of Atlantic salmon restoration. All stockings occur in Beaverdam Brook near the outlet of the Hatchery.

DEC data and observations suggest substantially increased catches of Atlantic salmon in both the Lake and the River over the past decade. Catches of Atlantic salmon during the 2011-2012 Salmon River creel survey increased almost threefold over the previous two surveys, but declined in the most recent survey (2015-16). However, the relatively high number of angler reports of landed Atlantic salmon in the River during the summers of 2016 and 2017 indicate far greater fishing success than seen in several decades.

One of the most promising aspects of increasing adult Atlantic salmon returns to the River is the opportunity to collect eggs and milt (gametes). These fish have successfully survived the unique conditions in Lake Ontario and likely possess the most desirable genetic characteristics for reestablishing a population. The TLAS continues to collect gametes from these returning adults, and rears the resulting offspring to both the fall fingerling and spring yearling stage. In 2016, gametes were collected from 65 returning adults. Another promising sign has been the collection of several wild juvenile Atlantic salmon in the River in recent years. While the intent of this program is to develop a strain of Atlantic salmon capable of supporting a self-sustaining population in Lake Ontario, the Department has no expectation that they will replace the trout and salmon species which currently provide the outstanding fishing opportunities in the lake and its tributaries.

Brown Trout

Lake run brown trout comprise a small part of the River fishery. Currently there is no formal brown trout stocking policy in the river, but surplus fish are stocked, as available, with the goal of providing a summer fishery until a more consistent Atlantic salmon and/or Skamania steelhead fishery develops. Despite the lack of a consistent stocking policy, lake run brown trout are caught each year with catch rates from recent creel surveys ranging from 0.003 to 0.02 brown trout per hour (Prindle and Bishop 2017). The origin of these lakerun brown trout is likely a combination of surplus fish stocked into the River and strays stocked at other Lake Ontario sites. Larger numbers of brown trout have not been stocked in the River due to concerns that they may compete with Atlantic salmon and also potentially interbreed with them. Hybrid wild fry of the two species were collected from the River in 2010 and 2011.

Angler Access

The Salmon River is the most intensively fished water in New York State, and the DEC is committed to improving access to this unique resource. Public access to the mainstem River is exceptional, however, angler density can be very high in some areas, leading to angler conflicts and less desirable angling experiences. High angler traffic on current trails, and in areas lacking trails, promotes erosion, and potentially unsafe conditions. Adding additional parking areas may spread the problem to new areas and this consideration must be addressed during project planning. Also, universally accessible access sites are limited.

Differing Angling Desires and Social Issues

The diversity of angler desires, in concert with very high angling effort, present significant and sometimes unavoidable challenges. Some anglers are content to fish in crowded conditions, while others are willing to hike to find a little extra room to cast. Likewise, some anglers prefer areas with limited tackle restrictions, while others favor areas with more restrictive regulations such as fly fishing only areas. There is also a need to minimize conflicts between River anglers utilizing boats and those fishing from shore.

Expanded public education efforts are needed to address stewardship issues such as angler etiquette, disposal of trash and fishing gear.

Angler Ethics and Law Enforcement

Unethical and illegal angler behavior in the Salmon River system remains a primary complaint expressed by anglers. Despite repeated efforts to limit intentional foul-hooking through terminal tackle restrictions, unethical angling practices persist. An expanded public education effort is needed to inform anglers about effective legal angling techniques. DEC also remains committed to maintaining a scientifically sound but socially reasonable regulatory structure, supported by a strong presence of both uniformed and undercover Environmental Conservation Officers. A highly visible ECO presence is a strong deterrent to illegal activities.

Survival of Trout and Salmon in Lake Ontario

A significant factor influencing the quality of the River's fisheries is survival of juvenile trout and salmon once they enter Lake Ontario. Survival can vary greatly, both between species in any given year, and for the same species from one year to the next. High stocking numbers and/or wild production one year is not a guarantee of good fishing several years later. A variety of factors such as prey availability, predator abundance, weather, and lamprey abundance, to name a few, influence how many juveniles make it to adulthood. Likewise, angler harvest in the lake also has some influence on fishing quality in the River and other tributaries. DEC will continue efforts to effect positive change on those factors which can be influenced, such as lamprey control, and work with constituency groups to consider the needs of lake and tributary anglers.

Thiamine Deficiency

Thiamine deficiency presents a major fisheries management challenge, affecting both natural reproduction of salmonids and the survival of eggs and fry reared at the Hatchery. Lake Ontario salmonids feed to varying degrees on alewife, an invasive preyfish that contains or produces thiaminase. Thiaminase destroys thiamine (vitamin B1) in alewife predators, and the resulting thiamine deficiency can cause early mortality syndrome (EMS). EMS is a reproductive disorder characterized by low egg thiamine levels due to poor maternal thiamine transfer, and results in high offspring mortality. Occasionally, adult fish can also be affected by severe thiamine deficiency which may result in death prior to spawning, as was the case for steelhead in the fall/winter of 2014.

Potential Threats

Several issues potentially threaten the future of the River's fisheries including climate change, overuse, large-scale water withdrawals from the aquafer, land use changes within the watershed, and the introduction/expansion of invasive species like knotweed, which threatens bank stability and, consequently, fish habitat and water quality.

Scope of the Management Plan

Management Goal-DEC will manage the River and its tributaries as a premier, high quality, year-round sport fishery with the opportunity to catch a diversity of trophy sized lake run trout and salmon species. To review the full 50 page management plan: **https://www.dec.ny.gov/docs/fish_marine_pdf/r7srmp2017.pdf**

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2018 Annual Report of the Lake Ontario Management Unit

Foreword

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

In 2018 a new fish counter system was tested on the Credit River. The Walleye telemetry study now has 149 tagged fish from both Ontario and New York State waters and, Lake Whitefish and Cisco were also implanted with acoustic tags to learn more about their movements and habitat use.

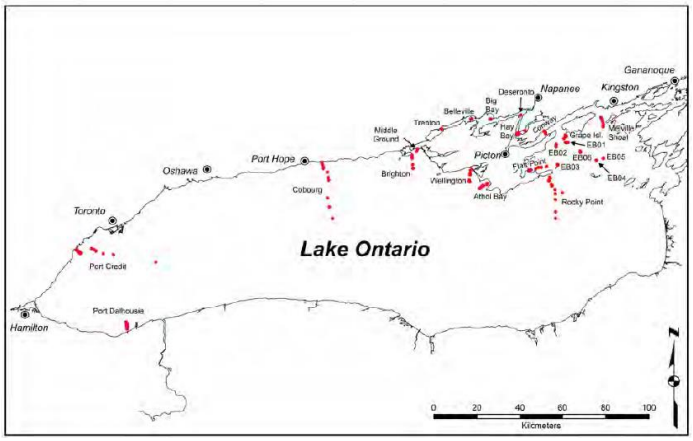

Fig 1.1 - Map of Lake Ontario showing index gill netting sites

In 2018, the Lake Ontario Prey fish Team with the support of the Lake Ontario large vessel fleet including MNRF Ontario Explorer, NYSDEC RV Seth Green and USGS Kaho, conducted 208 trawls starting in April to early May. The results of the prey fish survey show that adult Alewife abundance was low in 2018. Chinook Salmon condition also declined in 2018 and management agencies are concerned about the predator/prey balance in the lake.

1. Index Fishing Projects

Lake Ontario and Bay of Quinte Fish Community

Lake Ontario

Many species showed peak abundance levels in the early 1990s followed by dramatic abundance decline. Alewife, the most common species caught, has occurred at very high abundance levels after 2008 until 2014 when abundance declined precipitously. Alewife abundance increased in 2015 and again in 2016, remained stable in 2017, and declined in 2018. Yellow Perch abundance declined in 2018 to its lowest point in the time-series. Round Goby abundance declined after 2007 to low points in 2014 and 2015, increased in 2016, and remained stable in 2017 and 2018. Lake Trout abundance remained low in 2018. Walleye catch declined slightly in 2018 but remains high. Lake Whitefish remain at a very low abundance level. Rock Bass abundance declined and Smallmouth Bass abundance increased in 2018. Chinook Salmon and Brown Trout abundance increased in 2018.

Lake Trout, Lake Whitefish, Yellow Perch, Rainbow Smelt, Cisco, Chinook Salmon and Round Goby). Alewife catches were variable with high catches in some years: 1998-1999, 2010, 2012, 2016 and 2017. Lake Trout, Lake Whitefish, Rainbow Smelt, and Cisco abundance declined throughout the 1990s and remained low during the years that followed except that Cisco abundance increased markedly from 2014 to 2017 before declining in 2018. Chinook Salmon catches were relatively high in 2016 and 2017, and again in 2018. Round Goby catches continued to be highly variable.

Alewife abundance increased from 2007-2010, declined from 2010-2014, and increased significantly through 2016. Alewife catch was low in 2017 and 2018. Walleye abundance declined from 1992-2000 but has remained very stable since. Freshwater Drum and Gizzard Shad catches show no remarkable trends. White Sucker abundance declined since 1992, gradually levelling off in recent years but spiked in 2017 and 2018. Brown Bullhead abundance has declined precipitously to low levels. Bluegill and Pumpkinseed abundance increased in the late-1990s then declined through 2004. Thereafter, Bluegill catches increased but Pumpkinseed catches did not until 2016 through 2018 when Bluegill abundance was low. Cisco catches increased in the late-1990s then declined; most recently Cisco catch increased in 2015, 2016 and again in 2017. Cisco catch declined slightly in 2018.

Species	Observed catch	Standard catch	Mean weight (g)
Sea Lamprey	1	1	310
Lake Sturgeon	2	2	n/a
Longnose Gar	41	53	1,860
Bowfin	1	3	2,299
Alewife	14,568	43,252	34
Gizzard Shad	82	84	755
Coho Salmon	2	2	1,419
Chinook Salmon	46	51	1,523
Rainbow Trout	3	3	1,368
Atlantic Salmon	2	2	1,423
Brown Trout	90	92	2,302
Lake Trout	417	429	3,167
Lake Whitefish	32	32	1,004
Cisco	117	122	471
Rainbow Smelt	17	29	35
Northern Pike	33	35	2,244
White Sucker	205	205	672
Silver Redhorse	3	3	1,087
Shorthead Redhorse	1	1	1,147
River Redhorse	1	1	562
Common Carp	2	2	5,721
Golden Shiner	1	1	41
Brown Bullhead	25	25	311
Channel Catfish	3	3	3,355
American Eel	1	3	1,451
Burbot	5	5	3,333
Trout-perch	1	3	
White Perch	1,379	1,840	99
White Bass	42	47	243
Rock Bass	57	98	178
Pumpkinseed	52	68	56
Bluegill	23	55	41
Smallmouth Bass	70	76	1,231
Yellow Perch	1,569	3,770	73
Walleye	962	979	1,604
Round Goby	195	640	39
Freshwater Drum	204	209	625
Deepwater Sculpin	17	17	33
Lake Whitefish x Cisco	1	1	973

TABLE 1.1 -Species-specific catch per gill net set in 2018. A total of 374 gill nets were set and 38 species comprising 20,273 fish were caught.

	1992-2000											2001-2010								
	mean	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	**mean**	2011	2012	2013	2014	2015	2016	2017	2018
Bowfin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-
Alewife	**34.82**	49.58	107.40	31.81	22.39	41.27	72.52	3.52	89.17	209.81	67.05	**69.45**	307.74	138.36	295.25	70.48	343.08	191.56	174.10	87.35
Gizzard Shad	**0.44**	-	-	-	-	-	-	-	-	-	0.15	**0.02**	-	-	0.05	-	-	0.20	0.05	1.45
Coho Salmon	**0.004**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chinook Salmon	**0.74**	0.10	0.35	1.25	0.45	0.42	0.20	0.62	0.30	0.05	0.71	**0.44**	0.83	0.10	-	0.20	-	0.20	0.22	0.05
Rainbow Trout	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10	-	-	-	-	-
Atlantic Salmon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05
Brown Trout	**0.12**	-	-	0.35	0.20	0.05	0.15	0.10	0.30	0.15	1.25	**0.26**	0.60	0.50	0.15	0.10	0.20	0.20	-	0.30
Lake Trout	**5.22**	1.30	1.05	0.40	0.95	0.15	0.30	0.05	-	0.05	0.10	**0.44**	0.15	0.20	0.10	0.85	0.57	1.09	0.83	0.65
Lake Whitefish	**0.42**	0.05	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	-	0.05	-
Cisco	**0.12**	-	-	0.05	-	0.10	0.10	0.05	0.25	0.05	-	**0.06**	0.05	-	0.05	0.05	0.10	0.55	0.32	0.40
Round Whitefish	**1.19**	-	0.25	0.05	0.05	-	-	-	-	-	-	**0.04**	-	-	-	-	-	-	-	-
Rainbow Smelt	**0.11**	-	-	-	-	-	-	-	-	-	0.10	**0.01**	0.22	-	0.05	-	-	-	0.17	0.10
Northern Pike	**0.08**	-	-	0.05	-	0.10	-	0.20	0.05	0.05	-	**0.05**	0.05	-	-	0.15	0.30	-	-	0.05
White Sucker	**0.41**	-	0.10	-	0.05	0.15	0.05	0.10	-	-	0.05	**0.05**	0.05	-	-	0.15	-	0.35	-	-
Lake Chub	-	-	-	-	-	-	-	-	0.17	-	-	**0.02**	-	-	-	-	-	-	-	-
Common Carp	**0.12**	-	-	0.05	-	-	-	-	-	-	-	**0.01**	-	-	-	-	-	0.05	-	-
Brown Bullhead	**0.10**	0.52	0.20	0.85	0.27	0.35	-	0.25	0.22	0.05	-	**0.27**	-	-	-	0.17	-	-	-	-
Channel Catfish	**0.01**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
American Eel	**0.004**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Burbot	**0.05**	0.05	-	-	-	-	0.05	0.05	-	-	-	**0.02**	-	-	-	0.05	0.05	0.05	0.15	-
White Perch	**0.03**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rock Bass	**0.88**	-	0.32	0.63	0.76	0.32	0.15	0.32	0.80	0.33	0.33	**0.39**	-	1.65	-	0.22	0.05	0.47	1.52	0.37
Pumpkinseed	**0.01**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Smallmouth Bass	**0.00**	-	-	-	-	-	-	-	-	-	0.05	**0.01**	-	-	-	-	-	-	-	-
Yellow Perch	**15.64**	-	0.50	0.50	0.33	1.16	2.99	1.57	4.83	0.17	0.17	**1.22**	-	1.98	2.36	0.17	-	1.54	-	-
Walleye	**0.44**	-	0.15	0.25	0.50	0.20	0.05	0.75	0.10	-	0.10	**0.21**	-	0.43	0.05	0.15	0.10	0.45	0.20	0.20
Round Goby	-	-	-	0.17	0.17	4.45	1.98	0.63	1.70	1.32	0.99	**1.14**	1.21	2.31	0.99	0.17	1.82	3.30	2.64	2.64
Freshwater Drum	**0.17**	-	-	0.15	0.10	-	0.05	0.05	-	-	-	**0.04**	-	-	-	-	-	-	-	0.05
Total catch	**61**	52	110	37	26	49	79	8	98	212	71	**74**	311	146	299	73	346	200	180	94
Number of species	**13**	6	9	15	12	12	12	14	11	10	12	**11**	9	8	10	13	9	14	11	13
Number of sets		20	20	20	20	20	20	20	20	20	20		20	10	20	20	20	20	20	20

TABLE 1.2-Species-specific catch per gillnet set at Brighton in Northeastern Lake Ontario, 1992-2018. Annual catches are averages for 1-3 gillnet gangs set at each of 5 depths (7.5, 12.5, 17.5, 22.5 and 27.5 m) during each of 1-3 visits during summer. Mean catches for 1992-2000 and 2001-2010 time-periods are shown in bold.

Species Highlights

Lake Whitefish

Thirty-one Lake Whitefish were caught and interpreted for age in the 2018 index gill nets. Fish ranged in age from 3-25 years. Thirteen year-classes were represented. Fourteen (45%) whitefish were from either the 2013 and 2014 year-classes.

Cisco

One hundred and sixteen Cisco were caught and interpreted for age in the 2018 index gill nets. Fish ranged in age from 1-16 years. Fourteen year-classes were represented. Seventy-one (61%) Cisco were from the 2014 year-class.

Walleye

Five hundred and ninety-five Walleye were caught and interpreted for age in the 2018 summer index gill nets. One hundred and fifty-four Walleye (26%) were age-3 (2015 year-class) and 123 (21%) were age-4 (2014 year-class). In the Kingston Basin nearshore gill nets, 92% (196) of the 212 Walleye were age-5 or greater.

Lake Ontario and Bay of Quinte Fish Community Index Trawling

In 2016 and 2017, the three Kingston Basin sites that were dropped in 1992, were added back in to the sampling design, and trawling was not done at Cobourg or Port Credit. [Note that these sites were sampled in spring and fall prey fish assessments. In the Bay of Quinte, six fixed-sites, ranging in depth from about 4 to 21 m, are visited annually on two or three occasions during mid to late-summer. Four replicate ¼ mile trawls are made during each visit to each site.

Twenty-eight species and nearly 85,000 fish were caught in 77 bottom trawls in 2018. Alewife (25%). Round Goby (19%), Rainbow Smelt (14%), Yellow Perch (13%), Gizzard Shad (11%), White Perch (10%) collectively made up 92% of the catch by number.

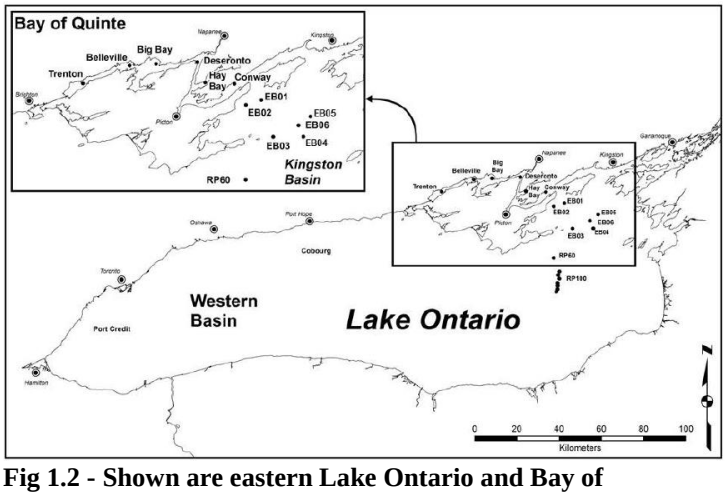

Fig 1.2 - Shown are eastern Lake Ontario and Bay of Quinte fish community index bottom trawling site locations.

Kingston Basin

Bottom trawls were conducted at six sites from June to September 2018. Seven species were caught with the most abundant species being Round Goby, Rainbow Smelt and Alewife. Round Goby abundance increased through the summer; catches were lowest in June and highest in September. Alewife and Rainbow Smelt catches were highest in June and lowest in August.

Three species: Round Goby, Rainbow Smelt and Alewife were caught at EB02 in 2018. Threespine Stickleback, having risen to high levels of abundance in the late 1990s, declined rapidly after 2003 and was absent in the EB02 catches since 2007. Slimy Sculpin, another formerly abundant species has also been absent since 2007

Three species: Round Goby, Rainbow Smelt and Alewife were caught at EB03 in 2018. Round Goby, having first appeared in the EB03 catches in 2004, now generally dominate the total catch. Rainbow Smelt abundance was higher in the last four years especially 2018. As was the case for EB02, Threespine Stickleback have been absent from the EB03 catches since 2007.

Three species: Round Goby, Rainbow Smelt and Alewife were caught at EB06 in 2018

Bay of Quinte

Nine species were caught at Conway in 2018. The most abundant species were Round Goby, Rainbow Smelt, Alewife and Yellow Perch.

Bottom trawl results were summarized across the six Bay of Quinte sites and presented graphically to illustrate abundance trends for major species in Fig. 1.2.3. All species show significant abundance changes over the long-term. The most abundant species remain White Perch, Yellow Perch, Alewife and Gizzard Shad. White Perch abundance declined significantly in 2014, remained low in 2015, increased in 2016 and 2017, and declined in 2018. Yellow Perch remain abundant but did decline in 2017 reflecting a poor year-class that year. Yellow Perch abundance increased in 2018. Alewife abundance remains high. Most centrarchid species are currently at moderate to high levels of abundance, although Pumpkinseed and Largemouth Bass catches were low in 2018. Other species currently at relatively high abundance levels include Gizzard Shad, Trout-perch, Spottail Shiner, Round Goby and Walleye. Species currently at low abundance levels relative to past levels include Brown Bullhead, Rainbow Smelt, White Sucker, Lake Whitefish and Johnny Darter.

Species Highlights

Age-0 Lake Whitefish were caught at Conway but not Timber Island in 2018. Except for the 2003 and 2005 year-classes, age-0 Lake Whitefish catches have been low since the late 1990s.

Age-0 Cisco catches at Conway in 2018 were moderate relative to recent years.

Age-0 catches of Yellow Perch were high in 2018. Four of the last five year-classes were high. Following two exceptionally strong year-classes in 2014 and 2015, the age-0 Walleye catch in 2016 was fair, in 2017 was poor, and in 2018 was good

Round Goby first appeared in bottom trawl catches in the Bay of Quinte in 2001 and in the Kingston Basin of eastern Lake Ontario in 2003. The species was caught at all Bay of Quinte trawling sites by 2003, peaking in abundance, at each site, between 2003 and 2005. Catches have been quite variable since but remain high. Round Goby catches in the Kingston Basin remained high in 2018.

Lake Ontario Nearshore Community Index Netting

Hamilton Harbour

Nearly 15,000 fish comprising 25 species were captured. The most abundant species by number were Brown Bullhead (8,535), White Perch (5,055), Bluegill (414), Rudd (354), Goldfish (116), and Common Carp (97). Walleye were the tenth most abundance species (44). Three American Eel and two different exotic species were captured (Tilapia (2) and an Iridescent Shark Catfish (

The catch was subsampled for biological sampling and the age distribution and mean length by age-class of selected species. Of particular note was the strong showing of age- 6 Walleye from the 2012 stocking event and the apparent absence of Walleye from subsequent events. In 2018 Walleye (age-2) from the 2016 stocking event were then detected.

Toronto Harbour

The most abundant species by number were Brown Bullhead (715), Pumpkinseed (258), Alewife (77), Rock Bass (59) and Common Carp (38). No walleye from the 2017 stocking event were observed (see Section 6.1).

Upper Bay of Quinte

Nearly 8,000 fish comprising 27 species were captured. The most abundant species by number were Bluegill (4,261), Pumpkinseed (1,574), Brown Bullhead (278), White Perch (266), Yellow Perch (167), Longnose gar (164), and Black Crappie (155). Twenty-three American Eel were caught.

Northern Pike abundance declined from 2001-2009, increased significantly in 2010, declined from 2010-2013, remained steady until 2015, then increased in 2016. 2016-2018 appears to be a period of stability with an average catch per trap net just below the Bay of Quinte Fisheries Management Plan (FMP) target. Brown Bullhead and Channel Catfish declined from 2001-2009; Brown Bullhead abundance remained low through 2018 and Channel Catfish increased somewhat in 2015-2018. American Eel abundance has been increasing since 2015 with 2018 values surpassing the high abundance levels observed in 2013-2014 and exceeding the Bay of Quinte FMP target. White Perch abundance was unusually high in 2013 but very few were caught in 2014 (7) and 2015 (11). Since 2015, abundance has been increasing.

Pumpkinseed abundance has been variable since 2011; 2018 showed an increase in abundance. Bluegill abundance has been increasing since 2016 with 2018 representing the highest catch since 2011. Smallmouth Bass abundance declined in 2018 and is well bellow the Bay of Quinte FMP target. Aside from a spike in 2011,

Largemouth Bass abundance is declining and remains below the Bay of Quinte FMP target. Black Crappie abundance declined slightly in 2018.

Yellow Perch abundance increased in 2018 and remains above the Bay of Quinte FMP target. Walleye abundance, having been unusually high in 2013, declined in 2014 and 2015. An increase in abundance was observed in 2016-2017 as a result of very strong 2014 and 2015 year classes. 2018 was a period of slight decline.

Ganaraska River Fishway Migratory Salmon and Trout Assessment

In the spring of 2016, the Lake Ontario Management Unit (LOMU) purchased new in-river fish counting technology to assess salmon and trout activity in the Ganaraska River fishway. This fish counter technology (known as the Riverwatcher) automatically counts fish as they pass through the counting tunnel and records both a silhouette image and short, high resolution video for each individual fish. The Riverwatcher was installed in the Ganaraska Fishway on March 26th, 2018 and continued to count fish through to November 22nd, 2018.

In this time, 25,650 migratory salmon and trout passed upstream through the Ganaraska Fishway. April 22nd, 2018 marked the most active day on the fishway with a total of 1,601 Rainbow Trout observed migrating upstream through the Riverwatcher. In the fall, September 12th, 2018 recorded the most upstream events through the Riverwatcher with 1,576 salmon and trout **(Fig. 1.3**. Throughout the monitoring period, data on Rainbow Trout, Chinook Salmon, Coho Salmon, Brown Trout and Atlantic Salmon were collected.

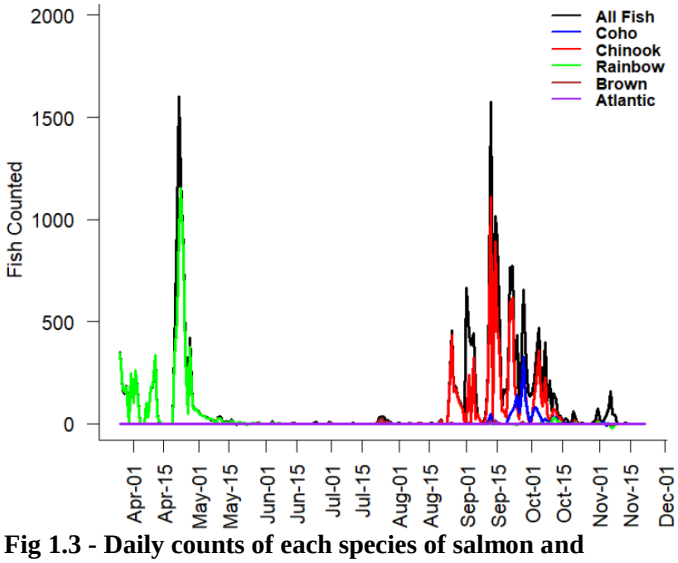

Fig 1.3 - Daily counts of each species of salmon and trout observed migrating through the Ganaraska River fishway at Port Hope, Ontario from March 26th to November 22nd, 2018.

Rainbow Trout

The number of Rainbow Trout "running-up" the Ganaraska River during spring to spawn has been estimated at the fishway on Corbett Dam, Port Hope, ON since 1974. Prior to 1987, the Rainbow Trout counts at the fishway were based completely on hand lifts and visual counts. Between 1987 and 2016, fish counts were made with a Pulsar Model 550 electronic fish counter. Based on visual counts the Pulsar counter was about 85.5% efficient, and the complete size of the run was estimated accordingly. In years where no observations were made, the run was estimated with virtual population analysis. The counter is usually operated from mid to late March until early May. In 2018, the count of Rainbow Trout migrating upstream through the Corbett Dam was determined using the Riverwatcher fish counting system. The Riverwatcher actively counted and recorded fish from March 26th to May 15th, 2018 when the Rainbow Trout spawning run ended.

In the spring of 2018, 9,014 Rainbow Trout were observed passing through the Ganaraska Fishway. This is above the average for the previous 10 years (7,392 fish on average from 2008 to 2017). The total observed run size from 2018 increased 30% from 2017 and is 25% below the peak estimated run in 2013. The 2018 spawning run estimate marks the second consecutive increase on the Ganaraska River since the 2013 peak.

Lamprey wounds on Ganaraska River Rainbow Trout in 2018 remain below the previous 10 year average (35%).

Chinook Salmon

A total of 9,067 Chinook Salmon were identified migrating upstream through the Riverwatcher in the Ganaraska Fishway in 2018. The first Chinook Salmon was observed July 23rd, 2018; this is well ahead of the main Chinook Salmon spawning run. Staff sampled a total of 677 Chinook Salmon; of the total, 149 fish were sampled in detail and the ages of these Chinook Salmon were interpreted from otoliths. Using this information, an age-length-key was created to assign ages to the remaining 528 Chinook Salmon. Through this process it was determined that the 2018 fall Chinook run was comprised of 1% age-1 (all male), 72% age-2 (73% male and 27% female), 23% age 3 (55% male and 45% female) and 3% age-4 (all female). In 2018, the average weight for age-2 males and females was 5,402 g and 5,960 g (respectively) and the average weight for age-3 males and females was 7,589 g and 7,466 g (respectively. Condition measured as the mean weight of a 914 mm or 36 inch (total length) Chinook Salmon in the Ganaraska River has declined for females and remained stable for males since 2015 (Fig 1.4).

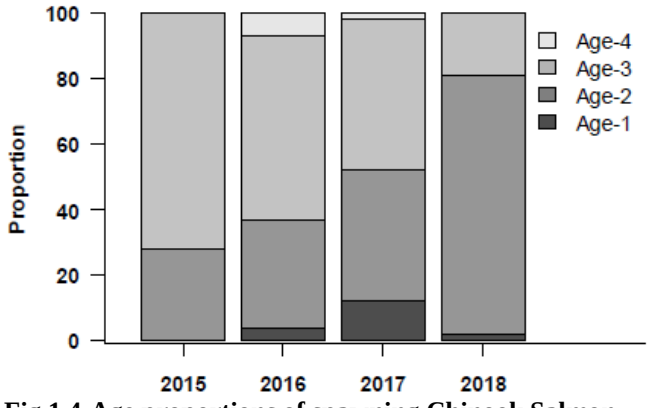

Fig 1.4-Age proportions of spawning Chinook Salmon (males and females pooled) sampled during the fall Ganaraska River Chinook Salmon Spawning Index, Port Hope, Ontario from 2015 – 2018. The four grey colours correspond to each age where Age 1 is the darkest and Age 4 is the lightest.

Coho Salmon
In 2018, 1,550 Coho Salmon migrated upstream through the Ganaraska Fishway; the first Coho Salmon observed at the Fishway in 2018 was on September 2nd and the last was observed on November 13th.

Brown Trout
A total of 183 Brown Trout migrated upstream through the Ganaraska Fishway; the first Brown Trout observed at the Fishway in 2018 was on March 31st. Of the Brown Trout identified passing through the fishway, the majority were observed in late-July.

Atlantic Salmon
The first Atlantic Salmon observed at the Ganaraska Fishway in 2018 was on July 27th. During the monitoring period, 23 Atlantic Salmon were identified moving upstream from the Corbett Dam.

Credit River Fishway Migratory Salmon and Trout Assessment

A total of 1,968 fish were observed moving upstream through the Streetsville Fishway.

Rainbow Trout
A total of 14 Rainbow Trout were identified migrating upstream through the Streetsville Fishway.

Chinook Salmon
A total of 1,390 Chinook Salmon were identified migrating upstream through the Riverwatcher in 2018.

Coho Salmon
A total of 253 Coho Salmon were identified exiting the Streetsville Fishway.

Brown Trout
A total of five Brown Trout were identified exiting the Streetsville Fishway

Atlantic Salmon
A total of five Atlantic Salmon were identified exiting the Streetsville Fishway

Chinook Salmon Spawning Index
Samples for the 2018 Chinook Salmon index were taken between October 3rd – 19th. Lengths were taken on a total of 1,040 Chinook Salmon 413 randomly selected fish (non-detailed sampling) and 627 fish where detailed sampling occurred. Of the randomly selected fish, 14.5% were observed with an adipose clip. To increase the diversity of the Chinook Salmon egg collection, LOMU began collecting Chinook Salmon eggs and milt from the Ganaraska River in addition to the Credit River.

Fish that were stocked into the Credit River that were collected from the Ganaraska River had their adipose removed prior to stocking. This allows LOMU staff to identify the stock origin (Credit River/ Wild = adipose fin intact; Ganaraska = adipose removed/clip) of the mature Chinook Salmon in the Credit River during the spawn/egg collection. Stocking of Ganaraska River Chinook Salmon into the Credit River began in 2015, so fish observed with an adipose clip would be from the 2016 and 2017 stocking events. Of the 60 fish observed with an adipose clip, 40 were male and 20 were female. Of the males 92.5% were age-2 (from the 2016 stocking event) and the remaining were age-1 (from the 2017 stocking event). Of the female fish, all 20 were age-2 (from the 2016 stocking event). In 2018, 62% of the spawning population (clipped and unclipped) were two years old (highest 2-year old proportion in the time series), 34% were age 3.

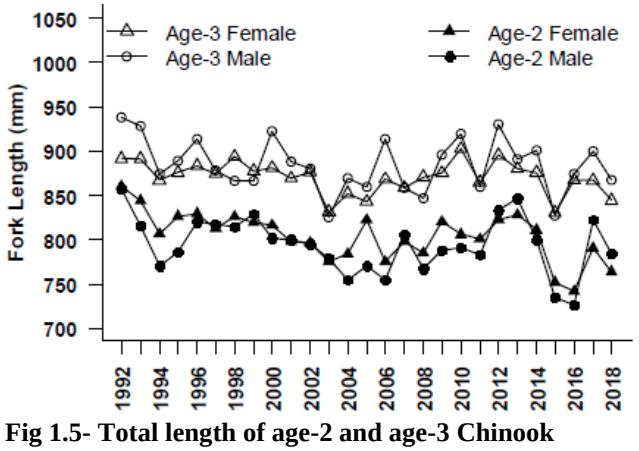

Fig 1.5- Total length of age-2 and age-3 Chinook Salmon by sex, caught for spawn collection in the Credit River during the fall spawning run (approximately first week of October), 1989-2018.

In 2018, average fork length of Chinook Salmon at age-2 and age-3 decreased for both males and females (**Fig. 1.5**). The average fork length of age-3 males (867 mm) decreased from 2017 and is 2% below the long-term average of 885 mm. Average length of age-3 females (845 mm) declined from 2017 and is 3% below the long-term mean (872 mm; **Fig. 1.5**). Length of age-2 females (764 mm) and males (785 mm) decreased from 2017 and are 5% and 1% (respectively) below the long-term averages.

The estimated weight (based on a log-log regression) of a 914 mm / 36" (total length) Chinook Salmon is used as an index of condition. In 2018, female condition was lower than 2017; its first decline since 2015 **(Fig. 1.6).** A sharp decline in male condition was observed in 2018 as well (Fig. 1.5.11). Female condition in 2018 (7,209 g) is the lowest in the 29 year time series; an 8% decline from the previous 10 year average (7,807 g). Male condition (6,832 g) in 2018 is 8% below the average condition over the past 10 years (7,420 g) and has declined 14% since its peak in 2016. It should be noted that the absolute difference between maximum and minimum condition for female (1995 and 2018) and male (1995 and 2018) Chinook Salmon in this time series is 1,605 g and 1,156 g (respectively).

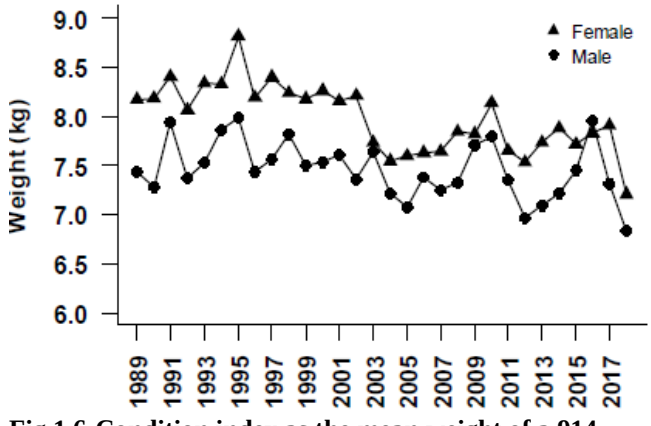

Fig 1.6-Condition index as the mean weight of a 914 mm / 36 inch (total length) Chinook Salmon in the Credit River during the spawning run (approximately first week of October), 1989-2018.

Lake Ontario Summer Pelagic Prey Fish Survey

A total of 18 species were captured in the midwater trawls eight of which were captured only in the Bay of Quinte. Lake catches were numerically dominated by Alewife and Rainbow Smelt in both seasons. When ranked according to biomass (kg), Cisco were the second most abundant species in July (after Alewife) and the most abundant in both regions in September. Also, of note, four juvenile Chinook Salmon (1 in July, 3 in September) were caught in tows near Cobourg (presumed age-0).

The 2016 survey estimate increases more than other years, possibly indicating faster growth of age-0 fish early in the season to reach the minimum target strength threshold by July; however, this hypothesis requires further investigation.

The age-1 and older Alewife index for 2018 is 1.97 billion fish down from 4.48 billion fish in 2017. Midwater trawl catches indicate a large proportion of age-2 fish (120 to 150 mm) (**Fig. 1.7**). Distribution across the lake differs significantly from the pattern observed in the Spring. During July, Alewife tend to be much more dispersed in relation to warm water. At the time the survey was conducted there was a significant upwelling event along the south east shore and lower density of Alewife in these areas. Few Alewife were caught in trawls at these areas at that time. In years where midwater trawling was conducted concurrently with the hydroacoustic transects the whole lake numeric index was converted to a biomass estimates (Table 1.6.4) using mean Alewife weight obtained from the trawls to provide a comparable index to bottom trawl surveys and other lakes.

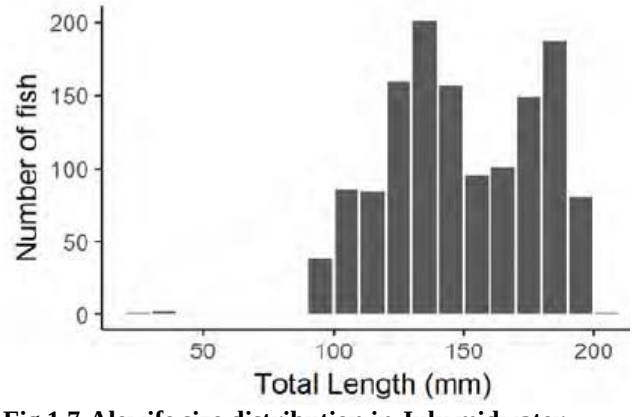

Fig 1.7-Alewife size distribution in July midwater trawl catches.

The index of Rainbow Smelt abundance increased in 2018 to 99.7 million fish but remains well below population levels observed in the 1990s. The areas of highest Rainbow Smelt density occurred in the eastern portion of the Lake. The Kingston Basin and the Stony Island area had unusually high numbers of Rainbow Smelt relative to other parts of the Lake

Lake Ontario Spring Prey Fish Assessment

In 2018, a total of 208 sites were conducted, sampling depths from 5 - 218 m between April 9th and May 3rd. The south shore has well distributed coverage as most depths between 8 - 200 m can be surveyed at each transect. Bottom trawling along the north shore is less uniform due to a lack of suitable trawl sites at shallower depths. Attempts to trawl at depths shallower than 80 m in the main basin have consistently resulted in snags and torn trawl nets. During the day, in early spring, most Lake Ontario Alewife are found near the lake bottom in the warmer, deeper water (75 m – 150 m) thus trawl sites at depths greater than 80m provide suitable index sites for Alewife.

The survey captured 384,651 individuals from 31 species. Alewife were 80% of the total catch by number and Round Goby, Deepwater Sculpin, and Rainbow Smelt comprised 12, 4, and 3% of the catch, respectively. Detailed results are provided in the Status of Prey Fish.

Lake Ontario Fall Benthic Prey Fish Assessment

The Lake Ontario offshore prey fish community was once a diverse mix of pelagic and benthic fishes but by the 1970s the only native fish species that remained abundant was Slimy Sculpin. Recent invasions of Dressenid mussels and Round Goby have further changed the offshore fish community. The 2018 survey consisted of 119 trawls conducted from September 27th through November 1st throughout the entire lake.

Round goby were the most abundant species caught (N = 39,603) followed by Alewife (N = 16,258), Deepwater Sculpin (N = 5,886) and Rainbow Smelt (N = 1,763).

St. Lake St. Francis Community Index Gill Netting

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.

In total, 407 fish were caught, which included 14 different fish species (Table 1.9.1). The average number of fish per set was 11.30, down 26% from 2016. The number of fish per set continued to decline from the record high in 2008 and is below the 1984 – 2016 average for the survey and it is now the lowest in the time series. The dominant species in the catch continues to be Yellow Perch (60% of the catch), followed by Rock Bass **(Fig 1.8**).

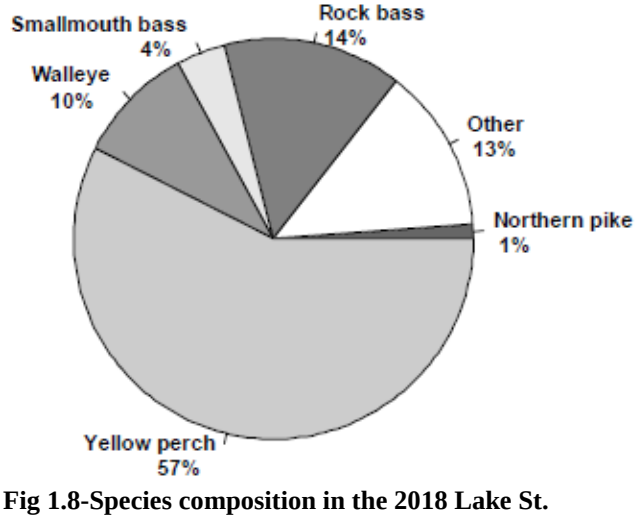

Fig 1.8-Species composition in the 2018 Lake St. Francis community index gill netting program.

Species Highlights

Yellow Perch

Catches of Yellow Perch continued to decline from peak levels seen previously in 2008 and 2010 **(Fig. 1.9).** Current Yellow Perch catch per net (6.5 fish per net) is below the 1984 – 2016 survey average (15.97 fish per net. An increase in the catch of large fish (> 220 mm) observed in 2008 and 2010 has been followed by continued decline in this group from 2012 to 2018 **(Fig. 1.9**). The catch per net of large fish in 2018 (0.62 fish per net) was the lowest observed in the time series (**Fig. 1.9).** Yellow Perch catch in 2018 contained fish from age-2 to age-8 with age-4 fish representing 42% of the total catch.

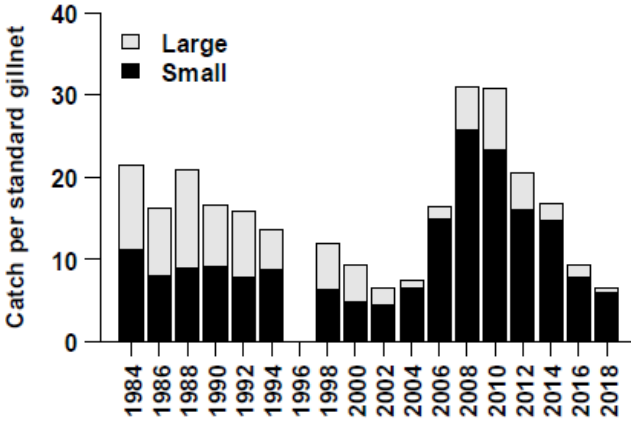

Fig 1.9-Catches of small (≤ 220 mm total length) and large (> 220 mm total length) Yellow Perch in the Lake St. Francis community index netting program, 1984 – 2018. Survey was not conducted in 1996.

Centrarchids

The centrarchids are represented by six species in Lake St. Francis: Rock Bass, Pumpkinseed, Bluegill, Smallmouth Bass, Largemouth Bass and Black Crappie. While Rock Bass remain the most abundant of the centrarchids, catches in 2018 were 33% of the previous decade. Smallmouth Bass catches increased in 2018 relative to the 2016 catch but are currently 38% below the previous 10-year average with the majority being age-3 and age-4 (Fig. 1.9.6). Pumpkinseed catches were unchanged from 2016 to 2018 (Fig. 1.9.7). Bluegill, Largemouth Bass and Black Crappie were historically at much lower levels than the former three species and remain so (Fig. 1.9.6). In 2018, Largemouth Bass catches were below the previous 10-year average (Fig. 1.9.7).

Northern Pike

In 2018, catches of Northern Pike were comparable to 2016. Northern Pike abundances have been in decline since the early 1990s and are currently at the lowest levels observed in the 34- year time series. A total of five Northern Pike were caught in 2018, ranging in from age-4 to age-8. In 2018, there were no small (≤ 500 mm) Northern Pike caught. No Muskellunge were caught in 2018.

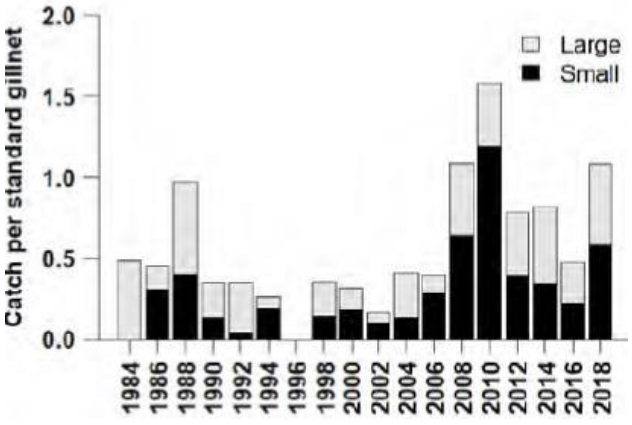

Fig 1.10-Catches of small (≤ 500 mm total length) and large (> 500 mm total length) Walleye in the Lake St. Francis Community Index Gill Netting Program, 1984 – 2018. Survey was not conducted in 1996.

Walleye

Walleye represented 10% of the total catch in 2018 with 39 individuals caught. The average catch per net was 1.08; an increase from 2016 and roughly 12% greater than the previous 10-year average. Catches of small fish (≤ 500 mm) and large (>500 mm) continue to remain almost equal **(Fig. 1.10).** Walleye ages ranged from 1 to 12 years of age with the majority being ages 3, 4 and 5.

2. Recreational Fishery

Fisheries Management Zone 20 Council Volunteer Angling Clubs

Council members represents a broad spectrum of interests across the zone including Muskies Canada, competitive bass anglers, Bay of Quinte and Upper St. Lawrence River Guides, Central Lake Ontario Sport Anglers, Metro East Anglers, Port Credit Salmon and Trout Association, Halton Region Salmon and Trout Association, St. Catharines Game and Fish Association, Ontario Sportfishing Guides Association, Ontario Commercial Fish Association, Ontario Federation of Anglers and Hunters, tributary anglers, academia, environmental interests and several unaffiliated anglers.

Many of our volunteer clubs (council-affiliated and others) help with the physical delivery of several management programs.

Multiple clubs help with planning and implementation of Lake Ontario's net pen rearing initiatives for Chinook Salmon. Others help with the annual delivery of our stocking program through the operation of community-based hatcheries. The Napanee Rod and Gun Club helps MNRF meet its stocking targets by rearing Brown Trout. The Credit River Anglers stock Rainbow Trout and Coho Salmon. The Metro East Anglers, through their operation of the Ringwood hatchery, help the province meet its Rainbow Trout, Brown Trout, Atlantic Salmon, and Coho Salmon targets. Numerous anglers and clubs also participate regularly by supplying catch and harvest information in our volunteer angler diary programs.

Lake St. Francis Recreational Fishery

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

The 2018 survey used both on-water boat counts and on-water angler interviews to determine angler activity and catch. There were 1,831 anglers interviewed (1,069 boats) by field crews. Seventy percent of anglers interviewed were local, 14% were from Québec, 13% were from Ontario (but not local) and 4% were U.S. residents. Total angler effort was estimated to be 53,567 hours. Anglers reported catching 19 different species. Most angling effort was targeted toward Yellow Perch (24,005 hours) followed by Walleye (15,039 hours), Smallmouth Bass (9,439 hours) and Largemouth Bass (3,384 hours).

Anglers caught an estimated 175,103 Yellow Perch and harvested 79,691 (release rate 55%). Angling success was relatively high at 7.27 Yellow Perch caught (3.3 fish harvested) per hour of fishing. Anglers caught 6,874 and harvested 4,958 Walleye. Walleye catch rate was 0.455 fish per hour and release rate was 27%. Anglers also caught 8,523 Smallmouth Bass (0.845 fish per hour) and 2,001 Largemouth Bass (0.496 fish per hour).

As in previous surveys, angling effort has targeted mainly Yellow Perch, however, angling effort targeting Yellow Perch has declined in proportion to the total effort in the fishery over the past 15 years. Anglers caught an estimated 175,103 Yellow Perch and harvested 79,691 (release rate 55%). Angling success for Yellow Perch was the lowest in the four surveys but remains relatively high at 7.27 Yellow Perch caught (3.3 fish harvested) per hour of fishing. Anglers caught 6,874 and harvested 4,958 Walleye. Walleye catch rate was 0.455 fish per hour and release rate was 27%. Anglers also caught 8,523 Smallmouth Bass (0.845 fish per hour) and 2,001 Largemouth Bass (0.496 fish per hour). Effort and catch of Walleye and Smallmouth Bass in 2018 were comparable to the 2009 and 2013 surveys but represent a large increase in both statistics from the 2003 survey. This may indicate a shift in the Lake St. Francis fishery, with more angling effort being devoted to these species. More work is needed to understand the dynamic of the Lake St. Francis fishery in its current ecological state.

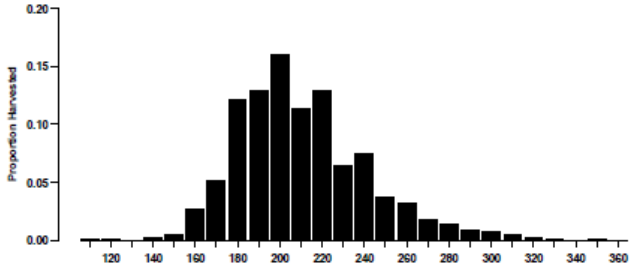

Fig .2.1- Length distributions of Yellow Perch sampled (harvested fish) during the Lake St. Francis recreational fishery survey, 2018. The mean fork length of harvested Yellow Perch was 211 mm.

The average size of Yellow Perch harvested was 211 mm **(Fig. 2.1**) and the average age was 4.4 years (Fig. 2.2.2). Twenty-three percent of anglers indicated that the Yellow Perch fishery was unchanged (10%) or had improved (13%) in the last five years. Seventy-seven percent thought that the fishery was worse (28%) or had no opinion (49%).

Bay of Quinte Volunteer Walleye Angler Diary Program

A volunteer angler diary program was conducted during late-summer and fall 2018 on the Bay of Quinte and Kingston Basin, eastern Lake Ontario. The diary program focused on the popular late-summer and fall recreational fishery for "trophy" Walleye, primarily on the middle and lower reaches of Bay of Quinte. A total of 18 diaries were returned as of February 2019.

Two of the 18 returned diaries reported zero fishing trips. The number of fishing trips reported in each of the remaining 16 diaries ranged from one to 23 trips. Fishing trips were reported for 127 out of a possible 154 calendar days from Jul 14 to Dec 15, 2018. There were from one to five volunteer angler boats fishing on each of the 127 days, and a total of 126 trip reports targeted at Walleye; 25 charter boat trips and 101 non-charter boat trips. Of the 126 trips, 91 (72%) were made on Locations 2 and 3 (middle and lower reaches of the Bay of Quinte), and 26 trips (21%) were made in Locations 4 and 5 (Kingston Basin, eastern Lake Ontario. The overall average fishing trip duration was 7.2 hours for charter boats and 5.3 hours for non-charter boats, and the average numbers of anglers per boat trip were 4.8 and 2.2 for charter and non-charter boats, respectively. In Locations 3, 4 and 5, where two lines are permitted, most anglers used two lines (1.9 rods per angler on average).

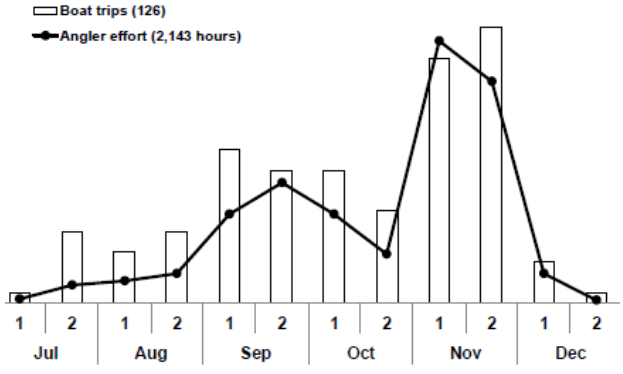

Fig. 2.2- Seasonal breakdown (summarized by first and second half of each month from the first half of Jul to the end of Dec) of fishing effort (boat trips and angler hours) reported by volunteer Walleye anglers during 2018 on the Bay of Quinte and the Kingston Basin, eastern Lake Ontario.

Fishing Effort

A total of 2,143 angler hours of fishing effort was reported by volunteer anglers. The seasonal pattern of fishing effort is shown in **Fig. 2.2.** Highest fishing effort occurred in November. Most fishing effort occurred in Location 3 (51%; lower Bay). Locations 4 and 5 (Kingston Basin, eastern Lake Ontario) accounted for 15% of the total fishing effort.

Catch

Seven species and a total of 463 fish were reported caught by volunteer anglers. The number of Walleye caught was 387; 186 (48%) kept and 201 (52%) released. The next most abundant species caught was Freshwater Drum (37) followed by Northern Pike (19), White Bass (11), and Smallmouth Bass (6).

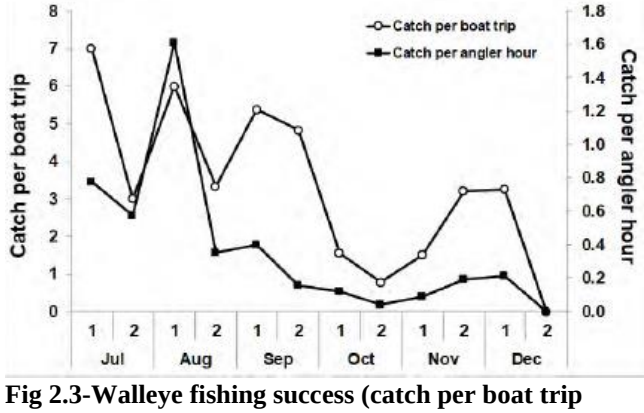

Fig 2.3-Walleye fishing success (catch per boat trip and per angler hour) reported by volunteer Walleye anglers in areas 2, 3 and 4 during late summer and fall 2018 on the Bay of Quinte and the Kingston Basin, eastern Lake Ontario (summarized by first and second half of each month from July to December).

Fishing Success

The overall fishing success for Walleye in fall 2018 was 3.1 Walleye per boat trip or 0.279 fish per angler hour of fishing. Seventy-five percent of all boat trips reported catching at least one Walleye ("skunk rate" 25%). Seasonal fishing success, for geographic Locations 2, 3 and 4 combined, is shown in Fig. 2.3. Success was high from July through September, low in October, and was high in late November and early December.

Length Distribution of Walleye Caught

Ninety-six percent of Walleye caught by volunteer anglers were between 16 and 30 inches total length **(Fig. 2.4).** Over the seven years of the volunteer angler diary program 3,279 Walleye lengths have been reported **(Fig. 2.4**). The proportion of Walleye released was highest for smallest and largest fish and lowest for fish of intermediate size. Only 24% of fish caught that were between 16 and 25 inches were released. In contrast, 59% of fish less than 16 inches and 67% of fish greater than 25 inches were released.

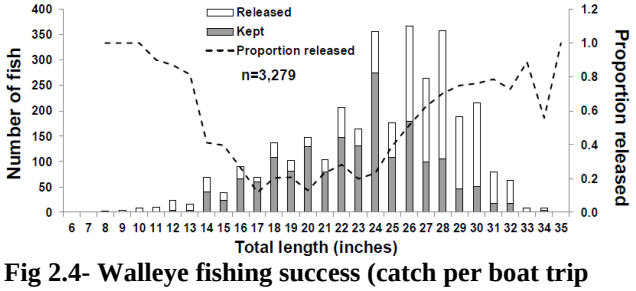

Fig 2.4- Walleye fishing success (catch per boat trip and per angler hour) reported by volunteer Walleye anglers in areas 2, 3 and 4 during late summer and fall 2018 on the Bay of Quinte and the Kingston Basin, eastern Lake Ontario (summarized by first and second half of each month from July to December).

Lake Ontario Chinook Salmon Tournament Sampling

Since 2010, the Lake Ontario Management Unit has been attending Lake Ontario fishing tournaments to sample Chinook Salmon periodically throughout the summer. On average LOMU visits six tournaments a season and collects biological information on harvested angler caught fish. The tournament sampling program provides insight into the age structure, condition and health of Lake Ontario salmon and trout throughout the summer months.

Due to inclement weather conditions, LOMU staff attended three tournaments in 2018, sampling a total of 55 Chinook Salmon, 23 Coho Salmon, 5 Lake Trout, 3 Rainbow Trout and 1 Atlantic Salmon. The average total length and weight for a Chinook Salmon sampled in the 2018 tournaments was 775 mm (30.5") and 5,610 g (12.37 lbs), respectively **(Table 2.1)**. The heaviest fish sampled by LOMU in the 2018 tournaments weighed 11,360 g (25.00 lbs).

Year	n	Avg. Total Length (mm)	Weight (g)		
			Avg.	Min.	Max.
2010	405	733	5.83	0.22	17.72
2011	220	831	6.58	0.40	16.00
2012	221	864	7.72	0.34	15.14
2013	340	872	8.02	0.39	15.96
2014	127	768	5.98	0.55	14.70
2016	118	811	6.92	0.41	15.01
2017	88	824	7.20	0.40	14.34
2018	55	775	5.61	0.68	11.36

TABLE 2.1- Summary of summer Chinook Salmon sampling on Lake Ontario, 2010 – 2018.

Chinook Salmon body condition was determined as the estimated weight (g) of a 914 mm (36") total length fish. Overall, Chinook Salmon body condition declined from 2010 to 2014. Since this time Chinook Salmon body condition increased to the highest value in the time series in 2017. In 2018, body condition of Chinook Salmon sampled in tournaments took a sharp decline and is at the lowest point in the nine-year time series. It should be noted that despite the variability observed from year to year, the absolute difference in body condition from 2010 to 2018 is 1,590 g (3.5 lbs). The Lake Ontario Management Unit would like to thank all the tournament organizers, volunteers and anglers involved in making this program a success over the past eight years.

Commercial Fishery

The Lake Ontario and St. Lawrence River Commercial Fishery Liaison Committee (LOLC) consists of Ontario Commercial Fishing License holders that are appointed to represent each of the quota zones, as well as representatives of the Ontario Commercial Fisheries' Association, and MNRF. Most of the commercial harvest occurring in Canadian waters of Lake Ontario east of Brighton (including the Bay of Quinte, East and West Lakes) and the St. Lawrence River. The waters west of Brighton (quota zone 1-8) currently have no commercial licences.

The total harvest (landed value) of all species was 335,493 lb ($454,354) in 2018, down 162,655 lb (33%) from 2017. The harvest (landed value) for Lake Ontario, the St. Lawrence River, and East and West Lakes was 230,388 lb ($319,053), 73,406 lb ($101,468), and 31,699 lb ($35,532), respectively. Yellow Perch, Lake Whitefish, Sunfish and Walleye were the dominant species in the harvest for Lake Ontario. Yellow Perch was dominant in the St. Lawrence River. Sunfish was the dominant fish in East and West Lakes.

Species	Lake Ontario			St. Lawrence River			All Waterbodies		
	Harvest	Price per lb	Landed value	Harvest	Price per lb	Landed value	Harvest	Price per lb	Landed value
Black Crappie	5,004	$3.29	$16,452	2,262	$2.71	$6,121	9,085	$3.04	$27,601
Bowfin	1,952	$0.30	$586	2,224	$0.60	$1,326	4,480	$0.50	$2,261
Brown Bullhead	3,319	$0.26	$858	10,785	$0.45	$4,835	14,114	$0.41	$5,729
Common Carp	4,037	$0.15	$616	0			4,350	$0.15	$663
Freshwater Drum	16,452	$0.10	$1,587	0			16,452	$0.10	$1,587
Cisco	2,988	$0.29	$861	0			3,057	$0.29	$883
Lake Whitefish	56,157	$1.74	$97,459	0			56,157	$1.74	$97,459
Northern Pike	7,464	$0.37	$2,763	1,118	$0.39	$432	10,555	$0.36	$3,764
Rock Bass	7,649	$0.63	$4,824	1,118	$0.66	$737	12,782	$0.63	$8,116
Sunfish	25,443	$1.26	$31,998	5,088	$1.06	$5,385	51,153	$1.20	$61,339
Walleye	26,201	$2.61	$68,487	0			26,201	$2.61	$68,487
White Bass	4,357	$0.52	$2,252	0			4,357	$0.52	$2,252
White Perch	7,820	$0.45	$3,534	16	$0.60	$10	9,905	$0.48	$4,764
White Sucker	13,270	$0.13	$1,724	0			13,300	$0.13	$1,725
Yellow Perch	48,275	$1.76	$85,052	50,795	$1.63	$82,622	99,545	$1.68	$167,725
Total	230,388		$319,053	73,406		$101,468	335,493		$454,354

TABLE 2.2- 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, 2018.

Major Fishery Trends

Harvest and landed value trends for Lake Ontario (Embayments included) and the St. Lawrence River are shown in **Table 2.2** Having declined in the early 2000s, commercial harvest appeared to have stabilized over the 2003-2013 time-period at about 400,000 lb and 150,000 lb for Lake Ontario (**Table 2.2**) and the St. Lawrence River respectively. In 2014, harvest declined again in both major geographic areas. In 2015, harvest declined in the St. Lawrence River and increased slightly in Lake Ontario. Harvest increased significantly in both areas in 2016 and again in 2017. In 2018, harvest declined in both geographic areas.

Major Species

Species-specific price-per-lb values are means across quota zones within a major waterbody (i.e., Lake Ontario and the St. Lawrence River).

Yellow Perch

Yellow Perch 2018 commercial harvest relative to issued and base quota by quota zone and total for all quota zones combined is shown in Fig. 3.2.6. Overall, 25% (99,545 lb) of the Yellow Perch base quota (395,882 lb) was harvested in 2018 down from 45% harvested the previous year. The highest Yellow Perch harvest came from quota zones 2-5 and 1-4. All but one quota zone (1-7) harvested less than 50% of base quota.

Yellow Perch quota was reduced 20% in 2018 in quota zones 1-1 and 1-2. Quota was increased 10% in quota zones 1-3 and 1-4, and left unchanged in quota zones 1-5, 2-7, 1-7, East Lake and West Lake. Harvest and price-per-lb decreased in 2018 in all quota zones.

Lake Whitefish

Overall, 42% (56,157 lb) of the Lake Whitefish base quota was harvested in 2018. Most of the Lake Whitefish harvest came from quota zone 1-2. Lake Whitefish is managed as one population across quota zones. Therefore, quota can be transferred among quota zones. Issued quota and harvest was significantly higher than base quota in quota zone 1-2. Relatively small proportions of base quota were harvested in quota zones 1-1, 1-3 and 1-4.

Base quota remained unchanged in 2018 compared to 2017. Lake Whitefish price-per-lb has been trending up since 2016.

Walleye

Walleye harvest decreased in 2018. Overall, 52% (26,201 lb) of the Walleye base quota (48,092 lb) was harvested. The highest Walleye harvest came from quota zone 1-4. Very small proportions of base quota were harvested in quota zones 1-1 and 1-2. Walleye (like Lake Whitefish) is managed as one fish population across quota zones. Therefore, quota can be transferred among quota zones 1-1, 1-2 and 1-4. In 2018, this resulted in issued quota and harvest being considerably higher than base quota in quota zone 1-4.

Quota has remained constant since the early 2000s (just under 50,000 lb for all quota zones combined). Walleye price-per-lb has been trending higher for the last number of years.

Black Crappie

Overall, only 12% (9,085 lb) of the Black Crappie base quota (73,013) was harvested in 2018. The highest Black Crappie harvest came from quota zones 1-3 and West Lake. Only a very small proportion of base quota was harvested in other quota zones.

Black Crappie harvest has been trending down in quota zone 1-3, though slightly increasing in 2018. Harvest remains steady in West Lake. Price-per-lb is currently high.

Northern Pike

Highest Northern pike harvest came from quota zone 1-3. In 2018, harvest declined in all quota zones except 1-2. Northern Pike is managed as an incidental harvest fishery. In 2018, the harvest season was closed from April 1st to the first Saturday in May. Historically, this time period accounted for a significant amount of the annual harvest.

Lake Whitefish Commercial Catch Sampling

Total Lake Whitefish harvest for 2018 was 56,156 lbs; 44% of the issued quota and 42% of base quota.

Most of the harvest was taken in gill nets, 97% by weight; 3% of the harvest was taken in impoundment gear. Ninety-seven percent of the gill net harvest occurred in quota zone 1-2. Fifty-three percent of the gill net harvest in quota zone 1-2 was taken in November and December. In quota zone 1-3 most impoundment gear harvest and effort occurred in November. Overall, about 26,000 lbs of Lake Whitefish were harvested before November 1, the date on which an additional 20% of base quota was made available to the "pool".

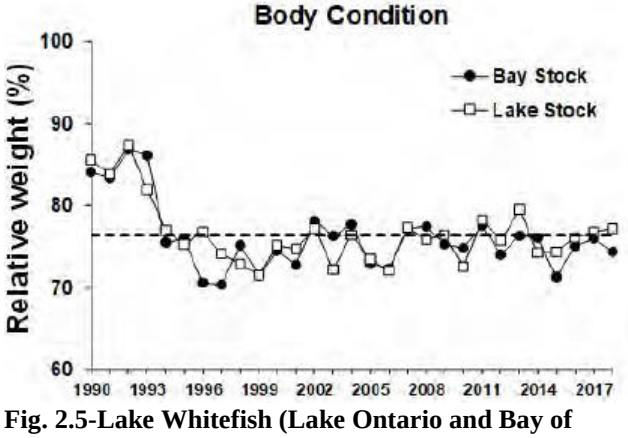

Fig. 2.5-Lake Whitefish (Lake Ontario and Bay of Quinte spawning stocks) relative weight, 1990-2018

The mean fork length and age of Lake Whitefish harvested during the gill net fishery in quota zone 1-2 were 477 mm and 10.1 years respectively. Fish ranged from ages 4-26 years. The most abundant age-classes in the fishery were aged 5-14 years which together comprised 93% of the harvest by number (93% by weight).

Lake Whitefish (Bay of Quinte and Lake Ontario spawning stocks) relative weight condition declined markedly in 1994 and remained low but stable.

Cisco Commercial Catch Sampling

Cisco appear to have increased in abundance in recent years. A small incidental commercial harvest of Cisco occurs in quota zone 1-3 where the species is taken in the fall Lake Whitefish targeted fishery. A sample of Cisco was taken in this fishery to examine size and age-class composition. In total, fork length was measured for 849 fish and otoliths, for age interpretation, were collected for a sub-sample of 111 fish (**Fig. 2.6).** Age data were not available at the time of this report. The mean fork length of Cisco harvested during the impoundment gear fishery in quota zone 1-3 was 344 mm.

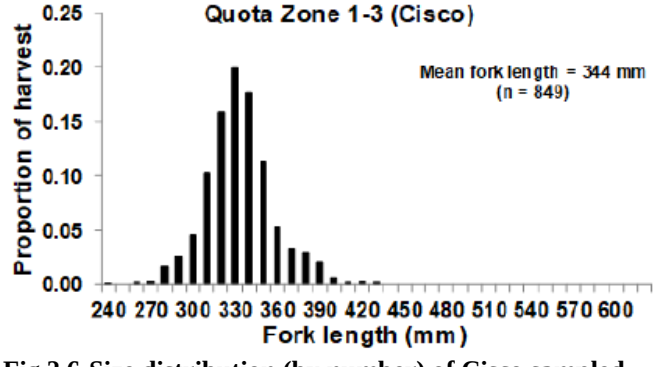

Fig 2.6-Size distribution (by number) of Cisco sampled in quota zone 1-3 during the 2018 commercial catch sampling program

Stocking Program

In 2018, OMNRF stocked over 2 million fish into Lake Ontario, equaling over 44,000 kilograms of biomass. The St. Lawrence River is not stocked. **Table 3.1** shows the 2018 stocking levels compared to the targets outlined in the 2015 strategy. **Fig 3.1** shows salmon and trout stocking trends in the Ontario waters of Lake Ontario for the most recent five years, broken down by species and stocking zone.

Species	Lifestage	Number	Biomass (kg)
Atlantic Salmon	Egg [1]	79,881	8
	Spring Fingerling	352,851	1,137
	Fall Fingerling	129,704	4,305
	Spring Yearling	129,452	8,847
	Adult	416	853
	Atlantic Salmon Total	**612,423**	**15,141**
Bloater	Fall Yearling	50,552	1,053
	Sub Adult	41,101	1,165
	Bloater Total	**91,653**	**2,217**
Brown Trout	Spring Fingerling	50,000	100
	Fall Fingerling	30,000	600
	Spring Yearling	178,549	7,756
	Brown Trout Total:	**258,549**	**8,456**
Chinook Salmon	Spring Fingerling	**413,824**	**2,291**
Coho Salmon	Fall Fingerling	**36,000**	**1,080**
Lake Trout	Spring Yearling	**362,878**	**10,681**
Rainbow Trout	Spring Yearling	**183,055**	**4,556**
Walleye	Non-feeding Fry [1]	1,000,000	10
	Summer Fingerling	82,176	49
	Walleye Total:	**82,176**	**49**
TOTALS		**2,040,558**	**44,473**

TABLE 3.1-Fish stocked into the Ontario waters of Lake Ontario in 2018. Numbers reflect both MNRF-produced fish and those raised by community groups.

A total of 413,824 (2,291 kg) Chinook Salmon spring fingerlings were stocked to provide put-grow-and-take fishing opportunities. This was 88% of our new interim target of 470,000. The shortfall in 2018 was due to a loss of fish at the hatchery, and losses at two stocking net pen sites (see section 6.2 for a detailed report of the 2018 stocking net pen program). All Chinook Salmon for the Lake Ontario program were produced at Normandale Fish Culture Station. A total of 223,471 (54% of 2018 total) Chinook Salmon were held in stocking net pens for a short period of time prior to stocking.

Atlantic Salmon were stocked in support of an ongoing program to restore self-sustaining populations of this native species to the Lake Ontario basin. In total, 612,423 (15,141 kg) Atlantic Salmon of several life stages were stocked in 2018 into tributaries including: Credit River, Duffins Creek and Cobourg Brook. Beginning in 2016, the Ganaraska River has been stocked with advanced life stages (spring yearlings and older), with the goal of establishing a fishery. Atlantic Salmon are produced at MNRF hatcheries, with some eggs being delivered to partner facilities for rearing. Stocking numbers for 2018 (all life stages combined) were 82% of target, however biomass (size of fish stocked) increased substantially.

A total of 362,878 (10,681 kg) Lake Trout spring yearlings were stocked in 2018 as part of an established, long-term rehabilitation program, supporting the Lake Trout Stocking Plan. The 2018 target was held at a 20% reduction in response to poor Alewife year classes. The stocking level for 2018 was 103% of our stocking strategy target.

The total number of Bloater stocked in 2018 was 91,653 (2,217 kg.). This small relative of the Lake Whitefish was an important prey item for Lake Trout until the late 1950's when both species were extirpated. A coordinated program involving staff from the US and Canada resulted in the initial stocking of approximately 15,000 Bloater in 2013. MNRF Fish Culture Section staff continue to work with our partner agencies to advance our understanding of the complicated process of rearing Bloater. See Section 8.4 for a detailed description of this restoration effort.

Rainbow Trout (183,055; 4,556 kg) and Brown Trout (258,549; 8,456 kg) were stocked at various locations to support shore and boat fisheries. Community hatcheries contribute to the stocking of both species. Coho Salmon were produced by stocking partner Metro East Anglers (approximately 36,000 fall fingerlings; 1,080 kg).

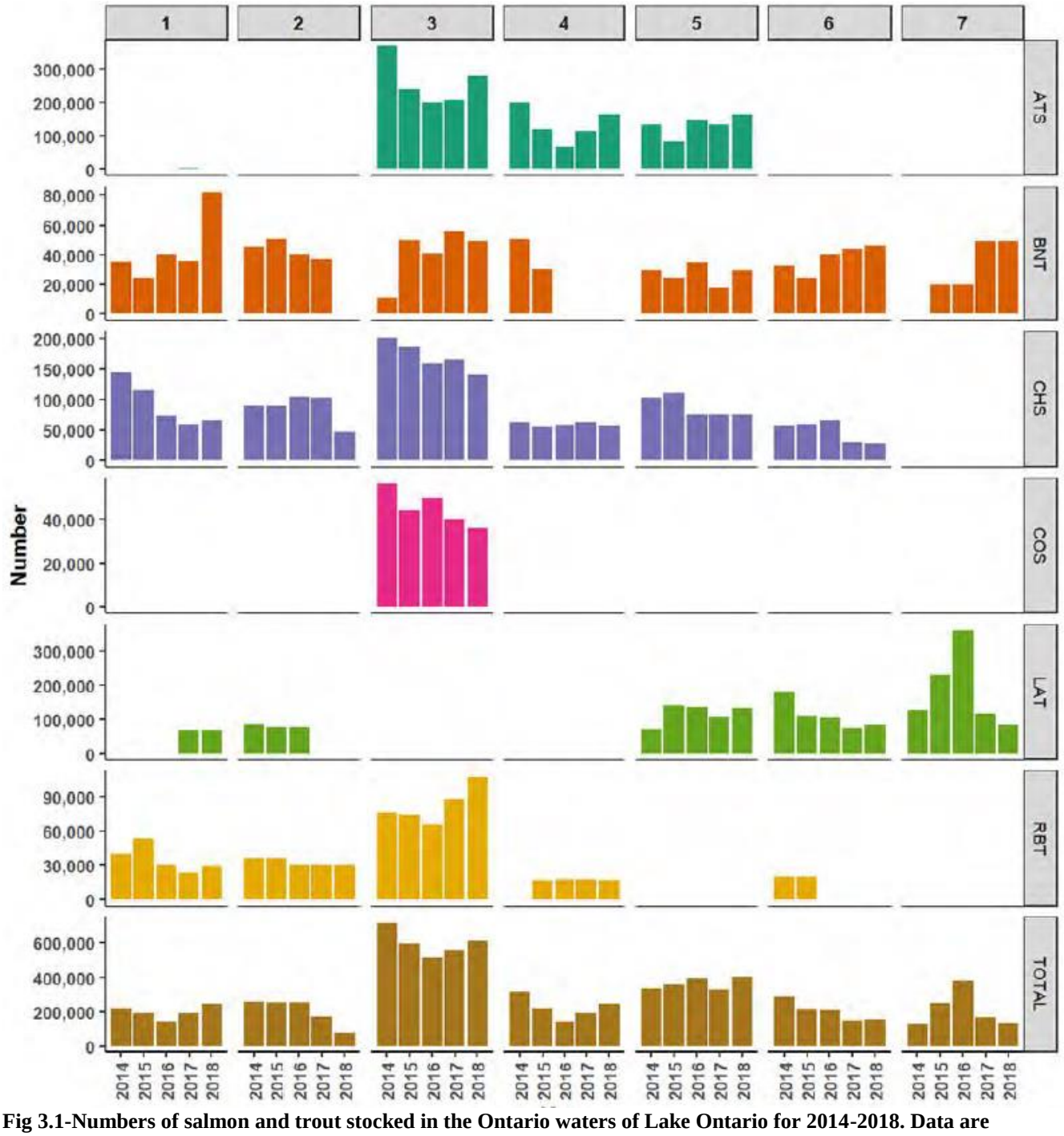

Fig 3.1-Numbers of salmon and trout stocked in the Ontario waters of Lake Ontario for 2014-2018. Data are presented by species (rows) and by stocking zone (columns). The bottom panel ("Total") shows the total for all six species for the same time frame. ATS = Atlantic Salmon, BNT = Brown Trout, CHS = Chinook Salmon, COS = Coho Salmon, LAT = Lake Trout, RBT = Rainbow Trout. Note that the y-axes are variable.

Walleye were stocked into Hamilton Harbour in 2018, continuing an effort to re-establish this native, predatory fish to the fish community and to promote urban, near-shore angling. Walleye stocking alternates annually between Toronto Harbour and Hamilton Harbour, (even years in Hamilton). In 2018 Hamilton Harbour received approximately 1,000,000 Walleye non-feeding fry in the spring, followed by over 82,176 fingerlings stocked in July. A hot summer contributed to difficult rearing conditions in the hatchery outdoor ponds, but 82% of our target was still met.

Chinook Salmon Net Pen Imprinting Project

A total of 223,471 Chinook Salmon were released from 6 sites (18 net pens) in 2018. This represents 54% of the total number (413,824) of Chinook Salmon stocked in the Ontario waters of Lake Ontario in 2018**.** 2018 was a challenging year for the net pen program. One site (Port Darlington) was not used to due safety concerns relating to dock maintenance and volunteer access to the net pens. The two pens from Darlington were transferred to Port Whitby for the 2018 season, which had four pens as a result. Site-specific data for the 2018 season is shown in **Table 3.2.**

Site	Club*	Number Stocked	# Net Pens	Stocking Date	Size (g) at stocking	Release Date	# Days	Release size (g)	Mort. (# fish)	Mortality (%)	Samples Taken	Number Released
Bluffers	MEA	45,043	3	Apr - 08	2.7	May - 15	38	6.1	-	0%	20	45,023
Bronte	HRSTA	30,069	2	Apr - 07	2.6	Apr - 18	12	3.3	20,480	68%	20	9,569
Credit	PCSTA	10,055	1	Apr - 07	2.6	-	-	-	10,055	100%	0	-
Dalhousie	SCFGC	65,281	4	Apr - 09	3.0	May - 11	33	5.9	-	0%	20	65,261
Darlington	MEA	-	0	-	-	-	-	-	-	-	-	-
Oshawa	MEA	25,078	2	Apr - 03	2.8	May - 11	39	5.8	-	0%	20	25,058
Wellington	CLOSA	30,127	2	Apr - 03	2.8	May - 08	36	5.6	1,515	5%	50	28,562
Whitby	MEA	50,018	4	Apr - 08	2.9	May - 12	35	6.8	-	0%	20	49,998
Average		31,959			2.8		32	5.6			21	31,924
Total		255,671	18						32,050		150	223,471

TABLE 3.2- Summary data of the 2018 Chinook Salmon stocking net pen program. Note that Port Darlington was not used in 2018. CLOSA (Central Lake Ontario Salmon Anglers); HRSTA (Halton Region Salmon and Trout Assoc.); MEA (Metro East Anglers); PCSTA (Port Credit Salmon & Trout Assoc.); SCFGC (St. Catharines Fish & Game Club)

Growth was slower than normal due to a cold spring. As a result, fish were held slightly longer than average (32 days for 2018; long-term average is 30.5 days**.** Fish were delivered to the pens at 2.8 g and weighed 5.6 g when released**.** The smaller size of fish in 2018 kept overall density in each pen low. A maximum of 15,000 fish are placed in each net pen, keeping the overall density under the guideline of 32g of fish per liter of water (net pens are ~ 4,000 litres, and we assume max size per fish is 8g at release).

Stock Status

Chinook Salmon

Ontario's Chinook Salmon stocking levels have remained relatively constant since 1985 (approximately 500,000 to 600,000 per year. Ontario's current based stocking target is 600k Chinook Salmon annually.

New York State Chinook Salmon stocking peaked in the early 1980s at over 3.5 million fish; their target was reduced in 1996 to the current base target of approximately 1.76 million fish. In 2017, lake-wide Chinook stocking targets were reduced 20% and remained at the reduced level for 2018 resulting in a new reduced target for Ontario of 480,000 Chinook Salmon. In 2018, due to unexpected mortalities in the hatchery and stocking net pens the actual number stocked was 413,824. Despite recent stable stocking levels, Chinook Salmon CUE in the Fish Community Index Gill Netting has been variable. Catches in 2018 (0.18 fish per net) increased from 2017 (0.13 fish per net) and are comparable to the previous 10-year average (0.16 fish per net from 2008 to 2017.

2016 marked the end of the Chinook Salmon coded wire tag (CWT) study. In general, the maximum age of a Lake Ontario Chinook Salmon is 4 years old. The last stocking event related to the Mark and Tag program was in 2011, thus all fish associated with this program left the Lake Ontario ecosystem in the fall of 2015. CWTs were collected from the Chinook Salmon Mark and Tag program from 2009 to 2015 and have shown a mixed population of Chinook Salmon (natural reproduced, stocked by New York and stocked by Ontario) originating from geographically widespread stocking locations. The mark and tag monitoring program has confirmed that Chinook Salmon returns to the Credit River tend to originate from fish stocked in the Credit River with a few strays from Bronte Creek stocking locations.

Release rates in both the Western Lake Ontario Boat Fishery and the Lake Ontario Volunteer Angler Program have generally increased through time. In 2016, the release rates in the Western Lake Ontario Boat Fishery declined to 50% from the 2004 to 2016 average of 59%. Chinook Salmon release rates reported in the Lake Ontario Volunteer Angler Program were lower in 2016 (55%) compared to 2015 (68%) and 2014 (65%).

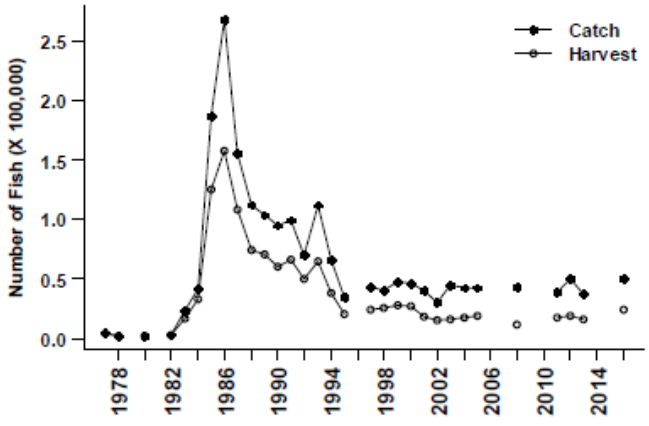

Fig 3.2-Number of Chinook Salmon caught (shaded) and harvested (open) annually in the Ontario waters of Lake Ontario (excluding the Eastern Basin), 1977 to 2016; dashed line represents the mean catch and harvest from 1997 to 2016

The condition of Chinook Salmon on the Ganaraska River has been measured over the past four years (2015 to 2018). On average, the condition of the Ganaraska River Chinook Salmon is lower than the Credit River. Similar to the Credit River, condition of Ganaraska River Chinook Salmon declined in 2018. 2018 marked a sharp decline in condition of Chinook Salmon harvested during summer tournaments (Section 2.4). The condition of Chinook Salmon sampled in tournaments (Section 2.4) and the Western Basin Angler Survey have been comparable and follow similar trends. In 2018, each of our three programs monitoring Chinook Salmon exhibited estimated declines in condition.

In 2018 a total of 1,390 Chinook Salmon were observed passing through the Riverwatcher fish counter on the Streetsville Fishway during the monitoring period (August 14th to November 15th, 2018). The Ganaraska and Credit River Trout and Salmon Assessment will continue in 2019 allowing for the development of new indices on this important species.

In 2018, average fork length of Chinook Salmon at age-2 and age-3 decreased for both males and females. The average fork length of age-2 and age-3 male/ female Chinook Salmon is not below the long-term average. In 2018, female condition was lower than 2017; its first decline since 2015. A sharp decline in male condition was observed in 2018 as well. Female condition in 2018 is the lowest in the 29-year time series; male condition in 2018 is below the previous 10-year average.

Rainbow Trout

Rainbow Trout are the primary target for tributary anglers, who take advantage of the seasonal staging and spawning runs of this species. Rainbow Trout are the second most sought-after species in the Ontario waters of the Lake Ontario offshore salmon and trout fishery.

The OMNRF stocks only *Ganaraska River* strain Rainbow Trout into Lake Ontario. A total of 183,100 Rainbow Trout were stocked, slightly above the 2009 to 2018 average of 166,390

In 2018, the spring Rainbow Trout run in the Ganaraska River increased from 6,952 fish in 2017 to 9,014 fish and is now above the previous 10-year average (7,823 fish from 2009 – 2018; Fig. 7.2.2). Additionally, Rainbow Trout were observed utilizing the fishway after the spring monitoring period. From March 26th to November 22nd, 2018 a total of 9,194 Rainbow Trout were identified migrating upstream through the Ganaraska Fishway.

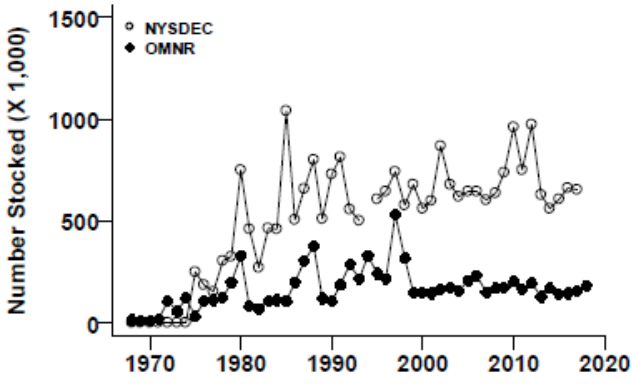

Fig 3.3-Number of Rainbow Trout stocked by New York State (NYSDEC) and OMNRF from 1968 – 2018.

From 1990 to 2018, the long-term trend shows slight decline in relative condition. Data on Rainbow Trout condition over the past 10 years are the most informative for the current population. Rainbow Trout condition declined to a low in 2008 then has increased up to 2013 (the highest in the whole time series since 1997). In 2015, Rainbow Trout condition declined significantly, to the lowest point since 1986. Since 2015 Rainbow Trout condition has remained stable (94-96%) but below the previous 10 year average relative condition value (97% from 2009 to 2018.

Brown Trout

Brown Trout, in conjunction with several other stocked and naturalized trout and salmon species support a Lake Ontario main basin recreational fishery. Salmon and trout returning to rivers to spawn also support important shore and tributary fisheries. Ontario's Brown Trout stocking levels have increased slightly from 2000 to 2018, while New York stocking rates have remained stable **(Fig. 3.4).** Stocking numbers in 2018 increased to the highest level since the early 1990s. The 2018 average catch per standard net (0.23 fish per net) in the Community Index Gill Netting showed a sharp increase from the previous four years and was comparable to the previous 10-year average (0.23 fish per net) in the Community Index.

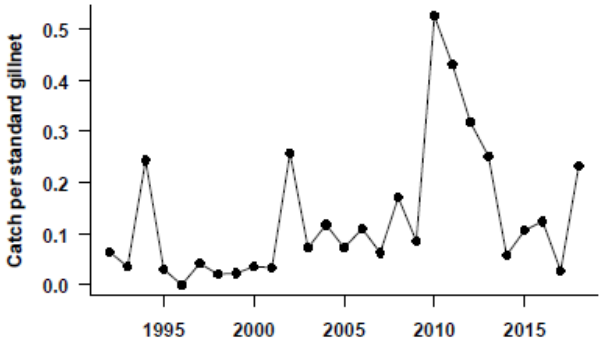

Fig 3.4- Number of Brown Trout stocked by New York State (NYSDEC) and OMNRF from 1968 – 2018

Brown Trout are the least targeted salmon and trout species in the Lake Ontario open-water fishery. Catch per angler hour of Brown Trout in the recreational fishery (0.001 fish per ang-hr in 2016) has been low but stable since the early 2000s (0.003 fish per ang-hr. Catch and harvest in the most recent Lake Ontario salmon and trout recreational angler survey (2016 Lake Ontario Management Unit Annual Report) was the lowest since the mid- 2000s. Unlike other salmon and trout species (e.g., Chinook Salmon, Section 7.1) length distributions of Brown Trout harvested in the Lake Ontario recreational fishery and caught in Fish Community Index Gill Netting (Fig. 7.3.7) were similar.

Brown Trout are known to eat Round Goby to supplement their diets; the increase in Brown Trout body condition observed may be due to the incorporation of Round Goby in their diet. Body condition of large Brown Trout has been variable but stable throughout the time series.

Lake Whitefish

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

Commercial Fishery

Quota and harvest averaged 123,000 lb and 77,000 lb respectively, over the 2009-2018 time-period. In 2018, base quota was 134,879 lb, issued quota was 128,940 lb and the harvest was 56,156 lb. In recent years, most of the harvest occurs in quota zone 1-2, eastern Lake Ontario (**Fig. 7.4.2**). Here, fishing effort, harvest and harvest rate (HUE) declined from the mid- 1990s until the mid-2000s and then generally leveled off **(Fig. 7.4.3).**

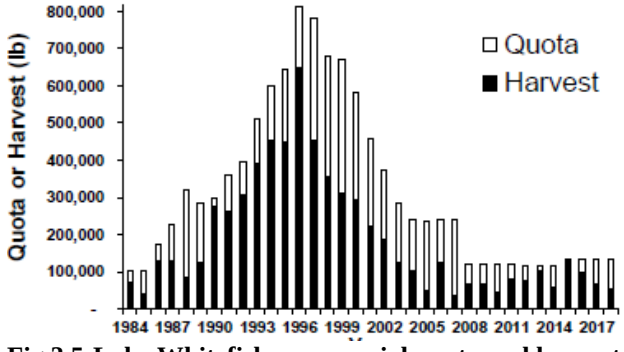

Fig 3.5-Lake Whitefish commercial quota and harvest, 1984- 2018

The age distribution of Lake Whitefish harvested is comprised of many age-classes (**Fig. 7.4.4).** Most fish are age-5 to age-14.

Lake Whitefish abundance, like commercial harvest, has been stable at a relatively low level for the last decade. YOY catches have been highly variable. Following severe declines in abundance, commercial harvest, growth and condition, during the 1990s, the eastern Lake Ontario Lake Whitefish population appears to have stabilized at a much reduced but stable level of abundance, and condition.

Walleye

Walleye is the Bay of Quinte fish community's primary top piscivore and of major interest to both commercial (Section 3.2) and recreational fisheries. The Walleye population in the Bay of Quinte and eastern Lake Ontario is managed as a single large stock.

Recreational Fishery

The recreational fishery consists of a winter ice-fishery and a three season (spring/summer/ fall) open-water fishery. Most Walleye harvest by the recreational fishery occurs in the upper and middle reaches of the Bay of Quinte during the winter ice-fishery and the spring/early summer open-water fishery. All sizes of fish are caught during winter while mostly juvenile fish (age-2 and age-3) are caught during spring and summer. A popular "trophy" Walleye fishery occurs each fall based on the large, migrating fish in the middle and lower reaches of the Bay of Quinte at that time. Increasingly in recent years, there is also a late-summer fishery in eastern Ontario targeted at these large Walleye prior to their return to the Bay of Quinte. Trends in the open-water fishery are shown in **Fig 3.6**. Annual Walleye angling effort and catch (ice and open-water fisheries combined) has been relatively stable averaging over 330,000 hours and 63,000 fish caught during the last decade. Walleye catch and harvest spiked in the 2017 open-water fishery (102,351 and 52,651 fish, respectively) as two very strong year-classes (age- 2 and 3) recruited to the fishery.

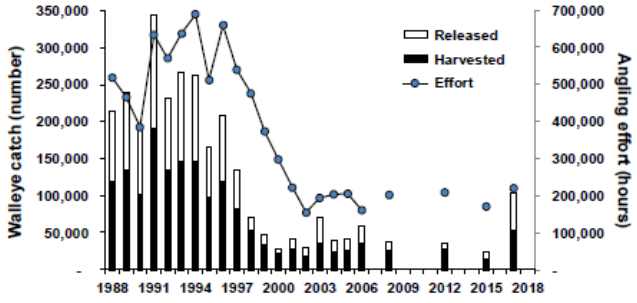

Fig 3.6-Bay of Quinte recreational angling effort and walleye catch (released and harvested) during the open-water fishery, 1988- 2017. No data for 2007, 2009-2011, 2013-2014, 2016 or 2018.

Commercial Fishery

Walleye harvest by the commercial fishery is highly regulated and restricted. No commercial Walleye harvest is permitted in the upper and middle reaches of the bay (Trenton to Glenora). A relatively modest Walleye commercial quota (48,093 lbs) is allocated in the lower Bay of Quinte and Lake Ontario with additional seasonal, gear, and fish-size restrictions. The commercial harvest of Walleye was 26,201 lbs in 2018. Commercial Walleye harvest has shifted location from quota zone 1-2 to 1-4 over the last decade. This shift has likely resulted in smaller, younger Walleye being harvested but this has not been measured.

Annual Harvest

The recreational fishery takes about 80% of the annual harvest with the open-water component of the recreational fishery making up 62% (by number) of total annual harvest.

Abundance

Walleye abundance is assessed in a number of programs. Summer gill net sampling is used to assess relative abundance of juvenile (Bay of Quinte) and adult (eastern Lake Ontario) fish. Young-of-the-year (YOY) abundance is assessed in Bay of Quinte bottom trawls (Fig. 7.5.7; Section 1.2).

Except for an unusually high catch in 2013, juvenile abundance in the Bay of Quinte has been very stable since 2001. The 2018 catch was average with a large contribution of age -3 and 4 fish. In eastern Lake Ontario index gill nets, after an unusually low catch in 2013, Walleye abundance in eastern Lake Ontario increased to a level similar to that observed in the previous few years. The 2018 catch was high. The 2014 catch of YOY Walleye in bottom trawls was the highest since 1994 **(Fig 3.7**) and the 2015 year-class was also very large. The 2016 year-class was of moderate strength, and the 2017 year-class was poor. The 2018 year-class was good. These recent year-classes foreshadow continued stability in the Walleye population and fisheries.

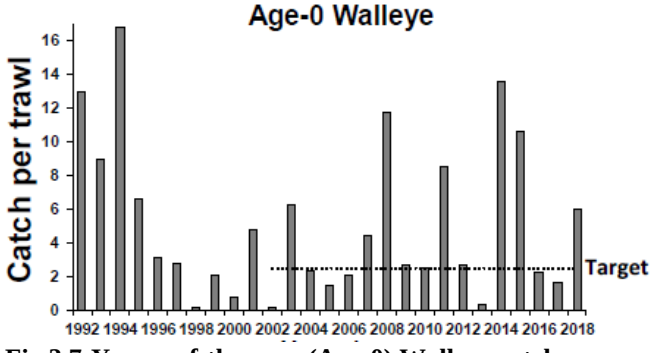

Fig 3.7-Young-of-the-year (Age-0) Walleye catch per trawl in the Bay of Quinte, 1992-2018. Also shown (dotted line) is the Bay of Quinte FMP (Fisheries Management Plan) "target" catch per trawl.

Growth

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

Condition

Condition has remained stable in Bay of Quinte fish (immature) and showed an increasing trend in Lake Ontario (mature fish) until 2014 when condition declined sharply; condition in the lake increased in 2015 and 2016, held steady in 2017, and declined in 2018.

Other Walleye Populations

The Bay of Quinte / eastern Lake Ontario Walleye population is the largest on Lake Ontario; smaller populations exist in other nearshore areas of the Lake Ontario. Walleye in these other areas are regularly assessed with a standard trap net program (Nearshore Community Index Netting; see Section 1.3). Highest Walleye abundance occurs in the Bay of Quinte, East Lake, West Lake, Weller's Bay and Hamilton Harbour. Walleye abundance increased in Hamilton Harbour after stocking efforts began in 2012. Index gill netting on Lake St. Francis (St. Lawrence River) in 2018 showed increased Walleye abundance compared to 2016 (See Section 1.9).

Walleye Stocking

Walleye stocking alternates annually between Hamilton Harbour and Toronto Harbour in an effort to re-establish this native, predatory fish and to promote urban, near-shore angling. In 2018, 1 million swim-up fry and 82,176 summer fingerlings were stocked in May and July respectively into Hamilton Harbour.

Overall Status

The overall status of Lake Ontario Walleye is good. The Bay of Quinte/eastern Lake Ontario population did decline during the 1990s but stabilized at levels that supports a high quality fishery including trophy fish. Recent recruitment levels forecast a healthy population over the next several years.

Yellow Perch

Yellow Perch is one of the most ubiquitous and abundant species in the Lake Ontario and St. Lawrence River warm and coolwater fish community. The species support important recreational and commercial fisheries and are prey for nearshore predators.

Recreational Fishery

The most significant Yellow Perch recreational fishery occurs on Lake St. Francis, below the Cornwall dam on the St. Lawrence River. The 2018 angling survey of this fishery estimated that anglers caught and harvested 175,103 (7.3 perch per hour by anglers targeting Yellow Perch) and 79,691 perch, respectively from May 5 to Oct 5. Catch and harvest declined more than 40% compared to the last angling survey conducted in 2013. On the Bay of Quinte in northeastern Lake Ontario, large numbers of Yellow Perch are caught by anglers that are otherwise primarily targeting Walleye. In a 2017 open-water angler survey on the Bay of Quinte, an estimated 261,747 perch were caught (2.1 perch per hour for anglers targeting Yellow Perch) but only 16,497 were harvested.

Commercial Fishery

Yellow Perch was the most important species, in terms of both total weight (99,545 lb) and landed value ($167,725), in the 2018 Lake Ontario and St. Lawrence River commercial fisheries. Most of the harvest was taken in the Bay of Quinte and the St. Lawrence River. Total annual Yellow Perch commercial harvest declined to a low point in 2015 and commercial quota was decreased in 2016 and again in 2017. Harvest and landed value increased in 2016 and 2017 and then declined sharply in 2018 **(Fig. 3.8).** The 2018 decline is attributed to poor markets and low fishing effort during spring 2018. For example, commercial Yellow Perch gill net effort in 2018 declined by 62% compared to the previous year.

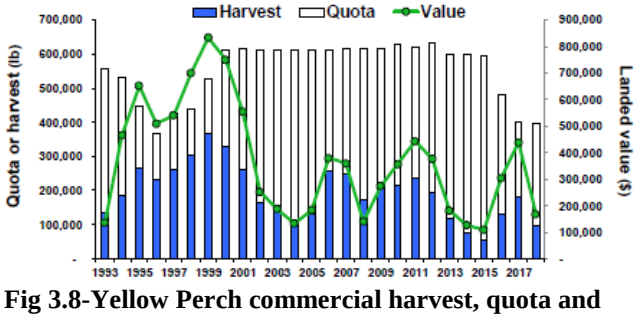

Fig 3.8-Yellow Perch commercial harvest, quota and landed value trends for Lake Ontario (including East and West Lakes) and the St. Lawrence River, 1993-2018

Abundance

Yellow Perch abundance is assessed in a number of index netting programs. Overall biomass was low through the 2012 to 2015 time-period and increased in 2016 and again in 2017. Biomass declined in 2018. Yellow Perch abundance is currently below target values in both areas, particularly in eastern Lake Ontario; abundance appears to be increasing in the Bay of Quinte.

Yellow Perch abundance in Lake St. Francis, St. Lawrence River decreased in 2018 and has now declined steadily since 2010.

Northern Pike

Widespread and long-term declines in pike abundance has been observed. The Bay of Quinte open-water recreational fishery was last assessed in 2017. This fishery is largely targeted toward Walleye with about 5% of the total fishing effort targeted at Northern Pike. About 5,000 pike were caught and about 500 harvested in the 2017 fishery. The 2018 Lake St. Francis angling survey (see Section 2.2) estimated that 1,444 Pike were caught and 245 harvested.

The Commercial fishery Northern Pike is managed as an incidental harvest (i.e. non-targeted) fishery.

Highest pike abundance occurs in Prince Edward Bay, Toronto Harbour, the Thousand Islands and the Lower Bay of Quinte. Index gill netting in Lake St. Francis shows a long term decline in pike abundance.

Prey Fish

The historical prey fish community was thought to have been dominated by cisco species (Cisco and deepwater forms such as Bloater). Alewife and to a lesser extent, Rainbow Smelt have been the dominant species throughout the modern era (1900s to present).

Alewife

Alewife are the dominant prey fish in Lake Ontario and are the primary prey item for Chinook Salmon and Rainbow Trout as well as other recreationally important species such as Walleye and Lake Trout. In contrast to the U.S. index, an adult Alewife index for trawls in Canadian waters increased in 2018 relative to 2017. Since the spring survey was expanded into Canadian waters, the U.S. and Canadian indices have trended in opposite directions. Given the alternating trends between the U.S. and Canadian Alewife indices, it is important to consider both when interpreting the Lake Ontario Alewife population trends.

As predicted, the large 2016 Alewife year-class (which was age-2 in 2018 and counted towards the adult index) increased the overall adult Alewife biomass, however at the time of sampling in April 2018, much of the adult population was in Canadian waters (**Table 3.3**). This apparent strong spatial variability in Alewife habitat use in April further emphasizes the need for whole-lake approaches to Lake Ontario fish sampling. The mechanisms contributing to the different spatial distribution across years are unknown.

Year	U.S.	Canada	Whole Lake
2016	32.0	60.1	46.6
2017	50.8	12.2	30.7
2018	21.5	44.9	33.7

TABLE 3.3-Lake Ontario Alewife biomass estimates in kilograms per hectare based on the spring bottom trawl survey. Whole lake figures are based on 52% of the lake area in Canada and 48% in U.S. waters.

The 2018 age-1 Alewife abundance index for U.S. waters (111 Alewife per 10-minute trawl) was substantially smaller than 2017 (3924) which was the highest figure observed in U.S. waters since the trawl survey adopted its current trawl design in 1997. The 2018 U.S. waters Age-1 index value was the third lowest observed since 1997 with lower values only in 2015 (16 fish per 10 minute tow) and 1997 (62 fish per 10-minute trawl). The index value in Canadian waters was also lower in 2018 (911) relative to 2017 (1012 fish per 10 minutes) but was higher than the U.S. indices. The relatively cool 2017 spring and cold winter likely contributed to the lower than average 2017 year-class since both spring and winter temperature has been shown to influence Alewife reproduction success.

Other Pelagic Fishes

Bottom trawl abundance indices for other pelagic species noted in fish community objectives (Threespine Stickleback, Rainbow Smelt, Emerald Shiner) either declined or remained at low levels in 2018 (Fig. 7.8.4). Rainbow Smelt abundance, while still the second most abundant pelagic species, declined through the 2000s but appears to have established a new lower equilibrium. Threespine Stickleback catches were high for a brief period in the late 1990s but are now caught only infrequently. Emerald Shiner catches have had brief periods of moderately higher abundance however their catches in the trawl surveys are generally quite low even at peak abundance.

Deepwater Sculpin

In 2018, Deepwater Sculpin were among the most abundant benthic prey fishes in Lake Ontario however their biomass estimates declined slightly from 2017 (Fig. 7.8.5). Interestingly, 9 of the 37 trawls that captured Deepwater Sculpin in the fall survey contained dead Deepwater Sculpin (24%). Deepwater Sculpin condition has been declining as their abundance increased over time (Fig. 7.8.6). Together these observations suggest that the Deepwater Sculpin population may be nearing carrying capacity in Lake Ontario and we would expect density and biomass to stabilize or decline slightly.

Slimy Sculpin

Slimy Sculpin abundance indices in 2018 were among the lowest observed for the entire time series (Fi. 7.8.5). Once the dominant benthic prey fish in Lake Ontario, Slimy Sculpin declines in the 1990s were attributed to the collapse of their preferred prey, the amphipod Diporeia. The declines that occurred in the mid-2000s appear to be related to Round Goby. Since Round Goby numbers have increased the proportion of juvenile Slimy Sculpin in the total catch of Slimy Sculpins dropped from ~10% to less than 0.5%. Round Goby could be limiting Slimy Sculpin reproduction or possibly recruitment of juvenile Slimy Sculpin to adult stages.

Round Goby

Round Goby density increased in 2018 relative to 2017 for both the U.S. abundance index and the whole lake index. Estimating Round Goby abundance using bottom trawls can be complicated by the fish's preference for rocky substrate and seasonal changes in depth distribution. Round Goby were captured during the US spring trawl survey as early as 2002, however that survey's trawl is likely less effective at capturing Goby since the foot rope is elevated off the lake bottom.

Cisco

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

One hundred and sixteen Cisco were caught and interpreted for age in the 2018 Lake Ontario Fish Community Index Gill Netting. Fish ranged in age from 1-16 years and represented fourteen year-classes. Contribution from the 2014 year-class as represented by index gill net catches continues to be significant

Species Rehabilitation

Atlantic Salmon Restoration

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

The Ganaraska River Riverwatcher fish counter monitored fish passage events from March 26 to November 22, 2018. The first Atlantic Salmon observed at the Ganaraska Fishway in 2018 was on July 27th. From that time until September 12th, 2018, 13 Atlantic Salmon were identified moving upstream from the Corbett Dam. The Credit River Riverwatcher fish counter monitored

fish passage events from August 14 to November 15, 2018. During the monitoring period, the Streetsville Riverwatcher documented a total of five Atlantic Salmon, the first on August 30th, 2018.

American Eel Restoration

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

By 2004, American Eel abundance in Ontario had declined to levels that warranted closure of all commercial and recreational fisheries in the province, and in 2007, American Eel was identified as Endangered under Ontario's Endangered Species Act (ESA). These events led to efforts to protect and restore the American Eel.

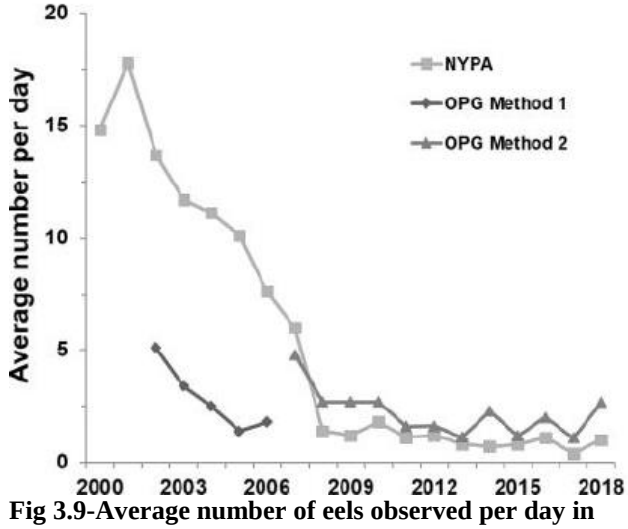

Fig 3.9-Average number of eels observed per day in the tail-waters of the Moses-Saunders Dam 2000-2018. Note that the OPG sampling methodology and route changed in 2007.

In 2018, the Saunders eel ladder was in operation 24 hours a day from June 15 to October 15. Over the course of these four months, passive integrated transponder (PIT) tag readers and an electronic fish counter were used to monitor the use of the ladder and quantify the number of eels passing upstream. In 2018, a total of 13,877 eels successfully passed through the OPG eel ladder. The number of eels passed through the Saunders ladder during 2018 was slightly higher than the number of eel that passed through a second eels ladder (Moses Ladder) on the New York portion of the MSPD, where 10,992 eels successfully exited.

The numbers passing up the ladder have been declining annually in recent years and the combined number of eels that passed through both ladders in 2018 (24,869 eels) represents the first increase since 2011. The number of eels ascending the ladders in 2018 is only 2.5% of the level of recruitment identified as a long-term indicator in the Lake Ontario Fish Community Objectives for American Eel (FCO 1.3; at least one million eels ascending the ladders annually).

Bloater Restoration

Potential long-term benefits of restoring Bloater include restoring historical food web structures and function in Lake Ontario, increasing the diversity of the prey fish community, increasing resistance of the food web to new species invasions, increasing wild production of salmon and trout by reducing thiaminase impacts of a diet based on Alewife and Rainbow Smelt, and supporting a small commercial fishery.

In 2018, there were 91,000 fall yearling (age-1) Bloater stocked by OMNRF at three stocking locations. Nine thousand yearlings were stocked near Main Duck Island to support ongoing research activities along with an additional 1,100 age-2 fish. Seventy-nine thousand were stocked in south of Cobourg in deep water and 3,000 were stocked in the lower Bay of Quinte near Bath. As production numbers increase the stocking strategy will focus on putting these fish in 80 m - 100 m depths south of Cobourg.

In 2018, there were no Bloater caught in the 248 gill nets, 102 bottom trawls and 46 midwater trawls conducted in multiple assessment programs in areas where Bloater could have inhabited.

Lake Trout Rehabilitation

Excessive harvest of Lake Trout began in the 1830s and despite an increase in abundance in the 1920s, harvest and Sea Lamprey predation resulted in Lake Trout being deemed extirpated in Lake Ontario in the 1950s. Rehabilitation of Lake Trout in Lake Ontario began in the 1970s with Sea Lamprey control and stocking of hatchery fish.

Stocking throughout the 1980s was successful in restoring Lake Trout biomass throughout Lake Ontario (**Fig. 3.10).** Ecosystem change, stocking cuts and a period of high Sea Lamprey mortality lead to declines in Lake Trout abundance throughout the 1990s to 2005 (2008 in the main basin). Since 2005 catches in the Ontario waters of the main basin have remained low but exhibit a moderate increasing trend. Within the Kingston Basin, the trend was increasing up until 2015, but has been declining in the most recent years

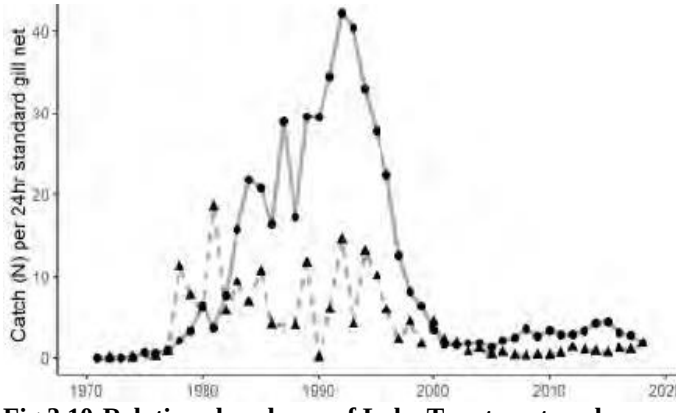

Fig 3.10-Relative abundance of Lake Trout captured in the Ontario waters of Lake Ontario from Fish Community Index Gill Netting sites meeting the criteria identified within the plan tracked with the main basin of Lake Ontario ("LAKE"; indicated by triangles and dashed line) and with the Kingston Basin ("KB", indicated by circles and solid line).

Hamilton Harbour Walleye Reintroduction

In 2018, 1,000,000 swim-up fry were stocked in the spring, followed by over 82,176 fingerlings stocked in July. Results of the 2012 summer fingerling Walleye stocking event continue to be very successful, with subsequent stocking events less so to date. Moving forward, MNRFs stocking approach will be to stock approximately 100,000 summer fingerlings every other year.

A mean catch of 1.8 Walleye per trap net was observed. This is just below the restoration target of 2 fish per net established prior to commencement of the 2012 Walleye stocking initiative. Fourteen of the 24 trap net lifts in Hamilton Harbour caught at least one Walleye (Fig. 8.6.2). Walleye were captured throughout Hamilton Harbour where suitable trap net sampling locations were located.

All indications to date are that the 2012 Walleye stocking effort in Hamilton Harbour was highly successful in terms of survival and growth rates. 2018 was the first year Walleye from 2016 stocking efforts were likely to recruit into the trap net gear. Though lower in abundance when compared to 2014 (i.e. the first 2012 detections), observations of the 2016 stocking event suggests a positive outlook for this year class. These year classes will be continued to be monitored in future trap net surveys.

Lake Sturgeon

The 2018 Lake Sturgeon survey took place in the Trent River, downstream of Lock 1 to the mouth of the Bay of Quinte from April 23 to May 14. Survey gear included baited hook lines and boat electrofishing. Gillnets were not used in 2018 however effort with the other gears was increased. Despite the increased effort, the baited hook lines did not capture any Lake Sturgeon (or any other fish species).During the time of the survey, 2018 had the lowest average temperature of the three years surveyed, which may have affected Lake Sturgeon distribution.

In May 2018, ten PIT-tagged Lake Sturgeon were released. This brought the total number of Lake Sturgeon released to 34 (26 PIT-tagged only; 8 with an internal acoustic tag plus PIT tag). Only three Lake Sturgeon remain to be released (PIT-tagged only), and it is expected that this will occur in the spring of 2019.

Of the eight acoustically-tagged Lake Sturgeon, six were detected in the Napanee River receiver array (NPR-1, NPR-2, NPR-3). Of these six individuals, five remained within the Napanee River for the entire duration of the tag's lifespan (earliest detection March 27, 2018; latest detection August 27, 2018). One fish, part of the early release, moved beyond the Napanee River and moved west as far as Massassauga Point (MPT; see Fig. 8.7.1). The average length of time that the six Lake Sturgeon were detected by the deployed receivers was 372 ± 16 days. The expected battery life of the acoustic tags used is 376 days, so the tagged Lake Sturgeon will not be detected in the receiver array in 2019. Overall, the juvenile tagged Lake Sturgeon showed good survival, and did not venture far from the Napanee River during the first year of their release.

✧

2018-2022 Draft Lake Ontario Lakewide Action and Management Plan

Executive Summary

The Lake Ontario Lakewide Action and Management Plan (LAMP) is a binational ecosystem-based action plan to restore and protect the water quality of Lake Ontario and its connecting river systems, the Niagara and St. Lawrence Rivers. This is the first Lake Ontario LAMP under the 2012 amendment of the Great Lakes Water Quality Agreement (GLWQA). The LAMP was developed by member agencies of the Lake Ontario Partnership which is a collaborative team of natural resource managers led by the governments of the U.S. and Canada, in cooperation and consultation with State and Provincial Governments, Tribal Governments, and watershed management agencies committed to restoring and protecting Lake Ontario, the Niagara River and the St. Lawrence River. In preparing the LAMP, the Lake Ontario Partnership also sought input from scientists, First Nations, Métis, stakeholders, non-governmental organizations and the general public.

Lakewide management is guided by a shared vision of a healthy, prosperous, and sustainable Great Lakes region in which the waters of Lake Ontario are used and enjoyed by present and future generations. Lake Ontario is a valuable resource in many respects, from its significance to Indigenous Peoples, the ecosystem goods and services it provides, to the habitat and species it is home to, including globally significant ecosystems and migratory pathways. Lake Ontario is also home to a variety of natural resources, a regional economy, and a vibrant tourism and recreation industry.

The purpose of the 2018-2022 LAMP is: 1) to summarize the current state of Lake Ontario according to the nine General Objectives of the GWLQA and point out key threats; 2) to outline actions that will be taken to address the threats and contribute to the restoration and protection of water quality in Lake Ontario; and 3) to engage all groups and individuals in the Lake Ontario Basin to take action in protecting the water quality in Lake Ontario.

Current State of Lake Ontario

Overall, based on the scientific research, monitoring and reporting completed by over 180 government and non-government Great Lakes scientists and other experts, Lake Ontario is assessed to be in "fair" condition. Chemical contaminants, nutrient and bacterial pollution, loss of habitat and native species, and the spread of non-native invasive species limit the health, productivity, and use of Lake Ontario and its connecting river systems.

LAMP Management Actions

This 2018-2022 LAMP documents 29 actions to address identified threats and priority issues. Actions are grouped under five main issue areas:

1. Nutrient and bacterial-related impacts;
2. Loss of habitat and native species;
3. Aquatic invasive species;
4. Critical and emerging chemical contaminants; and
5. Other Substances, Materials and Conditions.

Over the next five years, these management actions will address key environmental threats using an integrated management approach. This approach recognizes the interactions across Lake Ontario and the need to maintain and enhance ecosystem resilience in view of climate change and other potential new or emerging threats such as plastics and microplastics.

The Lake Ontario Lakewide Action and Management Plan (LAMP) is a binational ecosystem-based strategy to restore and protect the water quality of Lake Ontario and its connecting river systems, the Niagara and St. Lawrence Rivers. This is the first Lake Ontario LAMP under the 2012 amendment to the Great Lakes Water Quality Agreement (GLWQA). It builds upon the work conducted under the pre-2012 LAMPs (Appendix A) and reflects that the best approach to restore the Lake Ontario ecosystem and improve water quality in the two countries to adopt common objectives, implement cooperative programs, and collaborate to address environmental threats. This LAMP covers the 5- year period from 2018 to 2022.

The LAMP was developed by the Lake Ontario Partnership, a collaborative team of natural resource managers led by the governments of the U.S. and Canada, in cooperation and consultation with State and Provincial Governments, Tribal Governments, First Nations, Métis, Municipal Governments, and watershed management agencies. The Lake Ontario Partnership identified the set of priority management actions outlined in this LAMP in consultation with Lake Ontario stakeholders and the public.

To review the full 149 page Management Plan, go to:
Lake Ontario Lakewide Action and Management Plan 2018-2022 (9.37 MB)

Sea Lamprey Control in Lake Ontario 2018

Approximately half of Sea Lamprey attacks result in the death of their prey and up to 18 kg (40 lbs) of fish are killed by every adult Sea Lamprey. The Sea Lamprey Control Program (SLCP) is a critical component of fisheries management in the Great Lakes because it facilitates the rehabilitation of important fish stocks by significantly reducing Sea Lamprey induced mortality.

Fish Community Objectives

The Lake Ontario Committee established the following goal for Sea Lamprey control in Lake Ontario:

● *Suppression of Sea Lamprey populations to early-1990s levels.*

• *Control Sea Lampreys so that fresh wounding rates (A1) of Lake Trout larger than 431 mm is less than 2 marks/100 fish.*

This objective is intended to maintain the annual Lake Trout survival rate of 60% or greater to support a target spawning stock of 0.5 to 1.0 million adults of multiple year classes. Along with Sea Lamprey control, angler and commercial exploitation will also be controlled so that annual harvest does not exceed 120,000 fish in the near term.

The adult index target for Lake Ontario of 15,502 Sea Lampreys was calculated from the average index estimated for the 5-year period, 1993-1997, when marking rates were closest to 2 marks per 100 Lake Trout >431 mm (1.6 A1 marks per fish >431 mm). During 2018, the index of adult abundance in Lake Ontario was estimated to be 11,666 (95% CI; 9,921 – 13,412), which is less than the index target.

Lampricide Control

Lake Ontario has 659 tributaries (405 Canada, 254 U.S.). Sixty-six tributaries (31 Canada, 35 U.S.) have historical records of larval Sea Lamprey production, and of these, 36 tributaries (18 Canada, 18 U.S.) have been treated with lampricides at least once during 2009-2018. Twenty-nine tributaries (15 Canada, 14 U.S.) are treated on a regular 3-5 year cycle. Details on lampricide applications to Lake Ontario tributaries and lentic areas during 2018 are found in **Fig** 1.

● Lampricide applications were conducted in 16 streams (6 Canada, 10 U.S.) and 1 lentic area (0 Canada, 1 U.S.).

● Salmon River and Lindsey Creek were treated in 2018 due to the presence of residual Sea Lamprey from the 2017 treatments.

● The Salmon River was treated from the Lighthouse Hill Dam in Altmar, New York for the first time since 1978 because Sea Lamprey larvae were collected immediately downstream of the Salmon River Fish Hatchery application site in 2017. In addition, lampricide was applied to large backwater areas harboring numerous residual Sea lampreys.

● Little Sandy and Lindsey creeks were rescheduled from late spring to October due to low discharge.

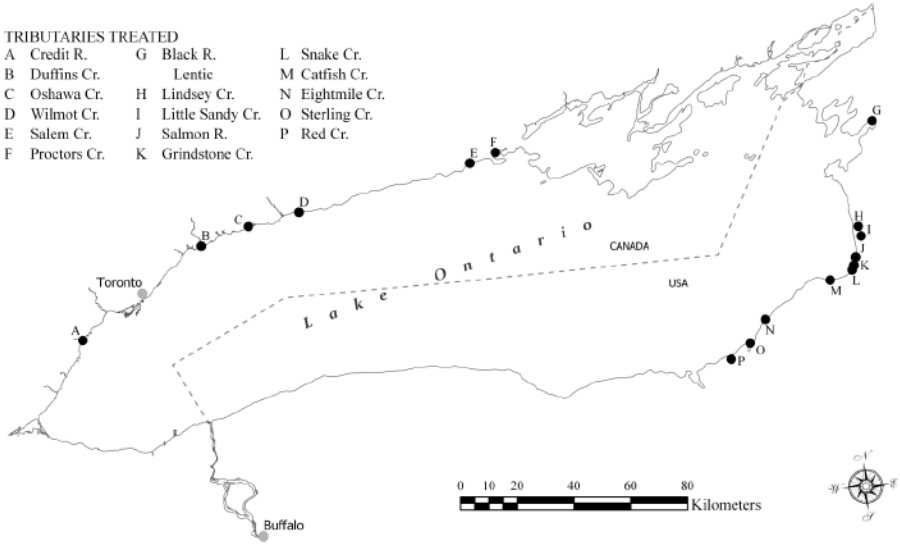

Fig 1. Location of Lake Ontario tributaries treated with lampricides during 2018.

Alternative Control

The Commission has invested in 16 barriers on Lake Ontario **(Fig 2**). Of these, 10 were purpose-built as Sea Lamprey barriers and 6 were constructed for other purposes, but have been modified to block Sea Lamprey migrations.

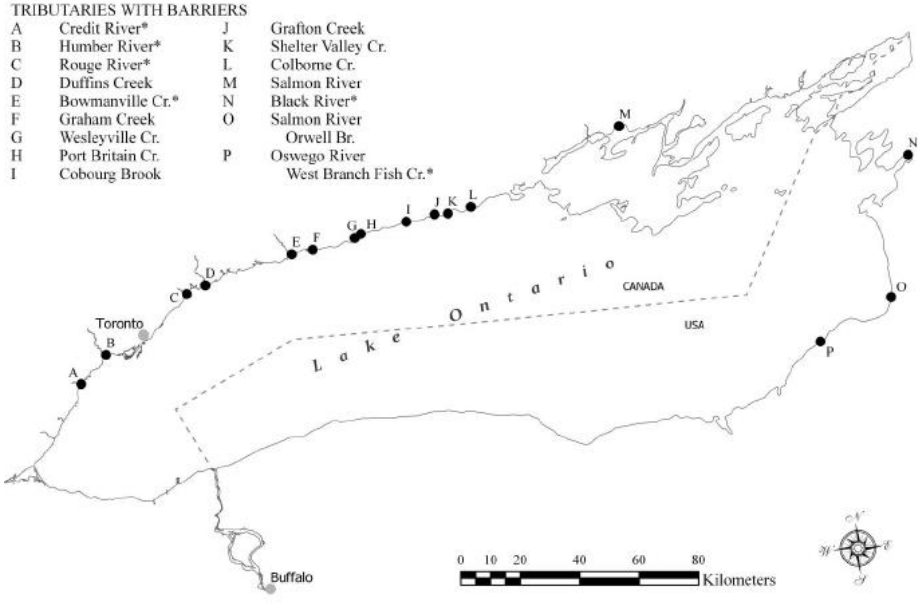

Fig 2. Location of Lake Ontario tributaries with Sea Lamprey barriers; structures that were not constructed by the Commission, but have been modified to prevent the upstream migration of Sea Lampreys are indicated by an asterisk (*).

Larval Assessment

Tributaries considered for lampricide treatment during 2019 were assessed during 2018 to define the distribution and estimate the abundance and size structure of larval Sea Lamprey populations. Assessments were conducted with backpack electrofishers in waters <0.8 m deep, while waters ≥0.8 m in depth were surveyed with gB or by deep-water electrofishing (DWEF).

- Larval assessments were conducted on 58 tributaries (32 Canada, 26 U.S.).

- Surveys to estimate abundance of larval Sea Lampreys were conducted in 10 tributaries (6 Canada, 4 U.S.).

- Surveys to detect the presence of new larval Sea Lamprey populations were conducted in 10 tributaries (7 Canada, 3 U.S.). No new Sea Lamprey infestations were detected.

- Post-treatment assessments were conducted in 13 tributaries (6 Canada, 7 U.S.) to determine the effectiveness of lampricide treatments conducted during 2017 and 2018. Surveys on the Salmon River (NY) found many residuals, resulting in the retreatment of some back-water areas during 2018.

- Surveys to evaluate barrier effectiveness were conducted in 28 tributaries (25 Canada, 3 U.S.). Due to high spring lake levels in 2017, several dams were inundated enabling sea lampreys to migrate further upstream. Graham Creek is scheduled for treatment upstream of the purpose built barrier during 2019.

- Routine maintenance, spring start-up, and safety inspections were performed on 13 barriers (10 Canada, 3 U.S.).

- Fish community assessment surveys were conducted on the Salmon River (15), tributary to Orwell Brook, to monitor the condition of the fish community.

- Larval assessment surveys were conducted in non-wadable lentic and lotic areas using 10.4 kg active ingredient of 3.2% gB (0 kg Canada, 10.4 kg U.S).

Juvenile Assessment

Based on standardized fall assessment data, the marking rate during 2017 was 0.005 A1 marks per 100 Lake Trout >431 mm which is less than the target of 2 A1 marks per 100 Lake Trout **(Fig 3**).

- Marking rates on Steelhead and Chinook salmon have been increasing and are a concern.

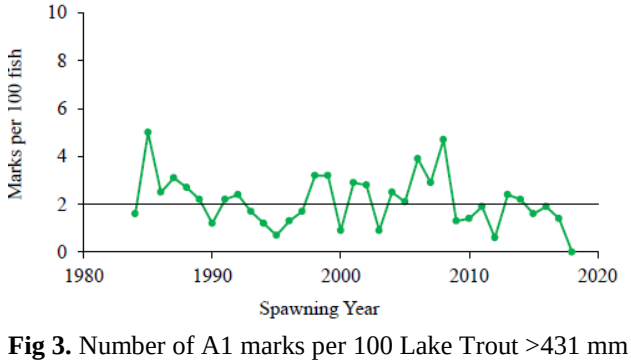

Fig 3. Number of A1 marks per 100 Lake Trout >431 mm from standardized fall assessments in Lake Ontario. The horizontal line represents the target of 2 A1 marks per 100 Lake Trout.

Adult Assessment

● A total of 5,428 Sea Lampreys were trapped in 8 tributaries during 2018, 5 of which are index locations. Adult population estimates based on mark-recapture were obtained from each index location **Fig 4**).

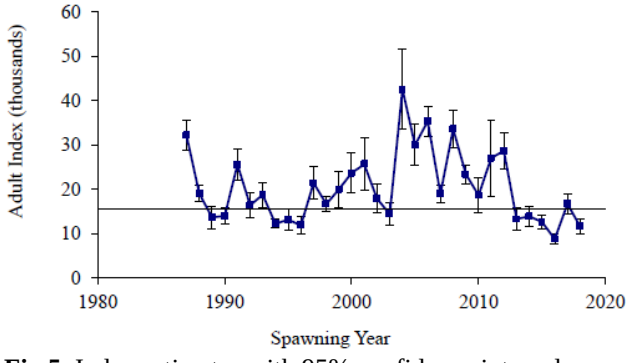

Fig 5. Index estimates with 95% confidence intervals (vertical bars) of adult Sea Lampreys. The adult index in 2018 was 11,666 (95% confidence interval 9,921 – 13,412). The point estimate is less than the target of 15,502 (black horizontal line). The index target was estimated as the mean of indices during a period with acceptable marking rates (1993-1997).

End

● The index of adult Sea Lamprey abundance was 11,666 (95% CI; 9,921 – 13,412), which is less than the target of 15,502 **(Figs 5-6).**

Fig 6. LEFT: Estimate of adult Sea Lampreys during the spring spawning migration 2018. Circle size corresponds to estimated number of adults from mark-recapture studies. RIGHT: Maximum estimated number of larval Sea Lampreys in each stream surveyed during 1995-2012. Tributaries composing over half of the lake-wide larval population estimate are identified (Salmon 1,400,000; Little Salmon 970,000; Credit 590,000; Black 470,000).