Inland Seas Angler

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Highlights of the Annual Lake Committee Meetings

Great Lakes Fishery Commission proceedings, Niagara Falls, ON

This last of a series of annual special reports is an extensive summary of Lake Ontario. These lake committee reports are from the annual Lake Committee meetings hosted by the Great Lakes Fishery Commission in April 2016. We encourage reproduction with the appropriate credit to the GLSFC and the agencies involved. Our thanks to the staffs of the GLFC, OMNR, USFWS, NYSDEC and Ohio DNRs 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 Lower Lake Committee meetings in Niagara Falls, Ontario.

Lake Ontario

Index of Reports

Key:

CPH = Catch per hectare
CPUE = Catch per unit effort
CWT = Coded Wire Tag
DFO = Dept. of Fisheries and Oceans
LOC = Lake Ontario Committee
DEC = NY Dept. of Environment Conservation
OMNR = ON Ministry Natural Resources
ODNR = Ohio Dept. of National 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

Status Alewife & Rainbow Smelt in U.S. Waters of Lake Ontario, 2015 (USGS)

Abstract

In 2015 the joint USGS and NYSDEC surveys for Alewife and Rainbow Smelt were combined for the first time into a comprehensive spring pelagic prey fish survey. The adult Alewife abundance and weight indices in 2015 increased slightly from 2014 levels, and Adult Alewife abundance has remained relatively stable for the past five years. Adult Alewife condition in both spring and fall increased from 2014 values and were above long-term means. Yearling Alewife abundance was the lowest observed in the 38-year time series. Alewife year class strength at age 1 is related to the number of spawning adults and summer temperatures and winter duration in the first year after hatching. Moderate year classes were produced during 2009-2011, and 2012 was the largest year class in the time series. However, severe winters in 2013-2014 and 2014-2015 contributed to two very small successive year classes for the first time in the time series. We expect adult Alewife abundance and biomass to decline in 2016 as older and larger fish decline in the population. The number of spawning adults increased in 2015, summer temperatures were slightly below average, and the anticipated winter duration is below average (i.e., milder winter) for 2015-2016, so these conditions will likely produce a low to moderate year class. A third successive weak year class could be problematic for the Lake Ontario Alewife population and may be of concern to binational lake managers. Rainbow Smelt were also assessed and the population continues to persist at a low and stable level.

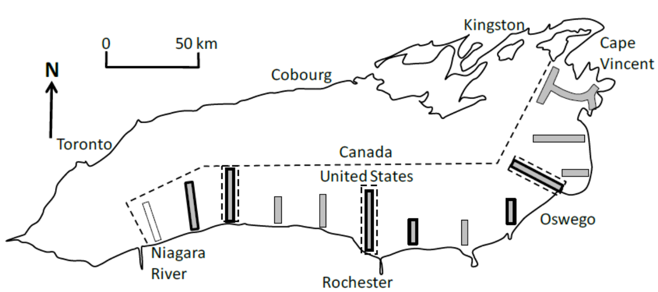

Fig 1-Lake Ontario showing 13 transects sampled in spring 2015 by USGS and NYSDEC with bottom trawls. Historic transect locations, noted as gray bars, from west to east are: Olcott, Thirty Mile Point, Oak Orchard, Hamlin, Rochester, Smoky Point, Sodus, Fair Haven, Oswego, Mexico Bay, Southwick, and Cape Vincent. The dashed outline denotes three "surveillance" transects. Farthest to the west, noted as a white bar, is a new transect located east of the Niagara River, which was sampled by USGS.

Introduction

Non-native Alewife is the most abundant pelagic planktivore in Lake Ontario and is an important prey for native and introduced salmon and trout and other piscivores. Alewife became established in Lake Ontario in the late 1800s after the opening of the Erie Canal system, and when populations are abundant, Alewife can alter zooplankton species composition and reduce recruitment of native species by predation on their larvae. Alewife also contain the enzyme thiaminase which breaks down thiamine (vitamin B1). Predators that consume Alewife, like salmon and trout, can suffer from thiamine deficiency which impacts reproductive success.

Non-native Rainbow Smelt were first reported in Lake Ontario in 1929 and are thought to have gained access from the upstream Finger Lakes, where they were intentionally introduced in 1917. Since the 1960s, Rainbow Smelt have been the second most common pelagic prey fish behind Alewife. When abundant, Rainbow Smelt were an important diet component of stocked and native Lake Ontario salmonids, as well as native Burbot. Christie (1972) suggested Lake Ontario Rainbow Smelt negatively influenced native prey fish species, noting that the Rainbow Smelt population increases in the 1940s coincided with declines of native Cisco populations in western lake regions.

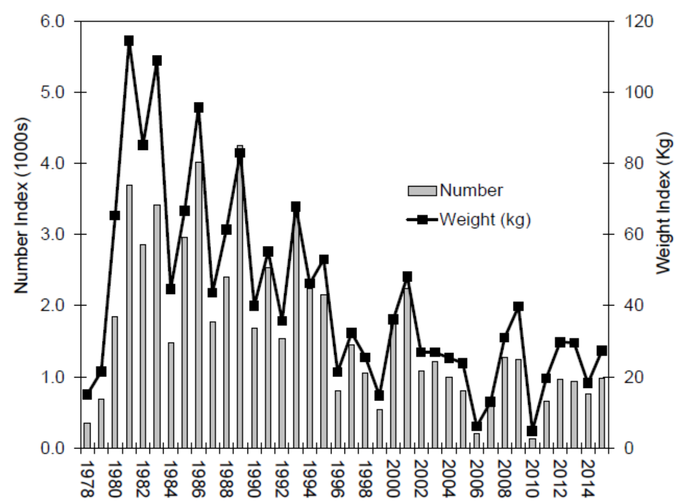

Fig 2- Abundance and weight indices for adult (age-2 and older) Alewife in the U.S. waters of Lake Ontario, 1978-2014. 1 kg = 2.205 lbs.

Alewife

In 2015, both the abundance (number) and weight (kg) indices for adult Alewife (age-2 and older) in U.S. waters of Lake Ontario increased slightly compared to 2014 values **(Fig 2).** The 2015 adult abundance index (972) was 1.29 times the previous 10-year average (772) and about 7.6 times higher than the record low in 2010 (128). The weight index (27.3 kg) was 1.25 times the previous 10-year average and 5.7 times higher than the record low from 2010 (4.76 kg). Adult Alewife abundance has remained relatively stable for the past five years.

The summer hydroacoustic prey fish survey conducted annually by the NYSDEC and OMNRF, which reports yearling and older Alewife numbers combined, indicated a 45 % decline in Alewife abundance from 2014 to 2015. The hydroacoustic and bottom trawl results are consistent, however, because the record low number of yearlings observed in 2015 during the spring bottom trawling survey are included in the adult summer hydroacoustic estimate. Targeted analyses of catchability and selectivity of both the bottom trawl and hydroacoustic program are ongoing to better understand population density estimates derived from each method.

Age-0 Alewife are not effectively captured by bottom trawls, so we index year class strength during the next spring's bottom trawling survey when Alewife are age 1. The age-1 Alewife abundance index in spring 2015 was the lowest value in the 38-year times series and it was 23 percent of the long term mean (390) **(Fig 3).** Age-1 Alewife abundance has been shown to be influenced by summer temperatures, winter duration, and the number of spawners (adults >150 mm). Weak year classes from 2013 and 2014 (indexed at age 1 in 2014 and 2015, respectively) were likely related to below average summer temperatures and long winter durations in both 2013-2014 and 2014-2015.

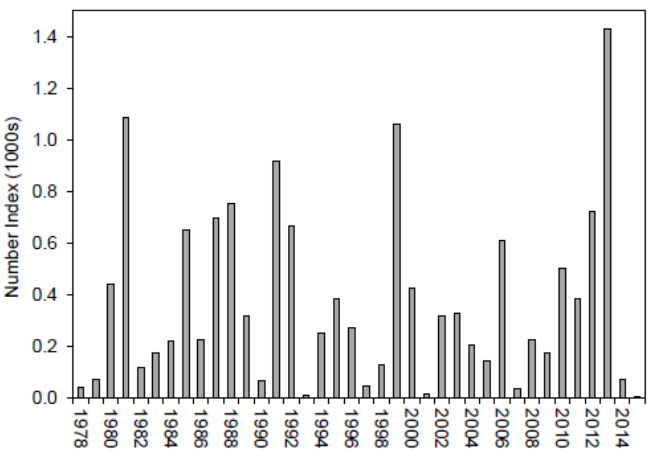

Fig 3 Abundance index for yearling (age-1) Alewife in the U.S. waters of Lake Ontario, 1978-2015.

Adult Alewife condition is measured as the estimated weight of a 165 mm Alewife and represents the relative plumpness of the fish as a surrogate measure of overall health and resource availability. In 2014, adult Alewife condition had declined slightly from the consistently high range of values observed during 2003-2013, but the 2015 values were above the 38-year survey means in both spring and fall. The four relatively strong year classes produced from 2009-2012 (including a record high year class of 2012) are now all part of the adult spawning population in Lake Ontario. However, Alewife >150 mm are currently 76 % of the population and will be subject to increased mortality through time, with few smaller fish in the population due to the weak year classes in 2013-2014.

In Lake Michigan, where Alewife numbers were near historic lows in recent years, the age structure was truncated with less than 1% of Alewife older than age 3 and no alewife older than age 5. Older Alewives in sufficient number are important for reproduction. By comparison, in 2015, as stated above, 76 % of the population was greater than 150 mm and the maximum age observed in Lake Ontario was nine. This suggests that predation intensity is lower than in Lake Michigan and that the Lake Ontario population has not yet reached a tenuous state where population collapse seems imminent.

The adult Alewife population in Lake Ontario has remained relatively stable for the last five years. But, the future direction of the Alewife adult population will depend on temperature conditions in 2016 and persistence of the large 2012 year class in the spawning population. A strong year class is needed in the next two years to sustain the Alewife population. Summer conditions during 2015 were cool, and the temperature index was 76% of the mean value since 1978. However, the winter of 2015-2016 has been mild, and the spawning stock of Alewife is relatively strong. Given these conditions we predict a low to moderate year class. A third successive weak year class could be problematic for the Alewife population and would raise concern about imbalance in predator-prey dynamics in Lake Ontario.

Rainbow Smelt

The adult population has remained at low and stable levels since around 2000, and in 2015, the abundance index for adult (age-1 and older) Rainbow Smelt increased relative to 2014 (**Fig 6).** Variability in the adult abundance index was within the range of the historic time series**.** Despite low population levels, there is successful reproduction each year to maintain the population. The 2014 abundance index value was approximately 60% of the 10-year average.

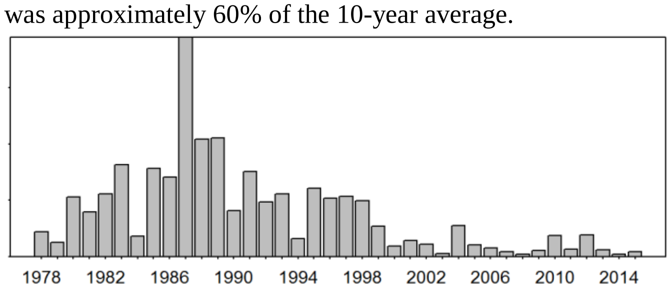

Fig 6-Catch of Rainbow Smelt (age-1 and older) from bottom trawls shoreward, 1978 - 2015.

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Lake Ontario Benthic Prey Fish Assessment, 2015 (USGS)

Abstract

Benthic prey fishes are a critical component of the Lake Ontario food web, serving as energy vectors from benthic invertebrates to native and introduced piscivores. Since the late 1970's, Lake Ontario benthic prey fish status was primarily assessed using bottom trawl observations confined to the lake's south shore, in waters from 8 – 150 m. In 2015, the Benthic Prey Fish Survey was cooperatively adjusted and expanded to address resource management information needs including lake-wide benthic prey fish population dynamics. Effort increased from 55 bottom trawl sites to 135 trawl sites collected in depths from 8 - 225m. The spatial coverage of sampling was also expanded and occurred in all major lake basins. The resulting distribution of tow depths more closely matched the available lake depth distribution. The additional effort illustrated how previous surveys were underestimating lake-wide Deepwater Sculpin, Myoxocephalus thompsonii, abundance by not sampling in areas of highest density. We also found species richness was greater in the new sampling sites relative to the historic sites with 11 new fish species caught in the new sites including juvenile Round Whitefish, Prosopium cylindraceum, and Mottled sculpin, Cottus bairdii. Species-specific assessments found Slimy Sculpin, Cottus cognatus abundance increased slightly in 2015 relative to 2014, while Deepwater Sculpin and Round Goby, Neogobius melanostomus, dramatically increased in 2015, relative to 2014. The cooperative, lake-wide Benthic Prey Fish Survey expanded our understanding of benthic fish population dynamics and habitat use in Lake Ontario. This survey's data and interpretations influence international resource management decision making, such as informing the Deepwater Sculpin conservation status and assessing the balance between sport fish consumption and prey fish populations. Additionally a significant Lake Ontario event occurred in May 2015 when a single juvenile Bloater Coregonus hoyi, was captured during the spring bottom trawl survey at 95m near Oswego, NY. This native, deep-water prey fish, last captured in Lake Ontario survey trawls in 1983, is part of an international, collaborative coregonid restoration effort in the Great Lakes.

Expanded Sampling

Changes to the 2015 sampling design increased benthic prey fish observations beyond the historically sampled southern shore sites. The new sampling design specifically added additional shallow and deep tows across all lake basins so that the proportion of depths sampled more closely matched the available lake depths **(Fig 2).** The expanded survey dramatically changed our understanding of Deepwater Sculpin habitat use and density across the lake**.** For example, if we use 2015 trawl catch observations from only the 55 historic sampling sites to estimate lake-wide Deepwater Sculpin density we would conclude density is approximately 9 Deepwater Sculpin per hectare, whereas using the entire 135 sites yields an estimate of 50 fish per hectare. The expanded survey did not appreciably change our understanding of Round Goby or Slimy Sculpin habitat use with respect to depth or our density estimates for those species, although the lake-wide coverage increased our confidence in making interpretations about these populations at the lake-wide scale.

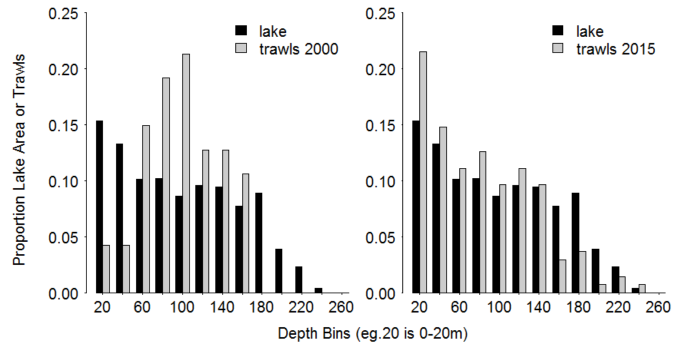

Fig 2-The Lake Ontario Benthic Prey Fish Survey trawl depth distribution (as a proportion of the total) relative to the available lake depths for the 2000 survey (left panel) that more closely followed the historic sampling design and the revised sampling design in 2015 (right panel).

Status of Species

Round goby

Round goby abundance indices increased in 2015 in both the spring and fall bottom trawl surveys relative to 2014, however both 2015 estimates are within the range previously observed in the time series **(Fig 4).** As has been observed in previous years, some proportion of the 2015 Round Goby population underwent a habitat shift associated with depth, where they moved from deep (100 – 150 m) winter habitats into shallower (< 30 m) summer habitats and by the fall survey were moving deeper as the highest fall catches were recorded at over depths from 25 – 75 m. Comparing Round Goby to other lakes finds Lake Ontario biomass density over the past five years (1.0 – 7.0 kg·ha-1) to Lake Michigan and greater than Lake Huron. Lake-wide biomass densities in

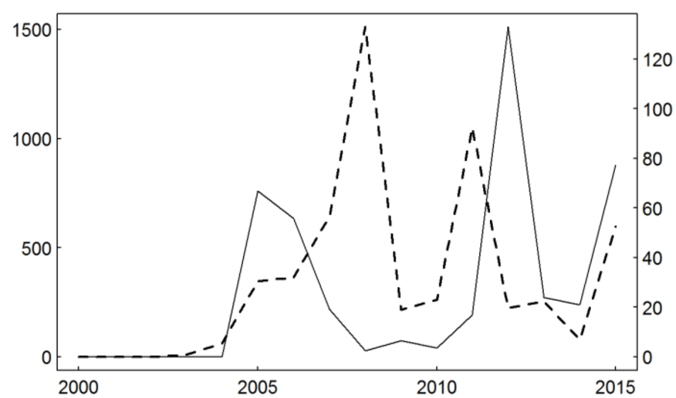

Fig 4-Round Goby density as number per hectare from the fall Benthic Prey Fish Survey (left y-axis and solid line) and the spring bottom trawl survey (right y-axis and dashed line).

Lake Ontario may also be similar or higher than those reported for Lake Erie where biomass density in the early 2000's reportedly ranged from 0.07 - 1.8 kg·ha-1.

Slimy Sculpin

Slimy Sculpin abundance in 2015 was similar to 2014, however both values are some of the lowest observed across the Lake's 38-year time series **(Fig 5).** Biomass density of Slimy Sculpin in Lake Ontario over the past five years (0.15 – 0.40 kg·ha-1) was similar to the Lake Michigan range of 0.01-0.70 kg·ha-1, but notably higher than the Lake Huron range 0.00 – 0.03 kg·ha-1, or Lake Superior where three common sculpin species in nearshore habitats are combined for reporting and are 0.02 - 0.05 kg·ha-1. As in previous years, few juvenile Slimy Sculpin less than 50mm were caught in Lake Ontario in 2015**.** While this metric varied across the period of observation in the 1970's through 1990's the sharp decline in juveniles in the mid 2000s' corresponds to the concurrent increases in Round Goby at the same time **(Fig 4).**

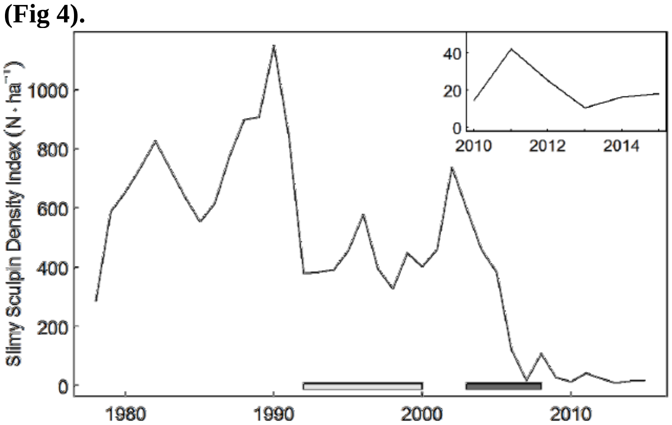

Fig 5- Slimy Sculpin density index in Lake Ontario from 1978-2015. The light gray bar above the x-axis represents the range when Dreissena sp. mussels were introduced and proliferated, while the darker gray bar represents when introduced Round Goby abundance increased.

Deepwater Sculpin

Deepwater Sculpin, previously considered extirpated and listed on threatened and endangered species lists, have undergone a dramatic population recovery since the mid-2000s. Both of the density indices considered, illustrated the Deepwater Sculpin population increased in 2015 relative to 2014 and the population has substantially increased since the individuals were first captured in the 2005 in the Benthic Prey Fish Survey **(Fig 7).** Comparing Lake Ontario Deepwater Sculpin density (or biomass density) estimates to other Great Lakes, where the species has been more common, provides context for how this population has recovered in Lake Ontario. The current lake-wide, Lake Ontario biomass density estimate for Deepwater Sculpin was 1.5 kg·ha-1 which is similar to Lake Michigan over the past five years (2010 - 2014) where Deepwater Sculpin biomass density reportedly ranged from approximately 0.5 – 3.0 kg·ha-1. Over the same time period, Lake Huron Deepwater Sculpin biomass densities ranged from approximately 0.0 - 1.0 kg·ha-1. Data from this USGS-lead survey are currently being used by conservation groups and agencies in both the United States and Canada to reevaluate the conservation status of Deepwater Sculpin in Lake Ontario.

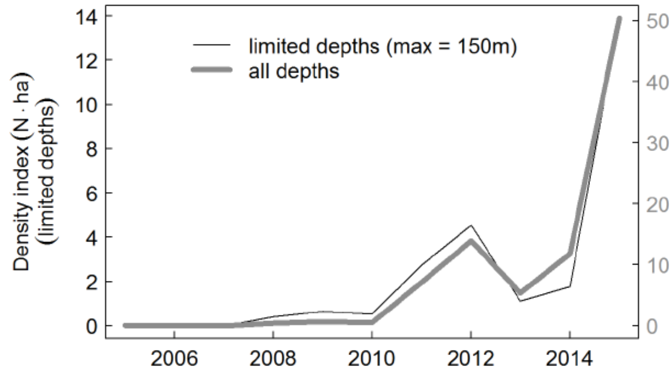

Fig 7-Lake Ontario Deepwater Sculpin density indices based on different depth ranges from the Fall Benthic Fish Survey, 2005-2015. The thin black line represents density estimates for lake areas less than or equal to 150m which have been consistently sampled through time. The thick gray line incorporates all trawls, including trawls deeper than 150m which were collected sporadically in recent years.

A juvenile Bloater was caught during the spring prey fish bottom trawl survey at 95 meters off of Oswego NY, May 2015. This individual fish was most likely from a 2014 stocking, which is part of the collaborative restoration effort underway in Lake Ontario between the USGS, NYSDEC, OMNRF, and USFWS. This species, once common in Lake Ontario, was an important species for commercial fishing but had dramatically declined by the mid-1900's. From 1978-2014, the only record of Bloater caught in over 14,000 USGS or NYSDEC bottom trawls was a single fish caught in 1983, east of Rochester NY.

Benthic Prey Fish Community

The Lake Ontario benthic prey community continues to be dominated by Round Goby however the proportion of Deepwater Sculpin in the community has steadily climbed since 2009 **(Fig 8).** Over the past 37 years, this survey collected on average 16 different species, however the expanded effort in 2015 collected 28 different species. Species richness was highest near shore and declined as depth increased, however that change was most pronounced for the new sites relative to the historic sites. The higher species richness in the new sites was associated with shallow sampling in both the eastern and western portions of the lake and may have been the result of more diverse habitat types available in these lake regions. Catches of note in 2015 include multiple trawls containing juvenile Round Whitefish, Lake Whitefish and Threespine Stickleback in the western lake regions and wild Lake Trout captured in the north shore and Eastern Basin. Eastern Basin trawls also recorded a variety of native benthic prey fishes that were once more common in the south shore sites, including Trout-perch, Log Perch, Spottail Shiner, and Johnny Darter.

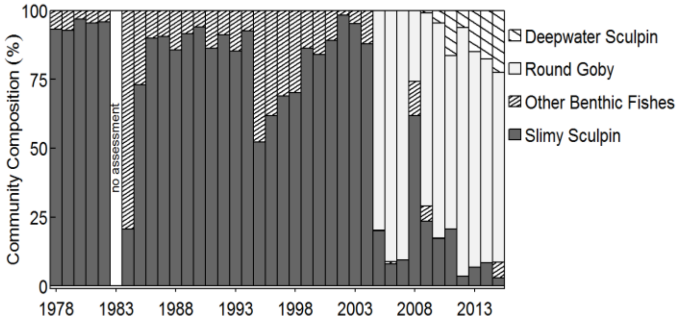

Fig 8-Lake Ontario benthic prey fish community composition, by biomass density, 1978-2015. The 'Other Benthic Fishes' is primarily composed of Trout-perch, Johnny Darter, and Spottail Shiner.

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Lake Trout Rehabilitation in Lake Ontario, 2015 (USFWS)

Abstract

Each year we report on the progress toward rehabilitation of the Lake Ontario lake trout population, including the results of stocking, annual assessment surveys, creel surveys, and evidence of natural reproduction observed from all standard surveys performed by USGS and NYSDEC. The first-year survival index for the 2013 year class declined by 32% from the relatively high values observed for the 2010 and 2012 year classes. The catch per unit effort of adult lake trout in gill nets increased each year from 2008-2014, recovering from historic lows recorded during 2005-2007. Adult abundance in 2015 declined by 18% from the 2014 level, but was nearly equivalent to the 1999-2004 mean which at the time appeared to be the new stable abundance following the 1993 stocking cuts. The 2015 rate of wounding by sea lamprey on lake trout caught in gill nets (1.94 A1 wounds per 100 lake trout) was below target (2 wounds per 100 lake trout). Estimates from the NYSDEC fishing boat survey indicated 2015 angler catch and harvest rates were more than nine times higher than the lows observed in 2007. Condition of adult lake trout, indexed in September from the predicted weight for a 700mm lake trout from annual length-weight regressions and Fulton's K for age-6 males, has generally remained at a high level during 2007-2015, but both values have exhibited a downward trend since 2011. July-August condition of juvenile lake trout indexed from the predicted weight of a 400 mm individual and Fulton's K for age-2 fish were among the lowest values recorded for the 1979-2015 time series. Reproductive potential for the adult stock, determined from the annual egg deposition index, rebounded from the 2007-2008 values that were the lowest observed since 1985 and stabilized during 2009-2015. Twenty one cohorts of naturally produced lake trout have been collected since 1994 with the largest catches occurring in 2014 and 2015.

Restoration of a naturally reproducing population of lake trout is the focus of a major international effort in Lake Ontario. Coordinated through the Lake Ontario Committee of the Great Lakes Fishery Commission, representatives from cooperating agencies NYSDEC, USGS, USFWS, and Ontario Ministry of Natural Resources and Forestry [OMNRF]) developed the Joint Plan for Rehabilitation of Lake Trout in Lake Ontario which guided restoration efforts and evaluation through 2014. A revised document, A Management Strategy for the Restoration of Lake Trout in Lake Ontario, 2014 Update, will guide future efforts. The present report documents progress towards restoration through 2015.

Stocking

From 1973 to 1977 lake trout stocked in Lake Ontario were raised at several NYSDEC and USFWS (Michigan and Pennsylvania) hatcheries with annual releases ranging from 0.07 million for the 1973 year class to 0.28 million for the 1975 year class **(Fig 1).** By 1978 (1977 year class) the USFWS Alleghany National Fish Hatchery was raising all lake trout stocked in U.S. waters of Lake Ontario and annual releases exceeded 0.60 million fish. In 1983, the first official Lake Ontario lake trout rehabilitation plan was formalized and it called for a U.S. target of 1.25 million yearlings. The stockings of the 1979-1986 year classes approached that level, averaging about 1.07 million annually. The number of yearling equivalents released declined by 22% between the stockings of the 1981 and 1988 year classes. Stocking declined by 47% in 1992 (1991 year class) due to problems encountered at the hatchery.

In 1993, fishery managers reduced the lake trout stocking target to 500,000 yearlings because of a predator-prey imbalance in Lake Ontario, and following recommendations from an international panel of scientists and extensive public review. Annual stockings were near the revised target level in 15 of 22 years during 1993-2014 **(Fig 1).** Combined production of the 2014 year class resulted in stocking of nearly 528,000 fall fingerlings and 521,000 spring yearlings.

During fall 2015, nearly 454,000 fall fingerlings (2015 year class) were stocked.

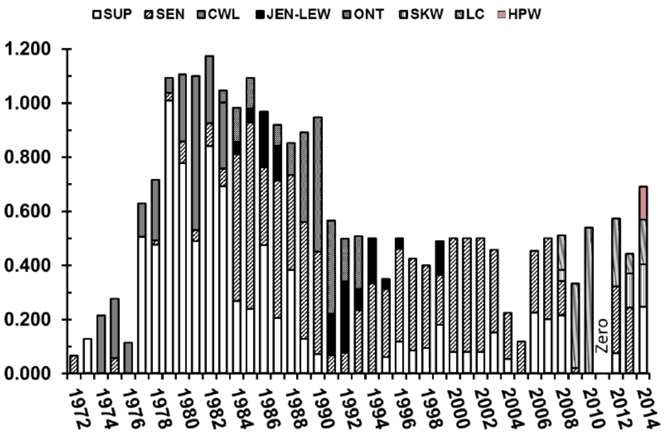

Fig 1- Total spring yearling equivalents (SYE) for lake trout strains stocked in U.S. waters, for the 1972 – 2014 year classes.

Abundance of age-3 and older Lake Trout

A total of 718 lake trout were captured in the Sept 2015 gill net survey resulting in a total CPUE of mature adults of 11.5 **(Fig 3).** Adult abundance in 2015 (CPUE: 11.5) was similar to the 1999-2004 average (CPUE: 11.1). Similar to the catch of age-2 lake trout from bottom trawls, the CPUE for immature lake trout captured in gill nets (generally ages 2 to 5) declined by 64% between the 1989-1993 (CPUE: 8.0) and the 1995-2004 intervals (CPUE: 2.9). Low CPUEs continued in 2015 (CPUE: 1.6).

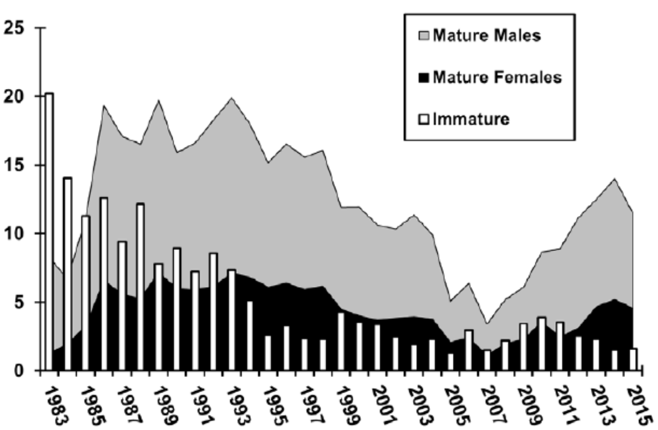

Fig 3-Abundance of mature and immature lake trout, during September 1983-2015

Natural Reproduction

Evidence of survival of naturally produced lake trout past the summer/fall fingerling stage occurred in each year during 1993-2014 **(Fig 11)** except 2008, representing production of 21 year classes. Numbers caught represent the entire annual bottom trawl catch from four surveys occurring during April-October 1979-2014. In 2015 the June bottom trawl survey was discontinued so total trawl effort decreased. Catch was not corrected for effort due to the low catch in most years and a relatively constant level of effort expended within the depth range (20m - 100m) where age-0 to age-2 naturally reproduced lake trout are most often encountered in Lake Ontario for most years.

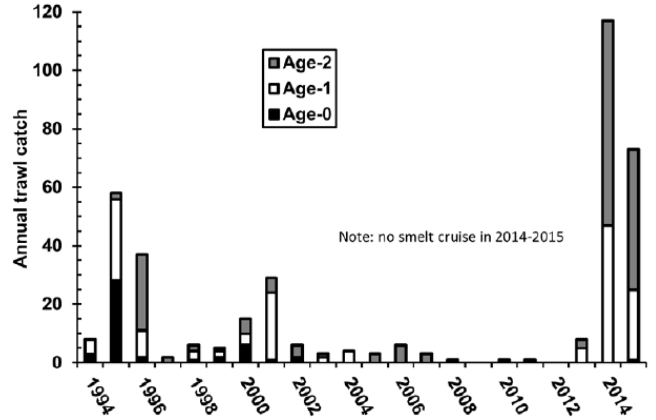

Fig 11-Numbers and ages of naturally produced lake trout captured with bottom trawls, 1994-2015. During 1980-1993, only one naturally produced lake trout was captured with bottom trawls.

The wild yearlings captured in 2010-2015 were the first wild yearlings caught since 2005. In 2014, the largest catch in the 22-year time-series occurred with 47 age-1 (93-186 mm, 3.7-7.3 in) and 70 age-2 wild lake trout (176-291 mm, 6.9-11.5 in) caught. The second largest catch in the time series occurred in 2015 with 24 age-1 (94-147 mm, 3.7-5.8 in) and 48 age-2 (167-262 mm, 6.6-10.3 in) wild lake trout.

The distribution of catches of wild fish suggests that lake trout are reproducing throughout New York waters of Lake Ontario with the greatest concentration coming off the Niagara Bar area at the mouth of the Niagara River **(Fig 12).** Catches from at least 21 cohorts of wild lake trout since 1994 and survival of those year classes to older ages demonstrates the feasibility of lake trout rehabilitation in Lake Ontario. Although recent large catches of wild lake trout are encouraging, achieving the goal of a self-sustaining population requires consistent production of relatively large wild year classes and survival of those fish to reproductive ages.

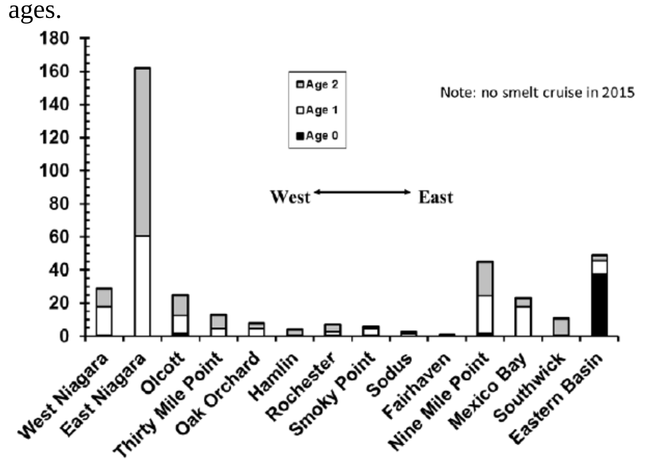

Fig 12-Numbers of wild lake trout (age 0 to 2) captured with bottom trawls, 1994 – 2015. ✧

New York 2015 Lake Ontario Fisheries Program Highlights

2015 Lake Ontario Stocking and Fall 2015 Salmon Egg Collections

Fish stocking in the New York waters of Lake Ontario in 2015 included 1.72 million Chinook salmon, 208,000 coho salmon, 466,000 rainbow trout, 411,000 brown trout, 152,500 Atlantic salmon, 975,600 lake trout (520,900 yearling; 454,700 experimental fall fingerlings), and 10,400 walleye.

A multi-agency, international effort to rehabilitate native ciscoes in Lake Ontario continued in 2015 with the stocking of approximately 61,600 fall fingerling bloaters by the US Geological Survey (USGS) and 20,000 fall fingerling bloaters by the Ontario Ministry of Natural Resources and Forestry. Bloaters are one of four extirpated species of deepwater ciscoes that once dominated Lake Ontario's forage base. In addition in 2015, USGS reared and stocked approximately 90,000 lake herring into Irondequoit Bay and 10,422 in Chaumont Bay in an effort to re-establish spawning populations in south shore embayments. Lake herring are a shallow-water form of cisco that exists only at remnant levels. Fall 2015 Chinook and coho salmon egg collections exceeded targets, and fish survival has been good to date.

2015 Water Temperatures and Weather

Many factors, including numbers of fish stocked and their survival, numbers of wild salmon produced and their survival, water temperature, and wind direction/speed, can strongly influence fish (their behavior, distribution and growth rates) and fishing success.

The winters of 2013/2014 and 2014/2015 were much colder than normal, resulting in record ice cover on the Great Lakes, including Lake Ontario. Lake Ontario's open lake water temperatures in 2014 and 2015 remained well below average May - August. The relatively cold water temperatures and atypical weather patterns during 2015 likely contributed to reduced trout and salmon fishing quality during the open lake season. Chinook salmon growth was below average in 2015, likely attributable to a second consecutive cold winter and summer. Condition (relative "plumpness") of Chinook salmon, however, was above average in 2015, suggesting that food availability was sufficient.

Sportfishery Assessments

Open Lake Fishing Boat Survey

The Lake Ontario Fishing Boat Survey was initiated on April 15 and ended September 30, 2015. The following results cover the April 15-September 30 period for each year 1985-2015. Lake Ontario's diverse trout and salmon fishery provides anglers with outstanding angling opportunities. Total trout and salmon fishing quality (number of fish caught per hour of angling on board a charter boat) in recent years remained at record high levels because of the variety of trout and salmon available to anglers **(Fig 2**).

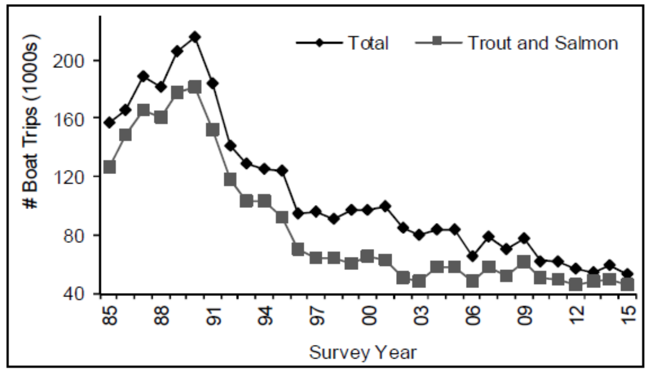

Fig 2. Estimated total fishing effort, and trout and salmon fishing effort (April 15-September 30)

Fishing quality during 2015 was likely impacted by colder than average water temperatures and atypical weather patterns. During 2015, there were periods and locations of both excellent and poor fishing quality. The four most sought after species are Chinook salmon, brown trout, rainbow trout, and coho salmon. NYSDEC fishing regulations permit a daily harvest limit of "3 in any combination" of these four species. The 2015 charter boat catch per angler hour for these four species combined was the lowest recorded since 2002, 16% below the long-term average, and 37% below the record-high levels observed 2003-2014 **(Fig 3).**

The best Chinook salmon fishing quality among charter boats occurred during 2003-2015. Fishing quality in 2015, however, was the lowest estimated during this time period and 26% below the 2003-2015 mean. Analysis of angler interview data by month and region confirmed angler reports of relatively lower Chinook fishing quality during portions of the 2015 fishing season and/or in specific areas. The 5.5 month average catch rate was positively influenced by good to excellent fishing during May in all regions, and particularly in the West Region.

• Fishing quality for brown trout was near record high levels in recent years, however, declined in 2015 to the lowest recorded since 2008 and 27% below the long-term average.
• Coho salmon fishing quality was excellent for 5 of the past 10 years, however, in 2015 was 57% below average.
Following seven consecutive years of record or near record high angling success for rainbow trout, the 2015 catch rate was the lowest level since 2005 and a 39% decrease compared to the long term average.
• Lake trout catch rates improved each year (2008-2013) from the 2007 record low. In 2015, catch rate was similar to 2013.
• Atlantic salmon catch rate remained relatively high and was 19% above average in 2015.

• An estimated 154,411 trout and salmon were caught during the open lake season, and the catch was primarily composed of Chinook salmon (38%) and lake trout (34%). Trout and salmon harvest was estimated at 77,887 fish, dominated by Chinook salmon (45%) and lake trout (24%).
• Fishing effort directed at trout and salmon has remained relatively stable for more than a decade, but was the second lowest on record in 2015 (46,142 boat trips targeted trout and salmon, 87% of all fishing trips).
• The number of lamprey observed per 1,000 trout and salmon caught was estimated at 15 in 2015, 13% below the previous 5-year average and 65% below the 2007 record high.

The estimated number of fishing boat trips targeting smallmouth bass during the traditional open season (3rd Saturday in June through September 30 when the creel survey ends) was 4,868 bass trips in 2015, a 29% decrease from 2014 and the lowest recorded. Fishing quality for smallmouth bass peaked in 2002, declined to its lowest level in 2010, then increased each year 2011-2013.
Fishing quality in 2015 was 0.5 bass per angler hour, similar to the previous 5-year average

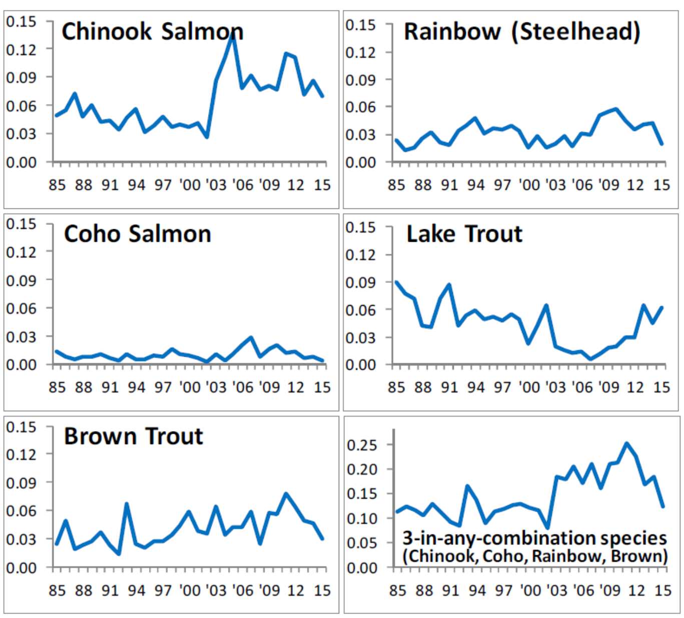

Fig 3-Trout and salmon catch rate for charter boats fishing the open waters of Lake Ontario April 15-September 30, 1985-2015.

Lake Ontario Tributary Angler Survey

NYSDEC is conducting a Lake Ontario tributary angler survey from September 2015 through April 2016. Preliminary results of the fall survey appear below. A final report with results of the entire survey period will be completed in spring 2017. The total estimated effort for 21 tributaries was 763,357 angler hours and 191,331 trips. The Salmon River accounted for 588,498 angler hours (77% of total) and 101,465 angler trips (53% of total). Five other tributaries accounted for at least 10,000 estimated angler hours each: Eighteenmile Creek and Niagara River in Niagara County, Genesee River in Monroe County, South Sandy Creek in Jefferson County, and Oak Orchard Creek in Orleans County.

• Sixteen of 21 tributaries surveyed had reported catches of Chinook salmon. The total estimated catch and harvest of Chinook salmon in 2015 was 43,589 and 26,045, respectively. The 2015 catch of Chinooks declined substantially from the three previous survey ('05, '06, and '11) estimates that ranged from 125,180 to 155,960 fish landed.
• Coho salmon were a small component of the 2015 tributary fishery, with an estimated 6,061 fish caught in nine of the 21 tributaries surveyed. Coho catches vary considerably in previous surveys, ranging from 5,804 in 2006 to 30,676 in 2011. The Salmon River accounted for 95% of the catch (5,738) and 89% of the harvest (2,307) in 2015.
• Eleven of the 21 tributaries surveyed had reported catches of steelhead with the total estimated catch and harvest of 17,223 and 2,623 fish, respectively. The Salmon River had the highest estimated catch (11,334 or 66% of total) and harvest (1,401 or 53% of total). The release rate for steelhead was 88% on the Salmon River and 85% for all tributaries combined.
• Ten of the 21 waters surveyed had reported catches of brown trout. The total estimated brown trout catch and harvest were 13,650 and 3,441 respectively. The estimated catches from the previous three comprehensive fall surveys ranged from 27,419 in 2006 to 40,192 in 2005.

Results of Alewife Bottom Trawl Surveys

Abundance of adult (age-2 and older) alewife in spring 2015 bottom trawling surveys increased slightly from 2014 levels, and adult abundance has been fairly stable for five consecutive years **(Fig 3a).**

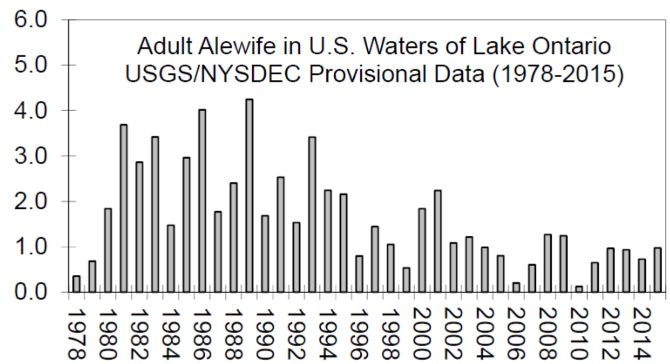

Fig 3a. Bottom trawl abundance indices for adult (age-2 and older) alewife.

For a second consecutive year, abundance of yearling (age-1) alewife was very low in 2015, the lowest observed in the 39-year time series. **(Fig 3b**). Below average summer temperatures and harsh winter conditions likely adversely affected reproduction and survival of young alewife in 2014-2015, leading to two successive years of low yearling abundance.

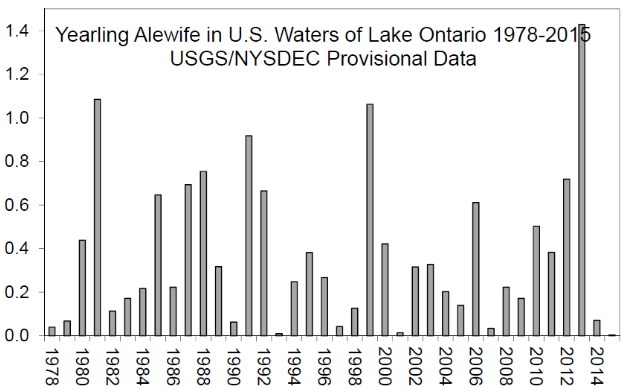

Fig 3b-Bottom trawl abundance indices for age-1 alewife.

In recent years, the relative body condition or plumpness of alewife has been high during both spring and fall. Alewife body condition in 2015 increased from 2014 and were similar to the relatively high values observed during 2003-2013 **(Fig 4).**

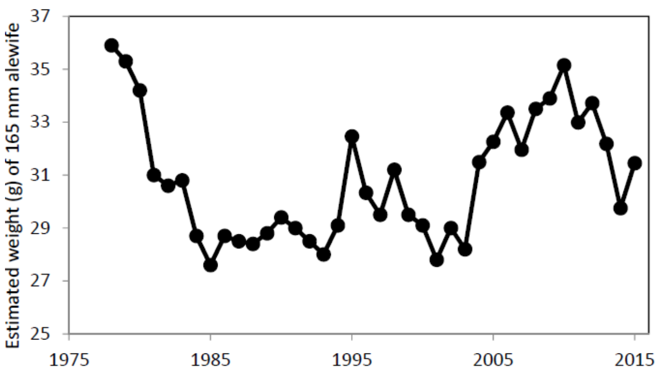

Fig 4 Body condition (weight of a 6.5" adult alewife) in spring 1978-2015

Growth and Condition of Chinook Salmon at the Salmon River Hatchery

The average weight of age-1 Chinook males (jacks) sampled in 2015 was 3.8 lbs, the second lowest value recorded. Age-2 males (12.3 lbs) were 1.1 lbs below average and age-2

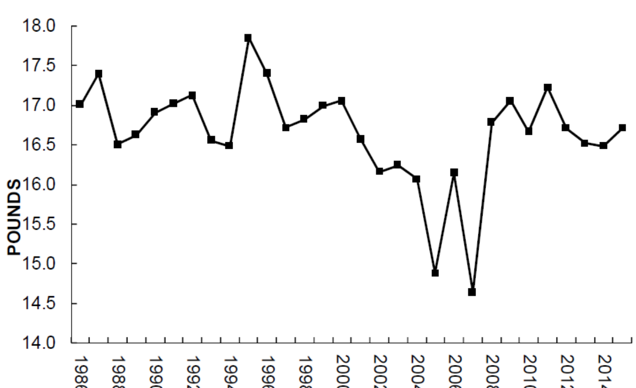

Fig 7-Estimated weights of a 36" Chinook salmon from the Salmon River Hatchery fall (October) collections 1986-2015.

females (12.8 lbs) were 1.9 lbs below average**.** Age-3 males (15.0 lbs) were nearly 4.0 pounds below average weight and age-3 females (16.7 lbs) were 3.1 lbs below the long-term average. The condition or relative "plumpness" of Chinook salmon (based on the predicted weight of a 36 inch long Chinook salmon) in 2015 was slightly above the historical average and nearly identical to the previous three years **(Fig 7).**

Chinook Salmon and Steelhead Pen-rearing Projects

Spring 2015 was the 18th year of volunteer-based pen-rearing projects for steelhead and Chinook salmon. Pen rearing projects were initiated with the intent of improving survival and/or homing of pen-reared fish when compared to traditional, shore-stocked fish. Approximately 450,800 Chinook salmon fingerlings were reared at seven pen sites comprising 25.5% of NYSDEC's 2015 Chinook stocking allotment. Approximately 39,560 steelhead (Washington strain) yearlings were reared at seven sites, representing 10.2% of NYSDEC's 2015 steelhead stocking allotment

Chinook Salmon Marking Projects

In 2008, NYSDEC purchased an automated fish marking trailer which is capable of adipose clipping and/or applying coded wire tags (CWTs) to salmon and trout at high speed and accuracy. To determine the proportions of wild and hatchery Chinook salmon in Lake Ontario, all Chinook salmon stocked by New York and Ontario from 2008-2011 were marked with an adipose fin clip. Percentages of wild Chinook salmon in Lake Ontario varied by year class and age and among regions from 2009-2015. The wild study was completed in 2015 and overall, wild Chinook were an important component of the Lake Ontario fishery averaging 47% of the age 2 & 3 Chinooks harvested in the lake.

To determine the degree of homing and straying to the Salmon River Hatchery, all Chinook Salmon stocked at the Salmon River received adipose fin clips and CWTs from 2008-2010. Returns to Salmon River from 2009-2014 varied with year class and age, but results suggest a high degree of homing and a low degree of straying from other stocking sites with straying rates averaging about 10%.

To evaluate the relative contributions of pen-reared vs. traditional shore-stocked salmon, Chinook salmon were marked and tagged in 2010, 2011 and in 2013. Tags were recovered from salmon from 2011 to 2015. Preliminary results from the 2010 and 2011 stockings (year classes) suggest that pen stocked salmon provide relatively higher contributions to the lake harvest than shore-stocked salmon (about 2:1). Tag recoveries for the 2013 stocking will continue through 2016. Returns of tagged Chinook salmon to tributaries from 2011-2015 suggest a high degree of homing by both pen and direct stocked fish. Over 80% of the salmon returning to individual stocking sites were stocked at those sites. Chinook strays to tributaries were comprised mainly of fish from other nearby stocking sites.

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. As part of a continuing effort to evaluate the effectiveness of stocking programs, the relative return of these stocking strategies will be compared by mass marking and tagging all coho salmon stocked by NYSDEC from 2016-2018.

Salmon River Wild Young-of-Year (YOY) Chinook Salmon Seining Program

Seining is conducted annually to index wild YOY Chinook salmon production in the Salmon River, the largest source of wild Chinook in New York. The mean peak catch of 608 YOY Chinook per haul in 2015 was over double the 2001-2014 average of 283, and was the second highest observed (2012 was the highest).

Progress toward Lake Trout Restoration

Following low population levels during 2005-2007, adult lake trout abundance increased each year from 2008-2014, then declined slightly in 2015. The number of fresh sea lamprey wounds on lake trout was just below the target of 2 wounds per 100 lake trout >17 inches long examined. Wild lake trout were collected each year from 1994-2015, representing 21 year classes of wild production. Catches of wild lake trout in 2014 and 2015 were the highest recorded since restoration efforts began over 30 years ago.

Eastern Basin Warmwater Fish Assessment

Relative abundance of all species in 2015 was 14.9 fish/gill net, a 51.7% decrease compared to the 2010-2014 average. For a second consecutive year, water temperatures were, on average, colder than those measured in recent years, particularly in the deepest waters sampled (51-100 ft.). Colder water during the assessment may have contributed to reduced catches.

Each year, from 1995-2013 smallmouth bass and yellow perch dominated survey catches. In 2015, however, catch was dominated by smallmouth bass (29.2% of total) and white perch (24.7% of total). Catches of smallmouth bass in 2014 and 2015 declined to the lowest levels since 2004. Smallmouth bass relative abundance was 4.4 fish/net, the lowest catch since 2004 and similar to 2000-2004 when smallmouth bass abundance was at the lowest levels recorded.

Yellow perch catches can be highly variable compared to other species, likely due to their schooling nature and the influence of temperature. Colder water may have contributed to the substantially decreased catches in 2014 and 2015 (the lowest values recorded; 1.7 fish/net and 0.8 fish/net, respectively). Relative abundance of walleye has remained relatively stable for several years, but decreased 47% in 2015 compared to the 2010-2014 average. Fish resulting from strong reproduction in 2003, 2005 and 2008 remained well-represented in assessment netting. Catches of age-4 walleye indicate a relatively strong year class produced in 2011.

OMNRF data indicate relatively strong natural reproduction also occurred in 2014; therefore, the walleye population is expected to remain stable for several more years. Lake sturgeon catches were extremely rare in this assessment prior to 1995; however, at least one lake sturgeon was collected in 15 of the last 21 years, suggesting improved population status. Three lake sturgeon were captured during 2015 netting.

Round gobies remain an important component of smallmouth bass diets in the eastern basin. Round gobies have also been observed in stomachs of walleye, brown trout, lake trout, lake whitefish, yellow perch, white perch, and rock bass. Production of walleye in eastern Lake Ontario may be limited by available spawning habitat. In the Black River, walleye ascend the river in the spring and, while successful spawning was suspected, it had not been documented. USGS Tunison Lab monitored walleye egg deposition and larvae production throughout the river from the Dexter dam to the mouth for three years. Surveys found walleye eggs in several areas each year and captured larval walleye during 2014 and 2015. Enhancing walleye substrate in the lower Black River is being explored as a means to increase walleye abundance.

Sea Lamprey Control

The estimated lake-wide population of adult sea lampreys during 2015 was just below the target value of 11,368. Sea lamprey control agents from Fisheries and Oceans Canada, contractors for the Great Lakes Fishery Commission, conducted sea lamprey control treatments in the following NY tributaries in 2015: Black River, Salmon River (Altmar Creek), Snake Creek, Catfish Creek, Oswego River (Owasco Lake Outlet), Eightmile Creek, Sterling Creek, Red Creek, and Sodus Creek. NY streams scheduled for sea lamprey control in 2016 include: South Sandy Creek, Little Sandy Creek, Grindstone Creek, and Oswego River. A total of 96 tributaries (65 Canada, 31 U.S.) were assessed for the presence of larval lamprey. Abundance of larval sea lampreys was estimated in 7 tributaries (5 Canada, 2 U.S.). An additional 67 tributaries (50 Canada, 17 U.S.) were surveyed to detect the presence of new larval populations, none were detected. ✧

2015 Lake Ontario Unit Annual Report

For the full 389 page copy of the **Lake Ontario Annual Report 2015:**
www.dec.ny.gov/docs/fish_marine_pdf/lorpt15.pdf

Executive Summary

The Lake Ontario ecosystem has undergone dramatic change since early European settlement, primarily due to human influences on the Lake and its watershed. The native fish community was comprised of a diverse forage base underpinned by coregonids (whitefish family) and sculpins, with Atlantic salmon, lake trout and burbot as the dominant piscivores (fish-eaters) in the system. Nearshore waters were home to a host of warmwater fishes including yellow perch, walleye, northern pike, smallmouth bass, lake sturgeon, and American eel. The dominant prey species in nearshore areas included emerald and spottail shiners.

Habitat and water quality degradation, overfishing, and the introduction of exotic species played major roles in the decline of the native fish community. By the 1960's, these impacts culminated in the virtual elimination of large piscivores, the reduction or extinction of other native fishes, and uncontrolled populations of exotic alewife, smelt, and sea lamprey. Since the early 1970's, water quality improvements resulting from the Great Lakes Water Quality Agreement (International Joint Commission 1994), sea lamprey control, and extensive fish stocking programs in New York and Ontario have resulted in increased diversity in the Lake Ontario fish community and a robust sportfishery. In 2007, anglers fishing Lake Ontario and its tributaries contributed over $114 million to the New York State economy.

In the 1990s, the Lake Ontario ecosystem experienced dramatic changes resulting primarily from the introduction of exotic zebra and quagga mussels. In addition, improvements in wastewater treatment have reduced excessive nutrient concentrations in the open lake to historic, more natural levels, thereby lowering the productive capacity of the Lake Ontario ecosystem. Zooplankton biomass in Lake Ontario's offshore upper thermal layer declined drastically over the last 30 years (as much as 99% by the early 2000s), attributable to reduced lake productivity and invasive predatory zooplankton. Since 2005, offshore zooplankton biomass improved but remains well below historic levels. The abundance and distribution of the native deepwater amphipod, *Diporeia* deteriorated markedly, likely due to range expansion of quagga mussels into deeper waters. The exotic round goby was first documented in New York waters of Lake Ontario in 1998, and spread throughout Lake Ontario and the St. Lawrence River rapidly. Goby abundance and biomass grew exponentially, then stabilized at lower levels. Round gobies have dominated the diets of Double-crested cormorants from colonies in eastern Lake Ontario and the St. Lawrence River for nearly a decade. Gobies have also been identified in the diets of numerous sportfish species including smallmouth bass, yellow perch, walleye, northern pike, brown trout, and lake trout, and are apparently responsible for markedly increased growth rates for some sportfish species including smallmouth bass and yellow perch. The effects of these ecosystem changes on the Lake Ontario fish community have not been manifested completely, nor are they fully understood.

Viral Hemorrhagic Septicemia virus (VHSv) was first documented in the New York waters of Lake Ontario and the St. Lawrence River in 2006. Substantial freshwater drum and round goby mortality events were observed, as well as numbers of dead muskellunge, smallmouth bass, and a moribund burbot. VHSv has also been identified in surveillance testing of healthy fish, including rock bass, bluegill, brown bullhead, emerald shiners and bluntnose minnows. The invasive "bloody red shrimp" is a small freshwater shrimp found near Oswego, NY in 2006, and has since spread in Lake Ontario and the St. Lawrence River. As with other aquatic invasive species in the Great Lakes system, the full impacts of these new invaders are unknown.

In the fall of 2014, Salmon River anglers reported numerous occurrences of steelhead swimming abnormally (e.g., laying on their sides or backs, only to swim strongly away when touched), and a number of dead steelhead were also reported. Subsequent laboratory analyses determined that these steelhead were suffering from low thiamine (vitamin B) levels. Low thiamine levels in Great Lakes fish predators, such as trout and salmon, have been linked to diets dominated by alewife. Alewife are known to produce the enzyme thiaminase, which destroys thiamine, although factors that influence thiaminase production remain unknown. New York State Department of Environmental Conservation (DEC) Salmon River Hatchery staff have historically observed mortality of newly hatched trout and salmon fry due to thiamine deficiency, and began treating salmon eggs with thiamine in the 1990s. This is the first known instance of thiamine deficiency causing mortality in adult Lake Ontario trout and salmon (salmonids), and the DEC is continuing its investigations with the assistance of experts from academia and other agencies. There were no documented instances of thiamine related steelhead mortality in 2015.

Maintaining balance between predators and prey, primarily salmonids (predominately Chinook salmon) and alewife, remains a substantive challenge in the face of lower trophic level disturbances and ongoing ecosystem changes. Although a very strong year class of alewife was produced in 2012, it did not contribute to the adult alewife population at age 2 in 2014 as anticipated. Two consecutive severe winters (2013/2014 and 2014/2015) followed by below average summer water temperatures resulted in very small 2013 and 2014 (record low) alewife year classes, which will result in a markedly reduced adult alewife population in 2016. These changes and potential outcomes are at the forefront of fisheries managers' concerns. This report summarizes cooperative research and monitoring activities conducted on Lake Ontario and the St. Lawrence River by the DEC, U.S. Geological Survey, Ontario Ministry of Natural Resources and Forestry, U.S. Fish and Wildlife Service, Fisheries and Oceans Canada, SUNY College of Environmental Science and Forestry and Cornell University in 2015.

►►Prey Fish Assessments

Each year Lake Ontario preyfish populations (primarily alewife, smelt, and sculpins) are assessed with bottom trawls (Section 12a and 12b) and hydroacoustics (sonar; Section 15).

In spring 2015 bottom trawl surveys, abundance of adult (age-2 and older) alewife increased slightly from 2014 levels, and adult abundance has been fairly stable for five consecutive years. For a second consecutive year, abundance of yearling (age-1) alewife was very low and the lowest observed in the 39-year time series. Severe winter conditions (winters of 2013/2014 and 2014/2015) and below average summer temperatures (2014 and 2015) likely adversely affected reproduction and survival of young alewife in 2014-2015.

In recent years, the relative body condition or "plumpness" of alewife was high during both spring and fall. Alewife body condition increased from 2014 and was similar to the relatively high values observed during 2003-2013 (Section 12a). In 2015, the abundance index for age-1 and older rainbow smelt increased relative to 2014 and was 60% of the previous 10-year average (Section 12a).

A significant Lake Ontario milestone occurred in May 2015 when a juvenile Bloater was captured during the spring bottom trawl survey at 95m (312 ft) near Oswego, NY. Bloater, a native deepwater prey fish, have not been captured in Lake Ontario survey since 1983. Stocking of bloater began in November 2012 (Section 1) as part of an international, collaborative coregonid restoration effort.

In 2015, the benthic prey fish bottom trawl survey was expanded to include north shore waters in Ontario. Effort increased from 55 bottom trawl sites to 135 trawl sites at depths from 8 – 225 m (26 – 738 ft). Expanded sampling revealed significantly higher densities of deepwater sculpin than previously detected. Although round goby and slimy sculpin density estimates did not appreciably change with expanded sampling, confidence in lakewide estimates greatly improved as did the representation of nearshore benthic fish community diversity (Section 12b).

Benthic prey fish surveys showed slimy sculpin abundance in 2015 was similar to 2014 and both values are among the lowest observed across the lake's 38-year time series, but deepwater sculpin increased substantially. Round goby abundance increased but was within the range of recent values (Section 12b).

The 2015 hydroacoustic survey of Lake Ontario preyfish populations consisted of the typical five cross-lake transects and an Eastern Basin transect. Estimated yearling and older alewife abundance declined by 45% in 2015. Ongoing research comparing hydroacoustic data collected with a hull-mounted transducer pointing downward (traditional approach; "downlooking") and a transducer at depth pointing upward (new approach; "uplooking") revealed substantial numbers of alewife at or near the surface on some nights. These fish were not previously detectable with "downlooking" hydroacoustics. In addition, three techniques for analyzing hydroacoustic data are under review. All three methods indicate a similar decline in alewife abundance in 2015. The rainbow smelt abundance estimate increased 87% relative to the record low observed in 2014 (Section 15).

►►Coldwater Fisheries Management

Fish stocking in the New York waters of Lake Ontario in 2015 included 1.76 million Chinook salmon, 230,760 coho salmon, 607,280 rainbow trout, 975,425 lake trout (520,860 yearling; and 454,565 experimental fall fingerlings), 449,160 brown trout, 152,502 Atlantic salmon, 61,617 bloater, and 100,311 cisco or lake herring. Of these, 76,020 brown trout and 115,460 lake trout were stocked offshore by military landing craft in an ongoing effort to reduce predation on newly stocked fish by double-crested cormorants and predatory fish (Section 1).

Average weights and condition (a measure of "stoutness") of salmonids at a given age serve as a potential index of relative balance between the number of predators (primarily salmonids) and preyfish; however, water temperatures also influence fish growth and condition. Average weights and condition are calculated for salmonids examined from the open lake fishery (Section 2) and as spawning adults at the Salmon River Hatchery (Section 9).

Chinook salmon growth was good to excellent in recent years, however, was below average in 2014 and 2015. The August 2015 mean length (35.9 in) of age-3 Chinook salmon from the open lake boat fishery was 0.9 in shorter than the long term average. Chinook salmon condition or relative "stoutness" in 2015 was within the range of values observed for previous years for all lengths evaluated and was above average for the three longest lengths evaluated. These results indicate that the recent long, cold winters (2013-2014 and 2014-2015) followed by below average summer temperatures may have negatively impacted growth in length, however, the good condition of Chinook salmon >28 inches indicated that alewife (the primary forage of Chinook salmon) abundance was sufficient to maintain Chinook condition (Section 2).

At the Salmon River Hatchery, average weight of age-1 Chinook males (jacks) sampled in 2015 was 3.8 pounds, the second lowest value recorded. Age-2 males (12.3 lbs) were 1.1 pounds below average and age-2 females (12.8 lbs) were 1.9 pounds below average. Age-3 males (15.0 lbs) were nearly 4.0 pounds below average weight and age-3 females

(16.7 lbs) were 3.1 pounds below the long-term average (Section 9).

Chinook salmon condition (based on the predicted weight of a 36 inch long Chinook salmon) in fall 2015 was slightly above the historical average and nearly identical to the previous three years (Section 9).

Steelhead are sampled in the spring and, unlike Chinook and coho salmon, do not reflect growth during the 2015 growing season. Weights reported here reflect conditions prior to and including 2014. The mean weights of age-3 males and females were 5.3 and 6.8 lbs, respectively, which were both 0.25 lbs more than their respective long-term averages. The mean weights of age-4 males and females were 7.0 lbs and 8.8 lbs, respectively, with males 0.1 lbs and females 0.3 lbs lighter than their long-term averages (Section 9).

Since the institution of seasonal base flows in the Salmon River in 1996, natural reproduction of Chinook salmon continues to be documented by an annual seining index conducted weekly during May and June at four sites. In 2015, the mean peak catch of 608 young of the year Chinook per haul was over double the 2001-2014 average of 283, and was the second highest mean peak catch observed (Section 8).

The eighteenth year of pen-rearing steelhead and Chinook salmon along the New York shoreline of Lake Ontario was successful due to low fish mortality and a substantial percentage of the Chinook salmon reaching target weights. A total of 39,600 Washington strain steelhead were raised at seven pen sites, comprising 11.2% of DEC's Lake Ontario yearling steelhead stocking allotment in 2015. Seven pen-rearing sites raised a total of 450,580 Chinook salmon, representing 25.6% of DEC's 2015 Chinook salmon stocking allotment (Sections 1 and 10).

In 2008, the DEC purchased an automated fish marking trailer (AutoFish) capable of adipose clipping and/or applying coded wire tags (CWTs) to salmon and trout automatically at a high rate of speed and accuracy. From 2008-2011, DEC and the Ontario Ministry of Natural Resources and Forestry "mass-marked" all stocked Chinook salmon with an adipose fin clip in Lake Ontario to determine the relative contributions of wild and hatchery stocked Chinook salmon to the fishery. To evaluate the relative performance of pen-reared and traditional, shore-stocked Chinook salmon, DEC marked sub-samples of Chinooks stocked at pen-rearing sites with CWTs in 2010, 2011, and 2013 (Section 3).

For the four year classes studied to determine the relative contribution of wild Chinook to the fishery (2008-2011 year classes), percentages of wild Chinook salmon in Lake Ontario varied by year class, age, and among regions from 2009-2015, but overall wild Chinook were an important component of the fishery averaging 47% of the age 2-and age-3 lake harvest. The percentages of wild Chinook salmon in New York tributaries also varied among regions from 2009-2015 with percentages of age 2-3 wild salmon averaging 7.5% in western region tributaries, 18% in eastern region tributaries, and 58% in the Salmon River.

Returns of Chinook salmon to the Salmon River Fish Hatchery from 2008-2010 year classes suggest a high degree of homing by fish stocked at the Salmon River and a low degree of straying from other stocking sites with estimated average straying rates of 12.4%, 8.4%, and 10.9%, respectively.

Preliminary results from the 2010 and 2011 year classes indicate that pen stocking at eight sites provided an average of 1.9 and 2.4 greater contribution, respectively, to the lake fishery per number stocked than direct stocking. The 2013 year class remains under study, and final results will be reported in spring 2017. Chinook salmon stocked at the Salmon River in 2010 provided about 2.1 greater contribution to the lake fishery per number stocked than their direct stocked counterparts. Results showed that the majority of fish returning to tributary stocking sites were stocked at those sites indicating good imprinting of both pen and direct stocked Chinook salmon.

►►Lake Trout Restoration

Restoration of a naturally reproducing population of lake trout is the focus of a major international effort in Lake Ontario. Each year several surveys measure progress toward lake trout rehabilitation (Section 5). Adult lake trout abundance in index gill nets increased each year from 2008-2014, recovering from historic lows recorded during 2005-2007. Adult abundance in 2015 declined by 18% from 2014.

The sea lamprey wounding rate on lake trout caught in gill nets was 1.94 fresh (A1) wounds per 100 lake trout, below the target of 2.0 wounds per 100 lake trout. The survival indices at age 2 for lake trout stocked in 2014 (2013 year class) declined by 32% from the relatively high values observed for the 2010 and 2012 year classes. Naturally produced lake trout were produced in 21 years since 1994. The largest catches of naturally produced lake trout occurred in 2014 and 2015.

Adult lake trout condition has generally remained at a high level during 2007-2015, but has exhibited a downward trend since 2011. Condition of juvenile lake trout in 2015 was among the lowest values recorded for the 1979-2015 time series.

In 2015, angler catch (52,294 fish) and harvest (18,780 fish) were more than 2-fold higher than their respective previous 10-year averages, and were more than nine times higher than the lows observed in 2007. Charter catch rate (0.05 lake trout per angler hour) was similar to the long term average (Section 2).

►►Status of Sea Lamprey Control

The sea lamprey is a destructive invasive species in the Great Lakes that contributed to the collapse of lake trout and other native species in the mid-20th century and continues to affect efforts to restore and rehabilitate the fish-community. Sea lampreys attach to large bodied fish and extract blood and body fluids. It is estimated that about half of sea lamprey attacks result in the death of their prey and an estimated 18 kg (40 lbs) of fish are killed by every sea lamprey that reaches adulthood. The Sea Lamprey Control Program is a critical component of Great Lakes fisheries management, facilitating the rehabilitation of important fish stocks by significantly reducing sea lamprey-induced mortality (Section 11).

In 2015, 19 Lake Ontario tributaries (ten Canada, nine NY) were treated with lampricides. Treatments in New York included Black River, Altmar Creek, Snake Creek, Catfish Creek, Owasco Outlet, Eightmile Creek, Sterling Creek, Red Creek, and Sodus Creek. A total of 4,184 sea lampreys were trapped in eight tributaries, five of which are index locations. The estimated population of adult sea lampreys was 10,298, which was less than the fish community objective target of 11,368.

Larval assessments were conducted on a total of 96 tributaries (65 Canada, 31 NY). Surveys to estimate abundance of larval sea lampreys were conducted in seven tributaries (five Canada, two NY). Surveys to detect the presence of new larval sea lamprey populations were conducted in 67 tributaries (50 Canada, 17 NY).

In 2015, two tributaries to the Credit River system were found to be infested for the first time. Multiple age classes including larval and juvenile life stages were found and are scheduled for treatment during 2016. Altmar Creek, a previously uninfested tributary to New York's Salmon River, was found to contain multiple age classes, including juvenile sea lampreys. A report of adult sea lampreys spawning in the Owasco Lake Outlet (Oswego River System) led to the discovery of multiple age classes, including juveniles, in the river.

Post-treatment assessments were conducted in 16 tributaries (ten Canada, six NY) to determine the effectiveness of lampricide treatments conducted during 2014 and 2015. Surveys to evaluate barrier effectiveness were conducted in eight tributaries (six Canada, two U.S.).
The rate of wounding by sea lamprey on lake trout caught in gill nets was 1.94 fresh (A1) wounds per 100 lake trout was below the target of 2 wounds per 100 lake trout (Section 5). There were an estimated 15.4 lamprey observed per 1,000 trout or salmon caught by anglers, the second lowest estimated since 2002, however, still about 2.6-fold higher than the 1986-1995 average rate (Section 2).

►►Warmwater Fisheries

A total of 69,600 fingerling walleye were stocked in the lower Niagara River (23,200), Irondequoit Bay (36,000), and Port Bay (10,400) (Section 1). The Eastern Basin warmwater index gill netting survey is conducted annually to assess relative abundance and population characteristics of warm and coolwater fish species. Total catch-perunit- effort (CPUE or relative abundance) of all species in 2015 was 14.9 fish/gill net, a 51.7% decrease compared to the 2010-2014 (previous five year) average. Cooler summer water temperatures in 2014 and 2015 may have influenced fish distribution and abundance in assessment nets. White perch (24.7%) and smallmouth bass (29.2%) were the most commonly caught species (Section 4).

►Smallmouth bass

Smallmouth bass abundance was 4.4 fish/net, the lowest catch since 2004 and comparable to (+3.4%) 2000-2004 when abundance was at the lowest levels recorded. Historically, the Eastern Basin smallmouth bass population periodically experienced years of strong natural reproduction, and these individual "year classes" often sustained the population and sportfisheries for many years. For example, fish resulting from strong natural reproduction in 1983 (1983 year class) were still contributing strongly to the sportfishery in 1998 as age 15 fish. In spite of conditions favoring strong reproduction in recent years, data indicate that the Eastern Basin smallmouth bass population is no longer producing strong year classes.

►Walleye

Walleye CPUE has remained relatively stable for several years, but decreased 46.8% compared to the 2010-2014 average. Strong year classes produced in 2003, 2005 and 2008 remained well represented in 2015 catches. Catches of age-4 walleye indicate that a strong 2011 year class was produced in both the Bay of Quinte and NY waters of the Eastern Basin.

►Yellow Perch

Following six years of improved yellow perch catches (2008-2013), yellow perch CPUE declined in 2014 (1.7 fish/net) and 2015 (0.8 fish/net) to the lowest levels observed. This decrease may be partly attributable to water temperature patterns and catch variability; however, angler reports also suggested lower yellow perch abundance during both years.

►White Perch

In 2008, Eastern Basin white perch abundance reached its highest level since 1991 and was the third most commonly caught species 2008-2013. In 2015, white perch CPUE (3.7) was similar to 2008, but a 27.1% decrease compared to the previous five year average.

►Round gobies

Round gobies first appeared in this assessment in 2005 in both gillnet catches and smallmouth bass diets. In 2015, 71.7% of the 120 non-empty bass stomachs contained goby. Gobies were present in walleye diets each year from 2006-2010 and 2012-2015, and have been found in northern pike, brown trout, lake trout, and lake whitefish.

At least one lake sturgeon was collected in the Eastern Basin in 15 of the last 21 years, suggesting improved population status.

Similar to the Eastern Basin index gill netting survey, surveys are conducted annually on the St. Lawrence River to assess warm and coolwater fish populations in the Thousand Islands and Lake St. Lawrence (Sections 6 and 7, respectively). Cooler summer water temperatures in 2014 and 2015 may have influenced fish distribution and abundance in assessment nets.

Thousand Islands smallmouth bass abundance increased from low 1996-2006 levels, and has varied at relatively high levels from 2007 to 2012. Catch in 2012 reached its highest level since 1988, but declined to a near record low by 2015. Yellow perch abundance increased substantially in 2006, remained high in 2007 and 2008, and then declined. Perch abundance fell to a record low level in 2012, and has remained low since. From 1996 to 2015, northern pike abundance has remained relatively low. Ongoing poor recruitment of northern pike is likely related to spawning habitat limited by water level regulation, and possibly by Double-crested Cormorant predation (Section 6).

Lake St. Lawrence yellow perch abundance was variable at a higher level from 2007-2015 as compared to most years during the 1990s and 2000s. Abundance declined 52% from 2012 to 2013 and has been relatively stable since then with numbers near the long-term average. Smallmouth bass catch has been variable since 2005, reached its second highest level in 2013, and was at the long-term average in 2015. The 2011 year class continues to be well represented for the third year. Walleye abundance fell to its lowest level since 2004, and below the long-term average for the first time in seven years (Section 7).

Abundance of spawning adult and young-of-the-year (YOY) northern pike in the Thousand Islands region of the St. Lawrence River continues to be suppressed likely due to habitat degradation resulting from long-term management of Lake Ontario/St. Lawrence River water levels. Overall, natural reproduction at natural and managed spawning marshes remains poor, due to low abundance of spawning adults and sex ratio dominance of females. Habitat restoration efforts including excavated channels and spawning pools has shown success for natural reproduction of YOY at many sites. Monitoring of outmigration of YOY at enhancement sites further indicates a strong linkage between higher spring water levels and spawning success (Section 22).

Muskellunge population indices in the Thousand Islands region of the St. Lawrence River continue to show signs of stress. Spring trap net surveys, summer seining surveys and an angler diary index all indicate reduced adult and YOY abundance. It is plausible that adult muskellunge mortality events attributed to outbreaks of the invasive Viral Hemorrhagic Septicemia virus are contributing to lower adult muskellunge numbers and reduced natural reproduction. (Section 19).

Targeted gill net sampling for lake sturgeon in Lake Ontario, Black River Bay, and the St. Lawrence River in 2015 produced a total catch of 169 fish. Passive integrated transponder (PIT) tags, which allow for future identification of individual fish, were implanted in 145 fish to monitor fish growth, movements, and to manage brood stock genetics in restoration stocking efforts. Twenty-three previously tagged sturgeon were re-captured in 2015. To date four sturgeon have been identified that have either passed through the Moses-Saunders Dam or through the St. Lawrence Seaway Eisenhower and Snell locks to be recaptured at the South Channel sturgeon egg take location (Section 18).

In an effort to gather baseline data on warm and cool water fishes, an electrofishing survey of the lower Niagara River was conducted during the summer of 2015 to assess the warm water fish community, and evaluate the effectiveness of electrofishing as a method for warm water fisheries surveys in the lower Niagara River. Twenty species were captured, the most abundant species were alewife and smallmouth bass. Walleye, American eel, and four species of suckers were also captured. Average catch rate of smallmouth bass was 76.4 fish per hour (SD = 43.3), one of the highest catch rates ever recorded in New York. Smallmouth bass condition as measured by relative weight averaged 96.5, higher than the statewide average of 90.0. Average catch rate of American eel was 3.1 (SD = 2.8) fish per hour, higher than a 2002 targeted survey conducted in the lower Niagara River (catch rate of 1.1 fish per hour), and likely attributed to experimental stockings of glass eels into Ontario waters of Lake Ontario and the St. Lawrence River between 2006 and 2010 (Section 21).

A seining sampling program was conducted in the Thousand Island (Chippewa Bay) and Lake St. Lawrence portions of the St. Lawrence River from 2002-2015. The Thousand Island area tends to be dominated by yellow perch and cyprinids whereas Lake St. Lawrence is dominated by centrarchids and round goby. Esocids are generally caught in higher numbers in Lake St. Lawrence although they represent a small proportion of the catch. Differences in fish species abundance between the two areas surveyed are most likely attributable to habitat differences (Section 17).

►►Sport Fishery Assessment

Each year from 1985-2015 the DEC surveyed boats operating in New York waters of Lake Ontario's main basin. The data collected from boat counts and interviews of fishing boats are used for management of the salmonid fishery and provide valuable information on other fish species (Section 2).

Fishing quality during 2015 was likely impacted by colder than average water temperatures and atypical weather patterns. During 2015, there were periods and locations of both excellent and poor fishing quality (measured as catch rate, i.e., number of fish caught per hour of angling). The four most sought after species were Chinook salmon, brown trout, rainbow trout, and coho salmon. The 2015 charter boat catch per angler hour for these four species combined (charter catch per angler hour=0.12) was the lowest recorded since 2002, a 16.2% decrease compared to the long-term average, and a 37.2% decrease compared to the record levels observed 2003-2014. Total trout and salmon catch (154,411 fish) and harvest (77,887 fish) were dominated by Chinook salmon (38.1% and 44.9%, respectively), lake trout (33.9% and 24.1%, respectively), brown trout (13.5% and 16.2%, respectively), and rainbow trout (11.3% and 11.8%, respectively).

The thirteen highest Chinook salmon catch rates among charter boats occurred during 2003-2015. Fishing quality in 2015 (0.07 fish/hour) was the lowest estimated during this time period and a 25.6% decrease compared to the 2003-2015 mean. Charter boat catch rate of coho salmon (0.004 fish/hour) was well below the long-term average (-56.8%).

Each year from 2008-2014 rainbow trout catch rates were among the highest recorded. In 2015, charter boats caught 0.02 rainbow trout per angler hour, the lowest level since 2005 and a 38.9% decrease compared to the long term average.

The charter boat catch rate for brown trout in 2015 was 0.03 fish/hour, the lowest recorded since 2008 and 27.2% below the long-term average.

During 2015, the charter boat catch rate of lake trout was 0.06 fish/hour, 43.8% increase compared to the long term average.

In 2015, total estimated fishing effort was 53,154 fishing boat trips (980,409 angler hours), among the lowest observed**.** Effort targeting trout and salmon remained relatively stable for more than a decade but was the second lowest on record in 2015. An estimated 46,142 boat trips targeted trout and salmon in 2015 (87% of fishing boat trips), which was an 11.1% decrease compared to the previous 10-year average.

Smallmouth bass was the most commonly caught species in the survey each year 1985-2006. In 2015, smallmouth bass was the sixth most commonly caught species.

An estimated 4,868 fishing boat trips targeted smallmouth bass during the 2015 traditional open season (3rd Saturday in June through September 30 when the creel survey ends), a 29.2% decrease from 2014 and the second lowest observed. Bass catch rates were relatively stable from 1985 through the early 1990s (mean=1.0 bass per angler hour), increased to the highest level in 2002 (2.0 bass per angler hour), then declined to record low levels. Smallmouth bass catch rate per angler hour in 2015 was 0.5, a 42.3% increase compared the 2010 record low and comparable to (-0.2%) the previous 5-year average. Several factors may have contributed to poor fishing quality, including expansion of round goby populations and possible smallmouth bass mortality from Viral Hemorrhagic Septicemia virus.

A NYSDEC angler survey was conducted on 21 major tributaries from September through November 2015 (Section 14). The total estimated effort for 21 tributaries was 763,357 angler hours and 191,331 trips. The Salmon River accounted for 588,498 angler hours (77% of total) and 101,465 angler trips (53% of total). Five other tributaries accounted for at least 10,000 estimated angler hours each: Eighteenmile Creek and Niagara River in Niagara County, Genesee River in Monroe County, South Sandy Creek in Jefferson County, and Oak Orchard Creek in Orleans County.

Sixteen of 21 tributaries surveyed had reported catches of Chinook salmon. The total estimated catch and harvest of Chinook salmon in 2015 was 43,589 and 26,045, respectively. The 2015 catch of Chinooks declined drastically from the three previous survey (fall 2005, 2006, and 2011) estimates that ranged from 125,180 to 155,960 fish caught.

Coho salmon were a small component of the 2015 tributary fishery, with an estimated 6,061 fish caught in nine of the 21 tributaries surveyed. Coho catches varied considerably in previous surveys, ranging from 5,804 in 2006 to 30,676 in 2011. The Salmon River accounted for 95% of the catch (5,738) and 89% of the harvest (2,307).

Eleven of the 21 tributaries surveyed had reported catches of steelhead with the total estimated catch and harvest of 17,223 and 2,623 fish, respectively. The Salmon River had the highest estimated catch (11,334 or 66% of total) and harvest (1,401 or 53% of total). The release rate for steelhead was 88% on the Salmon River and 85% for all tributaries combined.

Ten of the 21 waters surveyed had reported catches of brown trout. The total estimated brown trout catch and harvest were 13,650 and 3,441 respectively. The estimated catches from the previous three comprehensive fall surveys ranged from 27,419 in 2006 to 40,192 in 2005.

►►Double-crested Cormorant Management and Impacts on Sportfish Populations

Cormorant population management, along with a major cormorant diet shift to round goby, has essentially met objectives related to cormorant predation for protecting fish populations, other colonial waterbird species, private property and other ecological values (Section 13).

For the 17th consecutive year, cormorant population control was continued through oiling of eggs with food grade vegetable oil at the Little Galloo Island colony. No culling of adult birds was necessary in 2015. Nest destruction was employed to discourage nesting on Gull Island (n=769), but was not necessary on Calf and Bass Islands.

After dropping below target for the first time in 2010, the number of cormorant feeding days rebounded to 999,000 in 2011. In 2015, cormorant feeding days at the Little Galloo Island colony were estimated at 827,800, 6% above the target of 780,000. Feeding days have been within 12% of target since 2012.

Despite continued cormorant management and reduced consumption of yellow perch and smallmouth bass, abundance indices for these species declined in 2014 and remained low in 2015 indicating additional factors are currently affecting those populations (Section 4). ✧

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