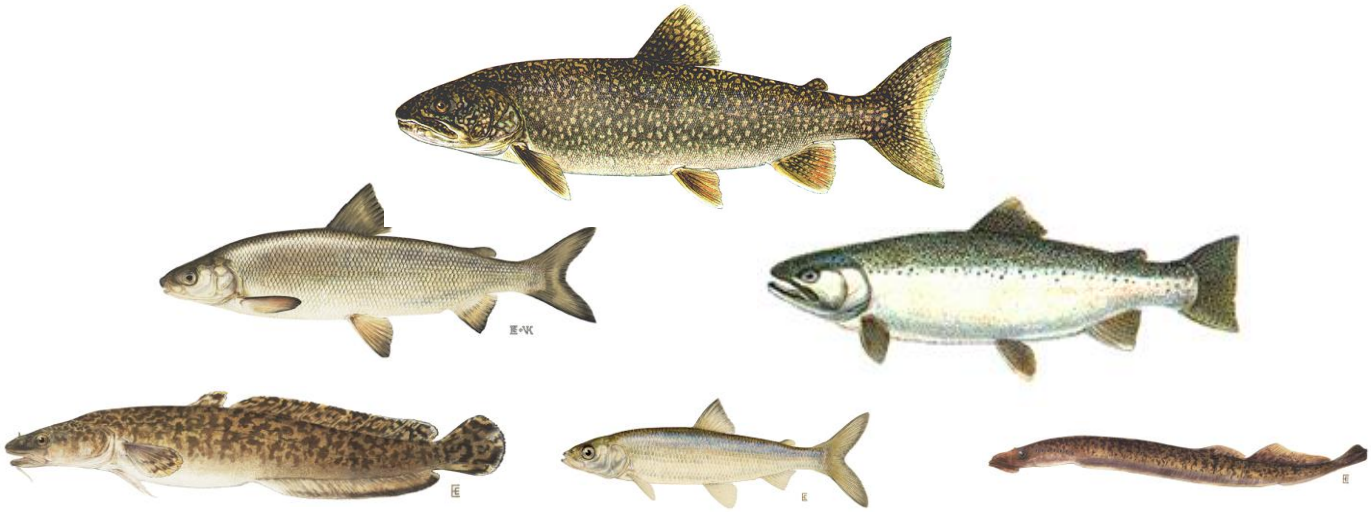
2021 REPORT OF THE LAKE ERIE COLDWATER TASK GROUP

March 2022

Presented to:
Standing Technical Committee
Lake Erie Committee
Great Lakes Fishery Commission



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MARCH 2022

Lake Erie Committee

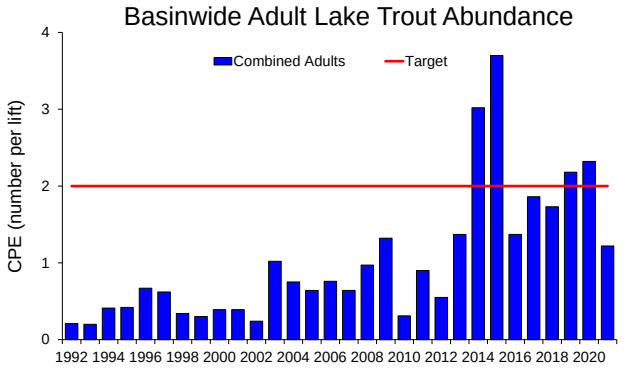
REPRESENTING THE FISHERY MANAGEMENT AGENCIES OF LAKE ERIE AND LAKE ST. CLAIR

Introduction

This year's Lake Erie Committee (LEC) Coldwater Task Group (CWTG) has produced an Executive Summary Report encapsulating information from the CWTG annual report. Four charges were addressed by the CWTG during 2021-2022: (1) Report on the status of the cold-water fish community, (2) Participation in the Integrated Management of Sea Lamprey Process on Lake Erie, outline and prescribe the needs of the Lake Erie Sea Lamprey management program. (3) Maintenance of an electronic database of Lake Erie salmonid stocking information, (4) Finalize the Lake Trout Rehabilitation Plan, within the scope of the new FCO's for LEC approval by March 14, 2021. The complete report is available from the Great Lakes Fishery Commission's Lake Erie Committee website at http://www.glfc.org/lake-erie-committee.php, or upon request from an LEC or CWTG representative.

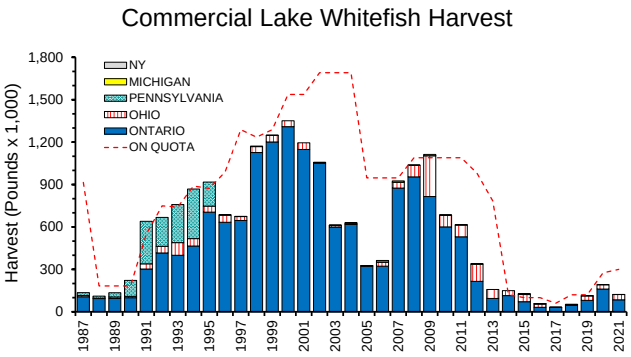
Lake Trout

A total of 217 Lake Trout were collected in the Coldwater Assessment Survey in 2021. Adult (age 5+) abundance declined to 1.2 fish per lift, below the target of 2.0 adults described in the 2021 Lake Management Plan. No management plan actions were triggered since three-year average was at 1.9 adults per lift (at target). There were 25 age classes and five strains captured in 2021. Lake Trout ages 5,6,9 and 11 were the dominate cohorts; Lake Trout older than age-10 continue to increase in abundance and comprised 35% of the total catch. Finger Lakes and Lake Champlain strains comprise the majority of the population. The Partnership Survey caught 56 Lake Trout in 2021. The Partnership index of 0.92 fish/lift increased from 2020 (0.55 fish/lift) and remained above the time series mean (0.45 fish/lift).



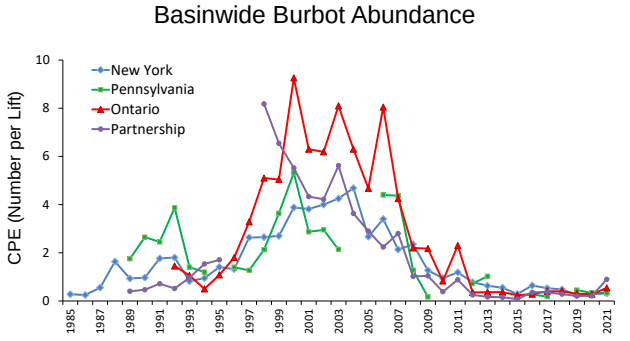
Lake Whitefish

Lake Whitefish harvest in 2021 was 121,863 pounds, distributed between Ontario (69%), Ohio (31%) and New York (<1%). Harvest decreased 36% from 2020 and remains low compared to previous decades. Gill net fishery age composition ranged from ages 2 to 19. The 2015-year class (age 6) represented the majority of Lake Whitefish harvested in 2021. Gill net surveys caught Lake Whitefish from ages 1 to 19. Bottom trawl and gill net surveys forecast modest recruitment of age 3 Lake Whitefish from the 2019 cohort in 2022. Future contributions to fisheries from the 2020 and 2021 cohorts are expected to be less. Declines in Lake Whitefish abundance are apparent, with status that may vary regionally among stocks yet to be defined.



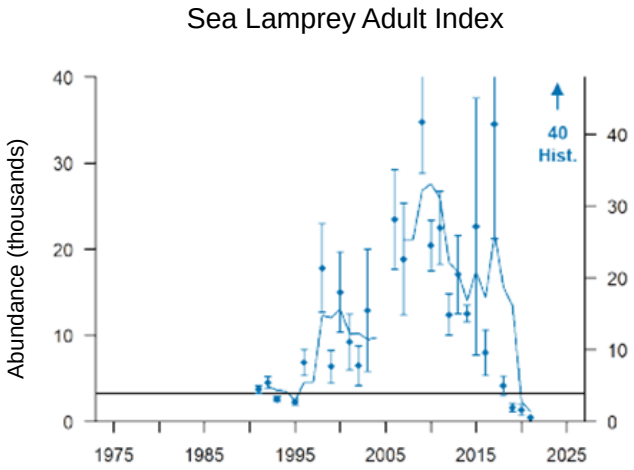
Burbot

Total commercial harvest of Burbot in Lake Erie in 2021 was 1,755 pounds. All was incidental. Burbot abundance and biomass indices from annual Coldwater and Ontario Partnership Gillnet Assessment Surveys remained at low levels, continuing a downward trend since the early-2000s. The Burbot catch rate in the Interagency Coldwater Assessment Survey averaged 0.44 fish/lift and in the Ontario Partnership Assessment Survey averaged 0.9 fish/lift. Burbot in the Coldwater Assessment Survey ranged in age from 0 to 19 and mean age was 7.3 years. Round Goby was the dominant prey item in Burbot diets.



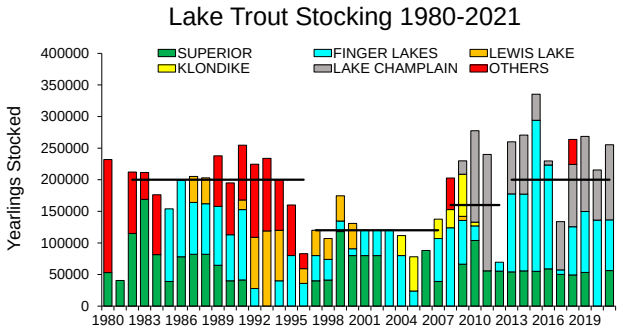
Sea Lamprey

The A1-A3 wounding rate on Lake Trout over 532 mm was 3.4 wounds per 100 fish in 2021. This was below the target rate of 5.0 wounds per 100 fish for the second time in the previous 26 years. Large Lake Trout over 736 mm continue to be the preferred targets for Sea Lamprey in Lake Erie. The Index of Adult Sea Lamprey Abundance (450) represents a substantial decrease compared to recent years and was below the target population of 3,300 for the third consecutive year. Lampricide treatments were completed in Big Creek and Big Otter Creek. Larval Assessments were conducted in 31 tributaries (12 Canada, 19 U.S.). Eight tributaries were surveyed for new larval populations (6 Canada, 2 U.S.). No new populations were detected.



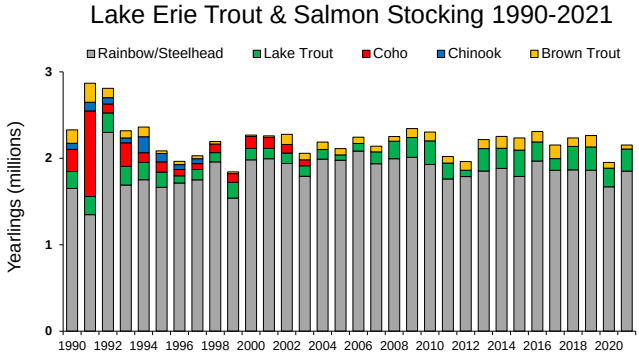
Lake Erie Salmonid Stocking

A total of 2,153,745 yearling salmonids were stocked in Lake Erie in 2021, which was slightly below the long-term average (1990-2020). Lake Trout stocking was above targets for the seventh time in the past eight years, and three different strains were stocked in 2021. By species, there were 255,338 yearling Lake Trout stocked in the east and central basins of Lake Erie, 46,607 Brown Trout stocked in Pennsylvania waters, and 1,851,800 Rainbow/Steelhead Trout stocked across all four US jurisdictional waters.



Steelhead

The summary of steelhead stocking in Lake Erie by jurisdictional waters for 2021 is: Pennsylvania (1,091,197; 60%), Ohio (498,972; 27%), New York (194,569; 11%), and Ontario (67,062; 4%). No steelhead were stocked by Michigan. Total steelhead stocking in 2021 (1.851 million) was slightly above the long-term average. Annual stocking numbers have been consistently in the 1.7-2.0 million fish range since 1993. The summer open lake steelhead harvest was estimated at 22,231 steelhead across New York, Pennsylvania and Ohio and near the long-term average harvest of 22,010. Tributary angler surveys, representing the majority (>90%) of the targeted fishery effort for steelhead, found average catch rates of 0.56 fish/hour in 2017-18 in New York tributaries, which are among the highest in the country. Steelhead catch rates in the Partnership Survey (0.05 fish/lift) were low relative to the 23-year time series.



Charge 1: Coordinate annual standardized cold-water assessment among all eastern basin agencies and report upon the status of the cold-water fish community

Jim Markham (NYSDEC) and Tom MacDougal (OMNDMNRF)

East Basin Coldwater Assessment Program

Two fishery independent gill net surveys are conducted each year in the eastern basin of the lake during thermal stratification: the inter-agency August Coldwater Assessment (hereafter referred to as the "Coldwater Assessment Survey") in New York, Ontario, and Pennsylvania waters of the eastern basin, and the Ontario Partnership Index Fishing Program (hereafter referred to as the "Partnership Survey") in Ontario waters.

The Coldwater Assessment Survey was redesigned in 2020 to provide better coverage of east basin cold-water habitat, decrease the number of required samples, and maintain comparable metrics between survey methodologies. The previous approach (1986 -2019) utilized a stratified, random transect design for locating bottom set gill nets during the month of August. Briefly, 5 gangs of gill net were set, parallel to the depth contour, at successively deeper locations, starting at a location prescribed relative to the 10^{o} C isotherm. Details of the design and net configurations can be found in earlier versions of this report. This survey design resulted in over-sampling of the area directly adjacent to the 10^{o} C isotherm and a complete lack of sampling in offshore waters.

The new survey used an analysis of catch-per-effort (CPE) trends for Lake Trout, Burbot, and Lake Whitefish to justify reducing the number of standard set gill net gangs from five to two (details; CWTG 2020); CPE estimates generated using only catches from net #1 and net #3 were shown to be comparable to those generated from the complete set of 5, over the complete survey time series.

The new survey continues to occur during August each year following stratification, covers a similar sampling area, and employs the same gill net configuration previously used. A 2.5-minute grid system is used for random selection of netting locations as opposed to the transect approach. Net sites are divided into two groups – standard assessment nets and offshore assessment nets.

Standard assessment nets are set in grids located in similar areas to the previous assessment survey. Two net gangs in each randomly chosen standard assessment grid are set as follows: net #1 is located 8-10 ft. deeper than the 10^{o}C isotherm, and net #3 is located 10 ft deeper than this. If the depth and temperature criteria were to fall outside of the standard assessment grid (i.e., shallower, or deeper), then nets would be moved to the adjacent grid to the north or south following the previous protocols. The nets are set parallel to the shoreline but otherwise can be placed anywhere within the grid following the traditional protocol for temperature and depth.

Offshore assessment nets are set in randomly selected offshore grids. Nets in these areas are set within the selected grid in a direction consistent with the bottom contour. Targeted effort varies for each jurisdiction (NY: 16 standard, 16 offshore; PA: 12 standard, 12 offshore; ON East and ON West: 12 standard, 13 offshore each). Altogether, a total of 52 standard assessment nets and 54 offshore assessment nets are targeted for a complete survey each year. Sampling was conducted in all jurisdictions in 2021 (Figure 1). Sampling effort included 52 standard assessment nets and 48 offshore assessment nets (100 sets total).

For the purposes of comparing relative abundance (CPE) of Lake Trout, Burbot, and Lake Whitefish, over the complete Coldwater Assessment Survey time series, only data from standard assessment nets (nets #1 and #3) are used. Unless indicated, all other metrics use data from all collected fish regardless of sampling location. Biased sets due to temperature shifts or other issues were deleted from abundance index calculations but are otherwise used for age, growth, diet, and wounding statistics.

The Partnership Survey is a lake wide gill net survey of Canadian waters that has provided a spatially robust assessment of fish species abundance and distribution since 1989. The Partnership Survey uses suspended and bottom set gill nets. While most catches of cold-water species occur in eastern waters during thermal stratification in September (Figure 1), some information also comes from the Central Basin of the lake following turnover.

All sampled Lake Trout are examined for total length, weight, sex, maturity, fin clips, and wounds by Sea Lamprey. Snouts from each Lake Trout are retained, and coded-wire tags (CWT) are extracted in the laboratory to accurately determine age and genetic strain. Otoliths and genetic samples are also retained when the fish is not adipose fin-clipped or does not contain a CWT. Stomach content data, if examined, are usually collected as on-site enumeration or from preserved samples.

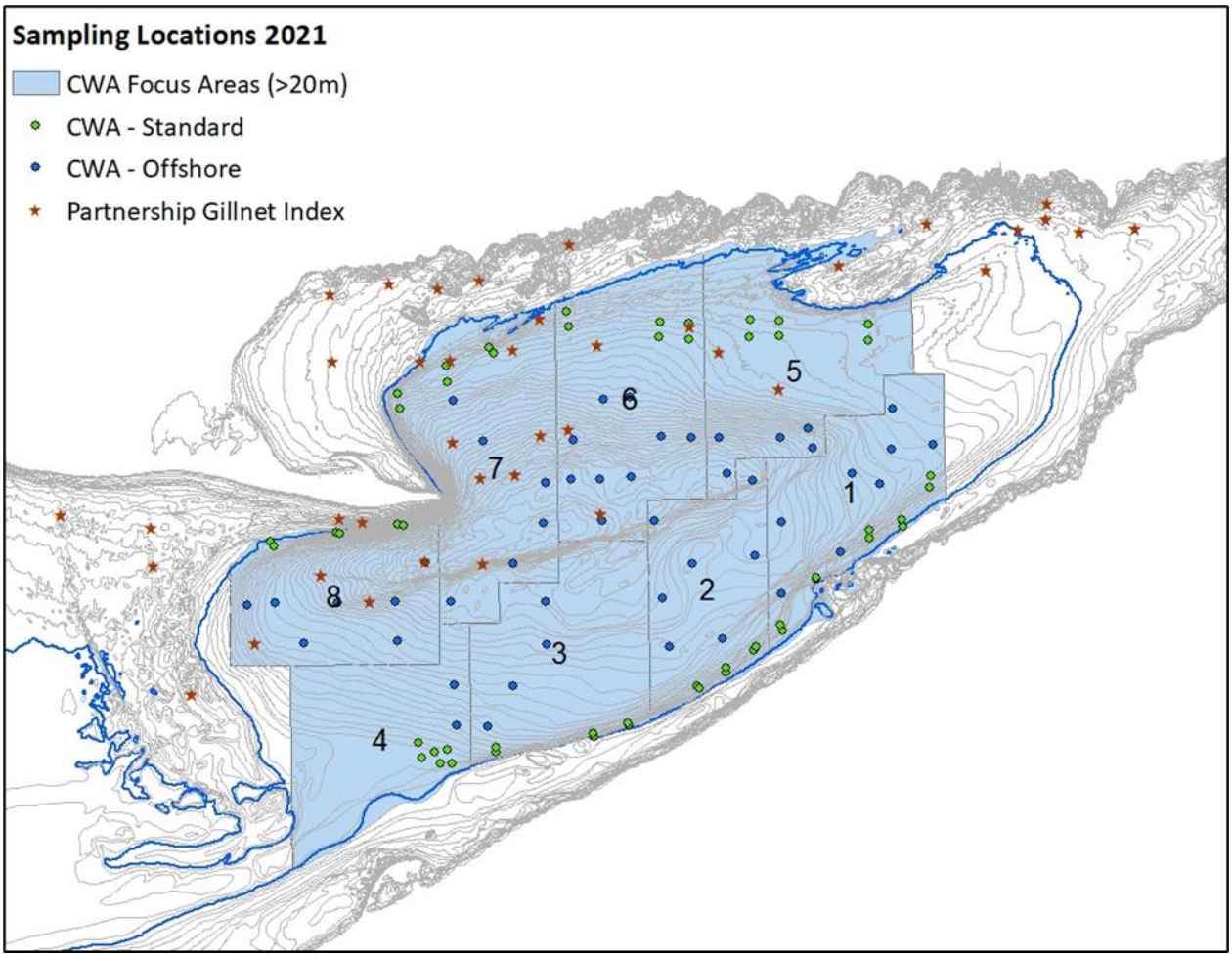


FIGURE 1. Locations of gill nets set for assessment of cold-water species during thermal stratification in the eastern basin of Lake Erie, 2021. Coldwater Assessment Survey sites are indicated with circles (green – standard sets; blue – offshore sets) within survey areas 1-8 (blue polygons bounded by the blue 20m depth contour. Partnership Assessment Survey sites are indicated with red stars.

1.1 Report on the status of the Lake Whitefish fishery.

Andy Cook (OMNDMNRF), Brian Schmidt (ODW), John Deller (ODW), and Megan Belore (OMNDMNRF)

Commercial Harvest

The total harvest of Lake Whitefish in Lake Erie during 2021 was 121,863 pounds (Figure 1.1.1). Ontario accounted for 69% of the lake-wide total, harvesting 84,489 pounds, followed by Ohio (31%; 37,360 pounds) and New York (<1%; 14 lbs). Lake Whitefish were not harvested in Pennsylvania or Michigan waters during 2021 (Figure 1.1.2). Total Lake Whitefish harvest in 2021 decreased 36% from 2020. Lake Whitefish harvest in Ontario declined 47% from 2020 whereas Ohio's harvest increased by 21% in 2021. Harvest was negligible in 2020 in Pennsylvania, Michigan, and New York but Whitefish harvest varied more in Pennsylvania and Michigan during prior years.

Ontario's harvest in 2021 represented 27% of the quota (300,000 pounds). Almost all (99%) of Ontario's 2021 Lake Whitefish harvest was from gill nets. The remaining harvest of 1,135 pounds was caught in trawls targeting Rainbow Smelt. The largest fraction of Ontario's Whitefish harvest (81%) was caught in the west basin (Ontario-Erie statistical district OE-1) followed by OE-2 (15%), with the remaining harvest distributed eastward among statistical districts OE-3 (2%), OE-4 (1%) and OE-5 (1%; Figure 1.1.2). Maximum harvest in Ontario waters during 2021 was distributed south of Pelee Island (Figure 1.1.2). Harvest in OE-1 from October to December represented 72% of Ontario's Lake Whitefish harvest. Peak harvests occurred in OE-1 during November (36,321 pounds) and December (22,320 pounds); with 11% of OE-1 harvest occurring from January to May. Central basin Lake Whitefish harvest (OE2, OE3) was comparable during the first (8,629 lbs) and second (5,871 lbs) halves of the year. Only 1781 pounds of Lake Whitefish were landed in eastern Lake Erie (OE-4 and OE-5) in 2021 with 64% of harvest from commercial trawls and the remaining 36% from gill nets. There was no reported effort targeting Lake Whitefish during 2021 in Ontario waters of Lake Erie. Lake-wide, Ontario's Lake Whitefish harvest came from fisheries targeting Walleye (86%), White Bass (8%), White Perch (4%), Yellow Perch (1%) and Rainbow Smelt (1%). An additional 276 pounds of Lake Whitefish were surrendered to MNRF that included Whitefish with acoustic tags and fish of unmarketable size.

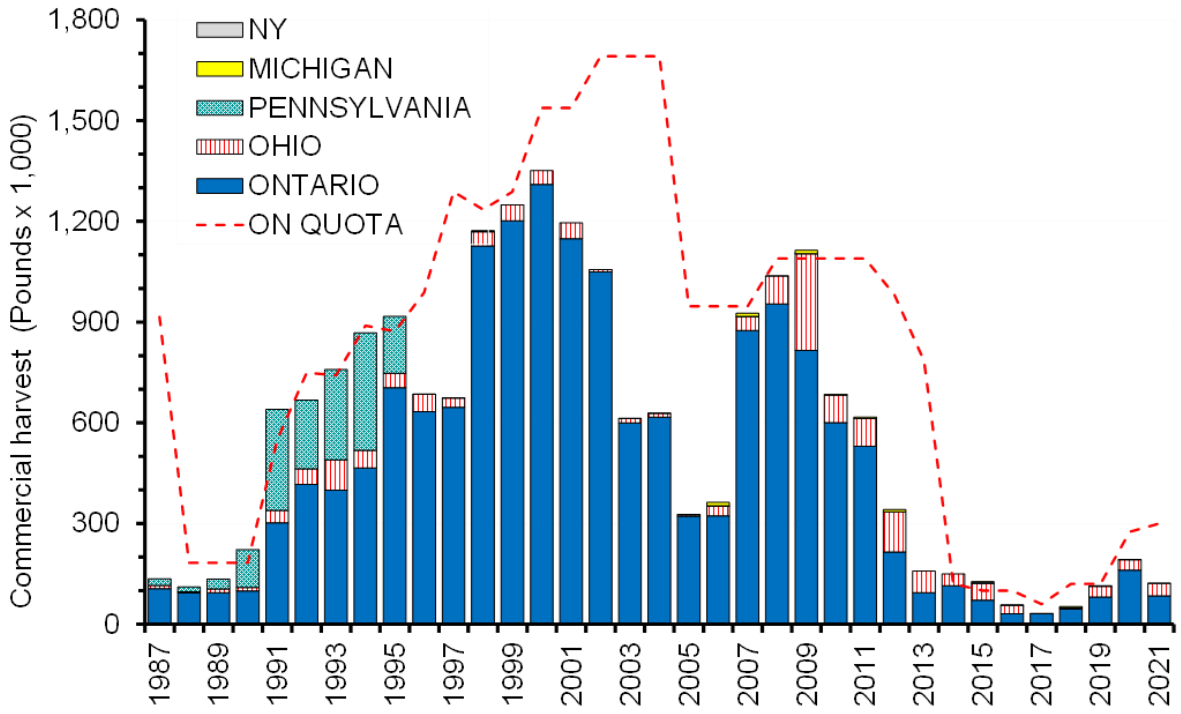


FIGURE 1.1.1. Lake Whitefish total harvest from 1987-2021 by jurisdiction in Lake Erie. Pennsylvania ceased gill netting in 1996. Ontario quota is presented as a dashed line.

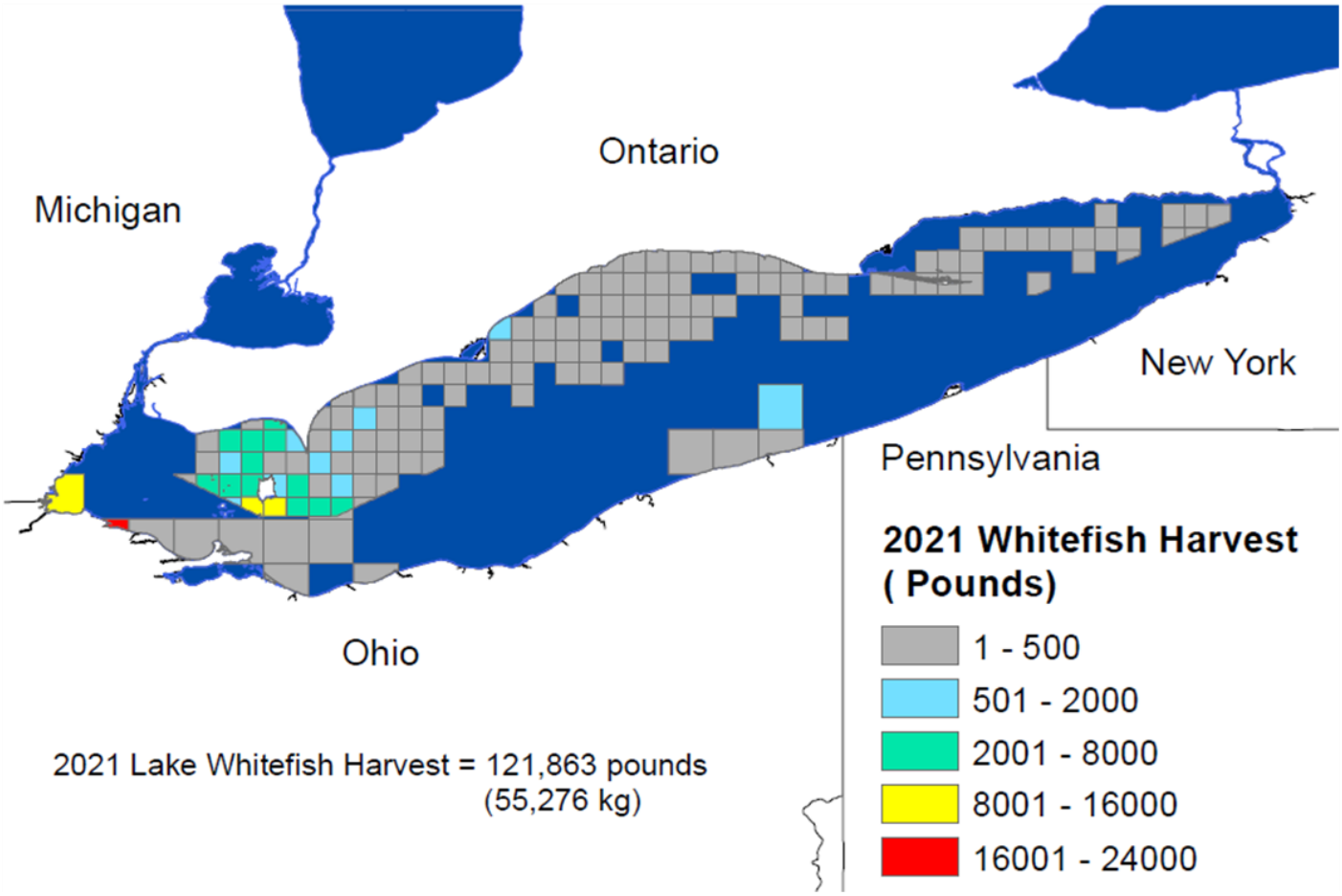


FIGURE 1.1.2. Commercial harvest of Lake Whitefish in Lake Erie during 2021 by 5-minute (Ontario) and 10-minute (U.S.) grids.

As there was no reported targeted gill net harvest or effort in 2021, Ontario annual lake-wide commercial catch rates are presented in three forms (Figure 1.1.3). Along with a time series of targeted catch rates (kg/km) lacking 2014-2021 data, catch rates are presented based on all large mesh (>=76 mm or 3") gill net effort (kg/km) and large mesh gill net effort with Lake Whitefish in the catch (kg/km; the latter excludes zero catches). Catch rates based on all large mesh effort and effort with Lake Whitefish in the catch during 2021 decreased by 53% and 37% from 2020, respectively. Harvest rate metrics in 2021 remained well below the time series averages (1998-2021).

Lake Whitefish harvest in Ohio waters during 2021 was exclusively from commercial trap nets. Ohio Lake Whitefish harvest in 2021 (37,360 pounds) was distributed among the west (O-1 97%) and central basin (O-2 <1%; O-3 %). Lake Whitefish were harvested from 946 trap net lifts (zero catches excluded) in 2021, with lifts distributed among District 1 (O-1) (65%), District 2 (O-2) (44%) and District 3 (O-3) (31%), respectively. Trap net harvest was greatest in November (86% or 32,221 lbs) followed by December (3,686 lbs or 10%) in O-1 and June (801 lbs or 2%) and May (351 lbs or 1%) in O-3. Trap net harvest in all districts during other months amounted to 292 lbs. Trap net catch rates (39.5 lbs / lift) in Ohio doubled the rate in 2020 and exceeded the mean (30 lbs/lift 1996-2021) (Figure 1.1.4). The majority (63%) of Lake Whitefish harvest in Ohio during 2021 was taken near Maumee Bay from grids 902 and 801 (Figure 1.1.2). Catch rates in grid 801 (218 lbs / lift) during 2021 were greater than 5 / 10 years recorded. Whitefish were not harvested in Pennsylvania waters during 2021.

Ontario's west basin fall harvest in 2021 was comprised of ages 2 to 19 with age 6 (2015 cohort) representing the majority of Lake Whitefish harvested (Figure 1.1.5). The age composition of Lake Whitefish harvested in U.S. waters was not assessed in 2021.

The landed value of Whitefish in Ontario during 2021 was $123,656 or $1.46 / lb CDN. The landed weight of roe from Ontario's 2021 Lake Whitefish fishery was 1,052 pounds, most (98%) of which was collected from the west basin during November. The remainder of roe was collected from October and December in the west basin, and November in the west-central basin. The approximate landed value of the roe was $ 2,792 or $ 2.65 / lb CDN.

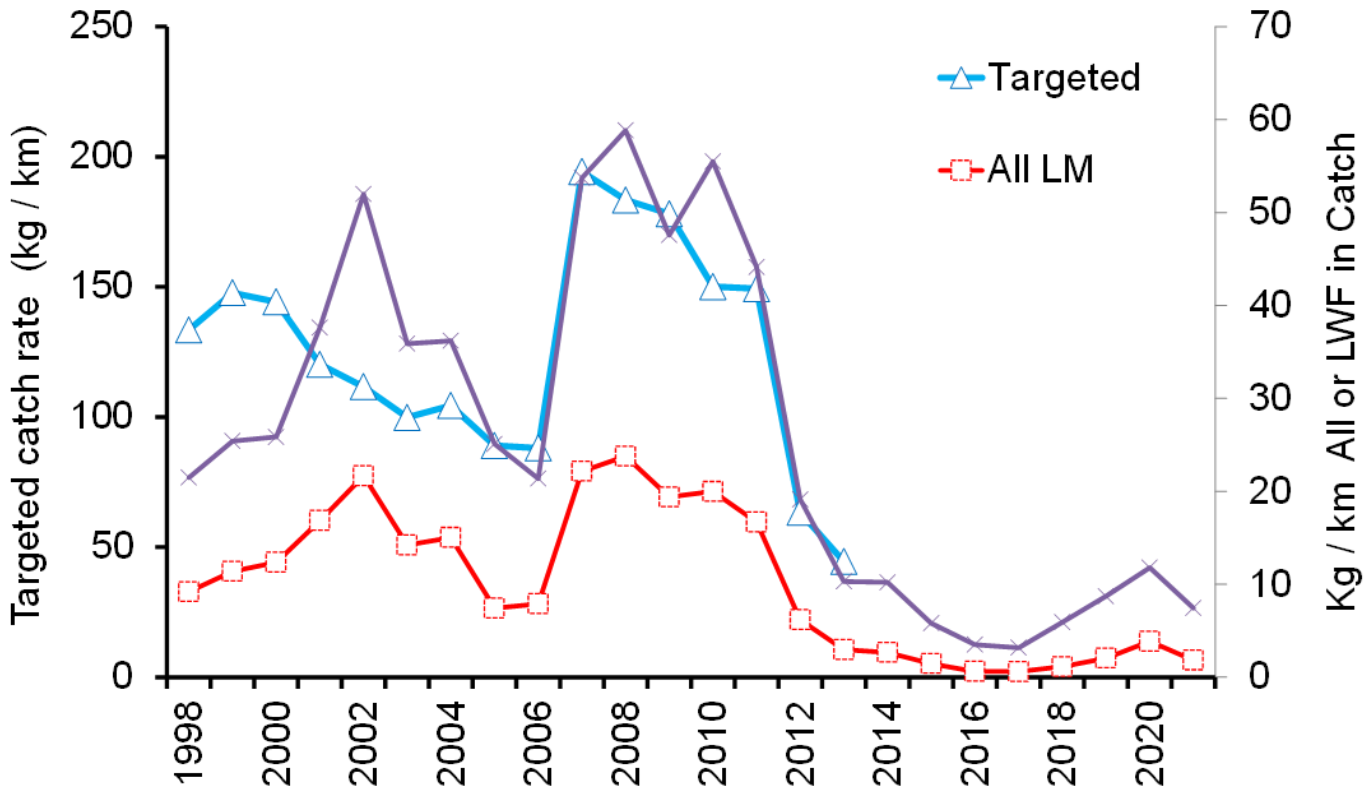


FIGURE 1.1.3. Lake-wide Ontario annual commercial large mesh gill net catch rates according to three forms of effort. Targeted Lake Whitefish catch rate (kg/km; left axis), catch rate relative to all large mesh gill net fished (kg/km; right axis), and catch rates from large mesh effort with Lake Whitefish in the catch (kg/km; right axis). No targeted Lake Whitefish effort or harvest was reported in 2014 - 2021.

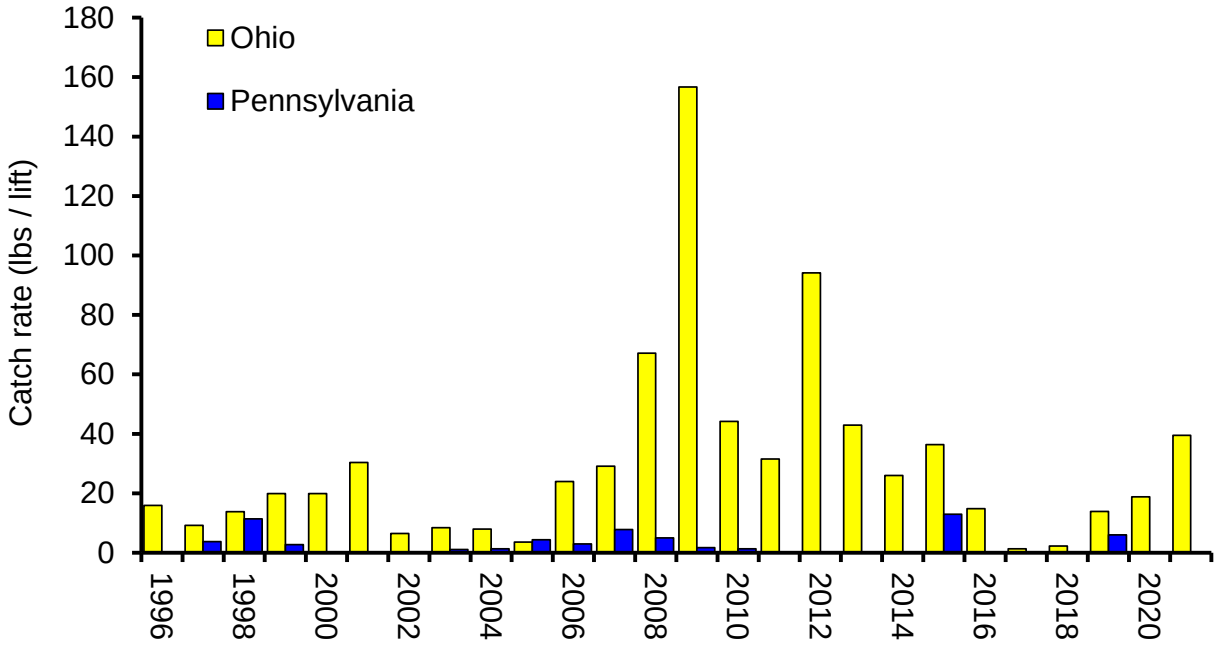


FIGURE 1.1.4. Lake Whitefish commercial trap net catch rates in Ohio and Pennsylvania (pounds per lift), 1996-2021. Zero harvest for PA in 2000-2001, 2011-2014 and 2021.

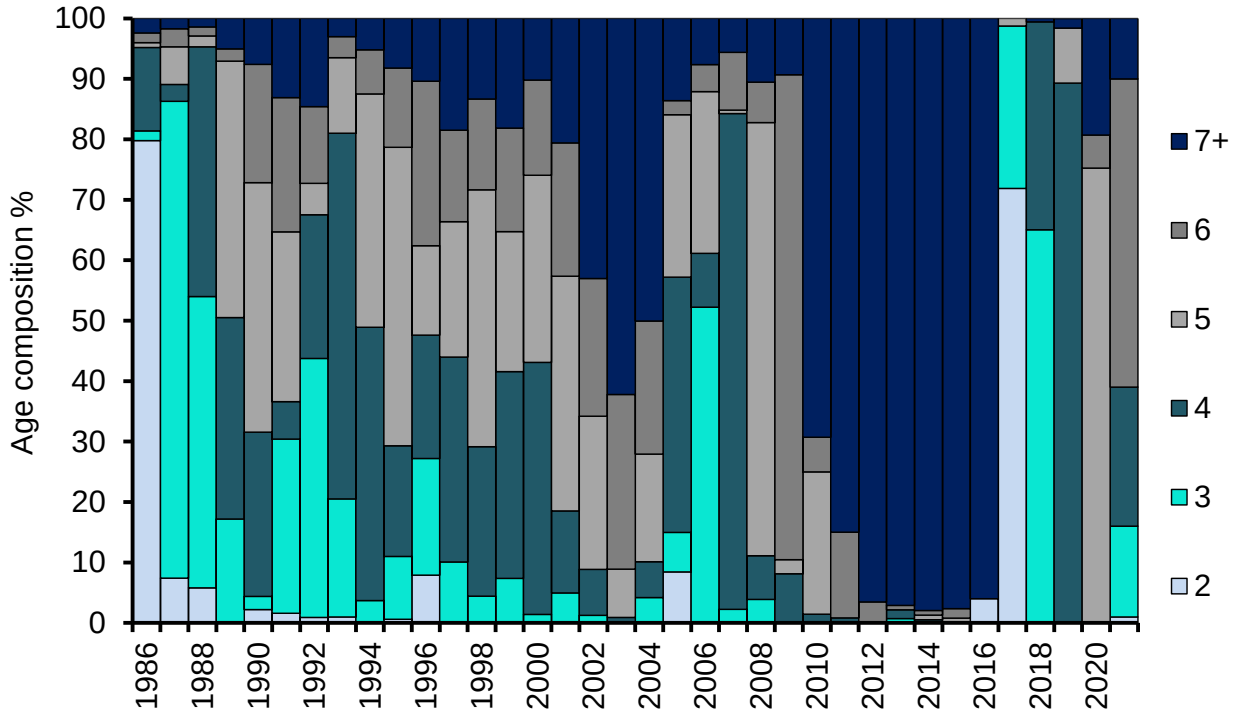


FIGURE 1.1.5. Ontario fall commercial Lake Whitefish harvest age composition in statistical district 1, 1986-2021, from effort with gill nets ≥3 inches, October to December. N=100 in 2021. Ages 7+ includes Whitefish ages 7 and older.

Assessment Surveys

Gill net assessment surveys of Lake Whitefish in Lake Erie include Coldwater Assessment (CWA) netting in New York, Ontario and Pennsylvania waters of the east basin and Ontario's Partnership Survey covering the east basin, Pennsylvania Ridge and central basin. Partnership Survey catch rates were pooled despite differences in thermal stratification, and migratory behavior when east and central basin surveys occur. The necessity of combining the Partnership Surveys arises from variable, low catches observed among all basin-specific surveys. Partnership Survey catch rates in 2021 were based on 111 sites with 222 gangs fished on bottom and at standard canned depths.

Lake Whitefish catch rates in CWA nets fished on bottom at standard stations (52 lifts) during 2021 (4.30 fish/lift) increased from 2020 (0.87 fish/lift) and was second highest in the 37-year time series 1985-2021 (Figure 1.1.6). The high catch rate was influenced by record high catches in New York waters. Catch rates by jurisdiction in 2021 were highest in New York (11.9 fish/lift), followed by Ontario (1.38 fish/lift) and Pennsylvania (0 fish/lift). Lake Whitefish (15) captured in the Ontario CWA survey ranged in age from 2 to 7 with ages 2,4 and 6 represented equally (27%) (Figure 1.1.7). None of the 230 Lake Whitefish caught by all jurisdictions during the 2021 CWA survey exhibited lamprey wounds or scars.

Partnership Survey catch rates of Lake Whitefish ages 0 to 2 was 0.07 fish/lift in 2021, comparable to 2020 (Figure 1.1.6). The catch rate for age-3 and older Lake Whitefish caught in 2021 Partnership Surveys was 0.13 fish/lift, down slightly from 0.15 fish/lift in 2020 (Figure 1.1.6). Lake Whitefish were caught in index nets (40) and auxiliary gear (3) throughout Lake Erie in 2021, excluding the west basin survey. The age composition observed in Partnership Survey index gear ranged from ages 1 to 19, with age-6 (38%; 2015-year class), age-2 (27%; 2019-year class), age-4 (11%; 2017-year class) and age-1 (9%; 2020-year class; Figure 1.1.7) contributing the most. Of the 43 Lake Whitefish examined from index and auxiliary gear, none exhibited Sea Lamprey s cars or wounds in 2021.

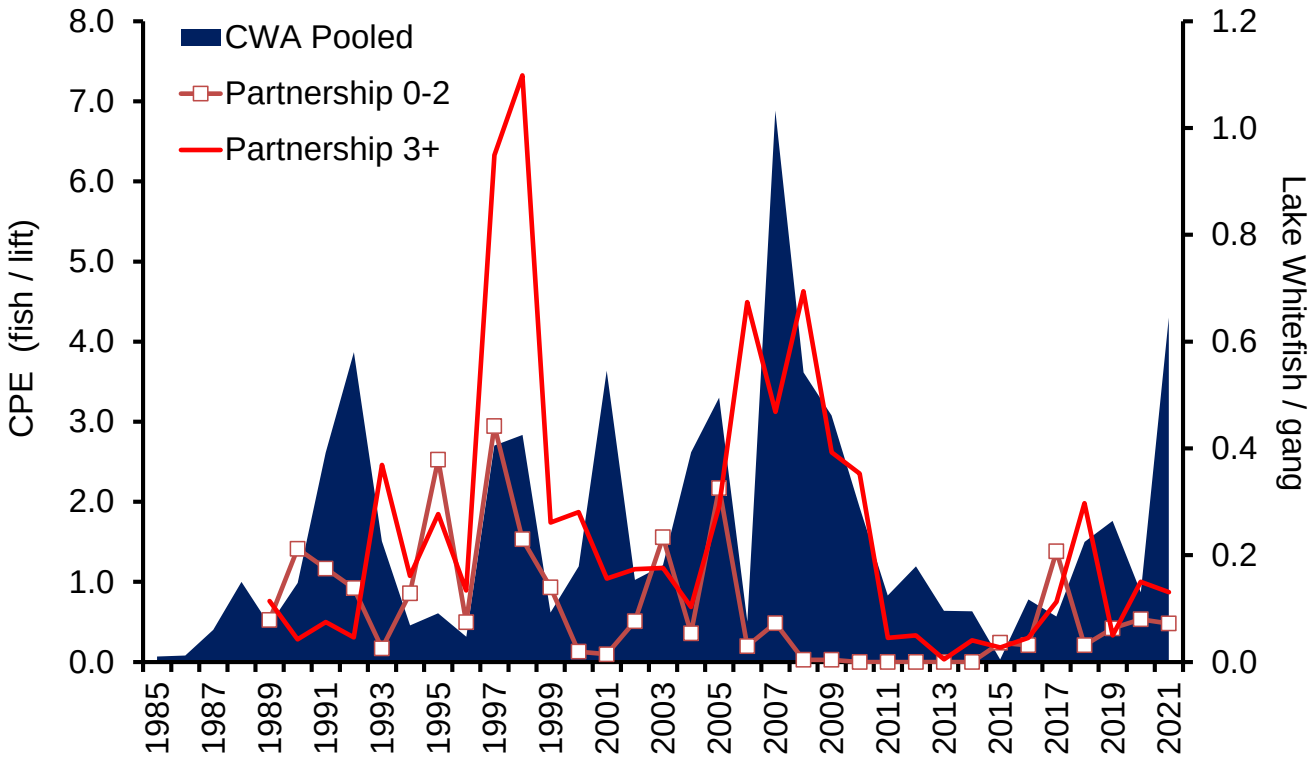


FIGURE 1.1.6. Catch per effort (fish/lift) of Lake Whitefish caught in standard Coldwater assessment gill nets (CWA) in New York, Ontario and Pennsylvania waters, weighted by number of lifts (blue area). Partnership Survey catch rates (fish/lift) for ages 0-2 (dots) and ages 3 and older (squares) are plotted on the second Y axis.

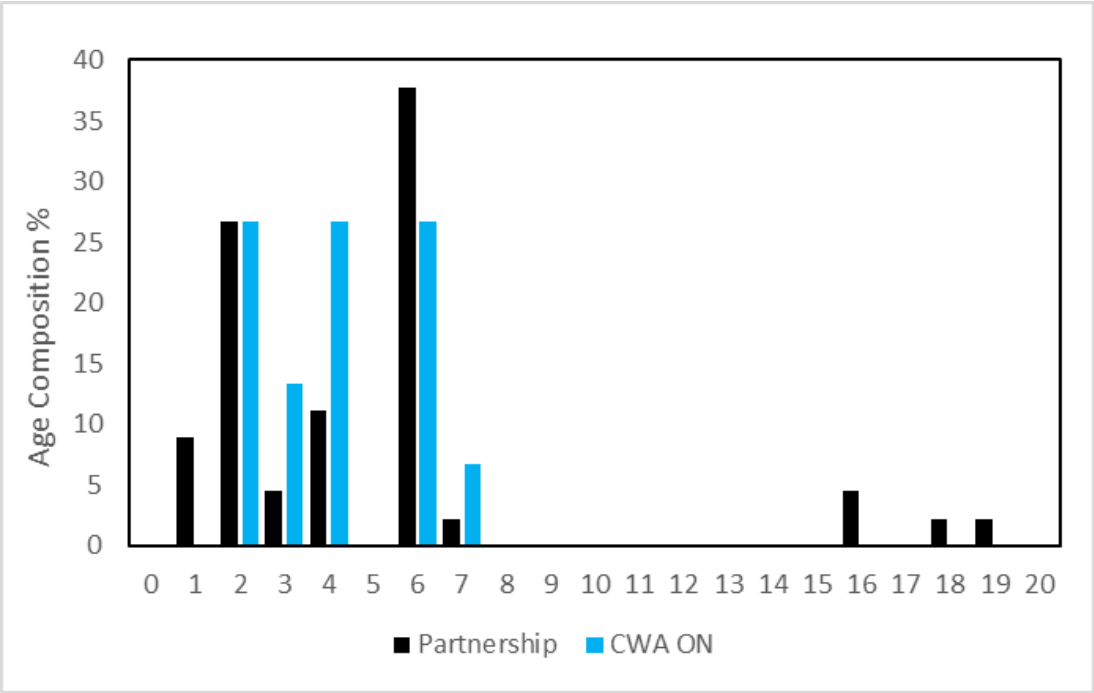


FIGURE 1.1.7. Age-frequency of Lake Whitefish collected from Cold Water Assessment (CWA) gill net surveys (ON) and Ontario Partnership Survey in 2021 (N=15 and 40). CWA ages are incomplete. Partnership age composition is weighted by effort.

Trawl surveys in Ohio waters of the central basin of Lake Erie (Ohio Districts 2 and 3 combined) encounter juvenile Lake Whitefish. June and October catch rates are presented in Figures 1.1.8 and 1.1.9 as indicators of year class strength. In 2021, the age 0 catch rate in the central basin was moderate in June (0.29 / ha) whereas age 0 were absent from October trawls (0 /ha) (Figures 1.1.8). Yearling Lake Whitefish were caught at low densities (0.06 /ha, 0.03 / ha) during June and October respectively (Figure 1.1.9). Pennsylvania did not complete any trawl surveys in 2021.

New York's east basin trawl survey in 2021 caught age 0 Lake Whitefish at low densities (0.18 / ha) (Figure 1.1.8). During some years, Lake Whitefish were encountered in Ontario's deep, offshore fall bottom trawl assessment in Outer Long Point Bay, however, in 2021, juvenile Lake Whitefish were not caught in the Long Point Bay survey.

Stock Discrimination - Genetics

Lake Whitefish tissue samples (N=88) collected from west, central, and eastern Lake Erie were sequenced using RAD-capture (Rapture) by Dr. Peter Euclide at Purdue University. Spawning Lake Whitefish samples from Niagara and Crib Reef (west basin) diverged from pre-spawn samples collected from the west basin (north side), central basin, and east basin of Lake Erie. While preliminary results suggest reproductively isolated spawning stocks may exist in Lake Erie, further research focused on stock differentiation is planned.

During 2021, Lake Erie Lake Whitefish tissue samples were provided to Dr. Louis Bernatchez (University of Laval) to support collaborative research with OMNDMNRF and DFO studying genomics of Lake Whitefish across the species range.

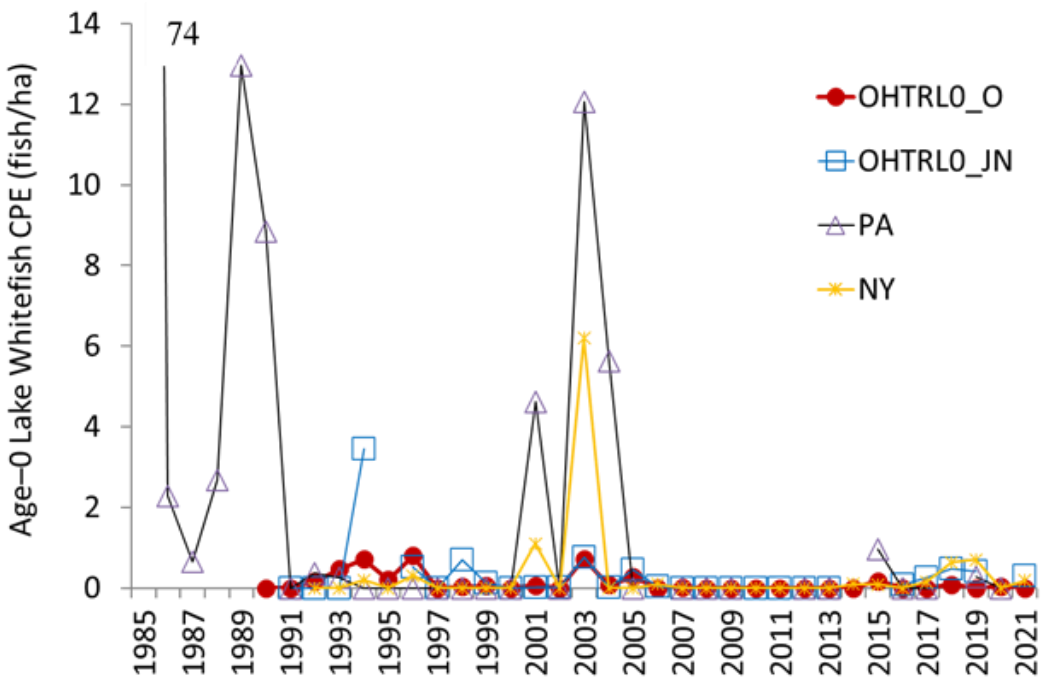


FIGURE 1.1.8. Age 0 Lake Whitefish catch per hectare in Ohio (central basin during June – OHTRL0_JN, October – OHTRL0_O), Pennsylvania (PA) and New York (NY) fall assessment trawls. Ohio data are means for October trawls in District 2 and 3. Pennsylvania did not conduct trawls during 2018, 2021. Ohio did not trawl in June 2020.

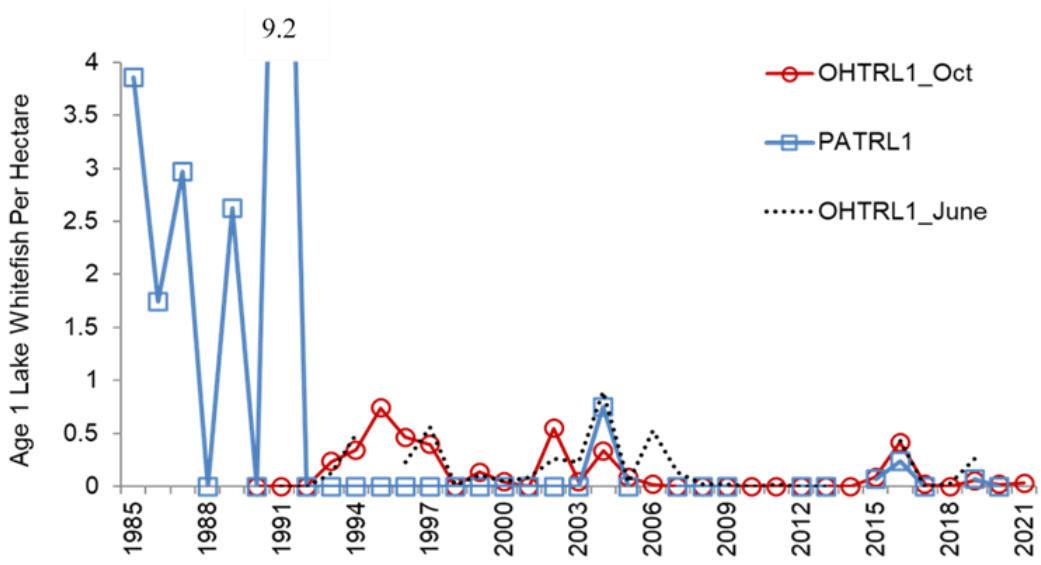


FIGURE 1.1.9. Age 1 Lake Whitefish trawl catch rates (number per ha) in Ohio waters during June (dotted line) and October (circles) and in Pennsylvania (PATRL1) waters (squares). Pennsylvania 1991 value (9.2) exceeds maximum axis value. Pennsylvania did not trawl in 2018 and 2021. Ohio did not trawl in June 2020.

Growth, Diet and Health

Trends in condition are presented for Lake Whitefish sampled by agencies in relation to historic Lake Whitefish condition reported by Van Oosten and Hile (1947). In 2021, samples were combined from commercial and survey data from Ontario and Ohio according to the following selection criteria: ages 4 and older collected from Oct-Dec, excluding spawning and spent fish. In 2021, female and male mean condition factors were above their respective historic means (Figure 1.1.10).

Lake Whitefish in Lake Erie exhibit a high prevalence of Digenean heart cysts from *Icthyocotylurus erraticus* (CWTG 2018). In 2021, 73% of Lake Whitefish examined from Ontario commercial samples had heart cysts compared to 79 % of Whitefish collected from the Partnership gill net surveys. Prevalence was greater in larger Whitefish compared to juveniles. Annual heart cyst prevalence in Lake Whitefish monitored in Partnership surveys exceeded 70% since 2016. This parasite is present in Lake Whitefish in the upper Great Lakes (Muzzal and Whelan, 2011). In Ireland, intermediate and final hosts of this parasite are snails and gulls respectively (Harrod and Griffiths 2005). Harrod and Griffiths (2005) reported that this parasite influenced gonad size of female Pollan with different effects on liver size and condition of males and females. This parasite was also identified in Rainbow Smelt in Lake Erie (Dechtiar and Nepszy, 1988). The impact of this parasite on Lake Whitefish in Lake Erie remains unknown.

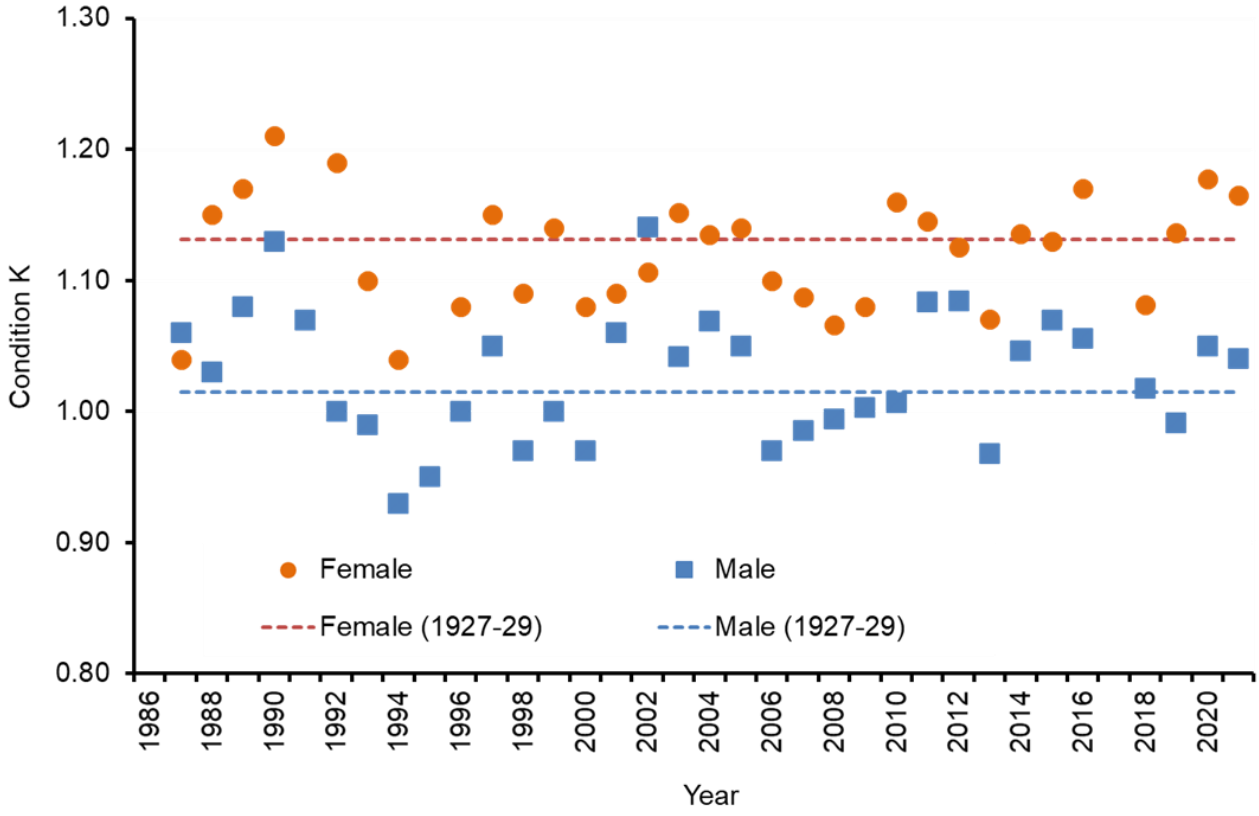


FIGURE 1.1.10. Mean condition factor (K) values of age 4 and older Lake Whitefish obtained from Ontario and Ohio commercial and survey data (Oct-Dec) by sex from 1987-2021. Samples sizes in 2021 were: Males N=17 and Females N=25. Historic mean condition (1927-29) presented as dashed lines calculated from Van Oosten and Hile (1947).

Acoustic Telemetry

Lake Whitefish were implanted with acoustic transmitters and tagged with external Floy tags from 2015 to 2021 to monitor seasonal movements as described by detections in the GLATOS (Great Lakes Acoustic Telemetry Observation System) acoustic receiver network. This research is a collaboration of USGS, ODNR, USFWS, OMNDMNRF, GLFC, GLATOS, TNC and local partners to increase knowledge of Lake Whitefish behavior and support management of this data deficient species. To date, 304 Lake Whitefish were tagged in the GLATOS LEWHF project in areas including the Maumee Bay Ohio, west basin spawning reefs in Ohio and in Ontario waters and near the Detroit River mouth (Table 1.1.1). In 2019, The Nature Conservancy (TNC) and ODNR tagged an additional 15 Lake Whitefish near the mouth of the Maumee River as part of a separate study (Table 1.1.1). Since 2015, 34 tagged Lake Whitefish were caught by Ontario's commercial fishery (Table 1.1.1). Spatiotemporal patterns of Lake Whitefish determine their vulnerability to capture by surveys and fisheries. Seasonal migrations through Lake Erie basins (west, central, and east) were described for each Lake Whitefish tagged in the west basin. The mean proportion of daily detections in each basin by month were calculated for tagged Lake Whitefish at large from 2017-2020 (Figure 1.1.11). Migratory Whitefish mainly occupied the central basin for 5 months of the year (Jan-May) before migrating eastward as the lake stratified thermally. Whitefish detections were shared between the central and east basins during August transitioning more to the east basin during September. As Whitefish migrated westward during October, detections were divided among the three basins. Most Whitefish were present in the west basin in November during peak spawning. Dispersal to the central basin during December was evident as the proportion of west basin detections declined. Surprisingly, telemetry observations revealed that Lake Whitefish were detected more frequently in the southern portion of the central basin. Whitefish habitat selection is part of ongoing research benefiting from acoustic telemetry, archival acoustic tags and in situ dissolved oxygen and temperature sensors. Information about this project and other GLATOS projects is online: https://glatos.glos.us.

Statistical Catch at Age Analysis (SCAA) Population Model

A two-gear statistical catch-at-age (SCAA) model for Lake Whitefish (CWTG 2021) was updated with 2021 harvest and survey data. The model configuration consists of equal weighting (lambdas=1) among data sources and a catchability block to address a switch by Ontario's gill net fishery to incidental harvest 2014-2021. The SCAA model consists of 2 gears (gill net fishery catch and effort and Partnership Survey catch rates) but includes harvest from all jurisdictions with an adjustment to gill net effort that accounts for the additional harvest. SCAA model results are presented in Figure 1.1.12. Principal components analysis (PCA) was used to consolidate 10 Lake Whitefish recruitment indices into 2 principal components (Y. Zhao, personal communication, 2015) for use in linear regression with SCAA age 3 abundance estimates to forecast future recruitment of age 3 Whitefish (Table 1.1.2, Figure 1.1.12). Age 3 abundance and subsequent trajectories were also estimated using PCA-regression to ground-truth SCAA age 3 abundance estimates from a model that may have been impacted by invalid assumptions related to the transition from targeted to non-targeted fisheries (Table 1.1.2, Figure 1.1.12). This alternate forecast (Figure 1.1.12 dotted line) was produced for comparison with SCAA estimates. Abundance and spawner biomass were forecasted to 2024 assuming 2021 SCAA survival estimates. Forecasted spawner biomass from 2022 – 2024 was compared to a State of the Lake (SOLE) limit reference point (LRP) to describe Lake Whitefish population status. The LRP was based on the range of depressed spawning stock biomass (SSB) estimated from 2014-2017. Lake Whitefish spawner biomass levels may remain above the 2014-2017 Limit Reference Point until 2024, provided fisheries' harvest remains conservative (Figure 1.1.13).

Identifying and Characterizing Lake Whitefish Spawning Habitat

In 2021 the USFWS, USGS, TNC, ODNR, OMNRF, Univ. of Toledo, and NYSDEC began a joint project to assess Lake Whitefish spawning activity and spawning habitat in Lake Erie. The project seeks to 1) describe the contemporary spawning habitat used by Lake Whitefish at known spawning locations in the western basin of Lake Erie 2) verify and describe suspected spawning sites used by Lake Whitefish in the central and eastern basins of Lake Erie 3) describe the factors (e.g., substrate composition, bottom slope, water temperature) influencing spawning of Lake Whitefish in the central and eastern basins and 4) evaluate restoration opportunities by describing habitat where future stocking could be successful. Fall of 2021 marked the first field season of the two-year project, with egg mats and egg pumping deployed by crews in nearshore areas of the central and eastern basins. Sampling was conducted following an occupancy modeling framework, with sampling sites revisited multiple times over the fall and winter, to determine the onset of spawning and account for imperfect detection of Lake Whitefish eggs. Crews collected Lake Whitefish eggs at multiple locations in the central basin, however, no Lake Whitefish eggs were collected in the eastern basin. The eggs were brought to the USGS

Great Lakes Science Center where they are being reared to the larval stage to confirm species identification and undergo genetic analysis to hopefully identify the spawning stock. Lake Trout eggs were also observed at sites in both basins. Another round of egg surveys are slated for next fall and this summer crews will be revisiting sampling sites to collect substrate and bathymetric data, which will be used to describe the bottom habitat where eggs were collected

Summary

Lake Whitefish fishery and survey indicators showed mixed signals in 2021 that may be related to stock-specific differences that are poorly understood. Total Lake Whitefish harvest in 2021 (121,863 pounds) decreased from 2020. Ontario's incidental harvest in 2021 attained 27% of Lake Whitefish quota of 300,000 pounds in 2021. Ohio's trap net fishery targeted Lake Whitefish in 2021, harvesting 37,360 pounds. To reduce Whitefish bycatch in the Walleye gill net fishery, Walleye quota transfers from the west basin (Quota Zone 1) to the central basin (Quota Zones 2 and 3) are permitted by Ontario. In 2021, 8% of Walleye quota in the west basin (MU1) was transferred to central basin Walleye fisheries, relieving fishing pressure on Whitefish spawning or aggregating in the west basin. In 2022, Lake Whitefish fisheries will be dominated by Whitefish ages 7 and older with increased contributions from the 2018 cohort (age 4) and modest recruitment from the 2019 cohort (age 3). The Coldwater Task Group recommends continued conservative management of Lake Whitefish.

TABLE 1.1.1. Number of Lake Whitefish tagged with internal acoustic transmitters and Floy tags by location 2015 – 2021. Number of tagged Whitefish recaptured by fisheries from 2016 – 2021.

			Recaptures						
Tag Year	**Tag Location**	**# Tagged**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Total**
2015	Maumee Bay	10		1					1
2016	Hen Island - Little Chicke	37	3			1	1		5
2017	Crib Reef	25		1		1	1	1	4
	Hen Island - Little Chicke	55		5	1	1	1	1	9
	Niagara Reef	25					2		2
2018	DR mouth	2							0
2019	Crib Reef	50					3	2	5
	DR mouth/Colchester	35				4	1	2	7
	Maumee Bay [1]	15							0
2020	Pelee Island	20					1		1
	DR mouth/Colchester	14							0
2021	Pelee Island	16							0
	Total	**304**	**3**	**7**	**1**	**7**	**10**	**6**	**34**

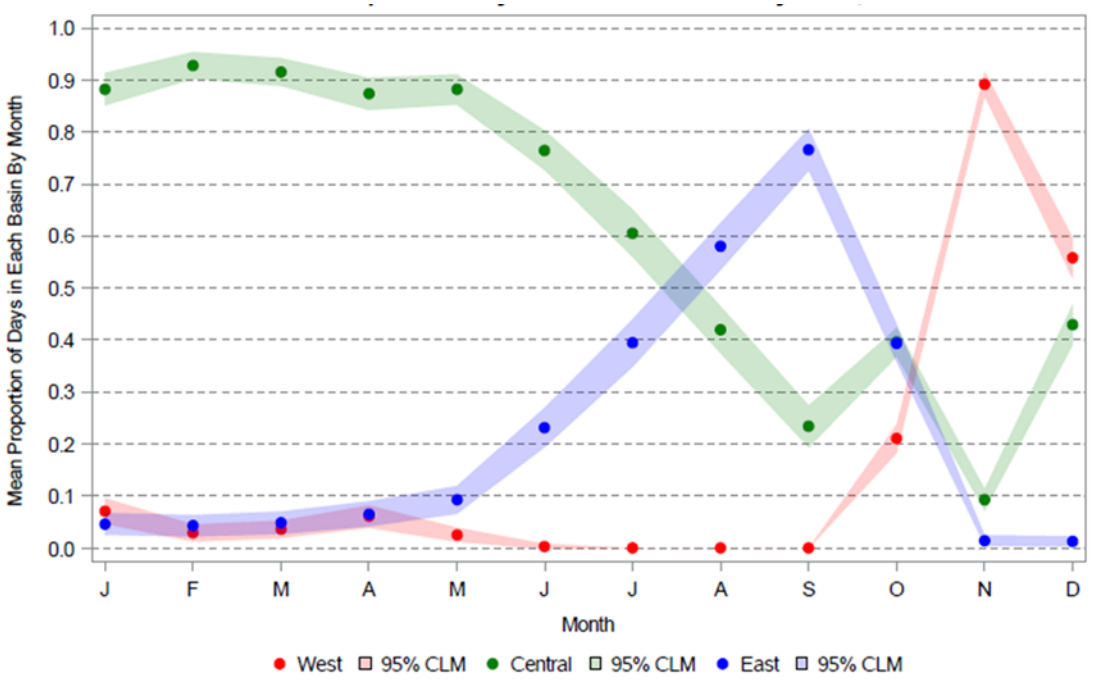


FIGURE 1.1.11. Mean proportion of days Whitefish were detected monthly in the west, central and eastern basins from 2017-2020. Includes Whitefish that were tagged in western Lake Erie 2015-2019. Analysis excluded detections during the year in which fish were tagged. Stationary fish detected but considered deceased were excluded from analyses.

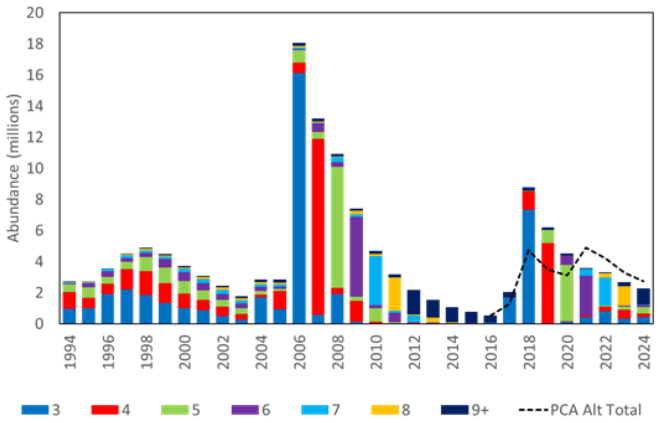


FIGURE 1.1.12. Lake Whitefish abundance estimates at age (3 to 9+) from SCAA (1994-2021) with projections to 2024 from recruit indices in PCA (stacked bar). Age 3 recruitment estimates from PCA – regression for cohorts 2014-2021 projected forward with SCAA terminal survival estimates as an alternate population assessment (dotted line).

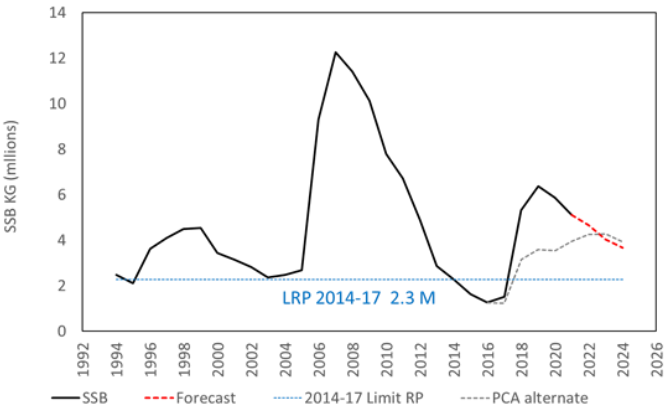


FIGURE 1.1.13. Lake Whitefish spawning stock biomass estimates (kg – black line) projected to 2024, assuming constant SCAA survival estimates from 2021. Alternate SSB trajectory (PCA alternate) based on recruit indices in PCA-regression for cohorts 2014-2021. SSB Limit reference point was based on low SSB 2014-2017 as dotted blue line.

TABLE 1.1.2. Age 3 abundance estimates from statistical catch at age analysis (SCAA). Principal components analysis (PCA) for juvenile Lake Whitefish indices (ages 0,1,2) used in linear regression with SCAA age 3 abundance estimates to estimate age 3 abundance of 2014 – 2021 cohorts. Number of surveys, ages and cumulative variance of 1st and 2nd principal components (P1, P2) presented for each cohort. Regression statistics R^2 and probability of significance (P>F).

Year	Year Class	SCAA	PCA REG	Lower	Upper	# Surveys	PCA Ages	Cumulative Variance P1, P2	Adj R^2	Pr > F
2017	2014	1,664,890	881,865	669,243	1,094,488	7	0,1,2	0.88	0.99	<.0001
2018	2015	7,349,660	3,815,322	3,444,052	4,186,593	9	0,1,2	0.87	0.98	<.0001
2019	2016	19,436	162,021	(154,898)	478,939	10	0,1,2	0.86	0.99	<.0001
2020	2017	142,554	674,932	342,784	1,007,081	9	0,1,2	0.83	0.98	<.0001
2021	2018	420,098	2,686,654	2,473,893	2,899,415	9	0,1,2	0.87	0.99	<.0001
2022	2019		802,417	449,062	1,155,773	9	0,1,2	0.85	0.98	<.0001
2023	2020		332,401	(73,994)	738,796	7	0,1	0.84	0.97	<.0001
2024	2021		422,916	199,654	646,179	4	0	0.91	0.98	<.0001

1.2 Report of the status of Lake Trout relative to rehabilitation plan targets

James Markham (NYSDEC), Andy Cook, Tom MacDougall (OMNDMNRF), Chuck Murray, Mark Haffley (PFBC), Joe Schmitt (USGS)

In 2021, 217 Lake Trout were caught in the Coldwater Assessment Survey; 103 of these were caught in standard assessment nets (Figure 1.2.1). Catch rates (CPE; fish/lift) for the standard assessment were highest in Pennsylvania (Areas 3 & 4; 3.6 fish/lift) and Ontario-west (Areas 7 & 8; 3.5 fish/lift) with lesser catches in New York (Area 1 & 2; 3.18 fish/lift) and Ontario-east (Areas 5 & 6; 1.75 fish/lift). Prior to 2021, the highest CPEs had typically been recorded in New York, coinciding with higher yearling Lake Trout stocking over time. Lake Trout catches are routinely lower in Ontario waters, where annual stocking was less and did not commence until 2006. In the more eastern portion of the lake (Areas 1,2,5,6) mean CPE for Lake Trout was higher in the newly introduced offshore assessment nets (3.9 fish/lift) when compared to the standard assessment sites (2.6 fish/lift).

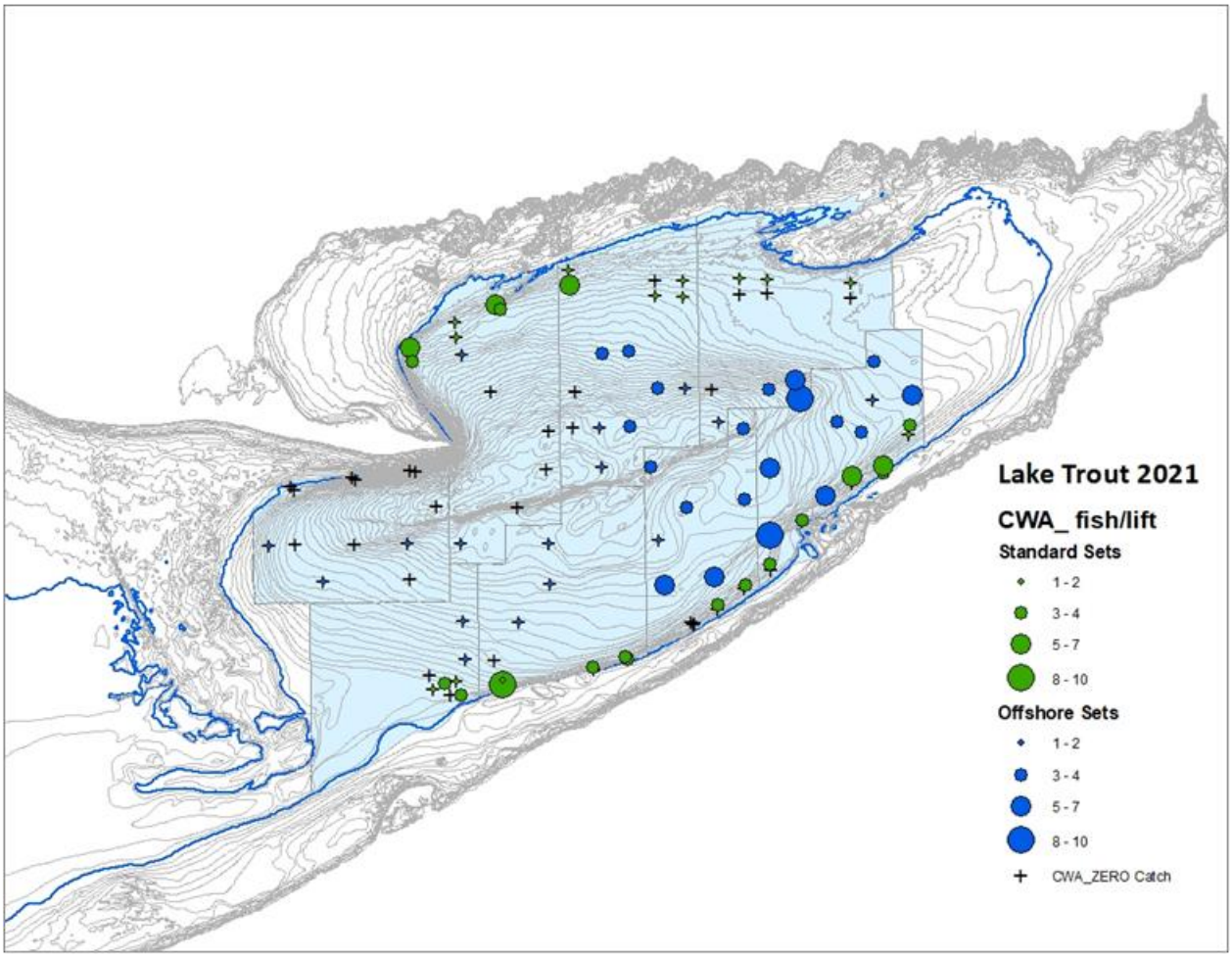


Figure 1.2.1 Catch rates (CPE; fish/lift) of Lake Trout (all ages) caught in the Coldwater Assessment Survey, Lake Erie 2021. Relative catch-per-effort (CPE; fish/lift) is indicated by scaled circle size. Green circles represent standard net set locations; blue circles indicate offshore net set locations; black crosses represent net sets where no Lake Trout were caught.

Lake Trout captured in assessment netting in 2021 represented twenty-five age-classes among five different strains (Figure 1.2.2). Ages 5, 6, 9 and 11 were the most abundant and represented 64% of the total catch. The abundance of Lake Trout older than age-10 has increased in recent years and comprised 35% of the overall catch in 2021. The strains of Lake Trout that contributed most to the total catch in 2021 were Lake Champlain (LC; 44%) and Finger Lakes (FL; 37%) followed by the Slate Island (SI; 14%) strain. These three strains have been the most commonly stocked Lake Trout strains in Lake Erie over the past twelve years. Catches of the Klondike (KL) ecotype have declined to the point that they are no longer detected in the survey.

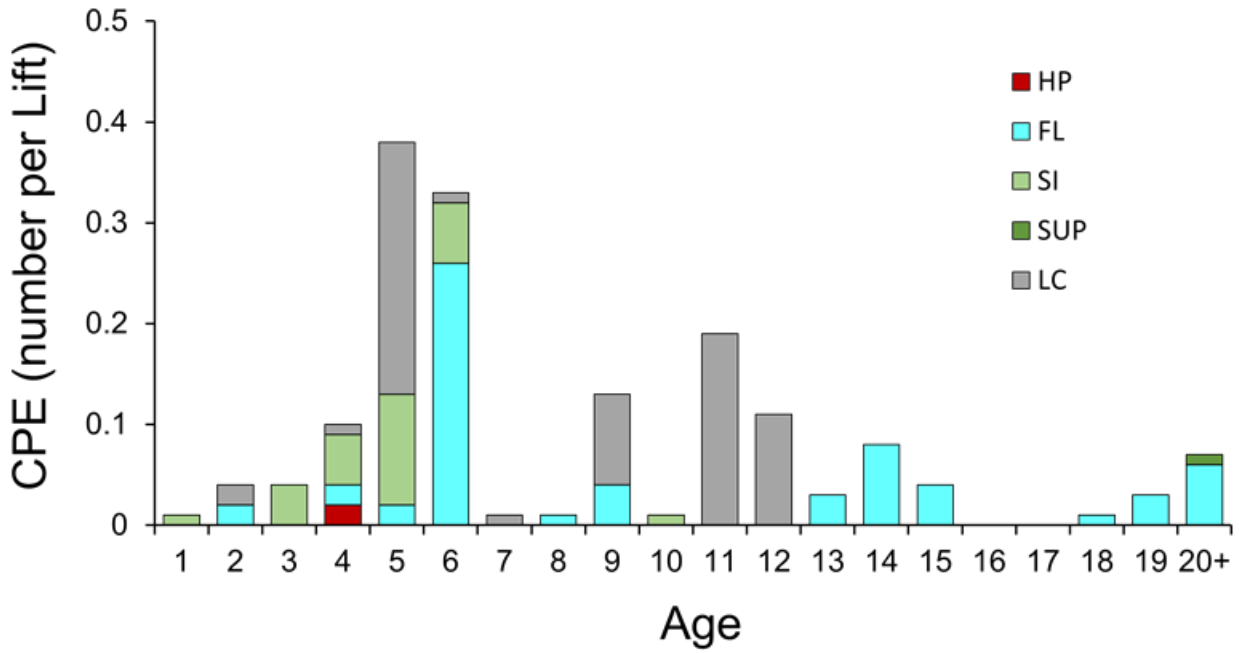


Figure 1.2.2. Relative abundance (fish/lift) by strain at age, of Lake Trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, August 2021. Abbreviations for strains include HP (Huron-Parry Sound); FL (Finger Lakes); SI (Slate Island); SUP (Superior); and LC (Lake Champlain).

The relative abundance of adult (age 5+) Lake Trout caught in standard assessment gill nets (weighted by area) in the Coldwater Assessment Survey serves as an indicator of the size of the Lake Trout spawning stock in Lake Erie. The targeted catch rate (CPE: fish/lift) described in the 2021 Rehabilitation Plan (hereafter: the Plan) is 2.0 fish/lift. Adult abundance decreased in 2021 to 1.2 fish/lift from 2.3 fish/lift in 2020, notably below target for the first time since 2018 (Figure 1.2.3). The 3-year running average of adult abundance was 1.9 fish/lift. No Plan management actions were triggered as the 95% confidence limits of the 3-year running average of the CPE continue to bound the target. (Figure 1.2.3).

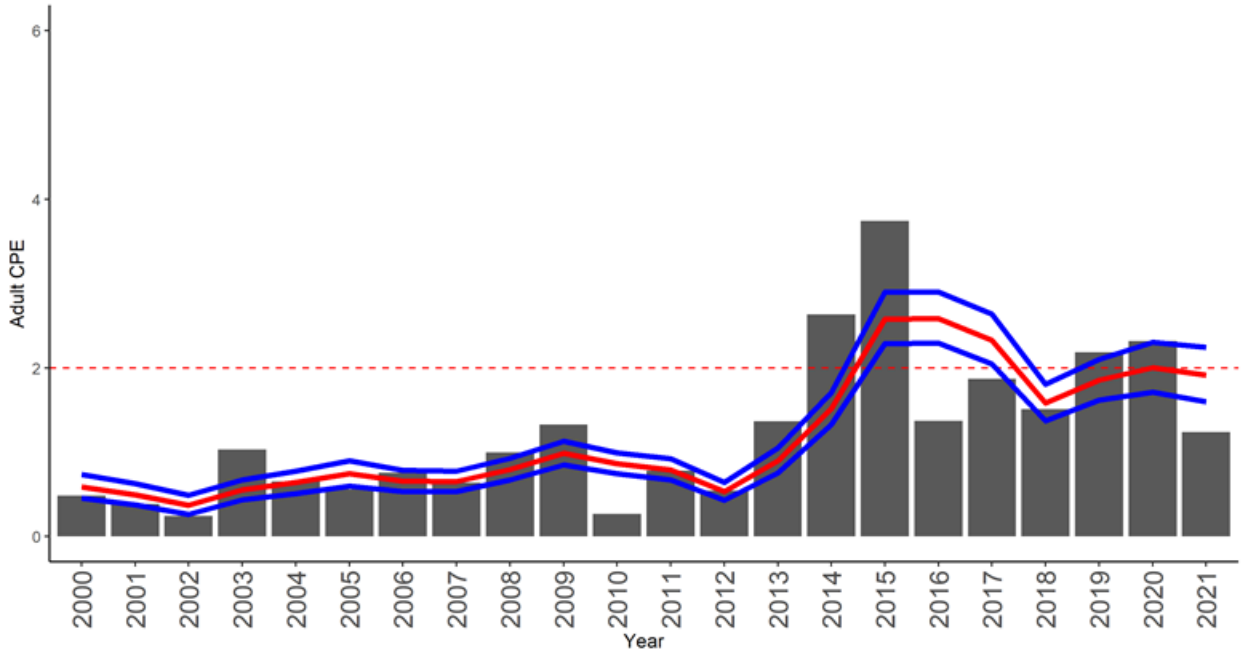


Figure 1.2.3 Mean combined CPE (fish/lift, weighted by area) for Lake Trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, 2000-2021. Grey bars: Annual mean adult (Age5+) Lake Trout CPE. Red dotted line: Targeted adult Lake Trout CPE (2 fish/lift). Red solid line: 3-year running average of Adult Lake Trout CPE. Blue solid lines: Bootstrap estimates of the 95% confidence intervals

Fifty-six (56) Lake Trout were caught in Partnership Survey index gear in the Pennsylvania Ridge (1) and east basin (55) surveys in 2021. Most Lake Trout were captured in nets fished on bottom (51) while the remainder (5) were caught in suspended nets in the east basin. The 2021 Lake Trout index in the east basin (0.92 fish/lift) increased from 2020 (0.55 fish/lift) and remained above the time series mean (0.45 fish/lift). Catch rates in the Pennsylvania Ridge survey (0.06 fish/lift) declined from 2020 and was below average (0.19 fish/lift) (Figure 1.2.4). Two additional Lake Trout were also caught in auxiliary 4 ¾" canned nets. Lake Trout with coded wire tags (40 or 69%) were assigned to the following strains: Slate Island (31 or 53%), Lake Champlain (7 or 12%), Finger Lakes (2 or 3%), unknown (6 or 10%, tags couldn't be read) and unknown (without coded wire tag: 12 or 21%). Five Lake Trout lacked fin clips (9%). Ages derived from coded wire tags ranged from 1 to 11 with ages-5 (21%) and 6 (22%) most abundant.

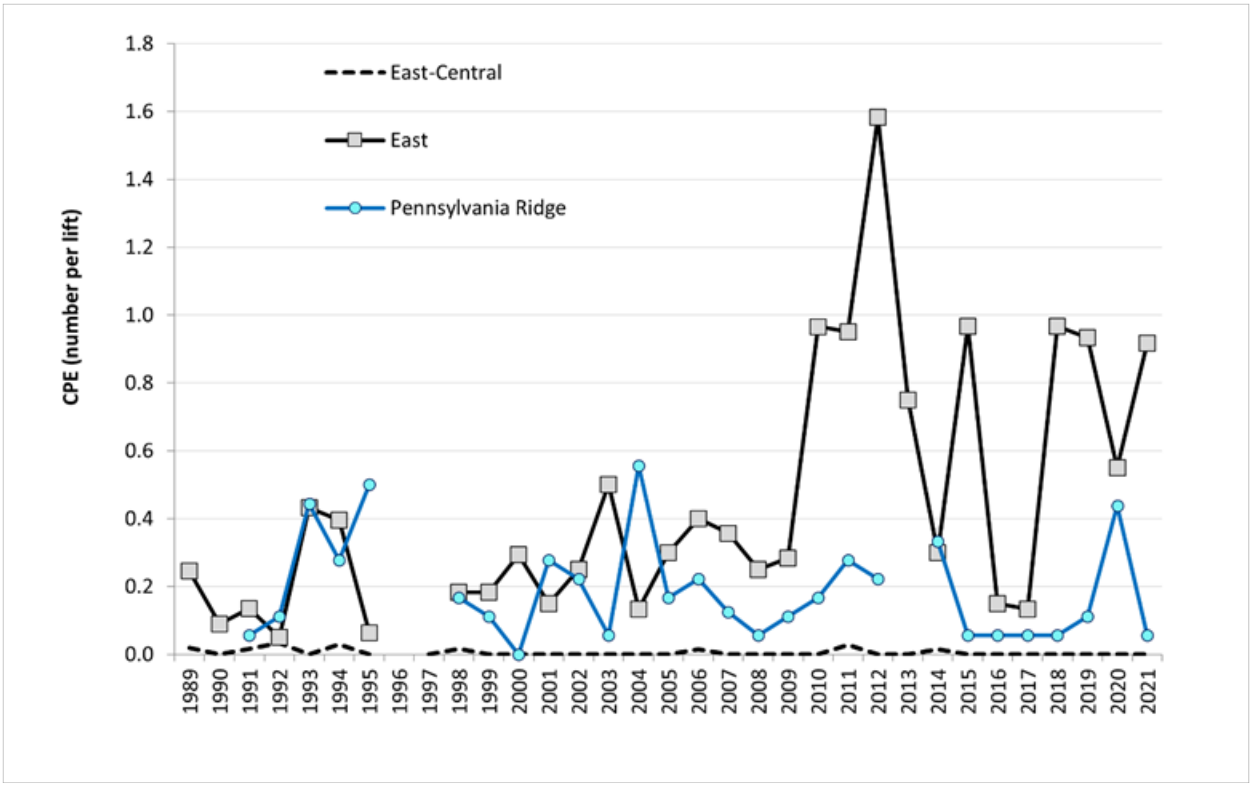


FIGURE 1.2.4. Lake Trout CPE (number per lift) by basin from the OMNRF Partnership Index Fishing Program, 1989-2021. Includes canned (suspended) and bottom gill net sets, excluding thermocline sets.

Recreational Catch and Harvest

Recreational angler catch of Lake Trout has increased over the past decade, coinciding with increases in adult abundance. However, angler harvest of Lake Trout in Lake Erie remains very low with total harvest in 2021 estimated at 282 fish (Figure 1.2.5). An estimated 114 Lake Trout were harvested in New York waters out of an estimated catch of 1,015 fish in 2021. Pennsylvania anglers harvested an estimated 168 fish from a total catch of 263 Lake Trout. It should be noted that these estimates do not include the fall nearshore fishery near spawning time (November, December), which has become more popular in recent years.

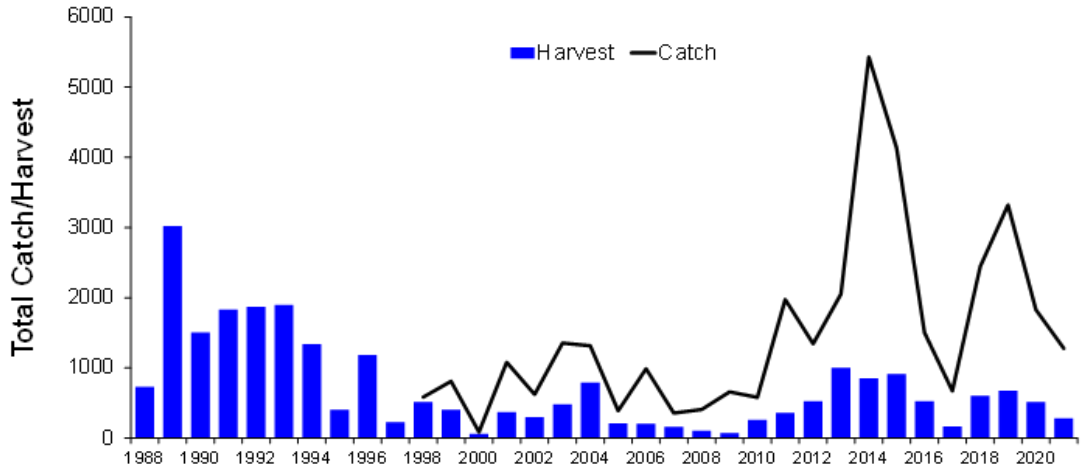


FIGURE 1.2.5. Estimated Lake Trout catch and harvest by recreational anglers in the New York and Pennsylvania waters of Lake Erie, May-October, 1988-2021.

Natural Reproduction

In Fall 2020, the results of an acoustic telemetry VPS array coupled with visual confirmation documented two Lake Trout spawning locations in the vicinity of Shorehaven Reef, NY. Egg trapping in May 2021 at these locations confirmed the presence of naturally reproduced Lake Trout fry, the first documentation of successful reproduction since rehabilitation efforts began. All Lake Trout stocked into Lake Erie are marked by fin clip and/or coded wire tag, and observations of unmarked juvenile or adult Lake trout remain low. However, when marking errors are taken into account, a small but growing contribution from probable wild-produced fish is evident and has been increasing (Figure 1.2.6). In 2021, three potentially wild fish (no fin clips; no CWT's) out of a total of 217 Lake Trout (all nets) were caught during the survey, representing 1.4% of the fish captured. Four additional non-clipped/non-tagged Lake Trout (7% of trout examined) were caught in the Partnership Survey. Altogether, a total of 90 potentially wild Lake Trout have been recorded since 2000 in the Coldwater Assessment Survey. Otoliths are collected from Lake Trout found without CWTs or fin-clips and will be used in future stock discrimination studies.

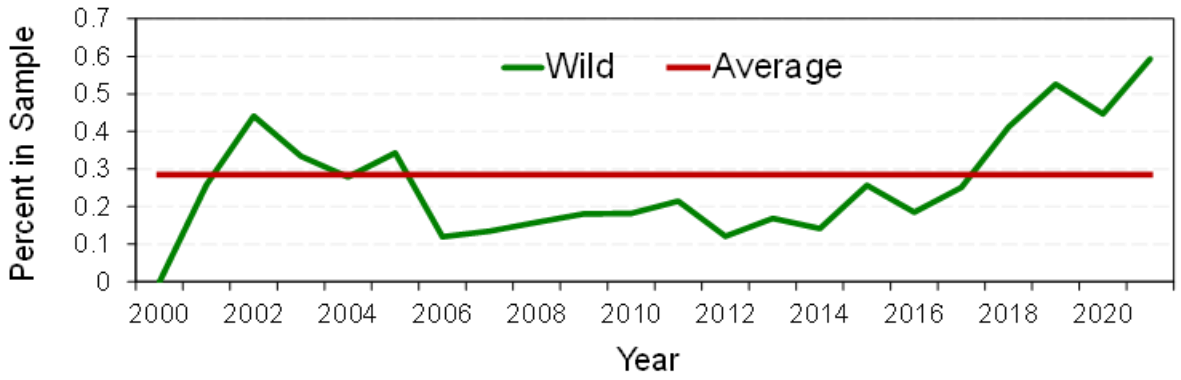


Figure 1.2.6. Percentage of potentially wild Lake Trout caught in the Coldwater Assessment Survey in the eastern basin of Lake Erie for 5-year running average time blocks, 2000–2021. A potentially wild fish has no fin clips and no coded-wire tag (CWT).

Diet

Seasonal diet information for Lake Trout is not available based on current sampling protocols. Diet information was limited to fish caught during August 2021 in the Coldwater Assessment Survey in the eastern basin of Lake Erie. Rainbow Smelt have traditionally been the main prey item for Lake Trout, usually comprising over 90% of Lake Trout diet items. However, Round Goby have become a common prey item since they invaded the east basin of Lake Erie in the early 2000's (Figure 1.2.7). In years of lower adult Rainbow Smelt abundance, Lake Trout prey more on Round Goby.

In 2021, Rainbow Smelt were the dominant prey fish, occurring in over 78% of the non-empty Lake Trout stomachs (Figure 1.2.7). Similar to the previous pattern over the past 15 years, the occurrence of Round Goby declined with high occurrence of Rainbow Smelt, representing less than 11% in stomachs. Yellow Perch (1.4%) were the only other identifiable fish species found in Lake Trout stomachs in 2021. The occurrence of fish species other than Rainbow Smelt and Round Goby in Lake Trout diets has increased in recent years but declined in 2021.

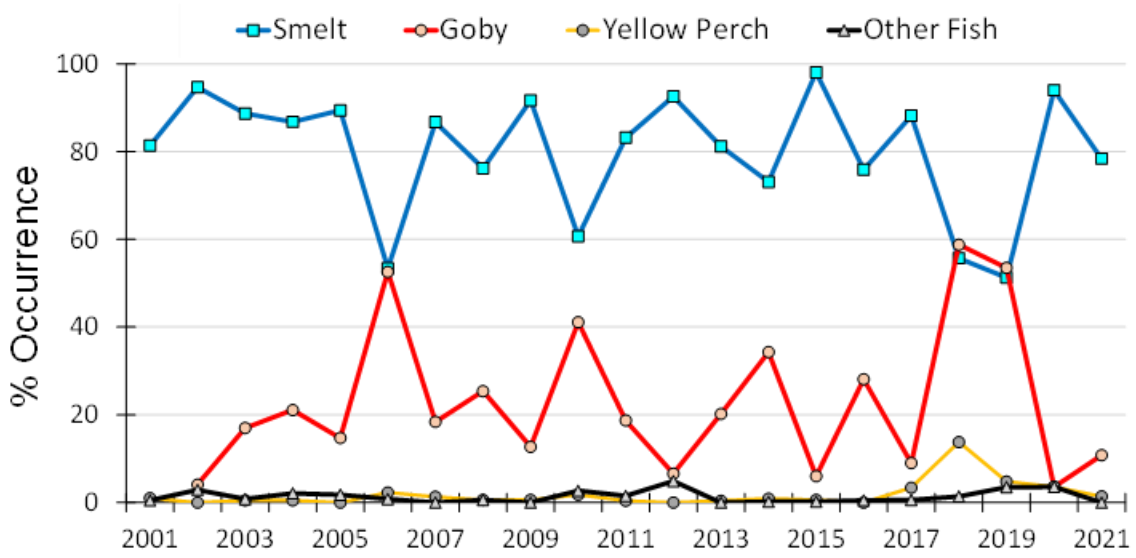


Figure 1.2.7. Percent occurrence in diet of Rainbow Smelt, Round Goby, Yellow Perch, and all other fish species from non-empty stomachs of Lake Trout caught in eastern basin assessment gill nets, August, 2001-2021.

1.3 Report on the Status of Burbot

Tom MacDougall (OMNDMNRF), *Andy Cook, (OMNDMNRF), James Markham (NYSDEC), Mark Haffley (PFBC), Joe Schmitt (USGS)*

Abundance and Distribution

Burbot are seasonally found in all the major basins of Lake Erie; however, the summer distribution of adult fish is restricted primarily to the 20-m and deeper, thermally stratified regions of the eastern basin. Coldwater Assessment and east basin Partnership Survey (bottom set nets) indices display similar trends and magnitudes with some annual variation. During the early 1990s, Burbot abundance was low throughout the lake. It increased between 1993 and 1998, peaked in the early 2000s, and then declined (Figure 1.3.1). For much of the past decade, catches have been consistently low with some regional differences; higher catch rates generally occurring in NY waters. In 2021, the mean Burbot catch rate (0.44 fish/lift) in the east basin CWA remained consistent with annual means since 2012 (range 0.39-0.67 fish/lift). Catch rates in Ontario waters in 2021 (in both the CWA and Partnership Surveys) were notably higher, increasing to decadal highs of 0.53 and 0.90 fish per lift, respectively. While catches were distributed across the basin in 2021, locations with the highest catch rates tended to be in deeper waters of the basin, not well sampled prior to 2020 by the CWA. In 2021, six additional Burbot were caught in the Partnership east-central basin survey assessed after fall turnover.

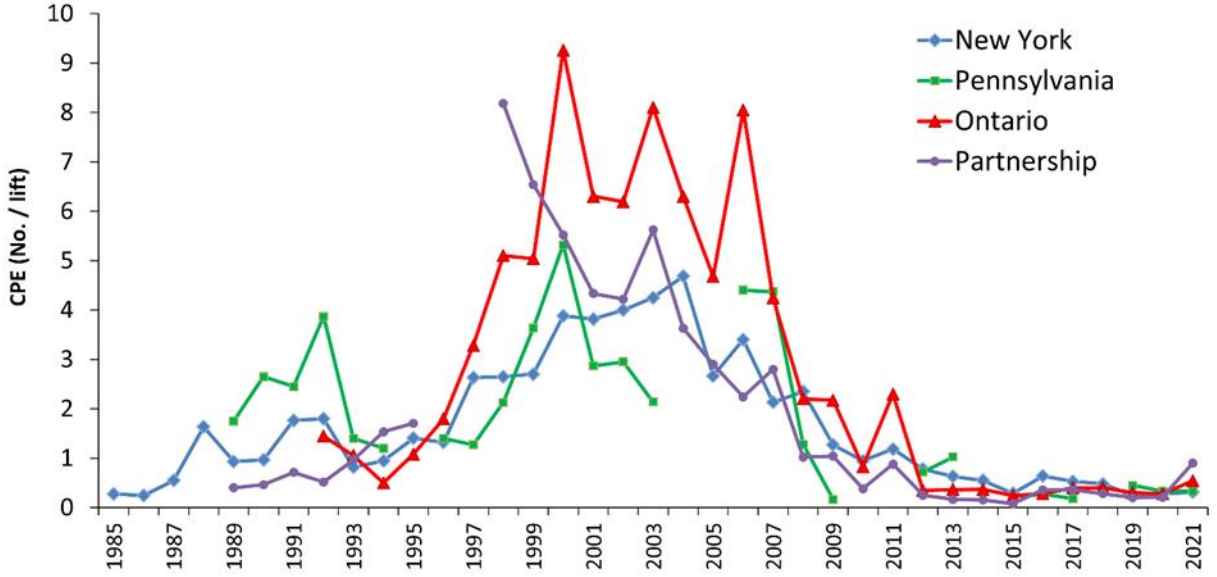


FIGURE 1.3.1. Burbot CPE (mean number per lift) by basin from the Interagency Coldwater Assessment (by jurisdiction; New York, Pennsylvania, Ontario) and the Ontario Partnership Survey (east basin bottom set nets), 1985-2021.

Most Burbot commercial harvest occurs in the eastern end of the lake, with minimal harvest occurring in Ohio waters and the western and central basins of Ontario waters. Historically, Burbot harvest was highest in Pennsylvania waters of Lake Erie. However, harvest decreased in Pennsylvania waters after 1995 following a shift from a gill net to a trap net commercial fishery, resulting in a substantial decrease of commercial effort (CWTG 1997). In 1999, a market was developed for Burbot in Ontario, leading the industry to actively target this species in 1999 and a concomitant increase was observed. However, this opportunistic market did not persist. Burbot catch is now incidental in nets targeting other species. The total commercial harvest for Lake Erie in 2021 was 1,755 lbs, down from 1,814 lbs in 2020 and 2,128 lbs in 2019. Catches were 1,102 lbs in Ontario, 551 lbs in New York, 68 lbs in Pennsylvania, and 35 lbs in Ohio.

Recent efforts have been directed at understanding the behavioural ecology of Burbot in Lake Erie using acoustic telemetry. Tagging of adult Burbot from Pennsylvania waters occurred in 2018 (n=2) and 2019 (n=22). Preliminary analysis of movement data collected to date indicates that most of these fish remain close to the release site over winter before moving eastward to NY waters. Most detections occurred on receivers in waters <30 m deep and along the south shoreline. Some individuals were by receivers in both the Pennsylvania Ridge area and the adjacent deeper waters south of Long Point, ON. One individual made extensive use of the eastern portion of the central basin. At least four of these fish continued to be detected into the spring of 2021, beyond which current receiver data is currently incomplete. The Ontario OMNDMNRF plans to capture and tag and additional 20 Burbot from north shore locations in 2022. For more information visit: https://glatos.glos.us/home

Age and Recruitment

Burbot ages are estimated using otoliths for fish caught in the Interagency CWA Survey and the annual Partnership Survey. Although the use of otolith thin sections is recommended as the best approach for accurate age determination of Burbot (Edwards et al. 2011), due to logistical constraints, initial aging of Burbot captured in 2021 was conducted using the crack-and-burn technique. To date, 64 Burbot from the 2021 Partnership (n=39) and CWA (n=25) surveys have been aged using this method. Burbot ranged in age from 0 to 19 years in 2021 (Figure 1.3.2). A notable change from recent years' reporting is the large contribution from young fish, aged 0 to 3 yrs. Most (88%) of these young fish were caught during the Partnership Survey.

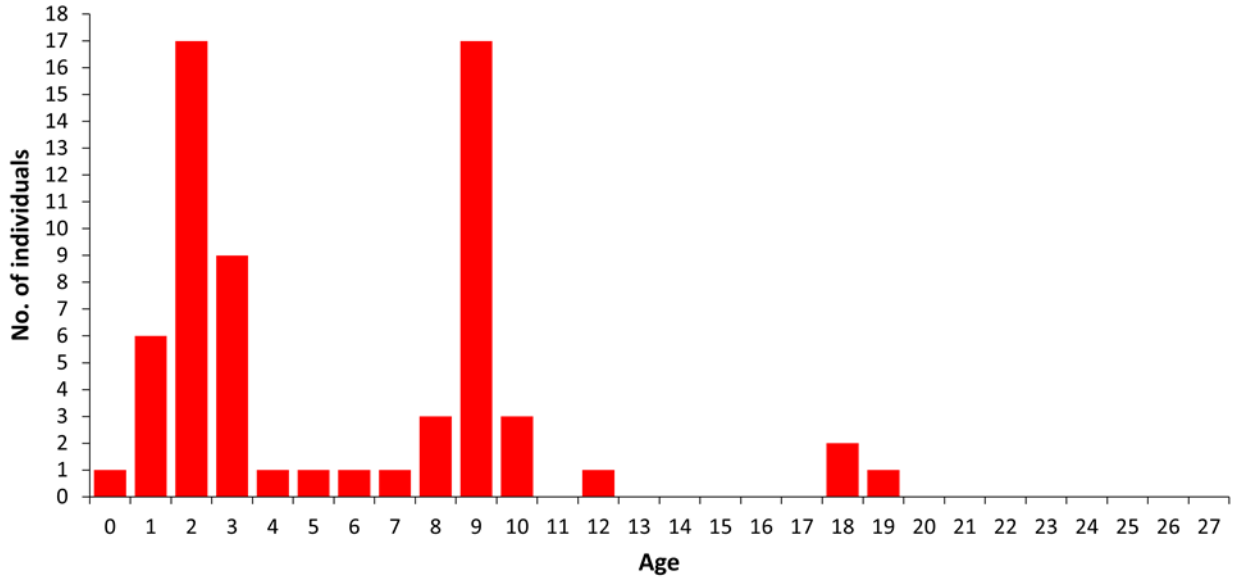


FIGURE 1.3.2. Age distribution of Burbot caught in the Coldwater Assessment Survey and the Partnership Survey in eastern Lake Erie, 2021 (N=64).

The annual mean age of Burbot in the Coldwater Assessment has been erratic but has generally been decreasing, from a high of 15.4 in 2013. In 2021 mean age was 7.3 years, down from 8.4 in 2020 and 12.1 in the 2019 CWA survey (Figure 1.3.3). The 2021 mean age was similar to that observed during the early 2000s, when overall CWA Burbot catch rates were at a high point in the survey time series (Figure 1.3.3).

Larval surveys conducted in recent years by the USGS continue to document production of Burbot associated with the Huron Erie Corridor (St. Clair River, Lake St. Clair, Detroit River) as well as the western basin of Lake Erie and at points eastward along the south shore, in particular sample sites at Dunkirk NY. While no surveys were conducted in 2020, Burbot larvae have been identified in preliminary analysis of 2021 samples (E. Roseman pers comm).

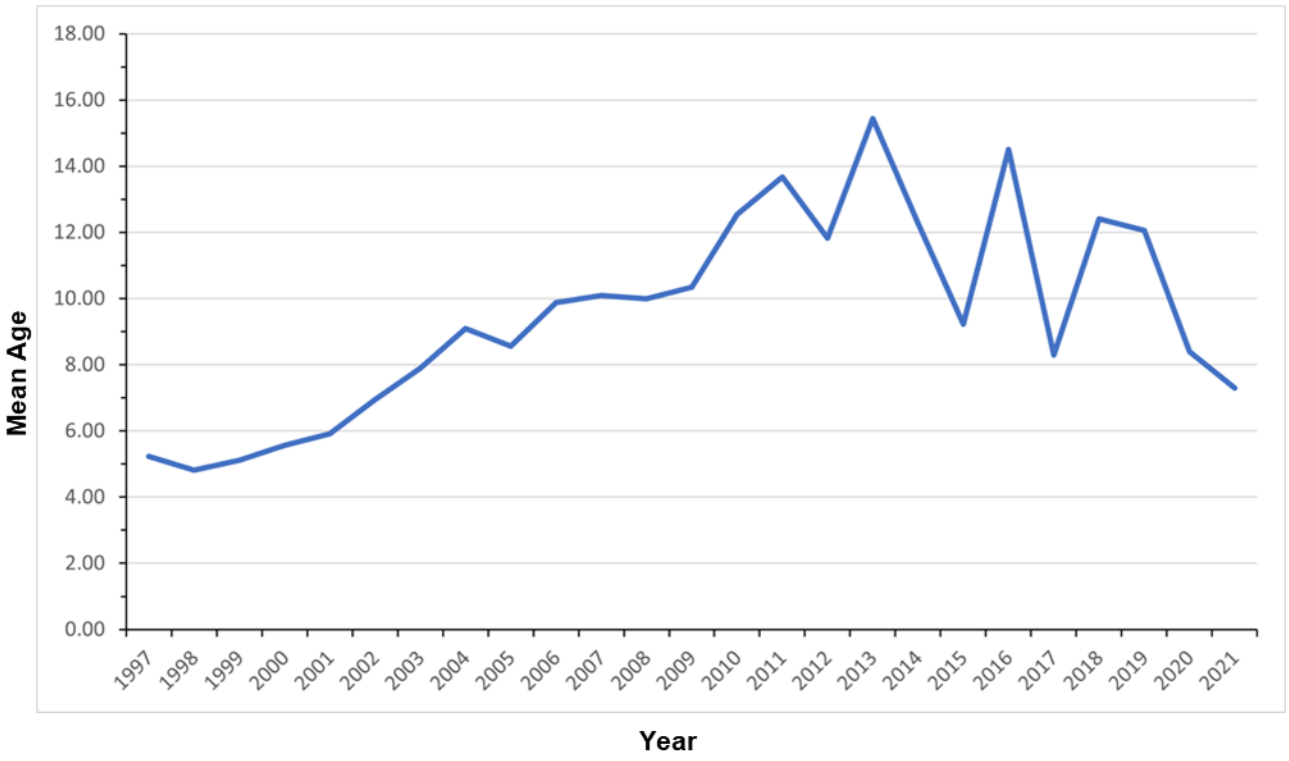


FIGURE 1.3.3. Mean age of Burbot caught in the Interagency Coldwater Assessment Survey in eastern Lake Erie from 1997-2021.

Diet

Diet information was collected for Burbot caught in the 2021 CWA Survey. Analysis of stomach contents revealed a diet made up mainly of fish (N=13, Figure 1.3.4). Burbot diets continue to be diverse, with four different identifiable fish species found in stomach samples. Round Goby was the most prevalent identifiable fish found in 46% of the stomachs examined. Rainbow Smelt were observed in 23% of the stomachs. Relative contributions from the Round Goby and Rainbow Smelt categories continue to fluctuate, relative to each other, from year to year. Fish species other than Rainbow Smelt or Round Goby (primarily Gizzard Shad), were collectively as abundant as Round Goby (46%) in 2021. One Burbot was observed with invertebrate prey in addition to fish.

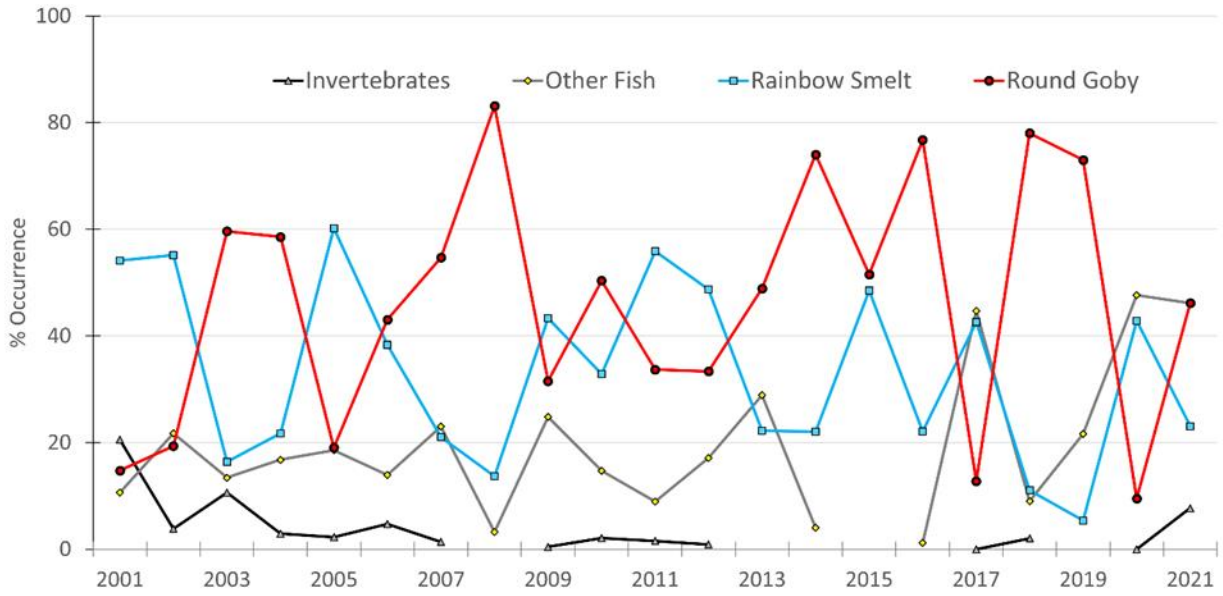


FIGURE 1.3.4: Frequency of occurrence of Rainbow Smelt, Round Goby, Other Fish, and Invertebrates in the diet of Burbot caught the Coldwater Assessment Survey in the eastern basin of Lake Erie, 2001-2021.

1.4 Report on Rainbow Trout / Steelhead

Chuck Murray, Mark Haffley (PFBC), James Markham (NYSDEC), John Deller (ODNR), and Tom MacDougall, Andy Cook (OMNDMNRF)

Tributary Angler Surveys

Rainbow/steelhead Trout (steelhead) are mainly a pelagic species in the open waters of Lake Erie and are not typically sampled efficiently in any of the long-term assessment surveys to attain population metrics such as age structure and estimates of abundance. The best measures of the status of the Lake Erie steelhead population are provided through comprehensive tributary angler surveys. Initial measures of the fishery were conducted in the 1980's and showed average steelhead catch rates of 0.10 fish per angler hour (Figure 1.4.1). Beginning in 2003-04, the NYSDEC began conducting tributary angler surveys to monitor catch, effort, and harvest of the New York steelhead fishery. These surveys were initially conducted in consecutive years, and at regular intervals (3-4 years) since then. Coincidentally, the PFBC conducted a similar survey on their steelhead fishery in 2003-04, and ODNR on theirs in 2008-09 and 2009-10. Results of these surveys showed high tributary catch rates that averaged 0.60 fish/angler hour in the mid-2000's, but then declined from 2009–2015 to 0.35 fish/hour. The most recent NYSDEC angler survey conducted in 2017-18 found tributary steelhead catch rates of 0.56 fish/angler hour, which were similar to the catch rates recorded in the mid-2000's. The Lake Erie tributaries remain one of the top destinations for Steelhead in the country.

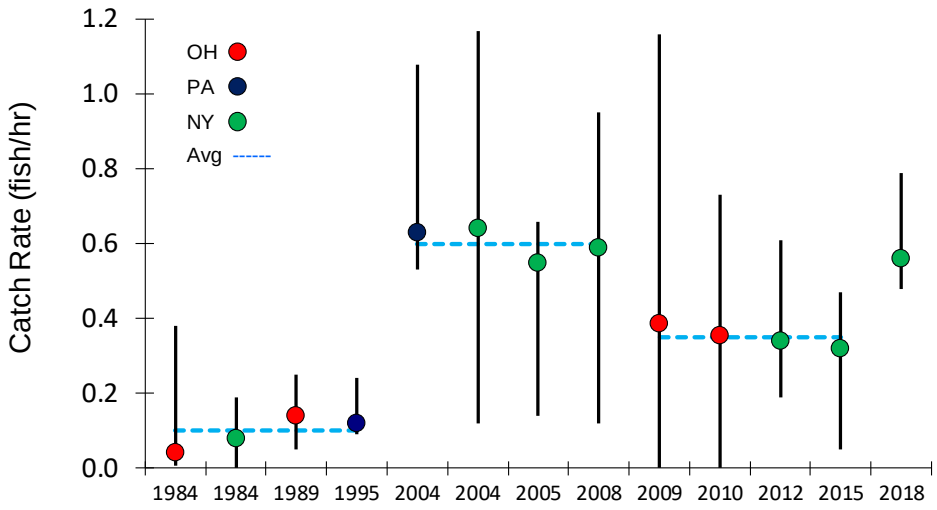


FIGURE 1.4.1. Targeted average steelhead catch rates (fish/angler hour) in Lake Erie tributary angler surveys by year and jurisdiction, 1984-2019. Vertical whiskers represent the range of individual tributary catch rates in the survey year.

Exploitation

While steelhead harvest by boat anglers represents only a fraction of the total estimated harvest, it remains the only annual estimate of steelhead harvest tabulated by most Lake Erie agencies. These can provide some measure of the relative abundance of adult Steelhead in Lake Erie. The 2021 estimated Steelhead harvest from the summer open-water boat angler fishery totaled 22,231 fish across all US agencies, a huge increase compared to 2020 and the highest harvest of steelhead since 2007 (Table 1.4.1). The vast majority of the harvest occurred in Ohio waters (20,991 fish (94.4%)) with the remainder in Pennsylvania (1,136 fish (5.1%)) and New York (104 fish (0.5%)). Open lake boat angler creel surveys have intermittently occurred in Ontario waters, but no data was collected in 2021.

TABLE 1.4.1. Estimated harvest by open lake boat anglers in Lake Erie, 1999-2021.

Year	Ohio	Pennsylvania	New York	Ontario	Michigan	Total
1999	20,396	7,401	1,000	13,000	100	41,897
2000	33,524	11,011	1,000	28,200	100	73,835
2001	29,243	7,053	940	15,900	3	53,139
2002	41,357	5,229	1,600	75,000	70	123,256
2003	21,571	1,717	400	N/A*	15	23,703
2004	10,092	2,657	896	18,148	0	31,793
2005	10,364	2,183	594	N/A*	19	13,160
2006	5,343	2,044	354	N/A*	0	7,741
2007	19,216	4,936	1,465	N/A*	68	25,685
2008	3,656	1,089	647	N/A*	39	5,431
2009	7,662	857	96	N/A*	150	8,765
2010	3,911	5,155	109	N/A*	3	9,178
2011	2,996	1,389	92	N/A*	3	4,480
2012	6,865	2,917	374	N/A*	9	10,165
2013	3,337	1,375	482	N/A*	53	5,247
2014	3,516	2,552	419	4,165	0	10,652
2015	4,622	1,165	673	N/A*	0	6,460
2016	3,577	806	452	N/A*	0	4,835
2017	6,804	1,727	516	N/A*	0	9,047
2018	5,330	837	783	N/A*	0	6,950
2019	2,887	1,719	224	N/A*	59	4,889
2020	N/A**	3,575	316	N/A*	19	3,910
2021	20,991	1,136	104	N/A*	0	22,231
mean	11,727	3,154	611	25,736	32	22,010

* no creel data collected by OMNRF in 2003, 2005-2013, 2015-2021. ** No creel data available due to COVID-19.

Abundance Indices

Partnership Surveys have run since 1989 in Ontario waters of Lake Erie. Index nets were fished at random locations in the west, west-central, east-central, Pennsylvania Ridge and east basin annually. At each site, monofilament index gill nets ranging in mesh sizes from 1 ¼" to 6" were fished on bottom and suspended (canned) at standard depths that vary according to each basin surveyed. In the east basin and Pennsylvania Ridge surveys, additional index gangs were suspended in the thermocline where depths permitted. Thermocline gangs account for the highest catches of steelhead in Partnership Surveys. Unfortunately, thermocline gangs were not fished regularly until 1999. Steelhead were also caught in central basin surveys at lower densities in nets fished on bottom and suspended and fished after fall turnover. The west basin survey occurred when water temperatures were excessively high for salmonids, making this unsuitable for steelhead assessment. Standardized steelhead catch rates (fish/lift) for combined surveys in the east, and central basins and Pennsylvania Ridge from 1999-2021 are presented in Figure 1.4.2.

Steelhead catch rates were generally high from 1999 to 2006 (average 0.27 fish/lift) but declined afterwards. Catch rates in 2021 (0.05 fish/lift, 14th percentile) were low relative to the 23-year time series. There were 13 steelhead caught in 2021 distributed between the east (8) and Pennsylvania Ridge (5) surveys. Catches were highest in thermocline nets (9), followed by canned (3) and bottom nets (1). One Steelhead had an adipose clip. None of the steelhead had lamprey wounds or scars.

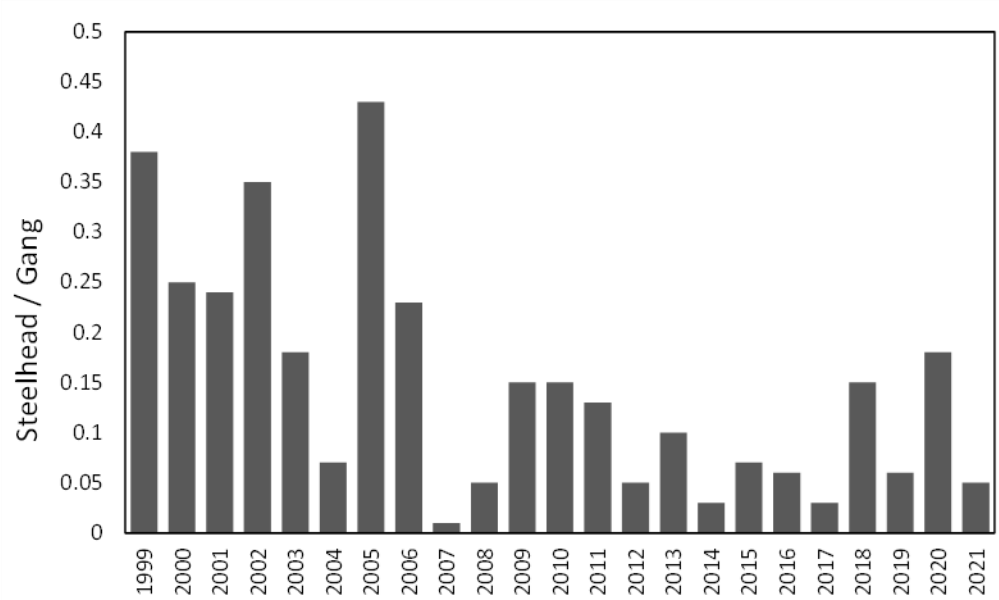


Figure 1.4.2. Steelhead catch per gang from 1999-2021. West-central, east-central, Pennsylvania Ridge, east basin, and east cap area surveys were included. Index bottom, canned and thermocline canned nets were included. Catch rates were standardized to equal effort among mesh sizes. Thermocline nets were not fished in 2007.

CHARGE 2: Continue to participate in the IMSL process on Lake Erie to outline and prescribe the needs of the Lake Erie Sea Lamprey management program.

Chris Eilers (USFWS), Lexi Sumner (DFO), James Markham (NYSDEC), and Andy Cook (OMNRF)

The Great Lakes Fishery Commission and its control agents (U.S. Fish and Wildlife Service and Fisheries and Oceans, Canada) continue to apply the Integrated Management of Sea Lamprey (IMSL) program in Lake Erie including selection of streams for lampricide treatment and implementation of alternative control methods. The Lake Erie Coldwater Task Group has provided the forum for the assemblage of Sea Lamprey wounding data used to evaluate and guide actions related to managing Sea Lamprey and for the discussion of ongoing Sea Lamprey and fishery management actions that impact the Lake Erie fish community.

Lake Trout Wounding Rates

A total of 7 A1-A3 wounds were found on 203 Lake Trout greater than 532 mm (21 inches) total length in 2021 during the Coldwater Assessment Survey, equaling a wounding rate of 3.4 wounds per 100 fish (Table 2.1; Figure 2.1). This was below the target rate of 5.0 wounds per 100 fish (Barber and Steeves 2020) for the first time since 2002 and only the second time in the past 26 years. Large Lake Trout continue to be the preferred targets for Sea Lamprey; Lake Trout greater than 736 mm (29 inches) were the only size group with fresh A1-A3 wounds (7.1 wounds/100 fish) in 2021 (Table 2.1). Small Lake Trout less than 532 mm (21 inches) are rarely attacked when larger Lake Trout are available.

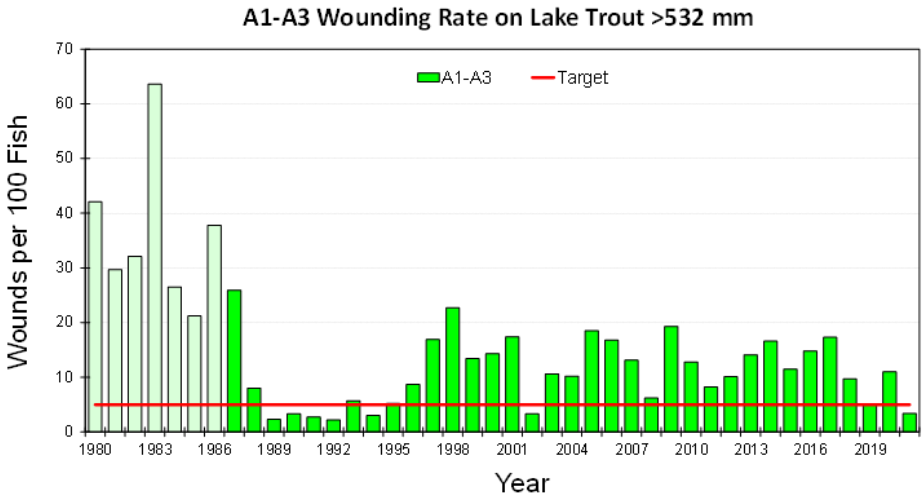


FIGURE 2.1. Number of fresh (A1-A3) Sea Lamprey wounds per 100 Lake Trout greater than 532 mm (21 inches) sampled in the CWA in the eastern basin of Lake Erie, August-September, 1980-2021. The target rate (red solid line) is 5.0 wounds per 100 fish. Lighter shading indicates pre-treatment years.

TABLE 2.1. Frequency of Sea Lamprey wounds observed on standard length groups of Lake Trout collected from the CWA in the eastern basin of Lake Erie, August 2021.

Size Class Total Length (mm)	Sample Size	Wound Classification				No. A1-A3 Wounds Per 100 Fish	No. A4 Wounds Per 100 Fish
		A1	A2	A3	A4		
432-532	4	0	0	0	0	0.0	0.0
533-634	18	0	0	0	0	0.0	0.0
635-736	86	0	0	0	3	0.0	3.5
>736	99	3	1	3	70	7.1	70.7
>532	203	3	1	3	73	3.4	36.0

Finger Lakes (FL) and Lake Champlain (LC) strain Lake Trout were the most sampled strains in 2021, and they accounted for four of the seven (57%) fresh (A1-A3) and nearly all of the healed (A4) Sea Lamprey wounds (Table 2.2). Wounding rates have typically been similar between these two strains in recent years. There were no signs of fresh or healed Sea Lamprey wounds on the Slate Island (SI) strain for the second consecutive year, which could indicate either a high avoidance behavior of Sea Lampreys or a low survival rate from a Sea Lamprey attack. Sample sizes on all other known strains (Superior (SUP), Huron-Parry Sound (HP) were too low (N=2) to provide meaningful measures of wounding. Lake Trout that could not be assigned a strain (i.e., no tag or clip present) accounted for a substantial portion (43% fresh;18% healed) of the wounding in 2021.

TABLE 2.2. Frequency of Sea Lamprey wounds observed on Lake Trout greater than 532 mm (21 inches), by strain, collected from assessment gill nets in the eastern basin of Lake Erie, August 2021. SI=Slate Island, FL=Finger Lakes, SUP=Superior, LC=Lake Champlain, HP=Huron-Parry Sound.

Lake Trout Strain	Sample Size	Wound Classification				No. A1-A3 Wounds Per 100 Fish	No. A4 Wounds Per 100 Fish
		A1	A2	A3	A4		
SI	28	0	0	0	0	0.0	0.0
FL	67	1	0	1	24	3.0	35.8
SUP	2	0	0	0	2	0.0	100.0
LC	79	0	0	2	34	2.5	43.0
HP	2	0	0	0	0	0.0	0.0
Unknown	25	2	1	0	13	12.0	52.0

Burbot Wounding Rates

The Burbot population, once the most prevalent cold-water predator in the eastern basin of Lake Erie, has declined over 95% (in relative abundance) since 2004 (see Charge 1). Coincidentally, both A1-A3 and A4 wounding rates on Burbot had increased since 2004 in eastern basin waters of Lake Erie but have declined in recent years coinciding with adult Burbot abundance (Figure 2.2). In 2021, there was no fresh (A1-A3) and one healed (A4) wounds on the 32 Burbot sampled greater than 532 mm (21 inches) during the Coldwater Assessment Survey. The low sample sizes on Burbot in recent years most likely provide a poor metric for actual wounding.

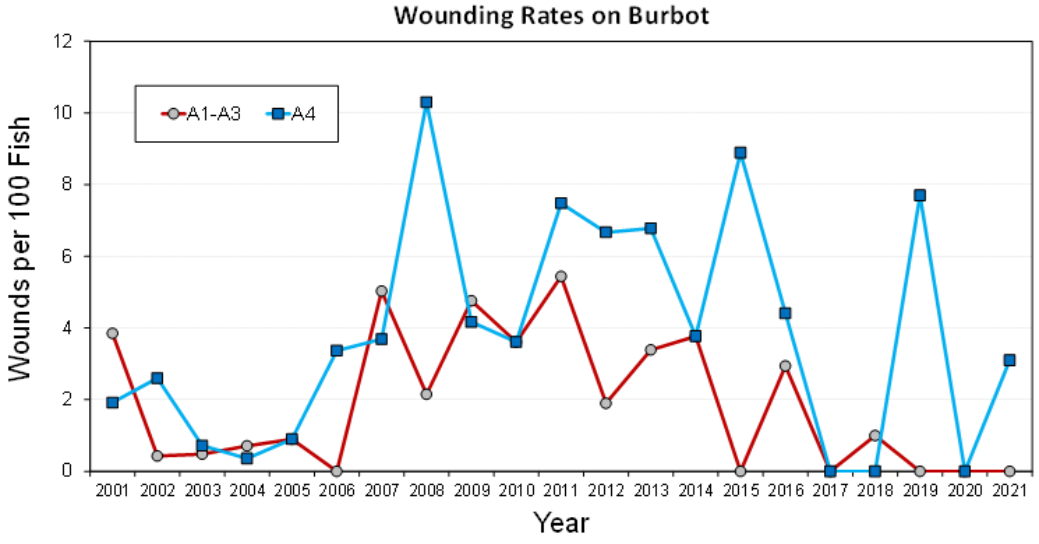


FIGURE 2.2. Number of A1-A3 and A4 Sea Lamprey wounds per 100 Burbot greater than 532 mm (21 inches) sampled in assessment gill nets in the eastern basin of Lake Erie, August, 2001-2021.

Lake Whitefish Wounding Rates

Reliable counts of Sea Lamprey wounds on Lake Whitefish have only been recorded since 2001. Wounds on Lake Whitefish were first observed in 2003, coincident with depressed adult Lake Trout abundance (see Charge 1) and have exhibited a general increasing trend since. A total of 154 Lake Whitefish greater than 532 mm (21 inches) were checked for evidence of Sea Lamprey attacks in 2021 assessment netting with no fresh or healed wounds recorded (Figure 2.3).

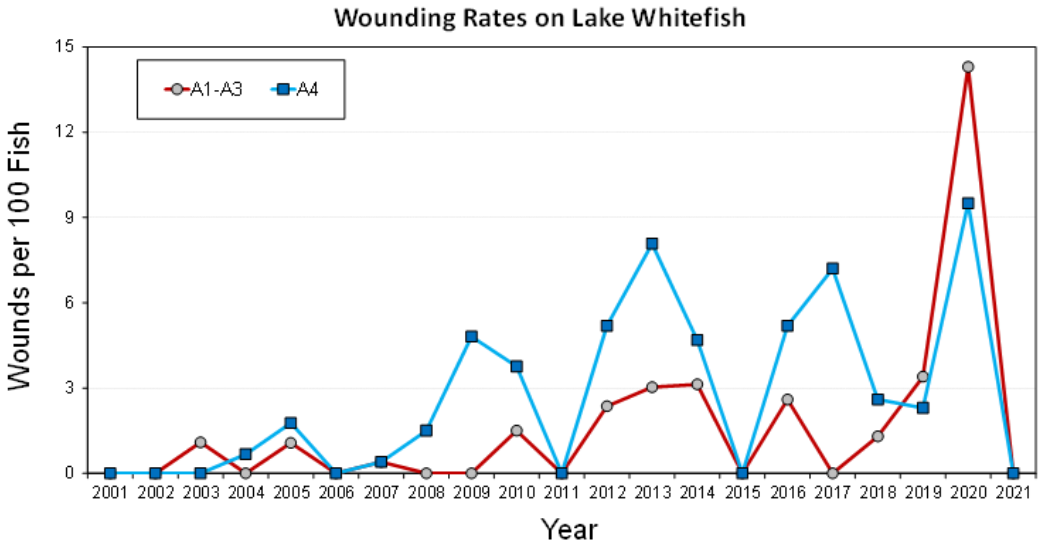


FIGURE 2.3. Number of A1-A3 and A4 Sea Lamprey wounds per 100 Lake Whitefish greater than 532 mm (21 inches) sampled in assessment gill nets in the eastern basin of Lake Erie, August, 2001-2021.

Ontario Partnership Program

The Ontario Partnership Index Fishing Program is an annual lake-wide gill net survey of the Canadian waters of Lake Erie. Index gill nets were fished on bottom and suspended in the water column at 133 sites in 2021. Auxiliary gill nets (121 mm stretched mesh size; gear height 50 meshes) were also fished suspended adjacent to index gear. Although Sea Lamprey wounds have been recorded on fish species since the survey began in 1989, detailed information on type and category of wound were not recorded until 2011.

In 2021, Sea Lamprey wounds and scars were not observed on any cold-water species such as Lake Trout (56), Lake Whitefish (40) and Burbot (38) for the second consecutive year. Wounds (A1-A4) were only observed on Yellow Perch (0.10 wounds / 100 fish); scars (B wounds) were observed on Yellow Perch (1/4028 examined) and Smallmouth Bass (1/25 examined). The spatial distribution of fish with Sea Lamprey wounds and scars in 2021 is shown in Figure 2.4.

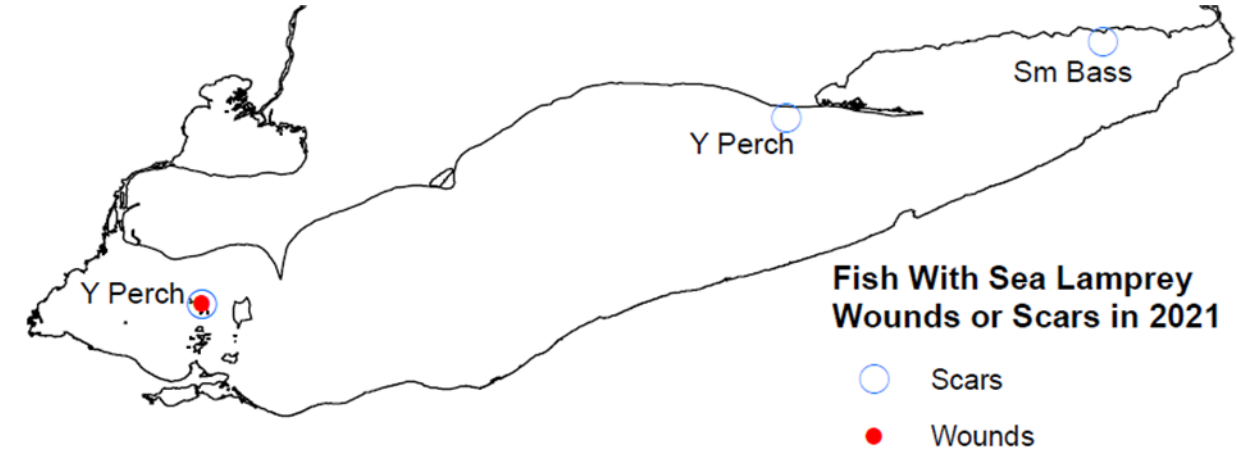


FIGURE 2.4. Individual fish with A1-A4 wounds (red circles) and B-type scars (blue squares) observed during Lake Erie Partnership surveys in 2021. Includes index and auxiliary gear.

Summary of 2021 Actions for the Integrated Management of Sea Lampreys in Lake Erie

Adult Assessment

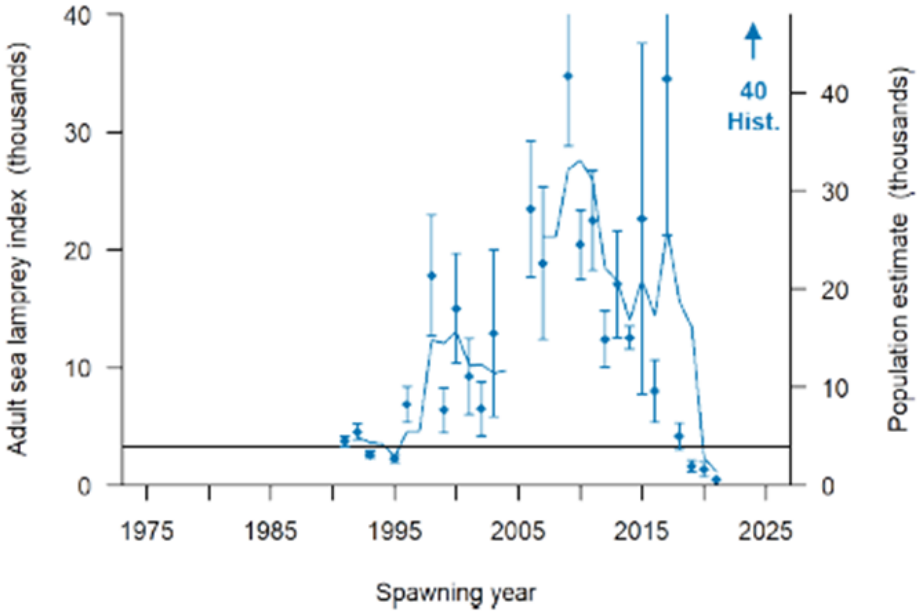


FIGURE 2.5. Index estimates with 95% confidence intervals (vertical bars) of adult Sea Lampreys, including historic pre-control abundance (as a population estimate) and the three-year moving average (line). The population estimate scale (right vertical axis) is based on the index-to-PE conversion factor of 1.2. The adult index in 2021 was 450 with 95% confidence interval (410-490). The three-year (2019-2021) average of 1,100 met the target of 3,300. The index target was estimated as the mean of indices during a period with acceptable marking rates (1991-1995).

- Mark-recapture estimates were generated for two of the five index streams and three estimates were modeled. The 3-year average adult index is the lowest in the time series (Figure 2.5).

- Fyke nets and portable traps were set in Conneaut Creek in 2021 to assess adult Sea Lamprey migrations; no Sea Lamprey were captured. Trapping is scheduled again for 2022.

- Construction of the Grand River barrier-integrated traps were completed in 2020. The traps were used for the first time in 2021 with a trap efficiency of 40%.

- With trapping efficiencies declining in Cattaraugus Creek over the past several years, FWS staff plan to investigate and assist the contractor during 2022.

LAMPRICIDE CONTROL

- Due to Covid-19 travel restrictions, the FWS deferred treatments of Raccoon Creek and Grand River.

- Big Creek and Big Otter Creek were treated in 2021. Larval Sea Lamprey abundance was low in Big Creek; Big Otter Creek had moderate larval abundance with numerous juvenile Sea Lamprey observed.

LARVAL ASSESSMENT

- Larval assessments were conducted in 31 tributaries (12 Canada, 19 U.S.).

- Surveys to detect the presence of new larval populations were conducted in 8 tributaries (6 Canada, 2 U.S.); no new populations detected.

- FWS completed six granular Bayluscide plots in U.S. waters of the St. Clair River; Sea Lamprey were captured in two of the plots.

- Due to Covid-19 travel restrictions, DFO deferred 24 plots in the upper section of the St. Clair River to 2022.

- FWS surveyed ten plots in the Detroit River around Belle Isle with granular Bayluscide; no Sea Lamprey were detected.

BARRIERS

- Surveys to evaluate barrier effectiveness were conducted on 7 tributaries (3 Canada, 4 U.S.). All barriers assessed were found to be effective in limiting Sea Lamprey infestations.

- The City of Rochester Hills, Clinton River Watershed Council, and MIDNR collaborated with FWS staff to block a natural bypass around the Yates Mill dam on the Clinton River. Remediation and permanent closure of the bypass is underway.

- To re-initiate the Cattaraugus Creek Springville Dam fish passage project, the USACE along with project partners from Erie County and NYDEC have pursued a design review to reduce costs and identify additional paths toward project completion.

- A partnership has formed between PFBC, GLFC, USACE, and the FWS to pursue construction of a Sea Lamprey barrier in Conneaut Creek. The goal of the project is to reduce the amount of stream miles exposed to lampricide application and protect sensitive, native species (mudpuppies, hellbenders, and Northern Brook Lampreys).

- In 2021, 109 barriers on Lake Erie tributaries were inspected to ground truth the current barrier inventory data within the Barrier Inventory and Project Selection System (BIPSS) database. An estimated 40 additional barriers on Lake Erie tributaries will be inspected in 2022.

RISK ASSESSMENT

- The Risk Management Team will participate with partner agencies and local community volunteers to conduct non-target mortality surveys in the Grand River during the spring lampricide treatment.

CHARGE 3: Maintain an annual interagency electronic database of Lake Erie salmonid stocking for the STC, GLFC, and Lake Erie agency data depositories.

Chuck Murray, Mark Haffley (PFBC), James Markham (NYSDEC), John Deller (ODNR), and John Buszkiewicz (MDNR)

Lake Trout Stocking

A total of 255,338 yearling Lake Trout were stocked in Lake Erie in 2021 (Figure 3.1). The USFWS Allegheny National Fish Hatchery stocked 80,618 yearlings in the eastern basin waters of Pennsylvania and 118,523 yearlings into the central basin at Fairport, Ohio. In addition, 56,197 yearlings were stocked in Ontario waters. No Lake Trout were stocked in New York waters in 2021 due to the new rotational stocking plan outlined in the revised Lake Trout Rehabilitation Plan (LEC 2021). The Lake Trout stocked in US waters were a mix of Finger Lakes (Seneca) and Lake Champlain strains; Slate Island strain fish were stocked in Ontario. The 2021 stocking exceeded the annual lake trout stocking goal of 200,000 yearlings by nearly 28%.

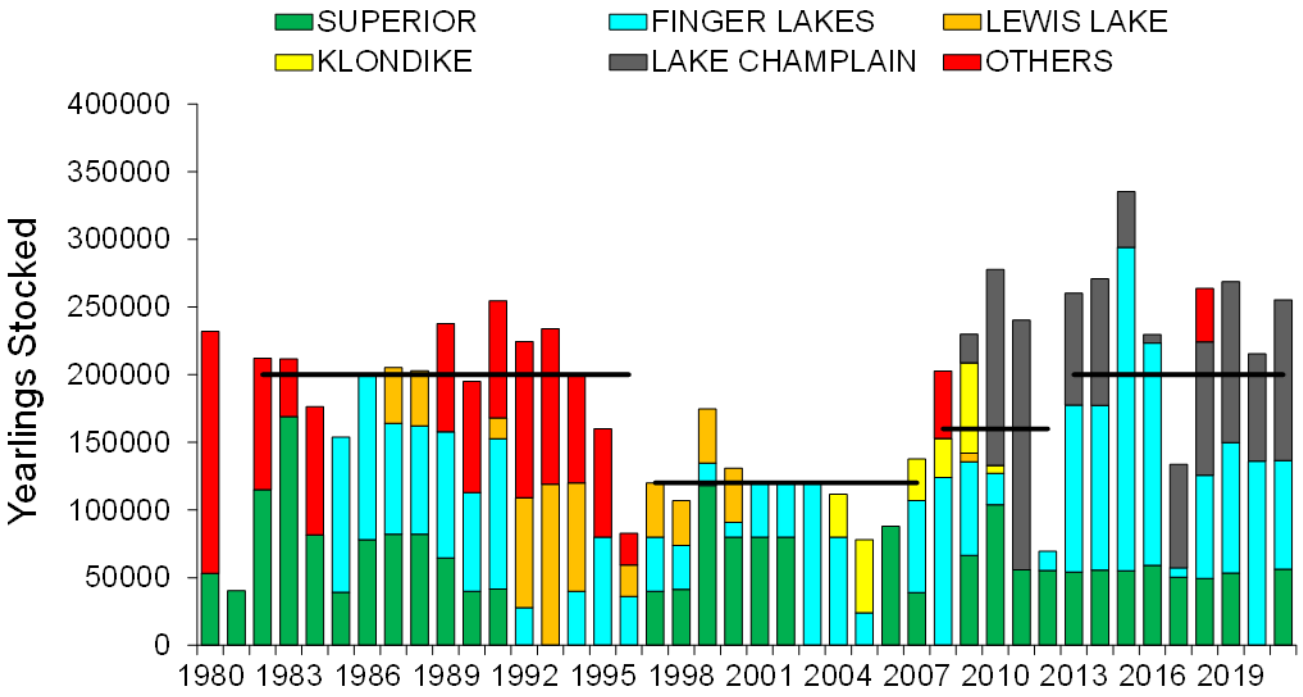


FIGURE 3.1. Lake Trout (in yearling equivalents) stocked by all jurisdictions in Lake Erie, 1980-2021, by strain. Stocking goals through time are shown by black lines dark lines; the current stocking goal is 200,000 yearlings per year. Superior includes Superior, Apostle Island, Traverse Island, Slate Island, and Michipicoten strains; Others include Clearwater Lake, Lake Ontario, Lake Erie, and Lake Manitou strains.

Stocking of Other Salmonids

In 2021, over 2.15 million yearling trout were stocked in Lake Erie, including Rainbow/steelhead Trout (steelhead), Brown Trout and Lake Trout (Figure 3.2). Total 2021 salmonid stocking increased 10.3% from 2020 but was 3.0% below the long-term average (1990-2020). Annual summaries for each species stocked within individual state and provincial areas are summarized in Table 3.1 and are standardized to yearling equivalents.

All of the US fisheries resource agencies and a few non-governmental organizations (NGO's) in Pennsylvania currently stock steelhead in the Lake Erie watershed. A total of 1,851,800 yearling steelhead were stocked in 2021, accounting for 86% of all salmonids stocked. This was a 10.9% increase from 2020 and near the long-term (1990-2020)

average annual stocking of 1,848,195 steelhead. Over half of all steelhead stocking occurred in Pennsylvania waters (58.9%), followed by 26.9% in Ohio waters, 10.5% in New York waters, and 3.6% in Ontario waters. Steelhead were not stocked in Michigan waters in 2021; no eggs were collected in 2020 due to COVID-19. The NYSDEC stocked 132,569 yearling steelhead and 62,000 domestic Rainbow Trout in 2021, which in combination was slightly above their stocking target of 192,500 yearlings. Steelhead stocking in Ohio was 24.7% above a target objective of 400,000 yearling steelhead while Pennsylvania steelhead stocking was 9.1% above a stocking objective of 1 million yearlings. Details of stocking locations and numbers of fish per stream can be found in agency reports.

Brown Trout stocking in Lake Erie totaled 46,607 yearling and adults in 2021, all in Pennsylvania waters to provide catchable trout for the opening of the 2021 Pennsylvania trout season. This was a 30% decrease from 2020 and 47% below the long-term (1990-2020) average annual stocking of 87,269 brown trout. These fish are in support of a put-grow-take brown trout program that was initiated in 2009. Brown trout stocking levels for catchable trout are expected to continue at the current rates in Pennsylvania.

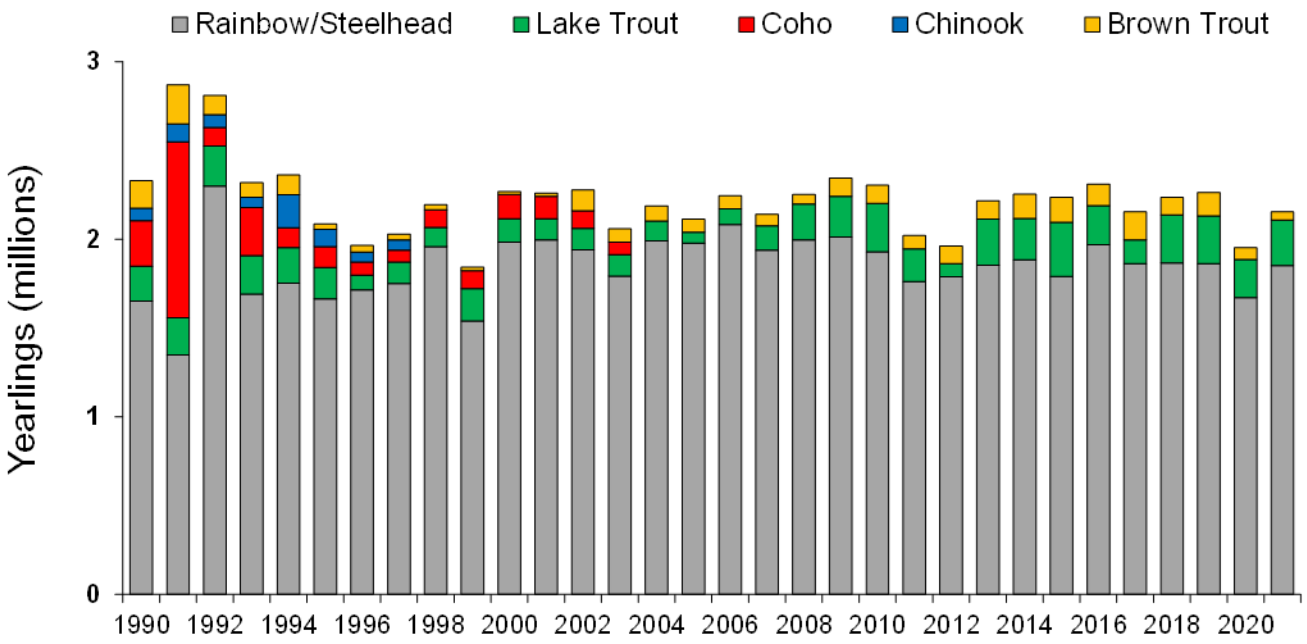


FIGURE 3.2. Annual stocking of all salmonid species (in yearling equivalents) in Lake Erie by all agencies, 1990-2021.

TABLE 3.1. Summary of salmonid stockings in numbers of yearling equivalents, Lake Erie, 1990-2021.

Year	Jurisdiction	Lake Trout	Coho	Chinook	Brown Trout	Rainbow/Steelhead	Total
1990	ONT.	--	--	--	--	31,530	31,530
	NYS DEC	113,730	5,730	65,170	48,320	160,500	393,450
	PFBC	82,000	249,810	5,670	55,670	889,470	1,282,620
	ODNR	--	--	--	--	485,310	485,310
	MDNR	--	--	--	51,090	85,290	136,380
	1990 Total	**195,730**	**255,540**	**70,840**	**155,080**	**1,652,100**	**2,329,290**
1991	ONT.	--	--	--	--	98,200	98,200
	NYS DEC	125,930	5,690	59,590	43,500	181,800	416,510
	PFBC	84,000	984,000	40,970	124,500	641,390	1,874,860
	ODNR	--	--	--	--	367,910	367,910
	MDNR	--	--	--	52,500	58,980	111,480
	1991 Total	**209,930**	**989,690**	**100,560**	**220,500**	**1,348,280**	**2,868,960**
1992	ONT.	--	--	--	--	89,160	89,160
	NYS DEC	108,900	4,670	56,750	46,600	149,050	365,970
	PFBC	115,700	98,950	15,890	61,560	1,485,760	1,777,860
	ODNR	--	--	--	--	561,600	561,600
	MDNR	--	--	--	--	14,500	14,500
	1992 Total	**224,600**	**103,620**	**72,640**	**108,160**	**2,300,070**	**2,809,090**
1993	ONT.	--	--	--	650	16,680	17,330
	NYS DEC	142,700	--	56,390	47,000	256,440	502,530
	PFBC	74,200	271,700	--	36,010	973,300	1,355,210
	ODNR	--	--	--	--	421,570	421,570
	MDNR	--	--	--	--	22,200	22,200
	1993 Total	**216,900**	**271,700**	**56,390**	**83,660**	**1,690,190**	**2,318,840**
1994	ONT.	--	--	--	--	69,200	69,200
	NYS DEC	120,000	--	56,750	--	251,660	428,410
	PFBC	80,000	112,900	128,000	112,460	1,240,200	1,673,560
	ODNR	--	--	--	--	165,520	165,520
	MDNR	--	--	--	--	25,300	25,300
	1994 Total	**200,000**	**112,900**	**184,750**	**112,460**	**1,751,880**	**2,361,990**
1995	ONT.	--	--	--	--	56,000	56,000
	NYS DEC	96,290	--	56,750	--	220,940	373,980
	PFBC	80,000	119,000	40,000	30,350	1,223,450	1,492,800
	ODNR	--	--	--	--	112,950	112,950
	MDNR	--	--	--	--	50,460	50,460
	1995 Total	**176,290**	**119,000**	**96,750**	**30,350**	**1,663,800**	**2,086,190**
1996	ONT.	--	--	--	--	38,900	38,900
	NYS DEC	46,900	--	56,750	--	318,900	422,550
	PFBC	37,000	72,000	--	38,850	1,091,750	1,239,600
	ODNR	--	--	--	--	205,350	205,350
	MDNR	--	--	--	--	59,200	59,200
	1996 Total	**83,900**	**72,000**	**56,750**	**38,850**	**1,714,100**	**1,965,600**
1997	ONT.	--	--	--	1,763	51,000	52,763
	NYS DEC	80,000	--	56,750	--	277,042	413,792
	PFBC	40,000	68,061	--	31,845	1,153,606	1,293,512
	ODNR	--	--	--	--	197,897	197,897
	MDNR	--	--	--	--	71,317	71,317
	1997 Total	**120,000**	**68,061**	**56,750**	**33,608**	**1,750,862**	**2,029,281**
1998	ONT.	--	--	--	--	61,000	61,000
	NYS DEC	106,900	--	--	--	299,610	406,510
	PFBC	--	100,000	--	28,030	1,271,651	1,399,681
	ODNR	--	--	--	--	266,383	266,383
	MDNR	--	--	--	--	60,030	60,030
	1998 Total	**106,900**	**100,000**	**0**	**28,030**	**1,958,674**	**2,193,604**
1999	ONT.			--		85,235	85,235
	NYS DEC	143,320		--		310,300	453,620
	PFBC	40,000	100,000	--	20,780	835,931	996,711
	ODNR			--		238,467	238,467
	MDNR			--		69,234	69,234
	1999 Total	**183,320**	**100,000**	**0**	**20,780**	**1,539,167**	**1,843,267**

TABLE 3.1. (Continued) Summary of salmonid stockings in number of yearling equivalents, 1990-2021.

Year	Jurisdiction	Lake Trout	Coho	Chinook	Brown Trout	Rainbow/Steelhead	Total
2000	ONT.	--	--	--	--	10,787	10,787
	NYS DEC	92,200	--	--	--	298,330	390,530
	PFBC	40,000	137,204	--	17,163	1,237,870	1,432,237
	ODNR	--	--	--	--	375,022	375,022
	MDNR	--	--	--	--	60,000	60,000
	2000 Total	**132,200**	**137,204**	**0**	**17,163**	**1,982,009**	**2,268,576**
2001	ONT.	--	--	--	100	40,860	40,960
	NYS DEC	80,000	--	--	--	276,300	356,300
	PFBC	40,000	127,641	--	17,000	1,185,239	1,369,880
	ODNR	--	--	--	--	424,530	424,530
	MDNR	--	--	--	--	67,789	67,789
	2001 Total	**120,000**	**127,641**	**0**	**17,100**	**1,994,718**	**2,259,459**
2002	ONT.	--	--	--	4,000	66,275	70,275
	NYS DEC	80,000	--	--	72,300	257,200	409,500
	PFBC	40,000	100,289	--	40,675	1,145,131	1,326,095
	ODNR	--	--	--	--	411,601	411,601
	MDNR	--	--	--	--	60,000	60,000
	2002 Total	**120,000**	**100,289**	**0**	**116,975**	**1,940,207**	**2,277,471**
2003	ONT.	--	--	--	7,000	48,672	55,672
	NYS DEC	120,000	--	--	44,813	253,750	418,563
	PFBC	--	69,912	--	22,921	866,789	959,622
	ODNR	--	--	--	--	544,280	544,280
	MDNR	--	--	--	--	79,592	79,592
	2003 Total	**120,000**	**69,912**	**0**	**74,734**	**1,793,083**	**2,057,729**
2004	ONT.	--	--	--	--	34,600	34,600
	NYS DEC	111,600	--	--	36,000	257,400	405,000
	PFBC	--	--	--	50,350	1,211,551	1,261,901
	ODNR	--	--	--	--	422,291	422,291
	MDNR	--	--	--	--	64,200	64,200
	2004 Total	**111,600**	**0**	**0**	**86,350**	**1,990,042**	**2,187,992**
2005	ONT.	--	--	--	--	55,000	55,000
	NYS DEC	62,545	--		37,440	275,000	374,985
	PFBC	--	--	--	35,483	1,183,246	1,218,729
	ODNR	--	--	--	--	402,827	402,827
	MDNR	--	--	--	--	60,900	60,900
	2005 Total	**62,545**	**0**	**0**	**72,923**	**1,976,973**	**2,112,441**
2006	ONT.	88,000	--	--	175	44,350	132,525
	NYS DEC		--	--	37,540	275,000	312,540
	PFBC	--	--	--	35,170	1,205,203	1,240,373
	ODNR	--	--	--	--	491,943	491,943
	MDNR	--	--	--	--	66,514	66,514
	2006 Total	**88,000**	**0**	**0**	**72,885**	**2,083,010**	**2,243,895**
2007	ONT.	--	--	--		27,700	27,700
	NYS DEC	137,637	--	--	37,900	272,630	448,167
	PFBC	--	--	--	27,715	1,122,996	1,150,711
	ODNR	--	--	--	--	453,413	453,413
	MDNR	--	--	--	--	60,500	60,500
	2007 Total	**137,637**	**0**	**0**	**65,615**	**1,937,239**	**2,140,491**
2008	ONT.	50,000	--	--	--	36,500	86,500
	NYS DEC	152,751	--	--	36,000	269,800	458,551
	PFBC		--	--	17,930	1,157,968	1,175,898
	ODNR		--	--		465,347	465,347
	MDNR		--	--		65,959	65,959
	2008 Total	**202,751**	**0**	**0**	**53,930**	**1,995,574**	**2,252,255**
2009	ONT.	50,000	--	--	--	18,610	68,610
	NYS DEC	173,342	--	--	38,452	276,720	488,514
	PFBC	6,500	--	--	64,249	1,186,825	1,257,574
	ODNR	--	--	--	--	458,823	458,823
	MDNR	--	--	--	--	70,376	70,376
	2009 Total	**229,842**	**0**	**0**	**102,701**	**2,011,354**	**2,343,897**

TABLE 3.1. (Continued) Summary of salmonid stockings in number of yearling equivalents, 1990-2021.

Year	Jurisdiction	Lake Trout	Coho	Chinook	Brown Trout	Rainbow/Steelhead	Total
2010	ONT.	126,864	--	--		33,447	160,311
	NYS DEC	144,772	--	--	38,898	310,194	493,864
	PFBC	1,303	--	--	63,229	1,085,406	1,149,938
	ODNR	--	--	--		433,446	433,446
	MDNR	--	--	--		66,536	66,536
	2010 Total	**272,939**	**0**	**0**	**102,127**	**1,929,029**	**2,304,095**
2011	ONT.	--	--	--	--	36,730	36,730
	NYS DEC	184,259	--	--	38,363	305,780	528,401
	PFBC	--	--	--	36,045	1,091,793	1,127,838
	ODNR	--	--	--	--	265,469	265,469
	MDNR	--	--	--	--	61,445	61,445
	2011 Total	**184,259**	**0**	**0**	**74,408**	**1,761,217**	**2,019,883**
2012	ONT.	55,330	--	--	--	21,050	76,380
	NYS DEC	--	--	--	35,480	260,000	295,480
	PFBC	--	--	--	65,724	1,018,101	1,083,825
	ODNR	17,143	--	--	--	425,188	442,331
	MDNR	--	--	--	--	64,500	64,500
	2012 Total	**72,473**	**0**	**0**	**101,204**	**1,788,839**	**1,962,516**
2013	ONT.	54,240	--	--	--	2,000	56,240
	NYS DEC	41,200	--	--	32,630	260,000	333,830
	PFBC	82,400	--	--	71,486	1,072,410	1,226,296
	ODNR	82,200	--	--	--	455,678	537,878
	MDNR	--	--	--	--	62,400	62,400
	2013 Total	**260,040**	**0**	**0**	**104,116**	**1,852,488**	**2,216,644**
2014	ONT.	55,632	--	--		56,700	112,332
	NYS DEC	40,691	--	--	38,707	258,950	338,348
	PFBC	53,370	--	--	97,772	1,070,554	1,221,696
	ODNR	83,885	--	--		428,610	512,495
	MDNR	--	--	--		67,800	67,800
	2014 Total	**233,578**	**0**	**0**	**136,479**	**1,882,614**	**2,252,671**
2015	ONT.	55,370	--	--	--	70,250	125,620
	NYS DEC	81,867	--	--	37,840	153,923	273,630
	PFBC	82,149	--	--	103,173	1,079,019	1,264,341
	ODNR	85,433	--	--	--	421,740	507,173
	MDNR	--	--	--	--	64,735	64,735
	2015 Total	**304,819**	**0**	**0**	**141,013**	**1,789,667**	**2,235,499**
2016	ONT.	60,005	--	--	--	4,324	64,329
	NYS DEC	51,461	--	--	38,110	407,111	496,682
	PFBC	32,500	--	--	83,249	1,074,849	1,190,598
	ODNR	75,650	--	--	--	416,593	492,243
	MDNR	--	--	--	--	66,000	66,000
	2016 Total	**219,616**	**0**	**0**	**121,359**	**1,968,877**	**2,309,852**
2017	ONT.	50,982				59,750	110,732
	NYS DEC	76,456			36,480	267,166	380,102
	PFBC				123,186	1,032,421	1,155,607
	ODNR					442,228	442,228
	MDNR					60,706	60,706
	2017 Total	**127,438**	**0**	**0**	**159,666**	**1,862,271**	**2,149,375**
2018	ONT.	55,940				35,500	91,440
	NYS DEC	95,445				311,843	407,288
	PFBC	39,660			98,966	979,851	1,118,477
	ODNR	79,230				478,408	557,638
	MDNR					62,000	62,000
	2018 Total	**270,275**	**0**	**0**	**98,966**	**1,867,602**	**2,236,843**
2019	ONT.	53,285				0	53,285
	NYS DEC	95,672				153,944	249,616
	PFBC	39,677			132,496	1,072,012	1,244,185
	ODNR	80,026				512,548	592,574
	MDNR					64,374	64,374
	2019 Total	**268,660**	**0**	**0**	**132,496**	**1,802,878**	**2,204,034**

TABLE 3.1. (Continued) Summary of salmonid stockings in number of yearling equivalents, 1990-2021.

Year	Jurisdiction	Lake Trout	Coho	Chinook	Brown Trout	Rainbow/Steelhead	Total
2020	**ONT.**	0				0	0
	NYS DEC	135,997				187,280	323,277
	PFBC	79,450			66,883	949,000	1,095,333
	ODNR					469,265	469,265
	MDNR					64,374	64,374
	2020 Total	**215,447**	**0**	**0**	**66,883**	**1,669,919**	**1,952,249**
2021	**ONT.**	56,197				67,062	123,259
	NYS DEC					194,569	194,569
	PFBC	80,618			46,607	1,091,197	1,218,422
	ODNR	118,523				498,972	617,495
	MDNR					0	0
	2021 Total	**255,338**	**0**	**0**	**46,607**	**1,851,800**	**2,153,745**

CHARGE 4: Finalize Lake Trout Rehabilitation Plan, within scope of new FCOs, for LEC approval by May 14, 2021.

The Lake Trout Rehabilitation Plan for 2021-2030 was completed in May of 2021. The complete plan is available on the Lake Erie Committee web site:
http://www.glfc.org/pubs/lake_committees/erie/LEC_lake%20trout%20management%20plan%202021_FINALdocx.pdf

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