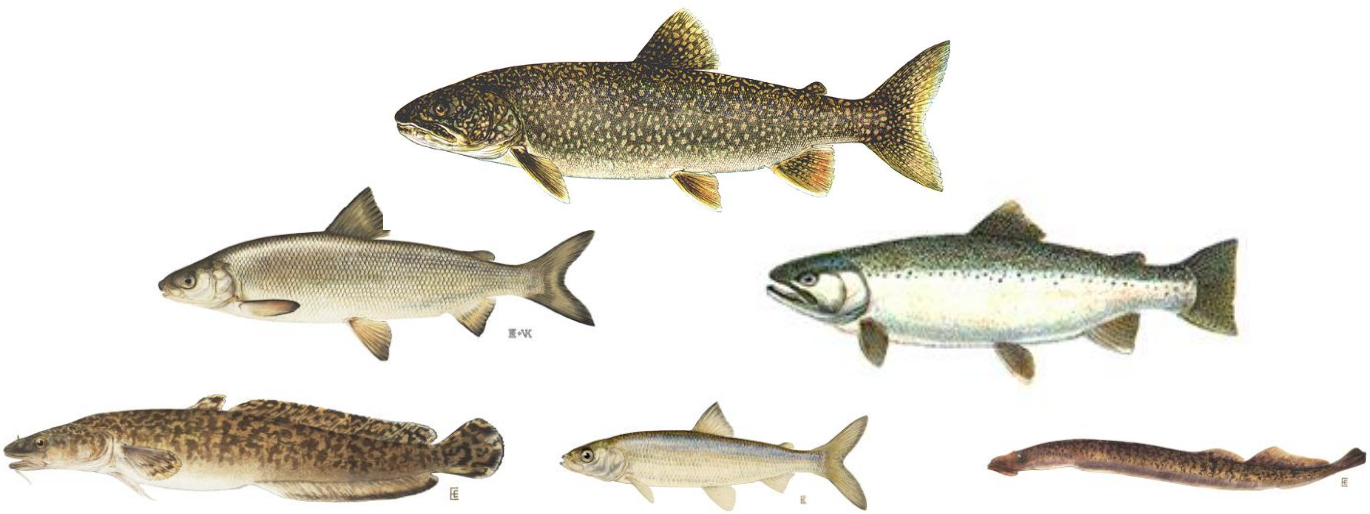
2019 REPORT OF THE LAKE ERIE COLDWATER TASK GROUP

March 2020

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



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Lake Erie Committee

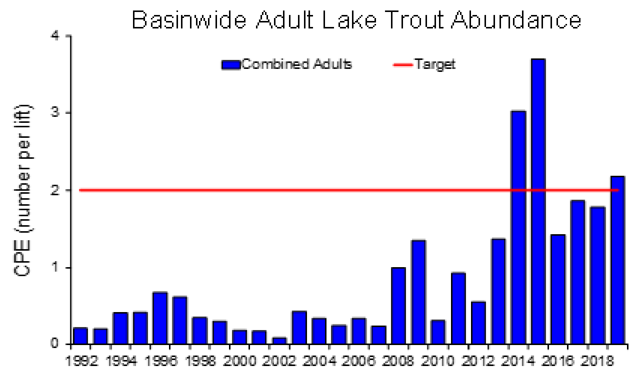
REPRESENTING THE FISHERY MANAGEMENT AGENCIES OF LAKE ERIE AND LAKE ST. CLAIR

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. Five charges were addressed by the CWTG during 2019-2020: (1) Report on the status of the cold water fish community, (2) Participation in Sea Lamprey assessment and control in the Lake Erie watershed, (3) Maintenance of an electronic database of Lake Erie salmonid stocking information, (4) Status of Steelhead and development of a mass marking study, and (5) Review and provide recommendations on Lake Trout Plan revision. The complete report is available from the Great Lakes Fishery Commission's Lake Erie Committee Coldwater Task Group website at http://www.glfc.org/lakecom/lec/CWTG.htm, or upon request from an LEC or CWTG representative.

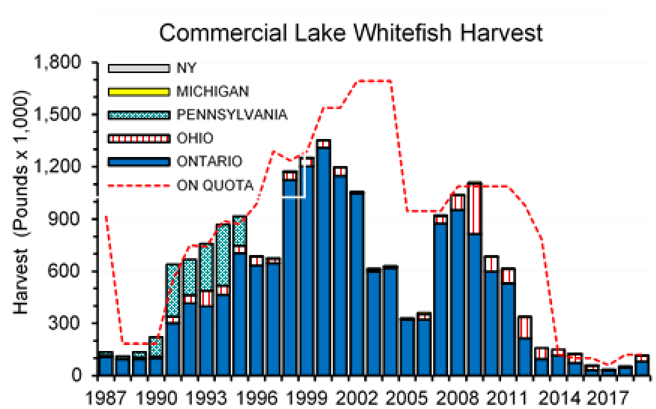
Lake Trout

A total of 570 Lake Trout were collected in 130 gill net lifts across the eastern basin of Lake Erie in 2019. Basin wide Lake Trout abundance was 4.1 fish/lift, which is above average for the time series but well below the rehabilitation target of 8.0 fish/lift. However, adult abundance (ages 5+) was at its third highest measure in the time series and slightly above the target of 2.0 fish/lift (see figure). Lake Trout ages 3, 4, 9, and 10 were the dominate cohorts; Lake Trout older than age-10 continue to increase in abundance. Finger Lakes and Lake Champlain strains comprise the majority of the population. The Lake Erie Lake Trout population continues to be supported by binational stocking efforts; natural reproduction has not been documented in Lake Erie despite more than 30 years of restoration efforts.



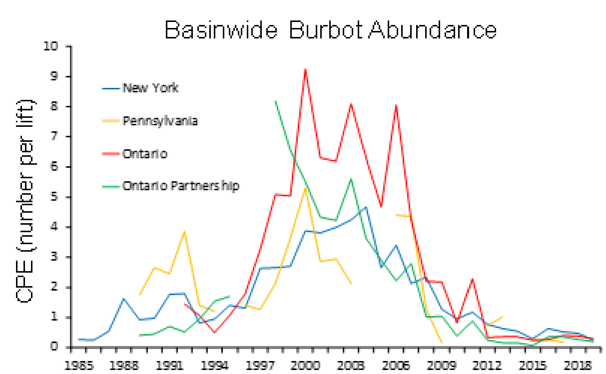
Lake Whitefish

Lake Whitefish harvest in 2019 was 114,703 pounds, distributed between Ontario (71%), Ohio (27%) and Pennsylvania (2%). Harvest more than doubled compared to 2018 but was low. Gill net fishery age composition ranged from ages 4 to 25 with additional ages (0,1,2) present in non-random samples. The 2015 and 2014 year classes (ages 4, 5) represented the majority of Lake Whitefish harvested. Gill net surveys caught Lake Whitefish from ages 1 to 27 with more diverse, older ages present in Coldwater Assessment nets fished in US waters. Central and east basin bottom trawl surveys forecast additional recruitment to follow the 2014 and 2015 cohorts; 2018 may be the most recent strong cohort. Conservative harvest is recommended until Lake Erie's Lake Whitefish status is better understood.



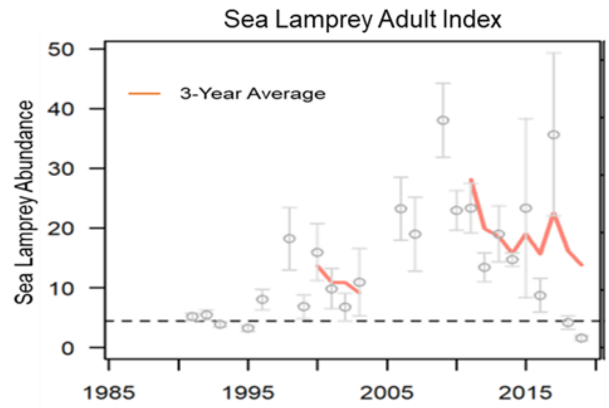
Burbot

Total commercial harvest of Burbot in Lake Erie in 2019 was 2,128 pounds. All harvest 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 catch rate in the Interagency Coldwater Assessment Survey averaged 0.3 fish/lift and in the Ontario Partnership Assessment Survey averaged 0.2 fish/lift. Burbot in the Coldwater Assessment Survey ranged in age from 4 to 26 and mean age was 12.0 years. Round Goby was the dominant prey item in Burbot diets.



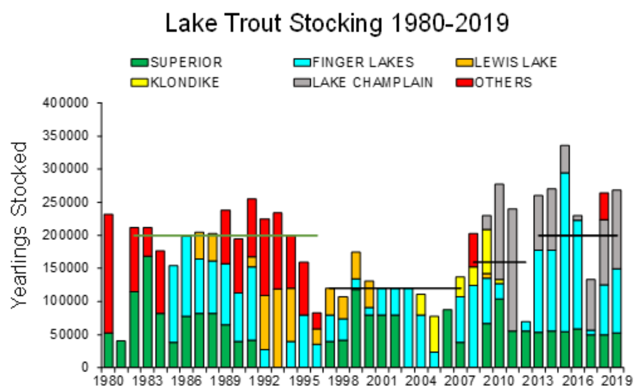
Sea Lamprey

The A1-A3 wounding rate on Lake Trout over 532 mm was 5.1 wounds per 100 fish in 2019. This was the lowest wounding rate since 2002 and near the target rate of 5.0 wounds per 100 fish. Wounding rates have been above target for 23 of the past 24 years. Large Lake Trout over 635 mm continue to be the preferred targets for Sea Lamprey in Lake Erie. The Index of Adult Sea Lamprey Abundance (1,587) represents a substantial decrease compared to recent estimates and was below the target population of 4,435 for the second consecutive year. Lampricide treatments were completed in four tributaries and comprehensive stream evaluations continued in 2019, including extensive detection surveys around the basin to inventory all sources contributing to the Lake Erie population.



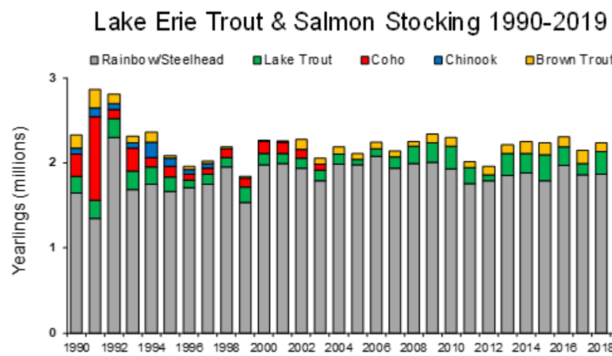
Lake Erie Salmonid Stocking

A total of 2,262,850 yearling salmonids were stocked in Lake Erie in 2019, which was near the long-term average (1990-2018). Lake Trout stocking was above targets for the sixth time in the past seven years, and three different strains were stocked in 2019. By species, there were 268,660 yearling Lake Trout stocked in all three basins of Lake Erie, 132,496 Brown Trout stocked in Pennsylvania waters, and 1,861,694 Rainbow/Steelhead Trout stocked across all four US jurisdictional waters.



Steelhead

All US agencies stocked yearling Steelhead in 2019; there were no Steelhead stocked in Ontario waters. The summary of Steelhead stocking in Lake Erie by jurisdictional waters for 2019 is: Pennsylvania (1,072,012; 60%), Ohio (512,548; 29%), New York (146,760; 8%), and Michigan (64,374; 4%). Total Steelhead stocking in 2019 (1.796 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 4,889 Steelhead across all US agencies in 2019. This was a 30% decrease compared to 2018 estimates and below the long-term average harvest of 8,600. Overall open lake catch rates remain near the long-term average, but reported effort remains small relative to percids. 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.



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

1.1 Report on the status of the Lake Whitefish fishery.

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

Commercial Harvest

The total harvest of Lake Whitefish in Lake Erie during 2019 was 114,703 pounds (Figure 1.1.1). Ontario accounted for 71% (81,007 pounds) of the lake-wide total, followed by Ohio (27%; 31,409 pounds) and Pennsylvania (2%; 2,286 pounds). No commercial harvest of Lake Whitefish occurred in New York or Michigan waters (Figure 1.1.2). Total Whitefish harvest in 2019 more than doubled the harvest in 2018. Lake Whitefish harvest increased in Ontario by 82% and more significantly in Ohio and Pennsylvania where minimal harvest occurred in 2018.

Ontario's harvest in 2019 represented 65% of the quota (120,000 pounds) after accounting for ice to preserve landed fish. Almost all (>99%) of Ontario's 2019 Lake Whitefish harvest was captured using gill nets. The remaining harvest of 294 pounds was caught in trawls targeting Rainbow Smelt (292 pounds) and impoundment gear (2 pounds). In addition to the Whitefish harvested, 450 pounds were surrendered to MNRF in 2019. The largest fraction of Ontario's Whitefish harvest (79%) was caught in the west basin (Ontario-Erie statistical district OE-1) followed by OE-2 (17%), with the remaining harvest distributed eastward among statistical districts OE-3 (3%), OE-4 (<1%) and OE-5 (<1%; Figure 1.1.2). Maximum harvest in 2019 was distributed west and north 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 (42,791 pounds) and December (10,335 pounds); only 9% of OE-1 harvest occurred from January to May. Whitefish harvest in the central basin (OE2, OE3) was distributed evenly between spring and fall months. Only 1,038 pounds of Whitefish were landed in eastern Lake Erie (OE-4 and OE-5) in 2019 with 72% of harvest from gill nets and 28% of harvest from Rainbow

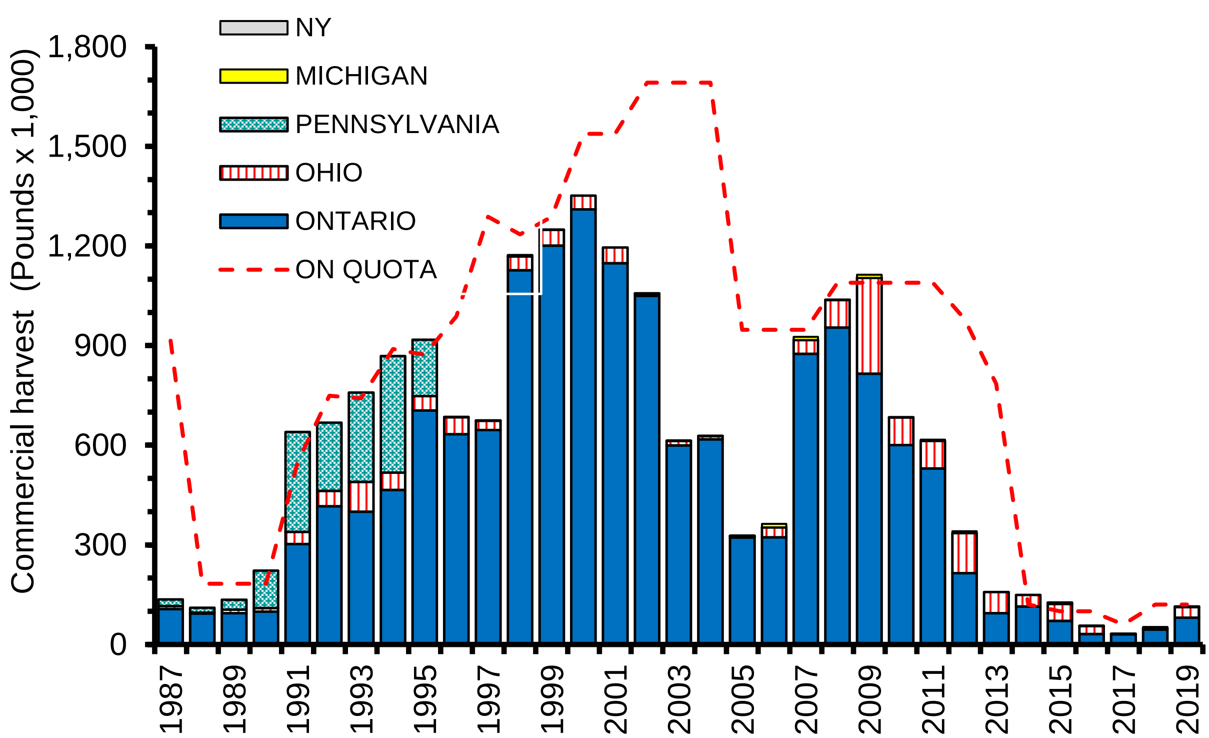


FIGURE 1.1.1. Lake Whitefish total harvest from 1987-2019 by jurisdiction in Lake Erie. Pennsylvania ceased gill netting in 1996. Ontario quota is presented as a dashed line.

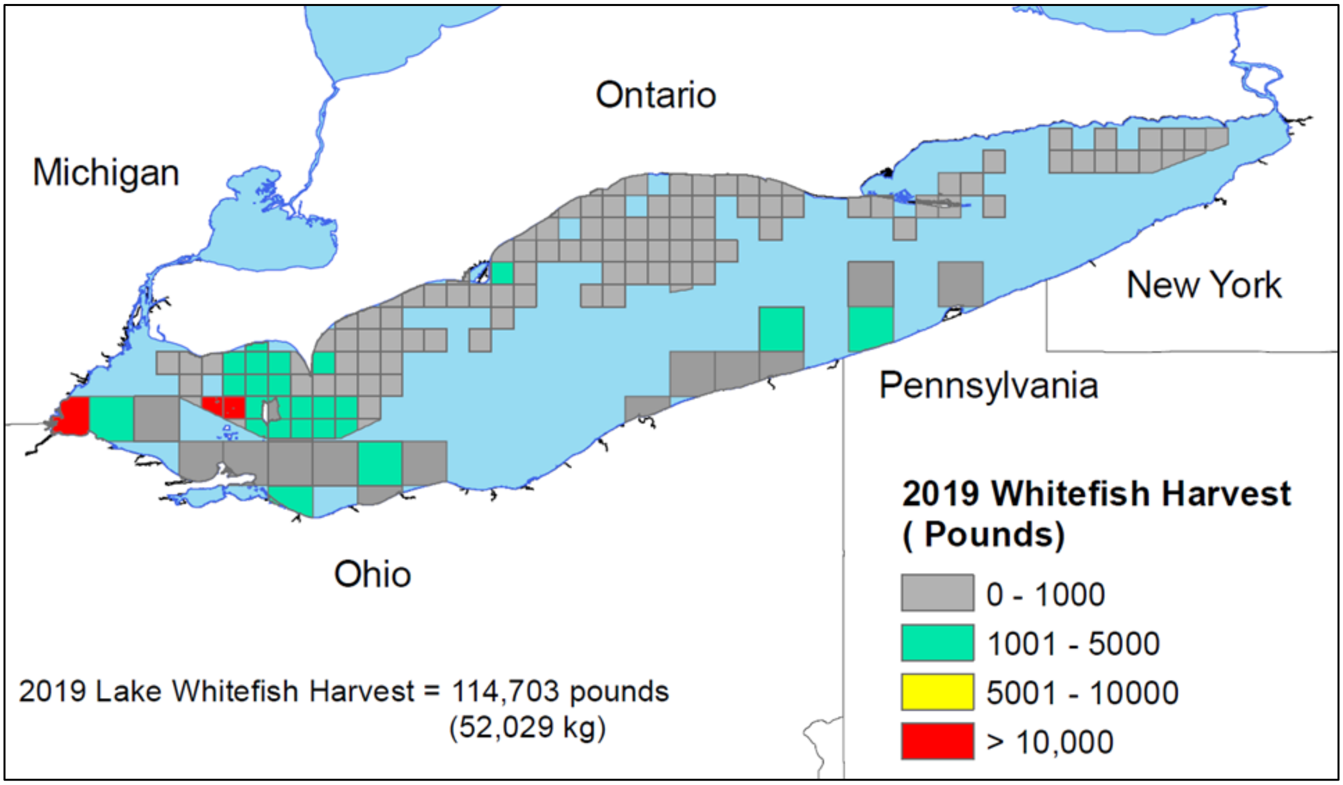


FIGURE 1.1.2. Commercial harvest of Lake Whitefish in Lake Erie during 2019 by 5-minute (Ontario) and 10-minute (U.S.) grids. Total harvest in 2019 = 114,703 pounds.

Smelt trawls. There was no reported effort targeting Lake Whitefish during 2019 in Ontario waters of Lake Erie. Lake-wide, Ontario's Lake Whitefish harvest came from fisheries targeting Walleye (93%), White Bass (5%), White Perch (1%), Yellow Perch (<1%) and Rainbow Smelt (<1%).

Ontario annual lake-wide commercial catch rates are presented in three forms: 1) catch rates from targeted gill net effort (1998-2013), 2) catch rates from all large mesh (≥ 76 mm) gill net effort, and 3) catch rates for all gill nets that had a Lake Whitefish in the catch (Figure 1.1.3). Targeted gill net fishing for Lake Whitefish ceased in 2013 and no data is available from 2014-2019. Catch rates based on all large mesh effort and effort with Lake Whitefish in the catch during 2019 increased by 80% and 47% from 2018, respectively. Although Whitefish harvest rates increased significantly in 2019, harvest rates were below average (1998-2019) for all large mesh gill net (2.0 vs 10.7 kg/km) and large mesh gill nets with Whitefish in the catch (8.7 vs 27.6 kg/km).

All Lake Whitefish harvested in Ohio waters during 2019 came from commercial trap nets. Ohio Lake Whitefish harvest (31,409 pounds) in 2019 was distributed among the west (O-1 77%) and central basins (O-2 16%; O-3 7%). Lake Whitefish were harvested from 2,262 trap net lifts (zero catches excluded) in 2019, with lifts distributed among District 1 (O-1) (39%), District 2 (O-2) (40%) and District 3 (O-3) (21%), respectively. Trap net harvest was greatest in November (65% or 20,490 pounds) in O-1 followed by May (15% or 4,622 pounds) in O-2 and December (8% or 2,578 pounds) in O-1. Ohio trap net catch rates in all districts (13.9 pounds/lift with Whitefish in the catch) in 2019 increased dramatically from 2018 (2.3 pounds/lift) but remained below the mean (30.0 pounds/lift 1996-2019) (Figure 1.1.4). These trends in catch rate are correlated to targeted effort, with targeted effort higher in 2019 relative to 2018, but below the mean. The Lake Whitefish catch rates in grids with frequent Whitefish harvest were below average in grid 801 (243 pounds/lift in 2019 compared to 291 pounds/lift average) and above average in grid 802 (115 pounds/lift in 2019 compared to 58 pounds/lift average). Although Whitefish harvest in Pennsylvania was nominal, the trap net catch rate in 2019 (6.0 pounds/lift) was above average (3.1 pounds/lift).

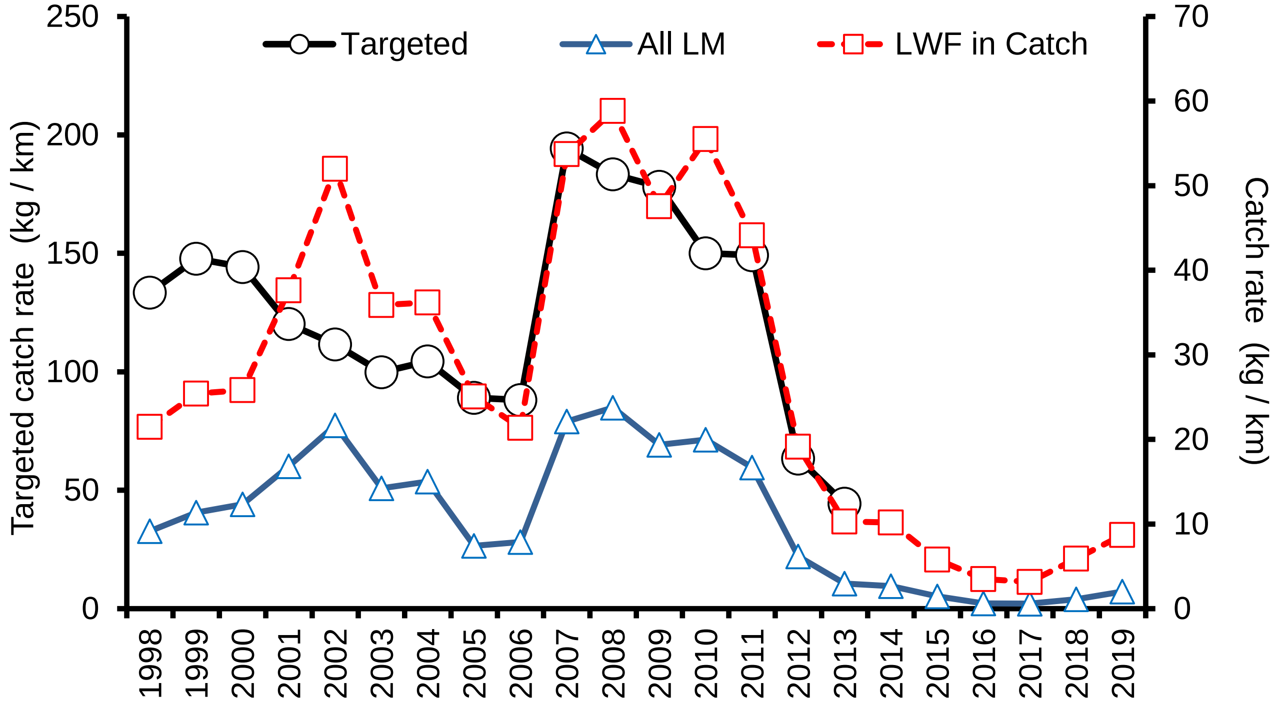


FIGURE 1.1.3. Lake-wide Ontario annual commercial large mesh gill net catch rates according to three forms of effort. Targeted Lake Whitefish catch rate (kg/km; left axis), catch rate relative to all large mesh gillnet fished (kg/km; right axis), and catch rates from large mesh effort with Lake Whitefish in the catch (kg/km; right axis). No targeted Lake Whitefish effort or harvest was reported in 2014 - 2019.

Ontario's west basin fall Lake Whitefish fishery in 2019 was dominated by age 4 and 5 fish (Figure 1.1.5). The age composition of Lake Whitefish harvest from Ontario reflects fish caught in gill nets targeting Walleye. Based on standard harvest monitoring, Ontario's Whitefish gill net harvest in 2019 was comprised of ages 4 (89%), 5 (9%),16 (<1%), 19(<1%) and 25(<1%) (N=207). Lake Whitefish sampled from a commercial Rainbow Smelt trawl sample (N=37) consisted of age 0 (97%) and age 1 (3%) Lake Whitefish. Age 2 Whitefish were exclusively represented in a non-random gill net sample (N=29) from eastern Lake Erie. The age composition of Lake Whitefish harvested in U.S. waters was not assessed in 2019. Lake Whitefish caught in fishery and surveys were aged using scales and otoliths. Age interpretation differed between structures in some cases, such that the distinction between 2014 and 2015 cohorts may be confounded over time.

The landed value of Whitefish in Ontario during 2019 was $110,798 or $ 1.37 / pound CDN. The landed weight of roe from Ontario's 2019 Lake Whitefish fishery was 1,246 pounds, most (88%) of which was collected from the west basin during November. The remainder of roe was collected during October in the west and November in the west-central basin. The approximate landed value of the roe was $ 4,484 or $ 3.60 / pound CDN.

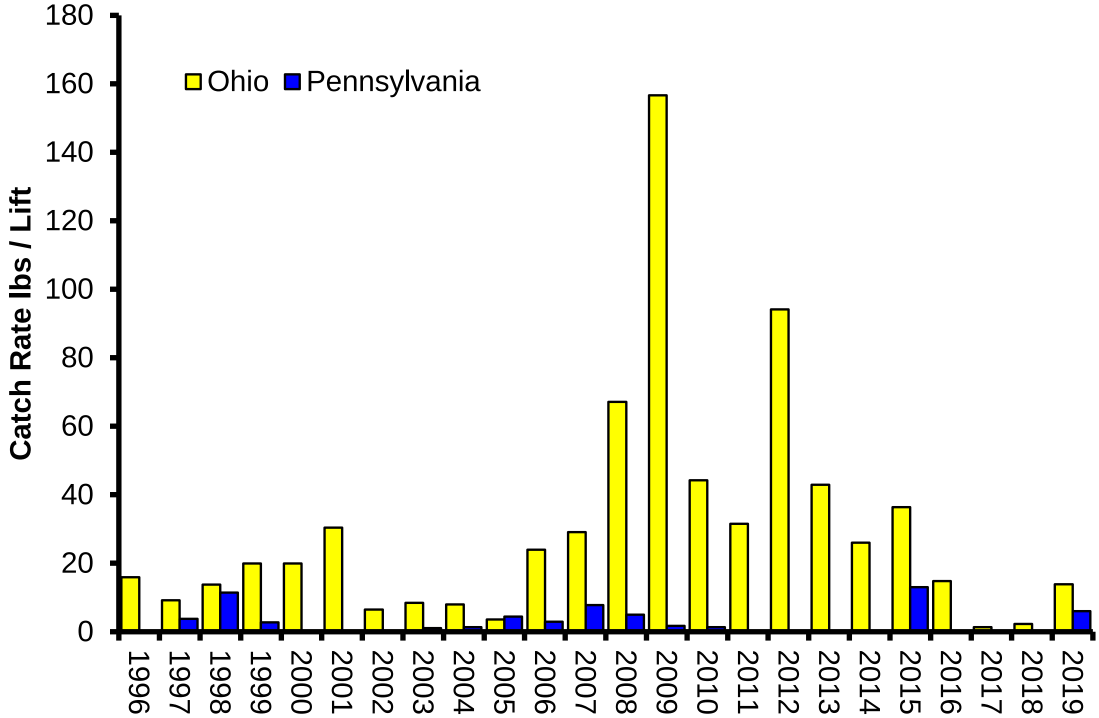


FIGURE 1.1.4. Lake Whitefish commercial trap net catch rates in Ohio and Pennsylvania (pounds per lift), 1996-2019. Zero harvest for PA in 2011-2014.

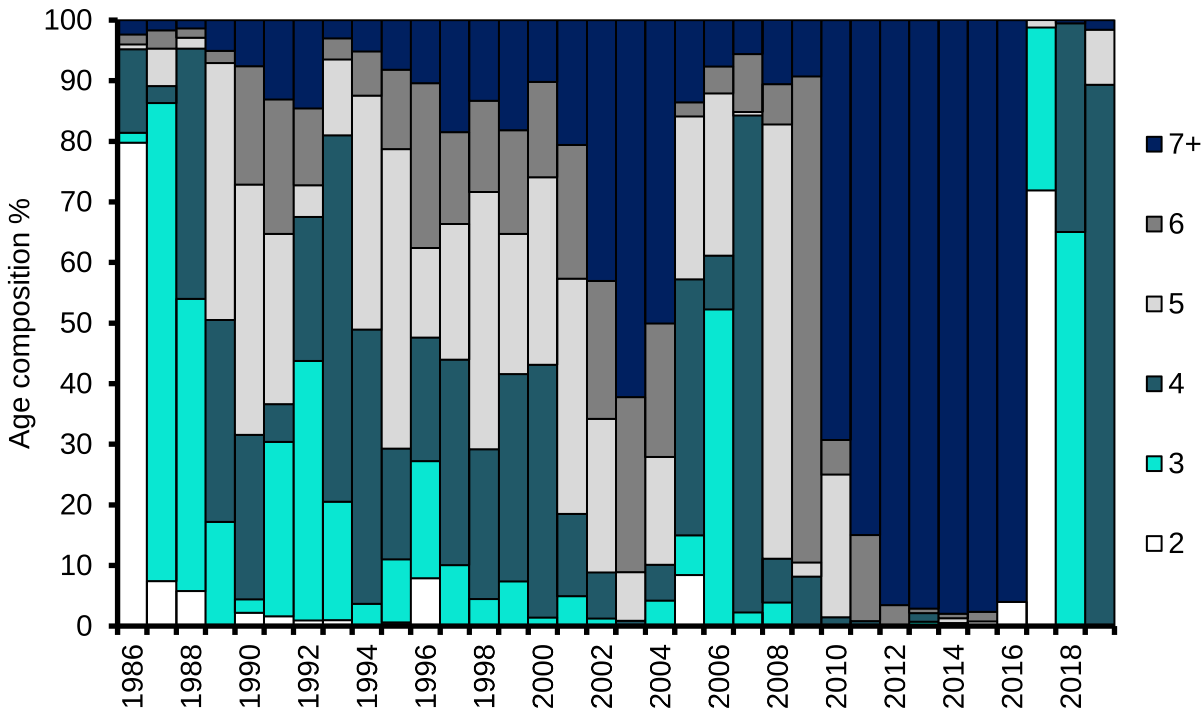


FIGURE 1.1.5. Ontario fall commercial Lake Whitefish harvest age composition in statistical district 1, 1986-2019, from effort with gill nets ≥3 inches, October to December. N=187 in 2019. Ages 7+ includes Whitefish ages 7 and older.

Assessment Surveys

Lake Whitefish gill net indices include east basin Cold Water Assessment (CWA) netting conducted in New York, Ontario and Pennsylvania waters, and Ontario's combined central and east basin Partnership gill net surveys. Partnership survey catch rates were pooled despite differences in thermal stratification, and migratory behavior when east and central basin surveys occur. The combined Partnership surveys increase sample size and catches at the expense of introducing bias associated with temporal and spatial differences in catchability. The necessity of combining the Partnership surveys arises from variable, low catches observed among all basin-specific surveys. Partnership catch rates in 2019 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 (130 lifts) during 2019 (1.8 LWF/lift) increased from 2018 (1.5 LWF/lift) and was ranked as the 68th percentile over the 35-year time series 1985-2019 (Figure 1.1.6). Among interagency CWA surveys in 2019, catch rates were highest in New York (4.4 LWF/lift), followed by Ontario (1.13 LWF/lift) and Pennsylvania (0.1 LWF/lift).

Partnership catch rates of Lake Whitefish ages 0 to 2 was 0.06 LWF/gang in 2019, an increase from 2018 (Figure 1.1.6). Catch rates for age-3 and older Lake Whitefish caught in 2019 Partnership surveys dropped to 0.05 LWF/gang from 0.30 LWF/gang in 2018 (Figure 1.1.6). Lake Whitefish were caught in index nets (25) and auxiliary gear (1) throughout Lake Erie in 2019 with the exception of the west basin survey. The age composition of Lake Whitefish caught in Partnership index gear ranged from ages 1 to 12, with age 2 (48%; 2017 year class), age 4 (28%; 2015 year class), age 5 (8%; 2014 year class) and age 1 (8%; 2018 year class; Figure 1.1.7) most abundant. Ages 3 and 12 each represented 4% of the index catch. Lake Whitefish mean age in Partnership gear during 2019 was 3.2 reflecting recruitment of younger fish in the population. Age assignment was based on scales (total length <500 mm) and otoliths (total lengths ≥ 500 mm). Of 26 Lake Whitefish examined, none had Sea Lamprey scars or wounds in 2019.

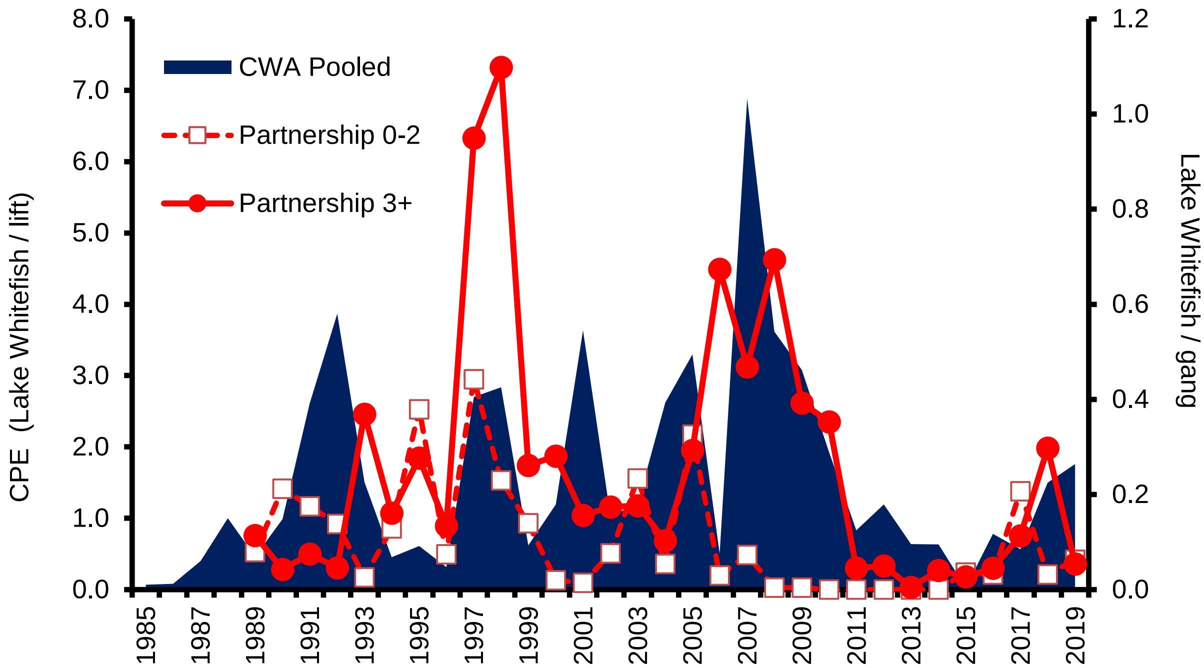


FIGURE 1.1.6. Catch per effort (number fish/lift) of Lake Whitefish caught in standard Cold Water Assessment gill nets (CWA) in New York, Ontario and Pennsylvania waters, weighted by number of lifts (blue area). Partnership index catch rates (LWF/gang) for ages 0-2 (dots) and ages 3 and older (squares) (second axis).

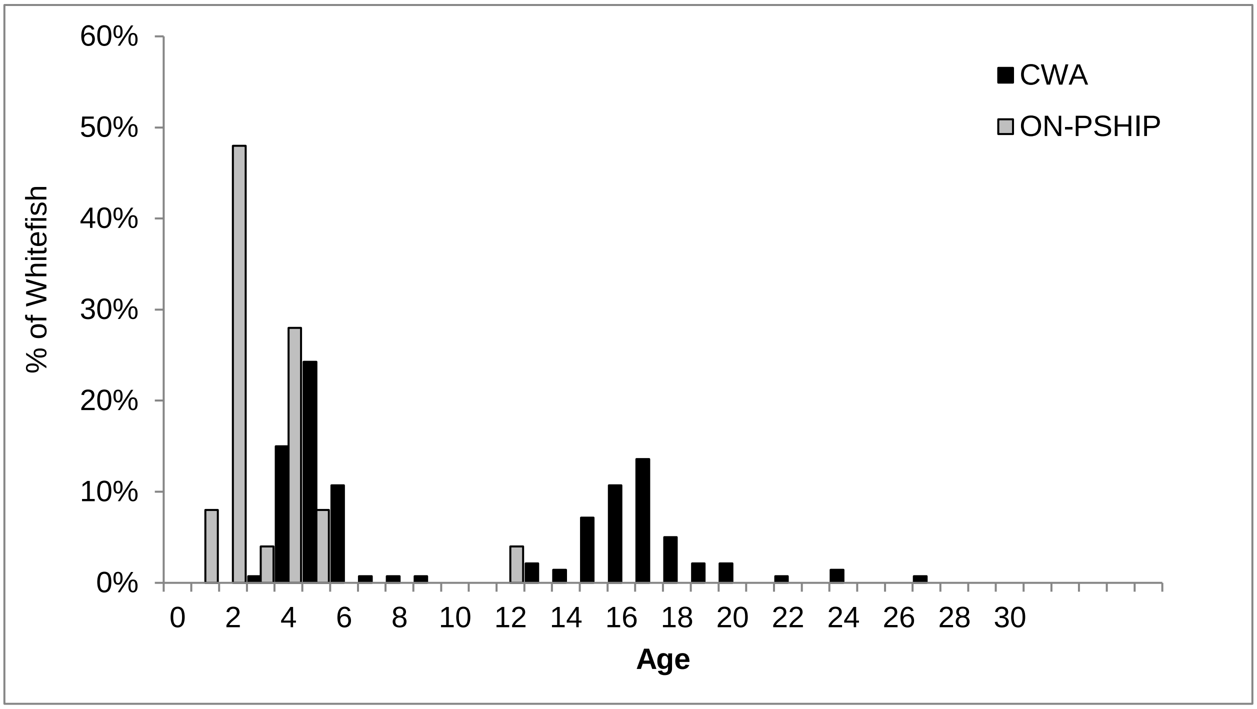


FIGURE 1.1.7. Age-frequency of Lake Whitefish collected from Cold Water Assessment (CWA) gill net surveys and Ontario Partnership index, 2019 (N=140 and 25 respectively).

Lake Whitefish captured in CWA surveys by all agencies (N=140) ranged in age from 3 to 27. Ages 5 (24%) and 4 (15%) were most abundant, followed by ages 17 and 16 (14%,11% respectively) (Figure 1.1.7). Mean age of Lake Whitefish caught in CWA nets was 10.7 years. The older age composition of Lake Whitefish caught in CWA nets compared to the Partnership Index may be due to differences in study design and/or age structure interpretation. The CWA nets were fished exclusively in the east basin hypolimnion whereas Partnership nets were fished above and below the thermocline in the Pennsylvania Ridge and east basin surveys and at all depths after fall turnover in the central basin. Alternatively, differences in age composition could be associated with different stocks of Lake Whitefish and/or spatial differences in mortality.

Trawl surveys in Ohio waters of the central basin of Lake Erie (Ohio Districts 2 and 3 combined) encounter juvenile Lake Whitefish and provide an indicator of year class strength. In 2019, age 0 Lake Whitefish catches were above average in June trawls (0.41 LWF/ha) while no age 0 were caught during October trawls (Figure 1.1.8). Similarly, the age 1 Lake Whitefish catch rate in 2019 (0.26 / ha) was above average in June but ranked below average during October trawls (0.06 / ha) in central Lake Erie (Figure 1.1.9).

Pennsylvania bottom trawl surveys from May to November also describe year class strength of Lake Whitefish as juveniles. Juvenile Lake Whitefish trawl indices experienced record highs during the 1980s and 1990s that have not been observed since (Figures 1.1.8 and 1.1.9). Catch rates in 2019 as age 0 (0.28 / ha) and age 1 (0.43 / ha) were both below average but were greater than their respective medians.

The New York east basin trawl survey indicated age 0 Lake Whitefish abundance in 2019 (0.70 /ha) was above average (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. In 2019, juvenile Lake Whitefish were not caught in this Long Point Bay survey.

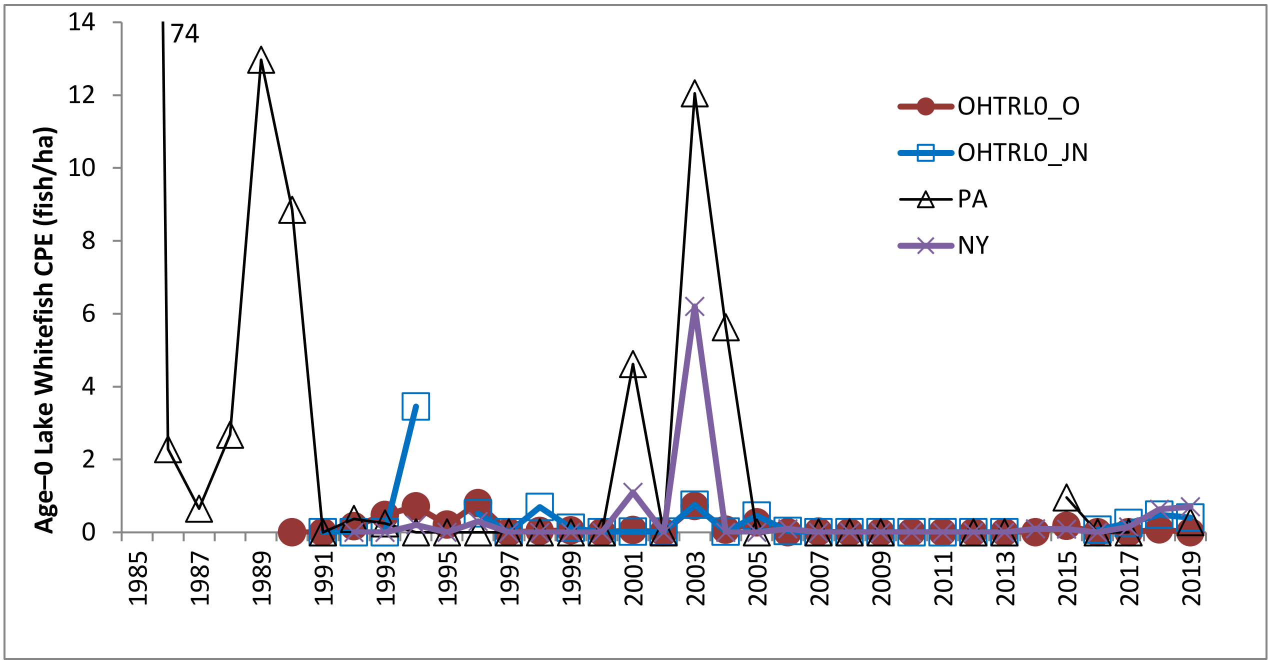


FIGURE 1.1.8. Mean age 0 Lake Whitefish catch per hectare in Ohio (central basin during June – OHTRL0_JN, October – OHTRL0_O), Pennsylvania (PA) and New York (NY) fall assessment trawls. Ohio data are means for trawls in District 2 and 3. Pennsylvania did not conduct trawls during 2018.

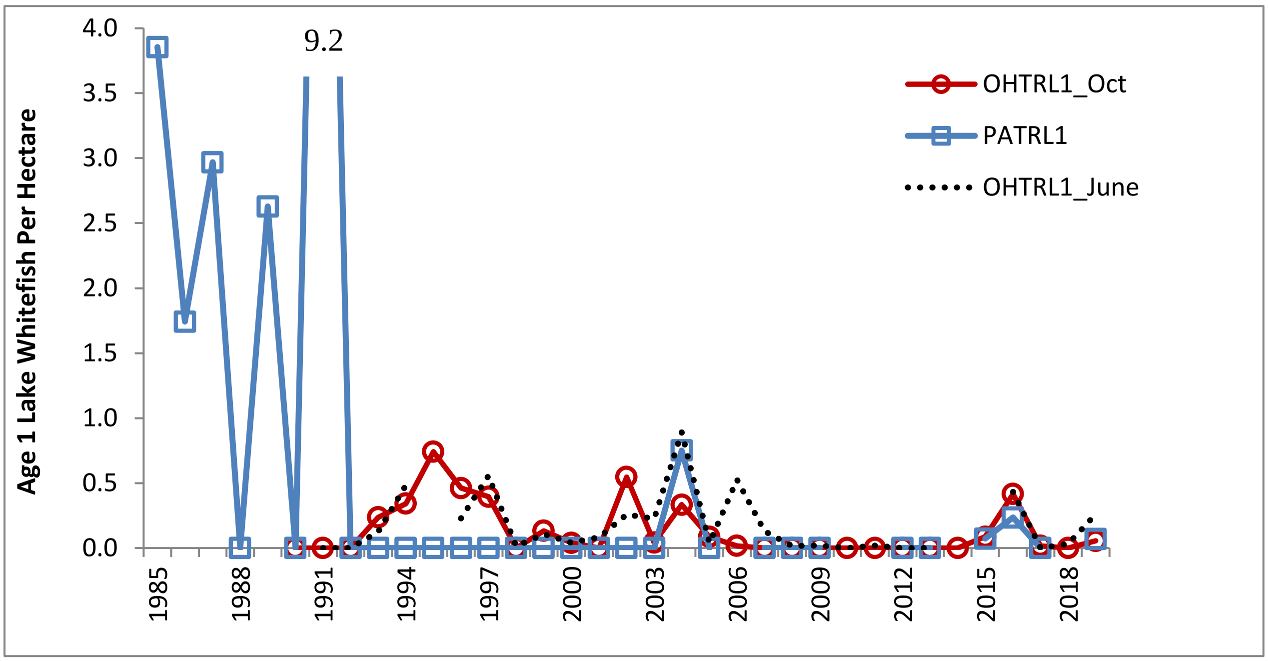


FIGURE 1.1.9. Age 1 Lake Whitefish trawl catch rates (number per ha) in Ohio waters during June (dotted line) and October (circles) and in Pennsylvania (PATRL1) waters (squares). Pennsylvania 1991 value (9.2) exceeds maximum axis value. Pennsylvania did not trawl in 2018.

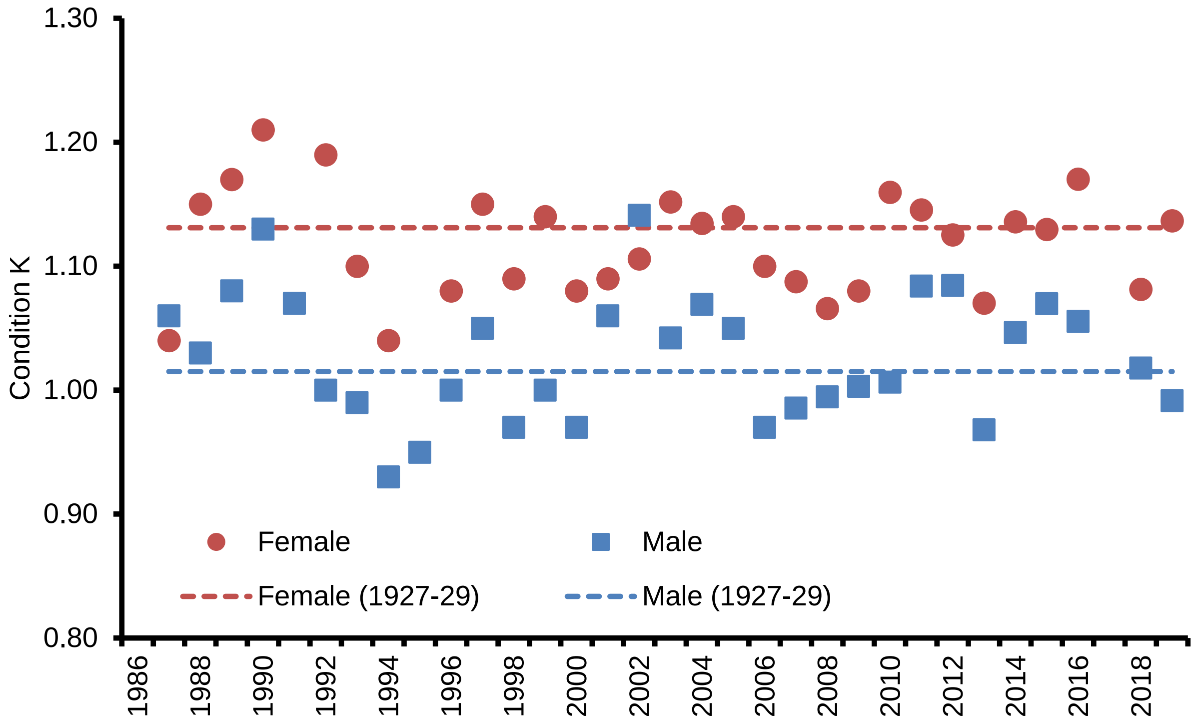


FIGURE 1.1.10. Mean condition (K) factor values of age 4 and older Lake Whitefish obtained from Ontario commercial and Ohio, Pennsylvania and Ontario survey data (Oct-Dec) by sex from 1987-2019. Samples sizes in 2019 were: Males N=45 and Females N=83. Historic mean condition (1927-29) presented as dashed lines calculated from Van Oosten and Hile (1947).

Growth and Diet

Trends in condition are usually presented for Lake Whitefish sampled by Ontario MNRF and Ohio DNR in relation to historic Lake Whitefish condition reported by Van Oosten and Hile (1947). In 2019, samples were combined from Ontario commercial, partnership and Ohio and Pennsylvania surveys where the following selection criteria were met: ages 4 and older collected from Oct-Dec, excluding spawning and spent fish. In 2019, Female condition was near the historic mean K whereas male condition was slightly below historic levels (Figure 1.1.10). Mean gonadosomatic index (GSI) of mature females with developing or developed ovaries in 2019 was 0.20 (Std=0.04 N=72).

Stomach contents from 17 adult Lake Whitefish caught in Ohio waters of Lake Erie were examined in 2019. Dry weights of Whitefish diets varied by season. Whitefish collected in June (N=9) contained Chironomids (76.1%) and Isopods (23.1%). October diets (N=8) were primarily Isopods (97.6%) and Sphaeriidae (2.3%).

Lake Whitefish in Lake Erie exhibit a high prevalence of Digenean heart cysts from *Icthyocotylurus erraticus* (CWTG 2018). In 2019, 88% of Lake Whitefish examined from Ontario commercial samples had heart cysts while 76 % of Whitefish collected from the Partnership gill net survey had heart cysts. This parasite is present in Lake Whitefish in the upper Great Lakes (Muzzall 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.

Acoustic Telemetry

Lake Whitefish have been implanted with acoustic transmitters and tagged with external Floy tags from 2015 to 2019. This collaboration of USGS, ODNR, USFWS, OMNRF, GLFC, GLATOS and local partners seeks to describe Lake Whitefish movements during spawning and other seasons. From 2015 to 2019, 239 Lake Whitefish were tagged in areas including the Maumee River Ohio, west basin spawning reefs in Ohio and in Ontario waters and near the Detroit River mouth (Table 1.1.1). Since the project began, 18 tagged Lake Whitefish were caught by Ontario's commercial fishery. Lake Whitefish movement is described from detections by acoustic receivers deployed throughout the Great Lakes. Detections were distributed lake-wide with the highest number of detections in the southern portion of the east-central basin. Fall spawning migrations to the west basin and movement eastward during thermal stratification were observed annually. To date, only a single Lake Whitefish was detected in the Detroit River; a male that was tagged near Hen Island in 2017. As data accumulates from this study, seasonal habitat use and population metrics such as mortality will inform Lake Whitefish population models and support Lake Whitefish management. Information about this project and other GLATOS projects is online: https://glatos.glos.us/.

TABLE 1.1.1. Number of Lake Whitefish tagged with internal acoustic transmitters and Floy tags by location 2015–2019. Number of tagged Whitefish recaptured by fisheries from 2015–2019.

			Year of Recapture				
Tag Year	**Tag Location**	**# Tagged**	**2016**	**2017**	**2018**	**2019**	**Total**
2015	Maumee Bay	10	0	1	0	0	1
2016	Hen Island - Little Chicken	37	3	0	0	1	4
2017	Crib Reef	25	0	1	0	1	2
2017	Hen Island - Little Chicken	55	0	5	1	1	7
2017	Niagara Reef	25	0	0	0	0	0
2018	Detroit River mouth	2	0	0	0	0	0
2019	Crib Reef [1]	50	0	0	0	0	0
2019	Detroit River mouth [2]	35	0	0	0	4	4
	Total	**239**	**3**	**7**	**1**	**7**	**18**

1 50 tags were temperature / depth sensors with 2 id numbers

2 10 tags were temperature / depth sensors with 2 id numbers

Statistical Catch at Age Analysis (SCAA) Population Model

A two-gear statistical catch-at-age (SCAA) model for Lake Whitefish (CWTG 2019) was used to estimate Lake Whitefish abundance in Lake Erie. The SCAA model consists of 2 gears (gillnet fishery catch and effort, and partnership survey catch rates) but includes harvest from all fisheries with an adjustment to gill net effort that accounts for the additional harvest. This configuration produced results that were more consistent with trends of fishery and survey catch rates (Figure 1.1.11). The SCAA model was modified by assigning equal weights (lambdas=1) to each data source and adding a catchability block to the time frame in which Ontario's commercial gill net fishery stopped targeting Lake Whitefish (2014-2019). Principal components analyses (PCA) were used to consolidate 10 Lake Whitefish recruitment indices (Y. Zhao, personal communication, 2015) for use in linear regression with SCAA age 3 abundance estimates to forecast future recruitment (Table 1.1.2). The 2014 and 2015 cohort abundances estimated by SCAA were higher than predicted by PCA – regression (Table 1.1.2, Figure 1.1.11). PCA-regression estimates of these year classes were used to forecast abundance and spawner biomass to 2022 assuming SCAA survival estimates from 2019. An alternate, more conservative forecast (Figure 1.1.11 dotted line) was produced using PCA estimates of recruitment for the 2014 and 2015 cohorts rather than SCAA. Forecasted spawner biomass from 2019 – 2022 was compared to unfished spawner biomass levels (SSB20%, SSB30%, SSB40%) (CWTG 2018) to assess Lake Whitefish population status. Lake Whitefish spawner biomass levels may remain above the mean SSB40% for the next several years to 2022, provided fisheries remain conservative (Figure 1.1.12). Significant uncertainty concerning Whitefish status remains but may lessen as Whitefish ages 5 and 6 dominate fisheries in 2020.

TABLE 1.1.2. Age 3 abundance estimates from statistical catch at age analysis (SCAA) for 2014 and 2015 year classes. Principal components analysis (PCA) for juvenile Whitefish indices (ages 0,1,2) used in linear regression with SCAA age 3 abundance estimates to estimate age 3 abundance of 2014 – 2019 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	2,431,080	771,524	563,865	979,182	7	0,1,2	0.89	0.99	<.0001
2018	2015	7,408,950	3,179,264	2,868,112	3,490,415	9	0,1,2	0.87	0.98	<.0001
2019	2016	10,608	222,676	(47,638)	492,990	10	0,1,2	0.86	0.99	<.0001
2020	2017		629,460	369,208	889,711	9	0,1,2	0.83	0.98	<.0001
2021	2018		2,364,171	2,149,330	2,579,012	8	0,1	0.86	0.99	<.0001
2022	2019		774,698	462,718	1,086,678	5	0	0.90	0.96	<.0001

Summary

Lake Whitefish fishery and survey indicators showed mixed signals in 2019. Total Lake Whitefish harvest in 2019 (114,703 pounds) more than doubled the harvest in 2018. Ontario's incidental harvest in 2019 attained 68% of Lake Whitefish quota (120,000 pounds) with no targeted harvest of Lake Whitefish. Ohio's trap net fishery targeted Lake Whitefish in 2019, harvesting 31,409 pounds. Lake Whitefish fisheries will be dominated by age 5 and 6 fish in 2020. Surveys indicated that recruitment will follow 2014 and 2015 cohorts, at varying magnitudes. 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 2019, 21% (0.904 million pounds) of Walleye quota in the west basin (MU1) was transferred to the central basin Walleye fisheries. The Coldwater Task Group recommends continued conservative management until more certainty exists concerning the improving status of the Lake Whitefish population.

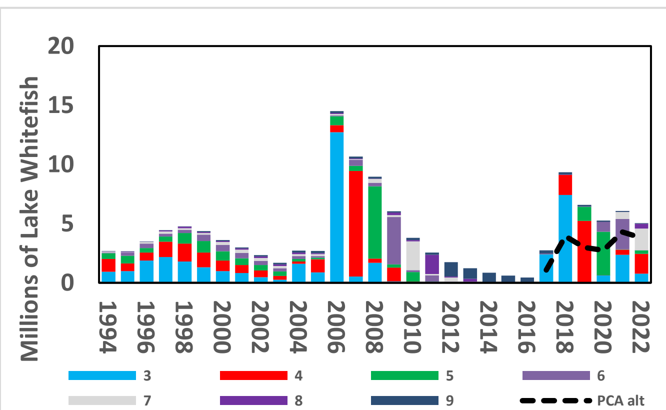


FIGURE 1.1.11. Lake Whitefish abundance estimates at age from SCAA and age 3 recruitment projections from PCA – regression estimates for cohorts 2014-2019. SCAA estimates of survival from 2019 assumed for 2020 – 2021. SCAA total abundance estimates since 2017 diverge due to higher SCAA estimates of 2014, 2015 cohorts compared to PCA-regression estimates (PCA alt - dotted line). (see Table 1.1.2).

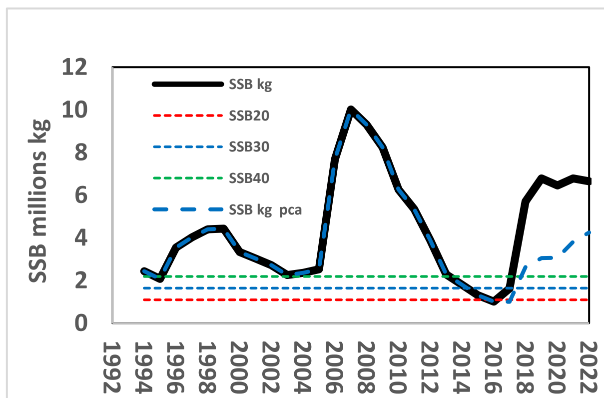


FIGURE 1.1.12. Lake Whitefish spawning stock biomass (SSB) estimates (kg - black line) projected to 2022 assuming constant survival from SCAA in 2019. Alternate SSB trajectory (dashed) based on PCA estimates of 2014, 2015 and more recent cohorts. Biological reference points SSB20%, SSB30%, SSB40% of unfished population (SSB0) presented for reference.

1.2 Report on the status Lake Trout relative to targets.

James Markham (NYSDEC), Andy Cook, Matt Heerschap, Chuck Murray (PFBC), Joe Schmitt, Ed Roseman (USGS), Jim Boase, Justin Chiotti (USFWS)

East Basin Cold Water Assessment Program

Two cold water assessments are conducted each year: 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 is a stratified, random, deep-water bottom set gill net assessment program conducted since 1986. The eastern basin of Lake Erie is divided into eight sampling areas (A1-A8; Figure 1.2.1). A1 and A2 have been the most consistently sampled areas across survey years while effort has varied in all other areas. Area A4 has been periodically sampled due to the lack of enough cold water to set gill nets according to the sampling protocol. Sampling was conducted in all eight areas in 2019 (Figure 1.2.1). Total sampling effort was 130 sets. Additional sampling was conducted in 2019 in areas offshore of traditional netting; for the purposed of this report, this data will only be used for sea lamprey wounding and length and weight information.

The Partnership Survey is a lake wide gill net survey of the 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.

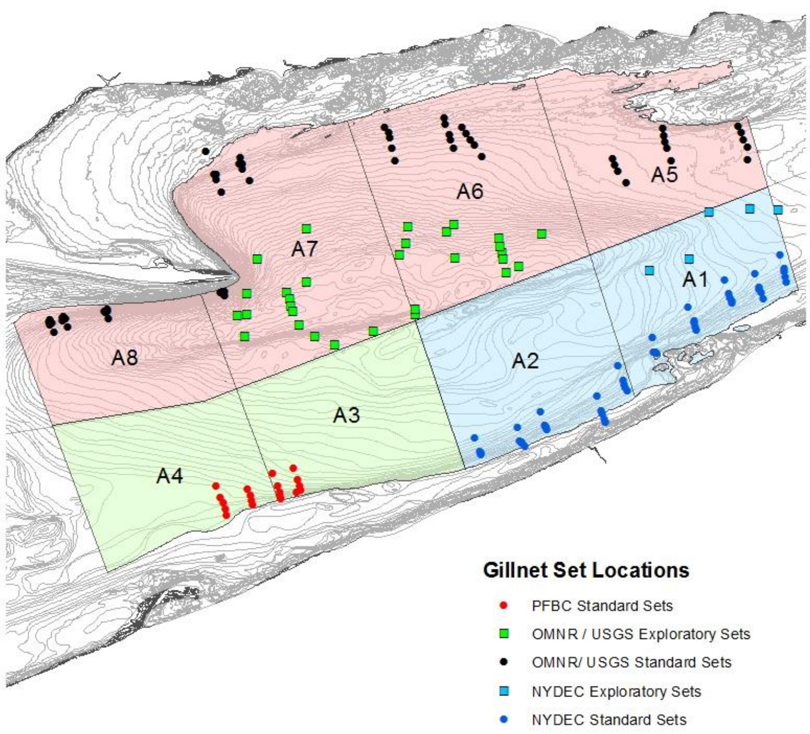


FIGURE 1.2.1. Standard sampling areas (A1-A8) used for assessment of cold water species in the eastern basin of Lake Erie, 2019. Colored circles represent the location of all standard nets set in each sampling area; colored squares represent offshore exploratory nets.

All Lake Trout in the Coldwater Assessment Survey are measured for total length and weight, as well as examined for 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. Stomach content data are usually collected as on-site enumeration or from preserved samples.

A total of 570 Lake Trout were caught in 130 unbiased lifts in 2019. Areas A6, A2 and A1 produced the highest catch per unit effort (CPE) values with slightly lesser catches in areas A5, A4, and A3. Areas A7 and A8 produced the lowest catches. The highest CPE's are typically recorded in Areas A1 and A2, coinciding with higher yearling Lake Trout stocking over time. Lake Trout catches are typically much lower in Ontario waters (A5-A8), where annual stocking is less and did not commence until 2006.

Lake Trout captured in 2019 represented nineteen age-classes among five different strains. Ages 3, 4, 9 and 10 cohorts were the most abundant and represented 64% of the total catch (Figure 1.2.2). The abundance of Lake Trout older than age-10 continues to increase and now comprises nearly 19% of the overall catch. Lake Champlain (LC) and Finger Lakes (FL) were the most numerous Lake Trout strains caught in 2019, followed by the Slate Island (SI) strain. These three strains have been the most commonly stocked Lake Trout strains in Lake Erie over the past eleven years. Catches of the Klondike (KL) strain have declined to the point that they were scarcely detected. One age-18 Superior (SUP) strain Lake Trout was caught in 2019; this was the first detection of this strain since 2011 in the Coldwater Assessment Survey.

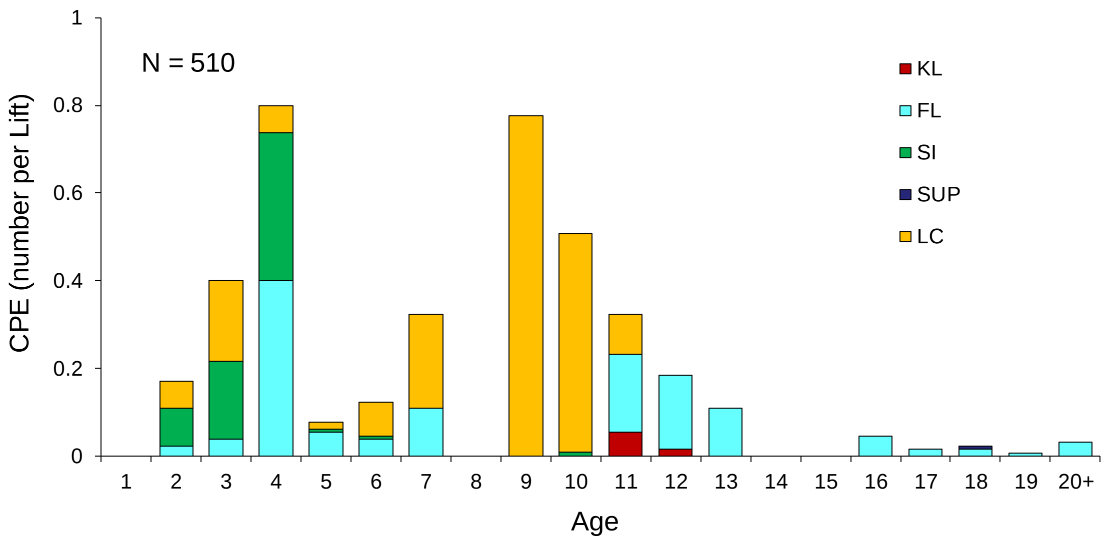


FIGURE 1.2.2. Relative abundance (number per lift) at age of Lake Trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, August 2019.

Area-weighted mean CPE of Lake Trout caught in the eastern basin in 2019 was 4.1 fish/lift (Figure 1.2.3). This was above average (2.3 fish/lift) for the time series but well below the rehabilitation target of 8.0 fish/lift (Markham et al*.* 2008).

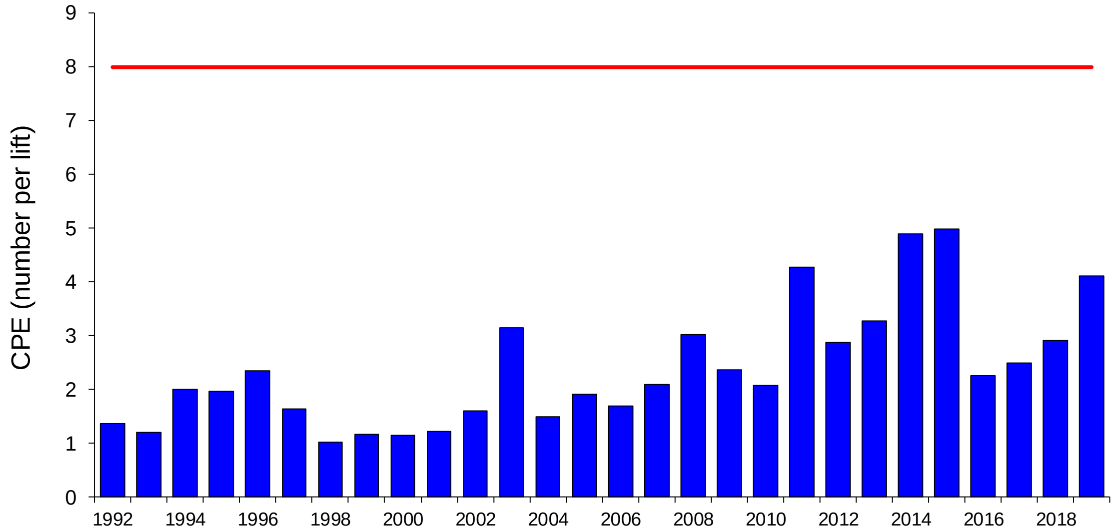


FIGURE 1.2.3. Mean combined CPE (number per lift, weighted by area) for Lake Trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, 1992-2019. The red solid line represents the rehabilitation target of 8.0 fish per lift for all ages.

The relative abundance of adult (age-5 and older) 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. Adult abundance increased in 2019 to 2.2 fish per lift, ranking as the third highest in 28 years and above the basin-wide rehabilitation target of 2.0 fish/lift (Figure 1.2.4).

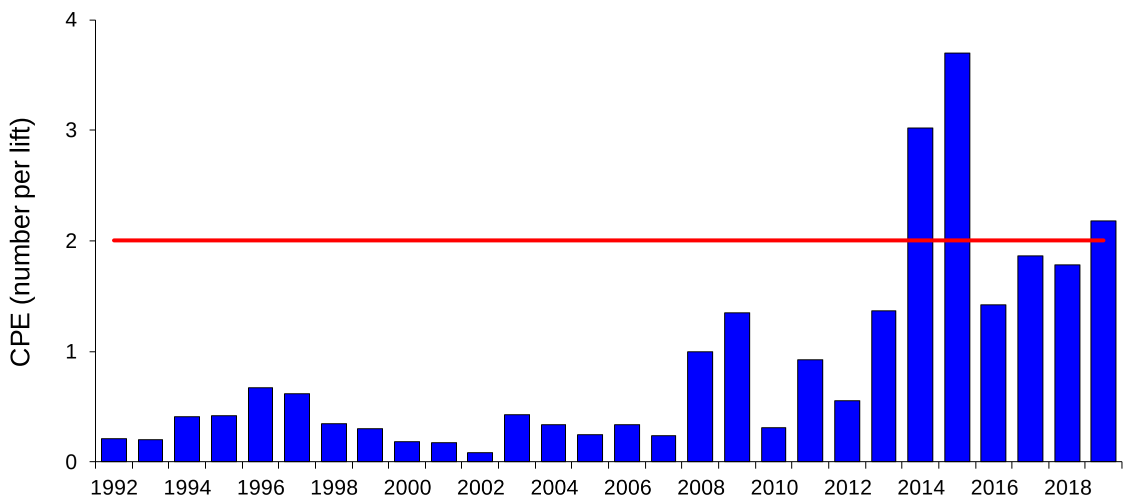


FIGURE 1.2.4. Relative abundance (number per lift, weighted by area) of age-5-and-older Lean strain and Klondike strain Lake Trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, 1992-2019. The red solid line represents the adult rehabilitation target of 2.0 fish per lift.

Fifty-nine (59) Lake Trout were caught in Partnership Survey index gear in the Pennsylvania Ridge (2) and the east basin (57). Lake Trout were captured mainly in nets fished on bottom (56); however, two were caught in standard canned nets while one Lake Trout was caught in a gang suspended in the thermocline. The 2019 Lake Trout index in the east basin (0.93 fish/lift) was well above the time series mean (0.43 fish/lift) for the second consecutive year while catch rates in the Pennsylvania Ridge survey (0.11 fish/lift) remained below average (0.18 fish/lift) (Figure 1.2.5). Five Lake Trout strains were identified from coded wire tags: Finger Lakes (32%), Slate Island (32%) Lake Champlain (15%), Klondike (2%) and Lake Ontario (2%). Ages derived from tagging codes ranged from 1 to 29 with age-4 comprising the largest fraction (22%).

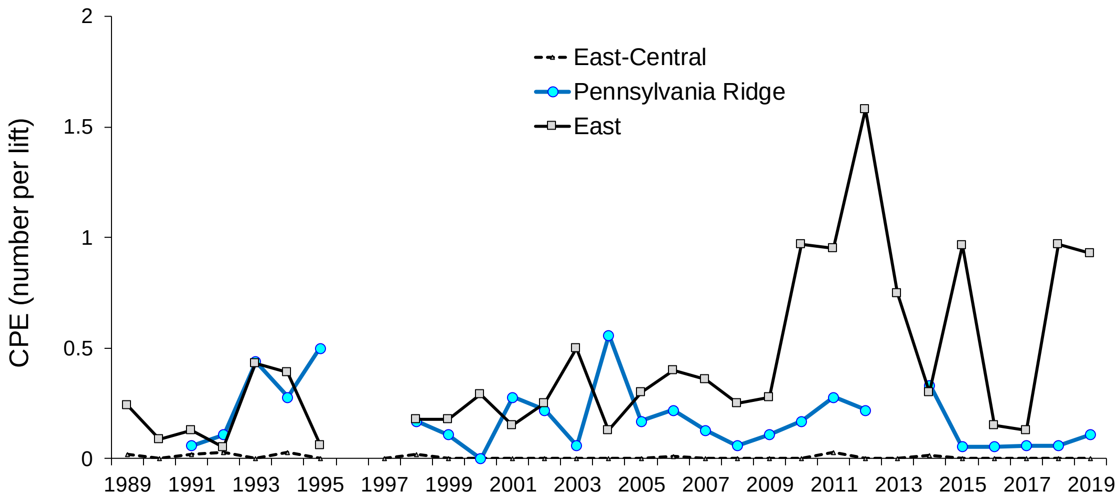


FIGURE 1.2.5. Lake Trout CPE (number per lift) by basin from the OMNRF Partnership Index Fishing Program, 1989-2019. Includes canned (suspended) and bottom gill net sets, excluding thermocline sets.

Harvest

Angler harvest of Lake Trout in Lake Erie remains very low. An estimated 340 Lake Trout were harvested in New York waters out of an estimated catch of 2,232 in 2019. Pennsylvania anglers harvested an estimated 337 fish from a total catch of 1,089 Lake Trout. (Figure 1.2.6).

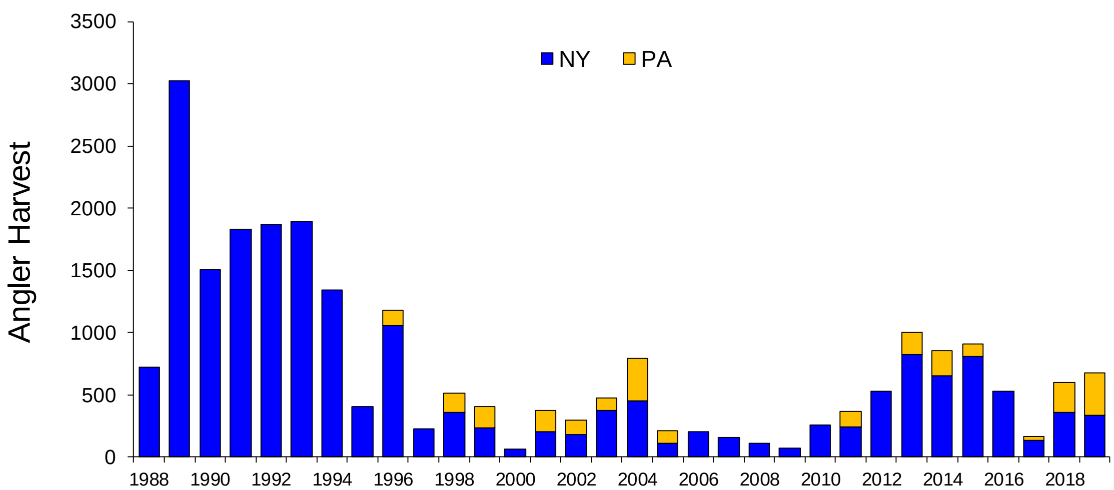


FIGURE 1.2.6. Estimated Lake Trout harvest by recreational anglers in the New York and Pennsylvania waters of Lake Erie, 1988-2019.

Natural Reproduction

Despite more than 30 years of Lake Trout stocking in Lake Erie, no naturally reproduced Lake Trout have been documented. Nine potentially wild fish (no fin clips; no CWT's) out of a total of 738 Lake Trout (all nets) were caught in eastern basin cold water gill net surveys in 2019, representing less than 2% of the fish captured. Four additional non-clipped/non-tagged Lake Trout were caught in the Partnership Survey. This was the most non-marked Lake Trout caught in survey netting to date. Altogether, a total of 85 potentially wild Lake Trout have been recorded over the past 19 years. Rates of unmarked fish remain similar to measures of unmarked fish in the hatchery. Otoliths are collected from Lake Trout found without CWTs or fin-clips and will be used in future stock discrimination studies.

Diet

Seasonal diet information for Lake Trout is not available based on current sampling protocols. Diet information was limited to fish caught during August 2019 in the cold water gill net assessment surveys 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 2000s (Figure 1.2.7). In years of lower adult Rainbow Smelt abundance, Lake Trout appear to prey more on Round Goby.

In 2019, Rainbow Smelt and Round Goby were the most prevalent diet items for Lake Trout, occurring in 61% and 37% of the non-empty stomachs, respectively (Figure 1.2.7). The occurrence of fish species other than Rainbow Smelt and Round Goby in Lake Trout diets has increased in recent years. Other fish species comprised 8% of the diets in 2019, which was the second highest occurrence in the time series. Yellow perch comprised the majority of this group (5%); other species included *Morone* spp. (White Perch, White Bass) (<1%), Freshwater Drum (1%), Emerald Shiner (<1%), Clupeids (Alewife, Gizzard Shad; <1%), and White Sucker (<1%). This was the first occurrence of a White Sucker in a Lake Trout stomach recorded in this survey.

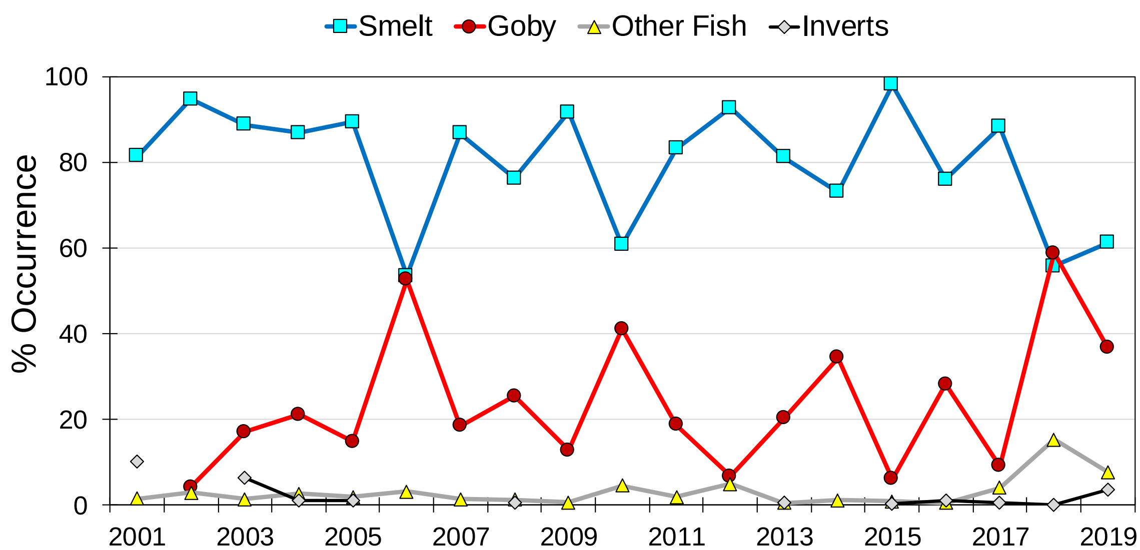


FIGURE 1.2.7. Percent occurrence in diet of Rainbow Smelt, Round Goby, all other fish species, and invertebrates from non-empty stomachs of Lake Trout caught in eastern basin Coldwater Assessment Survey gill nets, August, 2001-2019.

1.3 Report on the status of Burbot

Mathew Heerschap (OMNRF)

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. 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. Since 2012, catches have been consistently low. Burbot catch rates in Partnership Survey nets fished on bottom during thermal stratification (0.2 fish/lift) are presented for comparison with Coldwater Assessment Survey Burbot catch rates (0.3 fish/lift, Figure 1.3.1). Coldwater Assessment Survey and Partnership Survey east basin indices share similar trends and magnitudes with some annual variation.

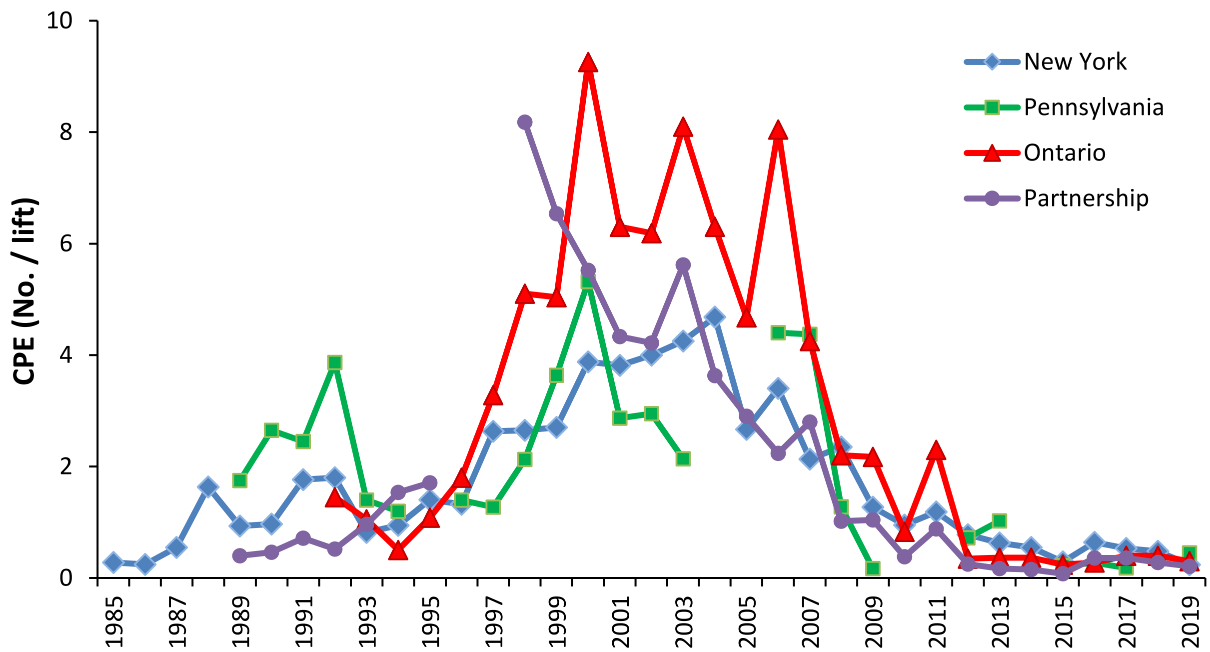


FIGURE 1.3.1. Burbot CPE (number per lift) by basin from the Interagency Coldwater Assessment and Ontario Partnership Surveys bottom set nets, 1985-2019.

Most Burbot commercial harvest occurs in the eastern end of the lake, with minimal harvest occurring in Ohio waters and the west 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 (CWTG 1997). In 1999, a market was developed for Burbot in Ontario, leading the industry to actively target this species 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 2019 was 2,128 lbs, down from 2,401 pounds in 2018. Catches were 108 pounds in Ontario, 583 pounds in New York, 1267 pounds in Pennsylvania and 170 pounds in Ohio.

In 2015, juvenile and adult Burbot were detected for the first time during U.S. Fish and Wildlife Service (USFWS) and U.S. Geological Survey (USGS) fisheries assessments in the St Clair - Detroit rivers. Since 2003, the USFWS and USGS have conducted annual surveys using a variety of gears (setlines, gillnets, hoop nets, and minnow traps) in an effort to measure fish response to artificial reefs that have been constructed in the two river systems. Assessment surveys since 2003 have resulted in over 4,000 gear deployment units of effort. Prior to 2015, juvenile and adult Burbot were undetected within the two rivers and since 2015, 29 Burbot of varying sizes have been captured. To date over 20 acres of artificial reefs have been constructed in these two river systems and, although not conclusive, 24 of the 29 Burbot were captured either on or near the artificial reefs.

Pelagic larval burbot collections continued in the St. Clair-Detroit River System (SCDRS) in 2019. In 2017, six larval burbot were captured during May and June sampling in the Detroit River. Most larval Burbot (5 of 6 fish) were captured during nighttime D-frame sampling near Belle Isle. Larval fish sampled in 2019 have yet to be identified. However, we have consistently collected Burbot in the SCDRS since our larval sampling program began (McCullough et al. 2015; Tucker et al. 2018).

Acoustic tagging of Lake Erie Burbot from Pennsylvania waters began in December 2018, when two Burbot were implanted with acoustic telemetry transmitters and released. Preliminary movement data indicates that one of these fish survived and remained close to the release site over winter and then began to move east towards Dunkirk, NY in the spring. In November 2019, 31 adult Burbot were collected from commercial trap nets near Erie, Pennsylvania, tagged with acoustic transmitters and held for four nights in 400-gallon recirculating tanks to assess post-surgery survival. Twenty two Burbot survived and were successfully released. Information gathered while assessing Burbot post-surgery survival will be used to help inform future Burbot tagging initiatives. For more information visit: https://glatos.glos.us/home/project/LEBUT

Age and Recruitment

Burbot ages are estimated using otoliths for fish caught in the Coldwater Assessment Survey. The use of otolith thin sections is recommended as the best approach for accurate age determination of Burbot (Edwards et al. 2011). Burbot ranged in age from 4 to 26 years in 2019 (N = 31, Figure 1.3.2). The mean age remained stable at 12.0 years in 2019, slightly down from 12.4 years in the 2018 survey (Figure 1.3.3). Age four fish, which are used as an indicator of recruitment, show a decline in burbot recruitment beginning in the late 1990s. Only two age four Burbot were caught in 2019.

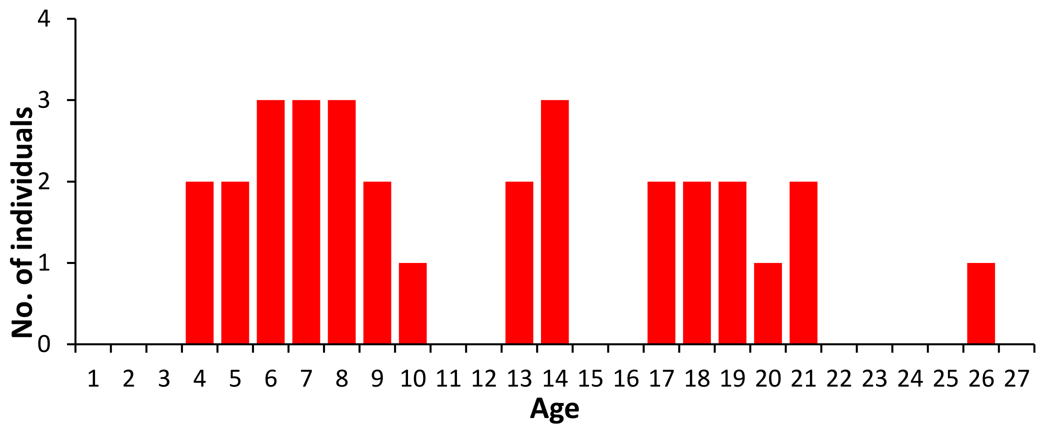


FIGURE 1.3.2. Age distribution of Burbot caught in the Interagency Coldwater Assessment Survey in eastern Lake Erie, 2019 (N=31).

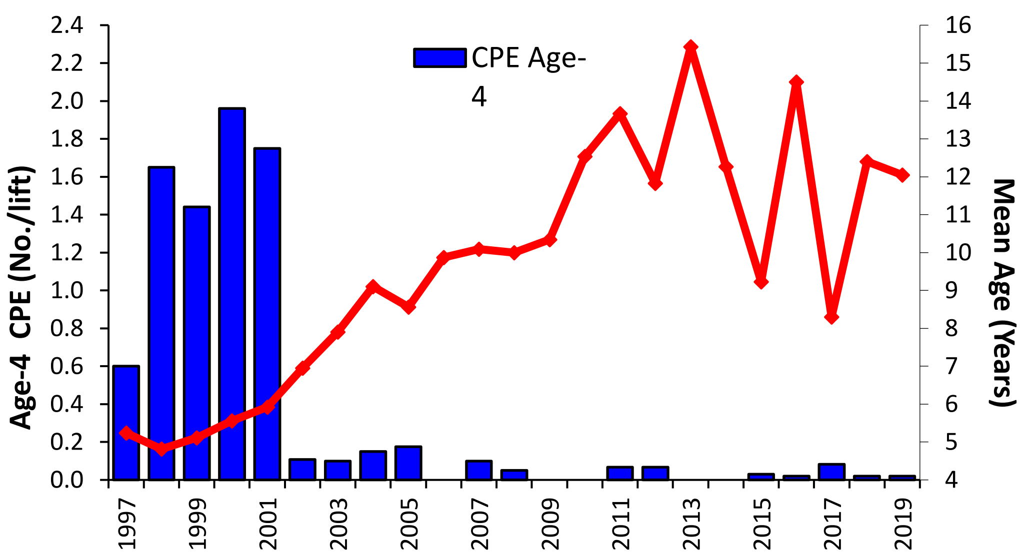


FIGURE 1.3.3. Mean age and average CPE of age-4 Burbot caught in the Interagency Coldwater Assessment Survey in eastern Lake Erie from 1997-2019.

Diet

Diet information was collected for Burbot caught in the 2019 Interagency CWA Survey. Analysis of stomach contents revealed a diet made up entirely of fish (N=37, Figure 1.3.5). Burbot diets continue to be diverse, with four different identifiable fish species found in stomach samples. Round Goby was the dominant prey item, occurring in 73% of Burbot diet samples, followed by Rainbow Smelt (5%), Yellow Perch (3%) and White Perch (3%) (Figure 1.3.5). Round Goby have become the dominate prey species for Burbot in most years since 2003.

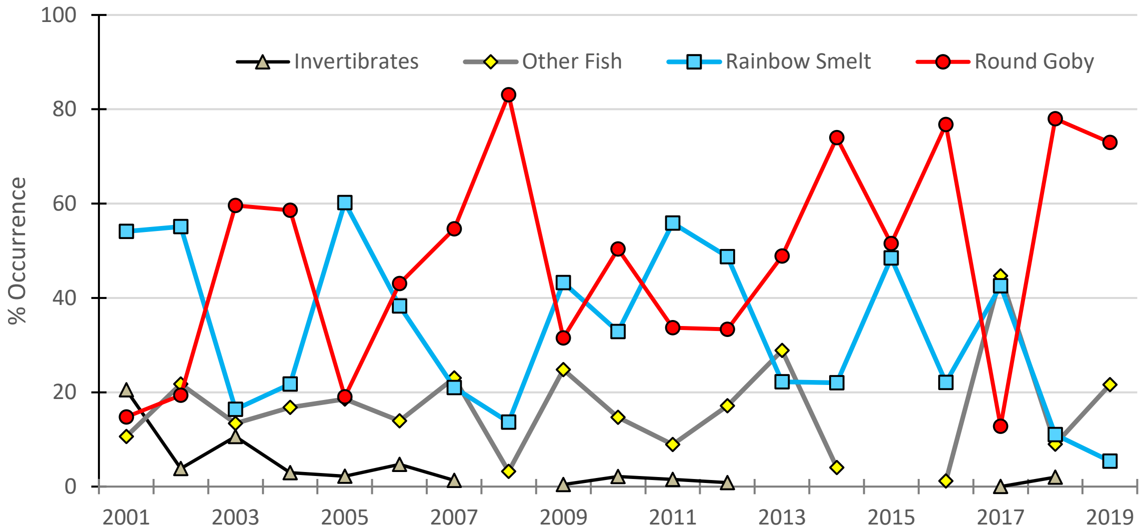


FIGURE 1.3.5: Frequency of occurrence of Rainbow Smelt, Round Goby, Other Fish, and Invertebrates in the diet of burbot caught the Coldwater Assessment Survey in the eastern basin of Lake Erie, 2001-2019.

Charge 2 Continue to participate in the Integrated Management of Sea Lamprey (IMSL) process on Lake Erie to outline and prescribe the needs of the Lake Erie Sea Lamprey Management Program.

Sean Morrison (DFO) and Christopher Eilers (USFWS)

Adult Assessment

- The index of adult Sea Lamprey abundance was 1,587 (95% CI; 1,105 – 2,069, Figure 2.1). The three-year trend in abundance is above target and has been holding steady over the past 5 years.

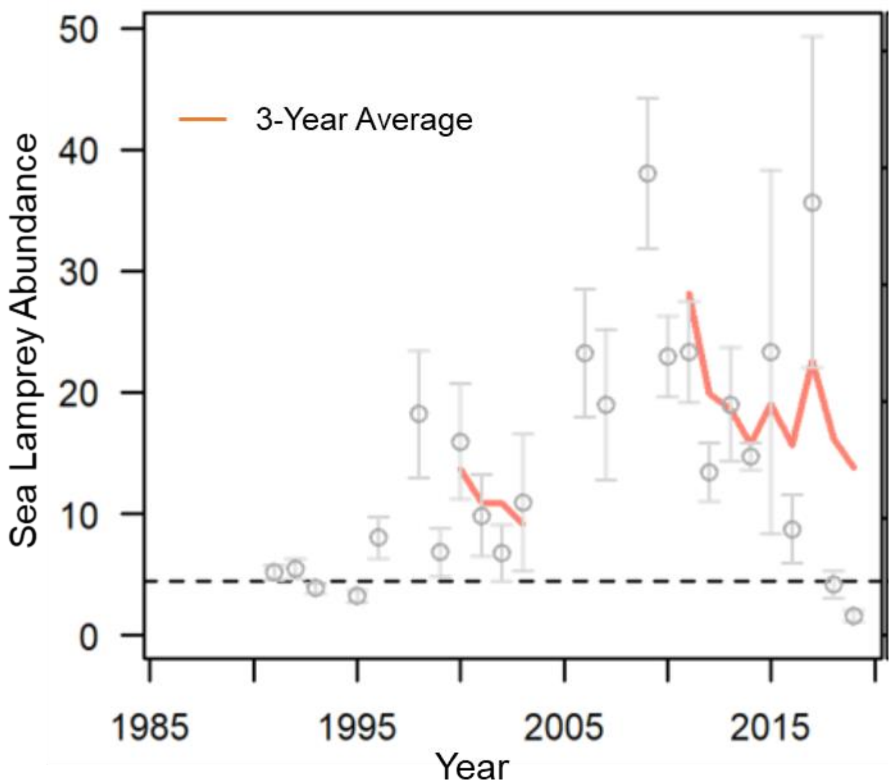


FIGURE 2.1 Adult index values for Lake Erie through 2019, with 3-year averages shown as red lines. Individual estimates with 95% confidence intervals are shown in gray. The target is represented by the horizontal line. The index target was estimated as the mean of indices during a period with acceptable marking rates (1991-1995).

- Based on all Coldwater Assessment data, the marking rate during 2018 was 9.7 A1-A3 marks per 100 Lake Trout >532 mm (Figure 2.2). The marking rate has been greater than the target for the last 16 years.

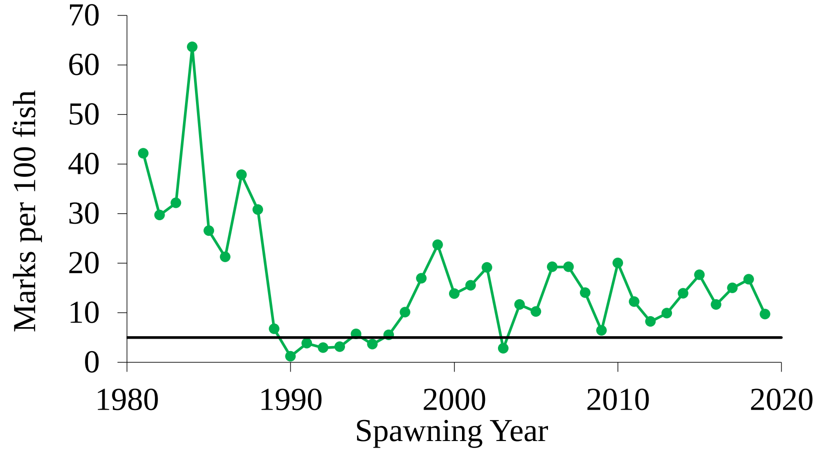


FIGURE 2.2 Average number of A1-A3 marks per 100 Lake Trout >532 mm from all Coldwater Assessment data in Lake Erie. The horizontal line represents the target of 5 A1-A3 marks per 100 Lake Trout. The spawning year is used rather than the survey year (shifted by one year) to provide a comparison with the adult index.

Lampricide Control

- Lampricide treatments were completed in four tributaries (zero Canada, four U.S.).

- Tributaries to Cattaraugus Creek (Clear Creek, Spooner Creek, and Derby Brook) were treated in April 2019. The Cattaraugus Creek mainstream treatment was completed in June due to high water conditions during April.

- Cayuga Creek (Buffalo River) was treated for the first time in 2019.

Larval Assessment

- Larval assessments were conducted in 43 tributaries (9 Canada, 34 U.S.) and offshore of 2 U.S. tributaries.

- Post-treatment assessments were conducted in four tributaries (0 Canada, 4 U.S.) to determine the effectiveness of treatments conducted during 2018 and 2019.

- Surveys to evaluate barrier effectiveness were conducted in 12 tributaries (4 Canada, 8 U.S.). Surveys indicated an infestation of sea lamprey above the barrier on Venison Creek (tributary to Big Creek). All other barriers assessed were found to be effective in continuing to block Sea Lampreys.

- A total of 1.3 hectares of the St. Clair River were surveyed with granular Bayluscide (gB), in the three main delta channels. Six Sea Lampreys were captured throughout the lower river with no additional areas of high density detected. Surveys were not conducted in the upper river in 2019 but are scheduled for 2020.

Barriers

- Black River – The MIDNR and USFWS-Alpena FWCO funded a feasibility study for the removal of Wingford dam. Project partners are currently working to find a mutually beneficial solution to allow fish passage while preventing sea lamprey escapement.

- Clinton River – The City of Rochester Hills, Clinton River Watershed Council, and MIDNR and are currently collaborating with Service staff to block a natural bypass around the Yates Mill dam. The landowner has signed an easement on the property to allow access for the construction of a barrier on the bypass channel. Construction could start as early as summer 2020.

- Cattaraugus Creek **–** The USACE, along with project partners Erie County and New York Department of Environmental Conservation (NYDEC) have approved the selected plan for the Springville Dam Ecosystem Restoration Project. A Denil fishway with a seasonal trap and sort operation is included in the design. Construction is targeted for 2021 following the Sea Lamprey spawning run.

- Grand River – The USACE is the lead agency administering a project to construct a Sea Lamprey barrier to replace the deteriorated structure in the Grand River. Construction of the dam began in summer 2019 and will be complete by mid-summer 2020.

- Conneaut Creek **–** The states of Pennsylvania and Ohio discussed with the Great Lakes Fishery Commission and the United States Fish and Wildlife Service the potential for constructing a new barrier on Conneaut Creek in Ohio or Pennsylvania. 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). A meeting was held in August 2019 to discuss project goals and visit potential barrier sites.

Research

Supplemental Sea Lamprey Control

Topic: Supplemental controls are tactics that supplement the two primary Sea Lamprey control tactics – lampricides and Sea Lamprey barriers. Supplemental controls primarily focus on the adult and juvenile life stages with the goal of reducing the reproductive potential of spawning populations within a tributary. Examples of these tactics include trapping adults or out-migrating juveniles, release of sterile males, and pheromone communication disruption. History provides key lessons concerning the use of supplemental controls (1) they may only be useful when integrated with other control methods and (2) assessing their impact is not trivial, and therefore, requires experimental planning prior to deployment and sustained effort for multiple years. Building on recent success with supplemental control in the Cheboygan and Black Mallard rivers (Lake Huron tributaries), our overall goals are to (1) develop, implement, and evaluate an integrated array of Sea Lamprey control tools focused on reducing reproduction that supplement on-going lampricide and barrier programs and (2) define stream characteristics where supplemental controls provide the greatest benefit.

Objective: Determine how effects of supplementing lampricide treatments with control tools that reduce reproduction vary among streams and why.

Method: Our objective will be accomplished by implementing an adaptive assessment plan on 12 experimental streams for 12 years to answer two guiding questions: (1) What is the relationship between reductions in reproduction via supplemental controls and recruitment of age-1 Sea Lamprey and (2) what ecological factors influence survival and growth from age 1 to the juvenile life stage? Hypotheses stemming from these questions will be investigated by collecting physical (temperature, discharge, larval habitat, spawning habitat), biological (adult abundance, juvenile abundance, larval abundance, larval pedigree analysis, close-kin capture-recapture), and lampricide treatment data. Within this adaptive assessment plan, suites of supplemental controls will be prescribed to complement the physical, biological, and social attributes of experimental streams for 6-8 years (treatment) with the remaining years serving as control. Lampricide treatment will occur when larval density exceeds thresholds set by the study team. Hence, supplemental controls (SupCon) and lampricide serve as management levers to vary spawning stock biomass (guiding question 1) and larval density (question 2) among several diverse streams.

Project Coordinators: Nicholas Johnson, USGS, Hammond Bay Biological Station; DFO: Gale Bravener, Fraser Neave, Bruce Morrison; USFWS: Sean Lewandoski, Lori Criger, Peter Hrodey, Aaron Jubar, Tim Sullivan, Matt Symbal, Jenna Tews; Michigan State University: Travis Brenden, Mike Jones, John Robinson, Kim Scribner; GLFC: Michael Siefkes.

Expected Products: (1) Improved Sea Lamprey control by reducing recruitment in streams where lampricide treatment is challenging. (2) Improved understanding of factors influencing Sea Lamprey recruitment, growth, and survival. (3) Science and technology transfer between field agents and researchers to address control program priorities. (4) Public engagement by conducting outreach in communities where supplemental controls will be tested. (5) Science products including peer reviewed publications and graduate student mentorship.

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 (PFBC) and James Markham (NYSDEC)

Lake Trout Stocking

A total of 252,169 yearling Lake Trout were stocked in Lake Erie in 2019 (Figure 3.1). The USFWS stocked 79,181 yearling Lake Trout in the eastern basin waters of New York, 80,026 yearlings in Ohio waters at Catawba (40,012) and Fairport (40,014) and 39,677 yearlings in Pennsylvania at the East Avenue, boat launch. In addition, the Ontario Ministry of Natural Resources and Forestry (OMNRF) stocked 53,285 yearlings at Nanticoke Shoal. Lake Trout stocked in New York and Pennsylvania waters came from the USFWS Allegheny National Fish Hatchery (ANFH) located in Warren, PA, and were Lake Champlain strains. The Lake Trout stocked in Ohio waters were also from the ANFH and were Finger Lakes (Seneca) strain. The yearlings stocked in Ontario waters were Slate Island strain Lake Trout. In addition to the yearlings, a total of 40,223 surplus fall fingerling Lake Trout (Finger Lakes strain) were stocked in New York Waters by the USFWS. The combined yearling and fall fingerling yearling equivalents totaled 268,660 yearlings, which exceeded the current annual Lake Trout stocking goal of 200,000 yearlings by 34%.

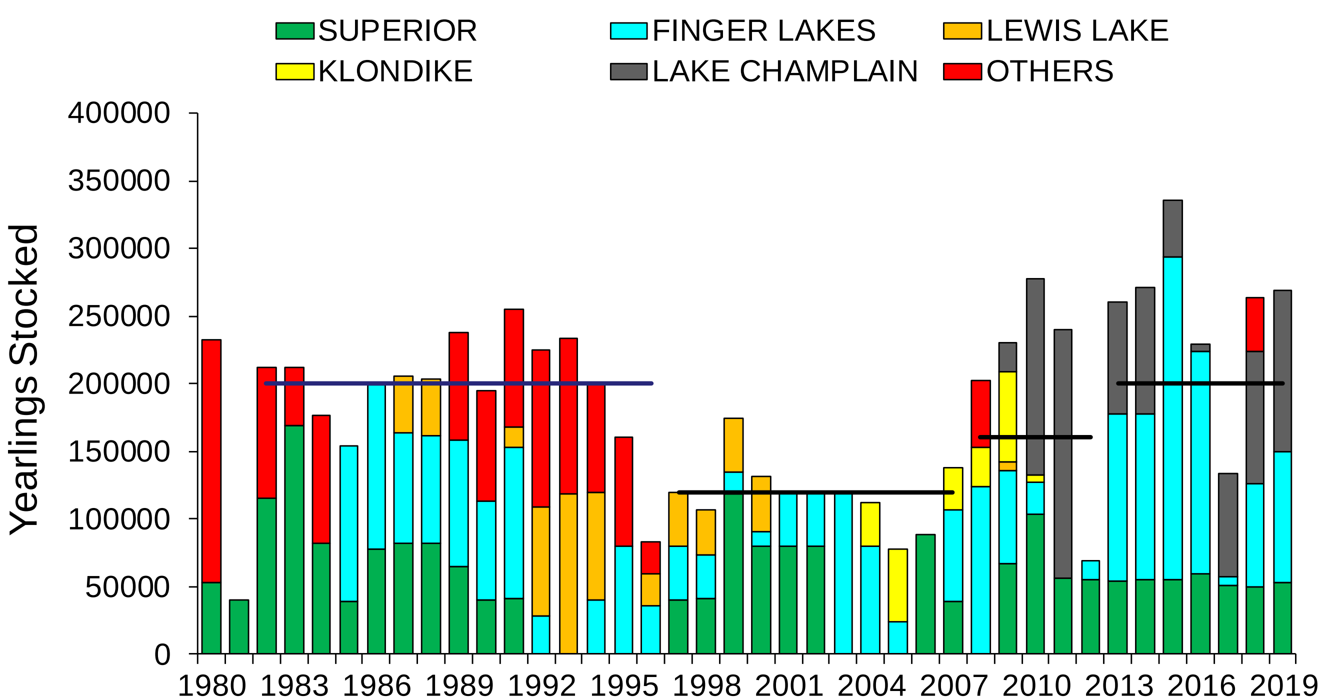


FIGURE 3.1. Lake Trout (in yearling equivalents) stocked by all jurisdictions in Lake Erie, 1980-2019, by strain. Stocking goals through time are shown by black lines dark lines; the current stocking goal is 200,000 yearlings per year. Superior includes Superior, Apostle Island, Traverse Island, Slate Island, and Michipicoten strains; Others include Clearwater Lake, Lake Ontario, Lake Erie, and Lake Manitou strains.

Stocking of Other Salmonids

In 2019, over 2.2 million yearling trout were stocked in Lake Erie, including rainbow/steelhead trout, Brown Trout and Lake Trout (Figure 3.2). Total 2019 salmonid stocking increased 1.2 % from 2018, and 1.5 % above the long-term average (1990-2018). 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 rainbow/steelhead trout in the Lake Erie watershed. A total of 1,861,694 yearling rainbow/steelhead trout were stocked in 2019, accounting for 82% of all salmonids stocked. This was essentially equal to the 2018 steelhead stocking numbers as well as the long-term (1990-2018) average of 1,854,343 yearling steelhead. About 58% of all steelhead stocking occurred in Pennsylvania waters, followed by 28% in Ohio waters, 11% in New York waters, and 3% in Michigan waters. No Rainbow Trout were stocked in Ontario waters in 2019. The NYSDEC stocked 146,760 yearling steelhead in 2019, which was 42% below stocking target (255,000 yearlings) due to shortages at the Salmon River Hatchery. New York also stocked 66,000 domestic Rainbow Trout in 2019. Steelhead stocking increased 7% in Ohio and was 28% above a target objective of 400,000 yearling steelhead. Pennsylvania steelhead stocking increased 9% from 2018 and was 7% above a stocking objective of 1 million yearlings. Michigan steelhead stocking increased 4% from 2018 and was 7% above their stocking objective of 60,000 yearling steelhead. A full account of rainbow/steelhead trout stocked in Lake Erie by jurisdiction for 2019 can be found under Charge 4 of this report, which also provides details about the locations and strains of steelhead/rainbow trout stocked across Lake Erie.

Brown Trout stocking in Lake Erie totaled 132,496 yearling and adults in 2019, all in Pennsylvania waters. This was a 34% increase from 2018 and 51% above the long-term (1990-2018) average annual stocking of 87,972 brown trout.

Between12 April and 15 May, about 22,000 adult Brown Trout were stocked by the PFBC to provide catchable trout for the opening of the 2019 Pennsylvania trout season. In a continued effort to provide a trophy Brown Trout program, Pennsylvania NGO hatcheries stocked about 53,000 yearling Brown Trout and the PFBC stocked about 47,000 yearling Brown Trout. These fish are in support of a put-grow-take Brown Trout program that was initiated in 2009. This program was implemented through the annual donation of 100,000 certified IPN-free eggs from the NYSDEC. The PFBC has now developed a captive brood egg source for this program to decrease the reliance on New York Brown Trout eggs. Brown Trout stocking levels for catchable trout are expected to continue at the current rates in Pennsylvania. The NGO hatcheries will no longer stock Brown Trout in support of the trophy Brown Trout program after 2019.

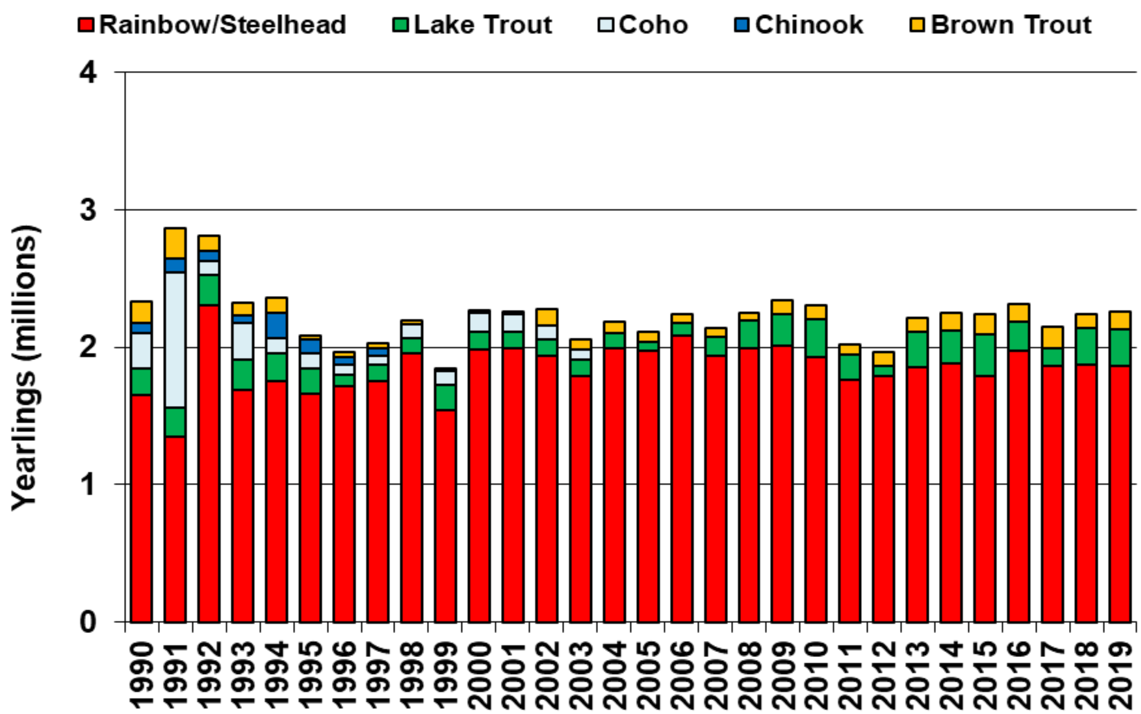


FIGURE 3.2. Annual stocking of all salmonid species (in yearling equivalents) in Lake Erie by all agencies, 1990-2019.

TABLE 3.1. Summary of salmonid stockings in numbers of yearling equivalents, Lake Erie, 1990-2019.

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, 1990-2019.

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, 1990-2019.

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	--	--	--	--	53,285
	NYS DEC	95,672	--	--	--	212,760	308,432
	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**	**1,861,694**	**2,262,850**

Charge 4. Report on the status of steelhead and develop a proposal for mass marking, including lake wide and agency goals and objectives, a study plan, and logistics by October 31, 2019.

Chuck Murray (PFBC) and James Markham (NYSDEC)

Tributary Angler Surveys

Steelhead (lake-run Rainbow Trout) are mainly a pelagic species in the open waters of Lake Erie and are not sampled efficiently in any of the long-term assessment surveys. Because of this, metrics of the population status, such as age structure and estimates of abundance, are not practical. 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 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 3-year intervals 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 in more recent years 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 and are among the best catch rates for Steelhead in the country.

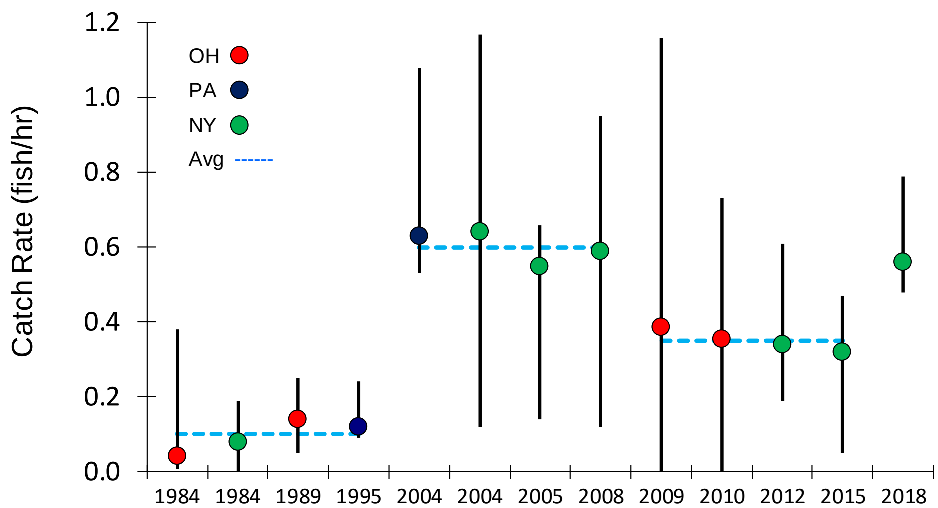


FIGURE 4.1. Targeted average Steelhead catch rates (fish/angler hour) in Lake Erie tributary angler surveys by year and jurisdiction, 1984-2019. Vertical whiskers represent the range of individual tributary catch rates in the survey year.

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 2019 estimated steelhead harvest from the summer open-water boat angler fishery totaled 4,889 fish across all US agencies, a 30% decrease from 2018 (Table 4.1). The Ontario Ministry of Natural Resources and Forestry (OMNRF) have intermittently conducted open lake boat angler creel surveys, but no data was collected in 2019. Open lake harvest decreased in Ohio (46%) and New York (71%) but increased in Pennsylvania (105%) and Michigan from 2018. This was the first recorded steelhead harvest in Michigan waters in six years. Among the US jurisdictions, about 49% of the reported harvest was in Ohio, 35% in Pennsylvania, 5% in New York waters and 1% in Michigan.

TABLE 4.1 Estimated harvest by open lake boat anglers in Lake Erie, 1999-2019.

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
mean	12,169	3,205	645	25,736	32	23,771

* no creel data collected by OMNRF in 2003, 2005-2013, 2015-2019

A small amount of targeted effort for steelhead occurs in the open lake. While the harvest rate statistics are based on a small number of interviews that limit the application of these results, the harvest rates can provide some measure of the overall performance of the steelhead fishery. Steelhead angler open-lake harvest rates were quite different between Ohio and Pennsylvania. Compared to 2018, the 2019 steelhead harvest rates increased 44% in Pennsylvania and declined 82% in Ohio. Compared to the interagency long-term average, Pennsylvania was 55% above the long-term average of 0.15 steelhead harvested/angler hour and Ohio anglers were 87% below the long-term average of 0.15 steelhead harvested/angler hour. (Figure 4.2).

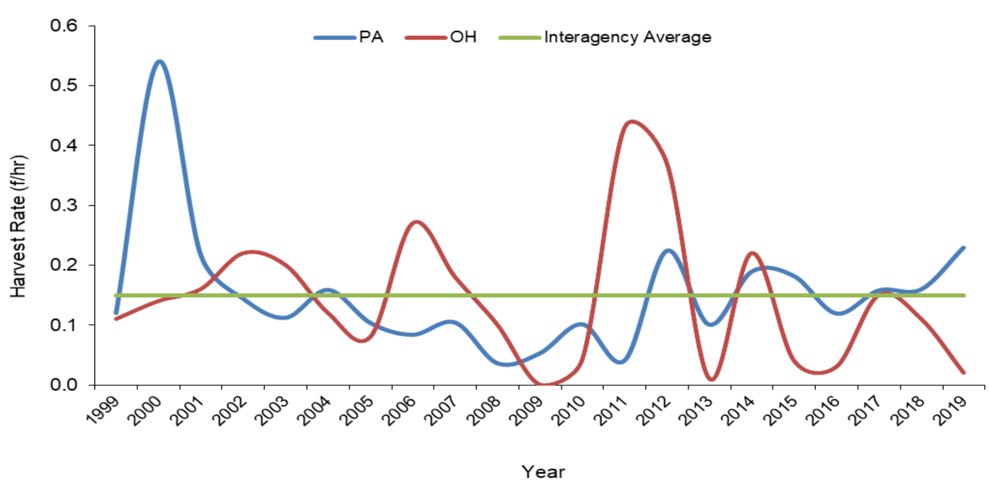


FIGURE 4.2. Targeted steelhead catch rates (fish caught/angler hr.) in Lake Erie by open lake boat anglers in Ohio and Pennsylvania 1996-2019.

Stocking

All Lake Erie jurisdictions stocked steelhead in 2019 (Table 4.2). Based on these efforts, a total of 1,795,694 yearling steelhead and 66,000 domestic strain Rainbow Trout were stocked in 2019, nearly equal to 2018 and the long-term (1990-2017) average. Nearly all (97%) of the steelhead stocked in Lake Erie originated from West Coast strains naturalized to the Great Lakes. Pennsylvania stocked a naturalized Lake Erie strain collected from Trout Run in Pennsylvania. New York stocked a Washington strain collected from Lake Ontario's Salmon River. Ohio stocked a combination of Manistee River strain (Lake Michigan), Ganaraska River strain (Lake Ontario) and Chambers Creek strain. Michigan stocked a Manistee River strain which is a naturalized strain from Lake Michigan. About 4% of the Rainbow Trout stocked in Lake Erie are a domestic strain stocked by the NYSDEC.

Fisheries agency stocking of spring yearlings took place between 22 February and 10 May, with smolts averaging about 183 mm in length (Table 4.3). MDNRF did an adipose (AD) fin clip on the steelhead they stocked in 2019. The is the first fin clip applied to steelhead since 2016. Table 4.4 provides a list of all fin clips on steelhead from 2000 – 2019

TABLE 4.2 Steelhead stocking by jurisdiction and location for 2019.

Jurisdiction	Location	Strain	Number	Life Stage	Yearling Equivalents	
Michigan	Huron River	Manistee River, L. Michigan	64,374	Yearling	64,374	
					64,374	**Sub-Total**
Pennsylvania	Conneaut Creek	Trout Run, L. Erie	75,000	Yearling	75,000	
	Crooked Creek	Trout Run, L. Erie	74,000	Yearling	74,000	
	Elk Creek	Trout Run, L. Erie	240,830	Yearling	240,830	
	Fourmile Creek	Trout Run, L. Erie	36,617	Yearling	36,617	
	Godfrey Run	Trout Run, L. Erie	18,499	Yearling	18,499	
	Lake Erie	Trout Run, L. Erie	70,000	Yearling	70,000	
	Presque Isle Bay	Trout Run, L. Erie	84,311	Yearling	84,311	
	Raccoon Creek	Trout Run, L. Erie	37,000	Yearling	37,000	
	Sevenmile Creek	Trout Run, L. Erie	37,051	Yearling	37,051	
	Sixteenmile Creek	Trout Run, L. Erie	18,536	Yearling	18,536	
	Trout Run	Trout Run, L. Erie	46,249	Yearling	46,249	
	Twelvemile Creek	Trout Run, L. Erie	37,271	Yearling	37,271	
	Twentymile Creek	Trout Run, L. Erie	111,137	Yearling	111,137	
	Walnut Creek	Trout Run, L. Erie	185,511	Yearling	185,511	
					1,072,012	**Sub-Total**
Ohio	Ashtabula River	Manistee River/Chamber's Creek/Ganaraska River	55,870	Yearling	55,870	
	Chagrin River	Manistee River/Chamber's Creek/Ganaraska River	109,285	Yearling	109,285	
	Conneaut Creek	Manistee River/Chamber's Creek/Ganaraska River	75,021	Yearling	75,021	
	Grand River	Manistee River/Chamber's Creek/Ganaraska River	99,448	Yearling	99,448	
	Rocky River	Manistee River/Chamber's Creek/Ganaraska River	96,576	Yearling	96,576	
	Vermilion River	Manistee River/Chamber's Creek/Ganaraska River	73,645	Yearling	73,645	
	Lake Erie - Cleveland Harbor	Manistee River/Chamber's Creek/Ganaraska River	76,568	Fall Fingerling	2,703	
					512,548	**Sub-Total**
New York	Silver Creek	Washington	8,750	Yearling	8,750	
	Walnut Creek	Washington	8,750	Yearling	8,750	
	Canadaway Creek	Washington	10,000	Yearling	10,000	
	Eighteen Mile Creek	Washington	20,000	Yearling	20,000	
	Chautauqua Creek	Washington	25,000	Yearling	25,000	
	Buffalo Creek	Washington	17,500	Yearling	17,500	
	Cayuga Creek	Washington	13,120	Yearling	13,120	
	Cattaraugus Creek	Washington	43,640	Yearling	43,640	
	Cattaraugus Creek	Domestic	15,000	Fall Fingerling	15,000	
	Eighteen Mile Creek	Domestic	10,000	Fall Fingerling	10,000	
	Canadaway Creek	Domestic	10,000	Fall Fingerling	10,000	
	Chautauqua Creek	Domestic	10,000	Fall Fingerling	10,000	
	Eighteen Mile Creek	Domestic	5,000	Yearling	5,000	
	Cattaraugus Creek	Domestic	4,000	Fall Fingerling	4,000	
	Eighteen Mile Creek	Domestic	4,000	Fall Fingerling	4,000	
	Canadaway Creek	Domestic	4,000	Fall Fingerling	4,000	
	Chautauqua Creek	Domestic	4,000	Fall Fingerling	4,000	
					212,760	**Sub-Total**
					1,861,694	**Grand Total**

TABLE 4.3. Stocking summaries of yearling steelhead by fisheries agency for 2019.

Agency	Range of Dates Stocked	mean length (mm)	N of yearlings stocked
Michigan Dept. of Natural Resources	6 April - 27 April	193	64,374
New York Dept. of Environmental Conservation	20 March - 5 May	127	212,760
Ohio Division of Wildlife	22 April - 10 May	191	512,548
Pennsylvania Fish and Boat Commission	22 February - 13 April	189	1,072,012
		183	1,861,694

TABLE 4.4. Rainbow trout (steelhead) fin-clip summary for Lake Erie, 2000-2019.

Year Stocked	Year Class	Michigan	New York	Ontario	Ohio	Pennsylvania
2000	1999	RP	RV	LP	-	-
2001	2000	RP	AD	-	-	-
2002	2001	RP	AD-LV	-	-	-
2003	2002	RP	RV	LP	-	-
2004	2003	RP	-	LP	-	-
2005	2004	RP	AD-LP	RP	-	-
2006	2005	-	-	LP	-	-
2007	2006	-	AD-LP	-	-	-
2008	2007	-	AD-LP	-	-	-
2009	2008	RP	-	-	-	-
2010	2009	-	-	-	-	-
2011	2010	-	AD-LP	-	-	-
2012	2011	-	-	-	-	-
2013	2012	-	-	-	-	-
2014	2013	-	-	-	-	-
2015	2014	-	AD; LV; CWT; AD+CWT	-	-	-
2016	2015	-	AD; LV; CWT; AD+CWT	-	-	-
2017	2016	-	-	-	-	-
2018	2017	-	-	-	-	-
2019	2018	AD	-	-	-	-

Clip abbreviations: AD=adipose; RP= right pectoral; RV=right ventral; LP=left pectoral; LV=left ventral; CWT=Coded Wire Tag.

Mass Marking

The CWTG and the USFWS Great Lakes mass marking group continued to develop a proposal for Rainbow Trout mass marking but after consultation with the LEC in the fall of 2019, the goal of tagging steelhead had been abandoned. Most members felt the information gained by this research did not rise to a sufficient level to justify the effort. Individual agencies may move forward with their own mass marking research to answer management questions related to strain performance, stocking strategies, growth, adult returns and contributions from natural reproduction.

Charge 5. Review and provide recommendations for the Lake Trout Management plan 2020. Report by Pre-LEC March 2020.

Tom MacDougall (OMNRF), James Markham (NYSDEC) and Mathew Heerschap (OMNRF)

In 2020, the task group worked to develop a process for reviewing the current Lake Trout Management Plan (Markham et al., 2008), assessing successes and failures, and utilizing lessons learned to inform a modified approach to Lake Trout management beyond 2020. Informal discussions throughout the year culminated in conference calls and a face-to-face meeting in February 2020. Discussion topics were broadly of two types: Management Strategies (attempted vs deferred) and Metrics to Assess Success.

Management strategies successfully pursued include: *Stocking at a rate of at least 200K* Lake Trout annually which has been achieved and surpassed in 8 of the past 10 years (Figure 3.1; Charge 3); *Identifying potential Lake Trout spawning habitat* which has seen considerable progress and is ongoing (via Sidescan Sonar mapping and acoustic telemetry); *Expanded distribution of stocked fish* under which fish have been stocked at new locations in the waters of Ontario, Pennsylvania, and Ohio; *Maintain genetic diversity* in stocked Lake Trout, attained by stocking five strains since 2008; and *Stock a variety of Life Stages* which was partially achieved through the stocking of fingerlings, opportunistically, in addition to planned yearlings.

Six specific metrics were used to define success (Table 5.1). Of these, four were related to relative abundance and demographics and could therefore be assessed using data from the Coldwater Assessment Survey. While overall abundance (3.67 fish/lift; past 5 years) has failed to meet the target objective (8 fish/lift), the three more specific targets (mature fish abundance; mature female abundance; broad demographic) have all been met in recent years (Table 5.1). The remaining targets were either not assessed (egg densities) or were dependent on observations of age 1 Lake Trout, which may have not been properly assessed using current methods.

Generally, it was felt that management beyond 2020 would benefit from a more specific stocking strategy which outlined timing, location (based on new habitat knowledge), and numbers, but left room for experimentation in a controlled way. Stocking numbers could be targeted at levels, greater than 200K, which have been achieved in recent years. Whereas the current plan emphasized basin-wide overall abundance, it is now recognized that goals associated with the relative abundance of mature fish, perhaps unevenly distributed in association with preferred habitat might be preferable. Instead of targeting a high (8 fish/lift) critical average abundance in order to meet a theoretical threshold developed for other lakes, future goals should seek to maintain a moderate but consistent abundance over time. Maintaining a broad distribution of mature age classes would also be desirable. Overarching goals from the current plan associated with consistent, and measurable contributions from naturally produced Lake Trout, and with Sea Lamprey control, should be maintained into the future.

Moving forward, upon the advice of the LEC, the CWTG will address this charge during the 2020/2021 cycle as follows:

1) Report on current management plan – A specific writing team will be designated and a draft overview report on the current plan will be completed through June 2020.
2) Create a new, revised management plan – The new plan will be scoped relative to the LEC's vision for Lake Erie as described in the recently updated Fish Community Goals and Objectives and from direct LEC input. It will make use of newly acquired knowledge and will include recommendations and measurable outcomes. A draft revised plan will be available for review by the CWTG and experts at large by fall 2020, with an official draft ready for LEC review by March 2021

TABLE 5.1. Observed measures of target objectives as defined in *A Strategic Plan for the Rehabilitation of Lake Trout in Lake Erie, 2008 – 2020* (Markham et al. 2008)

Lake Trout Management Plan Objectives	**Target**	**Pre-plan Average (2001-2007)**	**Plan Average (2008-2019)**	**Last 5 years (2015-2019)**
Lake Trout Abundance (All Ages)	8 fish/lift	**2.11 Fish/Lift**	**3.64 Fish/Lift**	**3.67 Fish/Lift**
Lake Trout Abundance (Age 5+)	2 fish/lift	**0.79 Fish/Lift**	**1.88 Fish/Lift**	**2.46 Fish/Lift**
Mature Female Population (+4500g) represent 25% of Adult Population	0.5 fish/lift	**0.25 Fish/Lift**	**0.48 Fish/Lift**	**0.71 Fish/Lift**
Minimum 10 year classes	10+	**17**	**18**	**18**
Egg densities	4 suitable spawning locations	**Not Assessed**		
Natural recruitment	Consistent contribution of age-1 Lake Trout	**Number of Unclipped & Untagged fish does not exceed tag retention estimates provided by hatchery**		

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