# REPORT OF THE LAKE ERIE COLDWATER TASK GROUP

26 March 2010

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|---|---|
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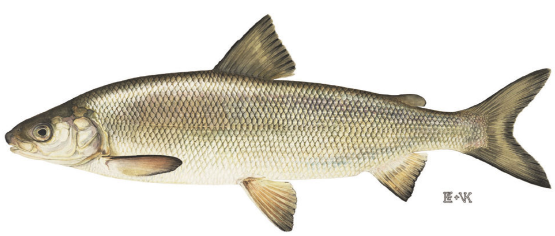
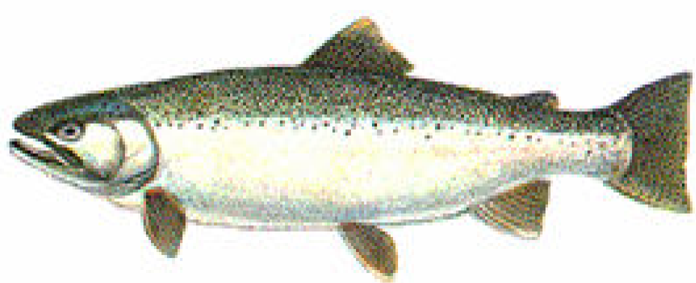


**Presented to:**

**Standing Technical Committee**
**Lake Erie Committee**
**Great Lakes Fishery Commission**



## Protocol for Use of Coldwater Task Group Data and Reports

The Lake Erie Coldwater Task Group (CWTG) uses standardized methods, equipment, and protocols as much as possible; however, data sampling and reporting methods do vary across agencies. The data are based upon surveys that have limitations due to gear, depth, time, and weather constraints that are variable from year to year. Any results or conclusions must be treated with respect to these limitations. Caution should be exercised by outside researchers not familiar with each agency's collection and analysis methods to avoid misinterpretation.

The CWTG strongly encourages outside researchers to contact and involve the CWTG members in the use of any specific data contained in this report. Coordination with the CWTG can only enhance the final output or publication and benefit all parties involved. Any CWTG data or findings intended for outside publication **must** be reviewed and approved by the CWTG members. Agencies may require written permission for external use of data, please contact the agencies responsible for the data collection.

**Citation:**

Coldwater Task Group. 2010. Report of the Lake Erie Coldwater Task Group, March 2010. Presented to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. Ann Arbor, Michigan, USA.

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Kraft, C.E., D.M. Carlson, and M. Carlson. 2006. *Inland Fishes of New York (Online)*, Version 4.0. Department of Natural Resources, Cornell University, and the New York State Department of Environmental Conservation.

# Table of Contents

## Background

The Coldwater Task Group (CWTG) is one of several technical groups under the Lake Erie Committee (LEC) that addresses specific charges related to the fish community. The group was originally formed in 1980 as the Lake Trout Task Group with its main functions of coordinating, collating, analyzing, and reporting of annual lake trout assessments among Lake Erie's five member agencies, and assessing the results toward rehabilitation status. Restoration of lake trout into its native eastern basin Lake Erie habitat began in 1978, when 236,000 surplus yearlings were obtained from a scheduled stocking in Lake Ontario. Similar numbers of yearlings were also available for Lake Erie in 1979. In 1982, the U.S. Fish and Wildlife Service (USFWS), in cooperation with the Pennsylvania Fish and Boat Commission (PFBC) and the New York State Department of Environmental Conservation (NYSDEC), committed to annually produce and stock at least 160,000 yearlings in Lake Erie and monitor lake trout restoration in the eastern basin.

A formal lake trout rehabilitation plan was developed in by the newly-formed Lake Trout Task Group in 1985 (Lake Trout Task Group 1985) that defined goals and specific quantitative objectives for restoration. A draft revision of the plan (Pare 1993) was presented to the LEC in 1993, but the revision was never adopted by the LEC because of a lack of consensus regarding the position of lake trout in the Lake Erie fish community goals and objectives (FCGOs; Cornelius et al. 1995). A revision of the Lake Erie FCGOs was completed in 2003 (Ryan et al. 2003) and identified lake trout as the dominant predator in the profundal waters of the eastern basin. A subsequent revision of the Lake Trout Rehabilitation Plan was completed by the task group in 2008 (Markham et al. 2008).

The Lake Trout Task Group evolved into the CWTG in 1992 as interest in the expanding burbot and lake whitefish populations, as well as predator/prey relationships involving salmonid and rainbow smelt interactions, prompted additional charges to the group from the LEC. Rainbow/steelhead trout dynamics have recently entered into the task group's list of charges and a new charge concerning lake herring rehabilitation was added in 1999. Continued assessments of coldwater species' fisheries and biological characteristics has added new depth to the understanding of how these species function in the shallowest and warmest lake of the Great Lakes.

This report is specifically designed to address activities undertaken by the task group toward each charge in this past year and is presented orally to the LEC at the annual meeting, held this year on 25-26 March 2010 in Windsor, Ontario. Data have been supplied by each member agency, when available, and combined for this report, if the data conform to standard protocols. Individual agencies may still choose to report their own assessment activities under separate agency reporting processes.

## References

Cornelius, F. C., K. M. Muth, and R Kenyon. 1995. Lake Trout Rehabilitation in Lake Erie: A Case History. J. Great Lakes Res. 21 (Supplement 1): 65-82, International Association of Great Lakes Research.

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Ryan, P.A., R. Knight, R. MacGregor, G. Towns, R. Hoopes, and W. Culligan. 2003. Fish-community goals and objectives for Lake Erie. Great Lakes Fish. Comm. Spec. Publ. 03-02. 56 pp.

# COLDWATER TASK GROUP EXECUTIVE SUMMARY REPORT MARCH 2010

**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. The complete report is available from the GLFC's Lake Erie Committee Coldwater Task Group website at http://www.glfc.org/lakecom/lec/CWTG.htm, or upon request from an LEC, Standing Technical Committee (STC), or CWTG representative.

Seven charges were addressed by the CWTG during 2009-2010: (1) Lake trout assessment in the eastern basin; (2) Lake whitefish fishery assessment and population biology; (3) Burbot fishery assessment and population biology; (4) Participation in sea lamprey assessment and control in the Lake Erie watershed; (5) Electronic database maintenance of Lake Erie salmonid stocking information; (6) Steelhead fishery assessment and population biology, and (7) Development of a cisco management plan.

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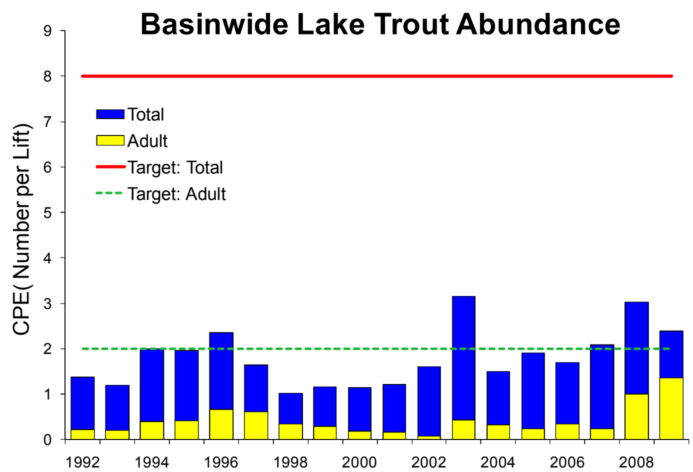
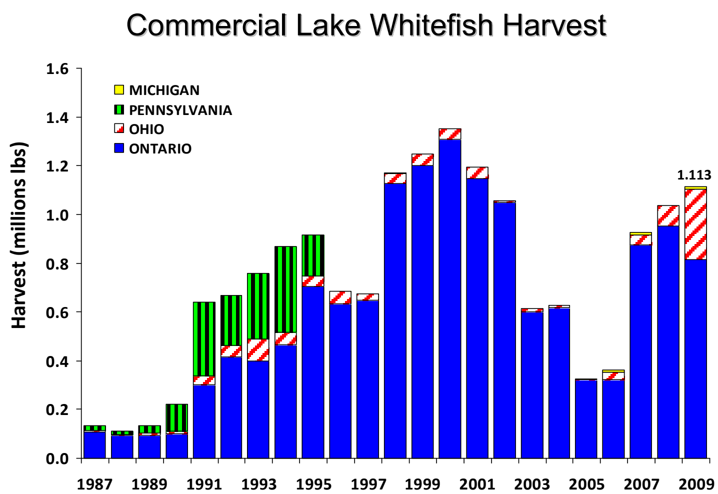
## *Lake Trout*

A total of 557 lake trout were collected in 129 lifts across the east basin of Lake Erie in 2009. Young cohorts (ages 2-5) dominated catches with lake trout ages 9 and older only sporadically caught. Basin-wide lake trout abundance declined in 2009 and remains well below the rehabilitation target of 8.0 fish/lift. Adult (age 5+) abundance increased to its highest level in the time series, but also remains below target. Klondike and Finger Lakes strain lake trout comprise the majority of the population. Klondike cohorts were smaller in lengths- and weights-at-age compared to lean lake trout strains.



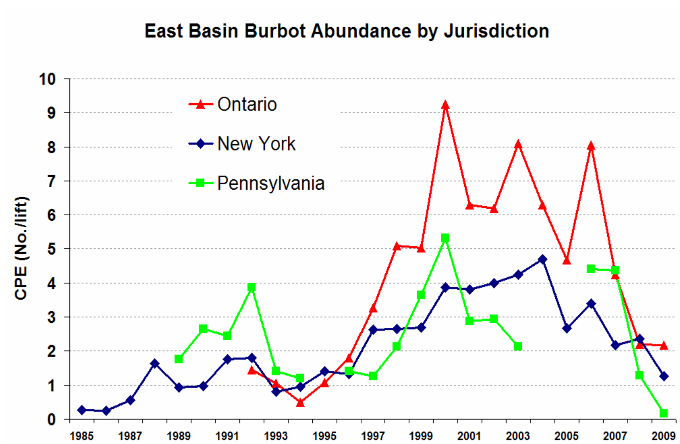

## *Lake Whitefish*

Lake whitefish harvest in 2009 was 1,113,488 pounds, distributed among Ontario (73%), Ohio (26%), Michigan (15%) and Pennsylvania (<1%) commercial fisheries. Ohio's harvest of 288,294 pounds was the highest in recent history, since the fishery was reopened in 1987. The 2003 year class (age 6) dominated the harvest and the population age structure in 2009. Ages present in the 2009 population ranged from 2 to 19 with no evidence of young-of-the-year or yearlings. With weak to moderate recruitment occurring, abundance appears to be declining. Fisheries in 2010 will continue to rely on the 2003 year class (age 7) with some contribution from the 2004 (age 6) and 2005 (age 5) cohorts and older lake whitefish. In 2009, female condition remained below the long term average, and the diet of benthic invertebrates was diverse.



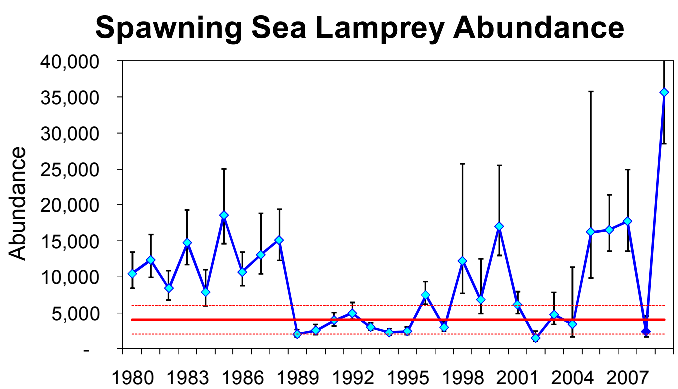

## *Burbot*

Total commercial harvest of burbot in Lake Erie during 2009 was 4,784 pounds, a 2.8-fold increase from the recent time series low observed in 2008. Abundance and biomass of burbot indices from annual coldwater gillnet assessments continued to decline or remained well below average throughout the east basin, following peaks in 2000 in Pennsylvania and Ontario and in 2004 in New York. Mean size (length and weight) and age of burbot has increased since the late 1990s, showing a recent trend of poor recruitment. Rainbow smelt and round gobies continue to be the dominant prey items in burbot diets in eastern Lake Erie.



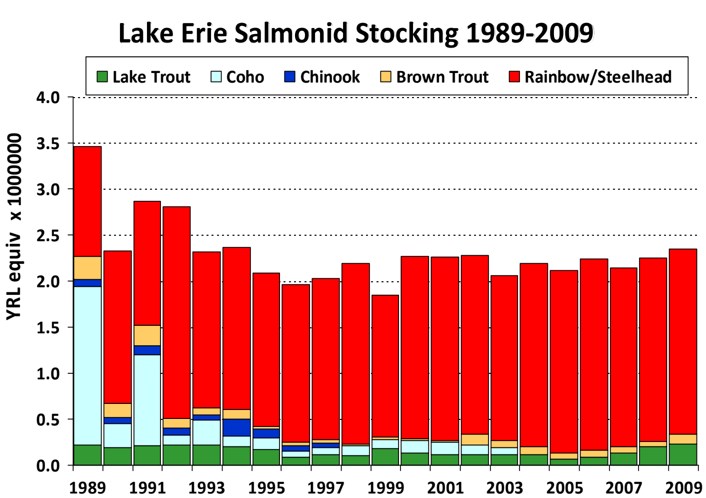
### Sea Lamprey

The A1-A3 wounding rate on lake trout over 532 mm was 19.3 wounds per 100 fish in 2009. This was over three times the 2008 wounding rate (6.2 wounds/100 fish) and the highest wounding rate since 1998. The wounding rate is nearly four times the target rate of 5 wounds/100 fish. Wounding rates have been above target for 14 of the past 15 years. Large lake trout over 736 mm continue to receive the highest percentage of the fresh wounds, but high wounding rates were found in all size categories greater than 532mm. A4 wounding rates also increased in 2009 to 51.5 wounds/100 fish, the third highest wounding rate in the 25-year time series. The estimated number of spawning-phase sea lampreys increased from 2,400 in 2008 to 35,635 in 2009. A two-year experiment of back-to-back lampricide treatments in the nine major sea lamprey producing streams began in spring 2008. These same streams were treated again in fall 2009 with treatment results expected to be seen in 2010.




### Lake Erie Salmonid Stocking

A total of 2,343,897 yearling-equivalent salmonids were stocked in Lake Erie in 2009. This was a 4% increase in the number of yearling salmonids stocked compared to 2008. By species, there were 229,842 lake trout stocked in New York, Pennsylvania and Ontario waters (the highest amount stocked in the 30-year time series); 102,701 brown trout stocked in New York and Pennsylvania waters (a 90% increase), and a total of 2,011,354 steelhead/rainbow trout stocked by all five jurisdictions (a 1% increase).




### Steelhead

All agencies stocked yearling rainbow trout/steelhead in 2009. Summarizing rainbow trout/steelhead stocked in Lake Erie by jurisdictional waters for 2009: Pennsylvania (1,186,825; 59%), Ohio (458,823; 23%), New York (276,720; 14%), Michigan (70,376; 3%) and Ontario (18,610; 1%). Overall, steelhead stocking numbers (2.011 million in 2009) were 11% above the long-term (1989-2008) average of 1.813 million yearlings. Stockings have been consistently in the 1.7-2.0 million range since 1993.

The summer open lake fishery for steelhead was again evaluated by Ohio, Pennsylvania and New York. Open lake harvest was estimated at 8,765, summed for all reporting agencies. Open lake steelhead harvest increased in Ohio and Michigan waters, but declined in New York and Pennsylvania waters compared to 2008. Similar to harvest estimates from the open lake boat fishery, catch rate statistics were mixed across the lake. Relative to historical catch rates, 2009 CUE's were below average in all jurisdictional waters in 2009, but the change was most pronounced in Pennsylvania. A combined interagency catch rate for 2009 of 0.09 steelhead per angler hour was below the combined long-term average of 0.12 fish per angler hour.

Catch rates for Ontario open-water angler diarists in 2009, expressed as fish per rod-hour, were lower than 2008 values in the west central and east basins. Catch rates for 2009 were near the long-term mean in the west central, above the long-term mean in the east central and well below the long-term mean in the east basin.

Based on open lake creel surveys and contemporary tributary creel surveys in New York, Pennsylvania and Ohio, the majority (>90%) of the fishery effort for steelhead remains in the tributaries, pier and shore access areas from fall through spring. Recent tributary creel surveys in Ohio showed significant increases in effort, harvest, catch rates, and legal-release rates compared to historic 1984 steelhead tributary creel survey data.

### Cisco

Cisco are considered extirpated in Lake Erie; however, commercial fishermen report them periodically. In 2009, there were no reports of cisco from commercial fishery, sport fishery or agency assessments. Genetic testing of recent catches found them to be most related to the historic Lake Erie stock, indicating the possibility that a remnant Lake Erie stock still exists.

In recognizing that stocking is a possible management decision, disease testing of potential broodstock was started. Positive results for BKD from Lake Superior bloaters have eliminated this lake as a potential source. Ciscoes collected from eastern Lake Ontario from 2006-2009 were negative for all diseases tested, but currently the cisco population there is low. There is a need to investigate the possibility of using Lake Huron and Lake Michigan stocks as a source of broodstock.

Preparation of a cisco management plan began in 2007 with the goal of rehabilitating cisco in Lake Erie. The final draft is expected to be completed in 2010.

## Charge 1: Coordinate annual standardized lake trout assessments among all eastern basin agencies and update the status of lake trout rehabilitation.

*James Markham, NYSDEC*

### Methods

A stratified, random design, deepwater gill net assessment protocol for lake trout has been in place since 1986. The sampling design divides the east basin of Lake Erie into eight sampling areas (A1-A8) of width defined by North/South-oriented 58000 series Loran C Lines of Position (LOP). The entire survey area is bound between the 58435 LOP on the west and the 58955 LOP on the east (Figure 1.1). New York is responsible for sampling areas A1 and A2, Pennsylvania A3 and A4, and USGS/OMNR

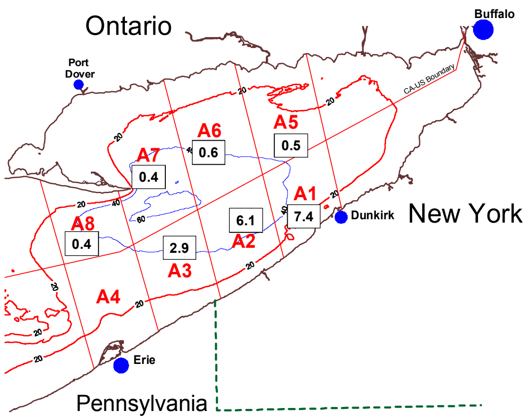



FIGURE 1.1. Standard sampling areas (A1-A8) used for assessment of lake trout in the eastern basin of Lake Erie, 2009, and catch per effort (number/lift) of lake trout in each area.

A5-A8. Each area contains 13 equidistant north/south-oriented LOPs that serve as transects. Six transects are randomly selected for sampling in each area. A full compliment of standard eastern basin effort should be 60 standard lifts each for New York and Pennsylvania waters (two areas each) and 120 lifts from Ontario waters (four areas total). To date, this amount of effort has never been achieved. A1 and A2 have been the most consistently sampled areas across survey years while effort has varied in all other areas (Figure 1.2). Area A4 has only been sampled once due to the lack of enough cold water to set nets according to the sampling protocol.

Ten gill net panels, each 15.2 m (50 ft) long, are tied together to form 152.4-m (500-ft) gangs. Each panel is constructed of diamond-shaped mesh in one of 10 size categories ranging from 38-152 mm on a side in 12.7-mm increments stretched measure (1.5-6 inches; 0.5 inch increments). Panels are arranged randomly in each gang. A series of five

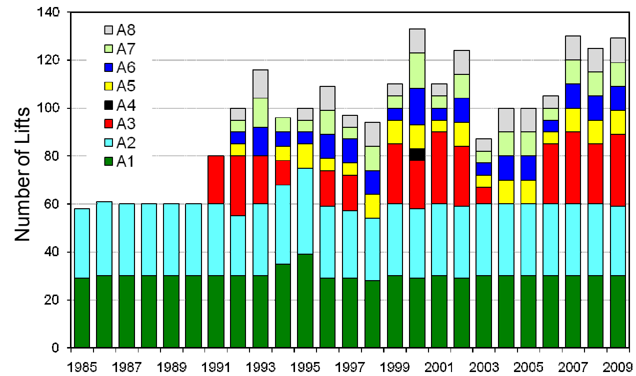



FIGURE 1.2. Number of coldwater assessment gill net lifts by area in the eastern basin of Lake Erie, 1985-2009.

gangs per transect are set overnight, on the bottom, along the contour, and perpendicular to a randomly selected north/south-oriented transect during the month of August or possibly into early September, prior to fall turnover. New York State Department of Environmental Conservation (NYSDEC) personnel modified the protocol in 1996 using nets made of monofilament mesh instead of the standard multifilament nylon mesh. This modification was made following two years of comparative data collection and analysis that detected no significant difference in the total catch between the two net types (Culligan et al. 1996). In 1998 and 1999, all Coldwater Task Group (CWTG) sampling agencies except the Pennsylvania Fish and Boat Commission (PFBC) switched to standard monofilament assessment nets to sample eastern basin lake trout. Personnel from the PFBC switched to monofilament mesh in 2006.

Sampling protocol requires the first gang in each five net series to be set along the contour where the 8° to 10°C isotherm intersects with the bottom. The top of the gang must be within this isotherm. The next three gangs are set in progressively deeper/ colder water at increments of either 1.5 m depth (5 feet) or a 0.8 km (0.5 miles) distance from the previous (shallower) gang, whichever occurs first along the transect. The fifth and deepest gang is set 15 m (50 feet) deeper than the shallowest net (number 1) or at a maximum distance of 1.6 km (1.0 miles) from net number 4, whichever occurs first. NYSDEC and PFBC have been responsible for completing standard assessments in their jurisdictional waters since 1986 and 1991, respectively. The Sandusky office of the U.S. Geological Survey (USGS) has assumed responsibility for standard assessments in Canadian waters since 1992. The Ontario Ministry of Natural Resources (OMNR) began coordinating with USGS in 1998 to complete standard assessments in Canadian waters. Total effort for 2009 by the combined agencies was 129 unbiased standard lake trout assessment gill net lifts in the eastern basin of Lake Erie (Figure 1.2). This included 59 lifts by the NYSDEC, 30 by the PFBC, and 40 by USGS/ OMNR.

All lake trout are routinely examined for total length, weight, sex, maturity, fin clips, and wounds by sea lampreys. 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 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.

TABLE 1.1. Number, sex, mean length (mm), mean weight (g), and percent maturity, by age class, of **Lean** strain lake trout collected in assessment gill nets from the eastern basin of Lake Erie, August 2009.

| AGE | SEX | NUMBER | MEAN LENGTH (mm TL) | MEAN WEIGHT (g) | PERCENT MATURE |
|---|---|---|---|---|---|
| 1 | Combined | 9 | 234 | 121 | 0 |
| 2 | Male<br>Female | 12<br>8 | 406<br>363 | 694<br>520 | 17<br>0 |
| 3 | Male<br>Female | 36<br>8 | 556<br>536 | 2120<br>1665 | 89<br>0 |
| 4 | Male<br>Female | 9<br>1 | 591<br>564 | 2337<br>1870 | 100<br>0 |
| 6 | Male<br>Female | 31<br>20 | 718<br>729 | 4536<br>4889 | 100<br>100 |
| 7 | Male<br>Female | 18<br>10 | 751<br>732 | 5424<br>5182 | 100<br>100 |
| 8 | Male<br>Female | 14<br>8 | 742<br>764 | 5253<br>5594 | 100<br>100 |
| 9 | Male<br>Female | 8<br>3 | 757<br>760 | 5281<br>5552 | 100<br>100 |
| 10 | Male<br>Female | 4<br>4 | 793<br>835 | 5887<br>7085 | 100<br>100 |
| 11 | Male | 1 | 794 | 5136 | 100 |
| 12 | Male | 1 | 857 | 7335 | 100 |
| 13 | Female | 1 | 855 | 8305 | 100 |
| 15 | Male | 1 | 875 | 9340 | 100 |
| 17 | Female | 5 | 833 | 8233 | 100 |
| 18 | Male<br>Female | 1<br>2 | 812<br>865 | 7090<br>8573 | 100<br>100 |
| 19 | Male<br>Female | 1<br>1 | 864<br>865 | 9040<br>8750 | 100<br>100 |
| 20 | Male<br>Female | 1<br>1 | 928<br>834 | 8815<br>7320 | 100<br>100 |
| 24 | Male | 1 | 952 | 9355 | 100 |
| 25 | Male<br>Female | 1<br>1 | 827<br>885 | 7774<br>9534 | 100<br>100 |

Klondike strain lake trout (KL) are an offshore form from Lake Superior and are thought to behave differently than traditional Lean lake trout strains (*i.e.* Finger Lakes (FL), Superior (SUP), Lewis Lake (LL) strains). They were first stocked in Lake Erie in 2004. In some of our analyses, Klondikes are reported as a separate strain for comparison with Lean strain lake trout.

## Results and Discussion

### Abundance

Sampling was conducted in seven of the eight standard areas in 2009 (Figure 1.1), collecting a total of 557 lake trout in 129 lifts. No effort was expended in area A4 due to the lack of coldwater habitat, and elimination of this sampling area is recommended by the CWTG. Areas A1 and A2 again produced the highest catch per unit effort (CPE) values (Figure 1.1), coinciding with stocking areas of yearling lake trout. Comparatively, lake trout catches were more than 10 times lower in Ontario waters (A5-A8), where stocking did not commence until 2006. Catches were intermediate in A3, an area adjacent to the stocked NY waters. The large disparity in lake trout catches among survey areas in the east basin indicates a lack of movement away from the stocking area.

Twenty age-classes of lake trout, ranging from ages 1 to 25, were represented in the 2009 catch of known-aged fish (Tables 1.1 and 1.2). Similar to the past eight years, young cohorts (ages 2-5) were the most abundant, representing 69% of the total catch in standard assessment nets (Figure 1.3). Cohort abundance continues to decline rapidly after age 6, and lake trout ages 9 and older were only rarely caught. Similar to the past four years, age 10 and older lake trout comprised less than 5% of the overall catch in 2009.

TABLE 1.2. Number, sex, mean length (mm), mean weight (g), and percent maturity, by age class, of **Klondike** strain lake trout collected in assessment gill nets from the eastern basin of Lake Erie, August 2009.

| AGE | SEX | NUMBER | MEAN LENGTH (mm TL) | MEAN WEIGHT (grams) | PERCENT MATURE |
|---|---|---|---|---|---|
| 1 | Combined | 16 | 251 | 144 | 6 |
| 2 | Male<br>Female | 10<br>8 | 384<br>393 | 638<br>668 | 0<br>0 |
| 3 | Male<br>Female | 40<br>6 | 510<br>497 | 1594<br>1410 | 93<br>0 |
| 5 | Male<br>Female | 103<br>91 | 602<br>621 | 2531<br>2822 | 100<br>100 |
| 6 | Male<br>Female | 8<br>7 | 643<br>657 | 3359<br>3599 | 88<br>100 |

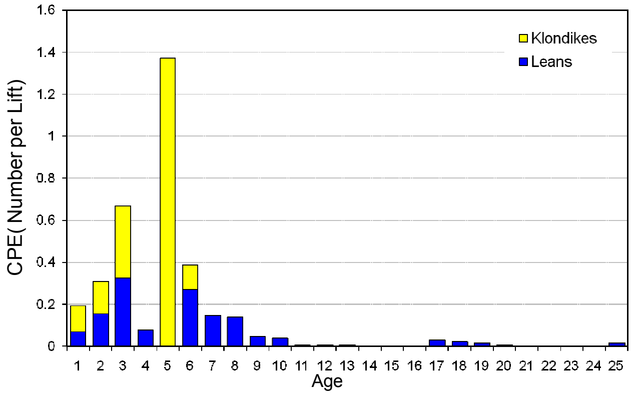



FIGURE 1.3. Relative abundance (number fish/lift) at age of Lean strain and Klondike strain lake trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, August 2009.

The overall trend in area-weighted mean CPE of lake trout caught in standard nets in the east basin decreased in 2009 to 2.38 fish/lift (Figure 1.4). Despite the recent decrease, basin-wide abundance has been steadily increasing since 1998 but remains well below the rehabilitation target of 8.0 fish/lift (Markham et al. 2008). Lake trout abundance remains high relative to the time series in both PA and NY surveys, but remains low in ON waters.

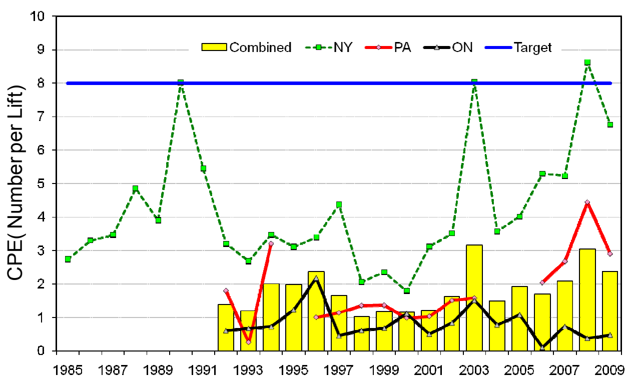



FIGURE 1.4. Mean CPE (number fish/lift) by jurisdiction and combined (weighted by area) for lake trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, 1985-2009.

The abundance of lake trout in the OMNR Partnership Index Fishing Program increased in the East and Pennsylvania Ridge areas in 2009 (Figure 1.5). Variability of abundance estimates in this survey is high due to low sample sizes, especially in the Pennsylvania Ridge, and to broad spatial sampling that may have extended outside the preferred habitat of lake trout. Abundance estimates in 2009 were below average in the Pennsylvania Ridge while the east basin lake trout index was near average and comparable to catch rates observed in Ontario's jurisdictional coldwater assessment survey.

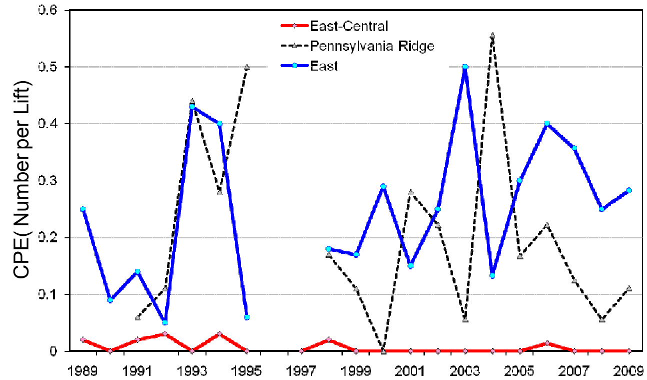



FIGURE 1.5. Lake trout CPE (number fish/lift) by basin from the OMNR Partnership Index Fishing Program, 1989-2009. Includes canned (suspended) and bottom gill net sets excluding thermocline sets.

The relative abundance of adult (age-5 and older) lake trout caught in standard assessment gill nets serves as an indicator of the size of the lake trout spawning stock in Lake Erie. Adult abundance declined in 1998 following a five year (1992-1996) period of steady growth, corresponding to a decrease in lake trout stocking numbers that began in 1994, poor post-stocking survival, and increased abundances of sea lamprey. Overall adult abundance reached a time series low in 2002 and remained at a slightly higher level through 2007. The CPE (weighted by area) for age-5 and older lake trout increased for the second consecutive year in 2009 to a time-series maximum of 1.35 fish/lift (Figure 1.6). The increase is mainly due to the highly successful Klondike strain lake trout stocked in both 2004 and 2005. The index remains below the rehabilitation target of 2.0 fish/lift (Markham et al. 2008).

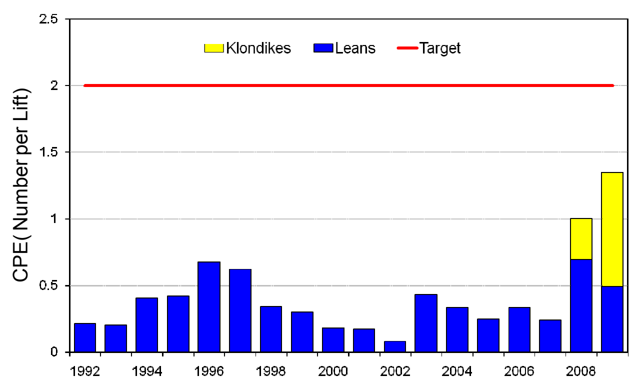



FIGURE 1.6. Relative abundance (number fish/lift) weighted by area of age 5 and older Lean strain and Klondike strain lake trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, August 1992-2009.

The relative abundance of mature females over 4500g, an index of repeat-spawning females ages 6 and older, increased in 2009 to a time series high of 0.23 fish/lift (Figure 1.7). However, this index value remains one-half of the rehabilitation plan target for adult female abundance (Markham et al. 2008). An overall pattern of low and variable abundance of the lake trout spawning stock may be a key contributing factor to the continued absence of any documented evidence of natural reproduction in Lake Erie.

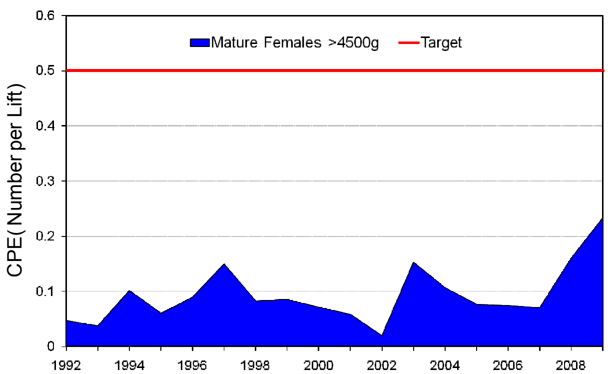



FIGURE 1.7. Relative abundance (number fish/lift) weighted by area of mature female lake trout greater than 4500g sampled in standard assessment gill nets in the eastern basin of Lake Erie, August 1992-2009.

## Recruitment

The proportion of stocked lake trout surviving to age 2 provides an index of recruitment. This index is calculated by dividing age-2 CPE from standardized gill net catches by the number of fish in that year-class stocked. The quotient is multiplied by $10^5$ to rescale recruitment to the number of age-2 lake trout caught per lift per 100,000 yearling lake trout stocked. The index shows declining survival of stocked lake trout from 1992 through 1998 with very few of the yearlings stocked from 1994 through 1997 surviving to age 2 in 1995 through 1998 (Figure 1.8). The index increased beginning in 1999, likely due to a combination of different stocking methods, increased lake trout size at stocking, stocking strains, and a decreased adult lake trout population. Of interest was the 2006 spike in survival index to 1.11, which was the highest value in the time-series and can be attributed entirely to returns from a Klondike-strain lake trout stocked in 2005. The 2009 age-2 survival index was 0.15, which was slightly below average for the time series. These lake trout were comprised of Klondike, Finger Lakes, and Lake Manitou strains of which Klondikes demonstrated the greatest age-2 recruitment.

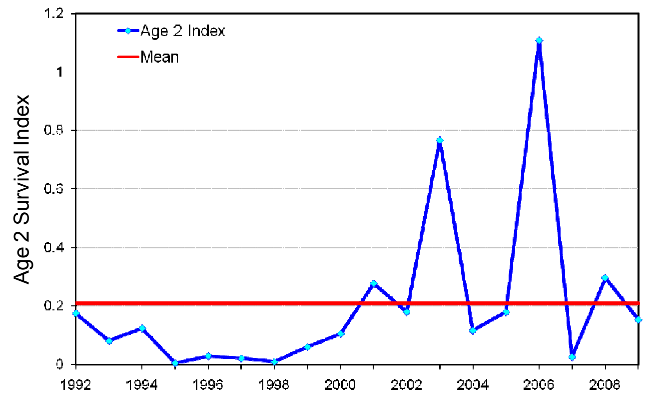



FIGURE 1.8. Index of survival for age-2 lake trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, August 1992-2009. The index is equal to the number of age 2 fish caught per lift for every 100,000 yearling lake trout stocked.

## Strains

Ten different lake trout strains were found in the 511 fish caught with hatchery-implanted coded-wire tags (CWTs) or fin-clips (Table 1.3). The majority of the lake trout (58%) were Klondike (KL) strain, which have only been stocked in small amounts in five of

TABLE 1.3. Number of lake trout per stocking strain by age collected in gill nets from the eastern basin of Lake Erie, August 2009. Stocking strain codes are: FL = Finger Lakes, LE = Lake Erie, LL = Lewis Lake, LO = Lake Ontario, SUP = Superior, KL = Klondike, Others = Slate Island, Traverse Island, Lake Champlain, Apostle Island and Lake Manitou. Shaded cells indicate ages strain was stocked.

| AGE | FL | LE | LL | LO | SUP | KL | Others |
|---|---|---|---|---|---|---|---|
| 1 | 5 | | | | | 16 | 4 |
| 2 | 16 | | | | | 21 | 4 |
| 3 | 34 | | | | | 47 | 10 |
| 4 | 5 | | | | | | 4 |
| 5 | | | | | | 194 | |
| 6 | 51 | | | | | 16 | |
| 7 | 28 | | | | | | |
| 8 | 20 | | | | 2 | | |
| 9 | 10 | | | | 1 | | |
| 10 | 5 | | | | 1 | | |
| 11 | | | | | | | |
| 12 | 1 | | | | | | |
| 13 | 1 | | | | | | |
| 14 | | | | | | | |
| 15 | 1 | | | | | | |
| 16 | | | | | | | |
| 17 | | 1 | | 3 | | | |
| 18 | 1 | | | 2 | | | |
| 19 | 2 | | | | | | |
| 20 | 2 | | | | | | |
| 21 | | | | | | | |
| 22 | | | | | | | |
| 23 | | | | | | | |
| 24 | 1 | | | | | | |
| 25 | 2 | | | | | | |
| TOTAL | 185 | 1 | 0 | 5 | 4 | 294 | 22 |

the past six years. Age-5 Klondikes alone comprised 38% of all lake trout caught in 2009. Finger Lakes (FL) strain lake trout were the only other strain caught in significant numbers, and they are the most stocked strain (in numbers) over the last ten years. Superior (SUP) strain lake trout, stocked extensively in Lake Erie in the 1980s and again from 1997-2002, have almost disappeared in assessment netting, presumably due to high mortality from sea lampreys. Lake Ontario (LO), Lake Erie (LE), Slate Island, Lake Champlain, Lake Manitou, Apostle Island, and Traverse Island strains all made minor contributions to 2009 returns. The FL strain continues to show the most consistent returns at older ages, including one age-24 and two age-25 lake trout, the oldest lake trout ever caught in the assessment surveys. Also of note was the absence of Lewis Lake (LL) strain lake trout in the population.

Returns of the deepwater Klondike (KL) lake trout strain were excellent through age 5. The number of age-3 returns from 31,600 yearlings stocked in 2004 (2003 year-class) was almost five times greater than a concurrent stocking of 80,000 FL strain lean lake trout when adjusted for stocking rates (Table 1.4a). Return rates decreased at age 4 and age 5, but KL returns remained at least two times higher than FL strain lake trout. However, as six year old fish in 2009, returns of KL strain fish continued to decline and were outnumbered by FL strain. Stocking adjusted return rates of the 2005 stocking (2004 year-class; 54,200 yearlings) at age-2 were the highest in the time-series in 2006 (see Figure 1.8) and over three times higher than KL strain and 13 times higher than FL strain lake trout (2003 year-class) at age-2 (Table 1.4b). Return rates at ages 3, 4, and 5 were similarly high. Age-5 Klondikes comprised over one-third of the Lake Erie lake trout catch in 2009.

TABLE 1.4a. Return rates (number per 100,000 yearlings stocked) of Klondike (KL) and Finger Lakes (FL) strain lake trout stocked in 2004 by age class and strain from the eastern basin of Lake Erie, August 2004-2009.

| AGE | STRAIN | NUMBER STOCKED | NUMBER RETURNS | RETURN RATES (per 100,000 stocked) | RATIO FL:KL |
|---|---|---|---|---|---|
| 1 | FL<br>KL | 80,000<br>31,600 | 4<br>1 | 5<br>3 | 1.7:1 |
| 2 | FL<br>KL | 80,000<br>31,600 | 7<br>11 | 9<br>35 | 1:3.9 |
| 3 | FL<br>KL | 80,000<br>31,600 | 19<br>35 | 24<br>111 | 1:4.6 |
| 4 | FL<br>KL | 80,000<br>31,600 | 70<br>55 | 88<br>174 | 1:2.0 |
| 5 | FL<br>KL | 80,000<br>31,600 | 81<br>77 | 101<br>244 | 1:2.4 |
| 6 | FL<br>KL | 80,000<br>31,600 | 51<br>16 | 64<br>51 | 1:0.8 |

TABLE 1.4b. Return rates (number per 100,000 yearlings stocked) of Klondike (KL) strain lake trout stocked in 2005 by age class from the eastern basin of Lake Erie, August 2005-2009.

| AGE | STRAIN | NUMBER STOCKED | NUMBER RETURNS | RETURN RATES (per 100,000 stocked) |
|---|---|---|---|---|
| 1 | KL | 54,200 | 14 | 26 |
| 2 | KL | 54,200 | 61 | 113 |
| 3 | KL | 54,200 | 146 | 269 |
| 4 | KL | 54,200 | 329 | 607 |
| 5 | KL | 54,200 | 194 | 358 |

### Survival

Cohort analysis estimates of annual survival (S) by strain and year class were estimated by taking the antilog of the slope of the regression of ln(CPUE) on age for fish that received coded wire tags. A three-year running average CPE for ages 4 through 10 cohorts in each year was used due to the high year-to-year variability in catches. Catches of lake trout age-11 and older were not used in calculations because survival often seemed to increase after age 10 and catch rates were too low to have confidence in the estimates (Lantry et al. 2006). Mean overall adult survival estimates were highest for the Lake Ontario (LO) strain (0.81) and lowest for the Lewis Lakes (LL; 0.592) and Superior (SUP; 0.591) strains (Table 1.5). Survival rates for the Lake Erie (LE) strain were also high (0.788), but this was based on only two year classes with low returns. The Finger Lakes (FL) strain, the most stocked lake trout strain in Lake Erie, had an overall mean survival estimate of 0.772. Mean overall survival estimates for all strains except for the LL and SUP strains were above the target goal of 60% or higher (Lake Trout Task Group 1985; Markham et al. 2008).

Recent decreased survival of SUP strain lake trout below target levels may be due to increased levels of sea lamprey predation. Survival estimates of the 1997-2001 year-classes of SUP strain fish ranged from 0.312-0.508. Survival estimates of FL strain lake trout during this same time period are much higher, but are based on very low returns. Recent survival estimates (1996-2001) are well below the ranges that were observed during the period of increased sea lamprey control (1987-1991) for both SUP and FL strain lake trout.

Table 1.5. Cohort analysis estimates of annual survival (S) by strain and year class for lake trout caught in standard assessment nets in the New York waters of Lake Erie, 1985–2009. Three-year running averages of CPE from ages 4–10 were used due to year-to-year variability in catches. Shaded cells indicate survival estimates that fall below the 0.60 target rate. Asterisk (*) indicates years where straight CPE's were used for ages 4-10 (SUP 99), 5-10 (FL 99), 4-9 (SUP 00), or 4-8 (SUP 01, FL 01).

| | STRAIN | | | | |
|---|---|---|---|---|---|
| **Year Class** | LE | LO | LL | SUP | FL |
| 83 | | | | 0.687 | |
| 84 | | | | 0.619 | 0.502 |
| 85 | | | | 0.543 | 0.594 |
| 86 | | | | 0.678 | |
| 87 | | | | 0.712 | 0.928 |
| 88 | | 0.784 | | 0.726 | 0.818 |
| 89 | | 0.852 | | 0.914 | 0.945 |
| 90 | | 0.84 | | 0.789 | 0.634 |
| 91 | | 0.763 | 0.616 | | |
| 92 | 0.719 | | 0.568 | | |
| 93 | 0.857 | | | | 0.85 |
| 94 | | | | | |
| 95 | | | | | |
| 96 | | | | | 0.78 |
| 97 | | | | 0.404 | 0.85 |
| 98 | | | | 0.411 | |
| 99* | | | | 0.377 | 0.763 |
| 00* | | | | 0.508 | |
| 01* | | | | 0.312 | 0.829 |
| **MEAN** | **0.788** | **0.810** | **0.592** | **0.591** | **0.772** |

## Growth and Condition

Mean length-at-age and mean weight-at-age of eastern basin Lean strain lake trout remain consistent with averages from the previous ten years (1999-2008) through age 9 (Figures 1.9 and 1.10). Deviations at age 4 and at age 10 and older were due to low sample sizes. Klondike strain lake trout show lower growth trajectories than Lean strain lake trout through age 6. Mean length and weight of Klondike strain lake trout was significantly less than FL strain fish by age-3 (two sample t-test; P<.01).

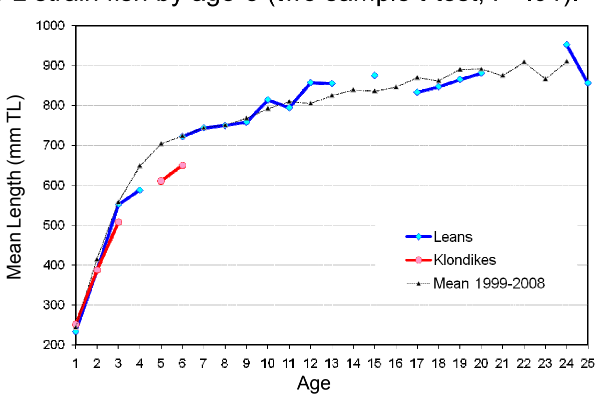



FIGURE 1.9. Mean length-at-age of Lean strain and Klondike strain lake trout sampled in assessment gill nets in the eastern basin of Lake Erie, August 2009. The previous 10-year average (1999-2008) from New York is shown for current growth rate comparison.

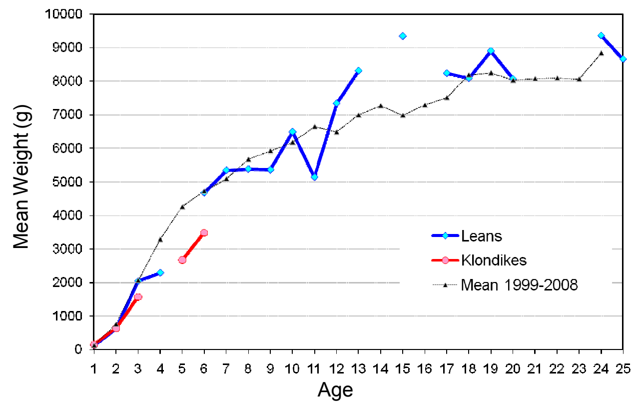



FIGURE 1.10. Mean weight-at-age of Lean strain and Klondike strain lake trout sampled in assessment gill nets in the eastern basin of Lake Erie, August 2009. The previous 10-year average (1999-2008) from New York is shown for current growth rate comparison.

Mean coefficients of condition (Everhart and Youngs 1981) were calculated for age-5 lake trout by sex to determine time-series changes in body condition. Overall condition coefficients for age-5 lake trout remain well above 1.0, indicating that Lake Erie lake trout are, on average, heavy for their length (Figure 1.11). Condition coefficients for age-5 male and female lake trout show an increasing trend from 1993-2000. Female condition began to decline in 2004 and male condition in 2001, but both increased again in 2007 and 2008. Condition of male and female age-5 fish was lower for Klondike than for Lean strain lake trout in 2008; condition of Klondike's in both sexes decreased in 2009.

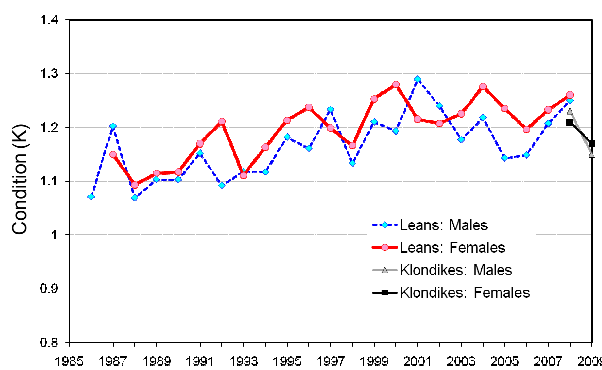



FIGURE 1.11. Mean coefficients of condition for age 5 Lean strain and Klondike strain lake trout, by sex, collected in NYSDEC assessment gill nets in Lake Erie, August 1985-2009.

## Maturity

Maturity rates of Lean strain lake trout remain consistent with past years where males are nearly 100% mature by age 4 and females by age 5 (Table 1.1). Klondike strain lake trout appear to have similar maturity rates to Lean strain lake trout in Lake Erie through age 6 (Table 1.2).

**Natural Reproduction**

Despite more than 30 years of lake trout stocking in Lake Erie, no naturally reproduced lake trout have been documented. Four potentially wild fish (no fin clips; no CWT's) were caught in eastern basin coldwater gill net surveys in 2009, making a total of 43 potentially wild lake trout recorded over the past nine years. Otoliths are collected from lake trout found without CWTs or fin-clips and will be used in future stock discrimination studies.

A GIS project was conducted by the USGS (Sandusky) and Ohio Division of Wildlife to determine potential lake trout spawning sites within Lake Erie (Habitat Task Group 2006). The goal of this exercise was to identify areas with suitable physical habitat for lake trout spawning within Lake Erie so that future stocking efforts may be directed at those sites. Side-scan sonar work was also accomplished during 2007, 2008 and 2009 on several of the identified sites in the eastern basin of Lake Erie near Port Maitland, Ontario, and at Brocton Shoal near Dunkirk, New York (Habitat Task Group 2010). Several funding proposals (Canada-Ontario Agreement; USFWS Restoration Funds) were accepted in 2007 and 2008 to further examine the sites identified in the GIS-phase of this exercise using side-scan sonar and underwater video imaging. Initial data analysis of the side-scan mosaics and underwater video indicate potential spawning habitat on Brocton Shoal, Nanticoke Shoal, Hoover Point, and Tecumseh Reef. This work is scheduled to continue in 2010.

For the second consecutive year, a gill net and egg trap survey was conducted by the NYSDEC during November to determine if lake trout were using any local spawning areas. A total of ten overnight gillnet gangs were set in five locations targeting spawning lake trout between 13 November and 25 November 2009 (Figure 1.12). Four sets were made on Brocton Shoal (offshore, deep), two at Barcelona Harbor (nearshore, shallow), one at Van Buren Reef (nearshore, shallow), one at Battery Point (nearshore, shallow) and two off Dunkirk (offshore, deep) where lake trout are commonly stocked. Bottom water temperature during all sampling days was 50F (10C). A total of 17 lake trout were caught; 15 at Barcelona Harbor and two at Battery Point. No lake trout were caught on Brocton Shoal. Gill nets in all locations were

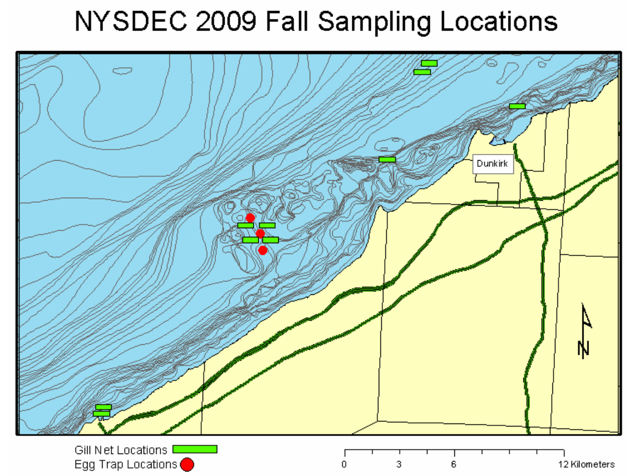



FIGURE 1.12. Gill net and egg trap survey locations sampled for spawning lake trout in the New York waters of Lake Erie, November 2009.

severely fouled with a decaying algae that may have affected catches. Four of the lake trout, all caught at Barcelona Harbor, were females and the rest of the fish were males. All fish were in spawning condition with the exception of one female that had undeveloped eggs. Captured lake trout were all Finger Lakes strain fish with the exception of one Lake Ontario fish and one LOxFL cross, and ranged from 4-20 years old. All but three of the fish caught in Barcelona were shore stocked either at Barcelona Harbor or in Pennsylvania while the two fish caught at Battery Point were both boat stocked offshore.

Three egg trap lines were set on raised rock ridges (i.e. suspected spawning areas) on Brocton Shoal on 10 November and recovered on 2 December 2009 (Figure 1.12). The traps were set to determine if lake trout were spawning over these areas. Water temperatures remained steady at 50F during the survey. No lake trout eggs were collected in the 19 egg trap buckets. *Hemimysis*, a new invasive species first observed in the lake trout traps in 2008, were again collected.

**Lake Trout Population Model**

The CWTG has assisted the Forage Task Group (FTG) in the past by providing a lake trout population model to estimate the lake trout population in Lake Erie. The model is a spreadsheet-type accounting model, initially created in the late 1980's, and uses stocked numbers of lake trout and annual mortality to generate an estimated adult (age 5+) population. The Lake Erie CWTG has been updating and revising the model since 2005, incorporating new information on strain performance, survival, sea lamprey mortality, longevity, and stocking. The most recent working version of the model separates each lake trout strain to accommodate strain-specific mortality, lamprey mortality, and stocking. The individual strains are then combined to provide an overall estimate of the adult (ages 5+) lake trout population. Unlike previous versions, the current model's output now follows the general trends of the survey data and computes mortality estimates that are near levels measured from survey data. While the absolute numbers generated from model simulations are probably not comparable to the actual Lake Erie lake trout population, the model does provide a good tool for predicting trends into the future under various management and population scenarios.

The 2009 lake trout model estimated the Lake Erie population at 209,210 fish and the age 5 and older population at 26,350 fish, less than one-third of what it was a decade ago when the lake trout population was at its peak (Figure 1.13). The Strategic Plan for Lake Trout Restoration (Lake Trout Task Group 1985) suggested that successful Lake Erie rehabilitation required an adult population of 75,000 lake trout. Model projections using low and moderate rates of sea lamprey mortality and proposed stocking rates show that the adult lake trout population is suppressed by one-third over the next decade with moderate mortality compared to low mortality. Model simulations indicate that both stocking and lamprey control are major influences on the Lake Erie lake trout population.

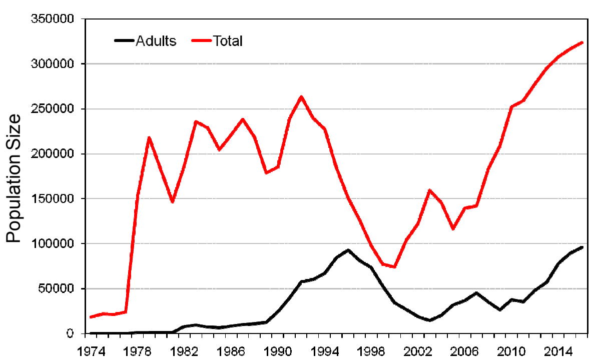



FIGURE 1.13. Projections of the Lake Erie total and adult (ages 5+) lake trout population using the CWTG lake trout model. Projections were made using low rates of sea lamprey mortality with proposed stocking rates. The model estimates the total 2009 lake trout population at 209,210 and the adult population at 26,350.

## Diet

Seasonal diet information for lake trout is not available based on current sampling protocols. Diet information was limited to fish caught during August 2009 in the coldwater gill net assessment surveys in the eastern basin of Lake Erie. Analysis of the stomach contents of lake trout revealed diets almost exclusively comprised of rainbow smelt and round gobies (Table 1.6). Rainbow smelt dominated the August diets of both Lean strain (92%) and Klondike strain (83%) fish in 2009. Round gobies occurred in less abundance in both lake trout forms (Leans = 13%; Klondikes = 21%). One yellow perch was the only other identified fish species in the stomach samples.

TABLE 1.6. Frequency of occurrence of diet items from non-empty stomachs of Lean and Klondike strain lake trout collected in gill nets from eastern basin waters of Lake Erie, August 2009.

| PREY SPECIES | Lean Lake Trout (N = 181) | Klondike Lake Trout (N = 168) |
|---|---|---|
| Smelt | 166 (92%) | 139 (83%) |
| Yellow Perch | 1 (1%) | |
| Round Goby | 23 (13%) | 35 (21%) |
| Unknown Fish | 8 (4%) | 11 (7%) |
| Number of Empty Stomachs | 50 | 56 |

The occurrence of round gobies decreased for the third consecutive year in the diet of Klondike strain lake trout in 2009 following a dramatic increase in 2006 (Figure 1.14). The increase and decline was also observed in Lean strain lake trout. Until 2008, Klondike strain lake trout appeared to have a higher preference for round gobies compared to Lean strain fish. However, the occurrence of smelt and round gobies was very similar in both Lean and Klondike strain lake trout stomachs in 2008 and 2009. Diets of lake trout appear to be closely related to the abundance of these two species in Lake Erie (see Forage Task Group 2010). When smelt are in good supply, they appear to be the preferred prey item for all lake trout. However, in years of low adult smelt abundance, lake trout appear to prey more on round gobies.

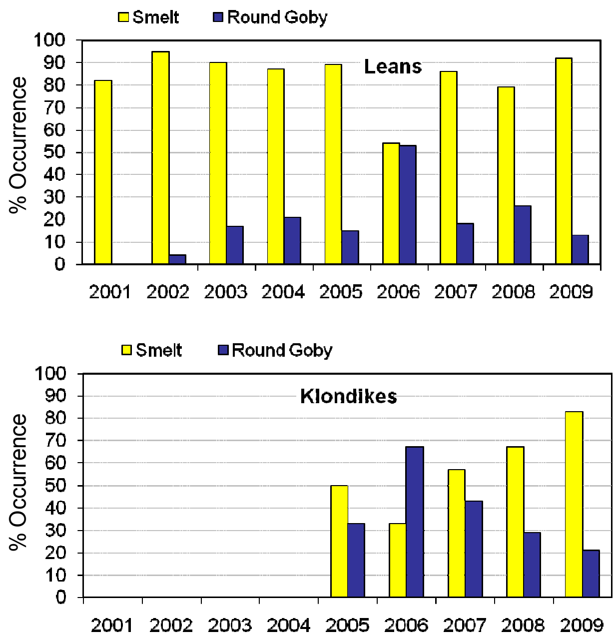



FIGURE 1.14. Percent occurrence of smelt and round goby in the diet of Lean strain (top) and Klondike strain (bottom) lake trout sampled in assessment gill nets in the eastern basin of Lake Erie, 2001-2009.

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## Charge 2: Continue to assess the whitefish fishery, age structure, growth, diet, seasonal distribution and other population parameters.

*Andy Cook, OMNR and Kevin Kayle, ODW*

### Commercial Harvest

The total harvest of Lake Erie lake whitefish in 2009 was 1,113,488 pounds (Figure 2.1). Ontario harvested 815,544 pounds, followed by Ohio (288,294 lbs), Michigan (9,439 lbs) and Pennsylvania (211 lbs). Total harvest in 2009 was 7% greater than the total harvest in 2008. The increase occurred in Ohio waters, where the 2009 harvest more than doubled the 2008 harvest. Ontario's whitefish harvest dropped by 15% from 2008. The 2009 lake whitefish harvest was distributed between Ontario (73%), Ohio (26%), Michigan (1%) and minimal harvest (<1%) in Pennsylvania.

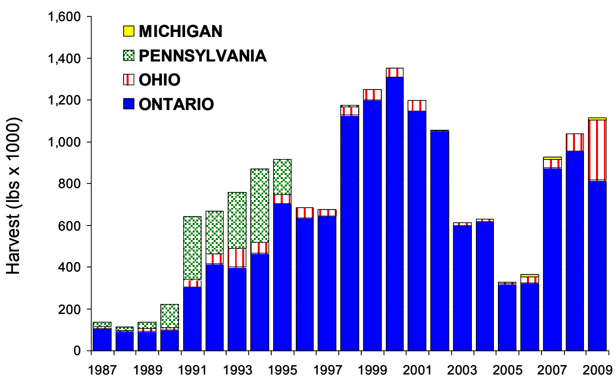


FIGURE 2.1. Total Lake Erie commercial whitefish harvest from 1987-2009 by jurisdiction. Pennsylvania ceased gill netting in 1996 and Michigan resumed commercial fishing in 2006, 2007.

The majority (98%) of Ontario's 2009 lake whitefish harvest was taken in gill nets. The remainder was caught in smelt trawls (2%) and a negligible amount (316 lbs.) in impoundment gear. The largest portion of Ontario's whitefish harvest (51%) was taken in the west basin (Ontario's OE 1) primarily during the fall, followed by the east basin - OE 5 (27%) mostly from July to September. The remainder came from OE 2 (17%) in spring and OE 4 (3%) during summer and OE 3 (1%) in the spring. In Ontario, 79% of whitefish were harvested from gill nets targeting whitefish, while white bass (11% ), walleye (9%), white perch (1%) and yellow perch (<1%) fisheries accounted for the remainder. The record harvest of whitefish in Ohio (Figure 2.1) occurred mainly (99.6%) in Ohio District 1 (O1) from October to December, with the peak harvest during November. Michigan's total commercial trap net harvest landed entirely during December amounted to 9,439 pounds. Ontario's 2009 catch rates decreased overall slightly from 2008, but increased marginally in the east half of Lake Erie (Ontario quota zone 3 or OEs 3,4,5) (Figure 2.2). Ohio's commercial trap net catches and catch rates were the highest since the whitefish fishery reopened in 1987 following a 1970 closure (Figure 2.3). In contrast, Pennsylvania's smaller commercial trap net fishery experienced a decrease in catch rates from 2008 (Figure 2.3). Similar to the temporal trend in harvest in OE1, Ontario's catch rates were highest during October, followed by November and December respectively (Figure 2.4). The landed weight of roe from Ontario's 2009 whitefish fishery was 23,069 pounds, most of which (98%) was collected in OE1 during October and November with an approximate landed value of CDN$ 54,966.

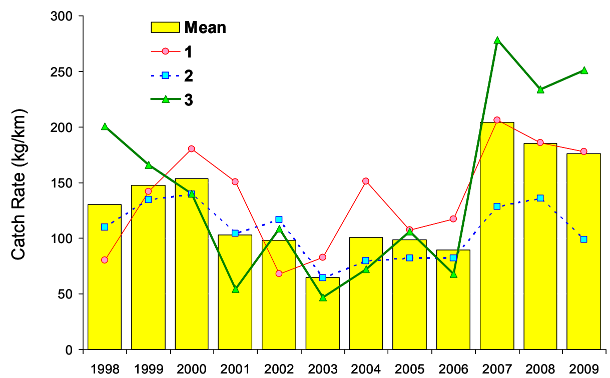


FIGURE 2.2. Ontario annual commercial large mesh gill net catch rates targeting lake whitefish by quota zone, 1998 - 2009. Bars represent averages of catch rates across quota zones.

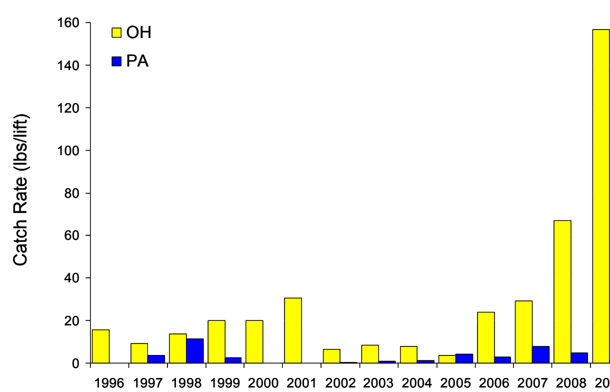


FIGURE 2.3. Ohio and Pennsylvania lake whitefish commercial trap net catch rates (pounds per lift), 1996-2009.

Ontario's west basin fall lake whitefish fishery was dominated by age-6 fish (Figure 2.5). The strong 2003 cohort dominated catches in targeted and non-targeted (white bass) fisheries with younger whitefish more common in Ontario's white perch fishery (Figure 2.6). The 2003 cohort dominated harvest since recruiting at age 3 up to age 6 in 2009. Age 4 was the next most abundant year class (2005) and the oldest whitefish in Ontario's harvest was 19. (Figure 2.5 and 2.6). Ohio's harvest consisted mostly of age-6 whitefish, followed by age 7 and age 4, with a range of ages up to 18 (Figure 2.6).

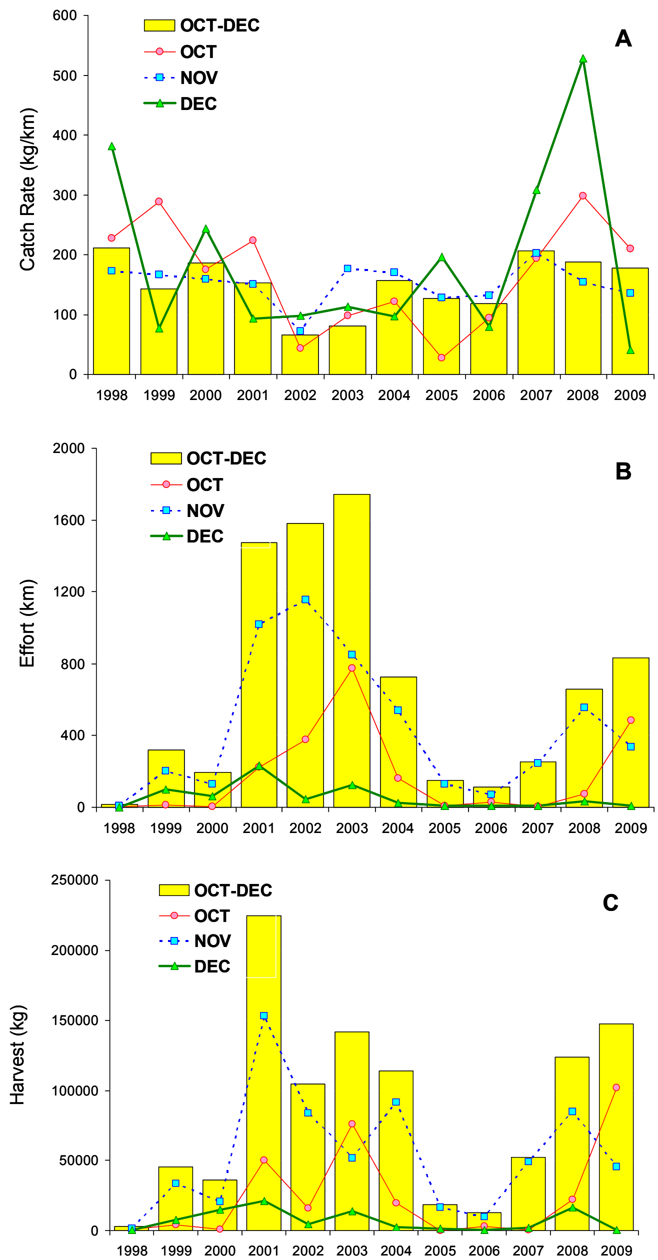


FIGURE 2.4. Targeted large mesh gill net catch rate (A), gill net effort (B) and harvest (C) for lake whitefish in the west basin for October, November, December and pooled (Oct-Dec) 1998 - 2009.

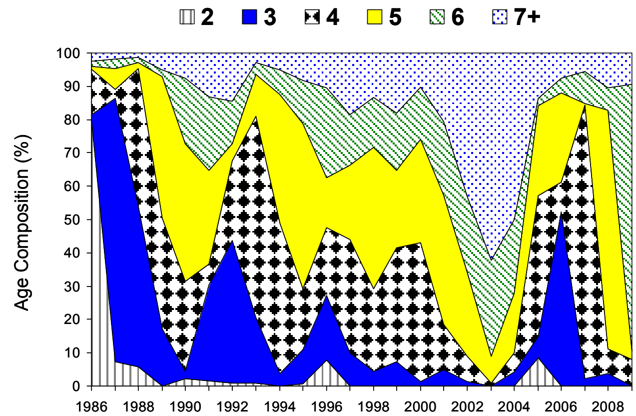


FIGURE 2.5. Ontario fall commercial whitefish harvest age composition in statistical district 1, 1986-2009. From effort with gill nets >=3 inches with whitefish in catch from October to December.

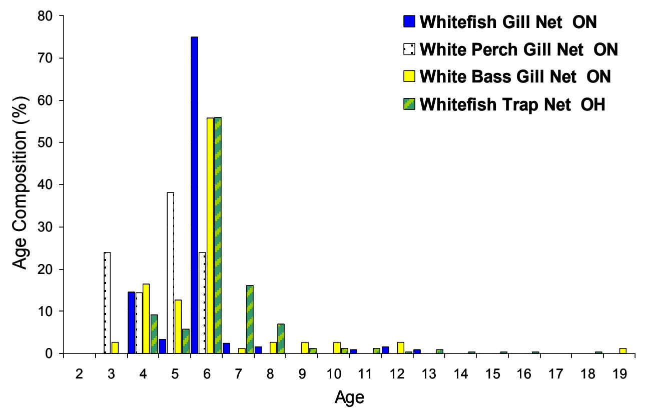


FIGURE 2.6. Age composition of lake whitefish caught commercially in Ontario (ON) and Ohio (OH) waters of Lake Erie in 2009 by target species fisheries. Otoliths and scales were used to age whitefish samples.

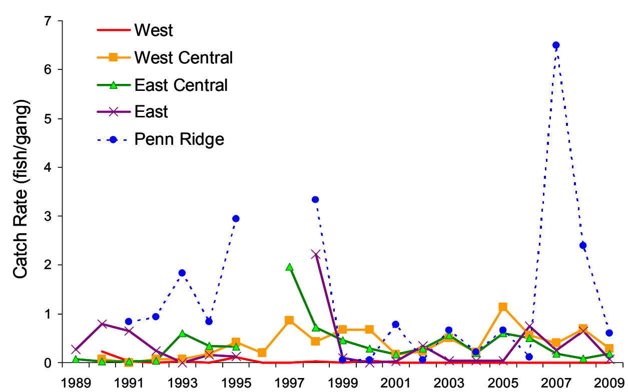


FIGURE 2.7. Catch rate (number per gang) of lake whitefish from Ontario partnership index gill netting by basin, Lake Erie, 1989 - 2009.

## Assessment Surveys

Lake whitefish abundance indices in the 2009 gill net assessments varied among jurisdictions and basins (Figures 2.7 and 2.8). Lake whitefish catch rates dropped in most areas in Ontario waters except in the east-central basin (Figure 2.7). Catch rates for lake whitefish in New York and Pennsylvania coldwater assessment surveys in 2009 decreased from 2008 levels (Figure 2.8).

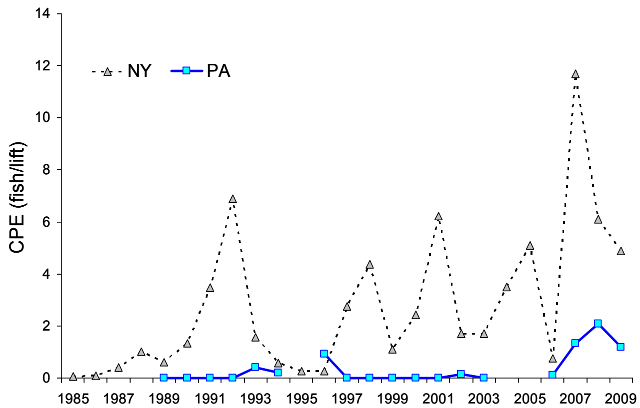


FIGURE 2.8. Catch per effort (number fish/lift) of lake whitefish caught in standard assessment gill nets from New York waters of Lake Erie, August 1985 - 2009 (triangles) and in Pennsylvania August assessment gill nets (squares) 1989 - 2009. No index sampling took place in Pennsylvania waters 1995, 2004, and 2005.

Length-frequency distributions of lake whitefish captured in Ontario partnership index gill netting showed the advance of the 2003 cohort (Figure 2.9); as most of the fish were in the 480-550 mm range. The majority of lake whitefish sampled in the Ontario partnership surveys were from the 2003 cohort, followed by the 2005 and 2001 year classes (Figure 2.10) similar to results seen in 2008.

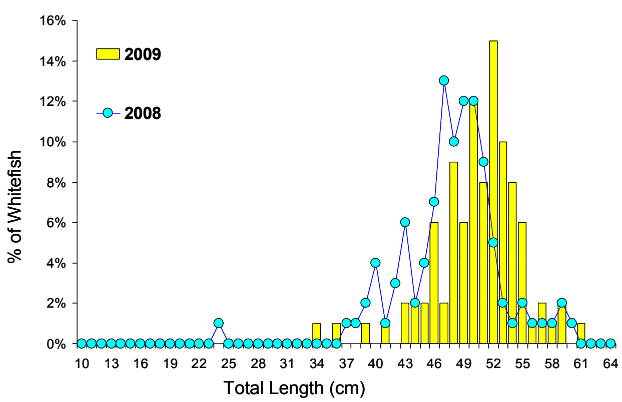


FIGURE 2.9. Length frequency distributions of lake whitefish collected during lake-wide partnership index fishing, 2008 and 2009. Standardized to equal effort among mesh sizes.

Ohio trawl surveys in the central basin of Lake Erie assess juvenile lake whitefish and describe the presence or general magnitude of year classes. Since the strong 2003 year class, Ohio central basin (District 2 and District 3) bottom trawl surveys conducted in August and October caught young-of-the-year (YOY) from the 2004, 2005 and 2007 year classes. In addition, yearlings from the 2004 and 2005 year classes have been caught in Ohio bottom trawls. While D-2 surveys suggest these three cohorts are moderate at best, D-3 indices appeared higher for the 2005 and 2004 year classes. The two most recent year classes, 2008 and 2009, were not present in the surveys.

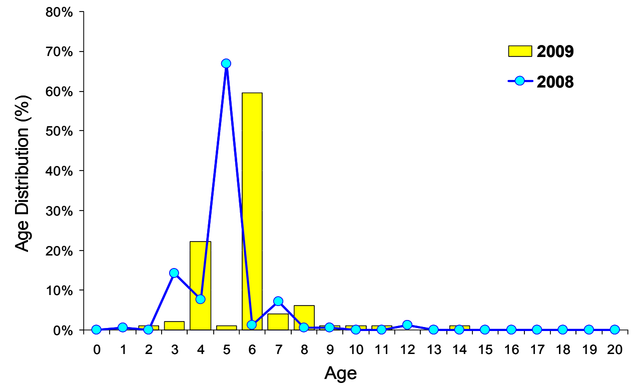


FIGURE 2.10. Age frequency distributions of lake whitefish collected during lake-wide partnership index fishing, 2008 and 2009. Standardized to equal effort among mesh sizes.

In trawl and gill net assessment surveys in Ohio waters of Lake Erie during 2009, a total of 58 adult lake whitefish were sampled. The 2003 year class (age 6) was most numerous (40%), with younger whitefish ages 4 (2%) and 5 (2%) present, while older whitefish ages 7 to 19 represented 56% of the age composition. The length-at-age and size compositions are presented in Figure 2.11.

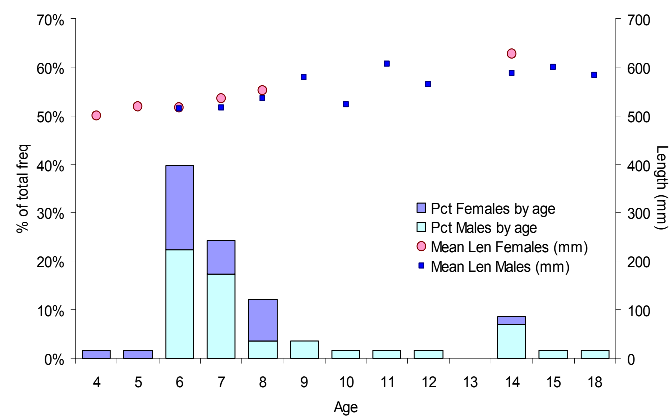


FIGURE 2.11. Age distribution and mean length-at-age of lake whitefish collected during trawl and gill net assessment surveys in Ohio waters of Lake Erie during 2009 (N=58).

## Growth and Diet

Ohio surveys also showed that whitefish condition in 2009 for age 4 and older whitefish sampled in assessment trawls and gillnets (females mean K= 1.067) remained below Van Oosten and Hile's (1947) historic condition references for the fourth consecutive year (Figure 2.12). In contrast, male condition (mean K= 1.035) in 2009 was slightly greater than Van Oosten and Hile's (1947) historic condition reference (Figure 2.12). Condition values

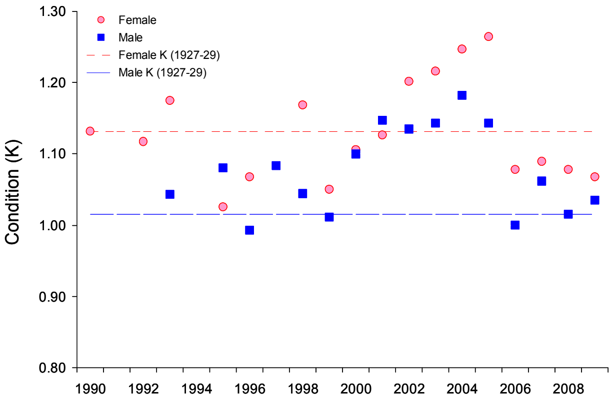


FIGURE 2.12. Mean condition (K) factor values of ages 4 and older lake whitefish sampled during Ohio assessment surveys in the central basin of Lake Erie, May-October 1990-2009. Historic mean condition (1927) presented as dashed lines from Van Oosten and Hile (1947).

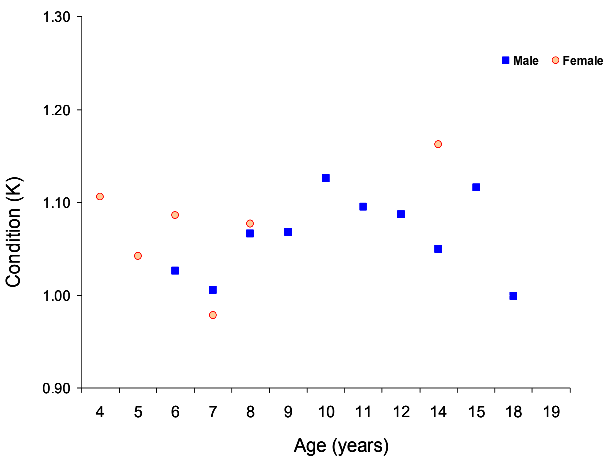


FIGURE 2.13. Mean condition (K) factor vs. age of lake whitefish (ages 4 and older) sampled during Ohio Division of Wildlife trawl and gill net assessment surveys in the central basin of Lake Erie, May-October 2009.

among ages by sex are presented in Figure 2.13.

In 2009, Ontario lake whitefish condition (ages 4 and older) remained below the historic average for each sex, but male condition increased gradually in recent years (Van Oosten and Hile 1947; Figure 2.14). For condition analyses, Ontario whitefish included age 4 and older whitefish that were not spent or running, collected from both survey and commercial samples October to December.

Lake whitefish diet information available from Ohio central basin surveys in 2009 differed between District 2 (west central) and District 3 (east central;

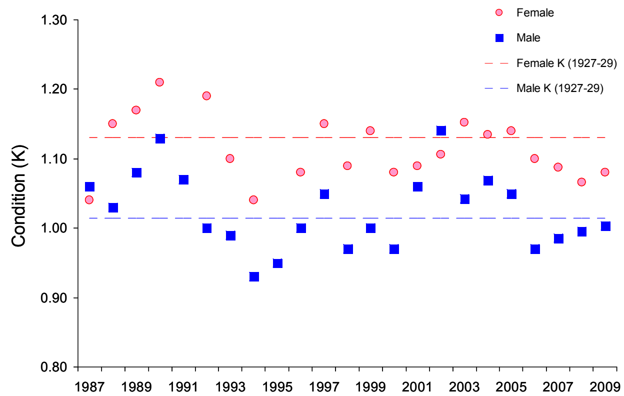


FIGURE 2.14. Mean condition (K) factor values of age 4 and older lake whitefish obtained from fall Ontario commercial and partnership survey data by sex from 1987-2009. Historic mean condition (1927-29) presented as dashed lines calculated from Van Oosten and Hile (1947).

Figure 2.15). Whitefish diet expressed as percentage total dry weight of all prey taxa in 2009 consisted of Sphaeriid clams, Chironomids, Isopods, Gastropods, Dreissenid mussels, trace zooplankton, and other prey taxa in District 2. Isopods, Chironomidae, Dreissenidae, Sphaeriidae, Gastropods, zooplankton, Hirudinea and other taxa comprised whitefish diets in District 3. The recent increased occurrence of Dreissenids is noteworthy.

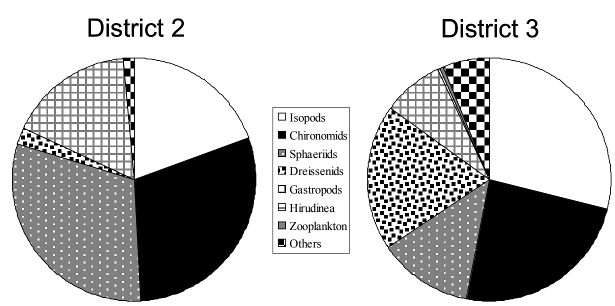


FIGURE 2.15. Diet composition (% dry weight) of lake whitefish from Ohio central basin assessment sites in 2009.

## Research Efforts

The CWTG continues to recognize and participate in lake whitefish research efforts led by Drs. Ed Roseman (USGS), Yingming Zhao (OMNR), and Tim Johnson (OMNR).

## References

Van Oosten, J. and R. Hile. 1947. Age and growth of the lake whitefish, *Coregonus clupeaformis* (Mitchill), in Lake Erie. Transactions of the American Fisheries Society 77: 178-249.

## Charge 3: Continue to assess the burbot age structure, growth, diet, seasonal distribution and other population parameters.

*Elizabeth Trometer (USFWS), Larry Witzel (OMNR) and Martin Stapanian (USGS)*

### Commercial Harvest

The commercial harvest of burbot by the Lake Erie jurisdictions was relatively insignificant through the late 1980's, generally remaining under 5,000 pounds (mean=2268 kg). Beginning in 1990, harvest began to increase (Table 3.1), coinciding with an increase in abundance and harvest of lake whitefish. Most 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.

TABLE 3.1. Total burbot commercial harvest (thousands of pounds) in Lake Erie by jurisdiction, 1990 -2009.

| Year | New York | Pennsylvania | Ohio | Ontario | Total |
|---|---|---|---|---|---|
| 1990 | 0.0 | 15.5 | 0.0 | 1.7 | 17.2 |
| 1991 | 0.0 | 33.4 | 0.0 | 1.2 | 34.6 |
| 1992 | 0.7 | 22.2 | 0.0 | 5.9 | 28.8 |
| 1993 | 2.6 | 4.2 | 0.0 | 3.1 | 9.9 |
| 1994 | 3.0 | 12.1 | 0.0 | 6.8 | 21.9 |
| 1995 | 1.9 | 30.9 | 1.2 | 8.9 | 42.9 |
| 1996 | 3.4 | 2.3 | 1.2 | 8.6 | 15.4 |
| 1997 | 2.9 | 8.9 | 1.7 | 7.4 | 20.9 |
| 1998 | 0.2 | 9.0 | 1.5 | 9.9 | 20.5 |
| 1999 | 1.0 | 7.9 | 1.1 | 394.8 | 404.8 |
| 2000 | 0.1 | 3.5 | 0.1 | 30.1 | 33.8 |
| 2001 | 0.4 | 4.4 | 0.0 | 6.5 | 11.2 |
| 2002 | 0.9 | 5.2 | 0.1 | 3.4 | 9.5 |
| 2003 | 0.1 | 1.8 | 0.2 | 2.3 | 4.4 |
| 2004 | 0.5 | 2.4 | 0.9 | 5.4 | 9.2 |
| 2005 | 0.7 | 2.2 | 0.4 | 10.0 | 13.3 |
| 2006 | 0.9 | 0.6 | 0.3 | 2.4 | 5.3 |
| 2007 | 0.4 | 1.1 | 0.1 | 3.6 | 5.2 |
| 2008 | 0.2 | 0.3 | 0.0 | 1.2 | 1.7 |
| 2009 | 0.4 | 0.6 | 0.0 | 3.76 | 4.8 |

Harvest decreased in Pennsylvania waters after 1995 with a shift from a gill net to trap net commercial fishery, resulting in a substantial decrease of commercial effort (CWTG 1997). Harvest of burbot in New York is from one commercial fisher. In 1999, a market was developed for burbot in Ontario, leading the industry to actively target this species. As a result, the commercial harvest in Ontario increased dramatically (Table 3.1). However, this opportunistic market did not persist, resulting in declining annual harvests. The Ontario harvest is now a by-catch from various fisheries. Most of the burbot by-catch in 2009 was caught in gillnets from the lake whitefish commercial fishery (69%) followed by the white bass commercial fishery (24%). The total commercial harvest for Lake Erie in 2009 was 4,784 pounds (2170 kg); a 2.8-fold increase from the recent time series low observed in 2008 (Table 3.1).

### Assessment Programs

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 (Figures 3.1 and 3.2).

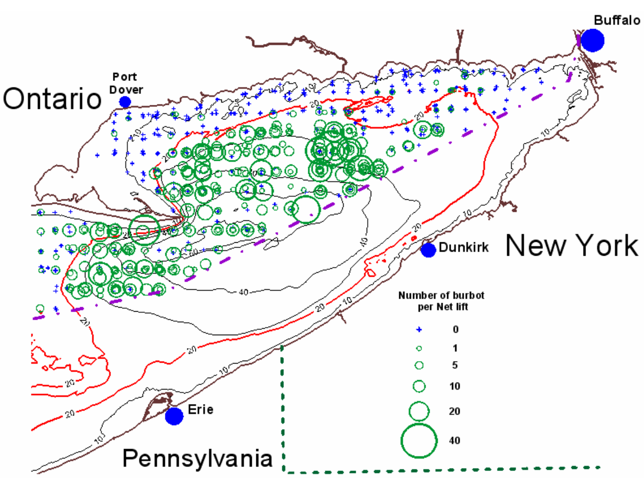


FIGURE 3.1 Distribution of burbot catches (No. per lift) in Ontario Partnership gill nets during August surveys of eastern Lake Erie, 1989 - 2009.

The Ontario Partnership Index Fishing Program is an annual lakewide gillnet survey of the Canadian waters of Lake Erie and has provided an additional and spatially robust assessment of fish species abundance and distribution since 1989. During the early 1990s, burbot abundance was low throughout the lake; catch rates in partnership index gill nets averaged less than 0.5 burbot per lift (Figure 3.2). Burbot abundance increased rapidly after 1993 in the Pennsylvania Ridge area and in the eastern basin, reaching a peak of about 4 burbot per lift in 1998. Burbot numbers in the central basin also peaked in 1998, but at a much lower catch rate of 0.5 burbot per lift. Catch rates in the Pennsylvania Ridge area during 1998 to 2004 remained high, but variable, ranging between 2.0 and 4.2 burbot per lift and then decreased to about 0.5 burbot per lift in 2005-2006. Catch rates in the eastern basin since 1998 have been variable in an overall decreasing trend. In 2009, burbot abundance decreased slightly or remained low relative to peak years throughout the eastern basin, Pennsylvania Ridge, and the central basin (Figure 3.2).

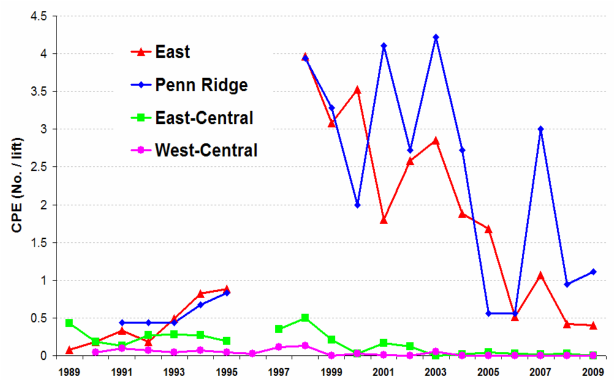


FIGURE 3.2 Burbot CPE (number of fish/lift) by basin from the Ontario Partnership surveys 1989–2009 (includes canned and bottom gill nets, all mesh sizes, except thermocline sets).

An examination of only the bottom sets in the Ontario Partnership assessment data for combined sample locations in the east basin and Pennsylvania Ridge show that the numeric abundance of burbot (in fish/lift) increased approximately eight-fold from 1993 to 1998, whereas the biomass CPE did not peak until 2003, some five years after maximum numeric abundance was observed (Figure 3.3). Burbot number and biomass have steadily decreased after reaching their respective peaks. Burbot abundance in 2009 was similar to 2008, but only one-eighth of 1998 peak numbers and one-fifth of 2003 peak biomass (Figure 3.3).

Numeric abundance of burbot as determined from coldwater assessment gillnetting increased sharply after 1993, peaking in 2000 in all eastern basin jurisdictions except New York, where peak abundance was not observed until 2004 (Figure 3.4). The highest catch rates of burbot have occurred in Ontario waters during most years since 1996. Burbot numeric abundance has decreased across all eastern basin jurisdictions in recent years. In 2009, burbot catch rates continued to decrease basin-wide, ranging from a low of 0.2 burbot per lift in Pennsylvania, 1.3 burbot per lift in New York, to a high of 2.2 burbot per lift in Ontario (Figure 3.4).

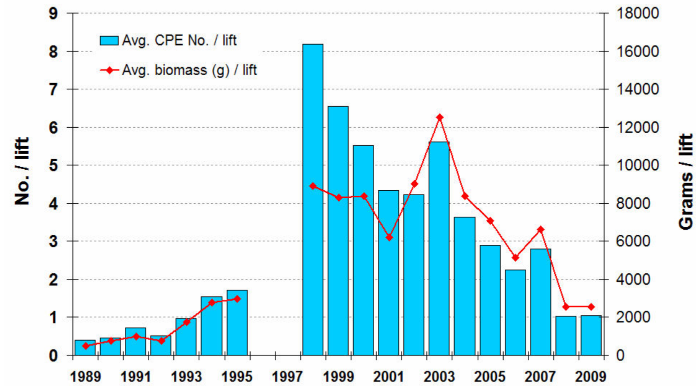


FIGURE 3.3. Average catch rate (CPE as number of fish/lift) and biomass (grams/lift) of burbot in Ontario waters of eastern Lake Erie, Ontario Partnership gillnet survey 1989–2009 (includes only bottom sets, all mesh sizes; PA-ridge and east basin sample sites).

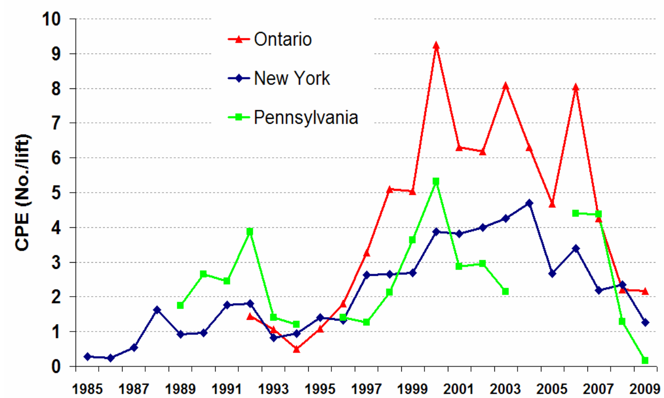


FIGURE 3.4 Average burbot catch rate (number of fish/lift) from summer coldwater gill net assessment by jurisdiction, 1985-2009.

Burbot biomass CPE in general has followed a similar pattern as numeric abundance except that burbot catches in summer coldwater gillnet assessments did not reach maximum biomass until 2006 in Ontario waters, some four years after maximum numeric abundance was observed (Figure 3.5). The average burbot biomass observed in 2009 represents a 3.3 to 3.5 fold decrease from peak levels recorded within the respective data series for New York and Ontario (Figure 3.5). In Pennsylvania, the 2009 burbot biomass estimate was the lowest in their time series.

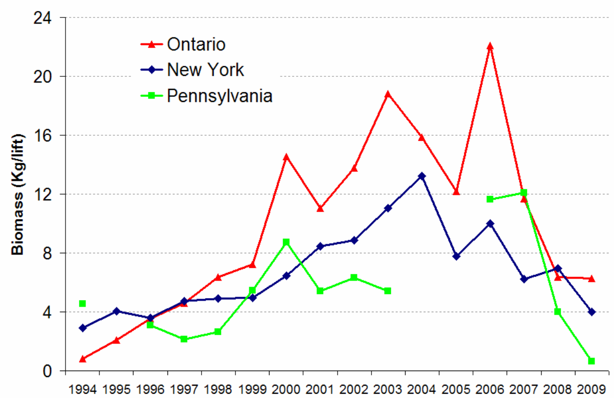


FIGURE 3.5 Average burbot biomass (kg/lift) from summer coldwater gill net assessment by jurisdiction, 1994-2009.

Burbot ages (from examinations of otoliths) have been estimated for fish caught in coldwater assessment gill nets in Ontario waters since 1997. Mean age of burbot has increased steadily during 1998-2008 (Figure 3.6). Preliminary results suggest that this trend continued in 2009.

Recruitment of age-4 burbot increased almost 2-fold from 1997 to 2000, but was followed by an abrupt decrease in 2002 and remained poor through 2008 (Figure 3.6). A recent published analysis (Stapanian et al. 2010) suggests that recruitment during 1997-2007 was associated with abundance of yearling and older yellow perch when the burbot were age 0, and winter water temperatures during the spawning and egg development phases of burbot. Preliminary results suggest that burbot recruitment was also low in 2009.

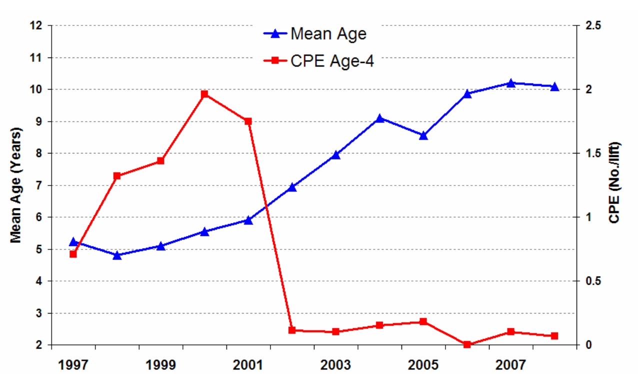


FIGURE 3.6. Mean age and average CPE of AGE-4 burbot caught in summer gill net assessment in Ontario waters of eastern Lake Erie during 1997-2008.

## Growth

Mean total length of burbot increased in most survey areas in 2009, continuing a trend that has predominated since the late 1990s (Figure 3.7). The 2009 estimate of burbot mean length in Pennsylvania was based on a sample of only five fish. Average weight of burbot has followed a similar trend, increasing steadily since 1998, reaching a time-series maxima in 2008 or 2009 in each of the east basin jurisdictions (Figure 3.8). These results reflect the increasing mean age of the burbot population.

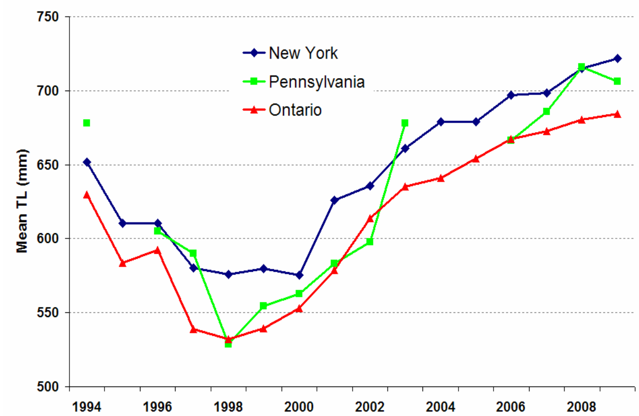


FIGURE 3.7 Average total length (TL) of burbot caught in summer gill net assessments by jurisdiction during 1994-2009.

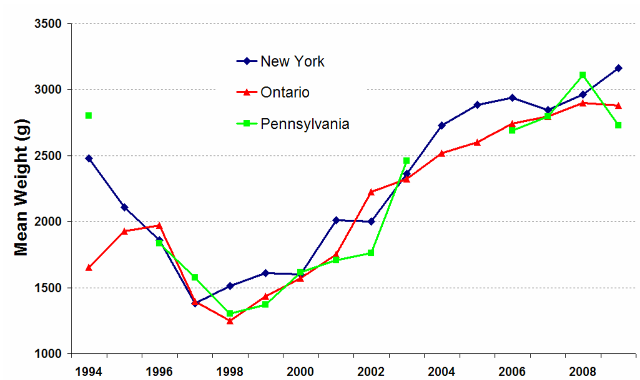


FIGURE 3.8 Average weight of burbot caught in summer gill net assessments by jurisdiction during 1994-2009.

## Diet

Seasonal diet information for burbot is not available based on current sampling protocols. Diet information was limited to fish caught during August 2009 coldwater gill net assessment surveys in the eastern basin of Lake Erie. Analysis of stomach contents revealed a diet made up mostly of fish (Figure 3.9). Burbot diets continued to be diverse with five different fish and one invertebrate species found in stomach samples. Rainbow smelt were the dominant prey item, occurring in 41% of the burbot stomachs, followed by round goby (36%). Other identifiable taxa were found in 5% or less of the stomachs and included yellow perch, lake trout, emerald shiners, and dreissenids. This is the first time a lake trout has been observed in the burbot diet.

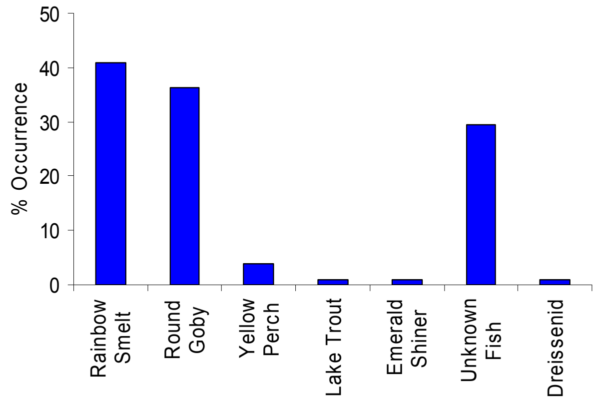


FIGURE 3.9. Frequency of occurrence of diet items from non-empty stomachs of burbot sampled in gill nets from the eastern basin of Lake Erie, August 2009. "Unknown Fish" refers to fish remains that could not be identified to species. Sample size is 105 stomachs.

Gobies have increased in the diet of burbot since they first appeared in the eastern basin in 1999 (Figure 3.10). They were the main diet item for burbot in five of the last seven years. Smelt were the dominant prey in 2005 and again in 2009.

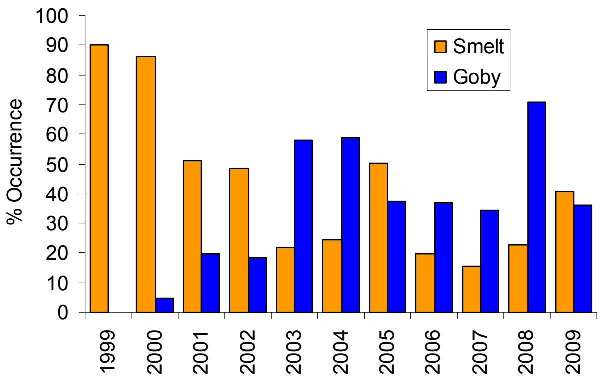


FIGURE 3.10. Frequency of occurrence of rainbow smelt and round goby in the diet of burbot caught in the eastern basin of Lake Erie, 1999-2009.

Preliminary analyses indicate that burbot exhibit predatory control of round goby in deep water (≥ 20 m) areas of the eastern basin (Madenjian et al. in review). Further, size-at-age of burbot has increased since round gobies became a significant component of the burbot diet (Stapanian et al. in prep.). This increase in size is associated with reduced foraging costs to burbot in consuming round goby, which like the burbot is a bottom-dwelling species.

**References**

Coldwater Task Group (CWTG). 1997. Report of the Coldwater Task Group to the Standing Technical Committee of the Lake Erie Committee, March 24, 1997.

Madenjian, C.P., M.A. Stapanian, L.D. Witzel, D.W. Einhouse, S.A. Pothoven, and H.L. Whitford. 2010. (in review). Evidence for predatory control of the invasive round goby. Biological Invasions.

Stapanian, M.A., L.D. Witzel, and A. Cook. 2010. Recruitment of burbot *Lota lota* in Lake Erie: an empirical modeling approach. Ecology of Freshwater Fish (in press).

Stapanian, M.A., W.H. Edwards, and L.D. Witzel. Diet shift to round goby resulted in increased size-at-age in burbot. Manuscript in preparation.

## Charge 4: Continue to participate in the IMSL process on Lake Erie to outline and prescribe the needs of the Lake Erie sea lamprey management program.

*Jeff Slade (USFWS), Fraser Neave (DFO), and James Markham (NYSDEC)*

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 83 A1-A3 wounds were found on 429 lake trout greater than 532 mm (21 inches) total length in 2009, equaling a wounding rate of 19.3 wounds per 100 fish (Table 4.1; Figure 4.1). This was over two times the 2008 wounding rate of 6.2 wounds/100 fish and the highest sea lamprey wounding rate since 1998. The wounding rate is nearly four times higher than the target rate of 5 wounds per 100 fish (Lake Trout Task Group 1985; Markham et al. 2008). Wounding rates have remained above target for 14 of the past 15 years following reduced sea lamprey control measures in the mid-1990's (Sullivan et al. 2003). Lake trout over 736 mm (29 inches) continue to be preferred targets for sea lamprey, but high wounding rates were found in all size categories greater than 532 mm (21 inch). Small lake trout in the 432-532 mm (17-21 inch) size category did not record any fresh wounds in 2009.

TABLE 4.1. Frequency of sea lamprey wounds observed on several standard length groups of lake trout collected from assessment gill nets in the eastern basin of Lake Erie, August 2009.

| Size Class Total Length (mm) | Sample Size | Wound Classification | | | | No. A1-A3 Wounds per 100 Fish |
|---|---|---|---|---|---|---|
| | | A1 | A2 | A3 | A4 | |
| 432-532 | 73 | 0 | 0 | 0 | 2 | 0 |
| 533-634 | 221 | 4 | 6 | 24 | 75 | 15.4 |
| 635-736 | 120 | 3 | 5 | 17 | 49 | 20.8 |
| >736 | 88 | 2 | 5 | 17 | 97 | 27.3 |
| >532 | 429 | 9 | 16 | 58 | 221 | 19.3 |

Fresh A1 wounds are considered indicators of the attack rate for the current year at the time of sampling (August). A1 wounding in 2009 was 2.1 wounds per adult lake trout greater than 532 mm, which was slightly above the series average of 2.05 wounds/100 fish (Table 4.1; Figure 4.2). A total of nine A1 wounds were found spread across all size categories.

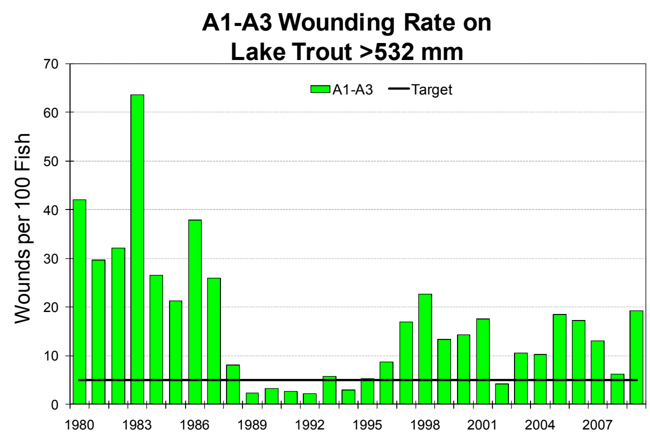


FIGURE 4.1. Number of fresh (A1-A3) sea lamprey wounds per 100 adult lake trout greater than 532 mm (21 inches) sampled in assessment gill nets in the eastern basin of Lake Erie, August-September, 1980-2009. The target rate is 5 wounds per 100 fish.

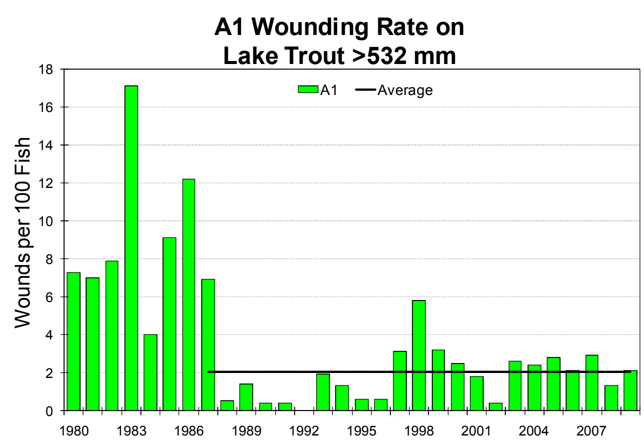


FIGURE 4.2. Number of A1 sea lamprey wounds per 100 adult lake trout greater than 532 mm (21 inches) sampled in assessment gill nets in the eastern basin of Lake Erie, August-September, 1980-2009. The post-treatment average includes 1987-2008.

The past year's cumulative attacks are indicated by A4 wounds. A4 wounding rates increased in 2009 to 51.5 wounds/100 fish (Figure 4.3). This was the third highest A4 wounding rate in the time series and over two times above the time series average of 21.5 wounds/100 fish. Unlike past surveys where the majority of the A4 wounds were on fish greater than 636 mm (25 inches) in total length, the A4 wounds were more evenly spread across all length categories (Table 4.1). A4 wounding rates on lake trout over 736 mm (29 inches) remain very high (110.2 wounds/100 fish) with many fish possessing multiple wounds.

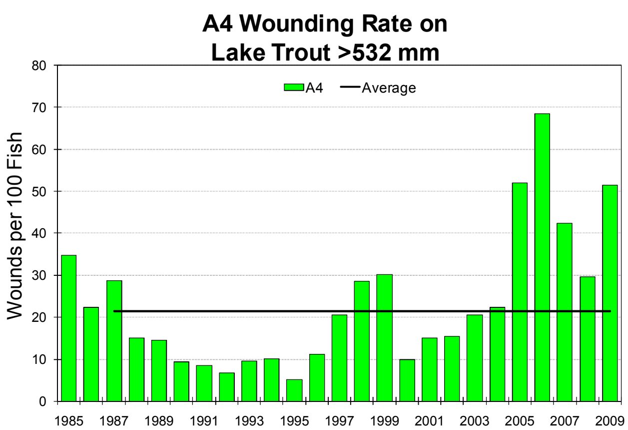


FIGURE 4.3. Number of healed (A4) sea lamprey wounds per 100 adult lake trout greater than 532 mm (21 inches) sampled in assessment gill nets in the eastern basin of Lake Erie, August-September, 1985-2009. The post-treatment average includes 1987-2008.

Finger Lakes (FL) and Klondike (KL) strain lake trout were the most prevalent strains sampled, and they accounted for the majority of the fresh (A1-A3) and A4 sea lamprey wounds (Table 4.2). Overall, fresh A1-A3 wounding rates were slightly higher on KL strain compared to FL strain lake trout while A4 wounds were higher on FL strain fish. However, almost all of the lake trout over 736 mm, which are the preferred targets, were FL strain fish. A4 wounding rates were very high on other lake trout strains (Lake Erie, Slate Island, Lake Ontario, Lake Superior, and Traverse Island) due to low sample sizes and multiple wounds per fish.

TABLE 4.2. Frequency of sea lamprey wounds observed on lake trout >532 mm, by strain, collected from assessment gill nets in the eastern basin of Lake Erie, August 2009.

| LAKE TROUT STRAIN | SAMPLE SIZE | WOUND CLASSIFICATION | | | | NO. A1-A3 WOUNDS PER 100 FISH | NO. A4 WOUNDS PER 100 FISH |
|---|---|---|---|---|---|---|---|
| | | A1 | A2 | A3 | A4 | | |
| FL | 158 | 2 | 6 | 20 | 94 | 17.7 | 59.5 |
| KL | 215 | 6 | 8 | 30 | 82 | 20.5 | 38.1 |
| LE | 1 | 0 | 0 | 1 | 3 | 100.0 | 300.0 |
| SI | 4 | 0 | 0 | 0 | 2 | 0 | 50.0 |
| LO | 5 | 0 | 1 | 1 | 14 | 40.0 | 280.0 |
| SUP | 4 | 0 | 0 | 2 | 9 | 50.0 | 225.0 |
| TI | 7 | 1 | 0 | 0 | 3 | 14.3 | 42.8 |

## Burbot Wounding Rates

The burbot population, once the most prevalent coldwater predator in the eastern basin of Lake Erie, has declined to levels less than half of those observed only a few years ago (see Charge 3). Both A1-A3 and A4 wounding rates on burbot have increased since 2001 in the New York waters of Lake Erie. The fresh (A1-A3) wounding rate on burbot increased to 7.1 wounds/100 fish in 2009 while A4 wounding rates declined to 8.3 wounds/100 fish (Figure 4.4). Both rates represent the second highest wounding rates in the nine year time series.

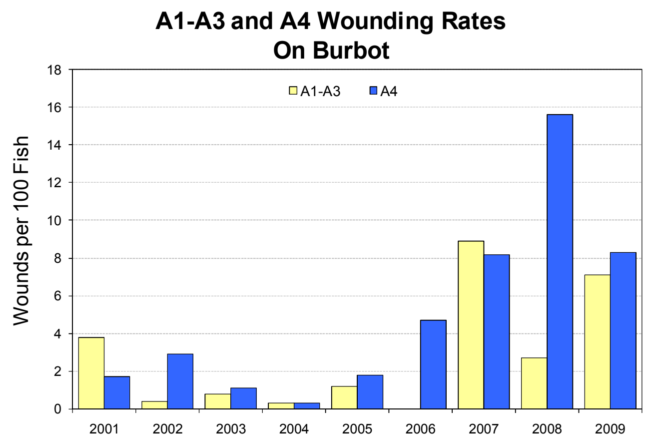


FIGURE 4.4. Number of A1-A3 and A4 sea lamprey wounds per 100 burbot (all sizes) sampled in assessment gill nets in the New York waters of Lake Erie, August, 2001-2009.

## Lake Whitefish Wounding Rates

Sea lamprey wounds on lake whitefish have not been consistently recorded in Lake Erie agency assessment surveys until 2001. Wounds on lake whitefish did not appear in New York assessment surveys until 2003, which coincides with the lowest level of adult lake trout abundance since the mid-1980's (see Charge 1). No fresh A1-A3 wounds were found on lake whitefish in 2009, but A4 wounding rates increased to 3.5 wounds/100 fish, which was the highest value in the time series (Figure 4.5). Overall, wounding rates on lake whitefish are low compared to lake trout and burbot and may be due to higher post-wounding mortality.

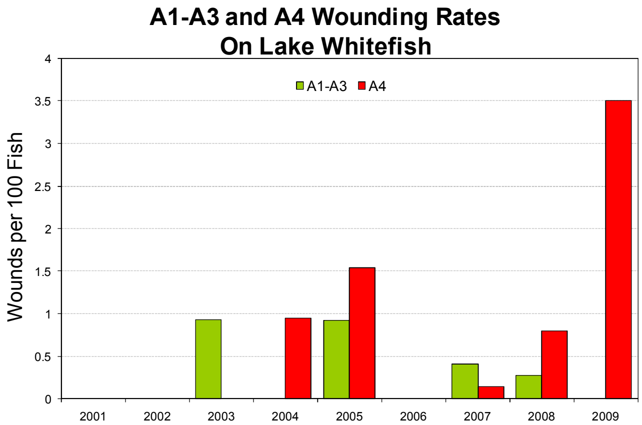


FIGURE 4.5. Number of A1-A3 and A4 sea lamprey wounds per 100 lake whitefish (all sizes) sampled in assessment gill nets in the New York waters of Lake Erie, August, 2001-2009.

## 2009 Sea Lamprey Control Actions

As part of a two year experiment designed to reduce the number of parasitic sea lampreys in Lake Erie to target levels of abundance, all streams that were treated in 2008 were treated again 2009. For the second consecutive year, treatments were conducted in 5 U. S. tributaries (Cattaraugus, Crooked, Raccoon and Conneaut Creeks and Grand River) and 4 Canadian tributaries (Silver, Big Otter, Big and Young's Creeks). South Otter Creek was also treated in 2009 after assessment surveys discovered several year classes of larval sea lampreys.

Assessments for larval sea lamprey were conducted in 39 tributaries (11 U.S., 28 Canada) and offshore of 3 U.S. tributaries (Table 4.3). Surveys to detect new populations were conducted in 20 tributaries (2 U.S, 18 Canada) and no new populations were discovered.

The estimated number of spawning-phase sea lamprey increased from 2,400 during 2008 to 35,635 during 2009, a significant increase from 2008 (Figure 4.6). A total of 4,291 spawning-phase sea lamprey were trapped in four tributaries (2 U.S., 2 Canada), a significant increase when compared to 2008 catches.

Plans were developed to replace the sea lamprey barrier on Normandale Creek that was destroyed by a flood in 2008. An intensive effort to inventory and ground truth the information contained in the National Inventory of Dams (NID) has been undertaken for barriers located on tributaries to the Great Lakes. During 2007-2009 over 2,500 barriers were inventoried throughout the Great Lakes basin, 93 were on tributaries to Lake Erie. This completes the first stage of ground truthing the current barrier data base. The Site Visit Report for construction of a permanent trap on Cattaraugus Creek at the Springville Dam was completed by Stanley Engineering. Initial work has begun on the Design and Development phase of this trap project.

The Lake Erie chapter of the Sea Lamprey Management plan was drafted. This draft is currently being modified based on comments received from the Great Lakes Fishery Commission's Sea Lamprey Integration Committee.

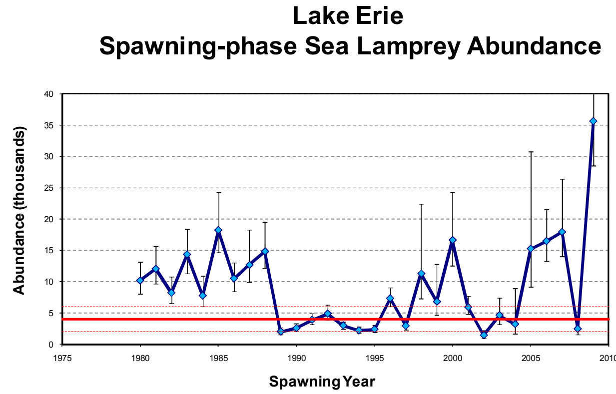


FIGURE 4.6. Lakewide estimate of spawning-phase sea lampreys in Lake Erie with 95% confidence limits, 1980-2009. Thick solid line indicates spawner abundance target level with 95% confidence range (thin lines).

A new approach to ranking streams for lampricide treatment was implemented throughout the Great Lakes in 2008. This new approach was based on several years of research, which demonstrated that streams could be ranked for treatment using a more rapid assessment technique (i.e. ranking surveys) and that as many or more lampreys would be killed as when streams were ranked with the more labor intensive quantitative assessment sampling used since the mid 1990's.

Due to the ongoing experiment designed to achieve target levels of sea lamprey abundance in Lake Erie, ranking surveys were not used in Lake Erie tributaries in 2009, but may be used after 2009 when required.

**2010 Sea Lamprey Control Plans**

South Otter Creek is scheduled for treatment in the fall of 2010. This will be the second consecutive treatment of this stream. Treatment of Cattaraugus Creek is scheduled pending the results of 2010 larval assessment surveys. An objective of these surveys is to evaluate the effectiveness of the 2009 treatment that may have been negatively impacted by high water.

Larval assessment surveys will be conducted to confirm lampricide application points on South Otter Creek and to evaluate the effectiveness of each stream treated in 2009. An additional 42 streams (28 U.S., 14 Canada) are scheduled to be surveyed for the presence of larval sea lampreys (Table 4.3).

Adult assessment traps will be operated on four streams (2 U.S., 2 Canada) to estimate lakewide spawning-phase abundance.

The Preliminary Restoration Plan for the Harpersfield Dam on the Grand River will be completed and the project will move into the Planning and Design Phase. Final design of a permanent trap at Springville Dam on Cattaraugus Creek will be completed and this project will be advertised for bids on construction late in 2010. The barrier on Normandale Creek is scheduled for construction.

The Lake Erie chapter of the Sea Lamprey Management Plan will be completed and presented to the Sea Lamprey Integration Committee in October 2010.

**Table 4.3. Larval sea lamprey assessments of Lake Erie tributaries during 2009 and plans for 2010.**

| Stream | History | Surveyed in 2009 | Survey Type[1] | Results | Plans for 2010 |
|---|---|---|---|---|---|
| **Canada** | | | | | |
| Unnamed (E-8) | Negative | Yes | Detection | Negative | None |
| Unnamed (E-9) | Negative | Yes | Detection | Negative | None |
| Unnamed (E-11) | Negative | Yes | Detection | Negative | None |
| Dolsons Creek | Negative | Yes | Detection | Negative | None |
| Mill Creek | Negative | Yes | Detection | Negative | None |
| Unnamed (E-16) | Negative | Yes | Detection | Negative | None |
| Unnamed (E-18) | Negative | Yes | Detection | Negative | None |
| Sturgeon Creek | Negative | Yes | Detection | Negative | None |
| Hillman Creek | Negative | Yes | Detection | Negative | None |
| East Two Creek | Negative | Yes | Detection | Negative | None |
| Willow Creek Drain | Negative | Yes | Detection | Negative | None |
| Indian Creek | Negative | Yes | Detection | Negative | None |
| Unnamed (E-42) | Negative | Yes | Detection | Negative | None |
| Unnamed (E-46) | Negative | Yes | Detection | Negative | None |
| Morden Drain | Negative | Yes | Detection | Negative | None |
| Sixteenmile Creek | Negative | No | | | Detection |
| Brock Creek | Negative | Yes | Detection | Negative | None |
| Kettle Creek | Negative | No | | | Detection |
| East Creek | Positive | Yes | Evaluation | Negative | Evaluation |
| Catfish Creek | Positive | Yes | Evaluation | Negative | Evaluation |
| Silver Creek | Positive | Yes | Dist/Trt. Eval. | Negative | Trt. Eval. |
| Unnamed (E-97) | Negative | Yes | Detection | Negative | None |
| Big Otter Creek | Positive | Yes | Dist/Trt. Eval. | Negative | Trt. Eval. |
| South Otter Creek | Positive | Yes | Eval./Ranking | Positive | Trt. Eval./Dist. |
| Clear Creek | Positive | Yes | Eval./Barrier | Negative | None |
| Long Point Creek | Negative | Yes | Detection | Negative | None |
| Big Creek | Positive | Yes | Dist./Trt. Eval. | Negative | Trt. Eval. |
| Dedrich Creek | Negative | No | | | Evaluation |
| Forestville Creek | Positive | No | | | Evaluation |
| Normandale Creek | Positive | Yes | Evaluation | Negative | None |
| Fishers Creek | Positive | No | | | Evaluation |
| Youngs Creek | Positive | Yes | Trt. Eval. | Negative | Trt. Eval. |
| Grand River | Positive | Yes | Evaluation | Negative | None |
| Frenchman Creek | Negative | No | | | Evaluation |
| Welland River | Negative | No | | | Evaluation |

**Table 4.3. (Continued) Larval sea lamprey assessments of Lake Erie tributaries during 2009 and plans for 2010.**

| Stream | History | Surveyed in 2009 | Survey Type[1] | Results | Plans for 2010 |
|---|---|---|---|---|---|
| **United States** | | | | | |
| Buffalo River | Positive | Yes | Evaluation | Negative | Evaluation |
| Pike Creek | Negative | No | | | Detection |
| Little Sister Creek | Negative | No | | | Detection |
| Delaware Creek | Positive | No | | | Evaluation |
| Cattaraugus Creek | Positive | Yes | Trt. Eval. | Negative | Trt. Eval. |
| (lentic) | Positive | Yes | Evaluation | Positive | None |
| Halfway Brook | Positive | No | | | Evaluation |
| Eight Mile Creek | Negative | No | | | Detection |
| Six Mile Creek | Negative | No | | | Detection |
| Four Mile Creek | Negative | No | | | Detection |
| Fairplain Creek | Negative | No | | | Detection |
| Townline Creek | Negative | No | | | Detection |
| Crooked Creek | Positive | Yes | Distribution | Negative | Trt. Eval. |
| Raccoon Creek | Positive | Yes | Distribution | Positive | Trt. Eval. |
| Turkey Creek | Negative | No | | | Detection |
| Conneaut Creek | Positive | Yes | Distribution | Positive | Trt. Eval. |
| (lentic) | Positive | Yes | Evaluation | Negative | None |
| Ashtabula | Positive | No | | | Evaluation |
| Grand River | Positive | Yes | Distribution | Positive | Trt. Eval./Barrier |
| (lentic) | Positive | Yes | Evaluation | Negative | None |
| Chagrin River | Positive | No | | | Evaluation |
| Cuyahoga River | Negative | No | | | Detection |
| Rocky River | Negative | No | | | Detection |
| Cahoon Creek | Negative | No | | | Detection |
| Porter Creek | Negative | No | | | Detection |
| Beaver Creek | Negative | No | | | Detection |
| Vermillion Creek | Negative | No | | | Detection |
| Chappel Creek | Negative | No | | | Detection |
| Old Women Creek | Negative | No | | | Detection |
| Huron River (OH) | Negative | Yes | Detection | Negative | None |
| Sandusky River | Negative | Yes | Barrier | Negative | None |
| Black River | Positive | Yes | Ranking | Negative | Evaluation |
| Clinton River | Positive | Yes | Evaluation | Negative | None |
| St. Clair River | Positive | Yes | Evaluation | Positive | None |
| Detroit River | Negative | No | | | Detection |

[1]*Evaluation survey* – conducted to detect larval recruitment in streams with a history of sea lamprey infestation.
*Detection survey* – conducted to detect larval recruitment in streams with no history of sea lamprey infestation.
*Distribution survey* – conducted to determine instream geographic distribution or to determine lampricide treatment application points.
*Treatment evaluation survey* – conducted to determine the relative abundance of survivors from a lampricide treatment.
*Ranking survey* – conducted to index the larval population to determine need for lampricide treatment the following year. Projected treatment cost is divided by the estimate of larvae > 100 mm to provide a ranking against other Great Lakes tributaries for lampricide treatment.
*Biological collection* – conducted to collect lamprey specimens for research purposes.
*Barrier survey* - conducted to determine larval recruitment upstream of barriers.

**Acknowledgement**

We are grateful to Sean Morrison (DFO) for his assistance to the task group while serving as a temporary replacement for Fraser Neave (DFO).

**References**

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Markham, J.L., Cook, A., MacDougall, T., Witzel, L., Kayle, K., Murray, M., Fodale, M., Trometer, E., Neave, F., Fitzsimons, J., Francis, J., and Stapanian, M. 2008. A strategic plan for the rehabilitation of lake trout in Lake Erie, 2008-2020. Great Lakes Fish. Comm. Misc. Publ. 2008-02.

Sullivan, W. P., G. C. Christie, F. C. Cornelius, M. F. Fodale, D. A. Johnson, J. F. Koonce, G. L. Larson, R. B. McDonald, K. M. Mullett, C. K. Murray, and P. A. Ryan. 2003. The sea lamprey in Lake Erie: a case history. Journal of Great Lakes Research 29 (Supplement 1): 615-636.

## Charge 5: 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 Stockings

The current lake trout stocking goal for Lake Erie (160,000 yearlings) was met for the second consecutive year (Figure 5.1). This also marks the first time that lake trout were stocked throughout the eastern basin within the same year. In 2009, lake trout were stocked in New York waters (173,342 yearlings), Ontario waters (50,000 yearlings) and Pennsylvania waters (6,500 yearlings). Combined, the 229,842 yearlings stocked in 2009 were the most lake trout stocked into Lake Erie in a single year over the history of the rehabilitation effort.

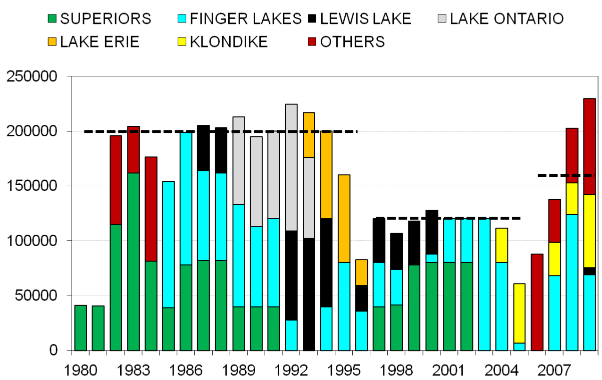


FIGURE 5.1: Lake trout stocked (in yearling equivalents) in eastern basin waters of Lake Erie, 1980–2009, by strain. Stocking goals through time are shown by black dotted lines. OTHERS = Clearwater Lake (1982-84), Slate Island (2006, 2009), Traverse Island (2007), Lake Manitou (2008), Apostle Island (2009), and Lake Champlain (2009).

While the Allegheny National Fish Hatchery (ANFH) remains closed for renovations, lake trout stocked in New York waters continued to be raised at White River National Fish Hatchery, a U.S. federal facility located in Vermont. These lake trout were stocked by New York Department of Environmental Conservation (NYSDEC) staff, offshore of Dunkirk in approximately 70 feet of water via the R/V ARGO between 27 April and 6 May, 2009. Four different strains were stocked including Finger Lakes, Klondike, Apostle Island, and Lake Champlain. The Vermont hatchery is scheduled to raise lake trout for Lake Erie until renovations at ANFH are complete. Current projections for resuming production at ANFH have been pushed back to 2013. Slate Island strain lake trout were boat-stocked by the Ontario Ministry of Natural Resources (OMNR) on 7-8 May 2009 off Port Dover onto Nanticoke Shoals, a potential lake trout spawning reef. Finger Lakes strain lake trout were shore-stocked by the PFBC on 9 May 2009 at Twentymile Creek.

### Stocking of Other Salmonids

In 2009, over 2.3 million yearling trout and salmon were stocked in Lake Erie, including rainbow/steelhead trout, brown trout and lake trout (Figure 5.2).

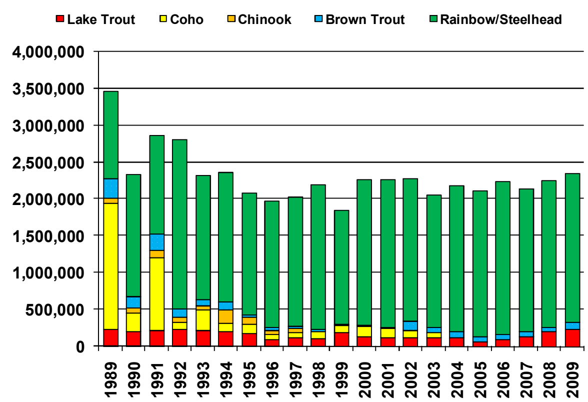


FIGURE 5.2: Annual stocking of all salmonid species (in yearling equivalents) in Lake Erie by all agencies, 1989-2009.

Total salmonid stocking increased 4% from 2008 and is 2% above the long-term average (1989-2008). Annual summaries for each species stocked within individual state and provincial areas are summarized in Table 5.1 and are standardized to yearling equivalents.

All of the U.S. fisheries resource agencies and a few non-governmental organizations (NGO's) in Ontario and Pennsylvania currently stock rainbow/steelhead trout in the Lake Erie watershed. A total of 2,011,354 yearling rainbow/steelhead trout were stocked in 2009, accounting for nearly 86% of all salmonids stocked. This represented a slight increase (1%) from 2008, and was 11% higher than the long-term average. The increase above the long-term average is primarily a result of the increased emphasis of rainbow trout/steelhead in jurisdictional fisheries and the elimination of other pacific salmon (Coho and Chinook salmon) over the last decade. A full account of rainbow/steelhead trout stocked in Lake Erie by jurisdiction for 2009 can be found under Charge 6 of this report, which details the location and strain of rainbow trout stocked across Lake Erie.

Brown trout stocking in Lake Erie totaled 102,701 yearlings in 2009. This was a 90% increase from 2008 and was the most brown trout stocked since 2002. Most of this increase is from a renewed interest in developing a trophy brown trout fishery in New York and Pennsylvania. In retrospect, this increase is relatively moderate, representing a 23% increase from the long-term average. Brown trout stocking was much more intensive two decades ago when stocking averaged 156,000 yearling brown trout between 1989 and 1994.

Most (63%) of the brown trout stocked in Lake Erie were in New York waters for the purposes of providing a put-grow-and-take (PGT) trophy brown trout fishery for offshore boat anglers and seasonal tributary anglers. Between 17 April and 28 April, 2009, the NYSDEC stocked 37,570 yearling brown trout. An additional 25,000 fall fingerlings were stocked on 11 November 2009. The NYSDEC began re-emphasizing brown trout stocking in place of domestic rainbow trout in 2002 for the purposes of diversifying their tributary trout/salmon fishery and for maintaining migratory behavior of their Salmon River steelhead strain.

Pennsylvania also stocked brown trout in the Lake Erie watershed. Between 17 April and 28 April, 2009, 19,750 adult brown trout (mean length = 267mm) were stocked to provide catchable trout for the opening of Pennsylvania trout season. Yearling and fall fingerling brown trout were also stocked in Pennsylvania waters in support of a new PGT brown trout fishery. A NGO stocked 42,950 yearling brown trout in May, and the PFBC stocked an additional 43,925 fall fingerlings between 29 September and 1 October 2009.

The PGT brown trout program was implemented in Pennsylvania waters of Lake Erie beginning in 2009 and is expected to continue until an evaluation of these efforts can be completed. This program was in response to requests from Pennsylvania angler constituency groups for increased diversity in trout fishing opportunities on Lake Erie since the discontinuation of the Coho salmon program in Pennsylvania that occurred in 2003.

Currently, the Pennsylvania program is supported through the annual donation of 100,000 certified IPN-free eggs from the NYDEC. The PFBC is now implementing plans to develop an in-house source of IPN-free eggs to perpetuate the program.

TABLE 5.1. Summary of salmonid stockings in numbers of yearling equivalents, Lake Erie, 1990-2009.

| Year | Agency | 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 5.1. (Continued) Summary of salmonid stockings in number of yearling equivalents, 1990-2009.

| Year | Agency | 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** |

## Charge 6: Continue to assess the steelhead and other salmonid fisheries, age structure, growth, diet, seasonal distribution and other population parameters.

*James Markham (NYSDEC), Kevin Kayle (ODW), and Chuck Murray (PFBC)*

### Stocking

All Lake Erie jurisdictions stocked lake-run rainbow trout (or steelhead) in 2009 (Table 6.1). Yearling plants take place each spring, between March and May, when smolts average about 150 mm in length. Additionally, a small number of domestic and golden rainbow trout were stocked to supplement the put-and-take trout fishery in Pennsylvania. Based on these efforts, a total of 2,011,354 yearling steelhead/rainbow trout were stocked in 2009, representing a 1% increase from 2008 and an 11% increase from the long-term (1989-2008) average. Nearly all of the rainbow trout stocked in Lake Erie originated from naturalized Great Lakes strains. A Lake Erie strain accounted for 59% of the strain composition followed by a Lake Michigan strain (26%) and a Lake Ontario strain (14%); less than 2% of the rainbow trout stocked in Lake Erie were miscellaneous strains including a Skamania strain (0.8%), a domestic strain (0.4%), and a golden rainbow trout strain (0.02%). Only the Manistee River strain rainbow trout stocked in Michigan received fin-clips in 2009 (Table 6.2).

### Assessment of Natural Reproduction

In anticipation of a fish passage project scheduled to be completed in 2010 on a series of dams in Chautauqua Creek (NY), a comprehensive survey of the fish community and assessment of juvenile production of steelhead both below and above the two existing fish barriers was conducted in 2007, 2008, and 2009 by the NYSDEC. The results of these surveys showed the impact of the two dams on the passage of steelhead and the overall fish community. Abundance of YOY steelhead was 3-4 times higher below the dams compared to sites above the dams, and composition of non-trout species differed as well. These results indicate that while some steelhead do make it over both barriers and are able to migrate upstream to spawn, the bulk of the fish are stopped and spawn in the riffle areas below the dams. Weather conditions play a large role in production and migration upstream with greater abundances of YOY steelhead above the dams in high flow years and greater survival in cool and wet summers. The abundance of YOY steelhead in Chautauqua Creek was comparable to fall densities found in higher quality Michigan streams (Seelbach 1993; Godby et al. 2007). However, densities were lower than Spooner Creek (3,245 fish/acre), which is considered the top steelhead producing stream in New York's Lake Erie watershed (Culligan et al. 2002). Further studies need to be conducted to determine if this production is contributing to the adult steelhead population of this stream.

### Exploitation

Although 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. All agencies provide annual measurements of open lake summer harvest by boat anglers, whether by creel surveys or angler diary reports. These provide some measure of the relative abundance of adult steelhead in Lake Erie.

The estimated harvest from the summer open-water boat angler fishery in 2009 was 8,765 steelhead in all US waters; a 61% increase from the estimated 2008 steelhead harvest (Table 6.3). It reversed a decline from the lowest open lake harvest of steelhead in the eleven-year time series. Annual increases in harvest were seen in Ohio (+110%) and Michigan (+285%), but declines were observed in Pennsylvania (-21%), and were more pronounced in New York (-85%).

Most of the reported harvest (58%) was concentrated in central basin waters of Ohio and Pennsylvania. The west-central basin waters of Ohio accounted for 40% the harvest. Less than 3% of the estimated steelhead harvest occurred in Michigan waters of the western basin (2%) and Eastern basin waters of New York (1%).

Similar to harvest estimates from the open lake boat fishery, catch rate statistics were mixed across the lake (Figure 6.1). Boat angler catch rates for steelhead in 2009 increased in Pennsylvania from 2008, but declined slightly in Ontario waters. Ohio catch rates increased substantially over 2008 catch rates; however, their significance is moderated by the low amount of directed fishing effort for steelhead. New York data are only summarized through 2008.

TABLE 6.1. Rainbow trout/steelhead stocking by jurisdiction for 2009.

| | Location | Strain | Fin Clips | Number | Life Stage | Yearling Equivalents | |
|---|---|---|---|---|---|---|---|
| **Michigan** | Flat Rock | Manistee River, L. Michigan | RP | 70,376 | Yearling | **70,376** | **Sub-Total** |
| **Ontario** | Mill Creek | Ganaraska River, L. Ontario | -- | 13,495 | Yearling | 13,495 | |
| | Erieau Harbour | Ganaraska River, L. Ontario | -- | 5,115 | Yearling | 5,115 | |
| | | | | | | **18,610** | **Sub-Total** |
| **Pennsylvania** | Conneaut Creek | Trout Run, L. Erie | -- | 75,000 | Yearling | 75,000 | |
| | Conneaut Creek, W. Branch | Domestic | -- | 150 | Adult | 150 | |
| | Crooked Creek | Trout Run, L. Erie | -- | 81,600 | Yearling | 81,600 | |
| | Elk Creek | Domestic | -- | 250 | Adult | 250 | |
| | Elk Creek | Trout Run, L. Erie | -- | 284,400 | Yearling | 284,400 | |
| | Fourmile Creek | Golden | -- | 100 | Adult | 100 | |
| | Fourmile Creek | Trout Run, L. Erie | -- | 20,400 | Yearling | 20,400 | |
| | Godfrey Run | Trout Run, L. Erie | -- | 75,400 | Yearling | 75,400 | |
| | Presque Isle Bay | Trout Run, L. Erie | -- | 91,800 | Yearling | 91,800 | |
| | Raccoon Creek | Trout Run, L. Erie | -- | 20,400 | Yearling | 20,400 | |
| | Sevenmile Creek | Golden | -- | 200 | Adult | 200 | |
| | Sevenmile Creek | Trout Run, L. Erie | -- | 20,400 | Yearling | 20,400 | |
| | Sixteenmile Creek | Trout Run, L. Erie | -- | 20,400 | Yearling | 20,400 | |
| | Taylor Run | Domestic | -- | 1,200 | Adult | 1,200 | |
| | Taylor Run | Golden | -- | 25 | Adult | 25 | |
| | Temple Creek | Domestic | -- | 900 | Adult | 900 | |
| | Trout Run | Trout Run, L. Erie | -- | 76,000 | Yearling | 76,000 | |
| | Twelvemile Creek | Trout Run, L. Erie | -- | 40,800 | Yearling | 40,800 | |
| | Twentymile Creek | Trout Run, L. Erie | -- | 163,200 | Yearling | 163,200 | |
| | Walnut Creek | Trout Run, L. Erie | -- | 214,200 | Yearling | 214,200 | |
| | | | | | | **1,186,825** | **Sub-Total** |
| **Ohio** | Chagrin River | Manistee River, L. Michigan | -- | 105,764 | Yearling | 105,764 | |
| | Conneaut Creek | Manistee River, L. Michigan | -- | 75,005 | Yearling | 75,005 | |
| | Grand River | Manistee River, L. Michigan | -- | 105,058 | Yearling | 105,058 | |
| | Rocky River | Manistee River, L. Michigan | -- | 90,063 | Yearling | 90,063 | |
| | Vermillion River | Manistee River, L. Michigan | -- | 82,933 | Yearling | 82,933 | |
| | | | | | | **458,823** | **Sub-Total** |
| **New York** | Walnut Creek | Chambers Creek, L. Ontario | -- | 10,000 | Yearling | 10,000 | |
| | Silver Creek | Chambers Creek, L. Ontario | -- | 10,000 | Yearling | 10,000 | |
| | Canadaway Creek | Chambers Creek, L. Ontario | -- | 20,000 | Yearling | 20,000 | |
| | 18 Mile Creek | Chambers Creek, L. Ontario | -- | 20,000 | Yearling | 20,000 | |
| | 18 Mile Creek, S. Branch | Chambers Creek, L. Ontario | -- | 20,000 | Yearling | 20,000 | |
| | Cayuga Creek | Chambers Creek, L. Ontario | -- | 10,000 | Yearling | 10,000 | |
| | Buffalo Creek | Chambers Creek, L. Ontario | -- | 15,000 | Yearling | 15,000 | |
| | Cazenovia Creek | Chambers Creek, L. Ontario | -- | 10,000 | Yearling | 10,000 | |
| | Buffalo River Net Pens | Chambers Creek, L. Ontario | -- | 10,000 | Yearling | 10,000 | |
| | Chautauqua Creek | Chambers Creek, L. Ontario | -- | 40,000 | Yearling | 40,000 | |
| | Cattaraugus Creek | Chambers Creek, L. Ontario | -- | 90,000 | Yearling | 90,000 | |
| | Cattaraugus Creek | Skamania, L. Ontario | -- | 17,000 | Yearling | 17,000 | |
| | Buffalo River | Domestic | -- | 3,780 | Yearling | 3,780 | |
| | Erie Basin Marina | Domestic | -- | 940 | Yearling | 940 | |
| | | | | | | **276,720** | **Sub-Total** |
| | | | | | | **2,011,354** | **Grand Total** |

TABLE 6.2. Rainbow trout fin-clip summary for Lake Erie, 1999-2009.

| Year Stocked | Year Class | Michigan | New York | Ontario | Ohio | Pennsylvania |
|---|---|---|---|---|---|---|
| 1999 | 1998 | RP | AD-RP | RV; AD; AD-RV | - | - |
| 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 | | | | |

AD=adipose; RP= right pectoral; RV=right ventral; LP=left pectoral LV=left ventral

Table 6.3. Estimated harvest of rainbow/steelhead trout by open lake boat anglers in Lake Erie, 1999-2008.

| 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 | - | 31,793 |
| 2005 | 10,364 | 2,183 | 594 | N/A* | 19 | 13,160 |
| 2006 | 5,343 | 2,044 | 354 | N/A* | - | 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 |

* no creel data collected by OMNR in 2003, 2005-2009
** 2004 OMNR sport harvest data is July and August, central basin waters only.

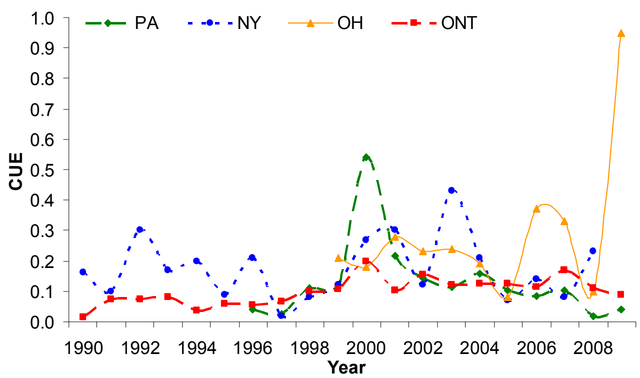


FIGURE 6.1: Targeted steelhead catch rates (fish/angler hour) in Lake Erie by open lake boat anglers in Ohio, Pennsylvania, New York and Ontario.

The Ontario Ministry of Natural Resources did not conduct open water angler surveys during 2009 that could provide measurable estimates of rainbow trout catch, effort, harvest and catch rates in open lake waters of Lake Erie. However, they collected angler diary reports that can detail trends over time by area of the lake. Angler diary reports from Ontario show that rod-hours for steelhead declined in the west central basin for the fourth consecutive year, and approached the long-term average (Figure 6.2). Rod hours for rainbow trout also declined in the east central (Figure 6.3) and east basin (Figure 6.4) of Ontario waters as well, and were also below the long-term mean values. Ontario diarist effort is dependent on the amount of angler participation and may not reflect trends in overall angler effort directed at steelhead

Catch rates for Ontario diarists in 2009, expressed as fish per rod-hour, were lower than 2008 values in the west central and east basins. Catch rates for 2009 were near the long-term mean in the west central, above the long-term mean in the east central and well below the long-term mean in the east basin.

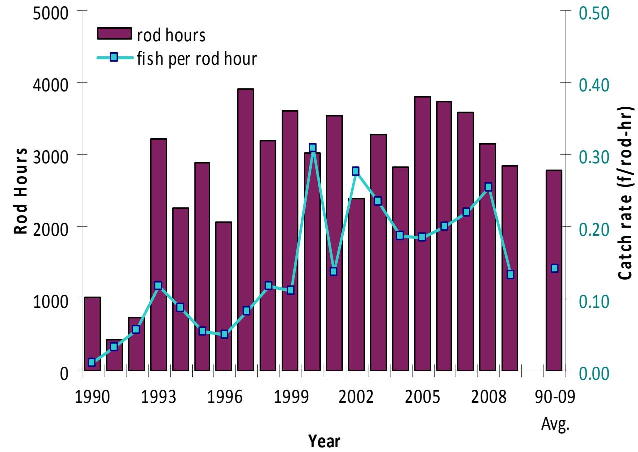


FIGURE 6.2: Targeted steelhead effort and catch rates in Lake Erie's west central basin as reported in angler diaries by open lake boat anglers in Ontario.

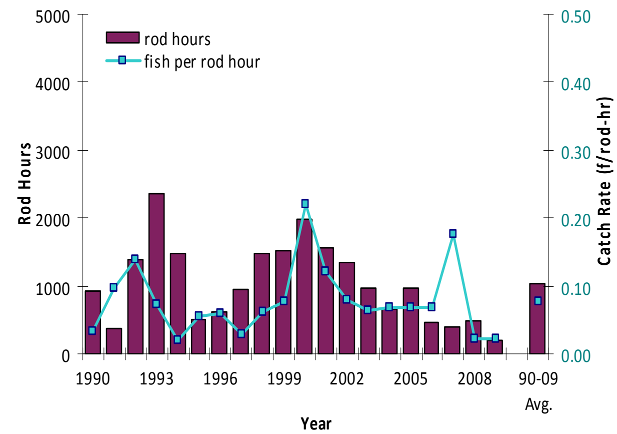


FIGURE 6.3: Targeted steelhead effort and catch rates in Lake Erie's east central basin as reported in angler diaries by open lake boat anglers in Ontario.

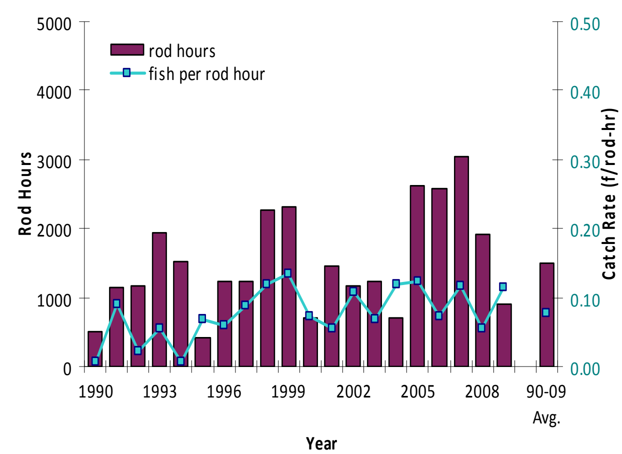


FIGURE 6.4: Targeted steelhead effort and catch rates in Lake Erie's eastern basin as reported in angler diaries by open lake boat anglers in Ontario.

**Tributary Creel Surveys**

The Lake Erie tributaries are the focal point of the steelhead fishery. Data on this segment of the sport fishery is fragmented, preventing a review of annual trends in targeted effort and catch rate.

An angler diary program maintained by the NYSDEC Lake Erie Fisheries Unit provides the best review of annual catch rates by tributary anglers through 2008. This data shows that steelhead catch rate by stream anglers in New York waters have steadily increased over the course of the diary program, and average 0.46 steelhead/angler hour. Catch rates peaked in 2006 at 0.81 steelhead/angler hour, and have remained well above average since then (Figure 6.5).

Ohio Division of Wildlife personnel completed the first of two consecutive years of creel surveys for the steelhead fishery on Ohio's Lake Erie tributaries and access points (Kayle 2009). Seventeen different streams and 89 locations were surveyed by two creel survey clerks during the period of late September, 2008, to early May, 2009. A total of 2,897 interviews of 3,838 anglers were completed during the survey period. Nearly all anglers interviewed (99.7%) were seeking steelhead. An estimated total of 361,423 angler hours were expended during the September-May survey period over all survey locations. The Grand River had the most angler effort (117,740 hours), while no angler effort was observed on Porter and Cahoon creeks. Overall steelhead catch rate during the time period was 0.387 fish per hour; with the harvested steelhead catch rate of 0.043 fish kept per hour and the released steelhead catch rate of 0.344 fish caught and released per hour.

An estimated 139,769 steelhead were captured in the study areas during the survey period, of which 124,286 (89%) were released. Release rates of legal-sized steelhead at 89% are comparable to those seen in Pennsylvania and New York tributary creel surveys during the 2000s (Figure 6.6). Average size of the 417 observed steelhead during the surveys was 625 mm. About 7% of steelhead observed by creel clerks in the surveys exhibited new or old sea lamprey wounds.

Demographic information collected during the creel surveys found that steelhead anglers came from 59 of Ohio's 88 counties and from 19 states and the province of Ontario to fish for steelhead in Ohio waters. Gear preferences for steelhead angling method were predominantly spinning (61%), followed by fly fishing (34%) and center pinning (4%). The majority of anglers (51%) stated that it was not important for them to keep the steelhead they caught; 24% stated it was only slightly important. Trip hours and expenditures were also calculated. Nearly all (97.7%) of the anglers recorded by sex in the survey were male, and the most frequent age for anglers (by decade) was the 40s. A total of 1,512 steelhead anglers were signed up for a more in-depth human dimensions survey of steelhead anglers through The Ohio State University School of Natural Resources. A second year of steelhead tributary creel surveys is planned for September 2009 through May 2010.

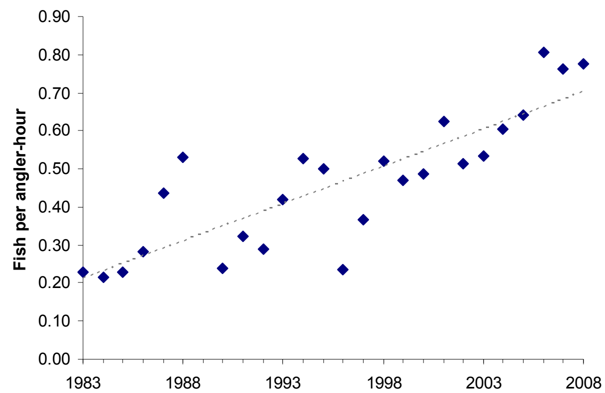


FIGURE 6.5: Targeted steelhead catch rates in fish per angler hour in Lake Erie tributaries by New York angler diary cooperators, 1987-2008.

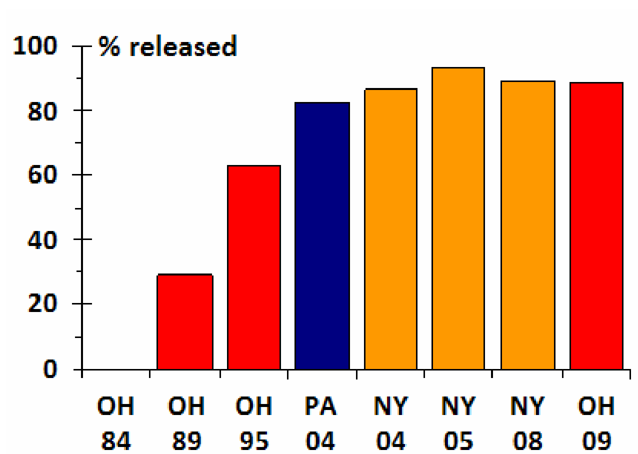


FIGURE 6.6: Legal release rates observed in Lake Erie steelhead tributary creel surveys.

**Otolith Microchemistry Research**

An update of the steelhead otolith research has been provided by Dr. Jeff Miner and Dr. John Farver of Bowling Green State University (BGSU) for this report (personal communication). The goal of this investigation is to use otolith chemistry to identify hatchery-specific chemical signatures for steelhead smolts from all New York, Pennsylvania, Ohio, and Michigan hatcheries providing smolts to Lake Erie. Standard signatures were developed by assessing juvenile hatchery fish collected in 2008 and 2009; these signatures are being further refined by analyzing additional hatchery fish before the 2010 stocking. Adult spawning fish have been obtained in various tributaries to Lake Erie for otolith extraction and chemical analysis. After the chemical signature is obtained from these structures, spatial statistical analysis will be applied to differentiate the stocks.

An investigation of the steelhead returns to Conneaut Creek has been ongoing. In spring and fall 2009, Pennsylvania Fish and Boat Commission and Ohio Division of Wildlife fisheries staff assisted BGSU researchers with the collection of returning adult steelhead in the Pennsylvania and Ohio waters of Conneaut Creek using electro-fishing gear.

Both agencies stock about 75,000 smolts each year, but Pennsylvania stocks fish about 35 miles upstream from the river mouth where Ohio stocks their fish. Preliminary results show that in both spring and fall collections, about 50% of the fish collected at the mouth of the river were Ohio fish (others were likely Pennsylvania fish, but this is more difficult to determine). In the Pennsylvania waters of Conneaut Creek, only one fish of 100 sampled (spring and fall combined) was of Ohio origin. These results suggest that spawning steelhead show good specificity to the stocking location and that stocking upstream in Pennsylvania is a good management decision for Pennsylvania anglers.

Additional samples of spawning steelhead in tributaries across Lake Erie (U.S. and Ontario waters) were collected in fall 2009 and will occur again in spring 2010 with help from state and provincial fisheries biologists. These collections will provide more information on steelhead stocking site fidelity, and the contribution of natural reproduction.

In an attempt to identify and quantify natural reproduction of rainbow trout in Lake Erie, summer 2009 resident steelhead (<200 mm TL) were collected from Cattaraugus and Chautauqua Creeks in NY to compare the proportions growing in streams that had converted the calcium carbonate matrix in their otoliths from an aragonite form to a vaterite form. While all steelhead start growing otoliths with aragonite, some will switch to growing at least part of their otolith as vaterite which they cannot revert. Stress is thought to be the reason for this shift. The proportion of steelhead in New York hatcheries that had undergone this shift were compared with the proportion found in stream residents. The results show a higher proportion of hatchery fish had vaterite in their otolith than did stream resident fish, suggesting that increased proportions of vaterite indicate possible hatchery origin. These results will be confirmed through increased sampling efforts. Additionally, BGSU researchers hope to determine if the proportion of stocked fish returning with vaterite in their otoliths is lower than the proportion of that year class when it was stocked thereby suggesting differential mortality in the lake.

Sea lamprey wounding rate and length frequency data has been collected in conjunction with some of these collections. Steelhead collected in the New York tributaries exhibited an 8% wounding rate for fresh wounds (A1-A3) and 36% wounding rate overall. Fish collected in Pennsylvania waters of Conneaut Creek on 8 December 2009 had no fresh wounds but showed an overall wounding rate of 14%. The task group would like to pursue a continued interest and effort in developing a sea lamprey wounding rate index time series for steelhead.

**References**

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Miner, Jeffery and John Farver. Department of Biological Sciences. Pers. Comm. Aquatic Ecology & Fisheries Laboratory. Bowling Green State University. Bowling Green, OH.

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## Charge 7: Prepare the Lake Erie Cisco Management Plan. Report on the status of Cisco in Lake Erie and potential for re-introduction and/or recovery.

*Elizabeth Trometer (USFWS), Tom MacDougall (OMNR) and Kurt Oldenburg (OMNR)*

Cisco (formerly lake herring) (*Coregonus artedii*) is indigenous to the Great Lakes and historically supported one of the most productive fisheries in Lake Erie (Scott and Crossman 1973, Trautman 1981). Cisco is considered extirpated in Lake Erie, although commercial fishermen report catches periodically (Table 7.1, Figure 7.1). Their demise was mainly through overfishing, although habitat degradation and competition likely contributed to recruitment failure (Greeley 1929, Hartman 1973, Scott and Crossman 1973). Siltation of spawning shoals, low dissolved oxygen episodes in the lake, and chemical pollution are a few factors contributing to habitat degradation (Hartman 1973). The cisco collapse also coincided with the introduction of both rainbow smelt (*Osmerus mordax*) and alewife (*Alosa psuedoharengus*), and the expansion of these exotic species in the 1950s may have prevented any recovery of cisco through competition and predation. Selgeby et al. (1978) documented consumption of cisco eggs by rainbow smelt. Evans and Loftus (1987) summarized two studies in which smelt consumed large numbers of cisco in the larval stage.

Numerous investigators have shown that alewife and smelt have negative effects on coregonid populations in the north-temperate lakes (Ryan et al. 1999). When alewife and rainbow smelt stocks are depressed, it creates an opportunity for coregonids to have stronger year classes. There is some evidence to indicate that this has occurred for lake whitefish (Oldenburg et al. 2007). Cisco should also be favored by these conditions. Rainbow smelt abundance declined sharply in the 1990's and continues to remain relatively low (Ryan et al. 1999 and FTG 2008). Alewife have never been very abundant in Lake Erie due to overwinter temperatures that frequently prove lethal (Ryan et al. 1999).

With the recent recovery of other native coldwater species (i.e. lake whitefish and burbot), and the relatively low abundance of rainbow smelt compared to the past, there has been an opportunity for cisco to recover in Lake Erie. Commercial fishermen have been reporting cisco since the 1990s, although these reports are rare. Recent reports and collections are listed in Table 7.1 with locations shown in Figure 7.1. There were no reports of cisco from either the commercial fishery or agency assessments in 2009.

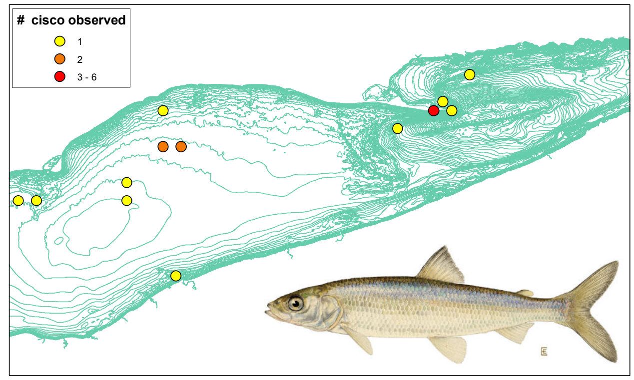


FIGURE 7.1. Spatial distribution of some recent (1996-2008) cisco observations. All reports are from the Ontario commercial gillnet and trawl fisheries with the exception of one occurrence in the ODNR index gillnet program near Fairport, OH. Total number of sightings is higher than shown as observation without location information have been excluded.

TABLE 7.1. Sampling details from a selection of cisco captured during commercial and fishing efforts, 1996-2008.

| Date caught | TL (mm) | FL (mm) | Weight (g) | Maturity | Sex | Age |
|---|---|---|---|---|---|---|
| 24-Apr-96 | 371 | 336 | 295 | Mature | F | 8 |
| Summer 1999 | 156 | 140 | 289 | Immature | F | 1+ |
| 10-Aug-99 | 153 | 137 | 275 | maturing | F | 1+ |
| 15-Aug-99 | 158 | 142 | 282 | Immature | M | 1+ |
| 24-Aug-99 | 211 | | | maturing | F | 2+ |
| 21-Sep-99 | 140 | 126 | 214 | maturing | M | 1+ |
| 21-Sep-99 | | 139 | 315 | Immature | F | 1+ |
| 06-Sep-02 | 315 | 284 | 239 | mature | F | |
| 06-Sep-02 | 170 | 153 | 135 | Mature | F | |
| 9-Jul-03 | 298 | 266 | 275 | u/k | M | 2+ |
| 9-Jul-03 | 222 | 203 | 103 | u/k | M | 1+ |
| 16-Jul-03 | 301 | 271 | 248 | u/k | UNK | UNK |
| 27-Aug-03 | 278 | | 183 | Immature | F | UNK |
| 22-Sep-04 | | | | | | |
| 17-Jun-05 | | | | Mature | F | 6 |
| 5-Aug-05 | | | | Mature | F | 6 |
| 8-May-07 | 389 | 352 | 427 | Mature | F | 7 |
| 15-May-07 | 333 | 300 | 295 | Mature | F | 7 |
| 27-Mar-08 | 464 | 420 | 874 | Mature | M | 7 |
| 27-Mar-08 | 413 | 373 | 537 | Mature | F | 9 |

### Rehabilitation Efforts

In recent years, there has been several management actions directed at the objective of re-establishing cisco in Lake Erie. A workshop sponsored by the Great Lakes Restoration Act was held in July 2003 reviewing the status and impediments for cisco recovery in the Great Lakes (Fitzsimons and O'Gorman 2004). The goal of the workshop was to help managers and interested researchers develop actions to assess cisco stocks and develop research with the goal of recovering remnant stocks. The loss of stocks was identified by the workshop participants as the most important impediment facing Great Lakes restoration efforts. Consequently, restoration stocking was identified as necessary, but only where it will not affect an existing remnant stock. Another cisco workshop was held in April 2006 to discuss a model developed for Lake Superior and implications for restoration in the Lower Great Lakes.

To determine if a remnant cisco stock still exists in Lake Erie, nine cisco specimens gathered over the past several years from Lake Erie were shipped to the USGS Leetown Science Center, Northern Appalachian Research Laboratory for genetic analysis using microsatellite markers. Recent and museum specimen cisco from Lake Erie and other Great Lakes, including archived Lake Erie specimens from 1955-65, were compared to determine if the Lake Erie specimens are genetically distinct from other Great Lakes stocks (i.e. remnant population) or are strays from other populations. The results of this research indicate that the recently caught cisco are genetically most similar to Lake Erie specimens from 1950s and 1960s, suggesting that a remnant of the original Lake Erie stock may exist (Rocky Ward, USGS Northern Appalachian Research Laboratory, Wellsboro, PA, unpublished data). The extant surviving cisco that is most similar to the Lake Erie remnant is from Lake Huron. The implications of these findings pose difficult management decisions for restoration efforts involving stocking with cisco from other sources of broodstock. However, current cisco stocks may not be large enough to re-establish themselves as a significant forage fish in Lake Erie.

In recognizing that stocking is one possible outcome of the management decision process, and realizing that a long lead time is necessary between the decision to stock and the first stocking event, proactive disease testing of potential broodstock from viable sources has begun. Positive results for BKD from Lake Superior bloaters in 2005 have eliminated this lake as a potential source of cisco broodstock gametes. Ciscoes collected from eastern Lake Ontario from November 2006 through 2009 were screened for various diseases by the NYSDEC Fish Disease Control Unit. Tests for VHS, IHN, IPN, BKD, heterosporis, and furunculosis were all negative for these fish. Negative results are required for three consecutive years before the collection of broodstock or gametes can be considered. There is a need to investigate the possibility of using Lake Huron or Lake Michigan stocks as a source of broodstock.

**Lake Erie Cisco Management Plan**

The Lake Erie Coldwater Task Group was charged with preparing a Lake Erie cisco management plan at the Lake Erie Committee Annual meeting in March of 2007. Preparation of the management plan began in fall 2007. An outline was developed and approved by the members of the Coldwater Task Group in December 2007. A first draft was completed in January 2009 and circulated to the Coldwater Task Group members for review. Those comments are in the process of being addressed.

Some issues that have arisen in the preparation of this plan:

- Do recently observed specimens represent a remnant stock?
- What is the population trend of cisco currently inhabiting Lake Erie? (There have been no directed surveys for cisco in Lake Erie. Occurrences in fishery catches are very likely unrecognized or underreported)
- Do Lake Erie cisco face different constraints than other coregonids which have shown evidence of recovery (e.g. whitefish; 1990s)
- Do we stock? Should we stock on top of a possible remnant population? If so, what is the best broodstock?
- What are the genetic implications of stocking on a remnant population? Is there currently a genetic bottleneck?

To address some of these issues the CWTG members are conducting a synthesis of current fishery assessment programs around the lake and overlaying it with historic information on cisco distribution. The purpose is to determine if current assessment programs are adequate (spatially, temporally and gear specific) to assess cisco status. A final draft of the plan will be completed by late spring 2010.

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