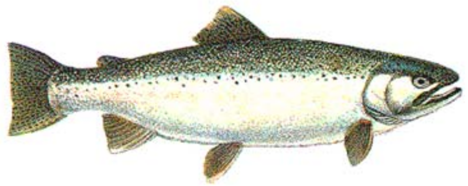

REPORT OF THE LAKE ERIE COLDWATER TASK GROUP

17 March 2008

Members:

James Markham	New York Department of Environmental Conservation (Co-Chair)
Larry Witzel	Ontario Ministry of Natural Resources (Co-Chair)
Andy Cook	Ontario Ministry of Natural Resources
John Fitzsimons	Department of Fisheries and Oceans, Canada
Mike Fodale	United States Fish and Wildlife Service
Jim Francis	Michigan Department of Natural Resources
Kevin Kayle	Ohio Division of Wildlife
Tom MacDougall	Ontario Ministry of Natural Resources
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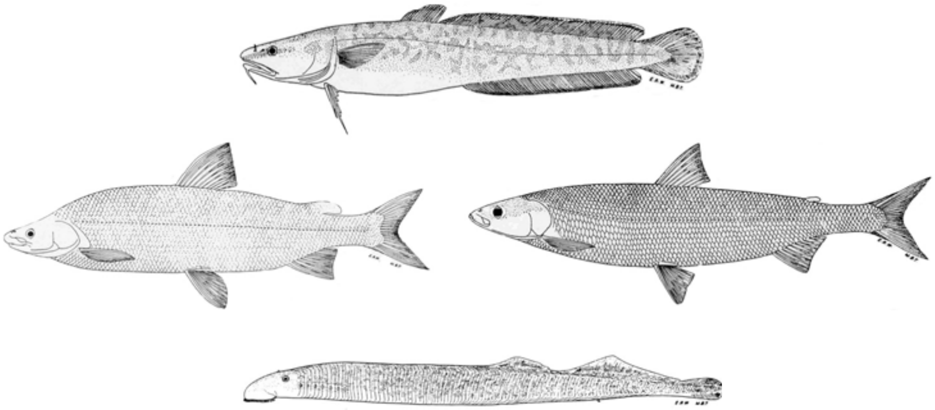
Elizabeth Trometer	United States Fish and Wildlife Service

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. 2008. Report of the Lake Erie Coldwater Task Group, March 2008. Presented to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. Ann Arbor, Michigan, USA.

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2007 – 2008 Coldwater Task Group Charges

Charge 1: Coordinate annual standardized lake trout assessment among all eastern basin agencies and report upon the status of lake trout rehabilitation.

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

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

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.

Charge 5: Maintain an annual interagency electronic database of Lake Erie salmonid stocking and current projections for the STC, GLFC and Lake Erie agency data depositories.

Charge 6: Report on the status of rainbow trout in Lake Erie, including stocking numbers, strains being stocked, academic and resource agency research interests, and related population parameters, including growth, diet and exploitation.

Charge 7: Prepare Lake Erie Herring Management Plan. Review ecology and history of this species and assess potential for recovery. Prepare an information paper for LEC recommending numbers needed for stocking for hatchery rearing considerations.

Charge 8: Revise Lake Trout Management Plan.

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 revision of the Lake Trout Management Plan is a part of the current charges to the Task Group.

The Lake Trout Task Group developed 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 verbally to the LEC at the annual meeting, held this year on 17 March 2008 in Niagara Falls, 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.

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COLDWATER TASK GROUP
EXECUTIVE SUMMARY REPORT
MARCH 2008

Lake Erie Committee

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

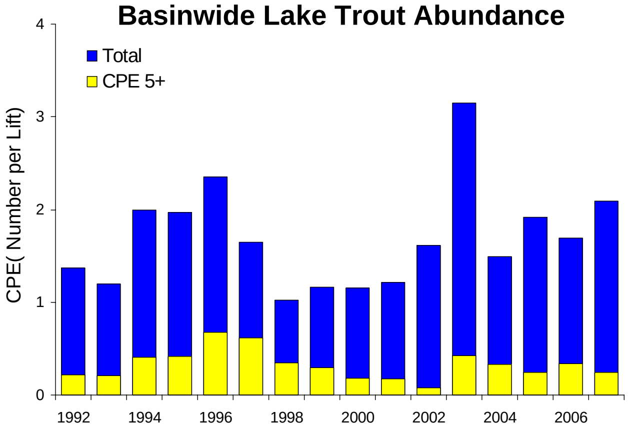
Introduction

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.

Eight charges were addressed by the CWTG during 2007-2008: (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; (7) Development of a Lake Herring management Plan and (8) Completion of a revision of the Lake Trout Management Plan.

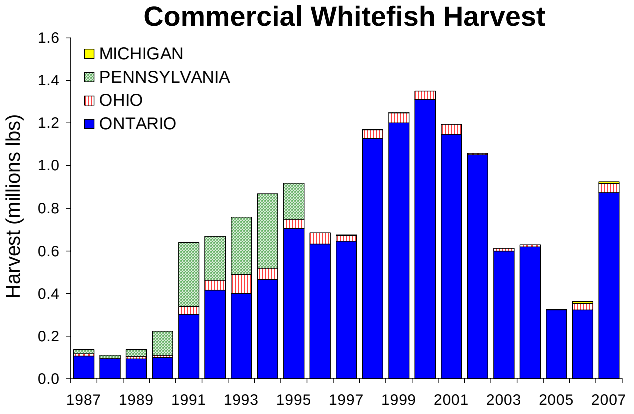
Lake Trout

A total of 468 lake trout were collected in 130 lifts across the eastern basin of Lake Erie in 2007. Young cohorts (ages 3-5) dominated catches with lake trout ages 8 and older only sporadically caught. Basin-wide abundance continues to slowly increase, but the abundance of adult lake trout age 5 and older remains well below average. The abundance of mature, repeat spawning females is at one fourth of the target level. Returns of Klondike strain lake trout remain strong through age-4, despite low stocking amounts. Klondikes are also exhibiting lower lengths- and weights-at-age compared to lean lake trout strains.


Basinwide Lake Trout Abundance

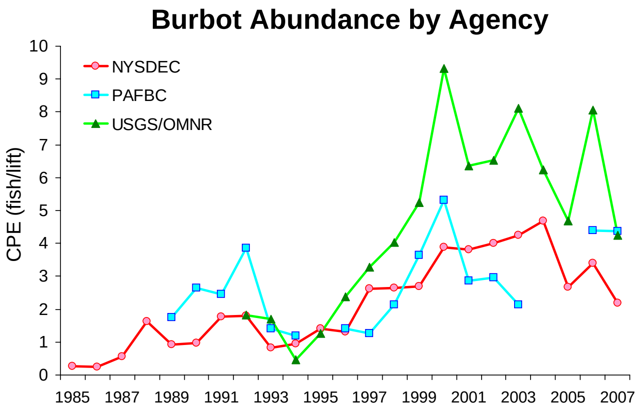
Whitefish

The total harvest of lake whitefish in 2007 was 925,834 pounds. The 2007 whitefish harvest was taken mostly in Ontario (94%), with Ohio (4%) and Michigan (1%) and trace harvest by Pennsylvania accounting for the remainder. A large proportion of Ontario's whitefish harvest (40%) was from gill nets targeting walleye and white bass. Ohio and Michigan whitefish harvest was from trap nets primarily during late fall. Fishery and survey catch rates were among the highest recorded from some sources. Four-year-old whitefish dominated fishery and survey catches across the lake in 2007. In addition to the dominant 2003 cohort, the 2001 year class and older fish were represented in fishery harvest. In assessment surveys, the 2005 cohort and to a lesser extent, the 2004 year class, were also present. Whitefish caught in 2007 surveys consisted of ages up to 20. In 2008, 5-year-old whitefish are expected to dominate the harvest, with nominal recruitment from the 2004 and 2005 year classes.


Commercial Whitefish Harvest

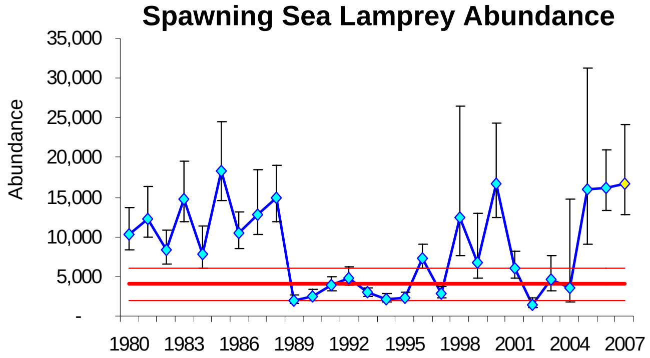
Burbot

Total commercial harvest of burbot in Lake Erie during 2007 was 5,198 pounds, a slight decrease from 2006, and the second lowest harvest observed since 1990. Abundance and biomass of burbot as determined from annual coldwater gillnet assessments increased from about 1993 through 2000 in all jurisdictions. Burbot abundance and biomass declined slightly after peaking in 2000 in Pennsylvania and Ontario and in 2004 in New York. Increasing mean age since 1998, and dramatically decreased age-4 abundance after 2001 in Canadian waters of the eastern basin, indicates an aging burbot population suffering from poor recruitment. Round gobies have replaced rainbow smelt as dominant burbot prey item in four of the last five years.


Burbot Abundance by Agency

Sea Lamprey

A1-A3 wounding rates on lake trout >21" was 14.9 wounds/100 fish in 2007, well above the target level of 5 wounds/100 fish. Wounding rates have been above target for 11 of the past 12 years. Large lake trout >25 inches continue to receive the highest percentage of the fresh wounds. A4 wounding declined to 48.2 wounds/100 fish, but is still the third highest A4 wounding rate in the 23-year time series. The estimated number of spawning-phase sea lampreys increased to 16,664 in 2007, which is over 4 times the target level. Control efforts in 2007 included lampricide treatment in Big Otter Creek (ON) and Cattaraugus Creek (NY) and assessments were conducted in 5 U.S. tributaries to rank them for possible treatment during 2008. A two year experiment of back-to-back lampricide treatments in the nine major sea lamprey producing streams will begin in 2008 to reduce the number of parasitic sea lampreys in Lake Erie to target levels.



Lake Erie Salmonid Stocking

A total of 2,140,491 salmonids were stocked in Lake Erie in 2007. This was a 4.6% decline in the number of yearling salmonids stocked compared to 2006, and 7% lower than the long-term average from 1989-2006. By species, there were 137,637 lake trout stocked New York waters; 65,615 brown trout stocked in New York and Pennsylvania waters, and a total of 1,937,239 steelhead/rainbow trout stocked by all five jurisdictions.

Steelhead

All agencies stocked yearling steelhead smolts in 2007. The vast majority (95%) of the steelhead were stocked in PA (1,222,996), OH (453,413) and NY (272,630) waters. Overall steelhead stocking numbers (1.937 million in 2007) were slightly above the long-term average of 1.795 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 25,685, summed for all reporting agencies. This was a substantial increase over the 2006 harvest estimate of 7,741, but does not approach the estimated harvest of over 123,000 by all agencies in 2002. Open lake angler catch rates, where surveyed, increased in 2007 compared to 2006. Catch rates for Ohio anglers seeking steelhead were as high as 0.33 fish/hr for private boaters and 0.29 fish/hr for charter boaters.

Steelhead diets were assessed again during the summer in Ohio's central basin. As in previous years, *Bythotrephes* was found most often in diets, but by dry weight analysis, fish (emerald shiners, rainbow smelt and gizzard shad) were the most important items of caloric value. A total of 16 different diet items were present in steelhead diets.

Steelhead catch-at-age data and catch curves were used to generate annual estimates of total mortality and survival. These rate function estimates were then applied to annual stocking numbers and estimates of natural reproduction to build an initial population model. Cursory estimates using fixed survival and mortality rates puts the adult Lake Erie steelhead population at a median value of about 800,000 fish with a range of 0.3-2.8 million adult fish.

Lake Herring

Lake herring are considered extirpated in Lake Erie, although commercial fishermen report them periodically. Two lake herring females (age 7) were caught in commercial nets in the eastern basin in May 2007. Genetic testing of recent catches found them to be most related to the historic Lake Erie stock and then to current Lake Huron stock. Disease testing of eastern Lake Ontario lake herring, a primary candidate source for stocking in Lake Erie, was negative for 2006 and 2007 samples; however, one more year of testing is needed. Preparation of a lake herring management plan began in fall 2007 with the goal of rehabilitating lake herring in Lake Erie. The final draft on the plan is expected to be completed in fall 2008.

Lake Trout Management Plan

A revised Lake Erie lake trout management plan, titled "A Strategic Plan for the Rehabilitation of Lake Trout in Lake Erie, 2008-2020", is completed. The plan covers the historical background of lake trout restoration in Lake Erie, current status of stocks, new goals and objectives, management strategies to achieve these new goals, and impediments to lake trout restoration. The document also outlines assessment and research needs by lake jurisdictions as well as the agency roles and responsibilities. The new goals defined in the plan to increase and maintain overall lake trout abundance recommend a combination of better sea lamprey control, increased stocking of at least 200,000 yearlings annually, and identification of potential lake trout spawning areas. Upon final approval by the LEC, the plan will be posted on the GLFC Coldwater Task Group's web page at: http://www.glfc.org/lakecom/lec/CWTG.htm . Copies will also be available upon request from an LEC, Standing Technical Committee (STC), or CWTG representative.

Charge 1: Coordinate annual standardized lake trout assessments among all eastern basin agencies and report upon 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 eastern 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 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. Areas A1 and A2 have been the most consistently sampled areas during the course of the survey 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.

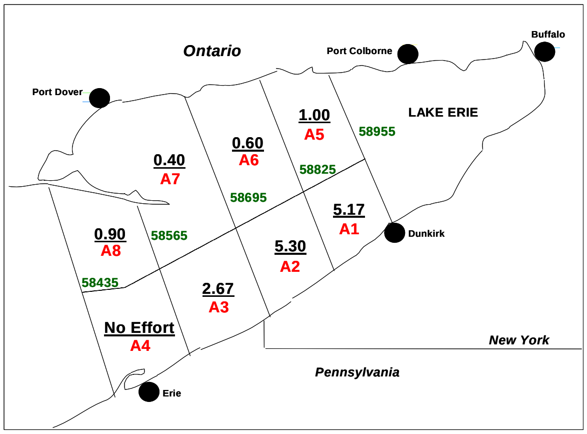


FIGURE 1.1. Standard sampling areas (A1-A8) used for assessment of lake trout in the eastern basin of Lake Erie, 2007, and catch per effort (number/lift) of lake trout in each area. Five digit numbers near the angled vertical lines that represent sample area grid borders are Loran TDs.

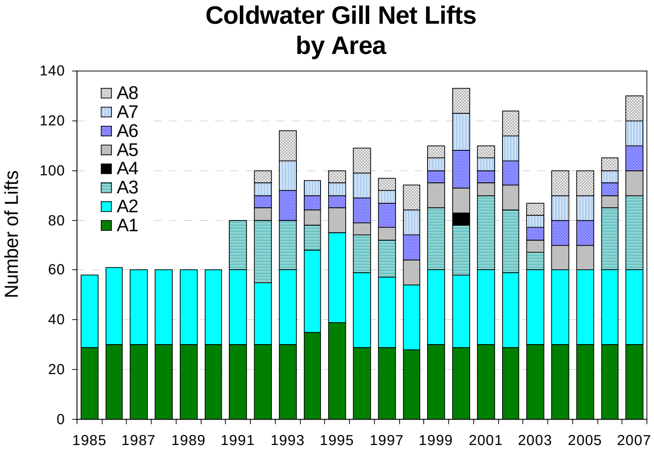


FIGURE 1.2. Number of coldwater assessment gill net lifts by area in the eastern basin of Lake Erie, 1985-2007.

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. Gangs are set overnight, on 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) 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 to be set along the contour at which 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 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 2007 by the combined agencies was 130 unbiased standard lake trout assessment lifts in the eastern basin of Lake Erie (Figure 1.2). This included 60 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 2007.

AGE	SEX	NUMBER	MEAN LENGTH (mm TL)	MEAN WEIGHT (g)	PERCENT MATURE
1	Male	1	268	155	0
	Female	3	253	148	0
2	Male	1	404	590	0
	Female	2	387	580	0
4	Male	52	626	2950	98
	Female	17	624	2907	47
5	Male	27	681	3814	100
	Female	51	691	4086	100
6	Male	24	717	4550	100
	Female	12	724	4703	100
7	Male	11	723	4629	100
	Female	10	749	5063	100
8	Male	2	756	5803	100
	Female	1	751	6437	---
9	Male	1	835	6695	100
	Female	1	745	6575	100
11	Male	0	---	---	---
	Female	1	830	7135	100
14	Male	1	892	8093	100
	Female	1	788	6210	100
16	Male	0	---	---	---
	Female	3	789	6570	100
18	Male	0	---	---	---
	Female	1	813	6390	100
19	Male	0	---	---	---
	Female	1	822	7200	100
20	Male	0	---	---	---
	Female	1	749	7397	100
21	Male	0	---	---	---
	Female	1	754	6455	100
23	Male	0	---	---	---
	Female	1	856	8160	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.* Fingers Lakes (FL), Superior (SUP, Lewis Lake (LL) strains). They were first stocked in Lake Erie in 2004. In some analysis, 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 2007 (Figure 1.1), collecting a total of 468 lake trout in 130 lifts. No effort was expended in area A4 due to the lack of coldwater habitat, and elimination of this sampling area is being recommended by the CWTG. Areas A1 and A2 again produced the highest catch per unit effort (CPE) values (Figure 1.1), coinciding with the areas in which stocking of yearling lake trout occurs. Comparatively, lake trout catches in ON waters (A5-A8), where stocking had not occurred until 2006, were over 5 times lower. Catches in area A3, which is adjacent to the stocked NY waters, were intermediate. The large disparity between lake trout catches in the east basin indicates a lack of movement away from the stocking area.

Seventeen age-classes of lake trout ranging from age 1 to 23 were represented in the catch of known-aged fish (Tables 1.1 and 1.2). Similar to the past six years, young cohorts (ages 3-5) were the most abundant, representing 84% of the total catch in standard assessment nets (mesh sizes 38-152 mm) (Figure 1.3). Cohort abundance continues to decline

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 2007.

AGE	SEX	NUMBER	MEAN LENGTH (inches TL)	MEAN WEIGHT (pounds)	PERCENT MATURE
1	Male	2	241	133	0
	Female	0	---	---	---
3	Male	107	499	1435	59
	Female	39	494	1374	0
4	Male	43	571	2179	86
	Female	12	572	2192	58

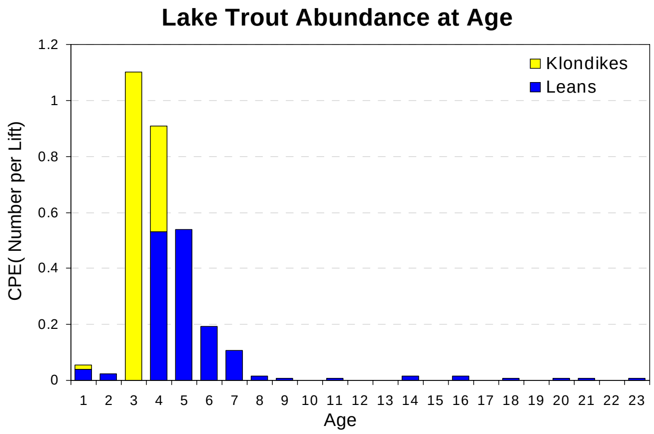


FIGURE 1.3. Relative abundance (number fish/lift) at age of Lean strain and Klondike strain lake trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, August 2007.

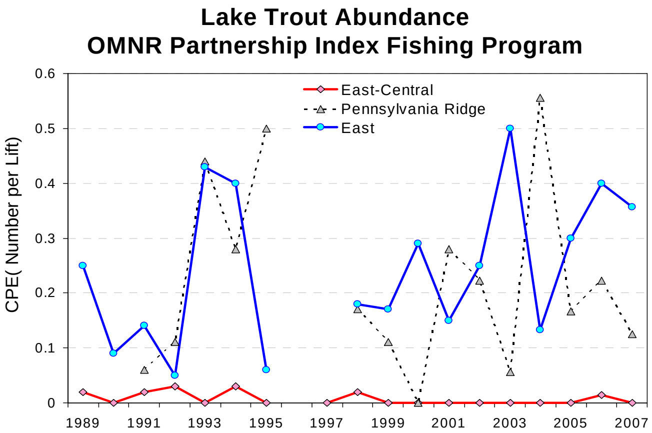


FIGURE 1.5. Lake trout CPE (number fish/lift) by basin from the OMNR Partnership Index Fishing Program, 1989-2007. Includes canned (suspended) and bottom gill net sets excluding thermocline sets.

rapidly after age 5, and lake trout ages 8 and older were only sporadically caught. Similar to the past two years, age 10 and older lake trout comprised only 2.6% of the overall catch in 2007. One age-23 lake trout was netted in sample area A1, representing the oldest known lake trout ever caught in the assessment surveys.

The overall trend in area-weighted mean CPE's of lake trout caught in standard nets in the eastern basin increased slightly in 2007 to 2.09 fish/lift (Figure 1.4). Basin-wide abundance has been slowly but steadily increasing since 1998. Lake trout abundance increased in both PA and ON surveys in 2007 but decreased slightly in NY waters. The abundance of lake trout in the 2007 OMNR Partnership Index Fishing Program index was slightly lower in all areas but comparable to 2006 results (Figure 1.5). Variability of abundance estimates in this survey is higher due to lower sample sizes, especially in the Pennsylvania Ridge, and to a broader spatial sampling that may have extended outside the preferred habitat of lake trout. The east basin lake trout index was high for the time series and comparable to abundances found in the jurisdictional coldwater assessment surveys in the Ontario waters of Lake Erie.

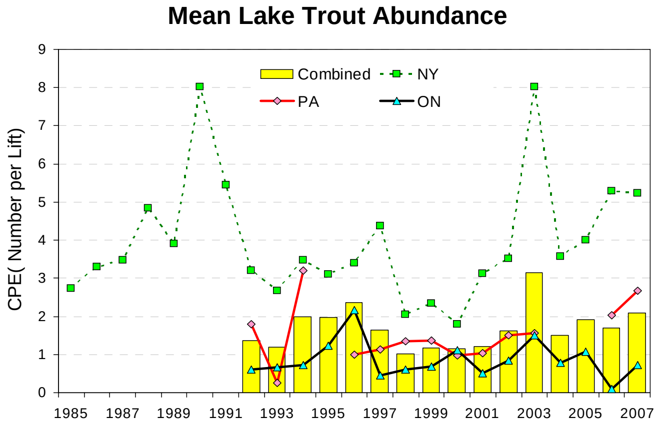


FIGURE 1.4. Mean CPE (number fish/lift) by jurisdiction and combined (weighted by area) for lake trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, 1985-2007.

The relative abundance of adult (age-5 and older) lake trout caught in standard assessment gill nets was initially monitored to gauge the response of the lake trout population to sea lamprey treatments initiated in 1986. The index now serves as an important indicator of the size of the lake trout spawning stock in Lake Erie. A significant ($P < 0.05$) drop in abundance of lake trout was observed in 1998 following a five year (1992-1996) period of steady growth, which corresponded to a decrease in lake trout stocking numbers that began in 1992 and increased abundances of sea lamprey (see Charge 4). Overall adult abundance has rebounded after reaching a time-series low in 2002 but remains well below the peak levels observed in 1996. The CPE (weighted by area) for age-5 and older lake trout declined to 0.24 fish/lift in 2007, remaining below the series average of 0.33 fish/lift for six of the past nine years (Figure 1.6).

The relative abundance of mature females >4500g, which represents repeat-spawning females ages 6 and older, decreased in 2007 to 0.07 fish/lift and below the time-series average of 0.08 fish/lift (Figure 1.7). It remains one half of the peak abundance that occurred in 1997 and 2003. Overall trends in this index indicate the instability of the lake trout spawning stock and may indicate the main

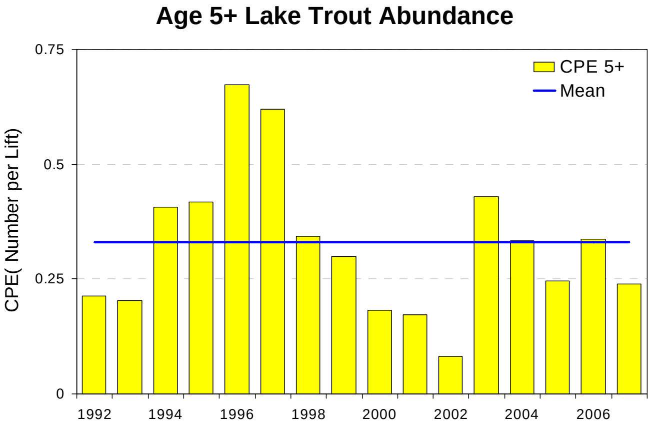


FIGURE 1.6. Relative abundance (number fish/lift) weighted by area of age 5 and older lake trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, August 1992-2007.

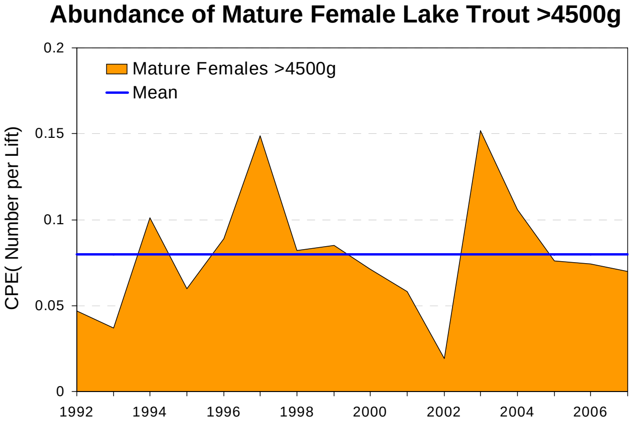


FIGURE 1.7. Relative abundance (number fish/lift) weighted by area of mature female lake trout greater than 4500g sampled in standard assessment gill nets in the eastern basin of Lake Erie, August 1992-2007.

reason that natural reproduction has yet to be documented in Lake Erie.

Recruitment

The relative abundance index of ages 1-3 was 1.18 fish/lift (Figure 1.8). This was above the series average (0.70 fish/lift) for the second consecutive year. The high abundance was primarily due to the excellent recruitment from the 2005 stocking (age-3) of Klondike strain lake trout. Despite the high single-year stocking of yearling (age 1) lake trout in 2007 (see Charge 5), only seven of these fish were caught during assessment gill net surveys. Three age-2 lake trout were caught in NY assessment nets. These fish were the first lake trout stocked in Ontario waters.

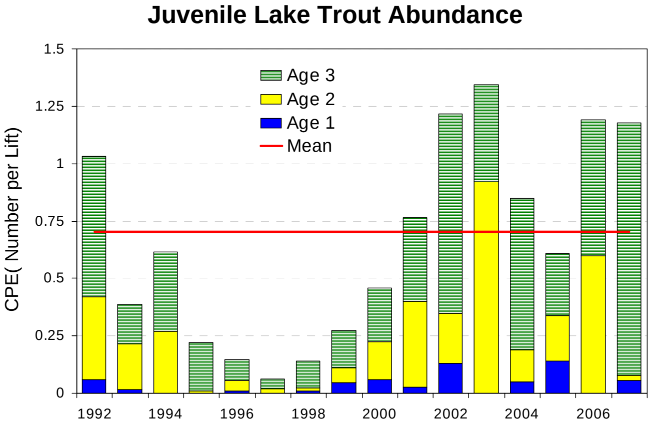


FIGURE 1.8. Relative abundance (number fish/lift) of juvenile (ages 1-3) lake trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, August 1992-2007.

The proportion of stocked lake trout surviving to age 2 provides an index of recruitment and is calculated by dividing age-2 CPE from standardized gill nets 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 recruitment 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 1.9). The index began to increase in 1999 as survival of stocked lake trout increased, likely due to a combination of different stocking methods, increased lake trout size at stocking, and a decreased adult lake trout population. The age-2 lake trout recruitment index increased to 1.11 in 2006, the highest value in the time-series, due to the excellent recruitment of Klondike strain lake trout stocked in 2005. The 2007 age-2 recruitment index dropped to 0.03, the lowest index since 1998.

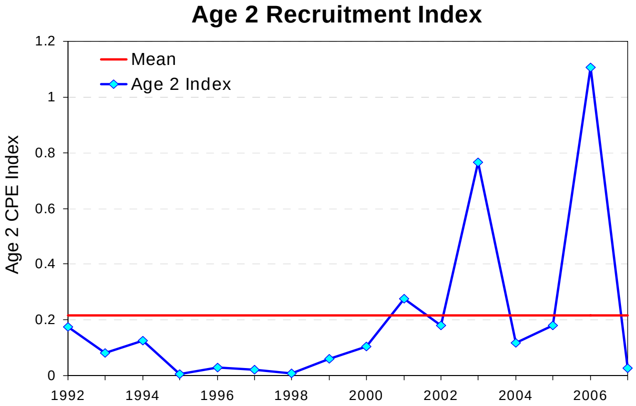


FIGURE 1.9. Index of recruitment for age 2 lake trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, August 1992-2007. The index is equal to the number of age 2 fish caught per lift for every 100,000 yearling lake trout stocked.

Strains

Eight different lake trout strains were found in the 431 fish caught with hatchery-implanted coded-wire tags (CWTs) or fin-clips (Table 1.3). The majority of the lake trout were Finger Lakes (FL) strain, which has been the most numerous stocked strain over the last eight years, and Klondike (KL) strain lake trout. Klondikes have only been stocked in small amounts in 2004, 2005, and 2007 but have become one of the most abundant lake trout strains caught in the assessment surveys. 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. Lewis Lake (LL), Lake Ontario (LO), Lake Erie (LE), Slate Island (SI), and Traverse Island (TI) strains all comprised minor contributions to the Lake Erie stock. The FL strain continues to show the most consistent returns, especially at older ages. With the exception of two LO strain fish, which are FLxSUP crosses, all lake trout older than age 10 were FL strain fish.

Returns of the new Klondike (KL) strain of lake trout have been excellent through age 4. Returns of 31,600 yearlings stocked in 2004 (2003 year-class) were almost five times higher at age 3 than a paired stocking of 80,000 FL strain lean lake trout when adjusted for stocking rates (Table 1.4a). Return rates declined at age 4 but still remained two times higher than FL strain lake trout. 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 1.9) 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). Returns rates at age 3 were similarly high (2.4 times KL strain; 11.3 times FL strain).

TABLE 1.3. Number of lake trout per stocking strain by age collected in gill nets from the eastern basin of Lake Erie, August 2007. Stocking strain codes are: FL = Finger Lakes, LE = Lake Erie, LL = Lewis Lake, LO = Lake Ontario, SUP = Superior, KL = Klondike, SI = Slate Island, TI = Traverse Island. Shaded cells indicate ages strain was stocked.

AGE	FL	LE	LL	LO	SUP	KL	SI	TI
1	3					2		1
2							3	
3						146		
4	70					55		
5	78							
6	25				10			
7	14				8			
8			1		2			
9					2			
10								
11	1							
12								
13								
14	1	1						
15								
16	1			2				
17								
18	1							
19	1							
20	1							
21	1							
22								
23	1							
TOTAL	**198**	**1**	**1**	**2**	**22**	**203**	**3**	**1**

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 2004-2007.

AGE	STRAIN	NUMBER STOCKED	NUMBER RETURNS	RETURN RATES (per 100,000 stocked)	RATIO FL:KL
1	FL	80,000	4	5.0	1.6:1
	KL	31,600	1	3.2	
2	FL	80,000	7	8.8	1:4.0
	KL	31,600	11	34.8	
3	FL	80,000	19	23.8	1:4.7
	KL	31,600	35	110.8	
4	FL	80,000	70	87.5	1:2
	KL	31,600	55	174.1	

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 2005-2007.

AGE	STRAIN	NUMBER STOCKED	NUMBER RETURNS	RETURN RATES (per 100,000 stocked)
1	KL	54,200	14	25.8
2	KL	54,200	61	112.5
3	KL	54,200	146	269.4

Survival

Cohort analysis estimates of annual survival (S) were calculated by strain and year class using a three-year running average of CPE with ages 4 through 10 (Table 1.5). A running average was used due to the high year-to-year variability in catches. Mean overall adult survival estimates were highest for the Lake Ontario (LO) strain (0.81) and lowest for the Lewis Lakes (LL) strain (0.59). Survival rates for the Lake Erie (LE) strain were also high (0.79), but this was based on only two year classes with relatively poor returns. The Finger Lakes (FL) and Superior (SUP) strains, the most stocked lake trout strains in Lake Erie, had overall mean survival estimates of 0.74 and 0.62, respectively. Mean overall survival estimates for all strains except for the LL strain were above the Strategic Plan's target goal of 60% or higher (Lake Trout Task Group 1985).

More recent estimates of survival indicate that survival has declined well below target levels. Survival estimates of the 1997-1999 year-classes of SUP strain fish using straight CPE's from ages 4-8 or 5-8 range from 0.29-0.42. Survival estimates of the 1997 FL strain stocking also declined to 0.62. Both of these survival estimates are well below the ranges that were observed for these strains during the period of high-lamprey control (1987-1991).

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, 1985–2007. 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 and ages 4-7 (FL 97), 4-8 (SUP 99), or 5-8 (SUP 97, 98).

	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*				0.419	0.617
98*				0.402	
99*				0.287	
MEAN	**0.788**	**0.810**	**0.592**	**0.616**	**0.741**

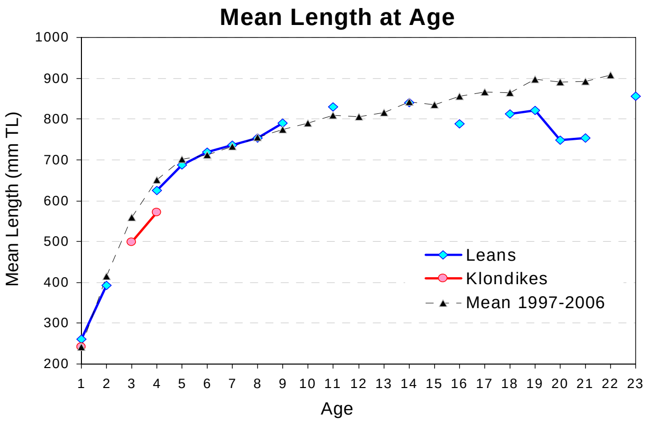


FIGURE 1.10. Mean length-at-age of Lean strain and Klondike strain lake trout sampled in assessment gill nets in the eastern basin of Lake Erie, August 2007. The previous 10-year average (1997-2006) from New York is shown for current growth rate comparison.

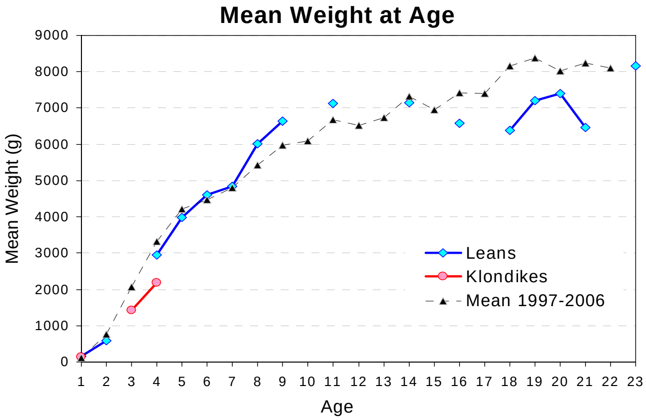


FIGURE 1.11. Mean weight-at-age of Lean strain and Klondike strain lake trout sampled in assessment gill nets in the eastern basin of Lake Erie, August 2007. The previous 10-year average (1997-2006) from New York is shown for current growth rate comparison.

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 (1997-2006) through age 7 (Figures 1.10 and 1.11). Deviations at age 8 and older were due to low sample sizes. Klondike strain lake trout show lower growth trajectories than Lean strain lake trout through age-4. Mean length and weight of Klondike strain lake trout was significantly less at age-4 (two sample t-test; P<.01) compared to the paired stocking of FL strain lake trout.

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 1.12). 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. Values in 2007 for both sexes were above 1.2, well above the standard (1.0).

Maturity

One hundred mature females ranging in age from 4 through 23 were sampled in standard assessment gill nets in 2007, generating a mean age of mature females of 6.48 years old (Figure 1.13). This is the sixth consecutive year that mature female lake trout have not met or exceeded the target mean age of 7.5 years established in the Strategic Plan (Lake Trout Task Group 1985), and it is reflective of the low abundance of female lake trout older than age 7 in the Lake Erie population. The Strategic Plan's objective assumes that adult females would need at

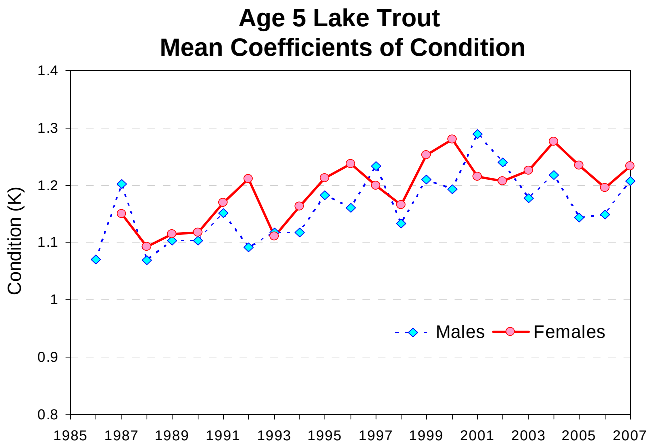


FIGURE 1.12. Mean coefficients of condition for age 5 lake trout, by sex, collected in NYSDEC assessment gill nets in Lake Erie, August 1985-2007.

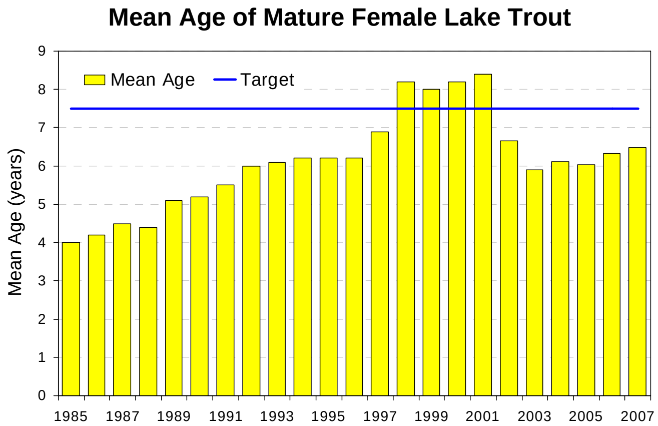


FIGURE 1.13. Mean age of mature female lake trout sampled in standard assessment gill nets in the eastern basin of Lake Erie, 1985-2007. The target mean age is 7.5 years.

least two spawning years to contribute to detectable natural reproduction. Female lake trout in Lake Erie reach 100% maturation by age 5 (Einhouse et al. 2008).

Natural Reproduction

Despite more than 20 years of stocking, no naturally reproduced lake trout have been documented in Lake Erie. Two potentially wild fish was caught in eastern basin coldwater gill net surveys in 2007, making a total of 31 potentially wild lake trout recorded over the past seven 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 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 2008). Several funding proposals (Canada-Ontario Agreement; USFWS Restoration Funds) were accepted in 2007 to further examine the sites identified in the GIS-phase of this exercise using side-scan sonar and underwater video imaging.

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 2007 lake trout model estimated the Lake Erie adult population of age 5 and older lake trout at around 46,000 fish, about half of what it was a decade ago when the lake trout population was at its peak (Figure 1.14). 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

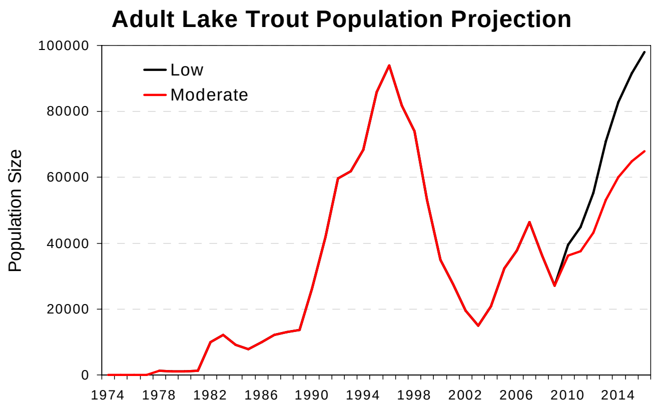


FIGURE 1.14. Projections of the Lake Erie adult lake trout population (ages 5+) using the CWTG lake trout model. Projections were made using both low and moderate rates of sea lamprey mortality with proposed stocking rates. The model estimates the 2007 population at 46,409 adult lake trout.

suppressed by one-third over the next decade with moderate mortality compared to low mortality (Figure 1.14). Model simulations indicate that both stocking and lamprey control are major influences on the Lake Erie lake trout population.

Diet

Seasonal diet information for lake trout is not available based on current sampling protocols. Diet information was limited to fish caught during August 2007 in the coldwater gill net assessment surveys in the eastern basin of Lake Erie. Analysis of the stomach contents of lake trout reveal diets almost exclusively made of fish (Table 1.6). Rainbow smelt, the longtime main prey item for Lean strain lake trout, dominated the August diets with over 86% of the non-empty stomachs containing at least one smelt. Gobies were the only other prey item that occurred regularly (18.4%) in Lean strain lake trout stomachs. Round gobies were more common in Klondike strain lake trout stomachs, occurring in over 43% of the non-empty fish, but were still not as prevalent as rainbow smelt (57.4%). Other fish species comprised minor contributions to the diets of both Lean and Klondike strain lake trout.

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 2007.

PREY SPECIES	Lean Lake Trout (N = 158)	Klondike Lake Trout (N = 122)
Smelt	136 (86.1%)	70 (57.4%)
Yellow Perch	2 (1.3%)	
Round Goby	29 (18.4%)	53 (43.4%)
Unknown Fish	5 (3.2%)	13 (10.7%)
Cladoceran *(B.c.)*		1 (0.8%)
Number of Empty Stomachs	49	23

The occurrence of round gobies decreased in the diets of both Lean and Klondike strains of lake trout in 2007 following a dramatic increase in 2006 (Figure 1.15). This may have been due to below average smelt populations in the eastern basin in 2006 (FTG 2007), causing a switch in targeted prey species. Smelt populations rebounded in 2007 (FTG 2008) and lake trout, especially Lean lake trout strains, targeted smelt once again. When smelt are in good supply, they comprise about 85-90% of the diets of Lean strain lake trout and 60% of Klondike strain lake trout. Round gobies typically comprise 15-20% of Lean strain and 50% of Klondike strain lake trout diets. However, in years of low adult smelt abundance, lake trout appear to rely more on round gobies as prey items.

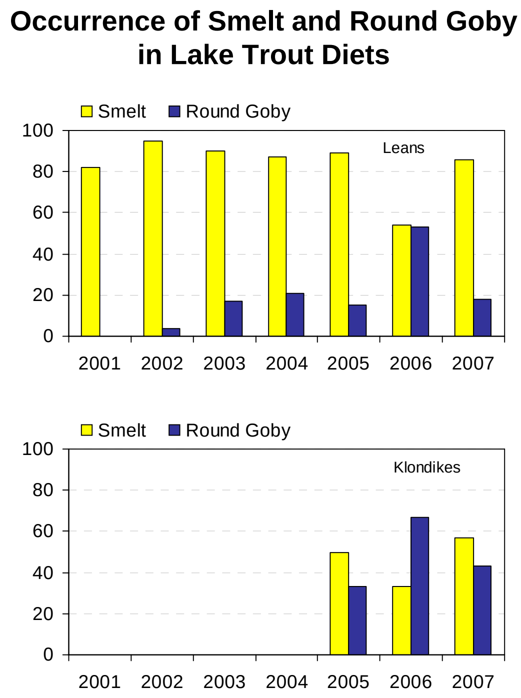


FIGURE 1.15. Percent occurrence of smelt and round goby in the diet of Lean strain (top) and Klondike strain (bottom) lake trout sampled in assessment gill nets in the eastern basin of Lake Erie, 2001-2007.

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Charge 2: Continue to assess the whitefish population 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 2007 was 925,834 pounds (Figure 2.1). Total harvest in 2007 was 2.5 times the 2006 total harvest, due primarily to an increase in Ontario waters (171%), though harvest increased in other jurisdictions by 39% (Ohio), 82% (Michigan) and 88% in Pennsylvania. The 2007 whitefish harvest was taken mostly in Ontario (874,976 lbs; 94%), with Ohio (41,554 lbs; 4%), Michigan (8,800 lbs; 1%) and trace harvest by Pennsylvania (684 lbs) accounting for the remainder. New York's Lake Erie trap and hoop net fishery harvested no whitefish in 2007.

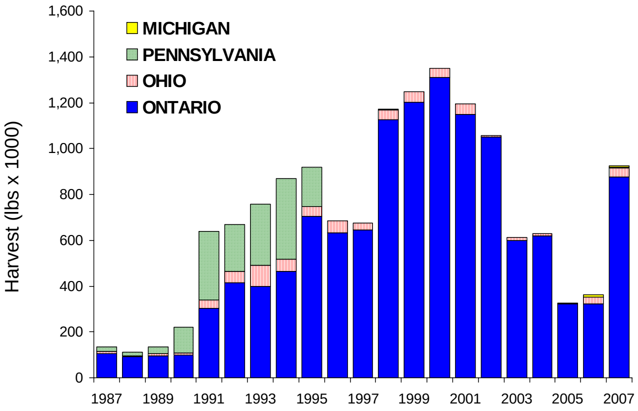

FIGURE 2.1. Total Lake Erie commercial whitefish harvest from 1987-2007 by jurisdiction. Pennsylvania ceased gill netting in 1996 and Michigan resumed commercial fishing in 2006.

The majority (95%) of Ontario's 2007 lake whitefish harvest was taken in gill nets. The remainder was caught in smelt trawls (5%) and a negligible amount (107 lbs) in impoundment gear. The largest fraction of Ontario's whitefish harvest (41%) was taken in the west basin (Ontario's OE 1) mostly during the fall, followed by the west-central area - OE 2 (28%) primarily in the first half of the year. The remainder came from OE 3 (2%) in spring and OE 4 (18%) and easternmost OE 5 (12%) from April to October. In Ontario, 58% of whitefish harvested in 2007 resulted from effort targeting whitefish, mostly outside of the western basin, while walleye (23%), white bass (17%), white perch (1%) and yellow perch (<1%) fisheries accounted for the remainder. Most (95%) of Ohio's commercial whitefish harvest was taken in district 1 (west basin) with the remaining 5% caught in district 2 (west central). Ohio's whitefish fishery harvested the majority of their fish (82%) in November, with the remainder harvested during December (10%), May (4%), and 3% during April, June, and October combined. Michigan's west basin harvest occurred primarily in November and December.

Ontario's annual targeted catch rates in 2007 were the highest or nearly so in each of the quota zones over the last 10 years (Figure 2.2). Similarly, Ohio's commercial trap net catch rates were among the highest since 1998 (Figure 2.3). Pennsylvania's

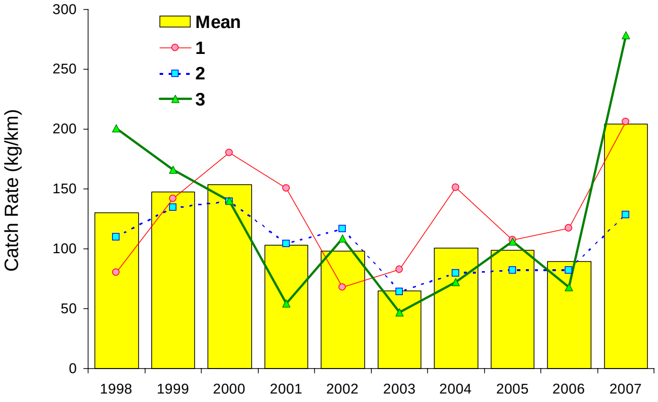

FIGURE 2.2. Ontario annual commercial large mesh gill net catch rates targeting lake whitefish by quota zone, 1998 - 2007. Bars represent averages of catch rates across quota zones.

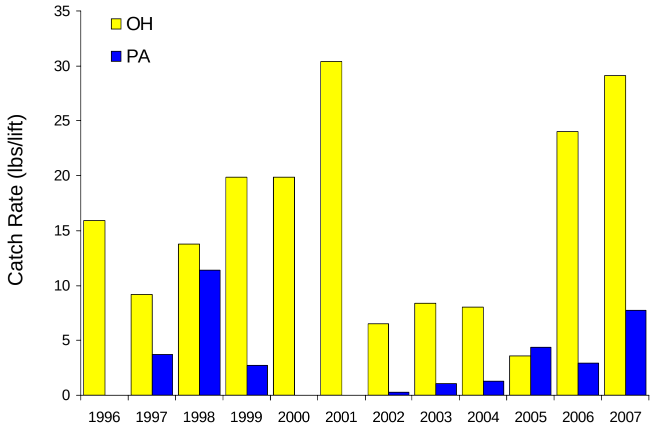

FIGURE 2.3. Ohio and Pennsylvania lake whitefish commercial trap net catch rates (pounds per lift), 1996-2007.

smaller commercial trap net fishery experienced a similar trend, with 2007 catch rates second only to 1998 (Figure 2.3). Ontario's 2007 catch rates targeting whitefish during and following spawning in west basin appeared to be the highest since 1998, but targeted effort and harvest were considerably less than during the Coordinated Percid Management Strategy (CPMS 2001-2003; Figure 2.4). The landed weight of roe from Ontario's 2007 whitefish fishery was 17,917 lbs (8,126 kg), with an approximate landed value of CDN$ 41,200.

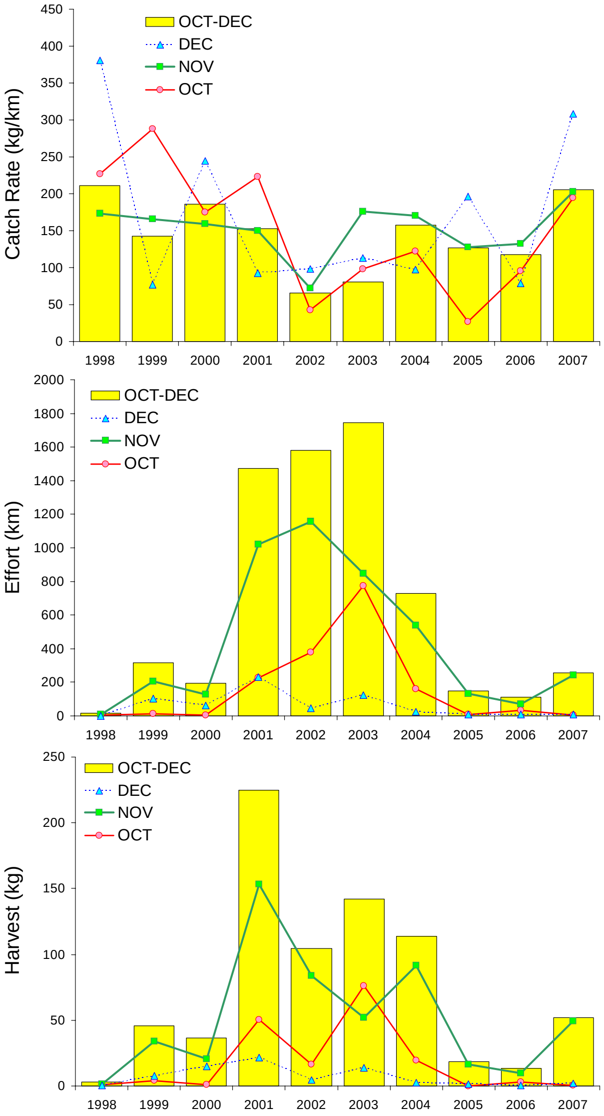

FIGURE 2.4. Targeted large mesh gill net catch rate (top), effort (middle) and harvest (bottom) for lake whitefish caught commercially in the west basin for October, November, December and pooled (Oct-Dec) 1998-2007.

Ontario's west basin fall lake whitefish fishery was dominated by age-4 fish (Figure 2.5). The strong 2003 cohort dominated catches in targeted and non-targeted Ontario fisheries throughout Lake Erie (Figure 2.6). There was no fall net-run sampling of whitefish from the Michigan and Ohio west basin fisheries to characterize harvest in this area of the lake in 2007. The 2003 cohort dominated harvest at age 3 in 2006 and more recently at age 4 in 2007. This cohort is expected to contribute significantly to fisheries again in 2008. A moderate 2005 year class will begin to contribute to the fishery late in 2008 and more fully in the next few years.

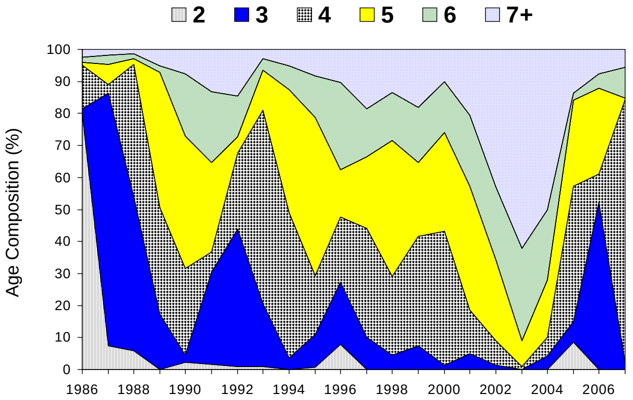

FIGURE 2.5. Ontario fall commercial whitefish harvest age composition in statistical district 1, 1986-2007. From effort with gill nets >=3 inches with whitefish in catch from October to December.

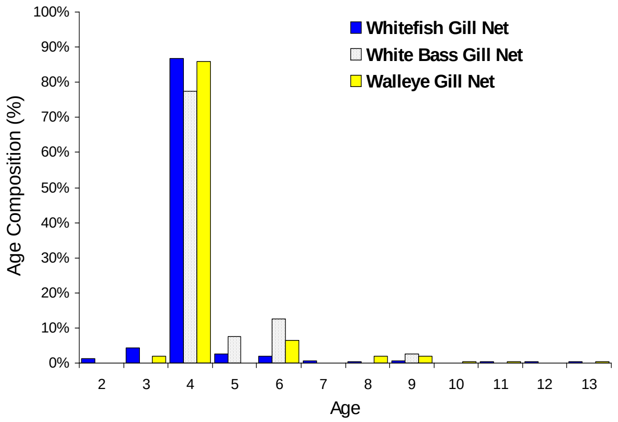

FIGURE 2.6. Age composition of lake whitefish caught commercially in Ontario waters of Lake Erie in 2007 by target species fisheries. Otoliths and scales were used to age whitefish samples.

Assessment Surveys

Lake whitefish abundance indices in the 2007 gill net assessments exhibited some similarities among jurisdictions and basins (Figures 2.7 and 2.8). Large catches occurred in the Pennsylvania Ridge area of Ontario waters, but were not as high elsewhere (Figure 2.7). New York 2007 indices were the highest in the time series (Figure 2.8).

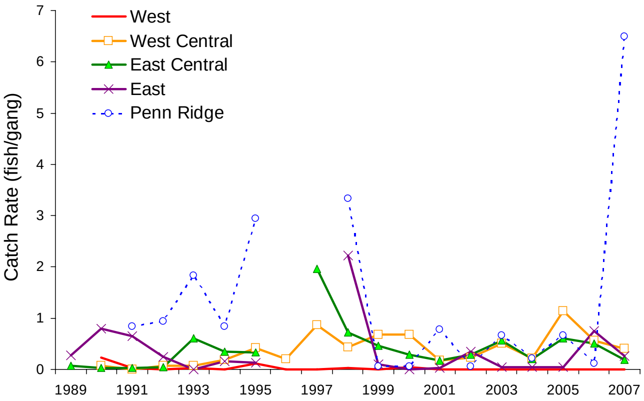

FIGURE 2.7. Catch rate (number per gang) of lake whitefish from Ontario partnership index gill netting by basin, Lake Erie, 1989 - 2007.

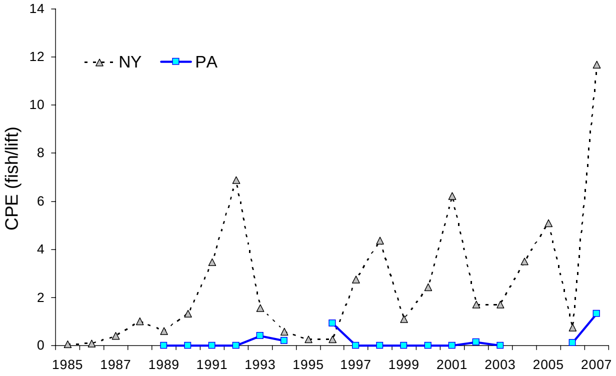

FIGURE 2.8. Catch per effort (number fish/lift) of lake whitefish caught in standard assessment gill nets from New York waters of Lake Erie, August 1985 - 2007 (triangles) and in Pennsylvania August assessment gill nets (squares) 1989 - 2007. No index sampling took place in Pennsylvania waters 1995, 2004, and 2005.

Pennsylvania's August gill net assessment does not frequently catch lake whitefish, but record high catches of 40 fish in 30 lifts occurred in 2007 (Figure 2.8). The size and age composition in Ontario's gill net surveys consisted mostly of age-4 lake whitefish (67%) followed by 2-year-olds (14%), and 6 year-old-fish (9%) with a range of ages from 2 to 20 (Figures 2.9 and 2.10).

Ohio trawl surveys in the central basin of Lake Erie assess juvenile lake whitefish and can describe the general magnitude of year class strength. In 2007, the August and October assessments for young-of year whitefish (0.1 fish per hectare) were below the 17-year mean. For yearling lake whitefish, the catch rates (0.0 f/ha) were below the 17-year mean for Ohio surveys in the central basin.

In trawl and gill net assessment surveys in Ohio waters of Lake Erie during 2007, a total of 104 adult, 1 yearling, and 5 YOY lake whitefish were sampled. The 2003 year class (age 4) were most numerous (46.4% of all whitefish sampled), followed by the 2005 year class (age 2 at 23.6%), and the 2001 year class (age 6 at 10.0%; Figure 2.11). Adult lake whitefish ranged in age from 2 to 13 in these surveys. Mean lengths for lake whitefish (excluding YOY which were not sexed) from the combined surveys were 432 mm for males and 417 mm for females (Figure 2.11).

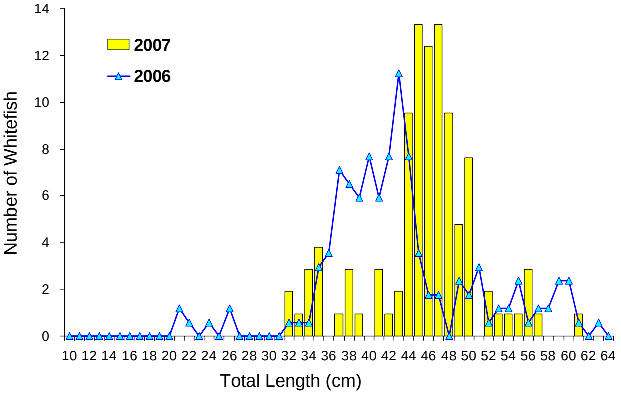

FIGURE 2.9. Length frequency distributions of lake whitefish collected during lake-wide partnership index fishing, 2006 and 2007. Standardized to equal effort among mesh sizes.

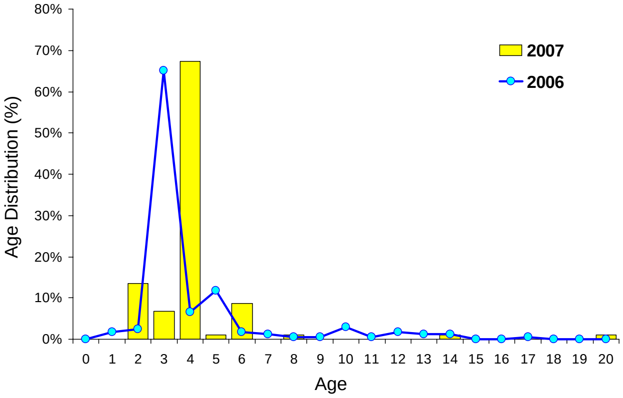

FIGURE 2.10. Age frequency distributions of lake whitefish collected during lake-wide partnership index fishing, 2006 and 2007. Standardized to equal effort among mesh sizes.

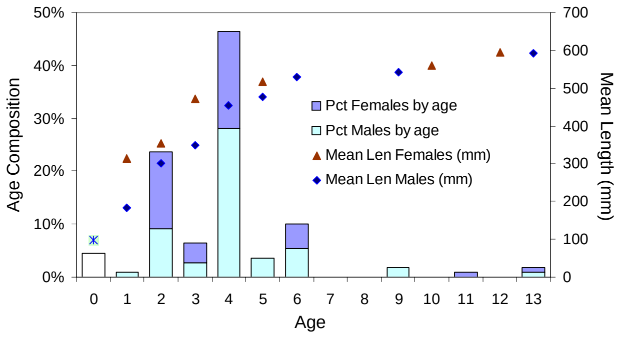

FIGURE 2.11. Age distribution and mean length-at-age of lake whitefish collected during trawl and gill net assessment surveys in Ohio waters of Lake Erie during 2007 (N=109). Sex was not determined for YOY lake whitefish.

Growth and Diet

Ohio surveys also showed that whitefish condition in 2007 for age 4 and older whitefish sampled in assessment trawls and gillnets (males, mean K= 1.061; se= 0.018; females, mean K= 1.089; se= 0.019) remained below Van Oosten and Hile's (1947) historic condition standards for the second consecutive year for females, but did improve slightly relative to 2006 (Figure 2.12). Males eclipsed the historic average again after one year below the historic mean value. Prior to 2006, Ohio surveys had shown a moderate increasing trend for condition of females and males ages 4 and older. In spite of these declines seen in the recent years of the surveys, there was still a general increasing trend for mean condition (K) with age (Figure 2.13) during 2007 similar to that noted in these reports for the last several years. This suggests that some oscillation in whitefish condition may be attributed to fluctuations in age composition.

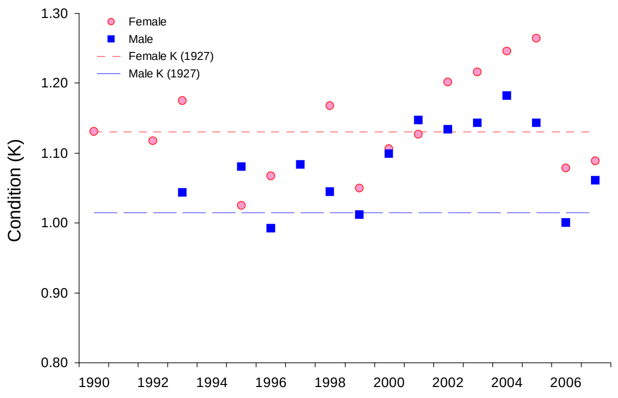

FIGURE 2.12. Mean condition (K) factor values of ages 4 and older lake whitefish sampled during Ohio assessment surveys in the central basin of Lake Erie, May-October 1990-2007. Historic mean condition (1927) presented as dashed lines from Van Oosten and Hile (1947).

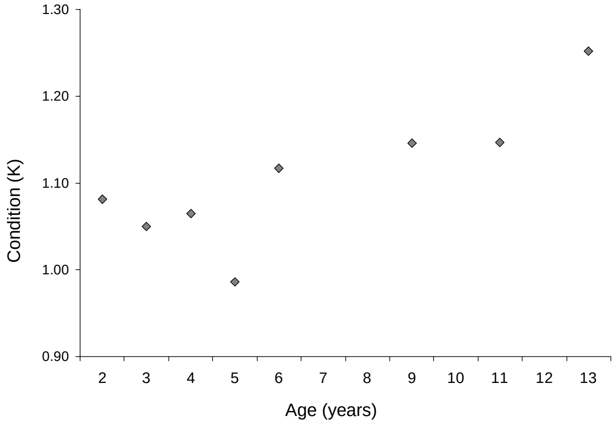

FIGURE 2.13. Mean condition (K) factor vs. age of lake whitefish (ages 2 and older) sampled during Ohio Division of Wildlife trawl and gill net assessment surveys in the central basin of Lake Erie, May-October 2007.

In 2007, Ontario lake whitefish condition (ages 4 and older) was relatively low again, falling below historic 1927-29 averages for each sex (Van Oosten and Hile 1947; Figure 2.14). Age 4 and older whitefish were included in calculations. Ontario assessment of whitefish condition showed a similar pattern across ages (*i.e.* from age 2 to age 10); K values were not different, but generally increased with age. Interpretation is difficult because of the small samples at age/sex for younger fish, but differences between sexes were apparent.

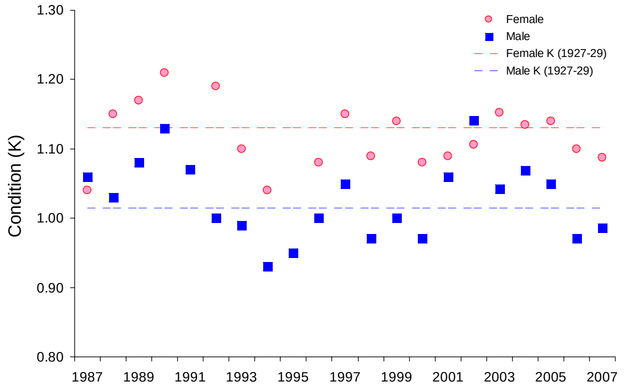

FIGURE 2.14. Mean condition (K) factor values of age 4 and older lake whitefish obtained from Ontario commercial and partnership survey data by sex from 1987-2007. Historic mean condition (1927-29) presented as dashed lines calculated from Van Oosten and Hile (1947).

Lake whitefish diet information available from Ohio surveys in 2007 showed the breadth of whitefish diets. The diets of whitefish collected from the central basin are described according to mean percent of diet items by dry weight (Figure 2.15). Chironomids made up the majority of central basin lake whitefish diets (55%), followed by isopods (40%), and sphaeriids (3%). Seventeen other food item types combined comprised 2% of the whitefish diets by dry weight.

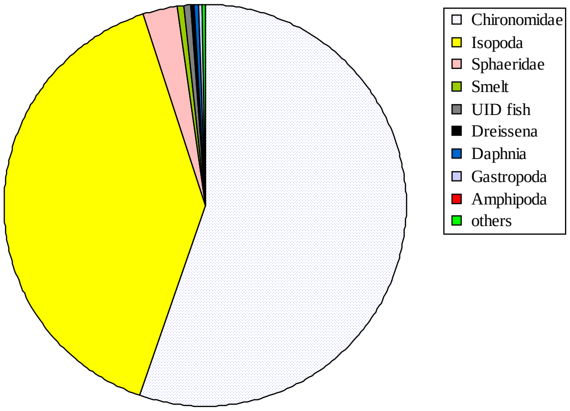

FIGURE 2.15. Diet composition (% dry weight) of lake whitefish collected from Ohio Division of Wildlife central basin assessment sites in May-October 2007.

Research Efforts

Ed Roseman began a GLSC/FWS (Great Lakes Science Center/U.S. Fish and Wildlife Service) project in 2005 to quantify and characterize lake whitefish reproductive habitat in the Detroit River and added western basin Lake Erie sites in 2006. Objectives include identifying spawning/incubation areas and associated physical characteristics; quantifying relative egg abundance and survival, assessing egg viability and physiological condition, predation of lake whitefish eggs, spawning stock characteristics (age, size, fecundity, and genotype) and developing a geographic database of spawning sites using a geographic information system. Information gained from this study will support the development of comprehensive models of spawning and nursery habitats. Adult whitefish in spawning condition were sampled on Toussaint Reef (averaging 50-60 fish per net-night). Some eggs were pumped from females, and fertilized eggs were retrieved from egg mats placed on spawning reefs. Subsequent larvae hatched in the lab were identified as lake whitefish.

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 another population parameters

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

Commercial Harvest

The commercial harvest of burbot in Lake Erie jurisdictions was relatively insignificant through the late 1980's, remaining under 5,000 pounds annually lake wide (Table 3.1). Harvest levels began to increase after 1989, coincident with increased abundance and harvest of lake whitefish (Figure 2.1). Most of the commercial harvest occurs in the eastern basin with only a minimal amount (typically <5% of the annual total harvest) coming from Ohio's and Ontario's jurisdictional waters of the western and central basins. 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 commercial fishing industry to actively target this species. As a result, the commercial harvest in Ontario increased some 85-fold from the previous 19-year average (Table 3.1). However, this market did not continue, and subsequent year's harvests have averaged about 8000 lbs. The Ontario harvest is a bycatch from various fisheries. Nearly half of the burbot bycatch in 2007 came from the lake whitefish commercial fishery followed by the yellow perch gillnet fishery (27%) and the rainbow smelt commercial trawl fishery (9%). The total commercial harvest for Lake Erie in 2007 was 5,198 pounds, a slight decrease from 2006 (5,305 lbs.) and the second lowest harvest observed since 1990 (Table 3.1).

TABLE 3.1. Total burbot commercial harvest (thousands of pounds) in Lake Erie by jurisdiction, 1980-2007.

Year	New York	Pennsylvania	Ohio	Ontario	Total
1980	0.0	2.0	0.0	0.0	2.0
1981	0.0	2.0	0.0	0.0	2.0
1982	0.0	0.0	0.0	0.0	0.0
1983	0.0	2.0	0.0	6.0	8.0
1984	0.0	1.0	0.0	1.0	2.0
1985	0.0	1.0	0.0	1.0	2.0
1986	0.0	3.0	0.0	2.0	5.0
1987	0.0	0.0	0.0	4.0	4.0
1988	0.0	1.0	0.0	0.0	1.0
1989	0.0	4.0	0.0	0.8	4.8
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	1.7	0.3	2.4	5.3
2007	0.4	1.1	0.1	3.6	5.2

Assessment Programs

Burbot is one of the most commonly caught species in annual eastern basin coldwater gill net assessment surveys. Numeric abundance of burbot as determined from coldwater gillnet assessments increased from about 1993 through 2000 in all jurisdictions, more so in Ontario waters (Figure 3.1). Of the three jurisdictional areas in eastern Lake Erie, Ontario has yielded the highest catches of burbot in all years since 1996 except in 2007 when catch rates were slightly higher in Pennsylvania (4.4 burbot/lift) than elsewhere (4.3 in Ontario and 2.2 burbot/lift in New York). Burbot populations in Pennsylvania and Ontario declined after peaking in 2000. Burbot population abundance in New York waters exhibited a gradual, less pronounced increase during the period from 1993 to 2004, and

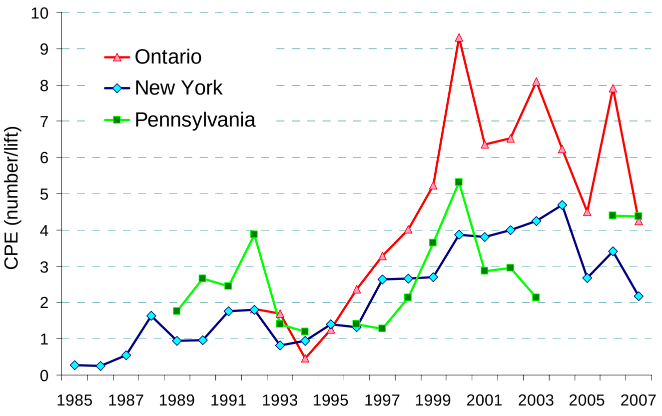

FIGURE 3.1. Average burbot catch rate (fish/lift) from summer gill net assessment by jurisdiction, 1985-2007.

primarily decreased thereafter. In 2007, catch per unit of effort (CPE as number of burbot/lift) and biomass (weight) per lift decreased from levels recorded in 2006 in most regions of eastern Lake Erie with the greatest decrease occurring in Ontario (-46% for both number and biomass/lift) and New York waters (-36% and -38% for number and biomass, respectively) (Figures 3.1 and 3.2). Burbot catches in Pennsylvania waters did not change much from 2006 with only a <1% decrease in number/lift and a 4% increase in biomass/lift. Biomass per lift in Pennsylvania in 2007 (12.1 kg/lift) was the highest ever recorded during the history of this survey.

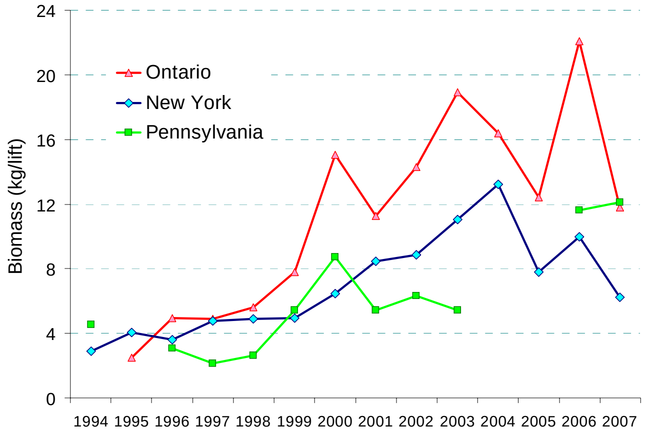

FIGURE 3.2. Average burbot biomass (kg/lift) from summer gill net assessment by jurisdiction, 1994-2007.

OMNR, in partnership with the Ontario Commercial Fisheries' Association has conducted an annual lake-wide gillnet survey of the Canadian waters of Lake Erie since 1989. This survey provides an additional and spatially robust index of fish abundance and distribution. The eastern basin was not surveyed in 1996 and 1997. Burbot are found in all the major basins of Lake Erie, but are most abundant in the deeper eastern regions and the Pennsylvania Ridge area (Figure 3.3). During the early 90's burbot abundance was low throughout the lake; catch rates averaged fewer than 0.5 fish/lift. Abundance increased rapidly after 1993 in the Pennsylvania Ridge and east basin, reaching a peak of about 4 fish/lift in 1998. Burbot numbers in the central basin also peaked in 1998, but at a much lower level of 0.5 fish/lift and less. Catch rates in the Pennsylvania Ridge during 1998 to 2004 remained high but variable between 2 and 4.2 fish/lift and then decreased to about 0.5 fish/lift in 2005-2006. East of the Pennsylvania Ridge, burbot catch rates during 1998 to 2006 were variable in a decreasing trend. Catch rates of burbot in 2007 increased in eastern Lake Erie, including the Pennsylvania Ridge, but remain very low in the central basin (Figure 3.3).

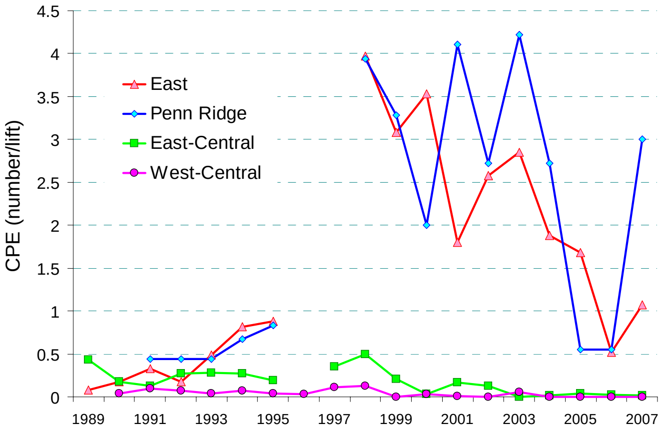

FIGURE 3.3. Burbot CPE by basin from OMNR Partnership Index Gillnet Survey, 1989-2007 (includes canned and bottom nets, excludes thermocline sets; all mesh sizes).

Figure 3.4 shows trends in numeric abundance and biomass of burbot using only bottom sets of the OMNR Partnership survey data from combined sample locations in the east basin and Pennsylvania Ridge. Abundance and biomass of burbot increased from 1993 to 1998 and then, with the exception of 2003 and 2007, numeric abundance has decreased progressively each year since 1998. Although biomass has also decreased since 1998, the downward trend has not been nearly as pronounced as for numbers of burbot (Figure 3.4). The difference in year-to-year patterns between numeric abundance and biomass can be attributed to an ageing burbot population, suffering from poor recruitment.

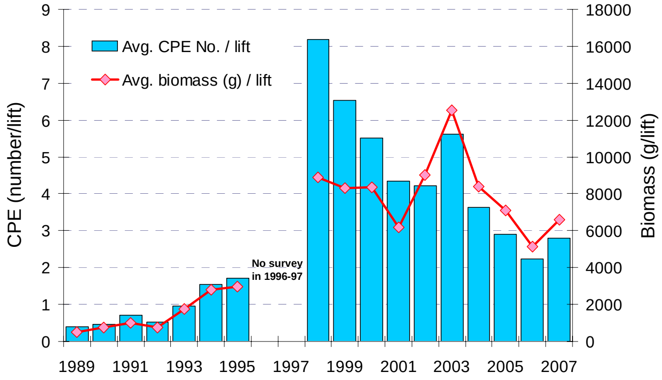

FIGURE 3.4. Burbot CPE (No./lift) and biomass (g/lift) in the Ontario waters of eastern Lake Erie, from OMNR Partnership Index Gillnet Survey, 1989-2007 (includes only bottom nets, all mesh sizes from all sample sites in Pennsylvania Ridge and east basin).

Burbot ages (from interpretation of otoliths) are available for fish caught in coldwater assessment gill nets in Ontario waters since 1997. Mean age of burbot has increased steadily since 1998 (Figure 3.5). Recruitment of age-4 burbot was good, increasing almost 2-fold from 1997 to 2000, but was followed by an abrupt decrease in 2002 and has remained poor for each of the last six years (Figure 3.5).

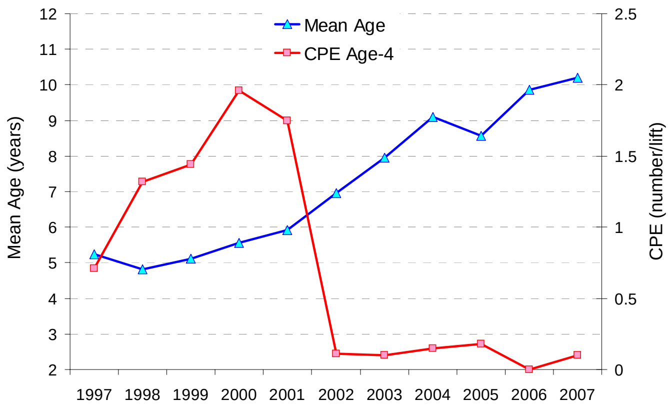

FIGURE 3.5. Mean age and average CPE of Age-4 burbot caught in summer gill net assessment in Ontario waters of eastern Lake Erie during 1997-2007.

Growth

Mean total length of burbot increased across all survey areas in 2007, continuing a trend that has been predominate since the late 1990s (Figure 3.6). Average mass of burbot has shown a similar trend, although in 2007 mean mass of burbot in New York waters decreased slightly to a weight (2846 g) very near that observed in Ontario and Pennsylvania waters (Figure 3.7).

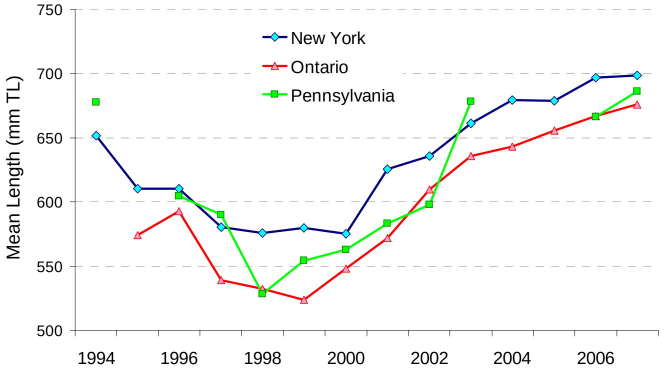

FIGURE 3.6. Average total length (mm) of burbot caught in summer gill net assessments by jurisdiction during 1994-2007.

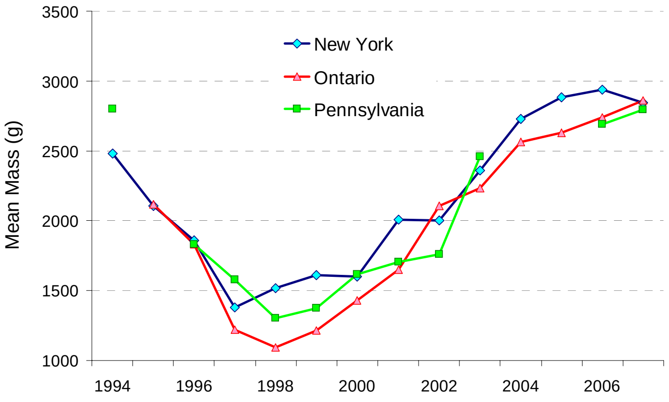

FIGURE 3.7. Average mass (grams) of burbot caught in summer gill net assessments by jurisdiction during 1994-2007.

Diet

Seasonal diet information for burbot is not available based on current sampling protocols. Diet information was limited to fish caught during August 2007 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 3.8). Burbot diets continued to be diverse with 5 different fish and 4 invertebrate species found in stomach samples. Round gobies were the dominant prey item, occurring in 43% of the burbot stomachs, followed by rainbow smelt (28% occurrence). Other identifiable taxa were found in 10% or less of the stomachs and included yellow perch, emerald shiner, gizzard shad, dreissenids, *Bythotrephes*, unionid clams, and chironomids.

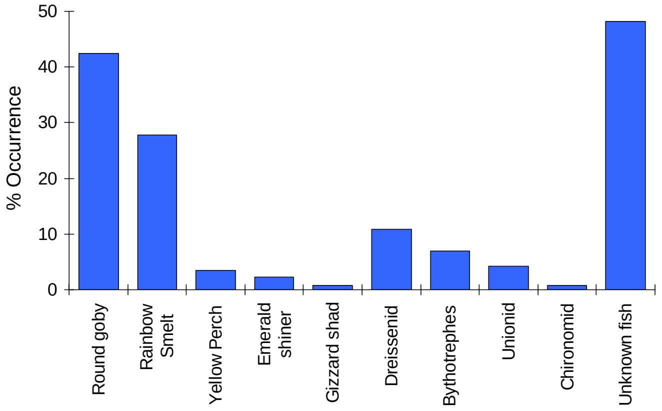

FIGURE 3.8. Frequency of occurrence of diet items from non-empty stomachs of burbot sampled in gill nets from the eastern basin of Lake Erie, August 2007. Sample size is 259 stomachs.

Gobies have increased in the diet of burbot since they first appeared in the eastern basin in 1999 (Figure 3.9). They were the main diet item for burbot in 4 of the last 5 years in New York waters. Smelt were the dominant prey in 2005, but goby was again the dominant prey in 2006 and 2007.

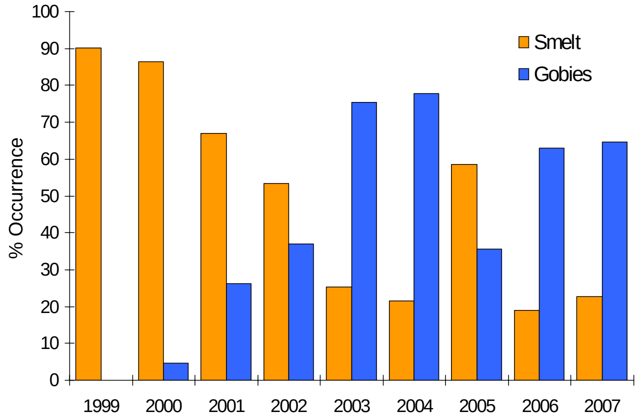

FIGURE 3.9. Frequency of occurrence of rainbow smelt and round gobies in the diet of burbot caught in the New York waters of the eastern basin of Lake Erie, 1999-2007.

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.

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.

Michael Fodale (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 Integrated Management of Sea Lampreys (IMSL) in Lake Erie including quantitative selection of streams for lampricide treatment and implementation of alternative control methods. The Lake Erie Coldwater Task Group has provided the forum for the discussion of concerns about wounding and lake trout mortality.

2007 Lake Trout Wounding Rates

A total of 38 A1-A3 wounds were found on 255 lake trout greater than 532 mm (21 in) total length sampled in the eastern basin of Lake Erie in 2007, equaling a wounding rate of 14.9 wounds per 100 fish (Table 4.1; Figure 4.1). This was slightly lower than 2006 (17.2 wounds/100 fish) but still almost three times higher than the target rate of 5 wounds per 100 fish (Lake Trout Task Group 1985b). Wounding rates have remained well above target level for 11 of the past 12 years following relaxed lamprey control measures in the mid 1990s (Sullivan et al. 2003). Lampreys continue to target larger fish with lake trout >736 mm (29 in) receiving the highest percentage of fresh wounds (Table 4.1) followed by fish in the 635-736 mm (25-29 in) range. For only the second year since 1988 (other being 2003), wounds were found on lake trout less than 533 mm (21 in) in total length. Two fresh wounds and seven A4 wounds were found on 117 lake trout between 432 and 532 mm (17 - 21 in), totaling a fresh wounding rate of 1.7 wounds per 100 fish.

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-September 2007.

Size Class Total Length (mm)	Sample Size	Wound Classification				No. A1-A3 Wounds per 100 Fish
		A1	A2	A3	A4	
432-532	141	1	0	1	7	1.4
533-634	114	0	1	2	20	2.6
635-736	158	2	4	12	59	11.4
>736	42	7	6	7	54	47.6
>532	314	9	11	21	133	13.1

Fresh A1 wounds are considered indicators of the attack rate for the current year at the time of sampling (August). A1 wounding in 2007 was 3.5 wounds per adult lake trout greater than 532 mm (21 in), which was the highest rate since 1998 and well above the series average of 2.1 wounds/fish (Figure 4.2). A1 wounding rates have remained at or above average for nine of the last eleven years. All but one of the A1 attacks occurred on lake trout >634 mm (25 in) in length (Table 4.1).

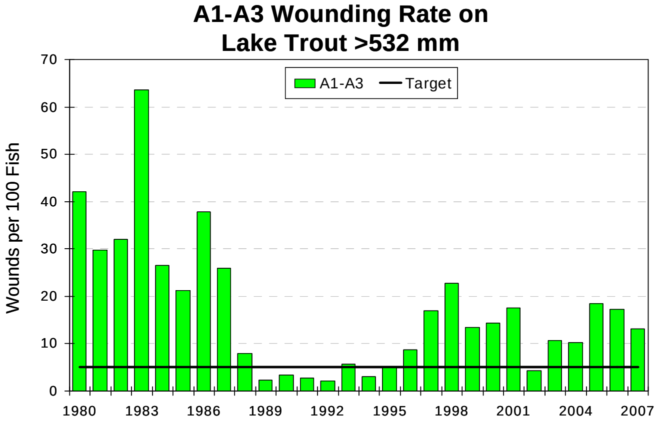

FIGURE 4.1. Number of fresh (A1-A3) sea lamprey wounds per 100 adult lake trout greater than 532 mm (21 inches) sampled in assessment gill nets in the eastern basin of Lake Erie, August -September, 1980-2007. The target rate is 5 wounds per 100 fish.

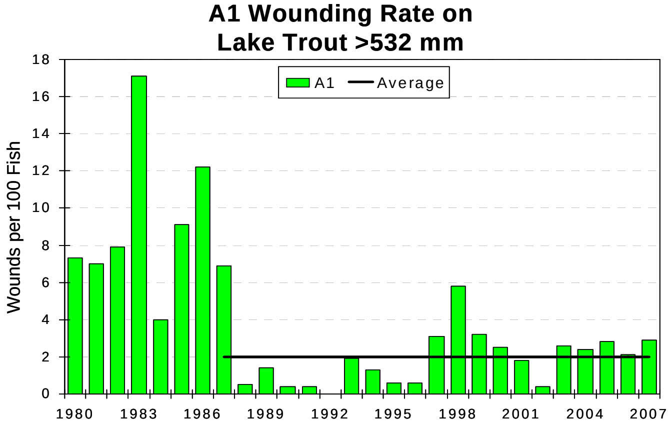

FIGURE 4.2. Number of A1 sea lamprey wounds per 100 adult lake trout greater than 532 mm (21 inches) sampled in assessment gill nets in the eastern basin of Lake Erie, August-September, 1980-2007. The post-treatment average includes 1987-2006.

The past year's cumulative attacks are indicated by A4 wounds. The A4 wounding rate decreased from the time series high of 68.4 wounds/100 fish in 2006 to 48.2 wounds/100 fish in 2007 for lake trout greater than 532 mm (21 in) (Figure 4.3). However, this is still the third highest A4 wounding rate in the time series (all occurring in the last three years) and over 2 times the series average of 21.4 wounds/100 fish. Similar to past surveys, the majority (86.2%) of the A4 wounds were found on fish greater than 634 mm (25 in) in total length (Table 4.1). Twenty-four of the 39 lake trout sampled >736 mm (29 in) in length (61.5%) possessed A4 lamprey wounds, and many of these fish had multiple wounds.

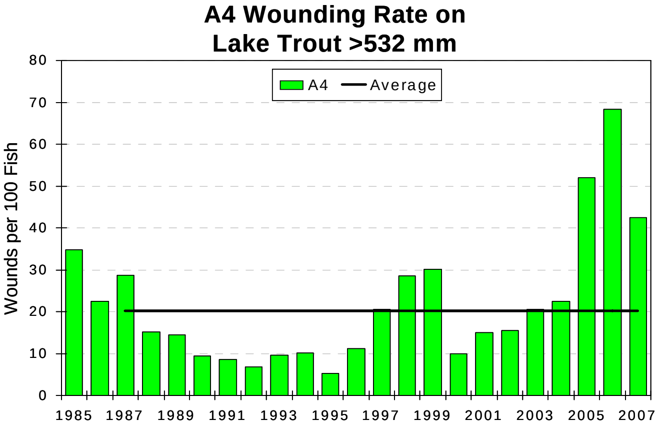

FIGURE 4.3. Number of healed (A4) sea lamprey wounds per 100 adult lake trout greater than 532 mm (21 inches) sampled in assessment gill nets in the eastern basin of Lake Erie, August-September, 1985-2007. The post-treatment average includes 1987-2006.

Wounding data indicates that mortality from sea lampreys is the main force driving the decline in the adult lake trout stock and altering the structure of the coldwater fish community. Adult lake trout, especially the larger fish over 736 mm (29 in), continue to decline rapidly within the lake trout population, presumably due to high lamprey mortality. Over 50 percent of the lake trout >736 mm exhibited recent lamprey attacks in 2007, and the average number of A4 wounds per fish was 1.3. Superior strain lake trout have been one of the most prevalent strains stocked in Lake Erie, but results indicate that they have almost disappeared. Sea lamprey attacks on this strain have been extremely high and recent survival rates are well below target levels (see Charge 1). Populations of burbot, once the most prevalent coldwater predator, have declined to less than half the numbers seen only a few years ago across the eastern basin (see Charge 3). Both A1-A3 and A4 wounding rates on burbot have increased since 2001 in the New York waters of Lake Erie (Figure 4.4). Sea lamprey control and lake trout stocking will need to be increased to bring stability back to the coldwater fish community and build adult lake trout populations to levels were natural reproduction is possible.

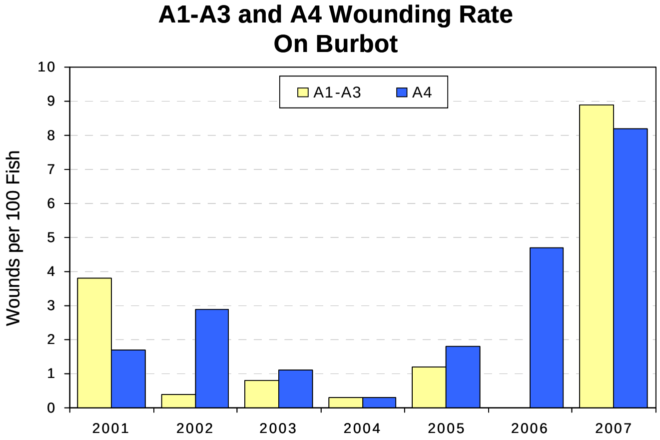

FIGURE 4.4. Number of A1-A3 and A4 sea lamprey wounds per 100 burbot (all sizes) sampled in assessment gill nets in the New York waters of Lake Erie, August, 2001-2007.

2007 Actions

Control efforts continued by GLFC agents during 2007 with lampricide treatments in 1 U. S. tributary (Cattaraugus Creek) and 1 Canadian tributary (Big Otter Creek). Assessments were conducted in five U.S. tributaries to rank them for possible lampricide treatment during 2008. Another 28 streams (15 U.S., 13 Canada) and an area offshore of one U.S. tributary were surveyed to search for new or monitor existing populations. For the third consecutive year, a survey to assess larval recruitment in a section of the Chagrin River above the washed out barrier at Daniels Park were conducted and no larval sea lampreys found.

The estimated number of spawning-phase sea lampreys increased from 15,874 during 2006 to 16,664 during 2007 (Figure 4.5). A total of 1,641 spawning-phase sea lampreys were trapped in four tributaries (2 U.S., 2 Canada) during 2007, a decrease of about 16% when compared to 2006 catches.

A study of paired quantitative assessment sampling and catch-per-unit-effort sampling was conducted in Cattaraugus Creek as part of a larger three-year project to examine the effectiveness of a less labor-intensive sampling method and an alternative model of stream selection for lampricide treatments. This GLFC-sponsored research project is being lead by Dr. Michael Jones of Michigan State University.

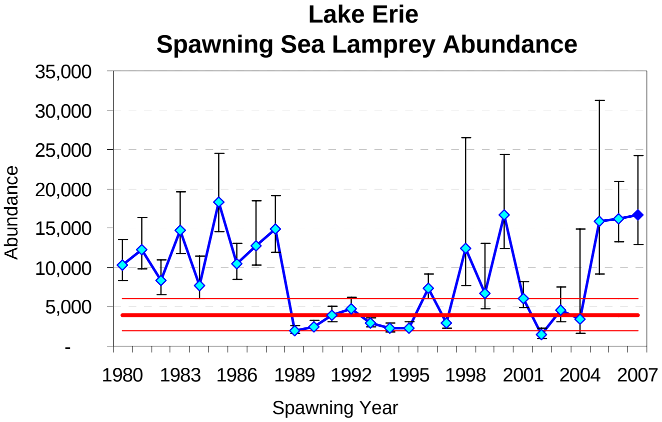

FIGURE 4.5. Lakewide estimate of spawning-phase sea lampreys in Lake Erie with 95% confidence limits, 1980-2007. Thick solid line indicates spawner abundance target level with 95% confidence range (thin lines).

2008 Plans

A new survey technique, termed Ranking Survey, was developed from the above study and will replace the conventional quantitative survey beginning in 2008. As well, to reduce the number of parasitic sea lampreys in the Lake Erie basin to target levels, the Great Lakes Fishery Commission and its agents will experiment with a two year back-to-back lampricide treatments in the nine major sea lamprey producing streams; the first round of treatment will occur during Spring 2008 followed by a second round of treatment during Fall 2009.

Larval assessments of 10 streams are planned in 2008 to search for new and monitor existing infestations (6 U.S., 4 Canada). Adult assessment traps likely will be operated on four streams (2 U.S., 2 Canada) to estimate the lake-wide spawning-phase abundance.

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Lake Trout Task Group. 1985. A sea lamprey management plan for Lake Erie. Report to the Great Lakes Fishery Commission, Lake Erie Committee, Ann Arbor, Michigan, USA.

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.

TABLE 4.2. Larval sea lamprey assessments of Lake Erie tributaries during 2007 and plans for 2008.

Stream	History	Surveyed in 2007	Survey Type	Results	Plans for 2008
Canada					
St. Clair R.	Positive	No	-	-	Evaluation
Unnamed (E-62)	Negative	Yes	Detection	Negative	None
Unnamed (E-63)	Negative	Yes	Detection	Negative	None
Unnamed (E-67)	Negative	Yes	Detection	Negative	None
Talbot Creek	Negative	Yes	Detection	Negative	None
Catfish Cr.	Positive	Yes	Evaluation	Negative	None
Silver Cr.	Positive	Yes	Evaluation	Positive	Distribution
Big Otter Cr.	Positive	Yes	Distribution	Positive	Distribution
Big Cr.	Positive	Yes	Treatment Evaluation	Negative	Distribution
Unnamed (E-109)	Negative	Yes	Detection	Negative	None
Unnamed (E-110)	Negative	Yes	Detection	Negative	None
Forestville Cr.	Positive	No	-	-	Evaluation
Normandale Cr.	Positive	No	-	-	Evaluation
Fishers Cr.	Positive	No	-	-	Evaluation

Young’s Cr.	Positive	No	-	-	Distribution
Unnamed (E-130)	Negative	Yes	Detection	Negative	None
Nanticoke Cr.	Negative	Yes	Detection	Negative	None
Stoney Cr.	Negative	Yes	Detection	Negative	None
United States					
Buffalo R.	Positive	Yes	Evaluation	Positive	None
Smoke Cr.	Negative	No	-	-	Detection
Rush Cr.	Negative	No	-	-	Detection
Delaware Cr.	Positive	Yes	*Quantitative*	Negative	None
Cattaraugus Cr.	Positive	Yes	Barrier	Negative	Distribution
Halfway Brook	Positive	Yes	Evaluation	Negative	None
Canadaway Cr.	Positive	Yes	Evaluation	Positive	Evaluation
Elk Creek	Negative	No	-	-	Detection
Crooked Cr.	Positive	Yes	Evaluation	Positive	None
Raccoon Cr.	Positive	Yes	*Quantitative*	Positive	None
Conneaut Cr.	Positive	Yes	*Quantitative*	Positive	None
Ashtabula R.	Negative	Yes	Evaluation	Negative	None
Wheeler Cr.	Positive	No	-	-	Evaluation
Grand R.	Positive	Yes	Treatment Evaluation	Positive	None
Chagrin R.	Positive	Yes	Evaluation	Negative	Evaluation
Black R.	Positive	Yes	*Quantitative*	Positive	None
Pine R.	Positive	Yes	Bio. Coll.	Negative	None
River Rouge	Negative	Yes	Detection	Negative	None
Brownstone Cr.	Negative	Yes	Detection	Negative	None

[1] *Quantitative survey* – conducted to estimate larval population and larvae expected to metamorphose in the following year. Projected treatment cost is divided by the metamorphosed sea lamprey estimate to provide a ranking against other Great Lakes tributaries for lampricide treatment.
[2] *Evaluation survey* – conducted to determine requirement for quantitative assessment.
[3] *Detection survey* – conducted to determine larval presence or absence in streams with no history of sea lamprey infestation.
[4] *Distribution survey* – conducted to determine instream geographic distribution or to determine lampricide treatment application points.
[5] *Treatment Evaluation survey* – conducted to determine if the relative abundance of survivors from a lampricide treatment is large enough to warrant a Quantitative survey.
[6] *Ranking survey* – conducted to index the larval population to determine need for lampricide treatment the following year. Projected treatment cost is divided by the metamorphosed larval estimate to provide a ranking against other Great Lakes tributaries for lampricide treatment.
[7] *Bio. Collection – research survey* – conducted to collect lamprey specimens for research purposes

Charge 5: Maintain an annual interagency electronic database of Lake Erie salmonid stocking and current projections 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 (160,000 yearlings) was not met for the fourth consecutive year (Table 5.1; Figure 5.1). However, the 137,637 yearlings stocked in 2007 were the most lake trout stocked into Lake Erie waters since 1995. Since the Allegheny National Fish Hatchery (ANFH) remained closed for renovations, lake trout were raised at two federal facilities in Vermont (White River and Pittsford National Fish Hatcheries) and stocked between 30 April and 15 May 2007. All lake trout were stocked offshore of Dunkirk, NY in approximately 70 feet of water via the R/V ARGO or the Buffalo State buoy tender SENECA. The majority of the stocked lake trout were Finger Lakes strain fish (68,011; 49%) with lesser numbers of both Klondike (30,675; 22%) and Traverse Island (38,951; 28%) strains. The Vermont hatcheries will continue to raise lake trout for Lake Erie until renovations at the ANFH are complete and production is resumed.

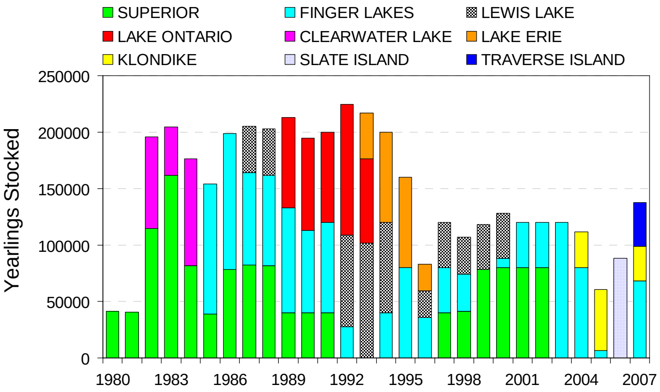

Figure 5.1. Yearling lake trout stocked (in yearling equivalents) in eastern basin waters of Lake Erie, 1980-2007, by strain. The current stocking goal is 160,000 yearlings per year.

Stocking of Other Salmonids

In 2007, over 2 million yearling trout and salmon were stocked in Lake Erie, including rainbow trout/steelhead, brown trout and lake trout (Figure 5.2). Total salmonid stocking decreased almost 5% from 2006 and 7% below the long-term average (1989-2007). Annual summaries for each species stocked within individual state and provincial areas are summarized in Table 5.1.

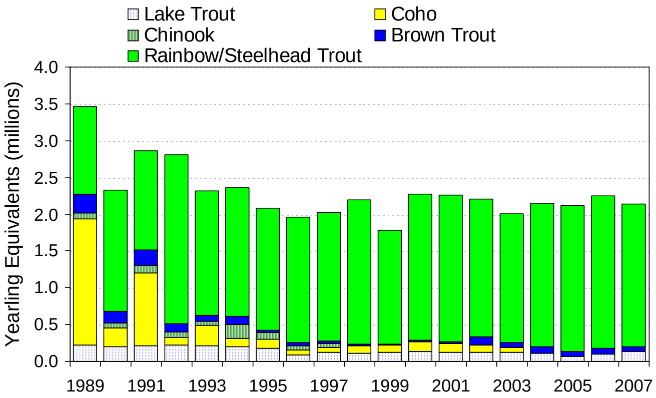

Figure 5.2. Annual stocking of all salmonid species (in yearling equivalents) in Lake Erie by all riparian agencies, 1989-2007.

All riparian agencies and a few non-governmental organizations (NGO's) in Ontario and Pennsylvania presently stock rainbow trout in the Lake Erie watershed. A total of 1,937,239 yearling rainbow trout were stocked in 2007, accounting for nearly 91% of all salmonids stocked. This represented a 7% decrease from 2006, but was 7.5% higher than the long-term average, primarily a result of the increased prominence of this species in jurisdictional fisheries over that last decade. The majority of rainbow trout stocked in Lake Erie are planted in Pennsylvania (1,122,996; 58%), followed by Ohio (453,413; 23%), New York (272,630; 14%), Michigan (60,500; 3%) and Ontario (27,700; 1%). Yearling plants take place each spring, between March and May, when smolts average about 150 mm in length. In addition to the yearlings listed in Table 5.1, there were 750 wild strain rainbow trout fry stocked into Young's Creek in Ontario. Details on strain composition and stocking location of rainbow trout are covered more extensively under Charge 6 of this report.

Brown trout stocking in Lake Erie totaled 65,615 yearlings in 2007. This represents a 10% decrease from 2006 and a 23% decrease from the long-term average. More than half (63%) of the brown trout stocked in Lake Erie were in New York waters for the purposes of providing a put-grow-take trophy brown trout fishery for offshore boat anglers and seasonal tributary anglers. 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 (27,715) in the Lake Erie basin. The majority (86%) of these fish were stocked for the opening day of trout season, and are managed according to standard put-and-take trout management strategies (9” MSL). Similar to NYSDEC brown trout stocking objectives, about 3,900 brown trout were stocked by PFBC-NGO groups directly into Lake Erie to provide offshore boat anglers and seasonal tributary anglers an opportunity to catch trophy lake run brown trout. There is a proposal to expand this program by the Pennsylvania Fish and Boat Commission, by supplanting a fraction (5-10%) of the steelhead yearlings with brown trout by 2009. This consideration is in response to requests from Pennsylvania angler constituency groups for increased diversity in trout fishing opportunities on Lake Erie and the discontinuation in the Coho salmon program in Pennsylvania that occurred in 2003.

TABLE 5.1. Summary of salmonid stockings in numbers of yearling equivalents, Lake Erie, 1990-2007.

	Lake Trout	Coho	Chinook	Brown Trout	Rainbow/Steelhead	Total
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**
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**
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**
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**
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**
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**
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**
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**
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**

TABLE 5.1. (Continued) Summary of salmonid stockings in number of yearling equivalents, 1990-2007.

	Lake Trout	Coho	Chinook	Brown Trout	Rainbow/Steelhead	Total
ONT.	--	--	--	--	85,235	85,235
NYS DEC	78,000	--	--	--	310,300	388,300
PFBC	40,000	100,000	--	20,780	835,931	996,711
ODNR	--	--	--	--	238,467	238,467
MDNR	--	--	--	--	69,234	69,234
1999 Total	**118,000**	**100,000**	**0**	**20,780**	**1,539,167**	**1,777,947**
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**
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**
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**
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**
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**
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**
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**
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**

Charge 6. Report on the status of rainbow trout in Lake Erie, including stocking numbers, strains being stocked, academic and resource agency research interests, and related population parameters, including growth and exploitation

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

Stocking

All Lake Erie jurisdictions stocked lake-run rainbow trout (or steelhead) in 2007 (Table 6.1). A total of 1,937,239 yearling steelhead were stocked, representing a 7% decrease from 2006 but 8% higher than the long-term (1989-2006) average. Nearly all of the rainbow trout stocked in Lake Erie originated from naturalized Great Lakes strains. A naturalized Lake Erie steelhead strain comprised approximately 58% of the strain composition followed by a Lake Michigan strain (26%) and a Lake Ontario strain (15%); about 0.2% of the stocked rainbow trout were of domestic origin. Only Skamania strain steelhead stocked by New York received fin-clips in 2007 (Table 6.2).

TABLE 6.1. Rainbow trout/steelhead stocking by jurisdiction for 2007.

Agency	Location	Strain	Fin Clips	Number	Life Stage	Yearling Equivalents	
Michigan	Flat Rock	Manistee River, L. Michigan	none	60,500		**60,500**	**Sub-Total**
Ontario	Mill Creek	Ganaraska River, L. Ontario and wild	none	16,500	Yearling	16,500	
	Erieau Harbour	Ganaraska River, L. Ontario	none	11,200	Yearling	11,200	
						27,700	**Sub-Total**
Pennsylvania	Conneaut Creek	Trout Run & Godfrey Run, L. Erie	none	75,000	Yearling	75,000	
	Conneaut Creek - W Br	Domestic	none	2,300	Adult	2,300	
	Conneaut Creek - W Br	Golden	none	60	Adult	60	
	Crooked Creek	Trout Run & Godfrey Run, L. Erie	none	56,161	Yearling	56,161	
	Elk Creek	Trout Run & Godfrey Run, L. Erie	none	267,725	Yearling	260,725	
	Elk Creek	Domestic	none	150	Adult	150	
	Elk Creek	Golden	none	50	Adult	50	
	Fourmile Creek	Trout Run & Godfrey Run, L. Erie	none	14,575	Yearling	14,575	
	Godfrey Run	Trout Run & Godfrey Run, L. Erie	none	117,440	Yearling	117,440	
	Presque Isle Bay	Trout Run & Godfrey Run, L. Erie	none	50,068	Yearling	50,068	
	Raccoon Creek	Trout Run & Godfrey Run, L. Erie	none	46,800	Yearling	46,800	
	Sevenmile Creek	Trout Run & Godfrey Run, L. Erie	none	19,640	Yearling	19,640	
	Sevenmile Creek	Golden	none	2	Adult	2	
	Taylor Run	Domestic	none	650	Adult	650	
	Taylor Run	Golden	none	55	Adult	55	
	Temple Creek	Domestic	none	3,090	Adult	3,090	
	Temple Creek	Golden	none	175	Adult	175	
	Trout Run	Trout Run & Godfrey Run, L. Erie	none	86,200	Yearling	86,200	
	Twelvemile Creek	Trout Run & Godfrey Run, L. Erie	none	42,510	Yearling	42,510	
	Twelvemile Creek	Golden	none	1	Adult	1	
	Twentymile Creek	Trout Run & Godfrey Run, L. Erie	none	149,760	Yearling	149,760	
	Walnut Creek	Trout Run & Godfrey Run, L. Erie	none	197,584	Yearling	197,584	
						1,122,996	**Sub-Total**
Ohio	Chagrin River	Manistee River, L. Michigan	none	89,999	Yearling	89,999	
	Conneaut Creek	Manistee River, L. Michigan	none	74,026	Yearling	74,026	
	Grand River	Manistee River, L. Michigan	none	102,262	Yearling	102,262	
	Rocky River	Manistee River, L. Michigan	none	114,422	Yearling	114,422	
	Vermillion River	Manistee River, L. Michigan	none	72,704	Yearling	72,704	
						453,413	**Sub-Total**
New York	Buffalo Creek	Chambers Creek, L. Ontario	none	10,000	Yearling	10,000	
	Buffalo River	Chambers Creek, L. Ontario	none	10,000	Yearling	10,000	
	Canadaway Creek	Chambers Creek, L. Ontario	none	20,000	Yearling	20,000	
	Cattaraugus Creek	Chambers Creek, L. Ontario	none	90,000	Yearling	90,000	
	Cattaraugus Creek	Skamania, L. Ontario	AD+LP	13,100	Yearling	13,100	
	Cayuga Creek	Chambers Creek, L. Ontario	none	10,000	Yearling	10,000	
	Chautauqua Creek	Chambers Creek, L. Ontario	none	40,000	Yearling	40,000	
	Dunkirk Harbor	Chambers Creek, L. Ontario	none	10,000	Yearling	10,000	
	Cazenonevia Creek	Chambers Creek, L. Ontario	none	15,000	Yearling	15,000	
	Eighteen-Mile Creek	Domestic	none	4,530	Yearling	4,530	
	Eighteen-Mile Creek	Chambers Creek, L. Ontario	none	20,000	Yearling	20,000	
	Eighteen-Mile Creek - S Br	Chambers Creek, L. Ontario	none	20,000	Yearling	20,000	
	Silver Creek	Chambers Creek, L. Ontario	none	5,000	Yearling	5,000	
	Walnut Creek	Chambers Creek, L. Ontario	none	5,000	Yearling	5,000	
						272,630	**Sub-Total**
All Agencies						**1,937,239**	**Grand Total**

TABLE 6.2. Rainbow trout fin-clip summary for Lake Erie, 1999-2007.

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+LV	LP	-	-
2006	2005	-	-	LP	-	-
2007	2006	-	AD+LP	-	-	-

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

Assessment of Natural Reproduction

A comprehensive, multi-year stream electrofishing survey cataloging New York's Lake Erie tributaries for steelhead reproduction potential began in fall 2002 (Table 6.3). Candidate streams for the survey include all of the New York tributaries known to have adult steelhead runs in the fall through spring. The majority of the streams sampled have limited potential for steelhead production, but thirteen streams have shown a higher potential for producing wild steelhead. Five streams (Spooner Creek, Derby Brook, Little Chautauqua Creek, North Branch Clear Creek, Chautauqua Creek) were judged to have a high potential for producing significant numbers of wild fish while three other streams (Clear Creek, Connoisarauley Creek, Coon Brook) were large enough in size, despite some limitations, to produce measurable amounts of juvenile recruits. Twenty Mile Creek, which runs through both New York and Pennsylvania, was sampled by NYSDEC Region 9 inland fisheries in 2006 and also appears to have significant production of wild juvenile steelhead.

TABLE 6.3. Tributaries to New York waters of Lake Erie known to have adult steelhead runs in the fall and/or spring. Sampled streams were assigned a RP Index (Range= 0-5), which is an index of reproductive potential to indicate its potential for producing wild steelhead trout.

Stream	Stream Code	County	Year Sampled	RP Index
Buffalo Creek	E.1	Erie	-----	
Beaver Creek	E.37-2	Chautauqua	2002	1
Beaver Creek (2nd Gulf)	E.31	Chautauqua	2002	2
Big Indian Creek	E.23-5	Cattaraugus	-----	1
Big Sister Creek	E.20	Erie	2002	1
Bournes Creek	E.61	Chautauqua	2006	1
Canadaway Creek	E.37	Chautauqua	2004	1
Cayuga Creek	E.1-6	Erie	-----	
Cazenovia Creek	E.1-4	Erie	-----	
Chautauqua Creek	E.68	Chautauqua	2001,2007	3
Clear Creek	E.23-6	Erie	2004	2
Connoisarauley Creek	E.23-27	Cattaraugus	2002	3
Coon Brook	E.23-25	Erie	2005	3
Corell Creek	E.51	Chautauqua	2002	1
Crooked Brook	E.36	Chautauqua	2002	1
Delaware Creek	E.21	Erie	2002	1
Derby Brook	E.23-28	Erie	2004, 2005	4
Doty Creek	E.65	Chautauqua	2006	2
Eighteen Mile Creek	E.13	Erie	-----	
Grannis Creek	E.23-18	Erie	2005	2
Half Way Brook	E.24	Chautauqua	2005	1
Kelly Brook	E.23-24	Erie	2006	0
Little Canadaway Creek	E.43	Chautauqua	-----	1
Little Chautauqua Creek	E.68-1	Chautauqua	2001	4
Little Indian Creek	E.23-5-1	Cattaraugus	-----	1
Little Sister Creek	E.19	Erie	-----	1
Morton's Corner	E.23-28-3	Cattaraugus	2005	3
Muddy Creek	E.22	Erie	2002	1
Nigh Creek	E.23-27-1	Cattaraugus	2005	1
N. Branch Clear Creek	E.23-6-4	Erie	2006	3
Point Peter Brook	E.23-19	Cattaraugus	2006	1
Reiter Creek	E.30	Chautauqua	2002	2
Scott Creek (1st Gulf)	E.32	Chautauqua	2002	1
Silver Creek	E.25	Chautauqua	-----	1
Slippery Rock Creek	E.50	Chautauqua	2002	1
Smokes Creek	E.2	Erie	-----	1
S. Branch Cattaraugus Creek	E.23-20	Cattaraugus	2004	1
S. Branch Eighteen Mile Creek	E.13-4	Erie	-----	
Spooners Creek	E.23-30	Erie	2001	5
Thatcher Brook	E.23-17	Cattaraugus	2005	1
Twenty Mile Creek	E.96	Chautauqua	2006	*
Utley Brook	E.23-23	Cattaraugus	1996	1
Walnut Creek	E.25-1	Chautauqua	-----	1
Waterman Brook	E.23-21	Cattaraugus	2004	1

* Twenty Mile Creek was sampled by Region 9 inland fisheries in 2006 and no RP index was determined. Significant numbers of steelhead were sampled in this stream.

In anticipation of fish passage scheduled for 2009 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. The results of this survey showed the impact of the two dams on the passage of steelhead. Overall estimated YOY trout density was 3 times higher just below the dams compared to the headwaters of the creek. 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. The densities of naturally produced steelhead was higher than expected given past sampling and poor water conditions present during the summer months. Steelhead densities were similar to those found in streams with optimal thermal habitats in Michigan for both YOY and yearlings (Seelbach 1993; Godby et al. 2007). However, densities were lower than Spooner Creek (19,815 fish/acre), which is considered the top steelhead producing stream in New York's Lake Erie watershed (Culligan et al. 2002). Previous juvenile sampling on Chautauqua Creek in 2001 revealed low numbers of naturally-produced YOY steelhead (Culligan et al. 2002), but this sampling occurred at locations lower in the creek and effort was not as comprehensive as the survey conducted in fall 2007.

Exploitation

Previous creel surveys confirm that the majority of rainbow trout (steelhead) angling activity takes place in the tributaries as fish move from the lake into the streams to spawn. This was confirmed through tributary creel surveys conducted in Pennsylvania and New York tributaries to Lake Erie in 2003 (NY and PA) and 2004 (NY). 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. Several agencies provide annual measurements of open lake summer harvest by boat anglers.

The estimated harvest from the summer open-water boat angler fishery in 2007 was 25,685 steelhead in all US waters; a 260% increase from the 2006 steelhead harvest (Table 6.4). It was the highest open lake harvest of steelhead since 2004, but did not approach the highest recorded steelhead harvest of over 123,000 in 2002. Steelhead harvest was up in all areas; more than tripling the previous year's harvest in Michigan, New York and Ohio and doubling the previous year's harvest in Pennsylvania. Boat angler catch rates for rainbow trout also improved over those seen in 2006 as well (Figure 6.1). Nearly all (95%) of the reported harvest was concentrated in Central Basin waters of Ohio (69%) and Pennsylvania (26%). The remainder of open lake harvest (5%) occurred in the eastern basin waters of New York. Michigan reported a minimal (68 fish) summer steelhead harvest in 2007. The Ontario Ministry of Natural Resources did not survey anglers in their waters to provide sport harvest estimates for steelhead in 2007.

Figure 6.4. Reported estimated harvest of rainbow/steelhead trout by open lake boat anglers in Lake Erie, 1999-2007.

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

* no creel data collected by OMNR in 2003, 2005, 2006 and 2007

** 2004 OMNR sport harvest data is July and August, Central basin waters only

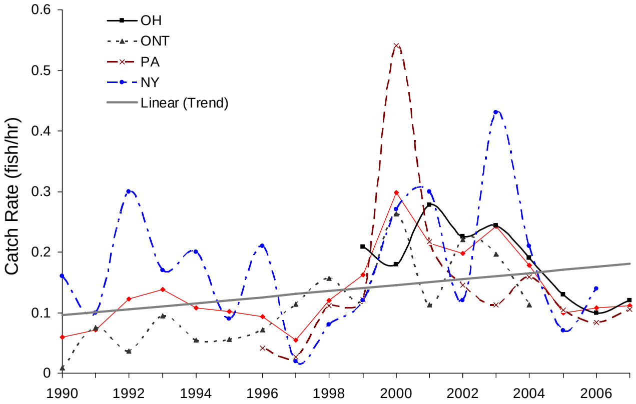

FIGURE 6.1. Targeted salmonid catch rates (fish/hr) by Lake Erie open lake boat anglers in Pennsylvania, New York, Ohio, and Ontario, 1990-2007. A linear trend line has been generated from mean interagency catch rates by year.

The Lake Erie tributaries provide the core of the steelhead fishery. Contemporary trends in the Lake Erie tributary fishery show increased effort in the last decade with anglers demonstrating a high catch and release ethic. Recent creel surveys on Lake Erie streams estimate steelhead angler release rates of 93% on New York tributaries (Markham, 2006), and 78% on Pennsylvania tributaries (Murray and Shields, 2004). The tributary steelhead fishery remains an exceptional fishery with high catch rates and increasing popularity. Trends in angler diary catch rates by steelhead anglers in Pennsylvania and New York waters have steadily increased since the late 1990s (Figure 6.2). However, diary reported catch rates have declined in Pennsylvania in 2005 and 2006. New York anglers' catch rates improved to a time-series high of 0.84 fish/hr in 2006. Steelhead catch rates in both areas remain at or above the long-term (1987-2006) average of 0.54 fish/hr.

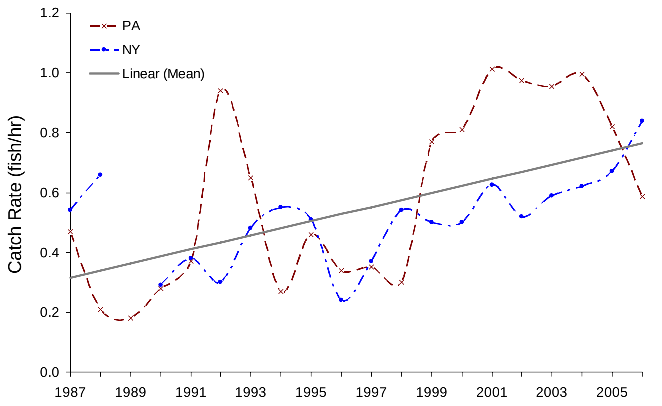

FIGURE 6.2. Targeted salmonid catch rates (fish/hr) in Lake Erie tributaries by Pennsylvania and New York angler diary cooperators, 1987-2006. A linear trend line has been generated from mean interagency catch rates by year.

Population Dynamics

Steelhead diets were assessed again during the summer in Ohio's central basin. As in previous years, *Bythotrephes* was found most often in diets, but by dry weight analysis, fish (emerald shiners, rainbow smelt and gizzard shad) were the most important items of caloric value (Table 6.5). A total of 16 different diet items were identified in steelhead diets. Once again, no alewife were found to be consumed by steelhead this year.

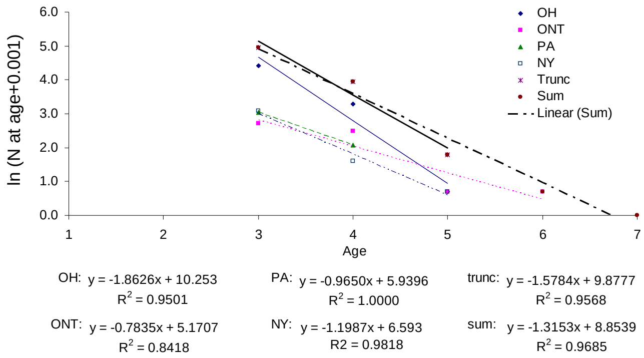

FIGURE 6.3. Estimation of instantaneous annual Z from catch curves using 2004 interagency steelhead catch-age information. Data summed for all agencies and non-zero-catch ages are presented as "sum". Data truncated for positive catches (exlcuding zero catches at age) are abbreviated at "trunc". Z values are calculated as the negative value of the slope of the line.

TABLE 6.5. Steelhead diet analysis from Ohio central basin cleaning house and assessment surveys, summer 2007.

Item	By % Occurrence	By % Dry Weight
Emerald shiner	16.2%	55.642%
UID fish	17.6%	18.081%
Bythotrephes	60.3%	7.529%
Gizzard shad	1.5%	6.419%
Rainbow smelt	7.4%	5.694%
Chironomids	23.5%	4.880%
Round goby	4.4%	1.304%
Yellow perch	2.9%	0.282%
Isopods	5.9%	0.127%
Dipteran	5.9%	0.016%
Sphaerids	5.9%	0.006%
Daphnia	10.3%	0.005%
Dreissena	11.8%	0.005%
Coleoptera	4.4%	0.004%
Gastropod	10.3%	0.003%
Amphipods	1.5%	0.002%
Hemiptera	2.9%	0.001%
Empty	14.7%	total N=68

Steelhead catch-at-age data from the 2004 interagency study (Clapsadl et al. 2006) were used to generate catch curves to estimate annual total mortality of steelhead (Figure 6.3; Kayle 2007). These rate function estimates were then applied to annual stocking amounts and estimates of natural reproduction to build an initial population model.

Total annual mortality, Z, was estimated from the slope of the regression lines produced from the summarized catch-at-age catch curves (Figure 6.3). Zero catches at age in the range presented were deleted in the regression analyses. Overall mean annual Z calculated for 2004 interagency steelhead ages 3-7 was 1.315. An annual Z estimate on a truncated age series (ages 3-6) that excluded low samples sizes of older-aged steelhead was 1.493, with a significant F-test (p=0.011). An annual Z estimate on a more truncated age series (ages 3-5) of older-aged steelhead was 1.578, but the F-test was not significant ($p>0.05$). Calculations of mean annual Z based on individual agency age data ranged from 0.784 (Ontario) to 1.863 (Ohio); however these results showed no significant F-tests ($p>0.05$).

By taking the exponentiated inverse of the natural log of the Z values, we calculated estimates of annual survival, $S=e^{-Z}$ (Table 6.6). Annual survival rates, S, are estimated at 0.268 for the combined

TABLE 6.6. Estimates of total annual mortality, Z, standard deviations of Z, and survival, S, for different agencies and combined catch-age data along with the P-value associated with the F-test for regression data.

	Z	std Z	S	F-test P
OH	1.863	0.427	0.155	0.143
ONT	0.784	0.240	0.457	0.082
PA	0.965	.	0.381	.
NY	1.199	0.163	0.302	0.086
all agencies ages 3-7	1.315	0.137	0.268	0.002
ages 3-5	1.578	0.335	0.206	0.133
ages 3-6	1.493	0.158	0.225	0.011
weighted agency mean	1.175	.	0.326	.

(ages 3-7) 2004 interagency data. Using age-truncated data sets, S=0.206 for the ages 3-5 data set and S=0.225 for the ages 3-6 data set. Estimates of mean annual S calculated from specific 2004 agency data varied from a low of 0.155 from Ohio 2004 data to a high of 0.457 from Ontario 2004 data. A weighted grand mean of all agencies survival rates was calculated at 0.326. Small sample sizes of specific ages for individual agencies led to wide error ranges in estimates for mean annual S and non-significant F-test values with p>0.05 (Table 6.6).

By having annual population parameters calculated for steelhead, we can begin to explore ways to estimate the standing population of steelhead in Lake Erie. A simplistic, accounting-style population model was built, similar to the CWTG lake trout model. This model takes available interagency steelhead stocking records, a crude estimate of natural reproduction based on an annual proportional production estimate, and a step factor for all sources of mortality: stocking mortality and estimates of annual total mortality, Z (and conversely, survival, S). Applying these fixed rate factors to annual production puts estimates of steelhead ages 1 and older at around 0.6-0.8 million fish (Table 6.7) for the last decade. Completing sensitivity analyses by varying the annual stocking survival from 0.1 to 0.9 across all years, and keeping annual S constant at 0.2684, moves the population abundance range from 0.3 to 2.8 million steelhead, respectively (Table 6.7, inset). Even with relaxing annual S to a weighted agency average of 0.3261 and keeping post stocking survival at a high 0.9, the adult steelhead population only attains a maximum abundance of just over three million steelhead during the last decade.

Estimates that place the current (2007) Lake Erie steelhead adult population at around 800 thousand ages one summer and older fish may be considered conservative based on fixed survival and mortality estimates. Even more aggressive estimates that peg post-stocking survival to very high levels buoy the estimates of age one and older steelhead to just under three million fish. These steelhead abundance values are only a small fraction of the populations of age-2-and-older walleye during the similar time frame (1997-2006) that ranged from 14 to 65 million fish (Walleye Task Group 2008) and are currently in the 23 million adult fish range in the west and central basins with a possible 6 million walleye inhabiting the eastern basin (Walleye Task Group 2008).

More work should be done to evaluate contributions of different strains of Lake Erie steelhead stockings and natural reproduction to the standing stock and tributary returns of steelhead. More work also needs to be done to evaluate steelhead fishery statistics on a routine basis to determine fishery rates such as F, M, Z, and S, as well as catch, age and growth information. More information is needed on the effect and magnitude of sea lamprey predation, wounding, and mortality on Lake Erie steelhead. With these developments, a framework would be in place to complete a Bayesian approach in catch-age modeling with uncertainty estimates and dynamic (rather than fixed) variables for F, M, Z, and S. These results and their implications can be applied in the future for a more meaningful bioenergetics modeling exercise for Lake Erie steelhead and other Lake Erie predators.

Table 6.7. Lake Erie steelhead population abundance estimator and estimates of abundance ranges (inset box) with variations in annual S and stocking S.

	Year Stocked																		
Agency	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Michigan	69,560	85,290	58,980	14,500	22,200	25,300	50,460	59,200	71,317	60,030	69,234	60,000	67,789	60,000	79,592	64,200	60,900	66,514	60,500
Ohio	242,000	485,310	367,910	561,600	421,570	165,520	112,950	205,350	197,897	266,383	238,467	375,022	424,530	411,601	544,280	422,291	402,827	491,943	453,413
Penn	720,920	889,470	641,390	1,485,760	973,300	1,240,200	1,223,450	1,091,750	1,153,606	1,271,651	835,931	1,237,870	1,185,239	1,145,131	866,789	1,211,551	1,183,246	1,205,203	1,122,996
New York	141,740	160,500	181,800	149,050	256,440	251,660	220,940	318,900	277,042	299,610	310,300	298,330	276,300	257,200	253,750	257,400	275,000	275,000	272,630
Ontario	14,370	31,530	98,200	89,160	16,680	69,200	56,000	38,900	51,000	61,000	85,235	10,787	40,860	66,275	48,672	34,600	55,000	44,350	27,700
sum age 0.1	1,188,590	1,652,100	1,348,280	2,300,070	1,690,190	1,751,880	1,663,800	1,714,100	1,750,862	1,958,674	1,539,167	1,982,009	1,994,718	1,940,207	1,793,083	1,990,042	1,976,973	2,083,010	1,937,239
Nat Rep 0.1	117,553	161,553	128,200	227,094	177,953	178,321	166,781	177,545	176,707	198,745	153,985	206,039	202,422	194,253	179,169	201,994	199,857	210,965	198,535
age 1.1	350,569	486,784	396,287	678,291	501,410	518,066	491,328	507,718	517,359	579,051	454,442	587,272	589,712	572,889	529,353	588,343	584,261	615,703	573,242
age 2.1		94,093	130,653	106,363	182,053	134,578	139,049	131,872	136,271	138,859	155,417	121,972	157,624	158,279	153,763	142,078	157,911	156,816	165,255
age 3.1			25,254	35,067	28,548	48,863	36,121	37,321	35,395	36,575	37,270	41,714	32,737	42,306	42,482	41,270	38,134	42,383	42,089
age 4.1				6,778	9,412	7,662	13,115	9,695	10,017	9,500	9,817	10,003	11,196	8,787	11,355	11,402	11,077	10,235	11,376
age 5.1					1,819	2,526	2,057	3,520	2,602	2,689	2,550	2,635	2,685	3,005	2,358	3,048	3,060	2,973	2,747
age 6.1						488	678	552	945	698	722	684	707	721	807	633	818	821	798
age 7.1							131	182	148	254	187	194	184	190	193	216	170	220	220
age 8.1								35	49	40	68	50	52	49	51	52	58	46	59
age 9.1									9	13	11	18	14	14	13	14	14	16	12
total population	model burn-in period, used to accumulate cohorts								702,796	767,679	660,483	764,543	794,911	786,240	740,376	787,056	795,503	829,212	**795,798**

Fixed S	**Stocking S**
0.2684	**0.2684**

Assumptions:
* Constant Z from year-to year, no age or sex differences.
** Z is source of all mortality: natural, stocking, sea lamprey, fishing.
*** Nat. rep. is 15% of NY stock and 10% of OH and PA stock in that year.
**** Assume Z is equal for all ages based catch curve; stocking Z=annual Z .

Population Estimates

Stocking S Fixed	Variable annual S	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.2684	0.2063	498,657	547,948	462,339	546,775	566,069	557,119	521,809	559,866	564,580	589,720	731,522
0.2684	0.2684	702,796	767,679	660,483	764,543	794,911	786,240	740,376	787,056	795,503	829,212	**795,798**
0.2684	0.3261	925,842	1,005,434	879,984	1,000,465	1,042,705	1,036,048	980,981	1,034,696	1,047,253	1,089,548	865,652
Variable Stocking S	Fixed annual S	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.1000	0.2684	261,846	286,020	246,082	284,852	296,166	292,936	275,848	293,240	296,387	308,946	296,497
0.3000	0.2684	785,539	858,061	738,245	854,556	888,499	878,807	827,543	879,720	889,162	926,839	889,491
0.5000	0.2684	1,309,232	1,430,102	1,230,409	1,424,260	1,480,832	1,464,679	1,379,239	1,466,199	1,481,936	1,544,732	1,482,485
0.7000	0.2684	1,832,924	2,002,143	1,722,572	1,993,964	2,073,165	2,050,550	1,930,935	2,052,679	2,074,711	2,162,625	2,075,480
0.9000	0.2684	2,356,617	2,574,184	2,214,736	2,563,668	2,665,498	2,636,422	2,482,630	2,639,159	2,667,485	2,780,518	2,668,474

Range	Stocking S	Annual S	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Low	0.1000	0.2063	241,715	265,608	224,110	265,039	274,391	270,053	252,937	271,384	273,670	285,855	272,549
High	0.9000	0.3261	2,555,221	2,774,886	2,428,659	2,761,173	2,877,750	2,859,378	2,707,398	2,855,646	2,890,303	3,007,032	2,902,709

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Table 6.7. Lake Erie steelhead population abundance estimator and estimates of abundance ranges (inset box) with variations in annual S and stocking S.

Agency	Year Stocked 1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Michigan	69,560	85,290	58,980	14,500	22,200	25,300	50,460	59,200	71,317	60,030	69,234	60,000	67,789	60,000	79,592	64,200	60,900	66,514	60,500
Ohio	242,000	485,310	367,910	561,600	421,570	165,520	112,950	205,350	197,897	266,383	238,467	375,022	424,530	411,601	544,280	422,291	402,827	491,943	453,413
Penn	720,920	889,470	641,390	1,485,760	973,300	1,240,200	1,223,450	1,091,750	1,153,606	1,271,651	835,931	1,237,870	1,185,239	1,145,131	866,789	1,211,551	1,183,246	1,205,203	1,122,996
New York	141,740	160,500	181,800	149,050	256,440	251,660	220,940	318,900	277,042	299,610	310,300	298,330	276,300	257,200	253,750	257,400	275,000	275,000	272,630
Ontario	14,370	31,530	98,200	89,160	16,680	69,200	56,000	38,900	51,000	61,000	85,235	10,787	40,860	66,275	48,672	34,600	55,000	44,350	27,700
sum age 0.1	1,188,590	1,652,100	1,348,280	2,300,070	1,690,190	1,751,880	1,663,800	1,714,100	1,750,862	1,958,674	1,539,167	1,982,009	1,994,718	1,940,207	1,793,083	1,990,042	1,976,973	2,083,010	1,937,239
Nat Rep 0.1	117,553	161,553	128,200	227,094	177,953	178,321	166,781	177,545	176,707	198,745	153,985	206,039	202,422	194,253	179,169	201,994	199,857	210,965	198,535
age 1.1	350,569	486,784	396,287	678,291	501,410	518,066	491,328	507,718	517,359	579,051	454,442	587,272	589,712	572,889	529,353	588,343	584,261	615,703	573,242
age 2.1		94,093	130,653	106,363	182,053	134,578	139,049	131,872	136,271	138,859	155,417	121,972	157,624	158,279	153,763	142,078	157,911	156,816	165,255
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age 4.1				6,778	9,412	7,662	13,115	9,695	10,017	9,500	9,817	10,003	11,196	8,787	11,355	11,402	11,077	10,235	11,376
age 5.1					1,819	2,526	2,057	3,520	2,602	2,689	2,550	2,635	2,685	3,005	2,358	3,048	3,060	2,973	2,747
age 6.1						488	678	552	945	698	722	684	707	721	807	633	818	821	798
age 7.1							131	182	148	254	187	194	184	190	193	216	170	220	220
age 8.1								35	49	40	68	50	52	49	51	52	58	46	59
age 9.1									9	13	11	18	14	14	13	14	14	16	12
total population	model burn-in period, used to accumulate cohorts								702,796	767,679	660,483	764,543	794,911	786,240	740,376	787,056	795,503	829,212	**795,798**

Fixed S	Stocking S
0.2684	**0.2684**

Assumptions:
* Constant Z from year-to year, no age or sex differences.
** Z is source of all mortality: natural, stocking, sea lamprey, fishing.
*** Nat. rep. is 15% of NY stock and 10% of OH and PA stock in that year.
**** Assume Z is equal for all ages based catch curve; stocking Z=annual Z .

Population Estimates

Stocking S Fixed	Variable annual S	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.2684	0.2063	498,657	547,948	462,339	546,775	566,069	557,119	521,809	559,866	564,580	589,720	731,522
0.2684	0.2684	702,796	767,679	660,483	764,543	794,911	786,240	740,376	787,056	795,503	829,212	**795,798**
0.2684	0.3261	925,842	1,005,434	879,984	1,000,465	1,042,705	1,036,048	980,981	1,034,696	1,047,253	1,089,548	865,652

Variable Stocking S	Fixed annual S	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.1000	0.2684	261,846	286,020	246,082	284,852	296,166	292,936	275,848	293,240	296,387	308,946	296,497
0.3000	0.2684	785,539	858,061	738,245	854,556	888,499	878,807	827,543	879,720	889,162	926,839	889,491
0.5000	0.2684	1,309,232	1,430,102	1,230,409	1,424,260	1,480,832	1,464,679	1,379,239	1,466,199	1,481,936	1,544,732	1,482,485
0.7000	0.2684	1,832,924	2,002,143	1,722,572	1,993,964	2,073,165	2,050,550	1,930,935	2,052,679	2,074,711	2,162,625	2,075,480
0.9000	0.2684	2,356,617	2,574,184	2,214,736	2,563,668	2,665,498	2,636,422	2,482,630	2,639,159	2,667,485	2,780,518	2,668,474

Range	Stocking S	Annual S	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Low	0.1000	0.2063	241,715	265,608	224,110	265,039	274,391	270,053	252,937	271,384	273,670	285,855	272,549
High	0.9000	0.3261	2,555,221	2,774,886	2,428,659	2,761,173	2,877,750	2,859,378	2,707,398	2,855,646	2,890,303	3,007,032	2,902,709

Charge 7: Prepare Lake Erie Herring Management Plan. Review ecology and history of this species and assess potential for recovery.

Betsy Trometer (USFWS), Tom MacDougall (OMNR), Kurt Oldenburg (OMNR)

Lake herring is indigenous to the Great Lakes and historically supported one of the most productive fisheries in Lake Erie (Scott and Crossman 1973, Trautman 1981). Lake herring is considered extirpated in Lake Erie, although commercial fishermen report it periodically (Figure 7.1). Their demise was mainly through over-fishing, 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, and chemical pollution are a few factors contributing to habitat degradation (Hartman 1973). Although lake herring collapsed prior to the expansion of introduced rainbow smelt (*Osmerus mordax*) and alewife (*Alosa psuedoharengus*) in the 1950s, these exotic species may have prevented any recovery of herring through competition and predation. Selgeby et al. (1978) documented consumption of lake herring eggs by rainbow smelt. Evans and Loftus (1987) summarized two studies in which smelt consumed large numbers of lake herring 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 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 whitefish in Lake Erie (Oldenburg et al. 2007). Lake herring would also be favored by these conditions. Rainbow smelt abundance declined sharply in the 1990s and continues to remain low (Ryan et al. 1999 and FTG 2007). Alewife has never been very abundant in Lake Erie due to overwinter temperatures that frequently prove lethal (Ryan et al. 1999). However, occasion strong year classes are produced in both the east and west basins that undoubtedly impact the fish community.

With the recent recovery of other native coldwater species (i.e. lake whitefish and burbot), and the continued low abundance of rainbow smelt, there has been an opportunity for lake herring to recover in Lake Erie. Commercial fishermen have been reporting lake herring since the 1990s, although these reports are rare.

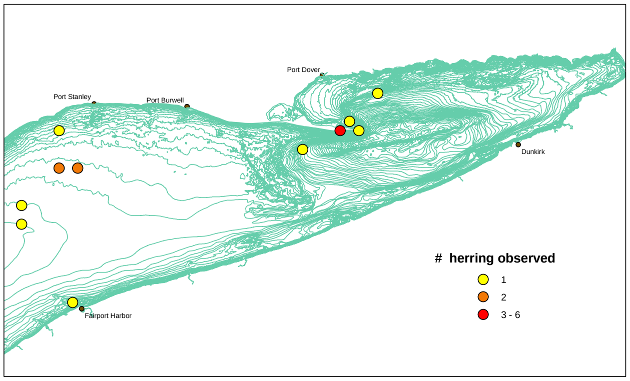

FIGURE 7.1. Spatial distribution of some recent (1996 – 2007) lake herring observations. All reports are from the Ontario commercial gillnet and trawl fisheries with the exception of one occurrence in the ODNR index gillnet program near Fairport, OH. Total number of sightings is higher than shown as observations without location information have been excluded.

Rehabilitation Efforts

Within the last few years, there have been several different management efforts leading toward the re-establishment of lake herring into Lake Erie. A workshop sponsored by the Great Lakes Restoration Act was held in July 2003 reviewing the status and impediments for lake herring 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 lake herring 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 lake herring workshop was held in April 2006 to discuss a model developed for Lake Superior and implications for restoration in the Lower Great Lakes.

In an effort to determine if a remnant lake herring stock still exists in Lake Erie, nine lake herring 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 lake herring from Lake Erie and other Great Lakes, including archived Lake Erie specimens from 1955-65, were compared to determine if the recent 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 lake herring are genetically most similar to Lake Erie specimens from 1950s and 1960s, suggesting that a remnant of the original Lake Erie stock exits (Rocky Ward, USGS Northern Appalachian Research Laboratory, Wellsboro, unpublished data). The extant surviving lake herring that is most similar to the Lake Erie remnant is from Lake Huron. Although recent observations of young individuals in Lake Erie (Table 7.1) suggest that natural reproduction of extant stocks may be occurring, the possibility that this represents downstream drift from Lake Huron cannot be ruled out. The implications of these findings pose difficult management decisions for restoration efforts involving stocking with lake herring from other sources of broodstock. However, the current stocks may not be large enough to ever re-establish a self-sustaining population that will contribute significantly to the forage fish community of eastern Lake Erie.

Disease testing of potential lake herring broodstock from other viable sources has begun in case stocking is required for lake herring rehabilitation. Positive results for BKD from Lake Superior bloaters in 2005 have eliminated the upper Great Lakes as a potential source of lake herring broodstock gametes. Lake herring collected from eastern Lake Ontario in November 2006 and 2007 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. New York Finger Lakes lake herring populations, such as the one found in Skaneateles Lake, are being considered for lake herring production as well, but no collections have occurred to date.

TABLE 7.1. Sampling details from a selection of lake herring captured during commercial and index (*) fishing efforts, 1996 – 2007.

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+
12/09/2000 *	238		111	maturing	F	UNK
06-Sep-02	315	284	239	mature	F	UNK
06-Sep-02	170	153	135	mature	F	UNK
9-Jul-03	298	266	275	UNK	M	2+
9-Jul-03	222	203	103	UNK	M	1+
16-Jul-03	301	271	248	UNK	UNK	UNK
27-Aug-03	278		183	immature	F	UNK
17-Jun-05	357			mature	F	6
5-Aug-05	367			mature	F	6
8-May-07	389	352	427	mature	F	7
15-May-07	333	300	295	mature	F	7

Management Plan

The Lake Erie Coldwater Task Group was charged with preparing a Lake Erie lake herring 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. The outline includes sections on: historical fish community and ecology, current status, opportunity for recovery or reintroduction, benefits of recovery or reintroduction, ecological risks and bottlenecks to recovery or reintroduction, mechanics of reintroducing lake herring, assessment and information needs, time frame and adaptive management. The final draft on the plan is expected to be completed in fall 2008 and reported in 2009.

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Charge 8: Revision of the Lake Erie Lake Trout Rehabilitation Plan

By James Markham (NYSDEC)

A revision of the Lake Erie Lake Trout Rehabilitation Plan was proposed through the Lake Erie Coldwater Task Group (CWTG) to the Lake Erie Committee (LEC) at the annual meeting in March 2006. The original Lake Trout Restoration Plan (Lake Erie Lake Trout Task Group 1985), written in 1985, precedes many of the changes that occurred in the Lake Erie fish community and ecosystem following the invasion of dreissenids and other invasive species. Some of these changes were documented in a 1993 revision of the Plan written by Pare (1993), but this revision was never officially adopted by the Lake Erie Committee. Since the initial restoration plan, we have gained 20 years of additional knowledge about lake trout, how the species functions in the Lake Erie community, and the challenges of population rehabilitation. This experience, combined with the goals and objectives of the initial restoration plan, provided a framework to develop a document to guide future efforts to rehabilitate lake trout in Lake Erie.

The new plan, titled “A Strategic Plan for the Rehabilitation of Lake Trout in Lake Erie, 2008-2020”, is currently in its final stages of completion. The plan covers the historical background of lake trout restoration in Lake Erie, current status of stocks, new goals and objectives, management strategies to achieve these new goals, and impediments to lake trout restoration. The document also outlines assessment and research needs by lake jurisdictions as well as the agency roles and responsibilities. The new goals defined in the plan to increase and maintain overall lake trout abundance recommend a combination of better sea lamprey control, increased stocking of at least 200,000 yearlings annually, and identification of potential lake trout spawning areas. Other management strategies include expanding the distribution of stocked fish, rotation of stocking areas, maintaining genetic diversity of stocked lake trout, and maintaining adult survival rates of at least 60%. Upon completion and final approval by the LEC, the plan will be posted on the Great Lakes Fishery Commission website (www.glfc.org/lakecom/lec/CWTG.htm). Copies will also be available upon request from an LEC, Standing Technical Committee (STC), or CWTG representative.

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