Report of the Coldwater Task Group To the Standing Technical Committee Of the Lake Erie Committee

28 March 2001

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Charges to Coldwater Task Group 2000 — Page

Background:

The Cold Water Task Group (CWTG) is one of several technical groups under the Lake Erie Committee (LEC) structure that addresses specific charges related to the coldwater fish community. The CWTG's primary function, originally, was the coordination, collation, analyses and reporting of annual lake trout assessments among its five member agencies and measuring the results toward rehabilitation status. Restoration of lake trout, back into its native eastern basin Lake Erie habitat, began in 1978 when 236,000 surplus yearlings from a scheduled Lake Ontario plant became available. Similar numbers of yearlings were also available for Lake Erie in 1979. From 1982, when a cooperative partnership for Lake Erie lake trout rehabilitation was struck between the Pennsylvania Fish and Boat Commission (PFBC), the U.S. Fish and Wildlife Service (USFWS), and the New York Department of Environmental Conservation (NYS DEC), to 1994 annual plants have averaged close to 200,000 yearlings. A formal rehabilitation plan was developed in 1985 and still serves as the working document guiding current assessment efforts.

In more recent years, interest in the expanding burbot and lake whitefish populations, as well as predator/prey relationships involving salmonines and rainbow smelt interactions have prompted additional charges from the LEC. Rainbow/steelhead trout dynamics have recently entered into the task group's list of charges. A new charge concerning lake herring was added in 1999.

This report is specifically designed to address each charge presented to the CWTG at the LEC's, March 2001, annual meeting. Data has been supplied by each member agency, when available, and combined for this report if it conforms to standard protocol. Individual agencies may still choose to report their own assessment activities, under separate agency letterhead.

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

Methods:

A stratified, random design, deepwater gill net assessment protocol for lake trout has been in place since 1986. NYS DEC modified the protocol in 1996 by fishing monofilament mesh, instead of the standard multifilament nylon mesh following two years of comparative data that detected no significant difference (P>.05) in the total catch (Culligan et al. 1996). In 1998 and 1999, all agencies used standard monofilament assessment nets to sample eastern basin lake trout, except Pennsylvania which still fishes multifilament nylon mesh. Some question still exists about the compatibility of Pennsylvania's gear to standardization due to their use of nylon mesh graded by 6.4 mm increments, rather than the standard 12.7 mm increment.

Net panels, each 15.2 m long, are randomly tied together to form 152.4 m gangs. Each panel consists of 38 to152 mm, by 12.7 mm increments, material. 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.

Sampling design divides the eastern basin of Lake Erie into eight equal areas using north/south-oriented 58000 series Loran C Lines of Position (LOP) bounded on the west by LOP 58435 and on the east by LOP 58955 (Figure 1.1). Each area contains 13 equidistant north/south-oriented LOPs that serve as transects. Three transects are randomly selected in each area and sampled first. Once completed, the whole process is repeated, including random selection. A full compliment of standard eastern basin effort should be 60 standard lifts each for New York and Pennsylvania waters (2 areas each) and 120 lifts from Canadian waters (4 areas total). This amount of effort has never been achieved, to date.

Sampling protocol calls for the first net gang to be set along the contour, where the 8° to 10°C isotherm intersects the bottom (top of net needs to be in this stratum). The next three gangs are set at increments of 1.5 m greater depth or 0.8 km distance from the previous (shallower) gang, whichever occurs first along the transect toward deeper/colder water. The fifth and deepest net gang is set 15 m deeper than the shallowest net (number 1) or 1.6 km distance from net number 4, whichever occurs first.

NYS DEC 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) Biological Research Division (BRD) has assumed responsibility for standard assessments in Canadian waters since 1992. The Ontario Ministry of Natural Resources (OMNR) coordinated with BRD in 1998 and 2000 to complete standard assessments in Canadian waters. In 2000, NYS DEC made 58 unbiased lifts, PFBC made 25 lifts, and BRD/OMNR made 50 unbiased lifts. Total effort for 2000 was 133 unbiased standard lake trout assessment lifts in the eastern basin of Lake Erie.

All lake trout are routinely examined for total length, weight, sex, maturity, fin clips, and sea lamprey wounding classification. Snouts from each lake trout are retained, and coded-wire tags (CWT) are extracted in the laboratory to accurately determine age and genetic strain. Scale samples and otoliths are also retained from most fish for aging when CWTs are not retrievable at the laboratory. Stomach data is usually collected as on-site enumeration or as a preserved sample.

Results and Discussion:

Abundance

Since 1992, both U.S. and Canadian waters of eastern basin Lake Erie have been sampled using standard techniques. The relative abundance of lake trout in 2000 was 1.32 fish per standard lift, the second lowest estimate in the time series (Figure 1.2). Overall indices of total lake trout abundance continue to indicate a decline in the Lake Erie population since 1998. Indices for 1998 - 2000 averaged more than 40 percent lower (1.46) and were highly significant ($P<.01$) from earlier indices for the period from 1992 to 1997 (2.63).

Overall lake trout catches by standard assessment area in 2000 were more dispersed than in previous years (Figure 1.1). Lake trout abundance in 1998 and 1999 were greatest in New York waters (A1, A2) and lessened on a northerly and westerly gradient. In 2000, A5 registered the highest CPE value. Higher numbers of lake trout were also found in A4 by PFBC. Areas A1-A3 continued to produce the most consistent catches from year to year, coinciding with the areas where stocking of yearling lake trout occurs.

Expansion of the adult (age-5-and-older) lake trout population, in response to initial sea lamprey treatments in 1986, has been monitored annually from standard assessments (Figure 1.3). A significant ($P<.05$) drop in abundance was observed in 1998, following a 6-year (1992-1997) period of steady growth. The 2000 relative index of abundance of 0.65 fish/lift continued the downward trend, registering the lowest index recorded since initial sea lamprey treatments in 1988.

Increases in juvenile abundance, which had not been seen since 1994, occurred in 2000 (Figure 1.4). Yearlings (1+), although not abundant, were present in gill net catches for the second consecutive year. Prior to this, yearlings were virtually absent from samples since 1993. Catches of age 2 lake trout were also at their highest levels since 1994. The increases may be due to new offshore stocking techniques or to suppressed levels of adult lake trout abundance. Overall juvenile abundance, although not a complete index due to their lack of full vulnerability to sampling gear, still suggests, as a group, they are less abundant today than they were in the mid to late 1980's in Lake Erie.

Sampling was conducted in all eight standard areas in 2000. A total of 213 lake trout were collected. The population was comprised of 15 year-classes from age 1 to 16 (Table 1.1). Sex ratios were, in general, split evenly between males and females after age four. Only seven fish older than age 12 were sampled with the oldest, and largest, being a 910 mm male weighing just over 8000 grams.

Survival

Annual survival, estimated from standard eastern basin assessment gill net catches, has remained relatively stable or increased since 1992 when sampling effort was implemented basinwide. The lake trout rehabilitation plan calls for survival of 60 percent or better (Lake Trout Task Group, 1985). Survival estimates have been above that level for the past three years (Figure 1.5). Since 1992, estimates of annual survival have averaged 65 percent, compared to pre-treatment era years prior to 1989 when survival was highly variable and averaged slightly over 30 percent (1981-1988). Survival of older fish has improved over time.

The estimated annual survival calculated from age-based catch curves using the 2000 basinwide lake trout catch from age 3 to age 12 was 92 percent, the highest recorded survival to date (Figures 1.5 and 1.6). Survival, however, is somewhat ambiguous as a measure of rehabilitation progress as populations grow, and in this case is misleading. Low abundance of middle aged (ages 4-7) and higher abundance of older (ages 8-12) lake trout flattened out the catch curve to provide the survival estimate. While survival of the older age classes was exceptional, recruitment and survival of the middle ages appeared poor. Future survival estimates should begin to decline once the middle age classes become the old lake trout in the Lake Erie population. At this point in time and with declining adult populations, juvenile lake trout survival, along with evidence of successful natural reproduction are the most important factors to the future of this program.

Growth

Mean lengths-at-age of all sampled eastern basin lake trout showed little deviation from the long-term New York average (Figure 1.7). With the exception of age 7, mean weights-at-age up to age 10 were consistently higher than the long-term New York average (Figure 1.8). Growth rate of Lake Erie fish tends to be among the fastest in the Great Lakes basin. A 7-year-old Lake Erie lake trout will have an average total length of 736 mm and weigh about 4855 grams. Long-term averages indicate the majority of growth in length occurs by age 10 with fish reaching a total length of 788 mm and weigh 6073 grams.

Maturity

Twenty-six mature females ranging from age 3 through 12 were sampled in standard assessment gill nets in 2000, generating a mean age of maturity of 8.2 years (Figure 1.9). This marks the third consecutive year mature female lake trout have met or exceeded the target mean age of 7.5 years, established in the Strategic Plan (Lake Trout Task Group 1985). The plan objective assumes adult females need at least two spawning years to contribute to the production of detectable, natural reproduction.

Stocking

The current lake trout goal of 120,000 yearlings stocked was surpassed for the second straight year (Figure 1.10). The Allegheny National Fish Hatchery (ANFH) supplied the bulk of the lake trout with 80,000 CWT/Ad clipped Superior strain fish stocked in New York in 90 feet of water, due North of Dunkirk. All fish were transported offshore in deck-mounted tanks using the NYS DEC Research Vessel, ARGO, on May 9-11, 2000. The ANFH also supplied the Pennsylvania waters of Lake Erie with 40,000 CWT/Ad clipped Lewis Lake strain lake trout. These fish were planted inshore at Safe Harbor Marina on May 9-12, 2000. An additional 7,000 fingerlings (LV fin clipped) and 8,000 yearlings (RV fin clipped) of Seneca strain were supplied by the Bath State Fish Hatchery and stocked in Barcelona Harbor, New York. ANFH also stocked 249 surplus 3-year olds from a future broodstock lot thinning at Dunkirk Harbor, New York.

Lake trout sac fry were available for planting on Brocton Shoal in Spring, 2000 from ANFH. Fry were stocked on cobble material by NY DEC personnel using SCUBA on 12 April (175,200) and on 15 May (87,500). This was the second largest stocking of lake trout sac fry since stocking started in 1990. All lake trout fry were temperature otolith marked prior to release for future identification.

Paired planting of yearling lake trout, to compare survival and growth rates of large versus small stocking size, was started in 2000. Yearling lake trout averaging 13 and 7 fish/pound were stocked by ANFH on 9-11 May 2000 north of Dunkirk in open water. Each of the size groups consisted of 40,000 fish and had different coded wire tag (CWT) numbers. Future assessment will evaluate size and frequency of these two groups to determine if yearling stocking size affects recruitment to adult sizes.

In total, Lake Erie received 128,000 yearlings, 249 three year olds, 7,000 fingerlings, and 262,700 sac fry lake trout in 2000.

Sea Lamprey Activity

Observed fresh wounding (A1-A3) on lake trout greater than 532 mm total length was 17.1 wounds per 100 fish in 2000, exceeding the target rate of 5 wounds per 100 fish for the fifth consecutive year (Figure 1.11). Since 1996, observed wounding on lake trout has been the highest since initial sea lamprey treatments took effect in 1988. All fresh lake trout wounds (A1-A3) occurred on fish greater than 633 mm. Overall, fresh wounding rates in 2000 were equal to 1999 rates, but lower than the 11-year high of 24.8 wounds per 100 fish in 1998.

A4 wounds, which indicate the past year's cumulative attacks, showed a 50% decline from 1999 rates, but were still higher than the lows observed from 1990 through 1995 (Figure 1.12). The observed 2000 attack rate was 16.2 wounds per 100 fish for fish greater than 532 mm.

Treatment of several Lake Erie tributaries during the spring 1999 appeared to have little effect on sea lamprey predation. Surveys of Cattaraugus Creek, a major sea lamprey spawning tributary in Lake Erie, revealed a high number of residual ammocetes present, indicative of an incomplete treatment. Cattaraugus Creek is targeted for sea lamprey treatment in spring 2001 with the hopes of decreasing wounding rates to early to mid-1990's levels.

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

Whitefish

Commercial Harvest

The total harvest of Lake Erie whitefish in 2000 was approximately 1.35 million pounds, representing an increase of 8% from 1999. Ontario accounted for 97% of the total harvest in 2000, most of which was from gill nets (97%). Ontario's remaining fraction came from trawling (3%) while trap nets represented less than 1% of the harvest. Approximately three percent (3%) of the Lake Erie whitefish harvest was from Ohio, while the harvest from Pennsylvania trap nets was negligible (Figure 2.1).

Relative harvests from gill nets in Ontario waters were 40%, 39%, 11%, 6%, and 4% for statistical districts (OE) 1 to 5, respectively. The majority of the Ontario harvest from the western basin (90%) was caught from October to December with the peak occurring during November. In the central basin, most of the harvest (89%) was taken from March to June. Whitefish catches in Ontario statistical district 4 were primarily distributed from August to November (95%). Gill netting and trawling represented almost identical proportions of the harvest from statistical district 4. In OE 5, the harvest was greatest during July (71%), followed by May (20%). The whitefish trawl harvest was negligible (<1%) from OE 5.

The age composition of whitefish caught during Ontario's fall fishery in statistical district 1 included fish ages 3 to 10, with 4 year-olds (1996 year class) representing 42% of the catch (Figure 2.2). Whitefish ages 3 to 12 comprised Ohio's harvest, with age 5 (1995 year class) representing the largest component (38%). The mean age of whitefish harvested from Ohio waters (5.4) was lower than the previous year (7.0) and similar to the mean age of Ontario's fall harvest in the western basin (5.0) (Figure 2.3).

Ontario's 2000 fall commercial gill net CPUE (27.9 kg / km) decreased 20% from 1999 (31.7 kg / km) (Figure 2.3). Fall catch rates were highest during the month of December (99 kg/km) in 2000, considerably higher than in November (33 kg/km) while the harvests during these two months were similar in magnitude. There was no apparent change in total mortality rate from the previous year's assessment, based on catch curve analysis using fall CPUE at age data from OE 1, 1997-2000 (Figure 2.4).

Index Fishing

With good representation in the 2000 harvest, the 1996 year class appears strong, confirming early indications of YOY and yearling abundance in Ohio August and October trawl indices within Districts 2 and 3. There is no evidence of strong year classes following the 1996 cohort, though the 1998 and 1999 year classes may be moderate with greater expectations for the latter cohort. No young-of-the-year whitefish were caught during 2000 in Ohio trawls. Index trawling conducted by the Pennsylvania Fish and Boat Commission has not produced juvenile whitefish since 1992, despite frequent catches of young fish during the previous decade**.**

The number of whitefish caught per standard gill net lift (1.4) was below average (1.9) in 2000 for the deep water gillnet assessment conducted by New York and Pennsylvania in eastern Lake Erie. However, the CPUE expressed as weight (2.5 kg / lift) was above the time series average of 1.7 kg per lift, reflecting the presence of older fish in the survey (Figure 2.5). The Ontario partnership gill net index failed to catch any whitefish in the east basin during 2000, and the Pennsylvania Ridge survey produced a single whitefish. In the east-central basin, catches were below average, but in the west-central basin, CPUE remained relatively high (Figure 2.6). The whitefish age composition from the Ontario partnership indices (all basins) included ages 1 to 12, with age 5 (1995 year class) representing 30% (Figure 2.7). The 1997 year class, initially considered weak, accounted for 16% of the whitefish caught in the Ontario partnership surveys.

Growth and Diet

The condition of mature whitefish exhibited strong fluctuations since 1987, according to New York survey and Ontario survey and commercial data (Figure 2.8). In 2000, condition was poor for both mature female and male whitefish. In 2000, whitefish were collected for diet analyses from the central basin (Ohio) and eastern basin (Ontario). Results from both studies suggested that Chironomids represented the greatest fraction of the whitefish diet in both basins of Lake Erie (Figures 2.9a,b). This was based on samples collected from May, June, August and October in the central basin (N=31) while samples from the eastern basin were obtained during February and May (N=36).

The poor condition evident in 2000 may be related to a number of factors including the absence of *Diporeia* in the eastern basin and possible diet overlap with abundant benthivores such as yellow perch.

Lake Whitefish Surveys

Lake whitefish are difficult to assess in Lake Erie, due to their migratory and schooling behavior. Fortunately, the Lake Erie Committee has been assembling lake whitefish survey data from all agencies into a single report to be completed in 2001. This report should contribute significantly to our understanding of whitefish trends in recruitment, adult abundance and growth. It should also provide a basis for improving whitefish assessment and management on Lake Erie.

Burbot

Abundance

Burbot is a coldwater species that inhabits the deeper waters of the eastern and central basin. It was considered common to abundant in the lake prior to 1950 (Greeley 1929, Trautman 1981, Van Meter and Trautman 1970). After 1950, burbot abundance decreased markedly as did other deep- and cold-water species, such as lake trout, cisco, whitefish, and blue pike (Trautman 1981). Causes for burbot decline are not known, but factors attributed to the declines in lake trout, cisco, whitefish and blue pike may also have affected the burbot population. Sedimentation, degradation of the oxygen regime in the central basin, and over-fishing are listed as possible factors in the declines of these species (Hartman 1973). In addition, burbot are vulnerable to sea lamprey predation (Paul Sullivan, pers. comm.).

Commercial Harvest

Burbot has been increasing in the commercial harvest since the late 1980's (Table 2.1). This increase coincided with the lake whitefish increase in abundance. Most commercial harvest occurs in the eastern end of the lake. Harvest decreased in Pennsylvania waters after 1995 due to a shift from a gill net to a trap-net commercial fishery. This change resulted in a substantial decrease of commercial fishing effort (CWTG 1997). Harvest of burbot in New York is from one commercial fisherman. In 1999, a market was developed for burbot in Ontario, leading the commercial fishing industry to actively target this species for the first time. As a result, the Ontario commercial harvest increased dramatically (Table 2.1). However, this market did not continue and resulted in a much lower harvest in 2000. The Ontario harvest comes from a combination of gill nets (54%) and trawls (46%). The majority of the harvest was in statistical district OE4 (62%), followed by OE2 (20%) and OE3 (11%).

Assessment Programs

The deepwater gill net assessment for lake trout in the month of August by the NYSDEC, PAFBC, USGS-BRD and OMNR also collects burbot (Figure 2.10). The catch has been steadily increasing since 1993 in all jurisdictions. Catch rates by standard sampling areas (see Figure 1.1) is as follows: A1 (NY) - 3.1 fish/lift; A2 (NY) - 4.6 fish/lift; A3 (PA) - 4.9 fish/lift; A4 (PA) - 7.0 fish /lift; A5 (Ont.) - 6.8 fish/lift; A6 (Ont.) - 5.9 fish/lift; A7 (Ont.) - 7.5 fish/lift; A8 (Ont.) - 19.8 fish/lift. Areas A7 and A8, where the catches were the highest, roughly corresponds to statistical district OE4, where the highest commercial harvest occurred.

The Ontario Ministry of Natural Resources (OMNR) Partnership gill net assessment conducted in Canadian waters of Lake Erie during the months of September and October (1989-1999) includes burbot. Burbot catches increased in the eastern basin and Pennsylvania Ridge from 1992 to 1998, with a 4-fold increase in catch occurring between 1995 and 1998 (Figure 2.11). There was no sampling in the eastern basin in 1996 and 1997. Burbot catch was lower in the central basin, with lowest catches in the west central basin. Catches declined in the east-central basin and Pennsylvanian Ridgefrom 1999 but increased in the east basin in 2000. The declines of burbot catches in the Pennsylvania Ridge area for the last 2 years is opposite of the trend observed in the lake trout assessment program.

Age Structure & Growth

Although age information has been reported in past reports, there is some concern about the accuracy of the age data. Until there is some verification of age data, length and weight distributions will be reported. Length and weight information is from burbot collected during the lake trout assessment by NYSDEC, USGS-BRD, and PAFBC. A total of 832 burbot were collected in 2000. Lengths ranged from 371 to 866 mm, with 85% of the catch between 450 and 650 mm (Figure 2.12). Weight ranged from 0.06 to 5.22 kg, with 81% of the catch between 0.5 and 2.25 kg (Figure 2.13).

Diet

Stomach contents were identified in burbot collected June through October 2000 by the Ohio DNR, PFBC, NYSDEC and OMNR (Table 2.2). Rainbow smelt was present in the diet for all months except June. Goby were the most abundant prey in the fish collected from Ohio waters in June and were present for the first year in burbot collected in New York waters. Although rainbow smelt occurred in more burbot collected in Ontario waters, alewife and yellow perch contributed more in volume in September. Quagga mussels were present in 25 % of the fish collected in both New York and Pennsylvania waters.

Seasonal Distribution

There is no information on seasonal distribution.

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

The Great Lakes Fishery Commission and its control agents (U.S. Fish and Wildlife Service and Fisheries and Oceans Canada) continued to implement the Integrated management of sea lampreys (IMSL) in Lake Erie in 2000 . This included a quantitative approach to stream treatment selection, lampricide treatments, and the application of alternative control methods. The Cold Water Task Group has provided a forum to discuss sea lamprey abundance, marking and mortality to lake trout.

2000 Actions

During 2000, assessments were conducted in 5 streams (3 U.S., 2 Canada) to rank them for lampricide treatments, and in another 20 streams (10 U.S., 10 Canada) to determine the presence or absence of sea lamprey larvae (Table 3.1). This latter group included the Canadian waters of the Detroit River. Of the 5 streams ranked for lampricide treatment, 4 are scheduled for 2001. While sea lamprey larvae were found in 4 additional streams, none were detected in the Detroit River.

Conneaut Creek was treated with lampricide in two phases in 2000. The upper river from Highway 198 downstream to Highway 215 was treated during April 28-30, and the remainder of the stream was treated during May 25-26.

Assessments to determine effectiveness of past lampricide treatments were conducted in Cattaraugus and Conneaut Creeks, last treated during 1999 and 2000 respectively, to investigate the potential for residuals as contributors to Lake Erie's parasitic population. Residual larvae were detected in both streams. As a result, Cattaraugus Creek is scheduled for treatment in 2001, a year earlier than the historical treatment cycle would indicate. Residual populations detected in Conneaut Creek were not sufficiently abundant to warrant lampricide treatment in 2001.

The Ohio Department of Natural Resources, Division of Wildlife began a feasibility study in the Grand River to determine if the need to treat with TFM could be eliminated or the frequency extended by reduction of the number of sea lampreys produced through alternative control measures. Alternative controls used in the study included the reduction of the number of larvae by capture with electro-fishing, and the reduction of the number of adult spawning sea lampreys by trapping. The information collected by the Department also provided additional data to the Great Lakes Fishery Commission for the assessment of sea lampreys in the Grand River. It was determined upon completion of the first part of this study that limitations in equipment would prevent achievement of the first objective. Plans for 2001 include enhanced adult sea lamprey trapping during the spring spawning migration.

A total of 1,189 spawning phase sea lampreys were trapped in 3 tributaries and the estimated 2000 spawning-phase population in Lake Erie was 15,570.

Several sea lamprey barrier projects are proceeding in tributaries of Lake Erie. Plans for the proposed barrier on Conneaut Creek continued in 2000. A multi-agency group was formed and collection of environmental data is scheduled for 2001. Proposals to remove the Harpersfield Dam on the Grand River (U.S.) was under consideration and alternatives currently are being evaluated. Performance of the Big Creek barrier and fishway was monitored. The barrier appeared to block most of the spawning adult sea lampreys during 2000, although some young-of-the-year larvae were captured upstream of the barrier during electro-fishing surveys. Negotiations to prevent sea lamprey passage at the fishway in the Grand River (Canada) continued between the Grand River Conservation Authority and the Department of Fisheries and Oceans.

2001 Plans

Sea lamprey management plans for Lake Erie in 2001 (Table 3.1) include lampricide treatment of 4 streams (Big Otter, Young's, Raccoon, and Cattaraugus Creeks), larval assessments of 17 streams (4 U.S., 13 Canada), and trapping of adult lampreys in 5 streams (3 U.S., 2 Canada). Of the 17 streams scheduled for larval assessments, 4 streams (Big, Crooked, and Canadaway Creeks, and the Grand River in Ohio) will be ranked for potential lampricide treatment in 2002.

During 2000, additional funding by the Great Lakes Fishery Commission provided for the accelerated lampricide treatment of Cattaraugus Creek in 2001. In addition, the portion of the main stream between Gowanda and Springville, NY (~30 km) will be treated for the first time.

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

In 2000, over 2.2 million yearling trout or salmon were stocked in Lake Erie, including rainbow trout, coho salmon, lake trout, and brown trout (Figure 4.1). Total salmonine stocking increased 23% from 1999, but represented a 4.6% decrease from the long-term average (1989-2000). Annual summaries for rainbow trout, coho salmon, lake trout, chinook salmon and brown trout for 1989-2000 by state or provincial jurisdiction are provided in table 4.1.

All riparian agencies stocked rainbow trout/steelhead trout in 2000. A total of 1,982,009 rainbow trout were stocked in 2000, representing a 29% increase from 1999 and a 16% increase from the long-term average. Increased stocking rates in 2000 were primarily due to increased trout production by the Ohio Department of Natural Resources, and a surplus production of over 200,000 steelhead trout by the Pennsylvania Fish and Boat Commission. The Ontario Ministry of Natural Resources reduced rainbow trout stocking significantly in 2000 in response to successful natural reproduction of this species in Big Creek, an Ontario tributary of Lake Erie.

The Pennsylvania Fish and Boat Commission stock coho salmon is the only agency on Lake Erie the continues to stock coho salmon. This once popular species has become a minor component to the anadromous fishery, representing about 6% of the total trout/salmon stocking effort in Lake Erie for 2000. A total of 137,204 yearling coho were stocked in 2000, representing a 37% increase from 1999, but a 57% decrease from the long-term average.

Lake trout stocking rates have been on a steady decline since the change of the Lake Erie trophic status induced by *Dreissena* mussel invasion. As the rainbow smelt population in eastern basin waters of Lake Erie became depressed, the Lake Erie Committee recognized the need to reduce predator demand on this primary component of the eastern basin forage fish community. The result was a reduction in lake trout stocking to a targeted baseline-stocking rate of 120,000 yearlings annually. Surplus production by the New York Department of Conservation supplements this modest effort. Lake trout stocking declined 28% from 1999 and 24% from the long-term average.

Brown trout stocking effort continued to be reduced in 2000. A total of 17,163 brown trout were stocked by a cooperative sportsman's group in Pennsylvania, representing a 28%(17%?) decrease from 1999, and an 81% decrease from the long-term average. Chinook salmon have not been stocked in Lake Erie since 1997.

5. Assist FTG with bioenergetics analysis of prey fish consumption by Coldwater predators.

The CWTG has assisted the FTG in the past by providing a Lotus spreadsheet simulation model of Lake Erie's lake trout population. Basically, the model starts with a known number of yearling equivalents for each cohort and then annually applies an appropriate survival rate to that cohort as it passes through the fishery, up to age 20. Applied mortality rates were derived from past standard assessment data and the literature, where information was lacking (CWTG, 1998).

The 1998 and 1999 CWTG reports highlighted several simulation parameters that required adjustment in order to more accurately depict the current lake trout population as perceived from standard, annual gill net assessment. The most notable adjustments were made to account for the extremely poor juvenile survival exhibited since the 1986 cohort was stocked in 1987 (Figure 1.4 Figure 1.4 from the 1999 CWTG is not in the 2000 report. Is this year's figure 1.4 okay to refer to?) and survival adjustments to the 1987-and-younger cohorts to account for reduced abundance observed for age 5? and older (Figure 1.3?). Minor adjustments were made to the 1998 version to incorporate increased mortality associated with increased sea lamprey wounding observed since 1996 (Figure 1.11?).

Further adjustments were made within the model for 2000 concerning the level sea lamprey mortality impacting the adult population between 1982 and 1987, during the pre-treatment era. The ML was increased to 0.37. The original model used ML=0.25 for all lake trout age 4 and older, even during those years (1982-1987) when age-4-and-older fish were rare in assessment catches due to heavy lamprey predation. The higher mortality rate reduces the unrealistic, high population level between 1982 and 1988. Such a change also lowers the adult estimate over time as these cohorts pass through the 20-year model.

The most recent version of the Lake Erie Lake Trout Model (Figure 5.1) estimates the adult population (age 5 and older) in 2001 at about 40,000 fish. An equilibrium yield model suggested that successful Lake Erie rehabilitation required an adult population of 75,000 lake trout (Ref?).

A preliminary review of the lake trout model by Dr. Pat Sullivan at Cornell University was conducted in 2000. The lake trout assessment data is presently archived by separate participating agencies and composition of the by-catch (non-target species) is not included in all spread sheet databases (Lotus). The goal for the CWTG in 2001 is to convert individual annual agency assessment data into a Microsoft Access database, append historical annual assessment data, include all species encountered in the assessment, and request another review by Dr. Sullivan.

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.

Stocking

Rainbow trout is the most stocked fish in Lake Erie with each of the 5 State and Provincial fisheries management agencies bordering Lake Erie maintaining a stocking program. Approximately 1.98 million yearling equivalent rainbow trout/steelhead were stocked into Lake Erie and its tributaries in 2000. The strains currently being stocked are variable with 97.6% of planted fish comprised of naturalized Great Lakes anadromous strains, and the remaining 2.4% being of domestic origin (Table 6.1). Most fish are stocked in the spring as yearlings in the lower reaches of tributaries or in near shore waters (Figure 6.1). The majority of the fish stocked in 2000 did not have any marks or fin clips (96%).

Assessment of Natural Reproduction

Efforts to assess wild rainbow trout production continued in 1999 with estimates of juvenile abundance carried out in two branches of Cattaraugus Creek, a Lake Erie tributary located in New York State. Significant numbers of wild young of the year (YOY) rainbow trout were sampled in both Derby Brook and Spooner Creek. Additionally, a smolt weir was constructed on Spooner Creek in an effort to assess emigration of wild juvenile rainbow trout into Lake Erie (Rob Roth, SUNY College at Fredonia, unpubl. data). An estimated 2,967 rainbow trout smolts moved out of Spooner Creek from March 25- June 21, 1999. It was interesting to note that 74% of emigrating rainbow trout were determined to be one year old.

Scale samples collected from adult spawning phase rainbow trout entering the Cattaragus watershed were analyzed to assess whether a method could be developed to differentiate wild versus hatchery origin fish. A graduate student from Buffalo State College found that some scale characteristics do differ between hatchery and wild rainbow trout in the Cattaraugus system. An estimated 18-25 % of adult rainbow trout captured in Clear Creek, Spooner Creek and Cattaraugus Creeks originated from wild stocks (M. Goehle Buffalo State College, unpubl. data).

Additionally, juvenile rainbow trout population estimates for 2 Pennsylvania tributaries, Crooked Creek and Trout Run, were reported for the first time in 1999 (Thompson, 1999).

Exploitation

Lake Erie

Angler survey data was collected in the Michigan, Ohio, Pennsylvania and New York waters of Lake Erie in 2000. Creel surveys were typically seasonal in nature and coincided with the summer open water fishing season. An estimated 45,400 rainbow trout were harvested from the United States waters of Lake Erie in 2000, representing a 37 % increase over 1999 estimates (Figure 6.1). The majority of the lake wide harvest originated from the central basin, followed by the eastern basin.

Findings from Ontrario's aerial creel survey, conducted June to August 1998, and the angler diary program from 1998 were compared, by basin, in order to determine a ratio which could be applied to the angler diary data from 2000. Effort (rodhours) and harvest (number of rainbow trout kept) were used to calculate catch per unit effort from the angler diaries, using non-chater diariest, only. The aerial creel CUE was divided by the angler diary CUE and this ratio was multiplied by the 2000 angler diary CUE. Effort was calculated the same way, using rodhours from the 2000 angler diary multiplied by the ratio calculated from the aerial creel survey and angler diary program in 1998. These corrected estimates of CUE and effort for 2000 were used to calculate an estimated harvest of rainbow trout. The same proceedure was conducted to estimate 1999 harvest. It was not possible to estimate harvest for Ontario waters of the western basin due to insufficient data. These calculations suggest 17,700 rainbow trout were harvested from the Ontario waters of the central basin in 2000, a 36% increase since 1999. The eastern basin harvest was estimated to be 10,500 rainbow trout which represented a 67% increase since 1999.

Tributaries

A significant sport fishery consisting of streamside anglers targeting spawning phase steelhead has developed in most jurisdictions surrounding Lake Erie. Catch and effort data for this fishery are incomplete. A number of jurisdictions do maintain angler diary programmes, which provide some year to year estimates of catch and effort.

7. Report on the current status of lake herring (*Coregonus artedii*) in Lake Erie and their potential for recovery (draft charge pending approval by STC).

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 it is reported periodically by commercial fishermen from the area of the Pennsylvania Ridge and the shoals of the western basin (Ryan et al. 1999). Their demise was mainly through over-fishing, although habitat degradation and competition likely contributed to recruitment failure (Greeley 1928, 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 2 studies in which smelt consumed large numbers of lake herring in the larval stage.

With the recent recovery of other native coldwater species (i.e. lake whitefish and burbot), and the decline in rainbow smelt abundance, there may be an opportunity for lake herring to recover in Lake Erie. Lake herring have been reported occasionally by commercial fishermen in the 1990s. Two large specimens (467+mm, 367mm) were collected from the eastern part of the central basin in 1995 and 1996 respectively. Herring were also recorded in the catch from an experimental gear study in 1997, south of Long Point, but their significance was not recognized and the fish were not examined. Small numbers of lake herring have been caught in the western basin commercial fishery during November and December, 1998 (J. Omstead, Omstead Foods, Wheatley, Ont. pers. com.)

The frequency of lake herring reports increased in 1999, as seven small herring (140-211 mm) were reported by commercial fishermen. Capture locations indicated there were herring present south of Long Point and southwest of Port Stanley. Fish were primarily captured in deep-water trawls targeting smelt. All specimens collected in the 1990s were examined at the Royal Ontario Museum (Erling Holm, unpubl. data). Counts of gill rakers placed them into the range for *Coregonus artedii* (Koeltz 1929, Scott and Smith 1962). The herring from 1995 and 1996 were aged as 9 and 7 + respectively. Five of the herring caught in 1999 were aged as 1+ (1998 year class) and 1 as 2+ (1997 year class).

Two more specimens were recorded from the central basin in 2000; one from Ohio (K. Kayle, ODNR, Fairport, OH, pers.com.) and one from Ontario (L.Witzel, OMNR, Port Dover, Ont., per. com.).

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Table 1.1. Number, sex, mean length and weight, by age class, of lake trout collected in gill nets (all gear types) from eastern basin Lake Erie, August, 2000.

AGE	SEX	NUMBER	MEAN LENGTH (mm)	MEAN WEIGHT (g)
I	Combined	10	234	105
II	Combined	25	434	924
III	Male Female	25 7	541 579	1987 2383
IV	Male Female	10 2	620 640	2992 3430
V	Male Female	4 4	697 705	4153 4507
VI	Male Female	4 3	689 758	4294 5779
VII	Male Female	1 3	736 706	4700 4631
VIII	Male Female	9 2	786 730	6527 5455
IX	Male Female	11 8	779 769	6206 6654
X	Male Female	9 7	800 774	6631 6490
XI	Male Female	3 6	830 780	7153 6895
XII	Male Female	3 4	806 811	6833 6982
XIII	Unknown	0 0	0 0	0 0
XIV	Male Female	2 1	813 867	7255 7920
XV	Male Female	3 0	884 ---	8395 ----
XVI	Male Female	1 0	910 ---	8040 ----

Table 2.1. Total burbot commercial harvest (thousands of pounds) in Lake Erie by jurisdiction, 1980-2000.

Year	New York	Pennsylvania	Ohio	Ontario
80	0	2.0	0	0
81	0	2.0	0	0
82	0	0	0	0
83	0	2.0	0	6.0
84	0	1.0	0	1.0
85	0	1.0	0	1.0
86	0	3.0	0	2.0
87	0	0	0	4.0
88	0	1.0	0	0.0
89	0	4.0	0	0.8
90	0	15.5	0	1.7
91	0	33.4	0	1.2
92	0.7	22.2	0	5.9
93	2.6	4.2	0	3.1
94	3.0	12.1	0	6.8
95	1.9	30.9	1.2	8.9
96	3.4	2.3	1.2	8.6
97	2.9	8.9	1.7	7.4
98	0.2	9.0	1.5	9.9
99	1.0	7.9	1.2	394.8
2000	0.1	2.3	0.1	30.1

Table 2.2. Prey of burbot collected in New York waters of Lake Erie in 2000 by month. Unit of measure: (A) % mean dry weight in grams, (B) % Occurrence, or (C) Mean % volume. Burbot with empty stomachs were not included in the sample size.

Month	June	August	Aug./Sept.	September		October
Area of Lake Erie	OH	NY	PA	Ontario		OH
Unit of Measure	(A)	(B)	(B)	(B)	(C)	(A)
Sample Size	6	124	48	12		1
Rainbow Smelt		79.8	12.5	58.3	22.36	99.98
Goby	66.67	4.0				
Gizzard Shad		1.6				
Alewife		0.8	2.1	16.7	39.93	
Clupeidae sp.		2.4				
Yellow Perch		4.0		16.7	32.79	
White Perch	33.33					
Morone sp.		0.8				
Emerald Shiner		1.6				
Smallmouth bass		0.8				
Troutperch		0.8				
Unidentifiable fish		8.9	72.9	16.7	4.92	
Amphipods			2.1			
Dreissena		25.0	25.0			0.02
Snails			2.1			

Table 3.1. Summary of larval sea lamprey assessments of Lake Erie tributaries conducted in 2000 and plans for 2001.

Stream	History	Surveyed In 2000	Survey Type	Results	Plans for 2001
USA					
Buffalo River					
Cayuga Creek	Positive	**Yes**	Evaluation	Positive	
Big Sister Creek	Negative	**Yes**	Detection	Negative	
Delaware Creek	Positive	**Yes**	Detection	Negative	
Muddy Creek	Negative	**Yes**	Detection	Negative	
Cattaraugus Creek	Positive	**Yes**	Treatment Eval.	Positive	**Lampricide treatment**
Chautaqua Creek	Negative	**Yes**	Detection	Negative	
Raccoon Creek	Positive	**Yes**	*Quantitative*	Positive	**Lampricide treatment**
Crooked Creek	Positive	**Yes**	Evaluation	Positive	*Quantitative survey*
Conneaut Creek	Positive	**Yes**	Treatment Eval.	Positive	
Ashtabula Creek	Negative	**Yes**	Barrier Eval.	Negative	
Indian Creek	Negative	**Yes**	Detection	Negative	
Grand River	Positive	**Yes**	Barrier Eval.	Negative	*Quantitative survey*
Cuyahoga River	Negative	**Yes**	Barrier Eval.	Negative	
Halfway Brook	Positive	No	-	-	Detection survey
Canadaway Creek	Positive	No	-	-	*Quantitative survey*
Canada					
Detroit River	Negative	**Yes**	Detection	Negative	
Kettle Creek	Negative	**Yes**	Detection	Negative	
Silver Creek	Positive	**Yes**	Evaluation	Positive	Evaluation survey
Big Otter Creek	Positive	**Yes**	*Quantitative*	Positive	**Lampricide treatment**
Big Creek	Positive	**Yes**	Evaluation	Positive	*Quantitative survey*
Unnamed E-110	Negative	**Yes**	Detection	Negative	
Unnamed E-116	Negative	**Yes**	Detection	Negative	
Young's Creek	Positive	**Yes**	*Quantitative*	Positive	**Lampricide treatment**
Nanticoke Creek	Negative	**Yes**	Detection	Negative	
Frenchman’s Creek	Negative	**Yes**	Detection	Negative	
Black Creek	Negative	**Yes**	Detection	Negative	
Welland River	Negative	**Yes**	Detection	Negative	
Sixteenmile Creek	Negative	No	-	-	Detection survey
East Creek	Positive	No	-	-	Detection survey
Catfish Creek	Positive	No	-	-	Detection survey
South Otter Creek	Positive	No	-	-	Detection survey
Clear Creek	Positive	No	-	-	Detection survey
Dedrick’s Creek	Negative	No	-	-	Detection survey
Forestville Creek	Positive	No	-	-	Detection survey
Normandale Creek	Positive	No	-	-	Detection survey
Fishers Creek	Positive	No	-	-	Detection survey
Lynn River	Negative	No	-	-	Detection survey
Sandusk Creek	Negative	No	-	-	Detection survey

Table 4.1. Summary of salmonid stocking in numbers of yearling equivalents, Lake Erie, 1989 to 2000

	Lake Trout	Coho	Chinook	Brown Trout	Rainbow/Steelhead	Total
ONT.	--	--	--	--	14,370	14,370
NYS DEC	143,200	154,210	70,370	54,590	141,740	564,110
PFBC	80,000	1,166,480	--	62,450	720,920	2,029,850
ODNR	--	--	--	92,120	242,000	334,120
MDNR	--	400,190	--	50,350	69,560	520,100
1989 Total	**223,200**	**1,720,880**	**70,370**	**259,510**	**1,188,590**	**3,462,550**
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**

Table 4.1. (Con't) Summary of salmonid stocking in numbers of yearling equivalents, Lake Erie, 1989 to 2000

	Lake Trout	Coho	Chinook	Brown Trout	Rainbow/Steelhead	Total
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**
ONT.					85,235	85,235
NYS DEC	143,320				310,300	453,620
PFBC	40,000	100,000		20,780	835,931	996,711
ODNR					238,467	238,467
MDNR					69,234	69,234
1999 Total	**183,320**	**100,000**	**0**	**20,780**	**1,539,167**	**1,843,267**
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**

Table 6.1. Rainbow Trout/Steelhead stocking by jurisdiction for 2000.

	Location	Strain	Fin Clips	Yearling Eq.
Michigan	Flat Rock	Manistee R. L. Mich.	RP	60,000
			SUBTOTAL	**60,000**
Ontario	Big Creek	Ganaraska R. L. Ont.	LP	10,787
			SUBTOTAL	**10,787**
Pennsylvania	Crooked Creek	Lake Erie/Trout & Godfrey Run	NO	48,564
	Elk Creek	"	"	250,000
	Fourmile Creek	"	"	15,486
	Godfrey Run	"	"	161,926
	Orchard Beach Run	"	"	20,000
	Peck Run	"	"	5,000
	Presque Isle Bay	"	"	50,000
	Raccoon Creek	"	"	41,839
	Sevenmile Creek	"	"	20,000
	Trout Run	"	"	284,100
	Twelvemile Creek	"	"	30,275
	Twentymile Creek	"	"	30,680
	Walnut Creek	"	"	280,000
			SUBTOTAL	**1,237,870**
Ohio	Conneaut Creek	Manistee R. L. Mich.	NO	99,910
	Rocky River	"	"	100,923
	Chagrin River	"	"	93,641
	Grand River	"	"	80,548
			SUBTOTAL	**375,022**
New York	Buffalo Harbor	Domestic	NO	2,500
	St. Colombans	Domestic	"	25,000
	Buffalo Creek	Chambers Cr. L. Ontario	"	20,000
	Cayuga Creek	"	"	15,000
	Eighteen Mile Creek	"	"	20,000
	Pt. Breeze Campgroud	Domestic	"	20,000
	S. Br. Eighteen Mile Creek	Chambers Cr. L. Ontario	"	20,000
	Cattaragus Creek	"	"	90,000
	Silver Creek	"	"	5,000
	Walnut Creek	"	"	5,000
	Canadaway Creek	"	"	20,000
	Chautauqua Creek	"	"	45,830
	Dunkirk Harbor	"	RV	10,000
			SUBTOTAL	**298,330**
			TOTAL	**1, 982, 009**

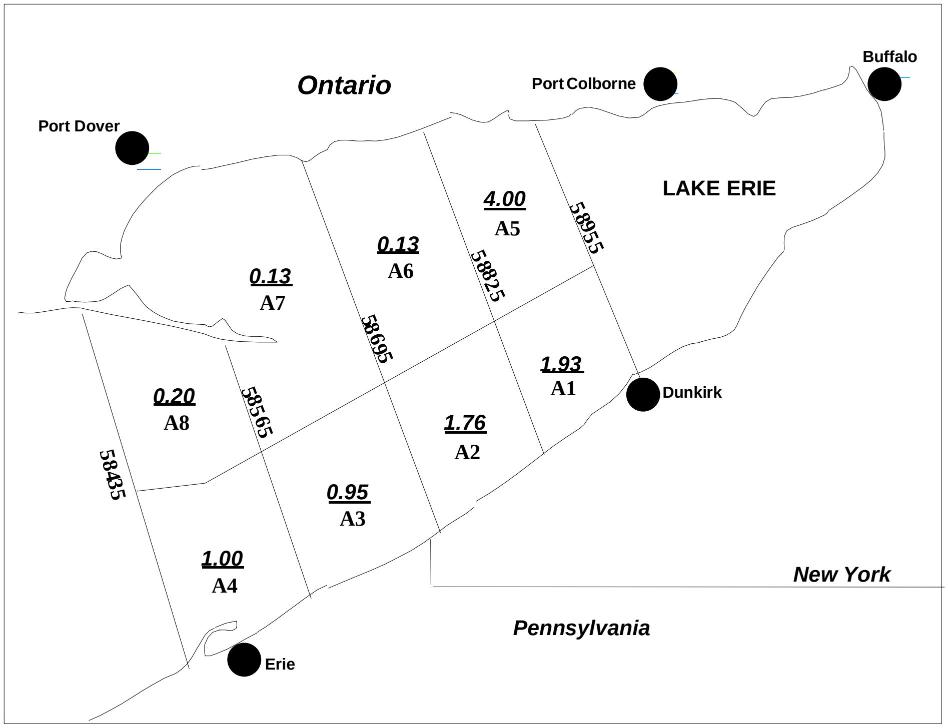

Figure 1.1. Standard sampling areas (A1 – A8) used for assessment of lake trout in the eastern basin of Lake Erie. The numbers in each area represent 2000 CPE (number/lift) for total lake trout catch within that area.

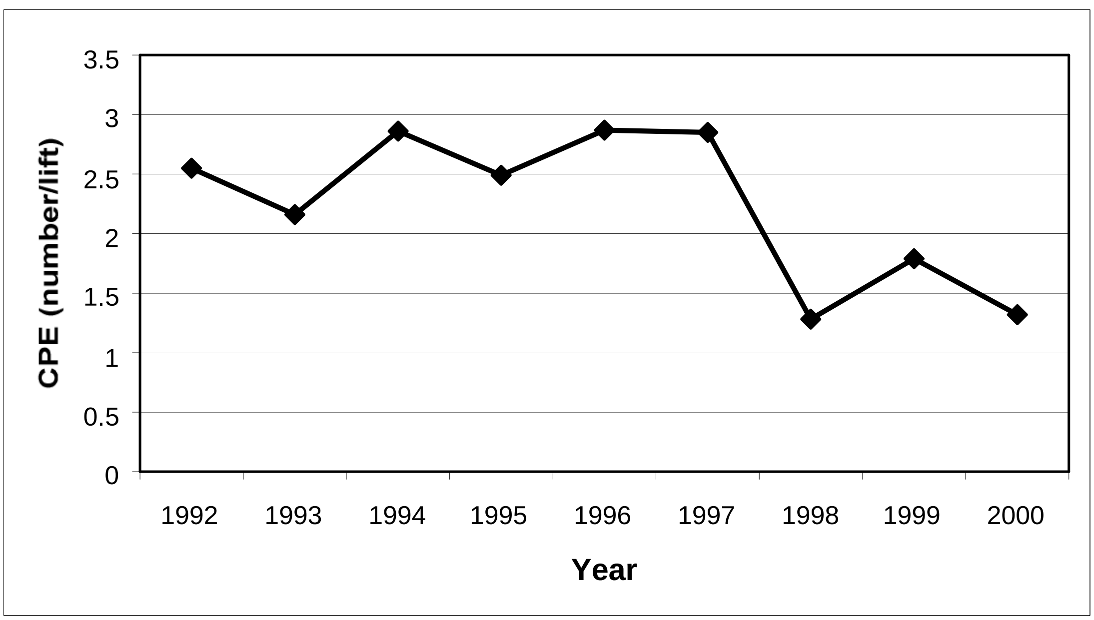

Figure 1.2. Relative abundance (number fish/lift) of all lake trout from a standard gill net assessment survey for Eastern Lake Erie, 1992 - 2000.

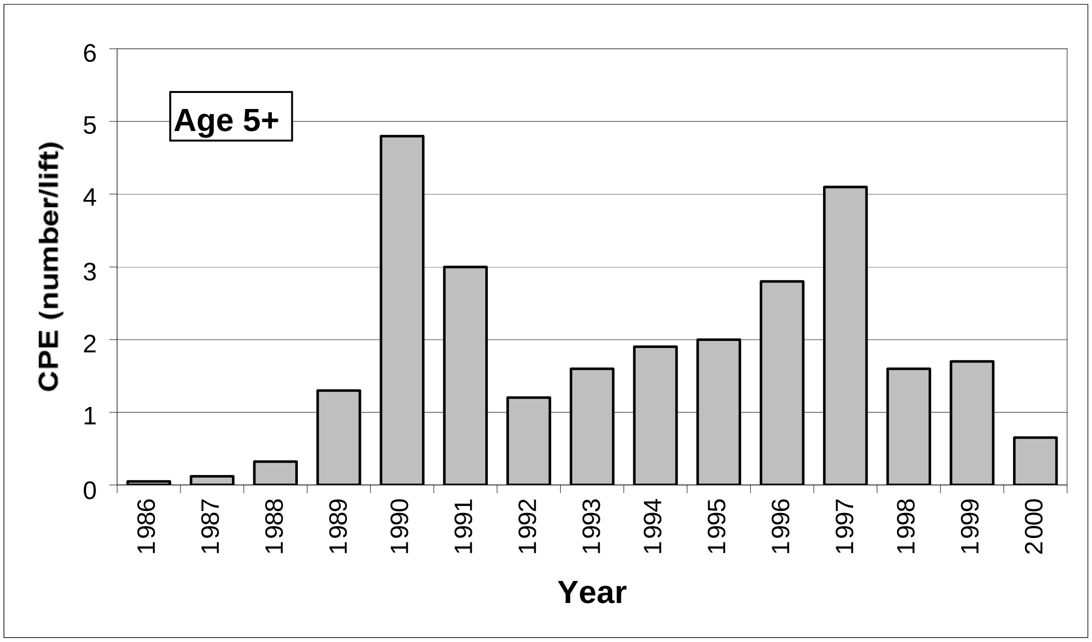

Figure 1.3. Relative abundance of age 5 and older lake trout sampled in gill nets from New York waters of Lake Erie in August of each year, 1986 - 2000.

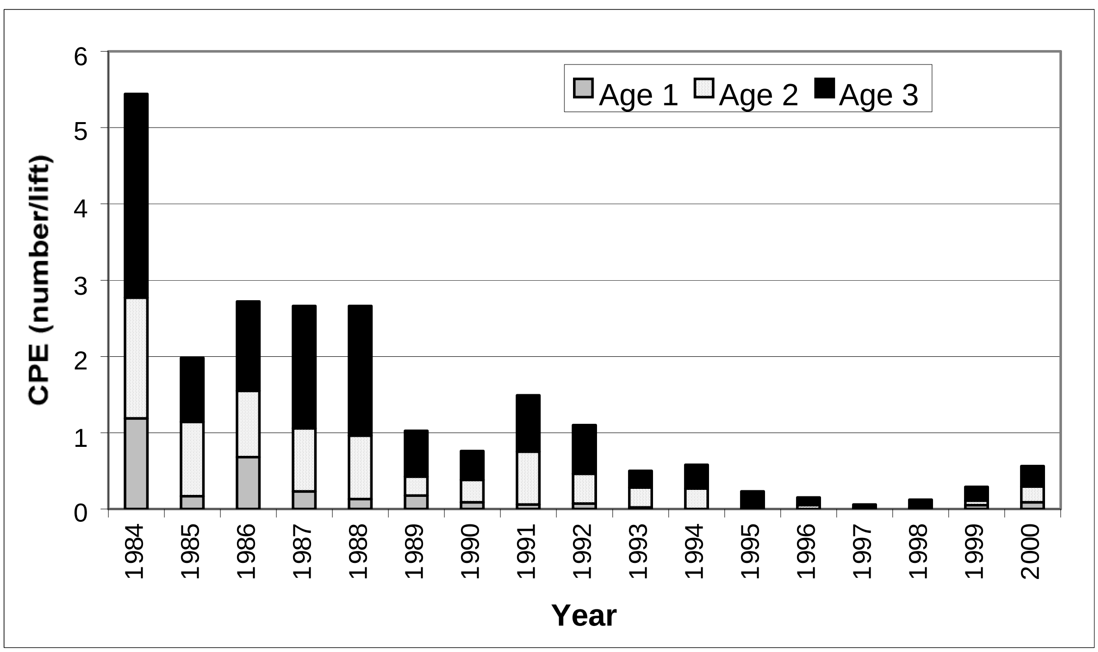

Figure 1.4. Relative abundance of juvenile (ages 1-3) lake trout collected from standard assessment gill nets fished in New York waters of Lake Erie, August, 1986 - 2000.

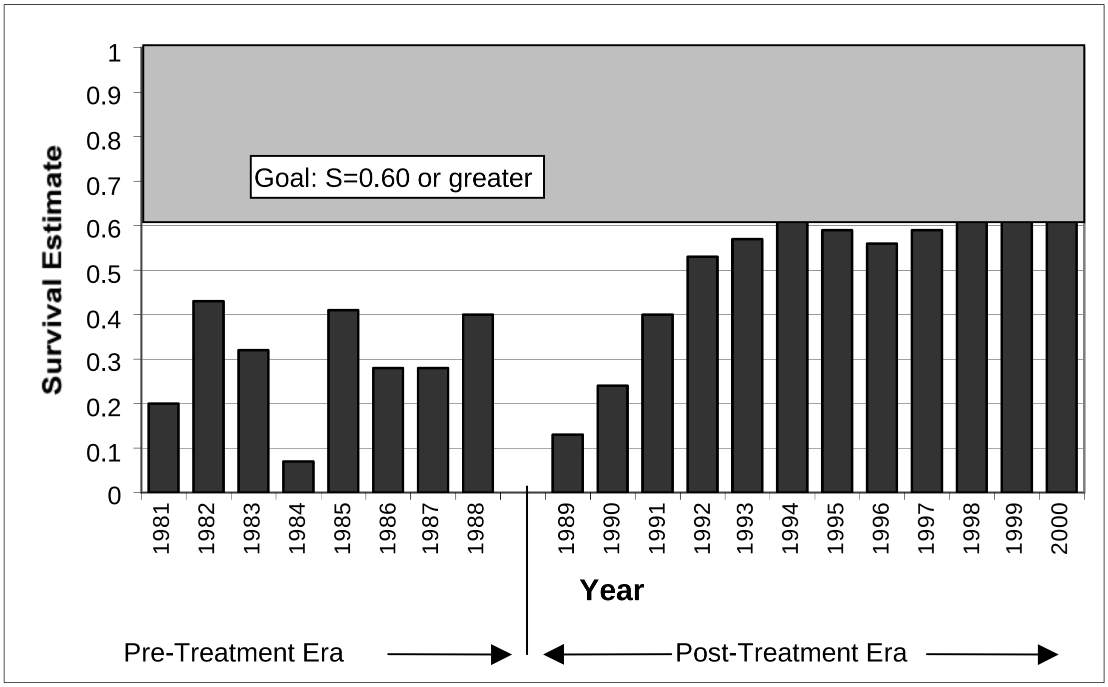

Figure 1.5. Annual estimates of lake trout survival in the eastern basin of Lake Erie, 1981-2000, derived from age-based catch curves. All catches are from standardized assessment gill nets and span pre- and post sea lamprey treatment years. The Strategic Plan's goal is S = 0.60.

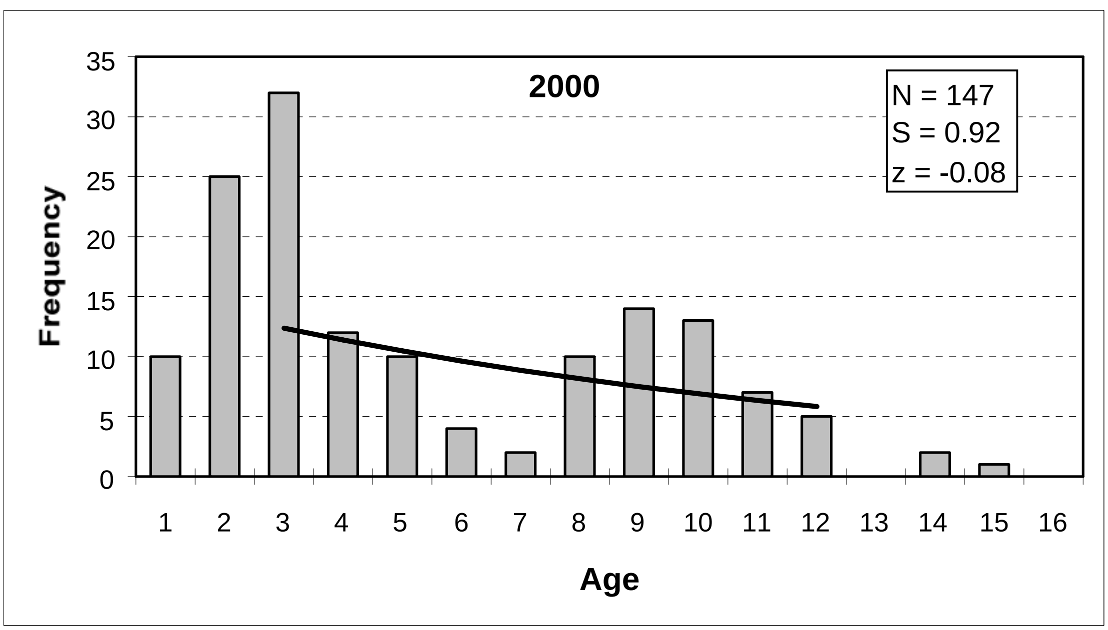

Figure 1.6. Age frequency distribution of lake trout collected from standard assessment gill nets fished in the eastern basin of Lake Erie, August 2000.

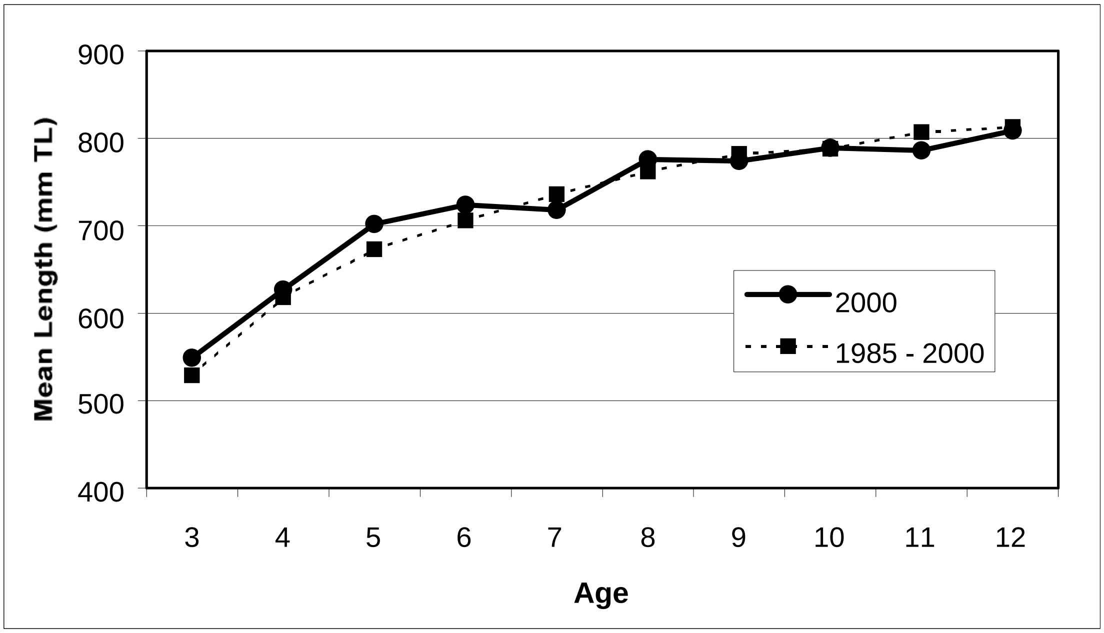

Figure 1.7 Mean length-at-age of lake trout collected in gill nets from the eastern basin of Lake Erie, August 2000. The long-term average from New York, 1985 - 2000, is also shown to compare current growth rates.

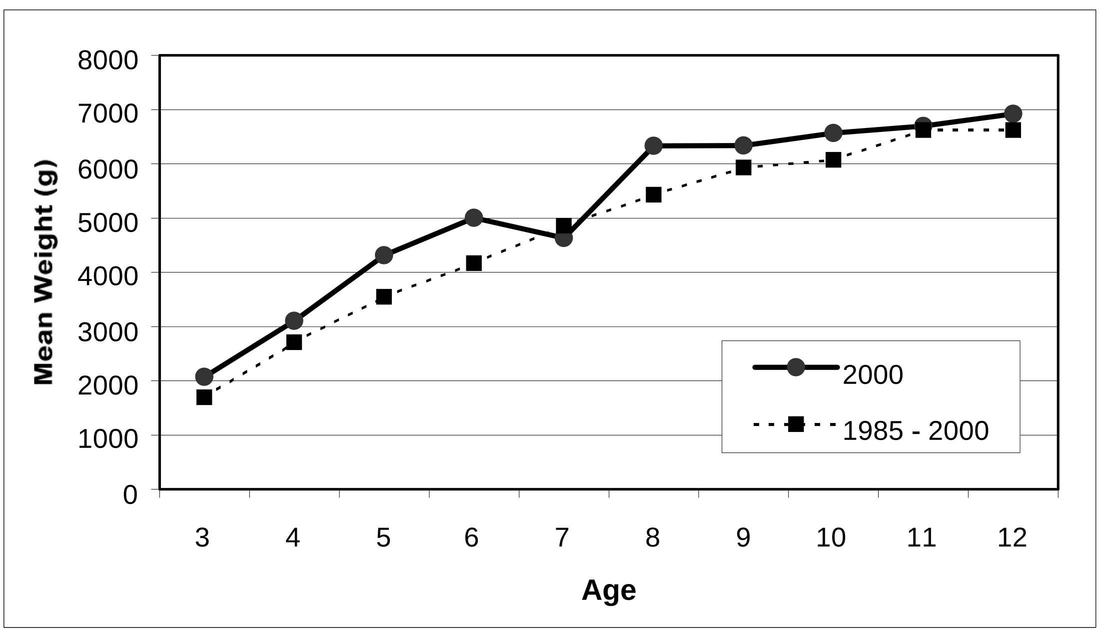

Figure 1.8. Mean weights-at-age of lake trout collected in gill nets from the eastern basin of Lake Erie, August 2000. The long-term average from New York, 1985 - 2000, is also shown to compare current growth rates.

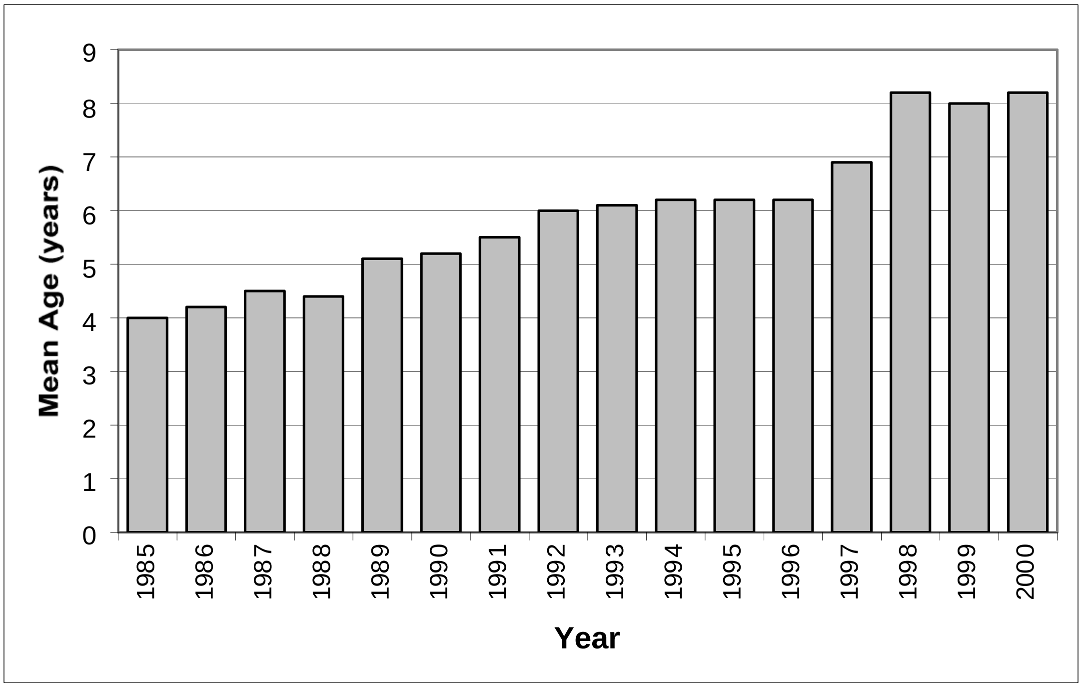

Figure 1.9. Mean age of mature female lake trout sampled in standard assessment gill nets from the eastern basin of Lake Erie, 1985 - 2000.

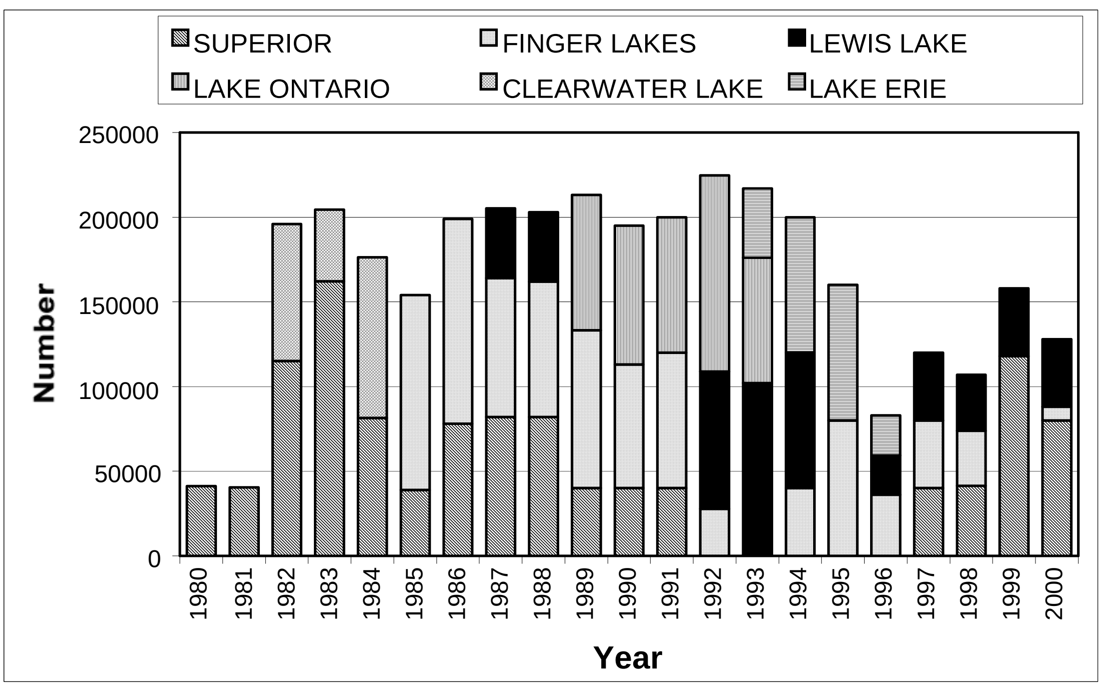

Figure 1.10. Yearling lake trout stocked in U.S. waters of the eastern basin of Lake Erie, 1980 - 2000, by strain. The current stocking goal is 120,000 yearlings per year.

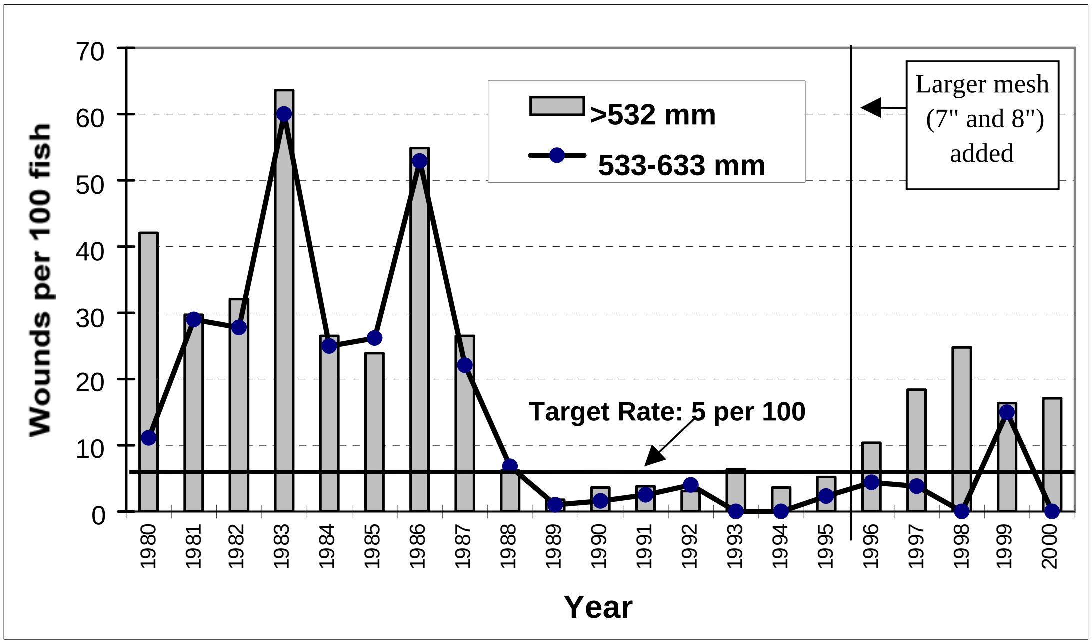

Figure 1.11. Fresh (A1-A3) sea lamprey wounds per 100 lake trout observed in gill net surveys from New York waters of Lake Erie, August, 1980 - 2000. The Strategic Plan target rate is 5 wounds per 100 fish.

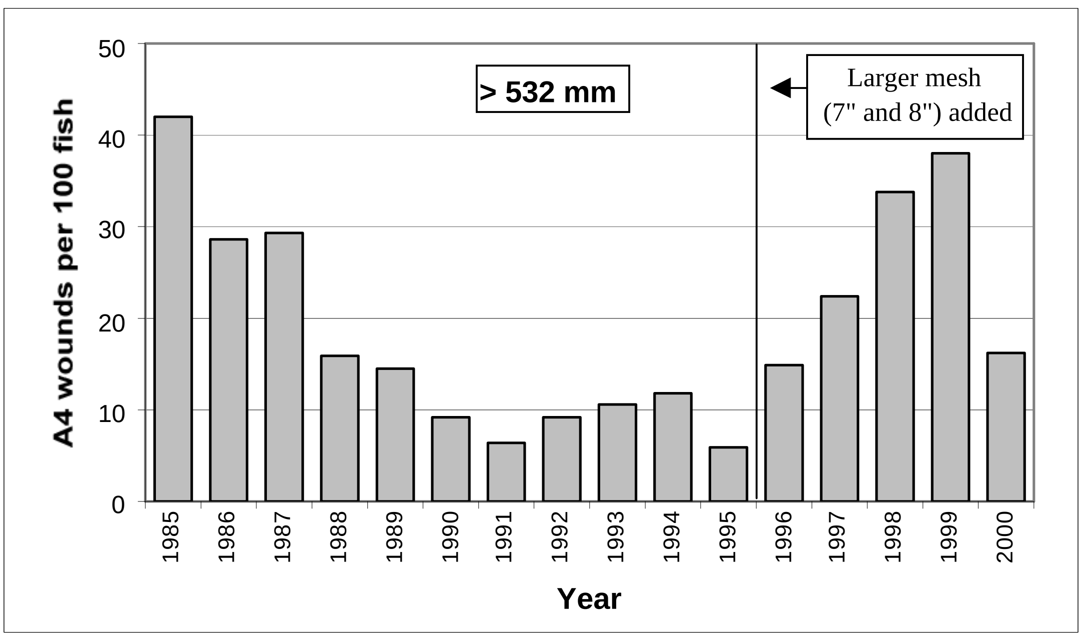

Figure 1.12. A4 sea lamprey wounds per 100 lake trout (>532mm) sampled in gill nets from New York waters of Lake Erie, August, 1985 - 2000.

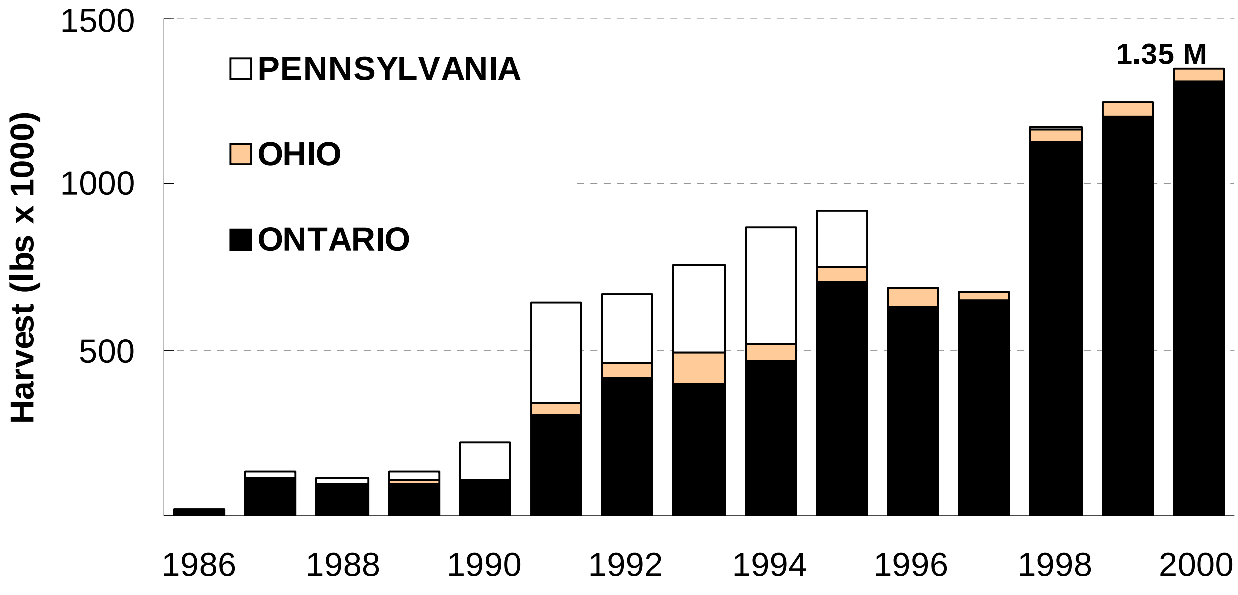

Figure 2.1. Total Lake Erie commercial whitefish harvest from 1986-2000 by jurisdiction. Pennsylvania ceased gill netting after 1995.

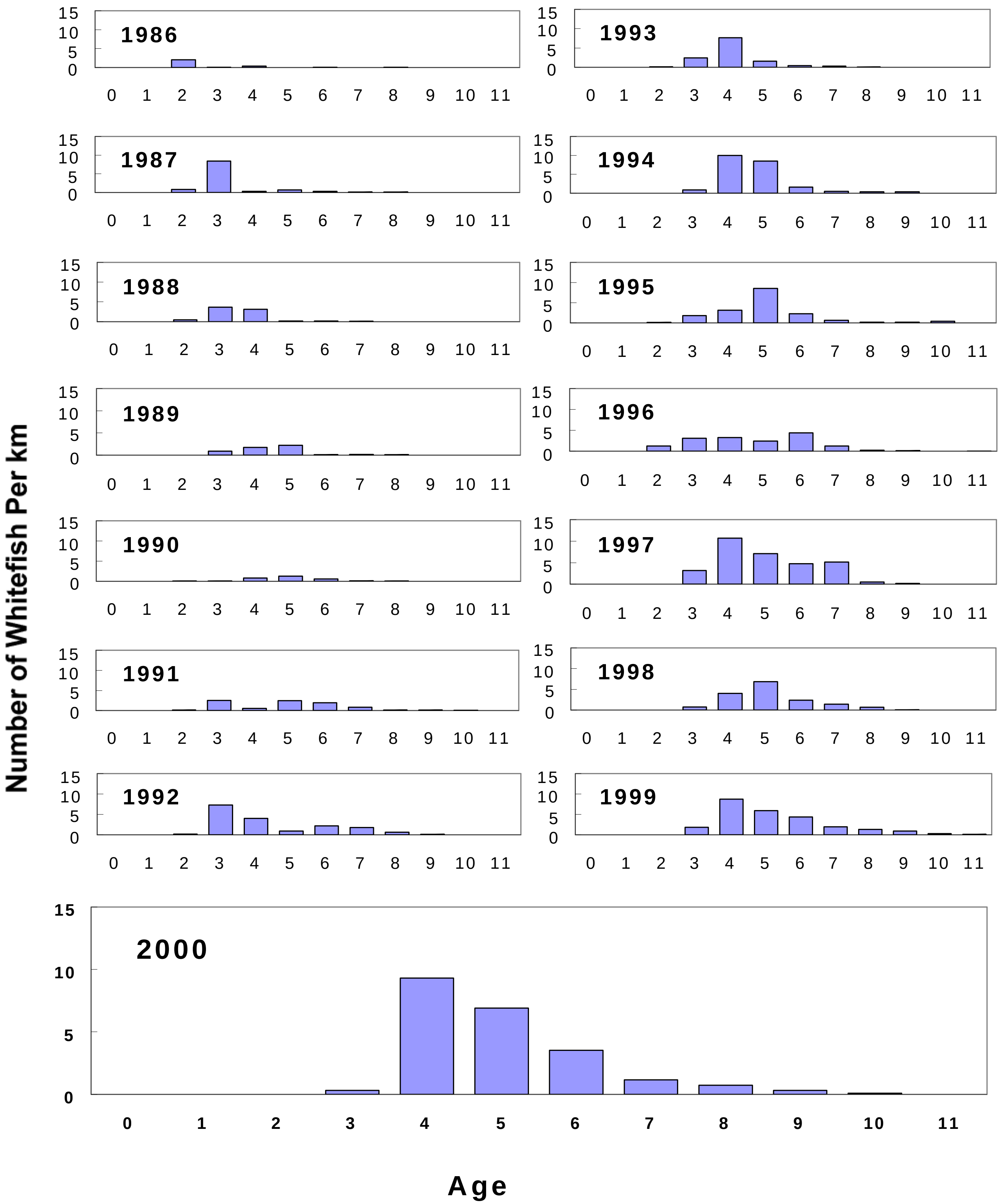

Figure 2.2. Ontario fall commercial whitefish CUE at age (# / km gill net) in statistical district 1, 1986-2000. Effort with gill nets ≥ 3 inches, with whitefish in catch from October to December

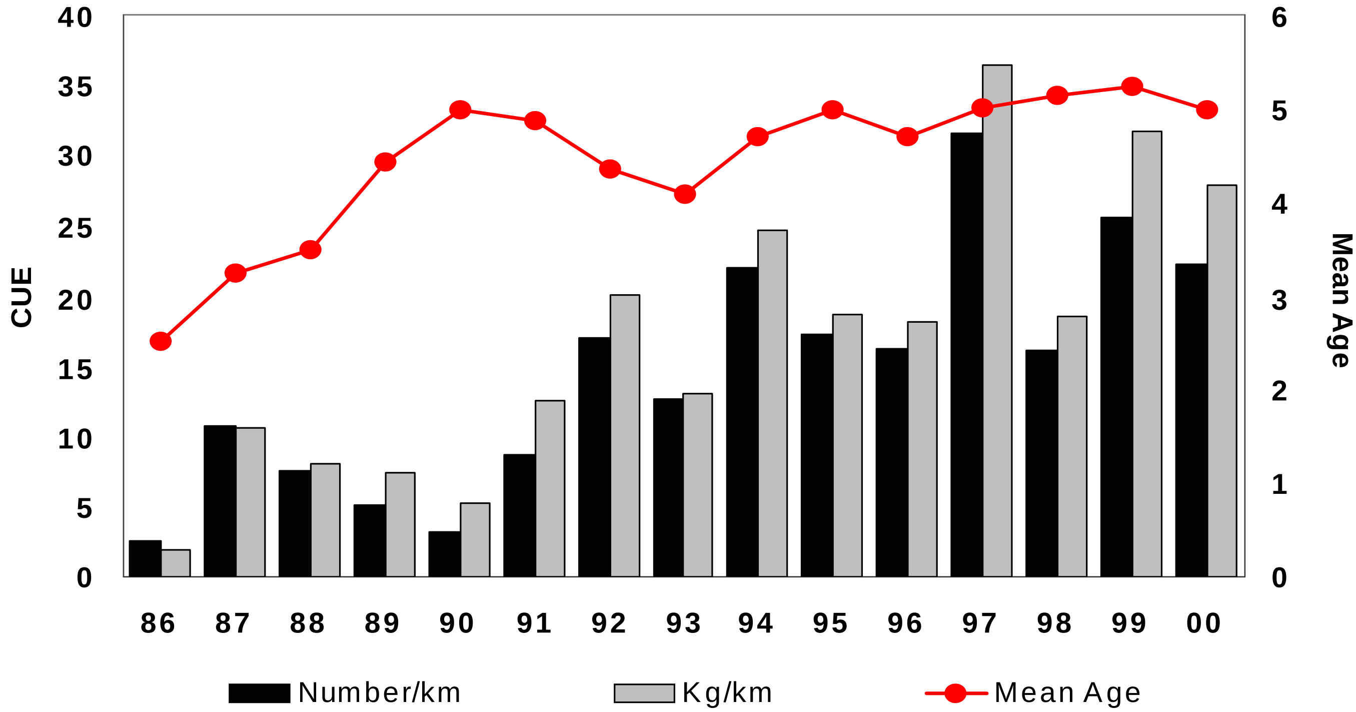

Figure 2.3. Catch rate (number and weight per km) and mean age of lake whitefish harvested by the Ontario fall gill net fishery, OE1, 1986-2000. (Fall = October to December).

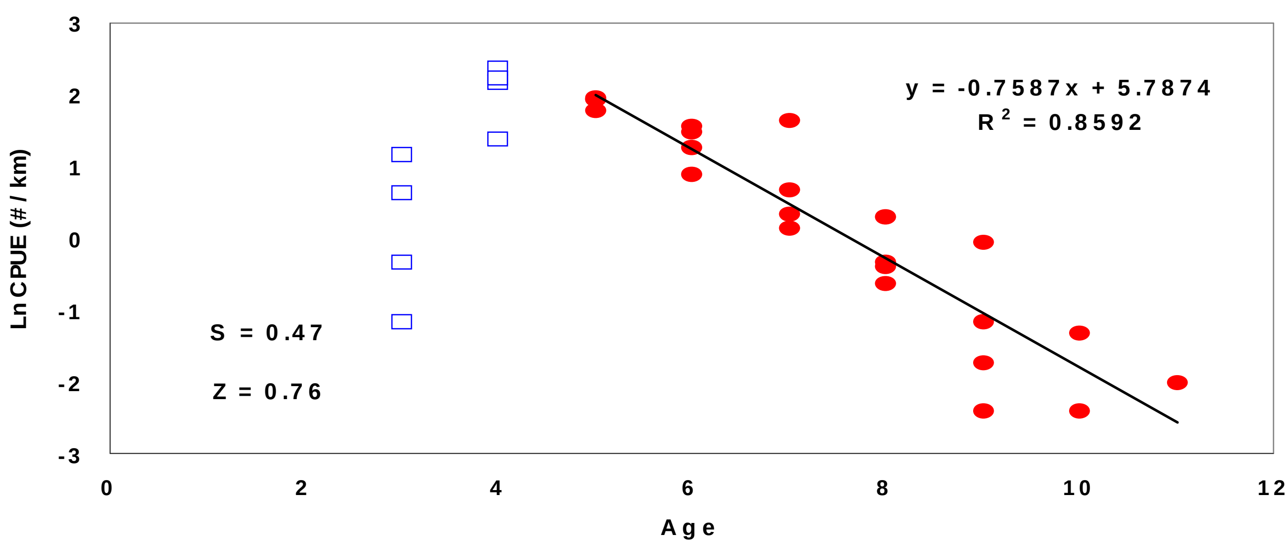

Figure 2.4. Catch curve for lake whitefish using Ontario fall large mesh gill net CPUE (number / km) from 1997 to 2000. Solid circles represent ages of whitefish (5 and older) fully recruited used in regression. Squares indicate ages of partial recruitment to the gear.

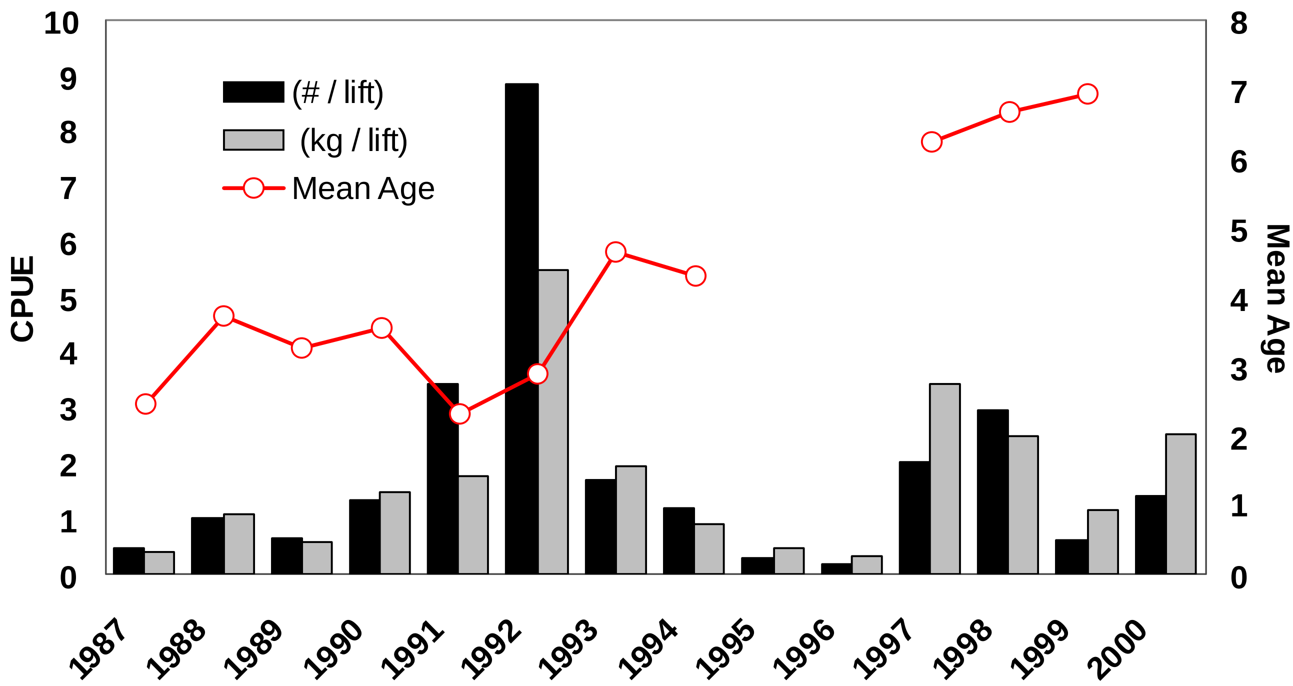

Figure 2.5. Catch rate (number and kg per lift) and mean age of lake whitefish from deep water gill net assessment in eastern Lake Erie, 1987 to 2000. CPUE corrected for 1996 to 2000 as gill net webbing changed from multifilament to monofilament. Age interpretations not completed for missing years.

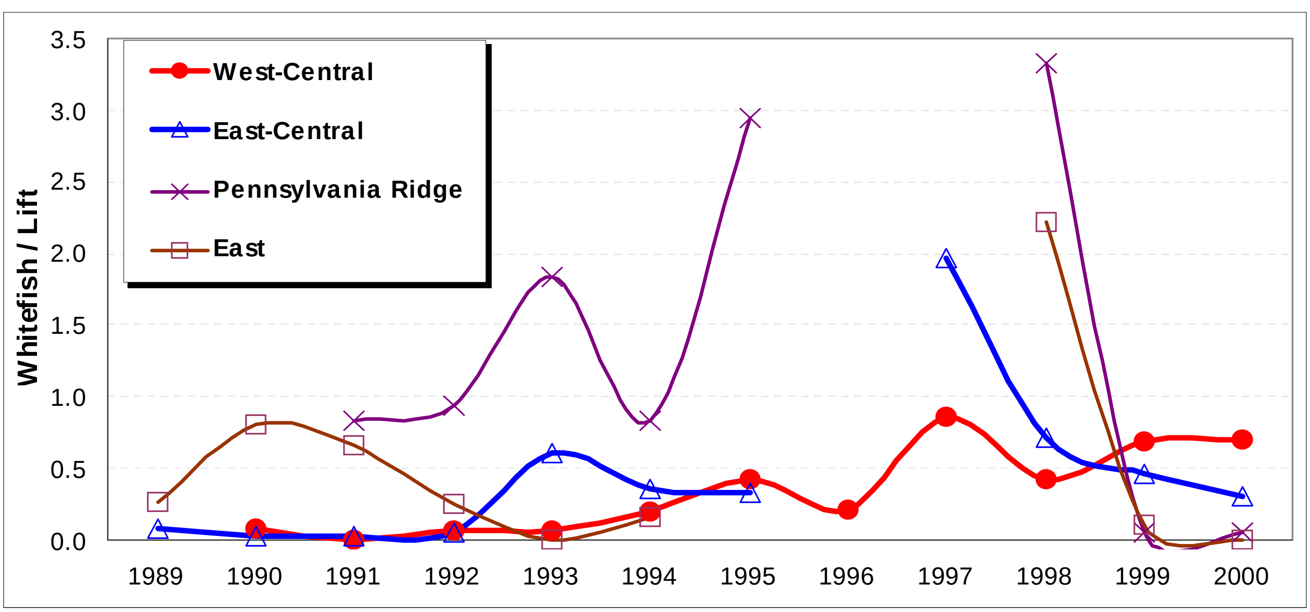

Figure 2.6. Catch rate (number per lift) of lake whitefish from Ontario partnership index gill netting by basin, Lake Erie, 1989 to 2000. West and west-central basins not surveyed in 1989. Pennsylvania Ridge and east basin not surveyed in 1996 and 1997. East basin data not presented for 1995 due to limited sampling. Includes canned (suspended) nets.

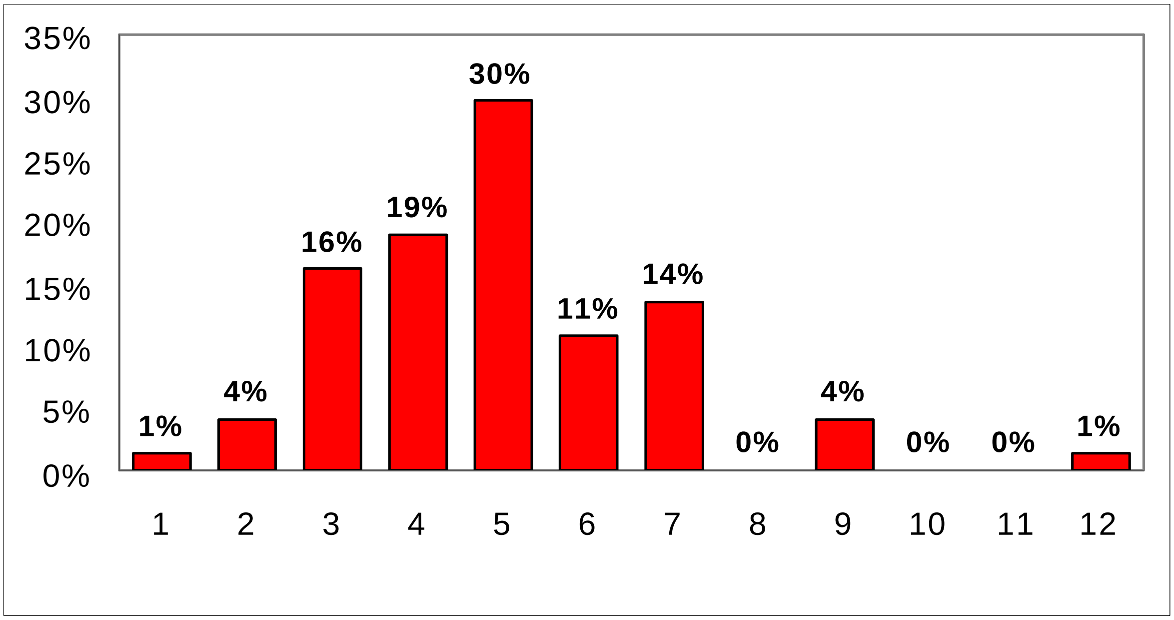

Figure 2.7. Age composition of lake whitefish collected from Ontario partnership index fishing, 2000. Whitefish were caught in the west, west-central, east-central and Pennsylvania Ridge surveys.

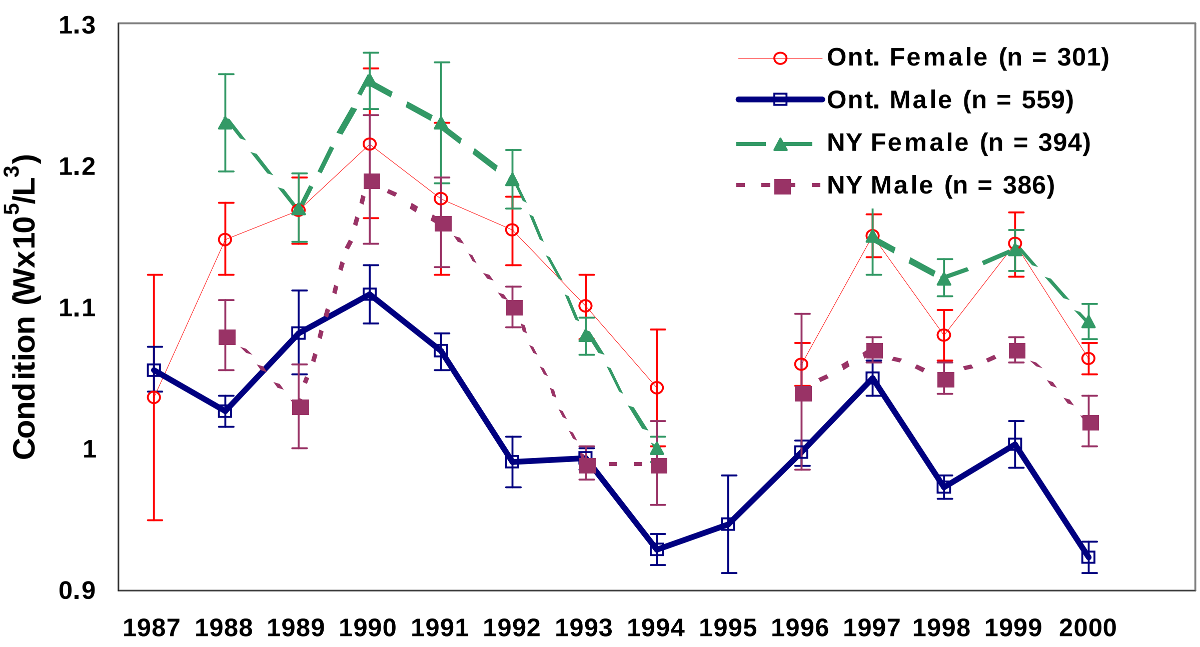

Figure 2.8. Mean condition of mature lake whitefish (ages 4 and older) during the fall (October to December). Ontario commercial and index gill net data. New York index gill net data dashed. One standard error shown. Spent fish excluded from analyses.

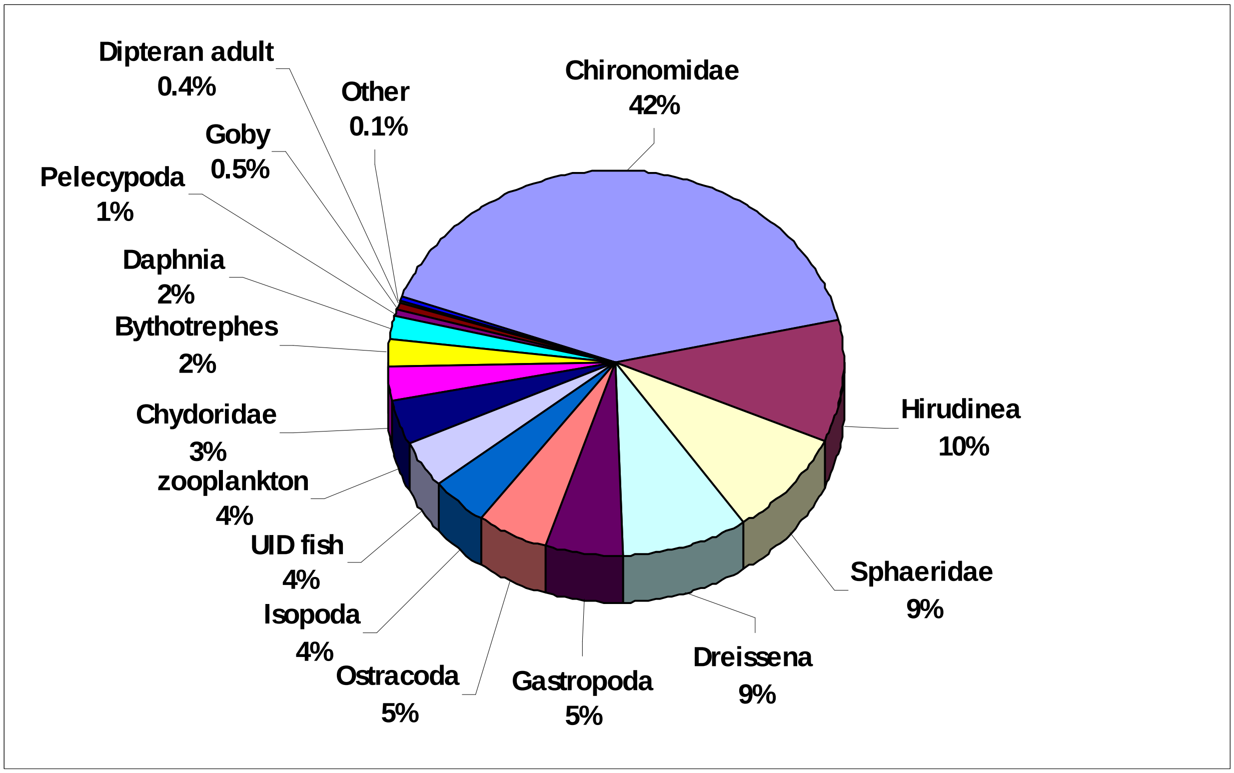

Figure 2.9a. Diet of lake whitefish from Ohio waters 2000, expressed as mean % dry weight. Values are means of monthly and area mean % dry weight. N = 31

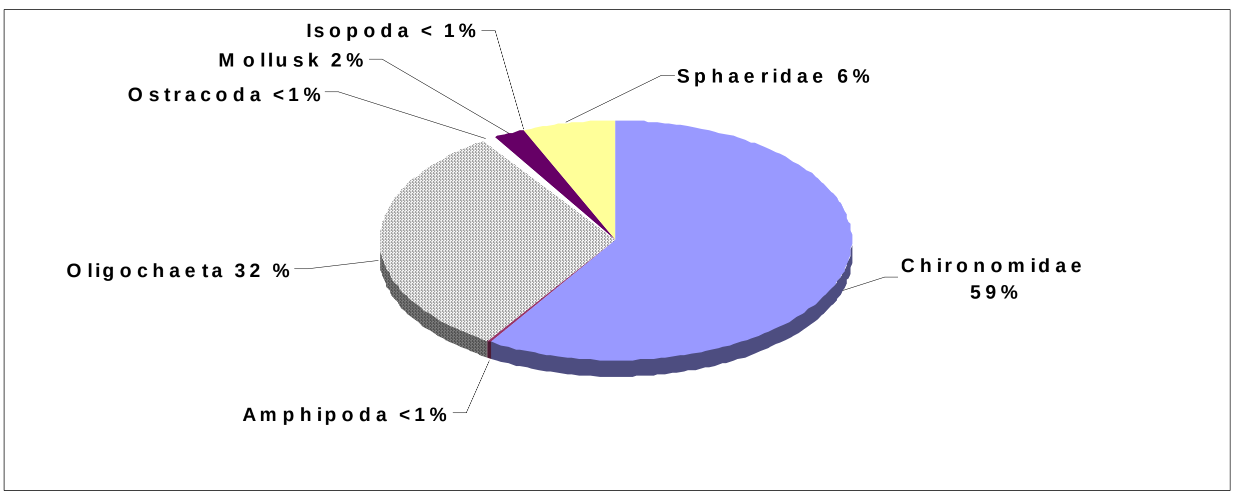

Figure 2.9b. Diet of lake whitefish from Ontario waters of the eastern basin, expressed as mean % composition by number. Whitefish were collected during February and May. N = 36.

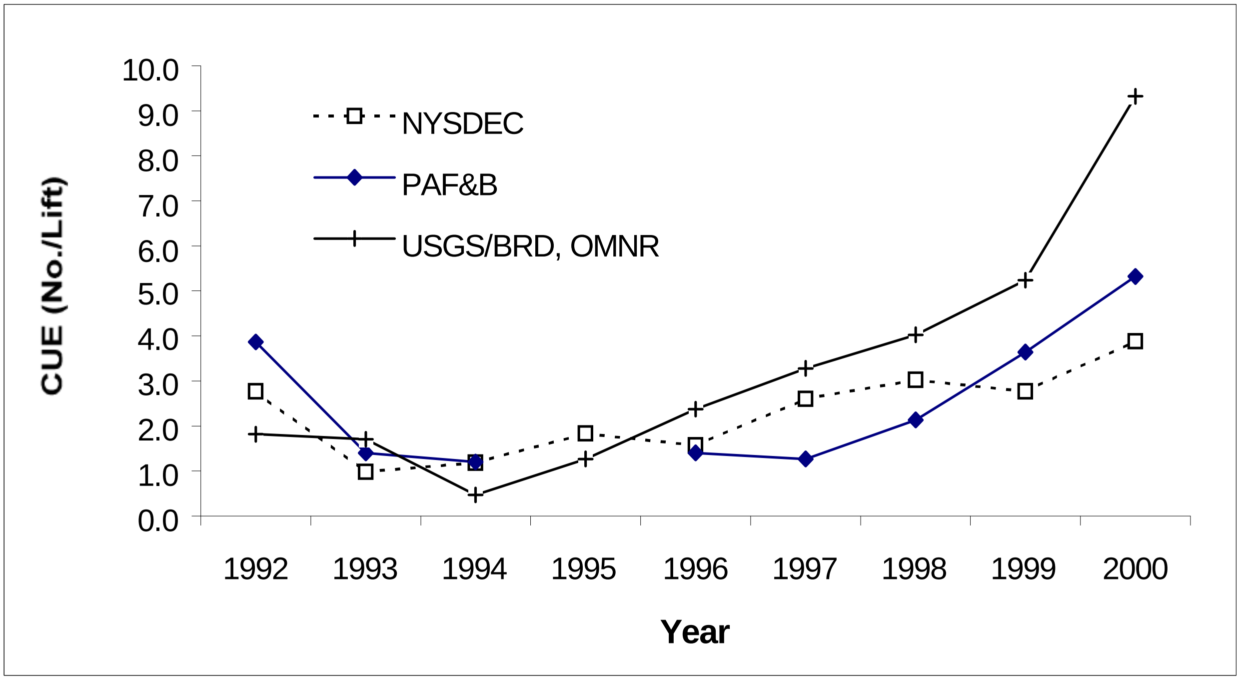

Figure 2.10. Burbot catch rate (fish/lift) from August gill net assessment by Agency, 1992 to 2000

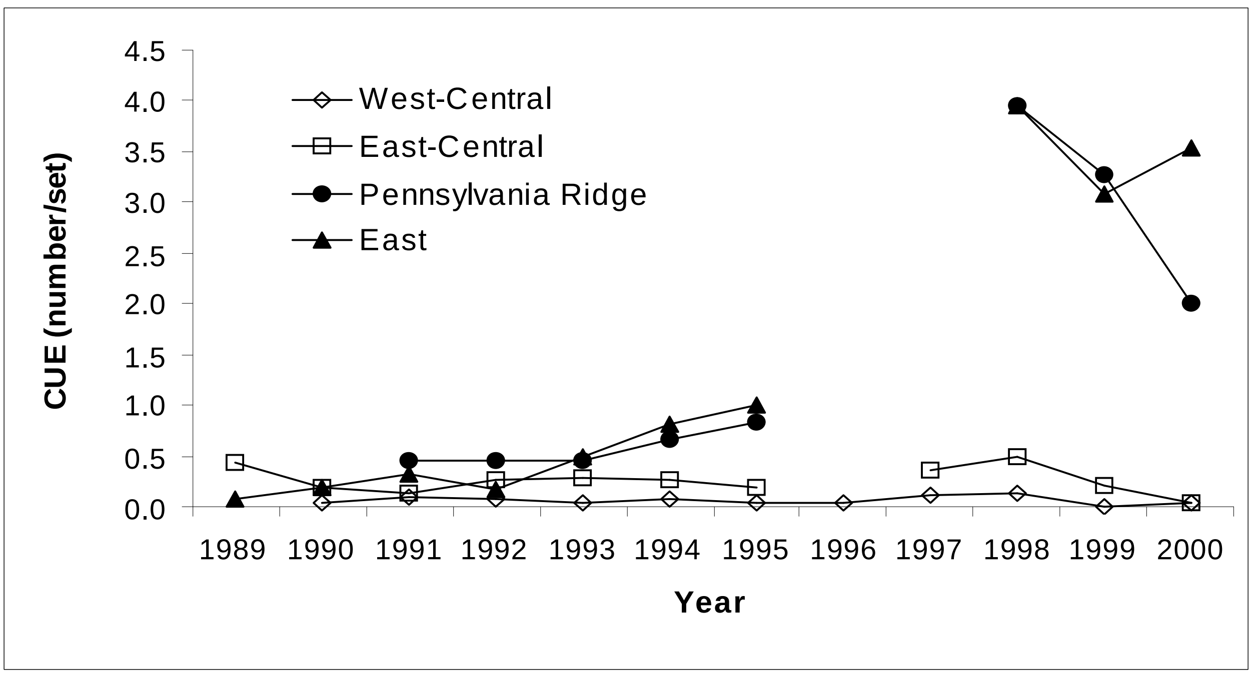

Figure 2.11. Burbot CUE (number / set) by basin from the OMNR Partnership Index Fishing Program, 1989-2000. (Includes canned and bottom nets, all mesh sizes, except thermocline sets).

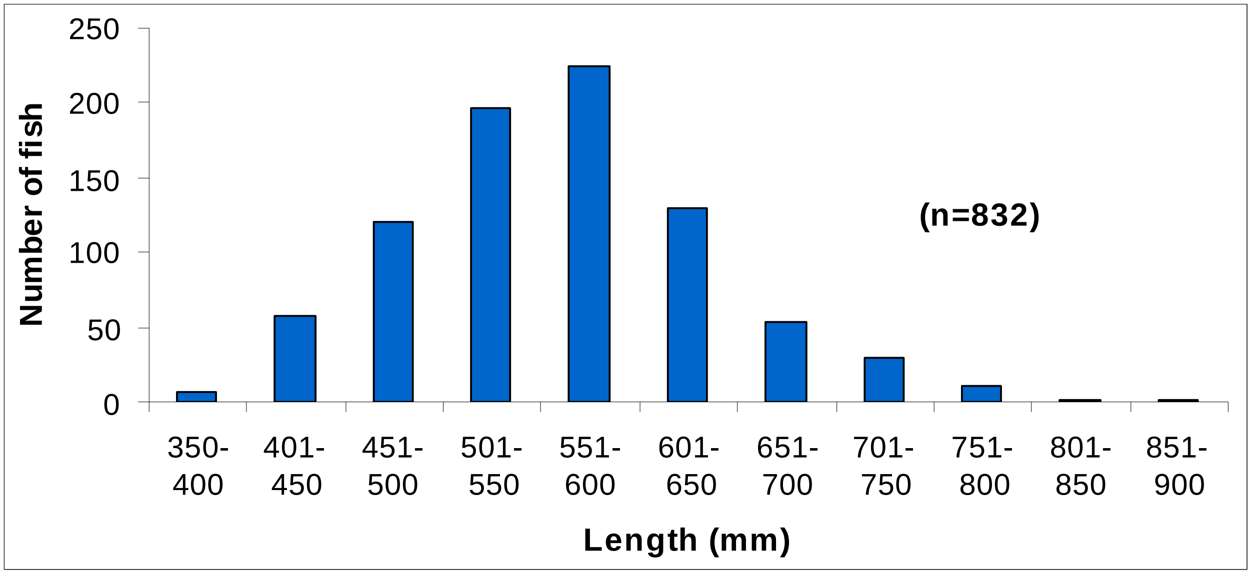

Figure 2.12. Size distribution of burbot collected in the Lake Trout Summer Assessment, 2000

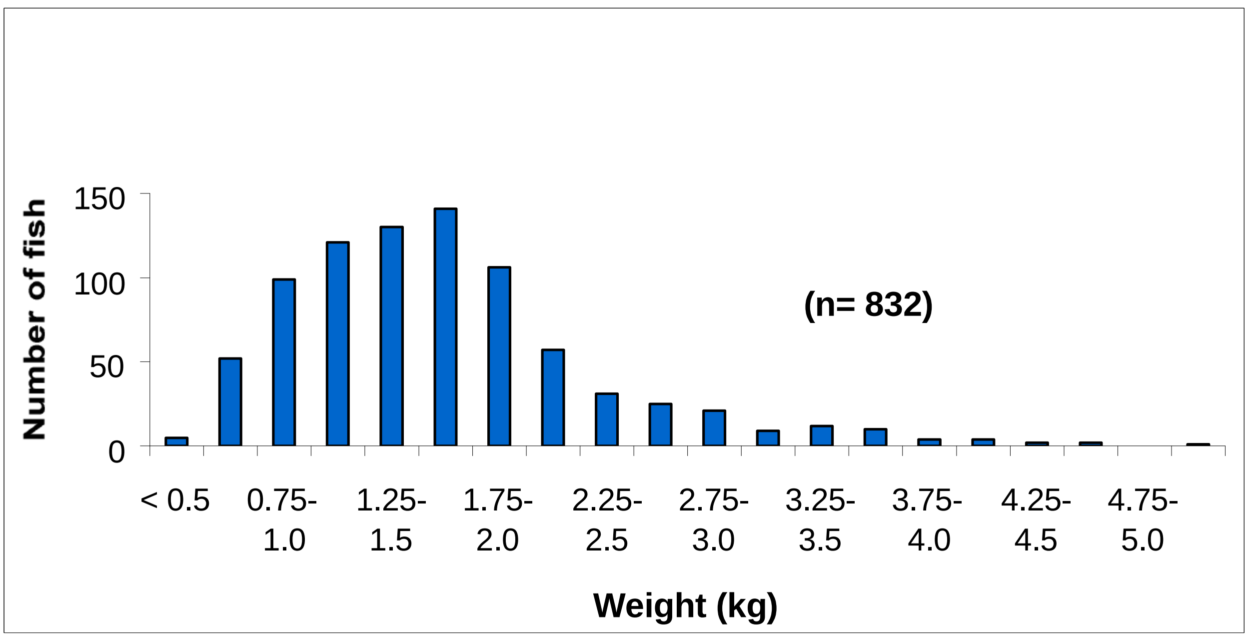

Figure 2.13. Weight distribution of burbot collected in the lake trout summer assessment, 2000.

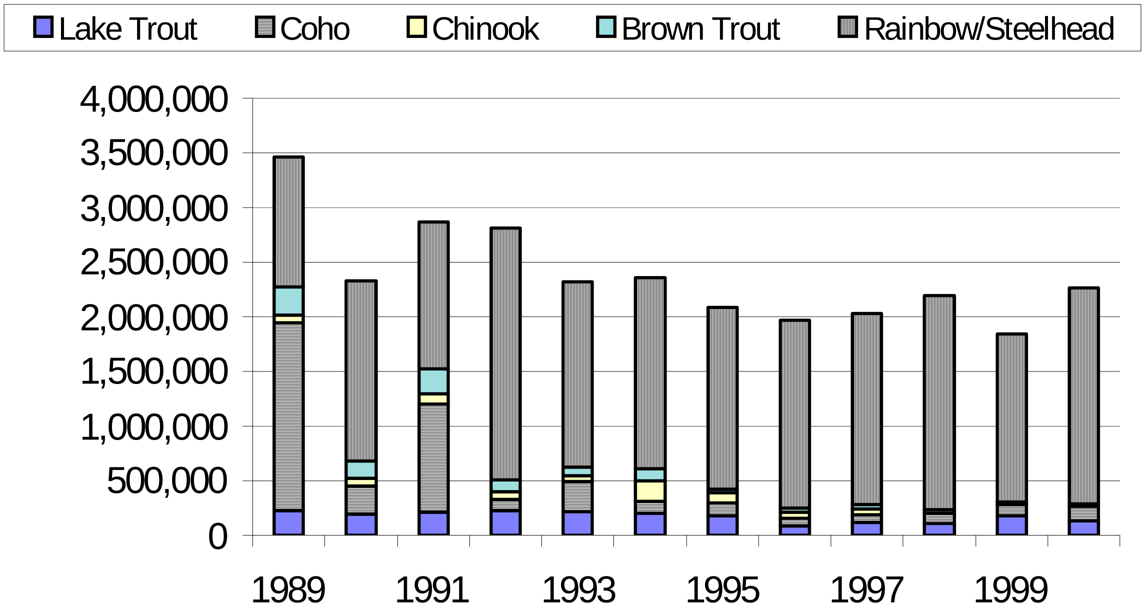

Figure 4.1. Annual stocking of all salmonid species in Lake Erie by all riparian agencies, 1989 to 2000. Numbers are in terms of yearling equivalents

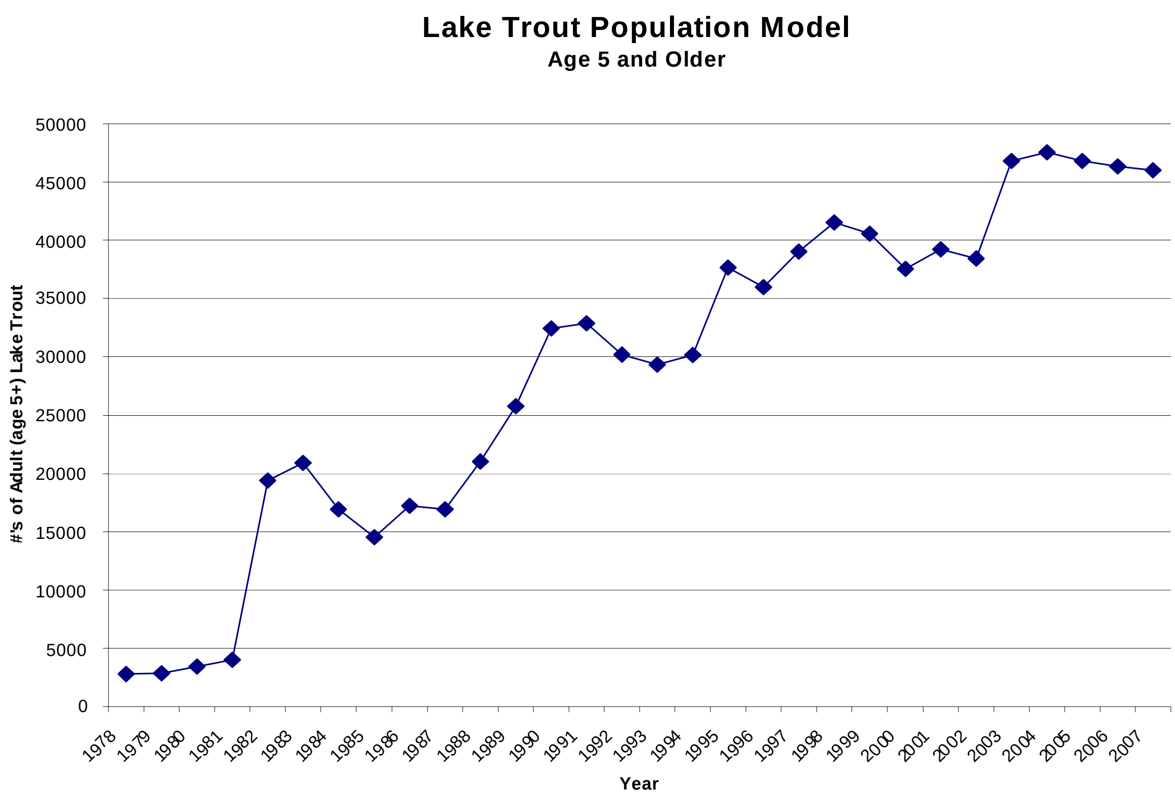

Figure 5.1. Simulated adult lake trout population model

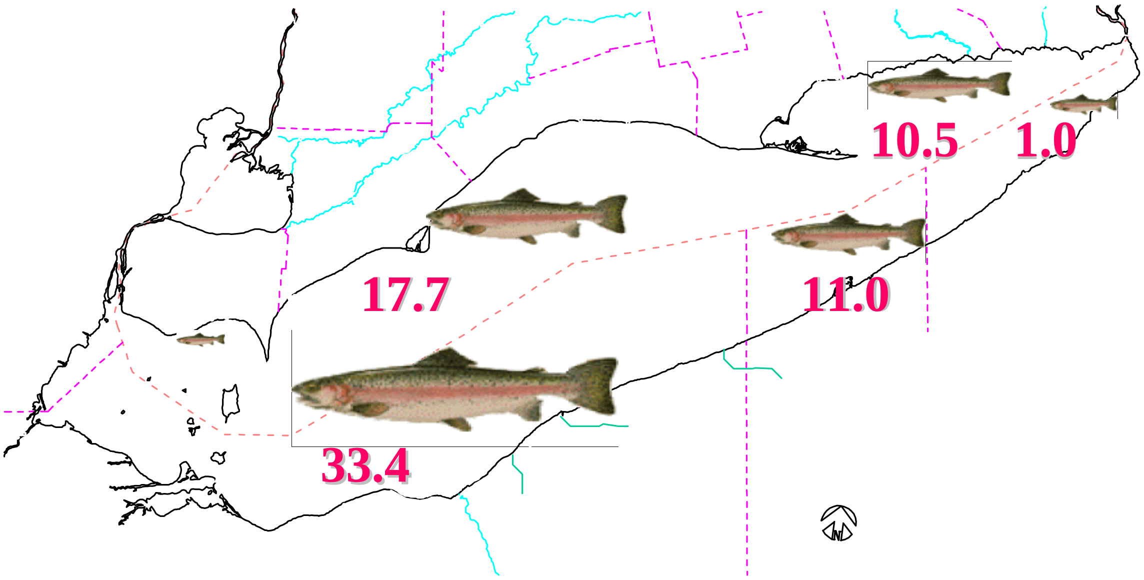

Figure 6.1. Estimated harvest of rainbow trout by sports fishery from Lake Erie in 2000. Harvest reported in thousands by jurisdiction and basin (Ontario data scaled using 1998 data).