Lake Erie

Coordinated Percid Management Strategy

Lake Erie Committee
Great Lakes Fishery Commission

Michigan Department of Natural Resources
New York State Department of Environmental Conservation
Ohio Department of Natural Resources
Ontario Ministry of Natural Resources
Pennsylvania Fish and Boat Commission

December, 2004

EXECUTIVE SUMMARY

Lake Erie walleye and yellow perch populations peaked in the late 1980s, but had declined to low levels of abundance by the late 1990s. As a result, the Lake Erie Committee decided to initiate the Coordinated Percid Management Strategy (CPMS), a 3-year (2001-2003) lake-wide management approach developed to halt population decline, ensure sustainable harvest, and promote stock recovery for walleye and yellow perch. The objectives of the strategy were to reverse declines and rebuild percid stocks to achieve broad distribution of benefits throughout the lake, and to improve approaches used to estimate percid abundance and determine sustainable harvest levels.

To achieve the first objective, the LEC reduced walleye harvest by altering recreational fishing regulations and reducing quota to the commercial fishery (Ontario). Population abundance of walleye increased during 2001-2003 as a result of harvest reductions and a strong 1999 year class. Although the decline in walleye abundance was halted, fisheries were not restored lake-wide to desired levels and the rebuilding effort was not completed in 2003.

Yellow perch abundance was increasing at the onset of the CPMS, thus the LEC continued to set conservative TAC's but did not reduce harvest between 2001 and 2003. Indeed, TAC increased during those years, reflecting the increased abundance of yellow perch.

To achieve the second objective, the previous virtual population model was replaced with a revised catch-at-age analysis that incorporated independent stock assessment data and longer time series of fishery data than previously used. Revised models for walleye and yellow perch were peer-reviewed by independent, non-government scientists. The reviewers largely supported the revisions and recommended some additional changes, several of which were subsequently put into practice.

The LEC realized that while exploitation could be curtailed to promote percid populations, a healthy Lake Erie environment would be necessary for long-term sustainability of fisheries. Therefore, a number of habitat restoration projects were initiated during the CPMS and much work was completed on drafting Environmental Objectives that could be used to influence future habitat projects.

INTRODUCTION

The Lake Erie Committee (LEC) is a bi-national committee of state and provincial fisheries agencies operating under the auspices of the Great Lakes Fisheries Commission (GLFC) to manage fish communities in Lake Erie. The LEC agencies include the MICHIGAN DEPARTMENT OF NATURAL RESOURCES (MDNR), NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC), the OHIO DEPARTMENT OF NATURAL RESOURCES (ODNR), THE ONTARIO MINISTRY OF NATURAL RESOURCES (OMNR), and the PENNSYLVANIA FISH AND BOAT COMMISSION (PFBC).

The LEC partner agencies conduct independent and joint fisheries monitoring programs to better understand fish stock dynamics. Lake Erie's Standing Technical Committee (STC) annually coordinates an array of assignments to task groups, made up of agency biologists, to assess data from these monitoring programs using state of the art methods and scientific knowledge. Fish population abundance models are annually updated with data from monitoring programs to determine current population sizes and to project future abundance for Lake Erie walleye and yellow perch populations. Annual reporting by task groups enables the LEC to establish and maintain lake-wide management initiatives and set allowable harvests.

Changes in the Lake Erie fish community were significant throughout the 20th Century, occurring in response to stresses such as over-exploitation, habitat alterations, changes in nutrient loading levels, and the unintentional arrival and spread of invasive species. Change also occurred as fish communities adapted to the losses of native species. Changes were particularly evident in the 1970s as percid populations adapted to decreases in phosphorus loadings, and again in the 1990s as zebra mussel populations expanded throughout the lake.

After peaking in the late 1980s, the abundance of both walleye and yellow perch declined. Subsequently, Lake Erie agency biologists began to question the ability of population models used to estimate fish abundance. By 1999-2000, the Lake Erie walleye population had declined to a low level of abundance. Yellow perch were not as abundant in the 1990s as they were at their peak in the late 1980s, although data collected in the late 1990s showed that the trend in declining yellow perch abundance appeared to have stopped and stocks were beginning to recover. Concern for the declining abundance of walleye and the low abundance of yellow perch in recent years prompted the LEC to initiate the Coordinated Percid Management Strategy (CPMS). The information that led to the LEC decision to implement a 3-year management approach, referred to as the CPMS, was documented in the Great Lakes Fishery Commission, Lake Erie Committee releases *Lake Erie Coordinated Percid Management Strategy Background Summary* and the *Lake Erie Coordinated Percid Management Strategy FAQs (Frequently Asked Questions)* (Appendix I). These documents were produced by the LEC in 2000 and readers should be cautioned that metrics in the Appendices, such as population abundance, will not match those in the document because of revisions in methodology, as explained herein.

COORDINATED PERCID MANAGEMENT STRATEGY (CPMS)

The CPMS was developed to halt population decline, ensure sustainable harvest, and promote stock recovery for walleye and yellow perch in Lake Erie. The CPMS had two objectives:

- ***reverse declines and rebuild percid stocks to achieve broad distribution of benefits throughout the lake,***

- ***improve approaches used to estimate percid abundance and determine sustainable harvest levels.***

The CPMS approach was lake-wide, international in scope, and based on the best information available. During the course of the CPMS, 2001-2003, the LEC agencies addressed five components:

1. Steps to halt and reverse declining percid populations by reducing harvest
2. Refinement of the methods used to develop recommendations for total allowable catch of both walleye and yellow perch
3. Examination of ways to reduce the harvest of immature walleye
4. Exploration of opportunities for habitat and ecosystem rehabilitation that would enable improvements to the productive capacity of Lake Erie
5. Steps to evaluate the success of the Strategy to achieve the desired objective of stock rehabilitation, including improved juvenile survival, a more broad representation of ages in the population, stronger reproduction, and to improve resolution of population estimators.

A summary of the progress towards components 1-3 is provided for walleye and for yellow perch, followed by a summary of progress towards components 4 and 5.

WALLEYE

1. Steps to halt and reverse declining percid populations by reducing harvest

The LEC decided to follow a conservative Total Allowable Catch (TAC) strategy for at least 3 consecutive years, 2001-2003. The conservative strategy set TAC significantly lower than recent walleye harvests to rebuild the walleye population to an abundance at or above that of 2000. The TAC was not to be exceeded during the designated 3-year period, although it would be reduced if necessary to meet the objective.

To calculate an appropriate TAC, the WTG set aside use of the past target fishing mortality rate ($F_{0.1}$) in favour of a more simplified approach that required no long-term assumptions about growth or natural mortality (Walleye Task Group 2001). Natural mortality (M) was assumed to be 0.32, as estimated from analysis of tag-return data (Walleye Task Group 2001) and the WTG balanced recruitment with combined fishing and natural mortality to project future walleye abundance that would be no lower than the abundance of walleye in 2000.

The LEC set the minimum tolerable walleye population abundance for the 3-year CPMS period to be equivalent to the abundance of the 2000 walleye population; with the intention to have the population abundance above this minimum in each year of the CPMS (i.e., 2001-2003). This minimum was considered by the LEC to reflect a population abundance that did not support desirable walleye fisheries. The most recent ADMB abundance estimate of the population in 2000 was 15.99 million age-2 and older walleye (Walleye Task Group 2004).

In 2001, TAC was set at 3.4 million fish, a reduction of 56% from the 7.7 million walleye allowed in 2000. The TAC remained at 3.4 million walleye in 2002 and 2003.

To ensure that the lake-wide TAC was not exceeded, each LEC agency took steps to decrease walleye harvest:

Michigan	- reduced creel limits from 10 to 6 walleye
New York	- maintained spring closure and 15 inch minimum size limit
	- creel limits lowered from 5 to 4 walleye
Ohio	- reduced creel limits from 10 to 4 walleye during March and April
	- reduced creel limits from 10 to 6 walleye from May to February
Ontario[1]	- reduced creel limits (central and western basins) from 6 to 4 walleye in March and April
	- reduced commercial harvest, including a reduction in spring allocation
Pennsylvania	- closed season from March 15 to first Saturday in May
	- creel limits remained at 6 walleye

Figure 1 shows Lake Erie sport fishing regulations in each jurisdiction.

[1] In Ontario, the 5-Year East Basin Rehabilitation Plan began in 2000. Harvest in both commercial and sport fisheries was restricted. Sport fishing restrictions included a closed walleye season from March 15-second Saturday in May and a possession limit reduction from 6 to 4 fish/day throughout the remainder of the year.

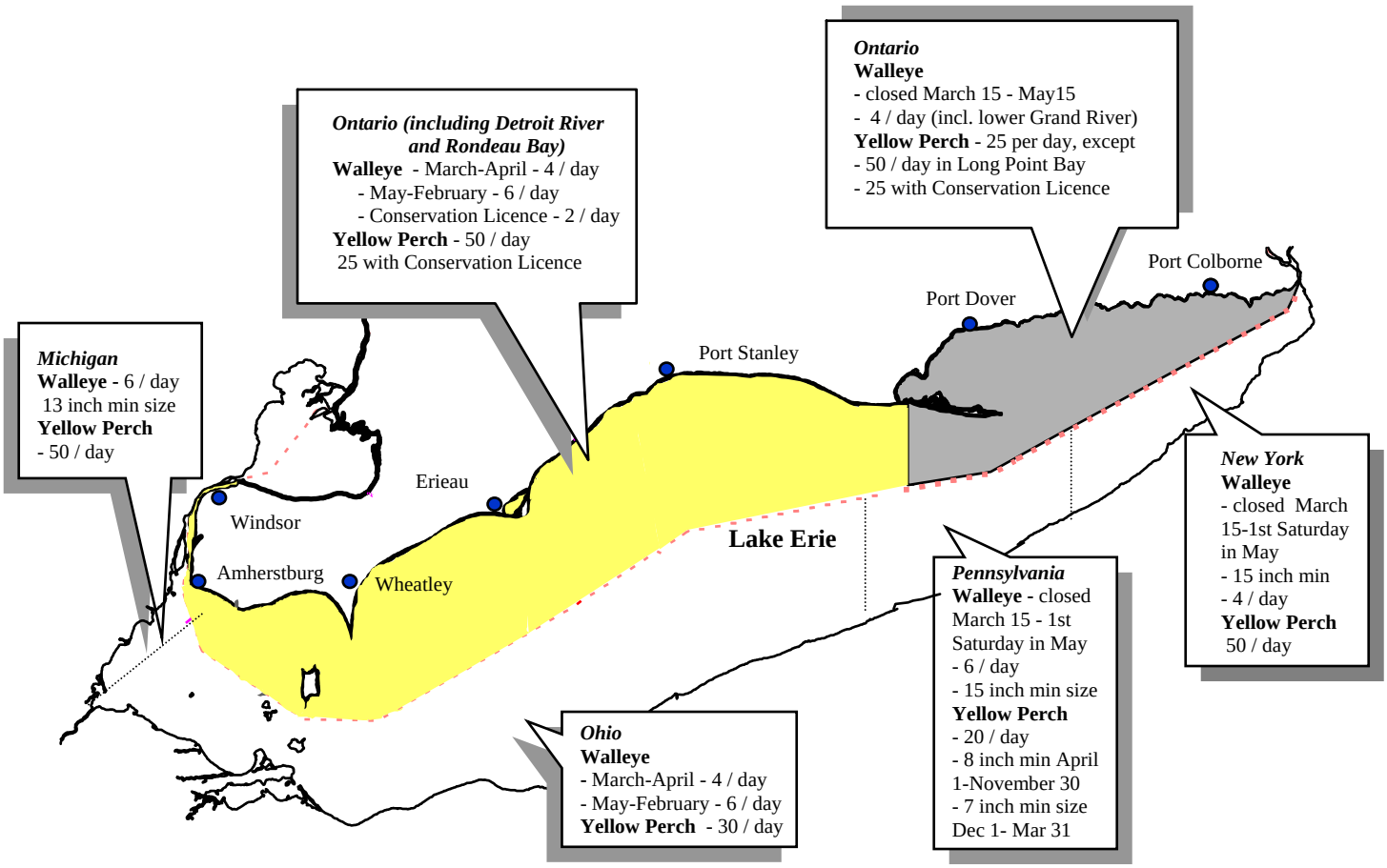


Figure 1. Recreational fishing regulations across jurisdictions for Lake Erie walleye and yellow perch in 2003.

In all 3 years of the CPMS, the established TAC of 3.4 million walleye was not exceeded. In those years, the total harvest was 2.9, 2.4, and 2.7 million walleye, respectively (Table 1).

Table 1. Lake Erie walleye harvest by Michigan, Ohio and Ontario (which are included in the TAC), total lake-wide harvest (all agencies), and estimated abundance in numbers of fish, from 2001 - 2003 (Walleye Task Group 2004).

Year	Harvest by MI, OH, ON	Total lake-wide harvest	Estimated Abundance
2001	2,815,916	2,922,879	24,844,484
2002	2,332,515	2,408,892	16,820,296
2003	2,600,554	2,704,307	29,119,466

In each jurisdiction, the average harvest of walleye during the CPMS period was lower than the average number of walleye harvested in the 3 years prior to the CPMS (Table 2).

Table 2. Average harvest of walleye (in numbers), by jurisdiction, for the 3-year period prior to the implementation of the CPMS (1998-2000) and during the 3-year CPMS period (2001-2003).

LEC Agency	Average Number of Walleye Harvested 1998-2000	Average Number of Walleye Harvested 2001-2003	Reduction in Average Harvest
Michigan	169,052	160,518	5%
New York	28,607	20,175	29%
Ohio	1,423,314	958,534	33%
Ontario*	3,371,942	1,500,007	56%
Pennsylvania	97,121	39,459	59%

*Ontario harvest includes commercial and sport harvests.

Steps to reduce harvest were intended to halt and reverse declining abundance of percid populations. With harvest reduction measures in place, population abundance did not fall below the 2000 abundance level.

These harvest reduction efforts were put in place to reduce harvest throughout the year, but also addressed a need to protect spawning walleye, particularly the 1999 year class, by reducing mortality on aggregated stocks.

2. Refinement of the science used to develop recommendations for total allowable catch of both walleye and yellow perch

The LEC committed to refining TAC methodology through both internal and external evaluations of current methods.

The Walleye Task Group (WTG) evaluated stock assessment methods (see Walleye Task Group 2001; 2002), especially regarding the accuracy of abundance estimates from its catch-at-age analysis (CAGEAN) model. Specifically, the WTG was concerned CAGEAN over-estimated population abundance.

The WTG evaluated alternative methods to assess walleye population dynamics and switched to a Statistical Catch at Age model (SCAA) executed with Auto-Differentiated Model Builder software (ADMB) to estimate abundance and mortality at various ages. The following is an excerpt from the Walleye Task Group report (2001):

> "The main advantages of ADMB catch-at-age analysis over CAGEAN include flexibility for adding longer time series (>16 years), including additional auxiliary information (survey data sets), and modification of output parameters. Moreover, WTG members could modify the program code to explore more options than available under CAGEAN……...
>
> After months of exploring various model configurations with ADMB, WTG members recommended ADMB to estimate abundance and mortality trends in the Lake Erie walleye population, due to the previously stated advantages of this model over CAGEAN. The group further agreed to 1) include the years 1978 through 2000 in the analyses, 2) establish blocks of time (1978-83, 1984-88, 1989-2000) to accommodate changing catchability in the fisheries, 3) accept an instantaneous natural mortality rate (M) of 0.32 for all age groups in all years (as derived from tag-return analyses), and 4) estimate catch, effort, and auxiliary gear weighting coefficients (lambdas) with techniques outlined by the original developers of catch-at-age analysis. Auxiliary survey gear data were derived from a composite, catch-per-unit-effort index of relative abundance that incorporated three fall index gill net series for the western and central basins (from MDNR, ODNR, and OMNR) and one spring trap net series (MDNR). The index was weighted to equally represent contributions from all surveys and generally depicted a growing walleye population from 1978-1989 that declined thereafter……..
>
> Thus, model outputs were strongly (but equally) influenced by fishery catch, gill net effort, and survey gear data sets, and were only marginally influenced by trends in angler effort. This configuration reflected the relative level of confidence attributed to each of these data sources as valid indicators of walleye abundance.
>
> Trends in abundance were highly correlated between CAGEAN and ADMB catch-at-age analysis runs but absolute abundance was substantially lower in the ADMB version. For example, walleye abundance in 1999 was estimated at 36.8 million fish,

> 36% lower than CAGEAN estimates in 2000 (57.9 million fish, Walleye Task Group 2000). Differences in estimated abundance between models were attributed to the expanded time series in the ADMB model (from 16 to 23 years) and the inclusion of the auxiliary survey gear index. Both models estimate declines in walleye abundance of about 60% from 1988 through 2000."

In 2001, the WTG continued to revise the ADMB model code and included three index gill net surveys (one each from Michigan, Ontario and Ohio) in the model (Walleye Task Group 2002). In 2002, the WTG assembled and analyzed explicit fisheries statistics specific to the east basin walleye population, a distinct walleye stock with associated walleye fisheries that are not managed within the western basin walleye quota system (WTG 2003). A separate strategy (Ontario Eastern Basin Rehabilitation Plan) provides guidance for setting Eastern Basin walleye allocations (Ontario fisheries only). In 2003, the WTG again updated the SCAA-ADMB model to standardize data input by quota area. In addition, a preliminary SCAA-ADMB model was initiated for the eastern basin walleye stocks, including 8 years of data (1996-2003) from Ontario, New York, and Pennsylvania fisheries and index netting programs.

Using SCAA-ADMB and recruitment indices, the WTG predicted fish abundance in future years. To project ahead, the WTG used estimated population abundance, survival, and age-2 recruitment from SCAA-ADMB. With each additional year of data, the population abundance estimates were refined for all previous years in the time series. For 2003, the final year of the CPMS, the projected population estimate was 26.1 million age-2 and older walleye (WTG 2003). After the 2003 fishing season, the population abundance estimate for 2003 was 29.1 million walleye (WTG 2004), indicating relatively close agreement between the initial projection and subsequent estimate of walleye abundance in 2003.

The LEC retained external experts (Dr. Ransom Myers, Dalhousie University, and Dr. Jim Bence, Michigan State University) to provide an independent review of the science used to determine population abundance and quotas. The following is a synopsis from the review document (Myers and Bence 2001a):

> "The walleye assessment team is to be congratulated on their excellent recent progress in the assessment of walleye in Lake Erie. The most recent assessment (i.e., the preliminary assessment provided to us as part of the review) is much better than previous assessments, and uses modern assessment tools. The assessment team has developed a custom assessment within the AD Model Builder environment. This has allowed them to evaluate alternative modeling options and has positioned them for greater flexibility in attempting to more realistically model the walleye of western and central Lake Erie. A major advance over previous assessments was the use and evaluation of a wealth of fishery independent (survey) data. We believe that previous assessments are likely to have overestimated walleye abundance and to have underestimated recent exploitation rates. The more pessimistic assessment of the status of the walleye in the most recent assessment is a change that we believe is in the right direction. In fact, we think there is a reasonably high probability that even this most recent assessment is overly optimistic. In addition, we believe that certain sub-stocks are likely being harvested at very high exploitation rates indeed. Below

> we report alternative analyses and observations supporting these views and provide recommendations that could be implemented from short-term (i.e., months to a year), mid-range (approximately one year to three years), and long-term (more than three years to implement)."

Efforts were undertaken in 2000 by the WTG to re-evaluate estimates of natural mortality (M) for walleye. The WTG examined data from New York tag studies, Ontario commercial fisheries, and the reward tag programs in Michigan, Ohio, and Ontario. The WTG also reviewed published literature reports documenting estimates for M in other walleye populations. From those efforts, the WTG decided to continue to use an estimate of M=0.32 until such time that additional evidence was sufficient in support of an alternative value.

3. Examination of ways to reduce the harvest of immature walleye

A study was undertaken in 2000 to investigate the incidence of yearling walleye "spikes" captured as by-catch in the Ontario yellow perch gillnet fishery. This study was a partnership initiative in cooperation with the Ontario Commercial Fisheries Association and the Ontario Lake Erie Management Unit enforcement and fisheries assessment staff. Throughout 2000, the yellow perch fishery was mimicked using a number of commercial mesh sizes fishing in locations that were closely associated with commercial fishing. Concurrently, enforcement and assessment staff closely monitored the small mesh commercial fisheries (yellow and white perch) on the lake. The information gathered was used to determine seasonal catch rates of spikes in a variety of gears. By extrapolating the by-catch rates against the total effort expended by various aspects of the commercial fishery, OMNR estimated that in 2000, the spike walleye by-catch was approximately 200,000 age-1 walleye. This level of by-catch would only occur in years following the production of a large cohort, e.g., in 2000 due to the strong 1999 year class. The relevance of this level of by-catch to walleye population growth is still being explored (and will depend on reporting rates, mortality, and the size of a cohort), as are management options to control it, if deemed necessary.

During the CPMS, three LEC jurisdictions protected immature walleye using size limit restrictions. In two of the jurisdictions, New York and Pennsylvania, the average age of fish harvested in the recreational fishery during the CPMS years was >age 6 (Walleye Task Group 2002; 2003) and the harvest of immature walleye was minimal. In Michigan, where a 13" minimum size limit (MSL) was in effect before the CPMS, only 1,444 age-1 walleye were harvested in 2000 and none were taken in 2001 or 2002 (Walleye Task Group 2001; 2002; 2003). Ohio did not enact a MSL during the CPMS and estimated harvest of age-1 walleye was 9,967 in 2000, 1,842 in 2001, 751 in 2002, and 0 in 2003. In general, harvest of age-1 walleye by angling fisheries was not substantial in any jurisdiction during CPMS but apparently was affected by year class strength and the availability of other ages to anglers.

YELLOW PERCH

1. Steps to halt and reverse declining percid populations by reducing harvest

The LEC decided to take a conservative approach to yellow perch management, but did not set a conservative 3-year total allowable catch, as enacted for walleye. In fact, the TAC was increased each year of the CPMS, reflecting increased yellow perch abundance. Table 3 shows TAC for yellow perch by management unit and Figure 2 shows the location of each management unit.

Table 3. Total allowable catch (TAC), in pounds, set for yellow perch by the Lake Erie Committee, 2001-2003.

Year	Management Unit 1	Management Unit 2	Management Unit 3	Management Unit 4	Lake-wide TAC
2001	1.8	3.5	1.73	0.070	7.100
2002	3.1	4.1	2.00	0.133	9.333
2003	2.6	4.2	2.90	0.206	9.900

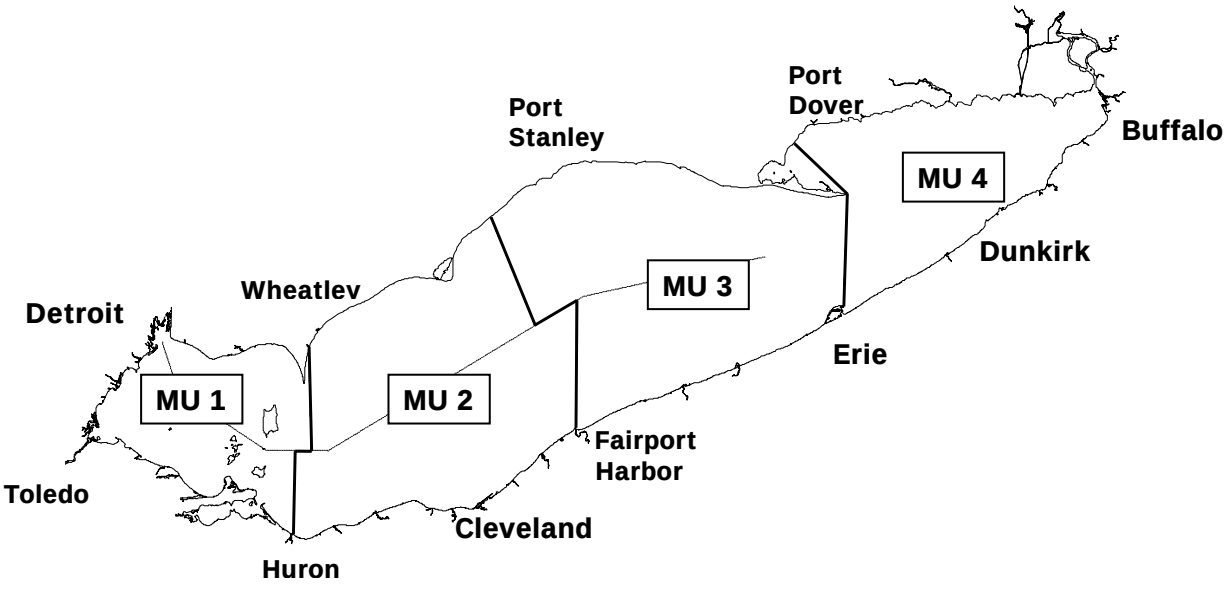


Figure 2. Management unit boundaries used for yellow perch in Lake Erie.

Ontario set catch and possession limits at 50 perch per day in the central and western basins. The Eastern Basin Rehabilitation Plan was in place and yellow perch sport harvests were set at 50 perch in Long Point Bay and 25 perch in the eastern basin. In Pennsylvania, a minimum size limit of 8" from April to November and catch and possession limits of 20 perch per day were set. Agency sport fishing regulations are shown lake-wide in Figure 1.

During the 3-year CPMS, yellow perch stock abundance estimates remained high and increased in management units 1, 2 and 4 in 2003 (Figure 3). This was primarily attributable to favorable recruitment of the 2001 year class.

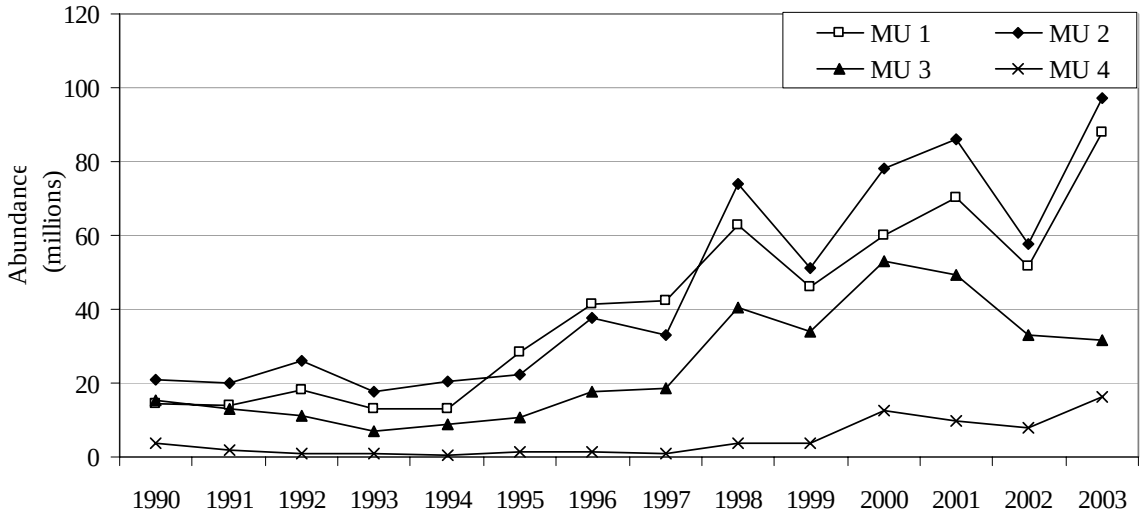


Figure 3. Yellow perch abundance (in millions) for Management Units 1-4, 1990-2003.

Harvest levels, in general, were higher in 2001 and 2002 than in 2000. The exception was a reduction in the harvest in Management Unit 1 in 2001 (Figure 4) (Yellow Perch Task Group 2004).

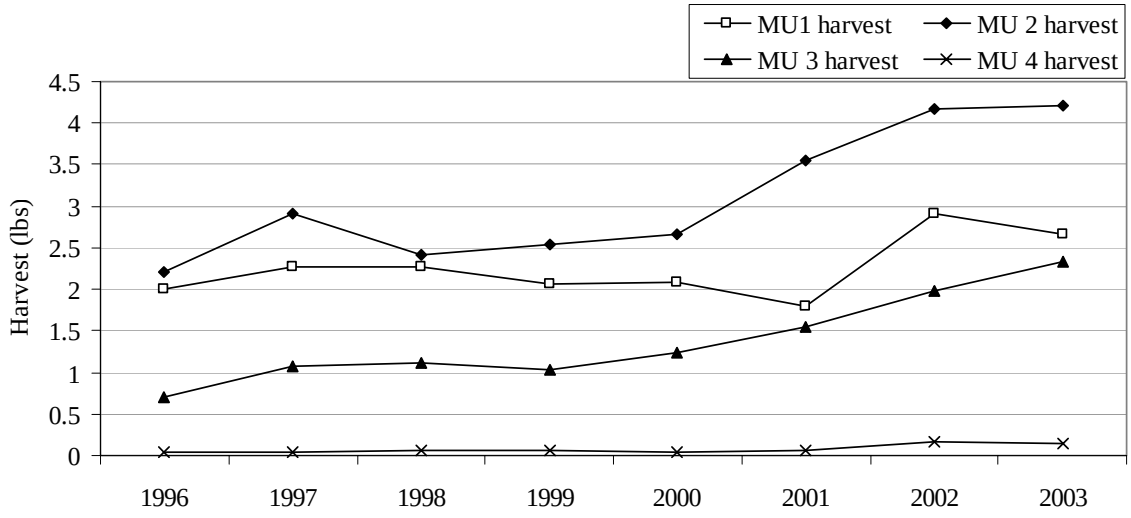


Figure 4. Yellow perch harvest, in pounds, by Management Unit.

Prior to 2001, harvest of yellow perch in all management units were within TACs. During the CPMS years, TACs were exceeded in management unit 2 (in 2001), management units 2, 3, and 4 (in 2002), and in management unit 1 (in 2003) (Yellow Perch Task Group 2002; 2003; 2004).

2. Refinement of the science used to develop recommendations for total allowable catch of both walleye and yellow perch

In 2001, the LEC retained external experts (Dr. Ransom Myers, Dalhousie University, and Dr. Jim Bence, Michigan State University) to provide an independent review of the science used to determine population abundance and quotas. The review concluded that the recent switch to ADMB from CAGEAN was an improvement, as was the inclusion of net survey data in the 2001 model. The review also concluded that the methods being used to derive 2001 recommended allowable harvests were fundamentally sound. The following is a synopsis from the review document (Myers and Bence 2001b):

> "The Yellow Perch Task Group (YPTG) is to be congratulated on their excellent recent progress in the assessment of perch in the 4 management areas of Lake Erie. The most recent assessment, i.e. the preliminary assessment provided to us as part of the review, is much better than previous assessments, and uses modern assessment tools. The assessment team has developed a custom assessment within the AD Model Builder environment. This has allowed them to evaluate alternative modeling options and has positioned them for greater flexibility in attempting to more realistically model the population dynamics of perch of western and central Lake Erie. A major advance over previous assessments was the use and evaluation of a wealth of fishery independent (survey) data. The reviewers have carried out independent analysis of the perch in Lake Erie, and the results from these analyses are in general agreement with the YPTG assessment. The reviewers have made extensive suggestions about how assessments and management strategies could be improved in the future; however, these should not be interpreted as concluding that the present assessment is incorrect. We emphasize that the following discussions of alternative methods describe suggestions about how to improve the assessments, rather than things that we feel "have" to be done. A major issue that needs to be addressed in future assessments is to account for changes in catchability due to factors such as changes in growth. This could be done in future assessments by assuming that the catch at age in known without error and that surveys catchabilities are length dependent, and depend upon the mean length observed in the surveys. The use of ADModel Builder has greatly improved the assessment, and we do not suggest that the YPTG move away from this approach. However, we do believe that it is relatively easy to convert the existing models with the assumption that catch-age-age is known without error. This is much preferable to using a canned program in the long run, e.g. the ICES package (however, the ICES package might be tried to verify the results). This cannot be done without some reprogramming. Alternative assessment approaches that allow for changes in catchability and errors in the catch-at-age might ultimately provide an even better assessment; however, such an approach would be very difficult to implement. We note that not all the CPUE series track one another. We suggest

taking out each series at a time, to determine how sensitive the results are to each one. Our analysis leads us to believe that the decision rules presently being used lead to a reasonable exploitation rate. On a longer term basis, we suggest that the task group move away from the $F_{0.1}$ management rule. Such an approach would take into account the spawner recruit relationship."

In 2001-2002, the YPTG examined relationships among yellow perch spawning stock, recruitment, and environmental variables (Yellow Perch Task Group 2003). In 2002-2003, simulations were developed based on stock recruitment functions that were influenced by environmental factors (Yellow Perch Task Group 2003).

Yellow Perch Population Simulation

To evaluate alternative yield strategies for yellow perch, the YPTG produced a simulation of the yellow perch population in 2003. The purpose of this simulation was to define the effects of various fishing mortality rates on yellow perch abundance. This simulation, applied to populations in each management unit, allowed the YPTG to quantify risk associated with various fishing rates, while giving consideration to stock recruitment patterns and environmental influences experienced by yellow perch during recent decades in Lake Erie.

The model is based on a gamma spawner-recruit relationship produced using 1975 to 2001 population abundance and demographic data from ADMB. Environmental scaling factors calculated from the residuals of the spawner-recruit relationship were then applied to the spawner-recruit relationship in the model. The environmental scaling factors were calculated by dividing the observed recruits by the predicted recruits in the gamma spawner-recruit relationship. Using recent and forecasted abundance (2003-2004) as initiators, the simulations estimated annual recruitment from the spawner-recruit function, then multiplied it by an environmental scaling factor selected randomly from the observed distribution of residuals. Other data input into the model included fishing and natural mortality values, selectivity, percent maturity at age, and weight at age. This process was extended over 20 years and 100 replicates under a broad range of fishing mortality rates (F=0.0 to 3.0) to produce measures of risk. The Model assumptions were constant fishery selectivity, growth rate (weight), maturity rate, fishing mortality, and natural mortality during the 20 year simulation periods. In addition, the number of environmental scaling factors was limited to the number of years included in the spawner-recruit relationship.

Biological reference points, including spawner biomass (as a fraction of an unfished population), survival rates, and the probability of attaining low levels of abundance comparable to 1993-1994 were included as outputs. The model calculated other parameters, including population abundance, number of spawners, number of recruits, spawner biomass, catch, and exploitation for each fishing mortality value.

3. Examination of ways to reduce the harvest of immature walleye

This issue was not applicable to yellow perch.

PROGRESS ON CPMS COMPONENTS 4 AND 5

4. Exploration of opportunities for habitat and ecosystem rehabilitation that would enable improvements to the productive capacity of Lake Erie

Considerable changes have occurred in the Lake Erie watershed, resulting in reductions in optimal fish habitat. Examples of such changes include the loss of wetlands in the south western portion of the lake, shoreline modification, nutrient enrichment, and tributary channelization (Ryan et al. 2003).

Rehabilitation efforts in eastern Lake Erie are either planned or have already been undertaken in New York (Cattaraugus Creek, Big Sister Creek, and the Buffalo River). In Ohio, dam removal has occurred on tributaries to Lake Erie. In Ontario, efforts undertaken for other initiatives (e.g., increases to spawning habitat in the Grand River for the Eastern Basin Rehabilitation Plan), have also benefited habitat and ecosystem rehabilitation for the CPMS. Participation in Canada-Ontario Agreement (COA) projects and the continued involvement on Lakewide Management Plan (LaMP) committees may also prove beneficial if future habitat improvement initiatives are carried out.

Habitat restoration and ecosystem rehabilitation are long-term objectives that necessitate each LEC agency to periodically review existing percid habitat and make improvements as resources become available. The LEC is developing Environmental Objectives to help direct interagency efforts to achieve Fish Community Objectives (Ryan et al. 2003).

5. Steps to evaluate the success of the Strategy to achieve the desired objective of stock rehabilitation, including improved juvenile survival, a more broad representation of ages in the population, stronger reproduction, and to improve resolution of population estimators

The implementation of short term harvest restrictions was beneficial to the walleye population. Population abundance was kept above the threshold level of the 2000 population abundance throughout the 3-year strategy period. However, walleye abundance was affected by recent year class failures that have prevented complete stock rehabilitation. Less than optimal environmental conditions prevented the production of strong year classes of walleye in 2000 and 2002. Although the 3-year CPMS period was of sufficient duration to stop the decline in walleye abundance, recovery of stocks to levels that support fishery benefits lake-wide will require additional time for adequate recruitment.

The number of juvenile walleye caught as by-catch in commercial fisheries was investigated in 2000 following the abundant 1999 year class. The relevance of this level of by-catch to walleye population growth is still being explored and regulations may be enacted as needed.

Although the walleye population is comprised of fish aged $0\text{-}7^{+}$, the LEC interpreted the concept of a *broad age composition* to mean that there was an abundance of walleye in several age classes within the population. As year class strength plays a large role in the age composition of

the population in subsequent years, the breadth of the walleye population will depend upon survival of the 1999, 2001 and 2003 year classes in coming years.

Strong reproduction occurs when there are a sufficient number of spawning adults, adequate quantity and quality of spawning habitat, and suitable environmental conditions, including food availability. In Lake Erie, the limiting factor appears to be suitable environmental conditions, since extant spawning stock biomass was able to produce a strong 2003 year class for both walleye and yellow perch.

External and internal reviews of methods used to calculate population estimators were conducted. Recommendations were used to improve the science used to calculate population abundance and total allowable catch for walleye and yellow perch. Improvements are ongoing as demonstrated by the development of a Yellow Perch Population Simulation model.

CONCLUSIONS

The Coordinated Percid Management Strategy was initiated to stop the decline in Lake Erie walleye and yellow perch abundance. The CPMS had two objectives:

- *reverse declines and rebuild percid stocks to achieve broad distribution of benefits throughout the lake,*

- *improve approaches used to estimate percid abundance and determine sustainable harvest levels.*

To achieve the first objective, the LEC reduced the harvest of walleye by altering recreational fishing regulations and reducing quota to the commercial fishery (Ontario). These actions reduced lake-wide harvest of walleye during 2001-2003. Population abundance of walleye increased during this time, as a result of harvest reductions and a strong 1999 year class. Although the decline in walleye abundance was halted, fisheries were not restored lake-wide to desired levels and the rebuilding effort was not completed in 2003.

Yellow perch abundance was increasing at the onset of the CPMS, thus the LEC continued to set conservative TAC's but did not reduce harvest between 2001 and 2003. Indeed, TAC increased during those years, reflecting the increased abundance of yellow perch.

To achieve the second objective, LEC agency biologists underwent training in new modelling technology. After considerable analysis, the previous virtual population model CAGEAN was replaced with a revised catch-at-age analysis, SCAA-ADMB, that incorporated independent stock assessment data and longer time series of fishery data than previously used. Revised models for walleye and yellow perch were peer-reviewed by independent, non-government scientists. The reviewers largely supported the revisions and recommended some additional changes, several of which were subsequently put into practice.

The LEC realized that while exploitation could be curtailed to promote percid populations, a healthy Lake Erie environment would be necessary for long-term sustainability of fisheries. A number of habitat restoration projects were initiated during the CPMS and much work was completed on drafting Environmental Objectives that could be used to influence future habitat projects.

The LEC also continued various assessment surveys of percid populations, the fish community, and fisheries during the CPMS. New surveys were initiated during CPMS as well to address specific issues of concern. Ultimately, the success of CPMS relative to stated objectives may not be fully understood until data series can be examined in the future through retrospective analytical techniques.

NEXT STEPS

The next steps currently being taken by the LEC are to evaluate individual jurisdictions harvest estimation methods; to continue to incorporate recommendations from the walleye and yellow perch external and internal methodology reviews; to move forward with risk-based approaches to allocation decisions, including the Yellow Perch Population Simulation and a Decision Analysis forecasting model for walleye; to develop management plans with clear objectives and management actions for walleye and for yellow perch; to publish Environmental Objectives as a Great Lakes Fishery Commission Technical Report; and to complete various research projects related to Lake Erie percids and incorporate results into management strategies.

REFERENCES

Myers, R.A. and J.R. Bence. 2001a. The Walleye of Western and Central Lake Erie. Unpublished Technical Review for the Lake Erie Committee of the Great Lakes Fishery Commission.

Myers, R.A. and J.R. Bence. 2001b. The 2001 Assessment of Perch in Lake Erie; A Review. Unpublished Technical Review for the Lake Erie Committee of the Great Lakes Fishery Commission.

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

Walleye Task Group. 2000. Report of the Walleye Task Group to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. 26 p.

Walleye Task Group. 2001. Report of the Walleye Task Group to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. 27 p.

Walleye Task Group. 2002. Revised Progress Report for 2001 by the Lake Erie Walleye Task Group to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. 25 p.

Walleye Task Group. 2003. Progress Report for 2002 by the Walleye Task Group to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. 27 p.

Walleye Task Group. 2004. Report of the Walleye Task Group to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. 27 p.

Yellow Perch Task Group. 2002. Report of the Lake Erie Yellow Perch Task Group to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. 39 p.

Yellow Perch Task Group. 2003. Report of the Lake Erie Yellow Perch Task Group to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. 44 p.

Yellow Perch Task Group. 2004. Report of the Lake Erie Yellow Perch Task Group to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. 43 p.

APPENDIX I

Lake Erie Coordinated Percid Management Strategy Background Summary

Lake Erie Coordinated Percid Management Strategy Frequently Asked Questions

Great Lakes Fishery Commission
Lake Erie Committee

Lake Erie Coordinated Percid Management Strategy Background Summary

The Lake Erie Committee (LEC) is a bi-national committee of state and provincial fisheries managers operating under the auspices of the Great Lakes Fishery Commission. LEC members have recently agreed to work together in a coordinated effort to rebuild Lake Erie populations of walleye and yellow perch (members of the percid family of fishes). What follows is a summary of facts relevant to this strategy.

Objectives of the Percid Strategy

- The overall objective is to reverse declines and rebuild stocks of walleye and yellow perch to achieve a broad distribution of fisheries benefits throughout Lake Erie.
- A secondary objective is to provide an opportunity for fisheries managers to develop new approaches to the estimation of walleye abundance and sustainable harvest levels.

Key Elements of the Strategy

The Coordinated Percid Strategy is consistent with the lakewide, cooperative, and science based management approach that reflects past management actions undertaken by the LEC.

- **Management actions associated with the strategy will begin in 2001, and stay in effect for a minimum of three years.**
- Management actions will be based on accepted resource management principles and rationale. An adaptive management approach will be used; meaning management practices are continually adapted based on observed/measured changes in stocks and the environment.
- Exploitation will be reduced to allow stocks an opportunity to recover and increase fishery benefits, while at the same time test relationships with stock size, recruitment and performance of population simulation models.
- The LEC will conduct additional assessment to evaluate the success of the strategy in achieving its goals for stock rehabilitation and improved resolution in population modeling. Targets for rehabilitation will be developed during the 3 year period
- ***For walleye***, the LEC is proposing that a conservative Total Allowable Catch (TAC) be set in March 2001 which will not be increased for 3 years. However, it may be further reduced if there is strong scientific evidence to indicate that it should be even more conservative.
- ***For yellow perch*****,** the LEC will continue to take a conservative approach to setting TACs, but will not necessarily set a conservative 3-year TAC, unless the recent positive stock trends are reversed.
- ***For both walleye and yellow perch***, state and provincial fisheries agencies will conduct a comprehensive review of existing harvest regulations (angler creel limits, seasons, size limits, sanctuaries and closures, etc.) for both recreational and commercial fisheries with the goal of revising regulations to reduce exploitation impacts and achieve consistency where possible.
- In addition to exploitation strategies (conservative TACs, regulation revisions), the LEC is committed to exploring opportunities for habitat and ecosystem rehabilitation that will result in

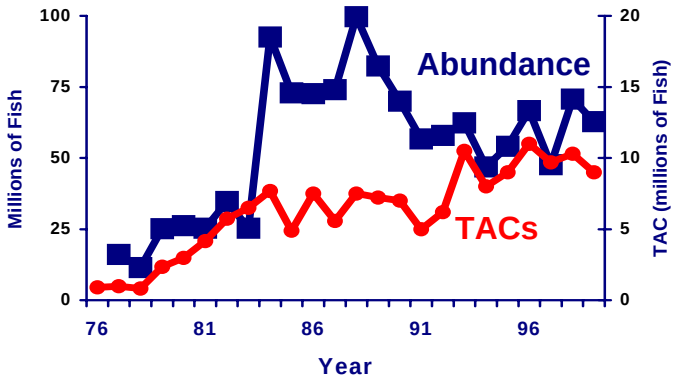
long term improvements to the overall carrying capacity of the lake for percids and other economically and ecologically important species.

Recent Trends and Concerns

Walleye:

Fisheries managers have been tracking a downward trend in the Lake Erie walleye fishery since stocks peaked in abundance in the 1980s. Trends are apparent when a number of different indicators point in the same direction. Several indicators show declining trends in both population abundance and fishery stability through the 1990s.

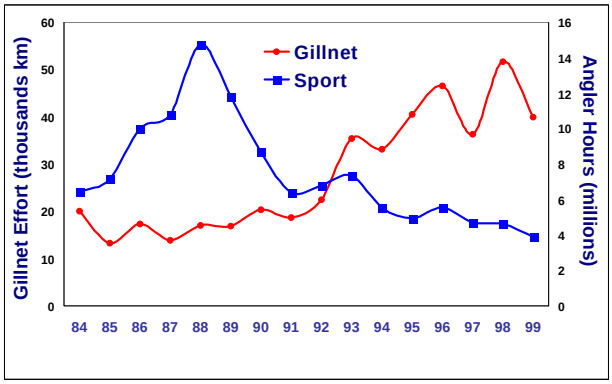
Trends In Walleye Abundance & TACs



- **Estimated abundance** of walleye older than 2 years peaked at over 100 million fish in 1988 and has since fluctuated between 50 - 70 million.
- **TACs** allocated by the LEC increased steadily between the 1970s & early 1990s.
- The TAC peaked at 11 million fish in 1996 and has since been reduced to 7.7 million (year 2000).
- The proportion of the total walleye population that has been allocated to the fishery was much higher in the 1990s than in the 1980s

Trends in Walleye Fishing Effort

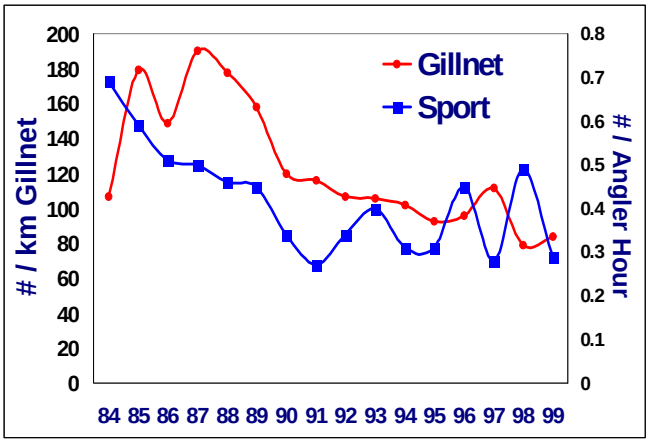
Fishing Effort (all basins combined)



- This chart shows trends in total fishing effort for both the Ontario commercial fishery and the sport fishery (all agencies combined) for all Lake Erie waters
- Anglers are fishing less in the 1990s than they did in the 1980s. As abundance decreases and fishing gets tougher, less people fish.
- Commercial fishing effort has generally increased, but has fluctuated widely in recent years. Decreased walleye abundance is a factor affecting commercial effort.

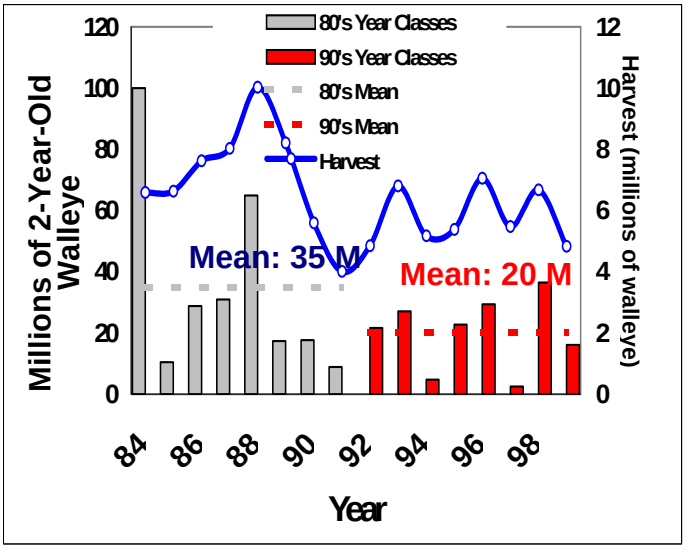
Walleye Catch Rates

Catch Rate (all basins combined)



- Angler catch rates peaked in the late 1980s and have declined steadily since.
- The decline in sport catch rates would be even more obvious if "casual" anglers who fished the lake during peak abundance years were still present. "Expert" anglers presently make up a higher proportion of the total angling effort.
- Dependence of the sport fishery on two-year-old recruits is evident by strong oscillations in catch success in recent years
- Commercial catch rates show a long term downward trend in response to lower abundance.
- The declining catch rate for commercial fishers is of special concern because theoretically, as stocks decline, commercial fishing efficiency increases.

Walleye Recruitment Trends



- Young walleye are "recruited" into the fishery at 2 years old. This chart shows the estimated number of two year old recruits between 1984 & 1999
- The mean number of recruits in the 1990s (20 million/year) is significantly lower than it was in the 1980s (35 million/year)
- Year classes in the 1990s are generally smaller than they were in the 1980s
- Since there are fewer old fish in the population, the fishery is now much more dependent on these two year olds than it was in the 1980s - harvest peaks in the 1990s correspond to peaks in abundance of 2 year olds

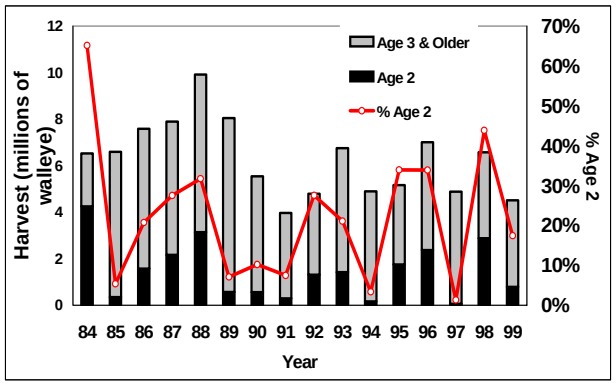
Other Concerns:

- A comparison of catch rates in various parts of the lake show that walleye stocks are shrinking back to their historic strongholds in the western basin and extreme eastern end of the eastern basin. This means that fishery benefits enjoyed when western basin stocks migrate to the central and eastern basins will continue to diminish.
- Ecosystem changes - which include changes in climate and productivity, as well as food-web instability resulting from invasion of exotic species - have added to uncertainty in future predictions of walleye recruitment, growth, and survival

- The Walleye Task Group of the LEC has become increasing concerned about the reliability of the current virtual population analysis model (CAGEAN) used to estimate walleye abundance. There are indications that the current CAGEAN model may be using inappropriately high natural mortality (M) inputs. A tagging study is currently underway to test the validity of the M value presently being used. In the meantime, it would be prudent to use a more conservative M value. This would result in lower abundance estimates and TAC recommendations.

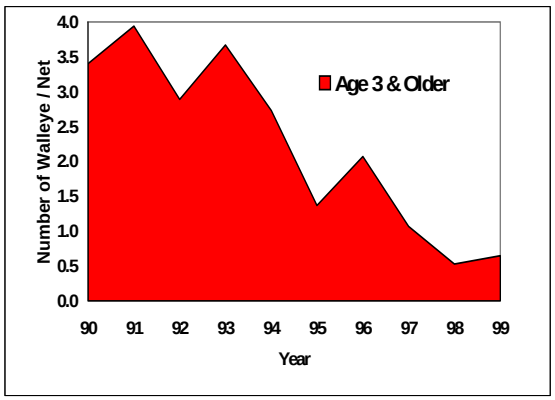
The Walleye Fishery is Not in Balance

Harvest by Age Group



- The top graph shows the proportion of two year old walleye in the lakewide harvest. In 1998 the proportion of two year olds exceeded 40 %. This reflects a lack of older fish in the population & an increasing dependence on recent spawning success to support the fishery
- The bottom graph shows the average number of older walleye (3 years & older) caught in Ontario Partnership Index Gill Nets in the western and central basins between 1990 and 1999
The partnership survey data confirm that there are fewer old fish in the population. The recent shift in the Lake Erie walleye fishery to young fish is a sign of instability and indicates that the fishery is not in balance with the supply of fish available

Average Catch in Ontario Index Survey Nets



- All of the above indicators and factors point to an immediate need for management action by LEC to reverse declines abundance and improve confidence in population analysis.

Yellow Perch:

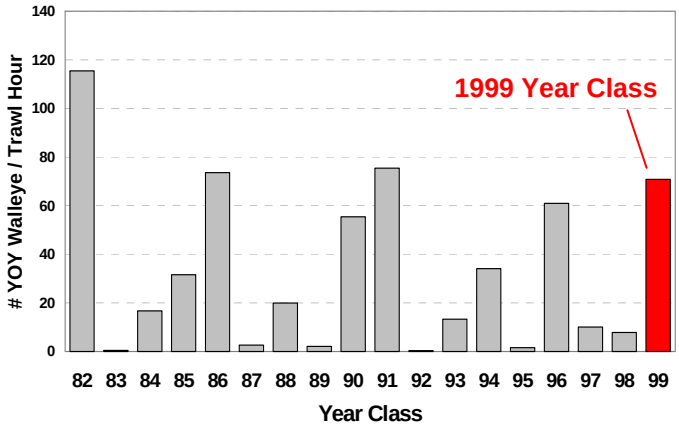
- Yellow perch are not as abundant as they were at their peak in the late 1980s, but there are indicators that the decline has been halted and stocks are beginning to recover.
- The LEC has taken a cautious approach in managing yellow perch TACs in recent years to conserve a very strong 1996 year class. This has contributed to recovery of perch populations in the western and central basin.
- The eastern basin perch fishery has not shown appreciable improvement to date. However, the 1998 year class appears to be very strong, and aggressive harvest controls recently initiated by Ontario (Eastern Basin Five Year Plan) should contribute to stock recovery there.

- Current conditions and trends indicate that there is still potential for considerable improvement in abundance and age composition in perch stocks. To avoid jeopardizing recovery, the LEC recommends a continued cautious approach in harvest management.

Can Percid stocks be rehabilitated?

- There are several positive signs that stock and fishery rehabilitation is a realistic goal for both yellow perch and walleye.
- Although the Lake Erie ecosystem has changed dramatically over the last decade, the basic habitat requirements for percids (moderate depth, temperature, and productivity levels) remain intact.
- There are signs that yellow perch stocks have been recovering in response to recent management actions taken by the LEC and member agencies to reduce exploitation.
- While they are not producing strong year classes at the same magnitude and frequency as they were in the 1980s, the general recruitment pattern for both yellow perch and walleye through the 1990s was fairly good. Exploitation controls in the short term and habitat rehabilitation in the longer term should help these recruits realize their maximum potential in terms of contribution to both the fishery and future reproduction.

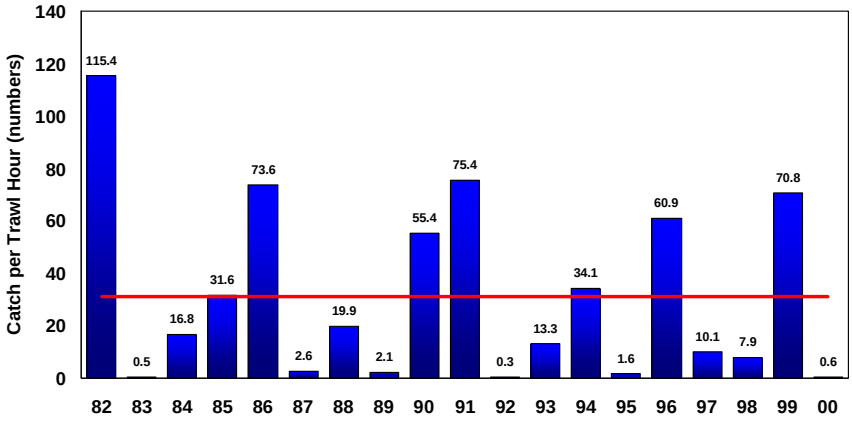
Walleye Young of Year Trawl Catch
Western Basin (Ontario) 1982-99



- The **1999 walleye year class** shows great promise for future recovery, with the potential to recruit 35 million age 2 fish into the population in 2001. A conservative harvest strategy for three years starting in 2001 will go a long way toward future stock rehabilitation.

Realistic Expectations

- The fantastic fishery experienced in the late 1980s is not a realistic goal for future yellow perch and walleye fisheries. The 1980s fishery was the product of a lake ecosystem moving through ideal conditions just prior to the invasion of exotic species that have disrupted the Lake Erie food web.
- It has become more difficult to predict the long term future of these fisheries because species invasions, loss of native species, climate change, habitat loss, and other disruptions have made the ecosystem itself less predictable.
- It is reasonable to assume, however, that conservative harvest management in the short term, coupled with habitat and ecosystem rehabilitation in the longer term, will result in broadening of age distribution, higher survival of recruits, and stronger reproduction in the future for both walleye and yellow perch stocks.



Version 2
Prepared July 25, 2000

Great Lakes Fishery Commission
Lake Erie Committee

Lake Erie Coordinated Percid Management Strategy
FAQ S (Frequently Asked Questions)

What is the Lake Erie Committee and what is its role in managing the fishery?

- The Lake Erie Committee (LEC) is a bi-national committee of state and provincial fisheries managers operating under the auspices of the Great Lakes Fishery Commission
- The LEC has representation from the states of Michigan, Ohio, Pennsylvania and New York, and the province of Ontario.
- Member agencies work to develop consensus on management issues and to coordinate fisheries management. Examples include the development of Fish Community Goal & Objectives, development of Environmental Objectives, fish stocking, lamprey control, and habitat management.
- Through the LEC, biologists and scientists from each agency share fisheries data and work cooperatively on technical committees - called Task Groups.
- A key role of the LEC is to annually set lakewide limits for Total Allowable Catch (TAC) for two of the lake's most ecologically and economically important species - walleye and yellow perch.

What are Percids and why are they important on Lake Erie?

- Walleye and yellow perch are members of the perch family of fishes (Percidae). Other percids include sauger, logperch, and darters.
- Most of the Great Lakes are too deep, cold and nutrient poor to support good walleye and perch fisheries. Lake Erie (with its moderate temperature, depth and nutrient status) has historically provided large areas of percid habitat.
- As keystone predators, walleye play an important ecological role in the Lake Erie aquatic community. Walleye predation regulates the abundance of other important components of the Lake Erie food web.
- Walleye and yellow perch are the two most important economic species on the lake, supporting large recreational, commercial and charter boat fisheries.

How does the Lake Erie Committee currently manage walleye and perch populations?

- The Walleye and Yellow Perch Task Groups of the LEC collect and evaluate fisheries data and conduct population modeling to come up with estimates of population abundance and recommendations for total allowable catch (TAC).
- The task groups use a number of stock and fishery indicators to determine the status of stocks and overall health of fish populations. No one indicator is used in isolation.
- The rationale behind setting a TAC is to use the best science available to develop a maximum limit on lakewide harvest that optimizes recreational and economic utilization of the resource, yet is biologically sustainable.
- Each March, LEC fisheries managers announce TACs for yellow perch and walleye based on Task Group recommendations.

- Portions of the TACs for perch and walleye are then allocated to each state and province based on sharing formulae.
- Each agency manages its commercial and/or sport fisheries to ensure that harvest does not exceed its allocation.
- The LEC is also currently examining opportunities to rehabilitate habitat in order to increase the carrying capacity of the lake to produce more fish. In the long run, this will have a beneficial effect on TACs.

What are the key elements of the Coordinated Percid Strategy announced by the Lake Erie Committee?

- The Coordinated Percid Strategy is consistent with the cooperative, science based management approach that reflects past management actions undertaken by the LEC.
- Management actions associated with the strategy will be lakewide and international in scope, and focus on rehabilitation of walleye and yellow perch stocks.
- Management actions associated with the strategy will begin in 2001, and stay in effect for a minimum of three years.
- All management actions associated with the strategy will be based on sound science and accepted resource management principles and rationale. An adaptive management principle will be used; meaning management practices are continually adapted based on observed/measured changes in stocks and the environment.
- Exploitation will be reduced to allow stocks an opportunity to recover and increase fishery benefits, while at the same time test relationships with stock size, recruitment and performance of population simulation models.
- The LEC will conduct additional assessment to evaluate the success of the strategy in achieving its goals for stock rehabilitation and improved resolution in population modeling. Targets for rehabilitation will be developed during the 3 year period
- ***For walleye***, the LEC is proposing that a conservative TAC be set in March 2001 (the exact level based on Walleye Task Group Recommendations) which will not be increased for 3 years. However, it may be further reduced if there is strong scientific evidence to indicate that it should be even more conservative.
- ***For yellow perch*****,** the LEC will continue to take a conservative approach to setting TACs, but will not necessarily set a conservative 3-year TAC, unless the positive stock trends observed in recent years are reversed.
- ***For both walleye and yellow perch***, state and provincial fisheries agencies will conduct a comprehensive review of existing harvest regulations (angler creel limits, seasons, size limits, sanctuaries and closures, etc.) for both recreational and commercial fisheries with the goal of revising regulations to reduce exploitation impacts and achieve consistency where possible.
- In addition to exploitation strategies (conservative TACs, regulation revisions), the LEC is committed to exploring opportunities for habitat and ecosystem rehabilitation that will result in long term improvements to the overall carrying capacity of the lake for percids and other economically and ecologically important species. Examples of projects that would produce meaningful positive results include barrier removal or modification in rivers and coastal wetlands, water quality improvements, and wetland habitat restoration.

What are the Objectives of the Percid Strategy?

- The overall objective of the strategy is to reverse declines and rebuild stocks of walleye and yellow perch in Lake Erie to achieve a broad distribution of benefits throughout Lake Erie.
- A secondary objective is to provide an opportunity to develop new approaches to estimation of walleye abundance and sustainable harvest levels.

What are fish stocks and why is it important to recognize and manage stocks?

- A fish stock is a species group or population that maintains itself over time in a definable area. Individual fish stocks have evolved with and are adapted to the local conditions.
- Tagging and genetic studies have confirmed the existence of distinct walleye stocks that spawn in various areas of the Lake Erie Basin; including the Maumee River and Bay, the Sandusky River and Bay, reefs in the western and eastern basins, and the Grand River in both Ohio and Ontario.
- Walleye have evolved into several stocks in order to fully utilize the spawning and rearing habitat available to them. Individual walleye stocks display reproductive strategies ranging from open water shoal spawning to upstream river spawning. Eastern Basin walleye stocks are suspected to be better adapted to colder and clearer water than those originating from the western basin.
- More limited work with yellow perch indicates that they also need to be managed as stocks.
- The LEC recognizes the importance that individual stocks make to the overall fishery. Each stock contributes to the fishery in a slightly different way. Stock management is the fisheries equivalent to not putting all your eggs in one basket .
- A fish population composed of several distinct stocks is more resilient to man-made or natural disturbances (e.g. extreme low lake levels, shoreline habitat destruction) than a population composed of a single stock.
- Lake Erie walleye stocks are very migratory. When western basin stocks are abundant, fish migrate east and contribute to fisheries in the central and eastern basin. This contribution has been reduced in recent years.
- The size of eastern basin stocks is small relative to western stocks. Eastern stocks have become increasing important to the open water mixed stock fishery of the eastern basin in recent years.

Why is walleye and perch fishing on Lake Erie not as good as a decade ago?

- Poor water quality and intensive fishing in the 1960s and early 1970s kept Lake Erie walleye and yellow perch numbers at a relatively low level - resulting in fair fishing for perch and poor fishing for walleye.
- Water quality began to improve when phosphorus inputs to the lake were cut after the signing of the Great Lakes Water Quality Agreement in 1972. The walleye fishery was closed due to mercury contamination in the early 1970s.
- Perch and walleye stocks responded positively to water quality improvements, with several excellent year classes produced through the late 1970s and early 80s. Walleye and perch abundance peaked in the late 1980s - a time when the nutrient levels in the lake appeared to be ideal for percid growth and survival.
- Walleye and yellow perch abundance began to decline after the arrival of zebra and quagga mussels in the late 1980s. These mussels potentially reduce the amount of food available to percids by filtering out the algae and affecting the invertebrates at the lower end of the food chain.
- The filter feeding activity of zebra & quagga mussels clears the water, which in turn alters the feeding behavior and movements of percids. Walleye are not physiologically adapted to high water transparency and are now feeding primarily in deep water or during low light periods (dusk to dawn, overcast or windy days).
- The resurgence of mayflies, the dramatic spread of gobies, and the recent high over-wintering survival of preferred prey species (like gizzard shad) have also contributed to poor walleye angling success in recent years. Lots of available food means walleye are less inclined to chase anglers' lures and baits.

- Lower walleye abundance, combined with clearer water, mean that commercial fishers are also now having to work harder to catch their harvest allocations.

Why are LEC fisheries managers concerned about the current status of walleye and yellow perch fisheries?

Walleye:

- Fisheries managers have been tracking a distinct downward trend in the Lake Erie walleye fishery since stocks peaked in abundance in the 1980s. Trends are apparent when a number of different indicators point in the same direction. Several indicators show declining trends in both population abundance and fishery stability through the 1990s.
- Adult catch rates have declined for both standardized survey gear (e.g. index gill nets) and sport and commercial fishing gear. The decline in commercial catch rates is especially disturbing because commercial fishers become more efficient over time and as stock abundance decreases and fish become more concentrated.
- A comparison of the declining catch rates for adult fish in various parts of the lake show that walleye stocks are shrinking back to their historic strongholds in the western basin and extreme eastern end of the eastern basin. This means that fishery benefits enjoyed when western basin stocks migrate to the central and eastern basins will continue to diminish.
- There are fewer older fish in sport and commercial catches relative to the 1980s. Increased reliance on young fish in the fishery means that the fishery is less stable from year to year (boom and bust fishery years depending on how good spawning success was 2 years earlier). It also means that few old fish produced in the western basin will migrate east to the central and eastern basins to support fisheries there.
- Exploitation is contributing to an unacceptable level of population instability by not allowing stocks to build up a large proportion of adult fish. More old fish in the population would buffer the effects of two or more consecutive poor spawning seasons.
- Analysis of juvenile abundance indices show that spawning success and juvenile survival was generally lower in the 1990s than the 1980s (mean of 20 million two years olds produced per year in the 1990s compared to 35 million in the 1980s).
- Ecosystem changes - which include changes in climate and productivity, as well as food-web instability resulting from invasion of exotic species - have added to uncertainty in future predictions of walleye recruitment, growth, and survival
- The Walleye Task Group of the LEC has become increasing concerned about the reliability of the current virtual population analysis model (CAGEAN) used to estimate walleye abundance. There are indications that the current CAGEAN model may be using inappropriately high natural mortality (M) inputs. A tagging study is currently underway to test the validity of the M value presently being used. In the meantime, it would be prudent to use a more conservative M value. This would result in lower abundance estimates and TAC recommendations.
- A revised CAGEAN modeling approach (AD Model Builder) is being developed that will allow the Task Group to use additional indicators (e.g. index fishing data) in its population simulations. Early testing of this model also indicates that the current model may be using inappropriate natural and fishing mortality inputs, and therefore is over-estimating walleye abundance.
- All of the above indicators and factors point to an immediate need for management action by LEC to reverse declines in abundance and improve confidence in population analysis.

Yellow Perch:

- Yellow perch are not as abundant as they were at their peak in the late 1980s, but there are indicators that the decline has been halted and stocks are beginning to recover.
- The LEC has taken a cautious approach in managing yellow perch TACs in recent years to conserve a very strong 1996 year class. This has contributed to recovery of perch populations in the western and central basin.
- The eastern basin perch fishery has not shown appreciable improvement to date. However, the 1998 year class appears to be very strong, and aggressive harvest controls recently initiated by Ontario (Eastern Basin Five Year Rehabilitation Plan) should contribute to stock recovery there.
- Current conditions and trends indicate that there is still potential for considerable improvement in abundance and age composition in the stocks. To avoid jeopardizing recovery, the LEC recommends a continued cautious approach in harvest management.
- Survival of juvenile perch appears to be lower in the 1990s compared to the 1980s. Early signs of good year class strength (as indicated high catch rates during fall trawling) are not as reliable at predicting future recruitment as they once were.
- The yellow perch task group recognizes the need to continue to refine and improve the cooperative assessment of yellow perch stocks.

What information was used to determine the need for management action?

- The LEC utilizes a variety of different indicators to evaluate the status of fish stocks. No one indicator is viewed in isolation.
- Indicators and assessment data used to evaluate the status of walleye & yellow perch stocks include the performance of fisheries and the results from directed survey assessments as conducted by all agencies around the lake:

    - Angler harvest, effort and catch success rates (CPUE) from angler creel surveys
    - Angler CPUE from voluntary angler diaries submitted annually
    - Commercial landed catch records
    - Commercial catch per unit effort (CPUE)
    - Fall juvenile index trawl surveys conducted to determine year class strength and the potential contribution (recruitment) of young fish to the fishery in the future
    - Fall Index gill netting throughout the eastern, central and western basins which measure the abundance and growth of larger fish in the populations
    - Genetic analysis to determine the identity of various stocks and their proportions in the fishery
    - Cooperative tagging studies to estimate survival rates and track distribution and relative contribution of various fish stocks to the overall fishery
- Confidence is increased and uncertainty is reduced when several indicators are in agreement. In the case of Lake Erie walleye stocks, it is important to note that a number of very independently measured indicators all point to the same conclusion - that stocks have declined over the last decade
- For walleye, the declining trends in various fishery indicators, coupled with uncertainties in the current population model used to calculate abundance, dictate that the LEC adopt an aggressive adaptive management approach to reverse declines, rebuild stocks, and increase confidence in population analysis.
- Yellow perch population indicators show that stocks are rebuilding, but there is room for improvement in the age structure and biomass of all stocks, especially in the eastern basin. The need for aggressive management is not as great as it is for walleye, but mixed signals

in the indicators warrant a continued "stay the course" conservative harvest management strategy.

What is the status of other important fish stocks in Lake Erie?

- Other economically or ecologically important stocks such as rainbow trout, lake whitefish, lake sturgeon, pike, burbot, and muskellunge are either stable or increasing in abundance in Lake Erie. These fish have responded positively to the changes in the ecosystem brought on by reduced phosphorus loadings and establishment of zebra and quagga mussels.
- Smallmouth bass populations in particular have responded positively to ecosystem changes over the past decade. Some area stocks have fluctuated over the last couple of years but the overall population status is excellent. Stock assessment is currently being conducted by several jurisdictions to monitor their status.
- Rainbow smelt, white bass, and white perch have declined in the commercial harvest in recent years as a result of ecosystem changes. There will be no changes in the management of these species under this strategy, but some species (e.g. white bass) will likely benefit indirectly from a conservative harvest strategy on percids.

What is likely to happen if the LEC doesn't act promptly?

- The primary concern with the LEC is the current status of walleye.
- We are not at a crisis level yet, but failure to act now could necessitate even more painful management action (i.e. more severe harvest restrictions over a longer period of time) in the near future.
- If we continue to ignore declining trends and uncertainties in population models for walleye, the ultimate result could be collapse of stocks to the point that all of the economic, recreational, and social benefits gained through the walleye restoration period of the 1970s and 1980s would be lost.
- An additional ecological consequence of walleye stock collapse would be loss of the keystone predator influence of walleye on the structure of the entire Lake Erie aquatic community. This could prevent recovery of native species like lake herring, and affect the stability of other species like yellow perch, bass, pike and rainbow trout through changes in the food web.

What effect would increased walleye predation (a consequence of walleye rehabilitation) have on the fish community?

- Increased walleye predation would have an overall beneficial effect on the fish community due to the role of walleye as a keystone predator in Lake Erie. Walleye predation adds stability and resilience to the community.
- Recovery of native species like lake herring would be enhanced in a predation-structured fish community due to reductions in exotic competitors such as alewife, gizzard shad, and smelt.
- Consumption of yellow perch by walleye does happen, but is unlikely to be significant except in instances of short duration in some areas and must be accepted as a consequence of having walleye as a top predator.
- Walleye predation adds to the resilience of the fish community, buffering the impact of invading exotic species. For example, walleyes may presently be acting as an agent to control goby abundance, and could act to control the colonization and spread of ruffe in the future.

Why focus on exploitation as a management strategy? What other management actions has LEC considered?

- Many factors that regulate the abundance of yellow perch and walleye stocks (climate, weather, habitat, exotic species, phosphorus management, food web) are very difficult to control directly. Exploitation is easier to manage, and the response is much quicker.
- Because walleye is a keystone predator, increased walleye predation resulting from exploitation controls will act indirectly to influence exotic species and food web effects.
- There is strong evidence to show that high exploitation is affecting the persistence of walleye year classes. Reduction in harvest should result in an immediate positive response in size and age structure.
- The strategy proposed does not ignore the importance of habitat rehabilitation in improving carrying capacity for long term benefits. The problem with carrying out habitat management actions without exploitation controls is that stocks would not be allowed to build up to a level where increased reproductive effort could take advantage of increased carrying capacity

Can Percid stocks be rehabilitated?

- There are several positive signs that stock and fishery rehabilitation is a realistic goal for both yellow perch and walleye.
- Although the Lake Erie ecosystem has changed dramatically over the last decade, the basic habitat requirements for percids (moderate depth, temperature, and productivity levels) remain intact.
- While they are not producing strong year classes at the same magnitude and frequency as they were in the 1980s, the general recruitment pattern for both yellow perch and walleye through the 1990s was fairly good. Exploitation controls in the short term and habitat rehabilitation in the longer term should help these recruits realize their maximum potential in terms of contribution to both the fishery and future reproduction.
- There are signs that yellow perch stocks have been recovering in response to recent management actions taken by the LEC and member agencies to reduce exploitation.
- The 1999 walleye year class shows great promise for future recovery, with the potential to recruit 35 million age-2 fish into the population in 2001. A conservative harvest strategy for three years starting in 2001 will go a long way toward future stock rehabilitation.

What are realistic expectations of stock recovery and fishery benefits if the Coordinated Percid Strategy is a success?

- The fantastic fishery experienced in the late 1980s is not a realistic goal for future yellow perch and walleye fisheries. The 1980s fishery was the product of a lake ecosystem moving through ideal habitat and productivity conditions just prior to the invasion of zebra mussels, gobies and other exotic species that have disrupted the Lake Erie food web.
- It has become more difficult to predict the long term future of these fisheries because species invasions, loss of native species, climate change, habitat loss, and other disruptions have made the ecosystem itself less predictable.
- It is reasonable to assume, however, that conservative harvest management strategies in the short term, coupled with habitat and ecosystem rehabilitation in the longer term, will result in broadening of age distribution, higher survival of recruits, and stronger reproduction in the future for both walleye and yellow perch stocks.
- In the past, the largest walleye and yellow perch year classes were produced during periods of conservative exploitation.

- Broader age distribution will stabilize the fishery (less dependence on recent spawning success), reduce risk of collapse, and (in the case of walleye) allow for broad distribution of fishery benefits when western basin stocks migrate to the central and eastern basin.

Is management action really required for perch stocks in light of the most recent data that show early signs of modest recovery?

- The LEC recognizes that there are recent, but very limited, increases in abundance, especially in the western and central basins
- The LEC and most stakeholders want to protect these increases and build on them.
- Yellow perch population indicators show that stocks are rebuilding, but there is room for improvement in the age structure and biomass of all stocks, especially in the eastern basin. The need for aggressive management is not as great as it is for walleye, but mixed signals in the indicators warrant a continued "stay the course" conservative harvest management strategy.

Version 6
July 25, 2000