Status of Yellow Perch in Lake Michigan
and
Yellow Perch Task Group Progress Report

REPORT OF THE LAKE MICHIGAN TECHNICAL COMMITTEE

Lake Michigan Committee
Ypsilanti, MI
March 24-25, 2004

Prepared by:
Dan Makauskas (ILDNR) and Paul Allen (BSU)

Table of Contents

List of Graphs

Yellow Perch Task Group Contact List: 2003-2004

This report was prepared from information provided by the following Lake Michigan Yellow Perch Task Group members and contributors. Questions regarding data from a specific area of Lake Michigan, or concerning a specific aspect of Lake Michigan yellow perch research, should be directed to the contributor of that information. See Appendix 1 for a map of lake areas.

NAME	AGENCY	E-MAIL	LAKE / SUBJECT AREA
Paul Allen	Ball State University	pallen@bsu.edu	Indiana
Jim Bence	Michigan State University	bence@pilot.msu.edu	Population models
Fred Binkowski	Univ. of Wisconsin – Milwaukee	sturgeon@csd.uwm.edu	WM-5 / Lab
Brian Breidert	Indiana DNR	bbreidert@dnr.state.in.us	Indiana
Mary Bremigan	Michigan State University	bremigan@pilot.msu.edu	Lab / WM-1
Dave Clapp	Michigan DNR	clappd@michigan.gov	MM-8 to MM-3
John Dettmers	Illinois Natural History Survey	dettmers@inhs.uiuc.edu	Illinois / Lab
Brad Eggold	Wisconsin DNR	Bradley.Eggold@dnr.state.wi.us	WM-5
Richard Fulford	North Carolina State Univ.	rsfulfor@unity.ncsu.edu	WM-5 / Lab
Justine Hasz	Wisconsin DNR	Justine.Hasz@dnr.state.wi.us	WM-1
Chris Heyer	Chesapeake Biological Lab.	heyer@cbl.umces.edu	WM-5 / Lab
Pradeep Hirethota	Wisconsin DNR	Pradeep.Hirethota@dnr.state.wi.us	WM-5
Jeff Holuszko	USGS-GLSC	Jeff_holuszko@usgs.gov	Lakewide
Bill Horns	Wisconsin DNR	William.Horns@dnr.state.wi.us	WM-1 to WM-6
John Janssen	University of Wisconsin	jjanssen@uwm.edu	Wisconsin/Illinois
Dave Jude	CGLAS, Univ. of Mich.	djude@umich.edu	MM-8 to MM-7
Chuck Madenjian	USGS-GLSC	chuck_madenjian@usgs.gov	Lakewide
Dan Makauskas	Illinois DNR	dmakauskas@dnrmail.state.il.us	Illinois
Scott McNaught	Central Michigan University	scott.mcnaught@cmich.edu	MM-6 / Lab
Loren Miller	University of Minnesota	lmm@fw.umn.edu	Lab / Genetics
Tom Miller	Chesapeake Biological Lab.	miller@cbl.umces.edu	WM-5 / Lab
Janel Palla	Indiana DNR	jpalla@dnr.state.in.us	Indiana
Steve Pothoven	GLERL/NOAA	pothoven@glerl.noaa.gov	MM-7
Jim Rice	North Carolina State Univ.	jim_rice@ncsu.edu	WM-5 / Lab
Phil Schneeberger	Michigan DNR	schneebp@michigan.gov	MM-1
Jim Thompson	Wisconsin DNR	James.M.Thompson@dnr.state.wi.us	WM-5
Mike Wilberg	Michigan State University	wilbergm@msu.edu	Population models

Status of Yellow Perch in Lake Michigan

Yellow perch assessment activity is occurring throughout the lake, with numerous agency and university personnel sampling perch utilizing various gear types in different seasons. Selected parts of this information are presented here, in three sections. The first section covers the relative abundance of adult (age 1 and older) yellow perch. The second section examines the most recent age and size structure data available for different parts of the lake. The final section consists of estimates (or indices) of juvenile yellow perch recruitment: most of this data comes from collections of age-0 yellow perch. Coordinated regulation of yellow perch harvest has been an important part of perch management in recent years. Current commercial and recreational regulations for all Lake Michigan jurisdictions are included as a final section of this status report.

Adult Relative Abundance

The data assembled was collected with either gill nets or bottom trawls (Figures 1 to 6). Generally, this information shows a long-term decline in adult yellow perch abundance. The longer data series show a peak abundance in the mid- 1980s to early 1990s, followed by significant declines through the early 2000s (Figures 1 to 4). Age 1 and older yellow perch trawl abundance increased in 2003 from observed 2002 levels in Green Bay, WI and Indiana water of Lake Michigan (Figures 1 and 2). Gill net assessment showed an increase in abundance for the southern jurisdictions, Illinois and Indiana, while Michigan and Wisconsin reported decreases in abundance from 2002 to 2003 (Figures 3 to 6). A lake-wide representation of the 2003 mean gill net catch of yellow perch shows a slight increase in abundance from 2002 (Figure 6). However, current abundance remains well below the historically observed abundance of the late 1980s and early 1990s.

Since the mid 1990s there has been a general upward trend in the frequency of females within the adult assessments (Figures 2 to 6). Percent females of the trawl catch in Indiana waters of Lake Michigan have fluctuated around 60% for the past six years (Figure 2). Females comprised near 50% of the gill net catch in Illinois, Wisconsin, and Michigan, while Indiana's catch exceeded 90% in 2003 (Figures 3 to 6).

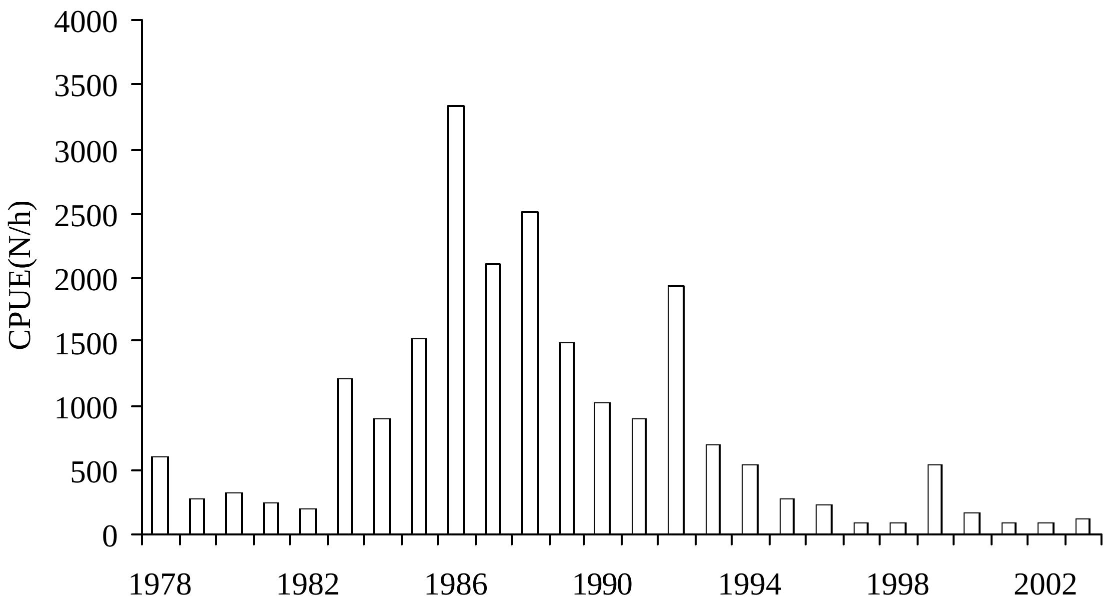


Figure 1. Age 1 and older yellow perch trawl CPUE from Wisconsin waters of Green Bay, 1978 to 2003.

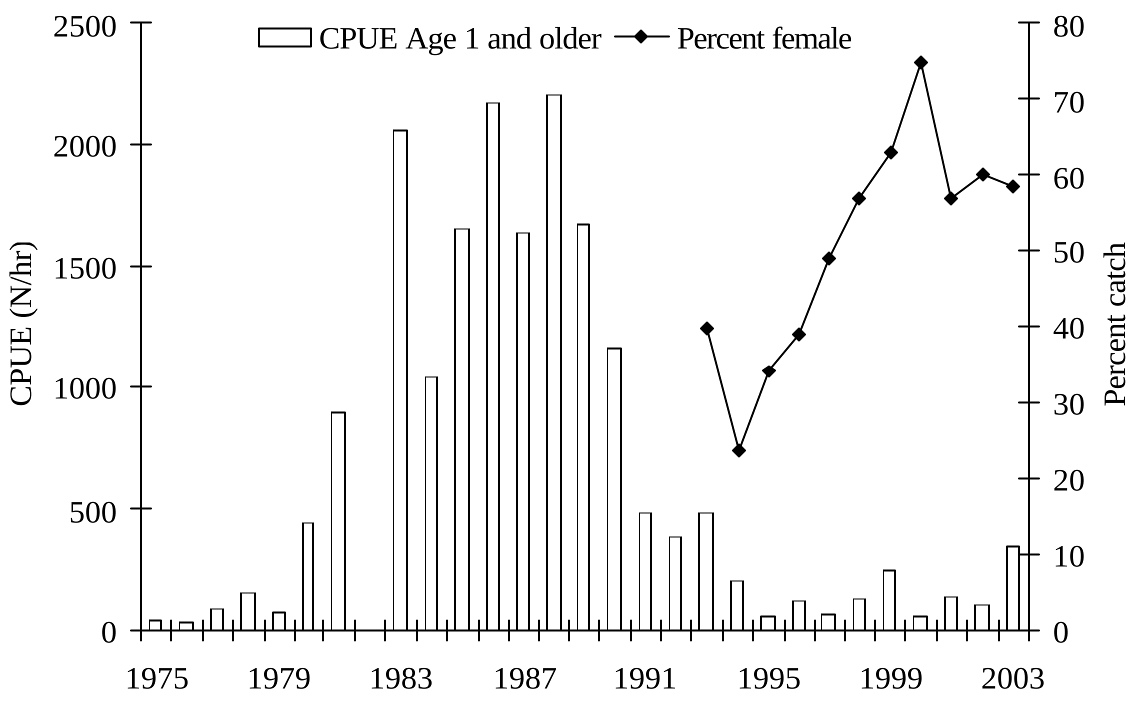


Figure 2. Age 1 and older yellow perch trawl CPUE and percent female from Indiana waters of Lake Michigan, 1975 to 2003.

GillNet

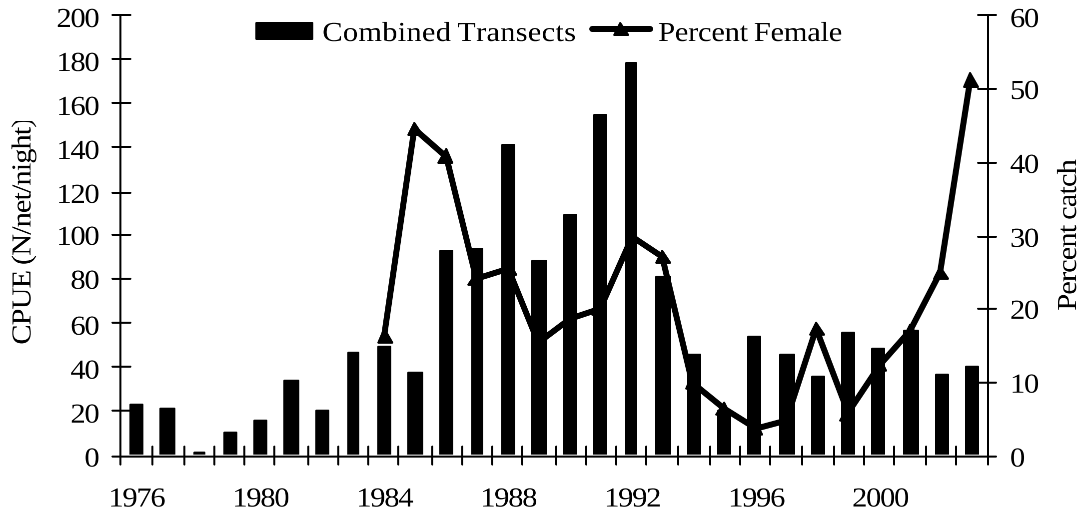


Figure 3. Adult yellow perch gill net CPUE and percent female from Illinois waters of Lake Michigan, 1976 to 2003.

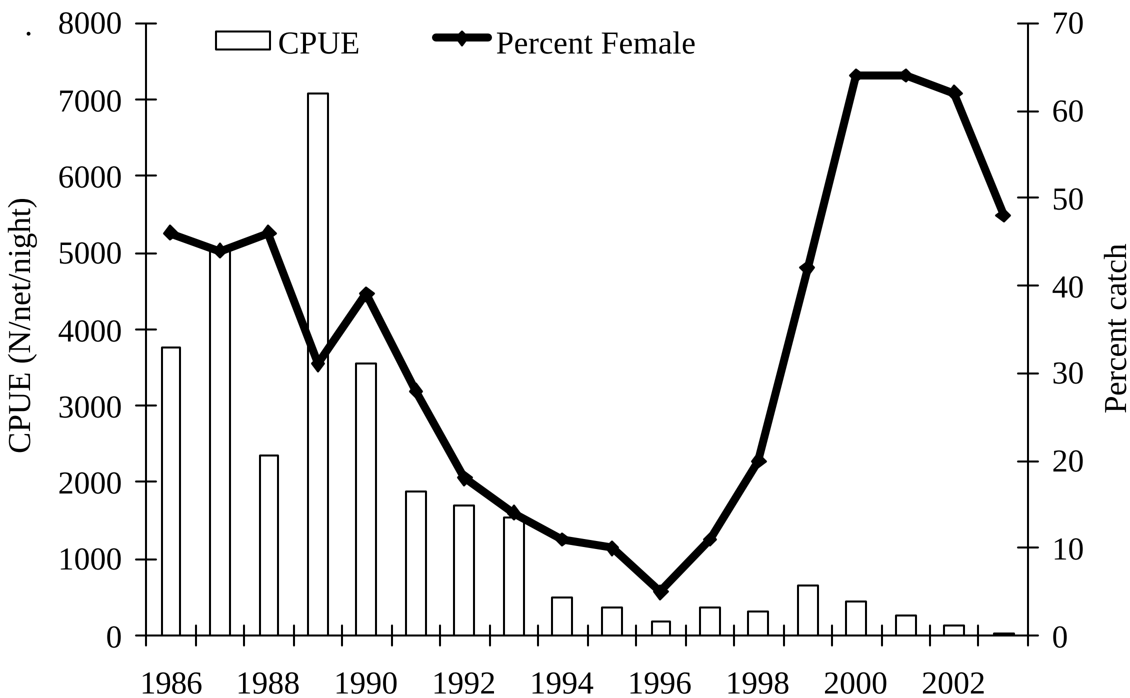


Figure 4. Adult yellow perch gill net CPUE and percent female from Wisconsin waters of Lake Michigan, 1986 to 2003.

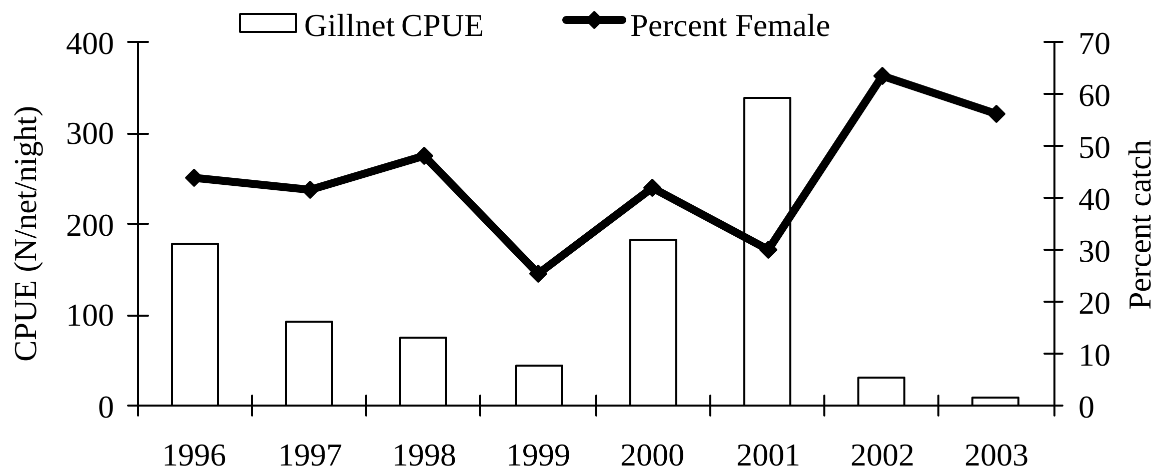


Figure 5. Adult yellow perch gill net CPUE and percent females from Michigan waters of Lake Michigan, 1996 to 2003.

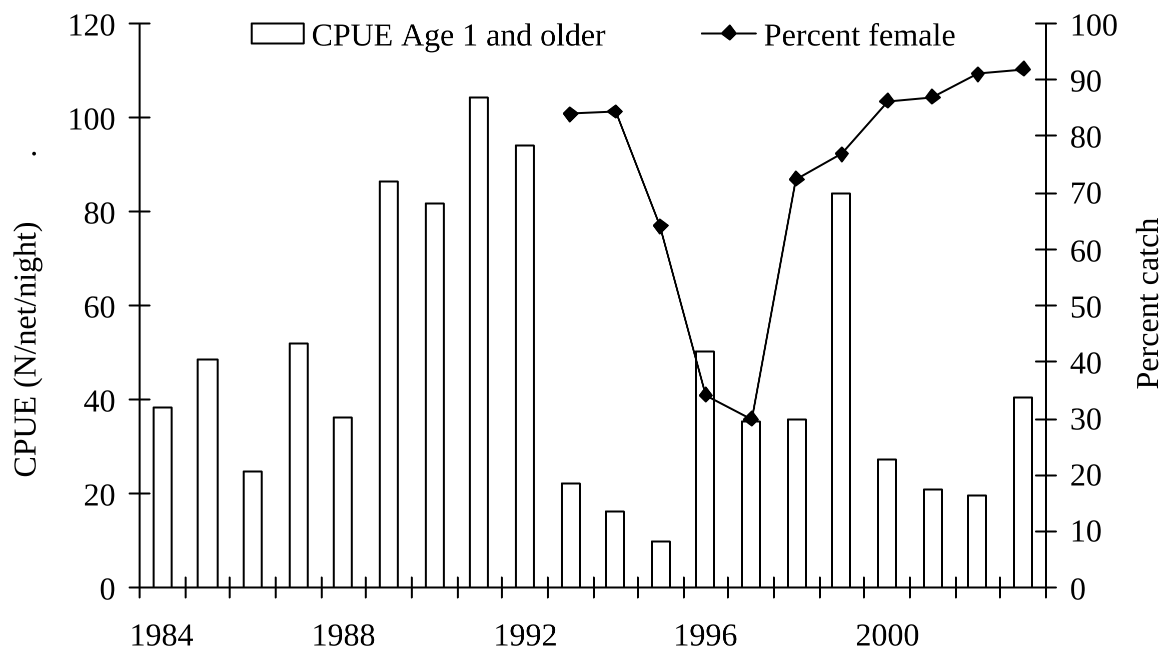


Figure 6. Adult yellow perch gill net CPUE and percent female from Indiana waters of Lake Michigan, 1975 to 2003.

Population Age and Size Structure

The yellow perch adult population age structure was determined by assessing otoliths, opercules, or spines by Lake Michigan management agency personnel and researchers. Although difference in aging techniques and collection methods and times occur between agencies, the 1998 class (age 5) continued to dominate the adult population in 2003 (Figure 8). Age 5 fish comprised from 73% to 96% of the total gill net catch as reported from the different jurisdictions. A length frequency distribution from Indiana waters of Lake Michigan depicts a positively skewed distribution with a range of 160 to 369mm and a mode at the 200mm length class (Figure 9). The 2003 length frequency distribution is somewhat similar to what was observed in 2002 with the exception of the major mode centered on the 190mm length class (Allen et al. 2003). This suggests a majority of the 1998 year class remains relatively slow growing when compared to rates exhibited by earlier year classes.

Bottom trawl assessment of the yellow perch population in Wisconsin waters of Green Bay showed a dominance of the 2002 year class (age 1) which comprised 79% of the total catch in 2003 (Figure 10). In addition, the prominence of the 2002 year class was observed in the Indiana waters of Lake Michigan which accounted for over 50% of the catch, while the 1998 and 2001 year classes (age 5 and age 2) comprised 23% and 11%, respectively in 2003 (Figure 11). The trawl length frequency distribution had of range 50 to 359mm and was bi-modal with modes at the 70 and 160mm length classes (Figure 12). The first mode represents the 2002 year class while the second mode expresses the 1998 year class. The trawl CPUE of the 2002 year class at age 1 (185/h) was slightly more than the 1998 year class at age 1 (171/h) (BSU, unpublished data). This anecdotal evidence suggests the 2002 year class may be the first significant year class produced by the 1998 year class.

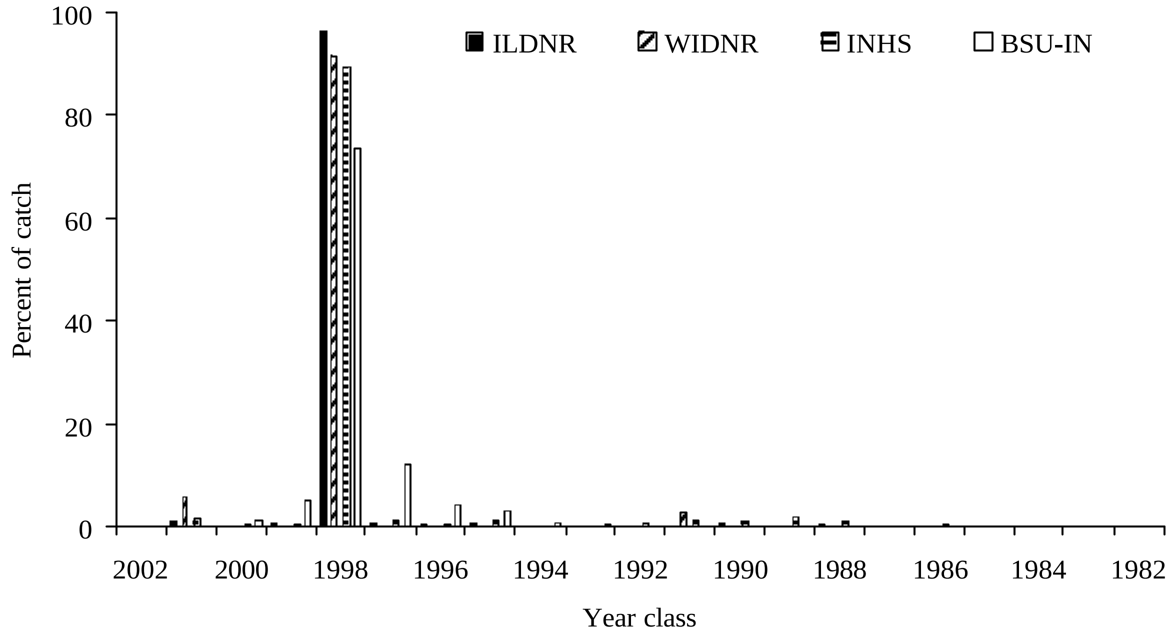


Figure 7. Yellow perch age structure from four jurisdictions in Lake Michigan, 2003. ILDNR; ages determined using otoliths. INHS; data from spring fyke net sampling, ages determined using otoliths. WDNR; ages determined using spines. BSU-IN; ages determined using opercules.

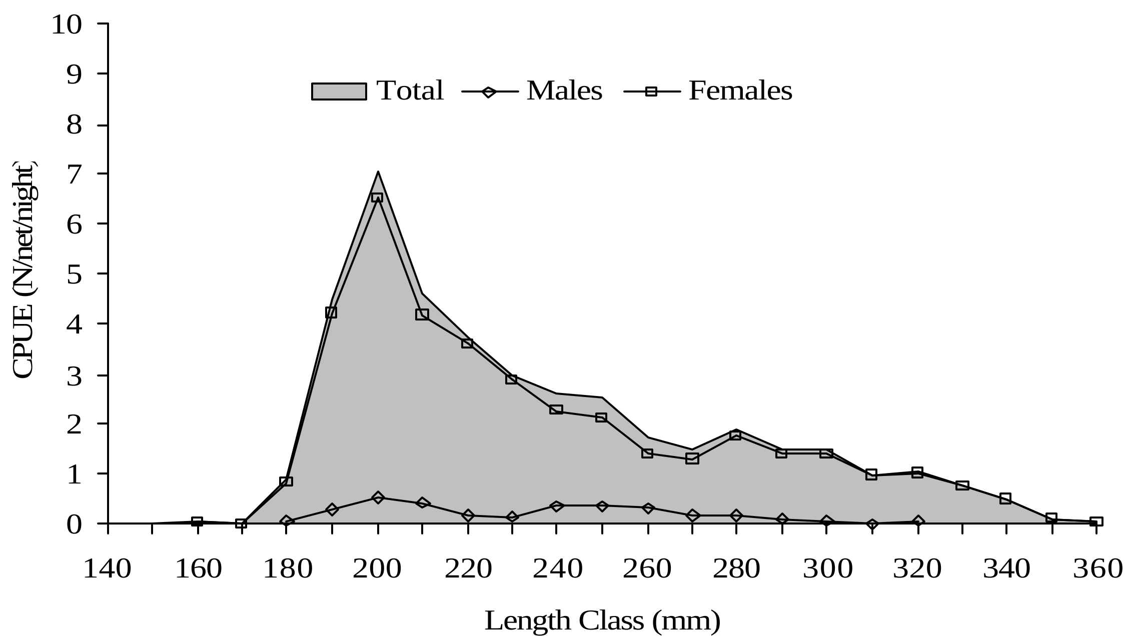


Figure 8. Yellow perch length composition from gill net assessments in Indiana waters of Lake Michigan, 2003.

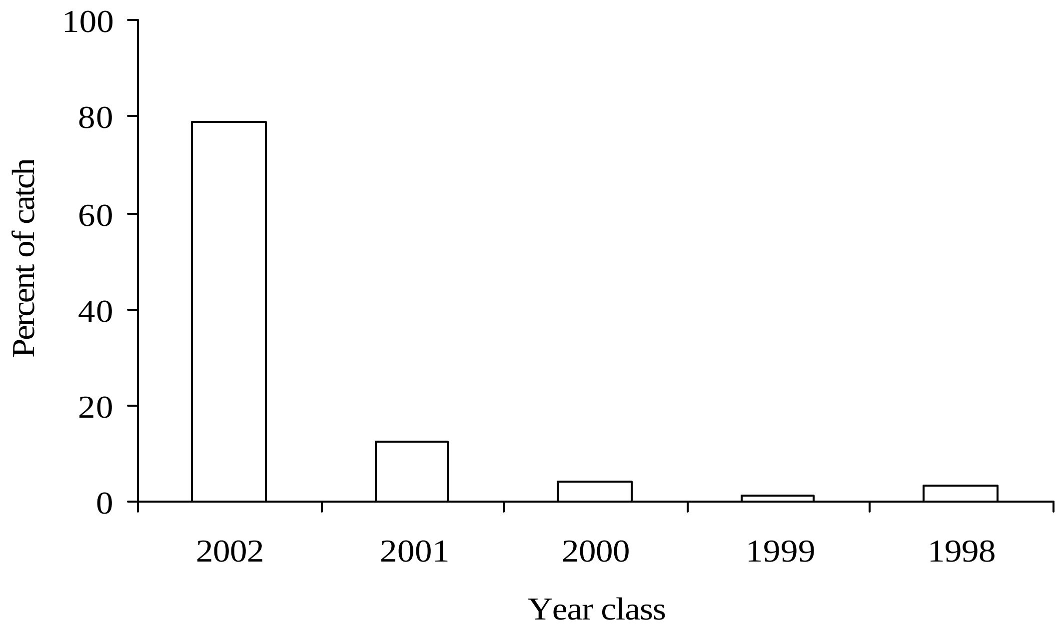


Figure 9. Yellow perch age structure from trawl assessments in Wisconsin waters of Green Bay, 2003.

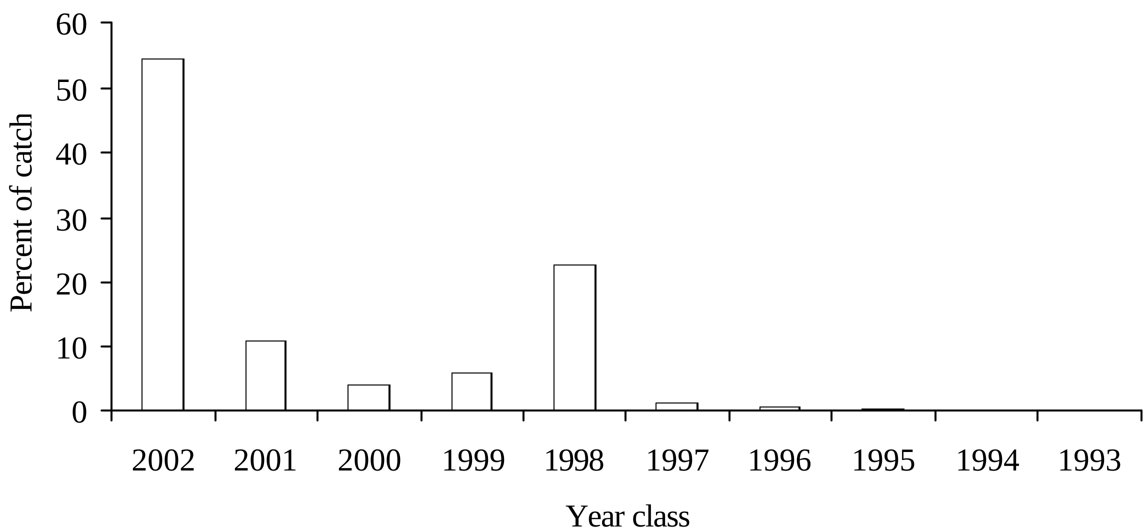


Figure 10. Yellow perch age structure from trawl assessment in Indiana waters of Lake Michgan, 2003.

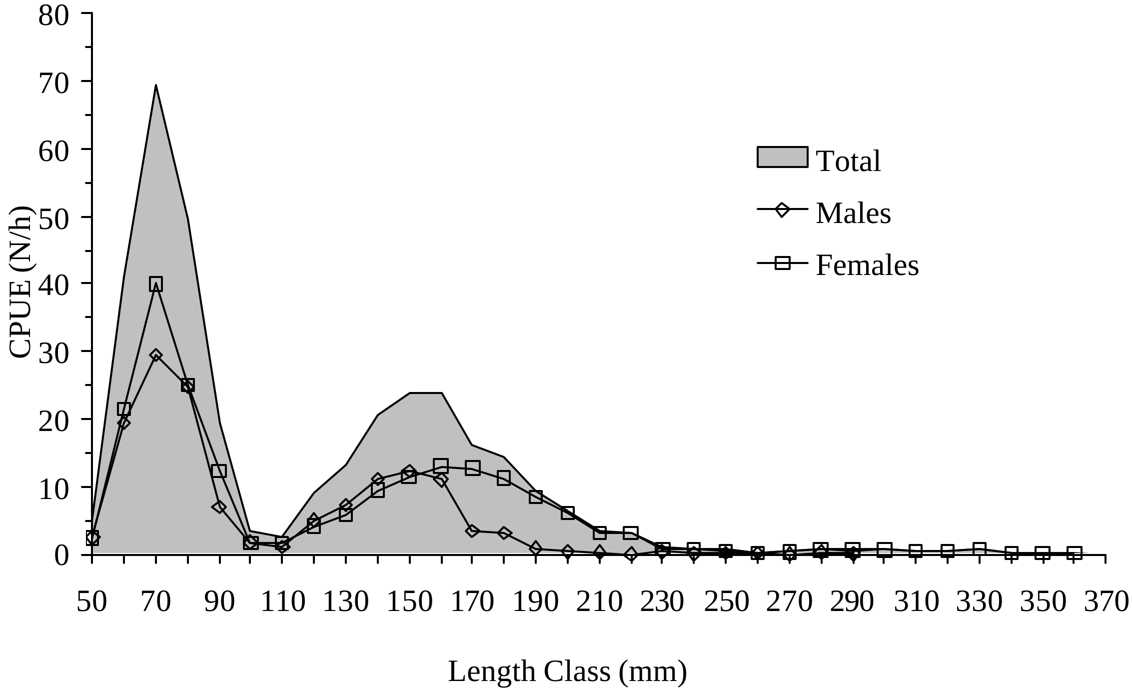


Figure 11. Length composition of the trawl catch of yellow perch in Indiana waters of Lake Michigan, 2003.

Recruitment

Having a reliable indicator of future inputs to an adult population is vital to understanding the dynamics of the fish population and helping predict changes in abundance. An early indicator of recruitment is most beneficial to managers. In Lake Michigan, indicators of this information are collected using bottom trawls or beach seines. Recruitment of young-of-the-year YOY (age-0) yellow perch in 2003 were at there highest level recorded in Green Bay, Wisconsin since 1978 and abundance levels in Indiana were similar to 2002 (Figures 13 and 14). Catch rates of YOY in Wisconsin and Illinois (ILDNR and INHS) were minimal in 2003 (Figures 15 to 17). The importance of these data will be played out in the upcoming years as the YOY yellow perch grow to become adults.

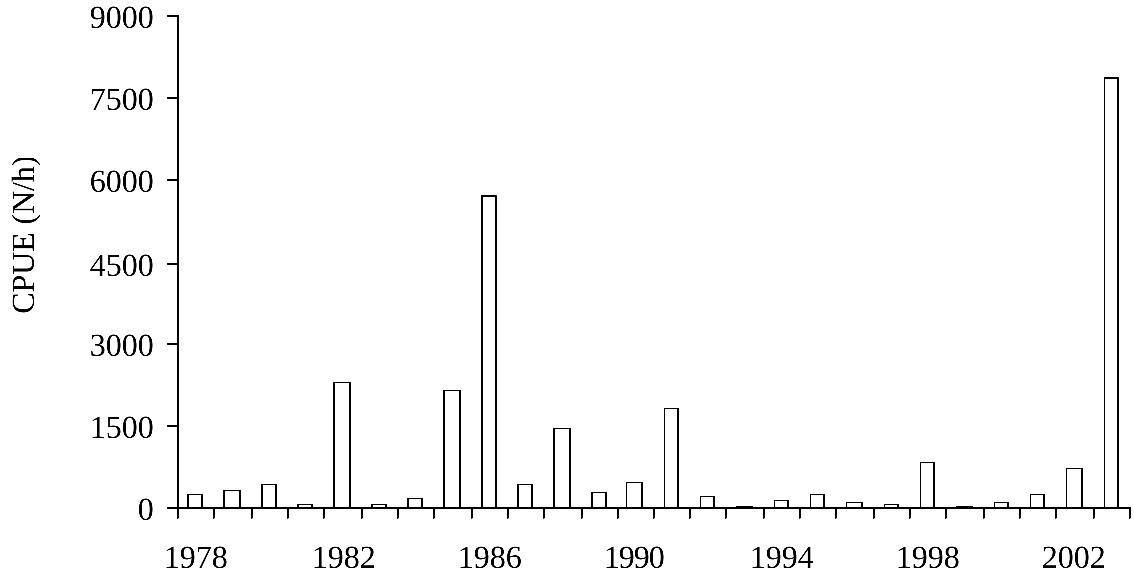


Figure 12. Age-0 yellow perch trawl CPUE from Wisconsin waters of Green Bay, 1978 to 2003.

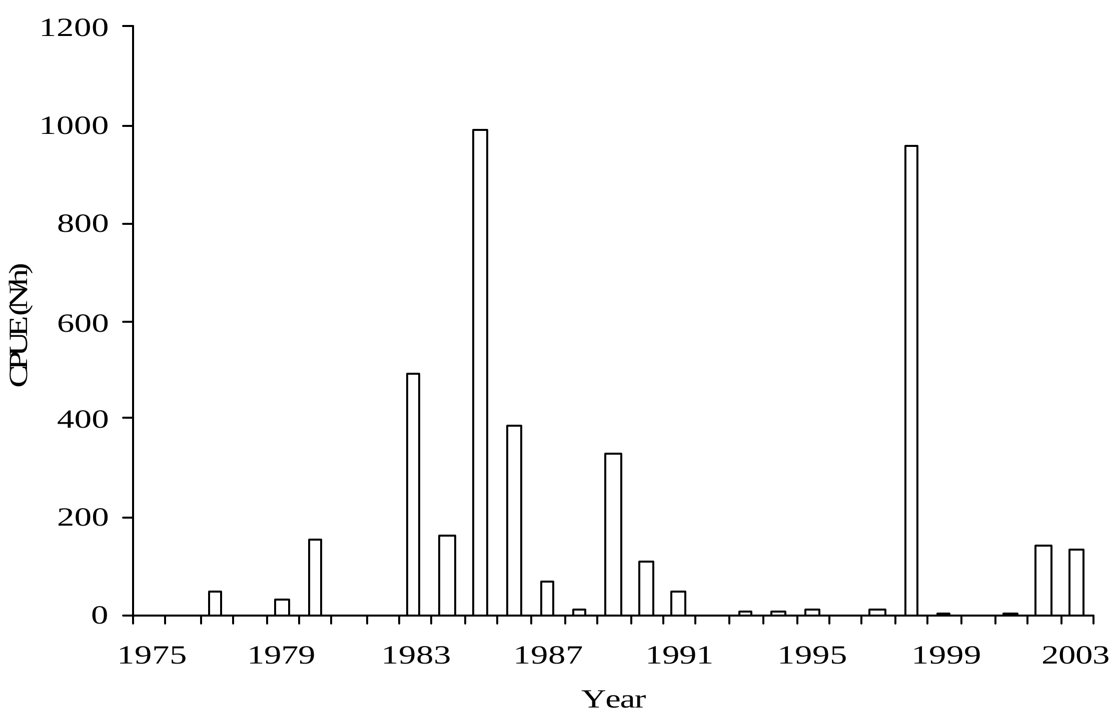


Figure 13. Age-0 yellow perch trawl CPUE from Indiana waters of Lake Michigan, 1975 to 2003.

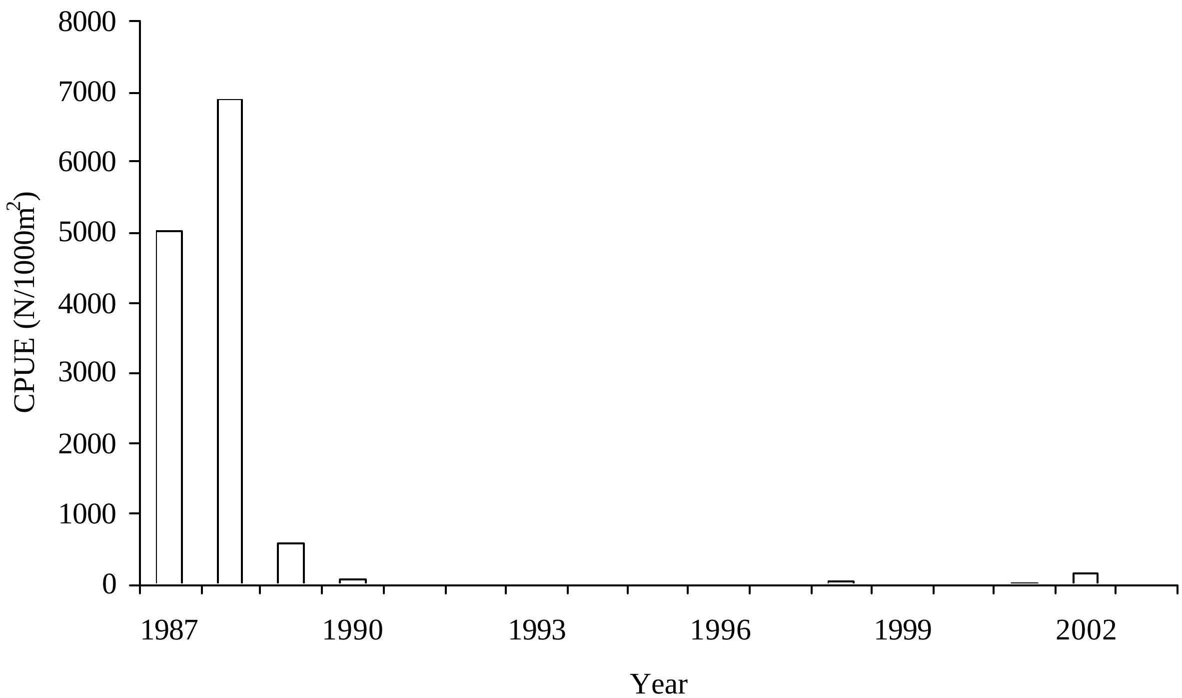


Figure 14. Age-0 yellow perch trawl CPUE from Illinois waters of Lake Michigan, 1987 to 2003.

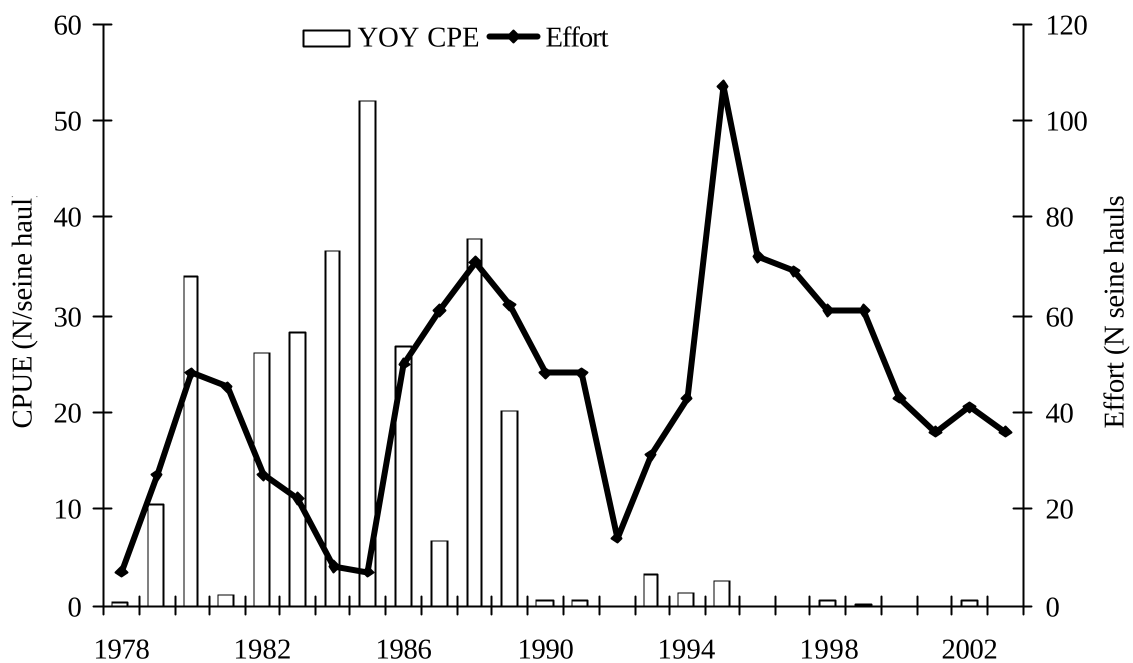


Figure 15. Age-0 yellow perch seine CPUE from the Illinois waters of Lake Michigan, 1978 to 2003.

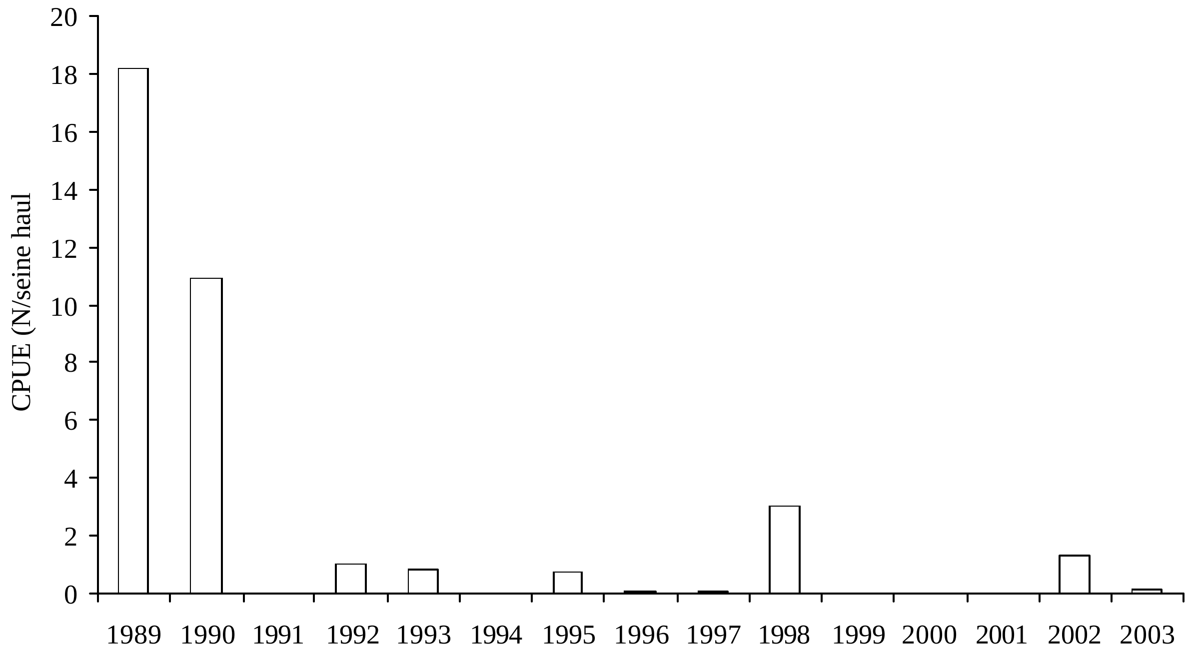


Figure 16. Age-0 yellow perch seine CPUE from the Wisconsin waters of Lake Michigan, 1989 to 2003.

2004 Yellow Perch Harvest Restrictions

Sportfishing regulations:

- Illinois
  - July closed to sportfishing for yellow perch
  - Daily bag limit 15 fish
- Indiana
  - No closed season for yellow perch
  - Daily bag limit 15 fish
- Michigan
  - No closed season for yellow perch
  - Daily bag limit 35 fish (south of the 45^{th} parallel)
- Wisconsin (Lake Michigan)
  - May 1 through June 15; closed to sportfishing for yellow perch
  - Daily bag limit 5 fish
- Wisconsin (Green Bay)
  - March 16 through May 15; closed to sportfishing for yellow perch
  - Daily bag limit 10 fish

Commercial regulations:

- Illinois perch fishery remained closed
- Indiana perch fishery remained closed
- Michigan does not allow a commercial harvest (outside of 1836 Treaty waters)
- Wisconsin perch fishery remained closed (outside of Green Bay, where quota is 20,000 pounds)

Yellow Perch Task Group Progress Report

The Yellow Perch Task Group (YPTG) was formally given the following four charges by the Lake Michigan Committee in May 2000 and an additional fifth charge in March 2003:

1. **Develop a Lakewide Assessment Plan for yellow perch and associated fish species by formalizing the procedures utilized to achieve compatibility of information and to standardized sampling methodology for yellow perch;**
2. **Formally summarize, in a GLFC report, a Fisheries article, or through other means, the work previously conducted by the Yellow Perch Task Group that addressed the original hypothesis set forward for yellow perch recruitment failure;**
3. **Identify any additional work necessary to address the original hypotheses for yellow perch recruitment failure; and**
4. **Develop and implement a lakewide population model that describes the yellow perch population in Lake Michigan providing estimates of total abundance, age and size structure, and geographical distribution.**
5. **a) Complete a review of assessment data collected during 2003 and b) Advise the LMC about potential risks to Lake Michigan yellow perch populations if current harvest regulations are maintained.**

The following section of this report provides a brief summary of the progress made towards the completion of these four charges.

Charge #1: Lakewide Assessment Plan.

A Lakewide Assessment Plan being developed by the YPTG will formalize the standard procedures utilized to sample yellow perch throughout Lake Michigan. The yellow perch section of the Lakewide Assessment Plan will be appended to the plans previously developed for lake trout, burbot, and chinook salmon by the Lake Michigan Technical Committee.

Currently, researchers are attempting to develop an ideal sampling strategy as well as alternative strategy for offshore sampling. This will require vessel determination; transect design and equipment, and day versus nighttime sampling. The anticipated completion date for this charge is December 2004.

Charge #2: Formalize YPTG work.

This charge was completed January 2003 with the submission of a manuscript to Fisheries. The article describes the development of a yellow perch research initiative on Lake Michigan and the progress made towards addressing yellow perch recruitment questions derived from previous charges from the LMC. As of February 2004 the article was under review for publication.

Charge #3: Identify any additional work to address yellow perch recruitment failure.

2003 marked the sixth year of the lakewide research initiative implemented by the Lake Michigan Management Agencies in 1997. The goal of this research effort is to identify likely causes for the lack of perch recruitment observed in Lake Michigan in the early 1990s. The Lake Michigan Yellow Perch Task Group has addressed several hypotheses that may be limiting the survival of yellow perch (see the 2000 and 2001 YPTG Progress Report for a list of hypotheses and the work conducted to address the hypotheses).

A lakewide yellow perch tagging database is being developed in hopes of providing better direction for future research in the areas of perch movement such as spawning-site fidelity, home range, and directional preference. The Illinois Natural History Survey will perform a double tagging study in 2003 and 2004 to compliment the lakewide mark and recapture performed from 1996 to 2000 by Illinois, Wisconsin, Michigan, and Indiana.

Researchers are the process of developing a study that focuses on off-shore transport of larval yellow perch in Lake Michigan and how that may effect perch recruitment. Their study would require sampling the areas of the lake10 to 20 miles offshore and further, which compliments the near–shore larval sampling already occurring on an annual basis. They are attempting to address the issues of the time it takes for larval yellow perch move offshore and how they make it back to near-shore areas.

Charge #4: Develop and implement a lakewide yellow perch population model.

Statistical catch-at-age models were developed for each region (Wisconsin, Illinois, and Indiana-Michigan) of the Lake Michigan yellow perch fishery. Indiana and Michigan were combined due to a limited long-term data set from Michigan and insufficient commercial fishery data from Indiana. Each model used data for male and female yellow perch separately from age 2 to 9 for the years 1986 through 2002. The instantaneous rate of natural mortality, M, was assumed to be 0.37 and fishing mortality was sex, year, and age specific. Selectivity of each fishery was modeled as a function of length, while growth was modeled to track changes in mean length at age over time for both sexes. Recruitment is estimated by the model, but not predicted by a functional relationship, thus forecasting beyond 2002 is not possible.

Due to poor fitting of data to the Indiana-Michigan model, results were unable to be provided at this time for these jurisdictions. However, both the Wisconsin and Illinois models provided useful information which is applicable to Indiana and Michigan based on our current understanding of the yellow perch population from those regions.

The following text comes from Wilberg et al. (2003). We have applied our catch-at-age models to Wisconsin and Illinois waters of Lake Michigan. The models fit observed commercial yield and recreational harvest well (Figure 16), and produced reasonable matches with total survey CPE and observed survey length-at-age. We are continuing to examine the details of how the model fits length and age compositions. The estimated abundance of yellow perch in Wisconsin waters of southern Lake Michigan increased from 1986 to 1990, and then decreased from 1991 to 2002 except for a small increase in 2000 (Figure 17). Estimated abundance of yellow perch in Illinois waters declined from 1986 to 2001, except during 1990 and 2000. In 2002, yellow perch abundance was approximately 7% of the 1986 abundance in Wisconsin and approximately 16% of 1986 abundance in Illinois. Changes in biomass were much less drastic than changes in abundance; biomass in 2002 was approximately 66% of

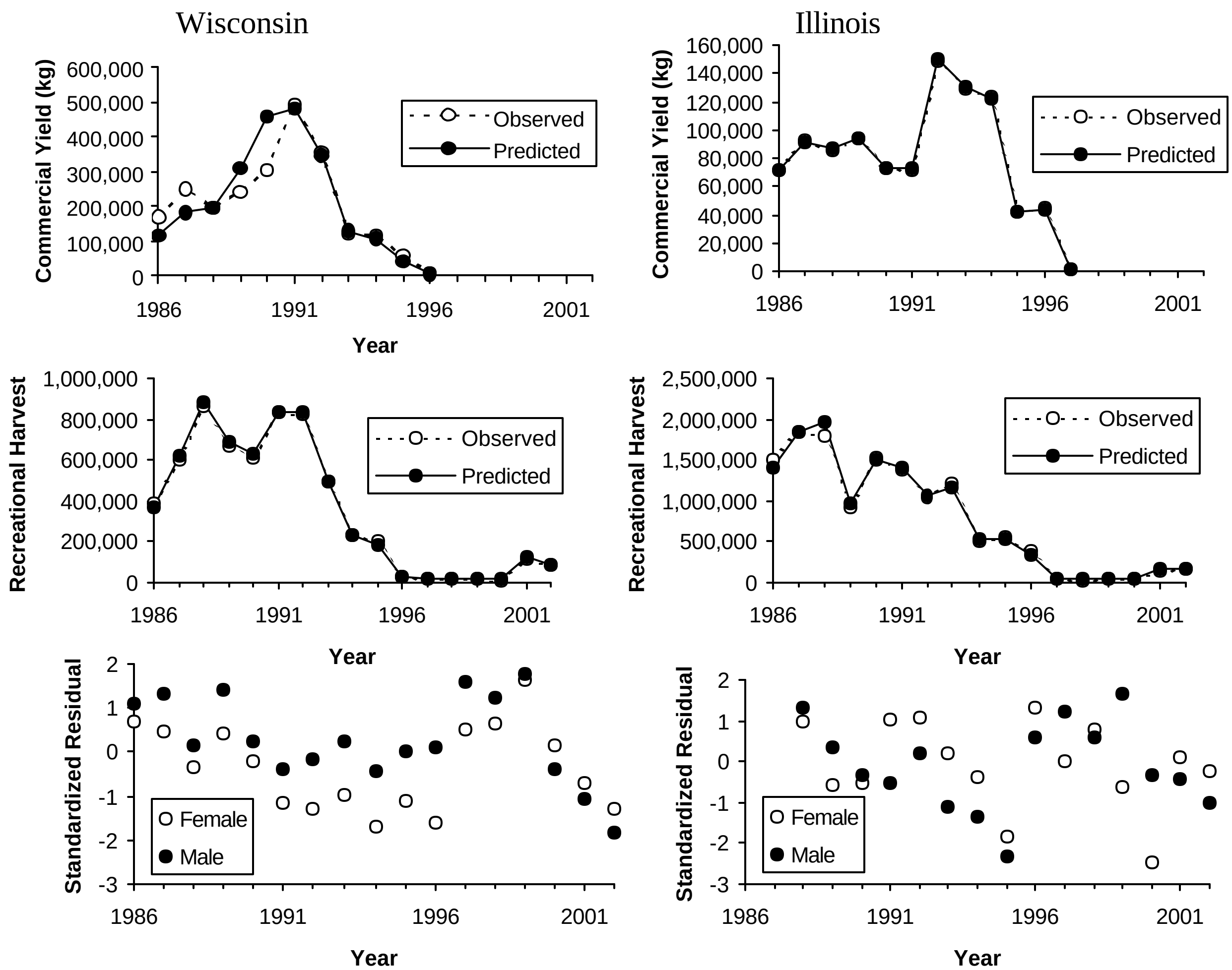


Figure 17. Comparison of observed and predicted commercial yield and recreational harvest of yellow perch in Wisconsin and Illinois waters of southern Lake Michigan (top four panels), and standardized residual plots of survey catch per effort (bottom two panels).

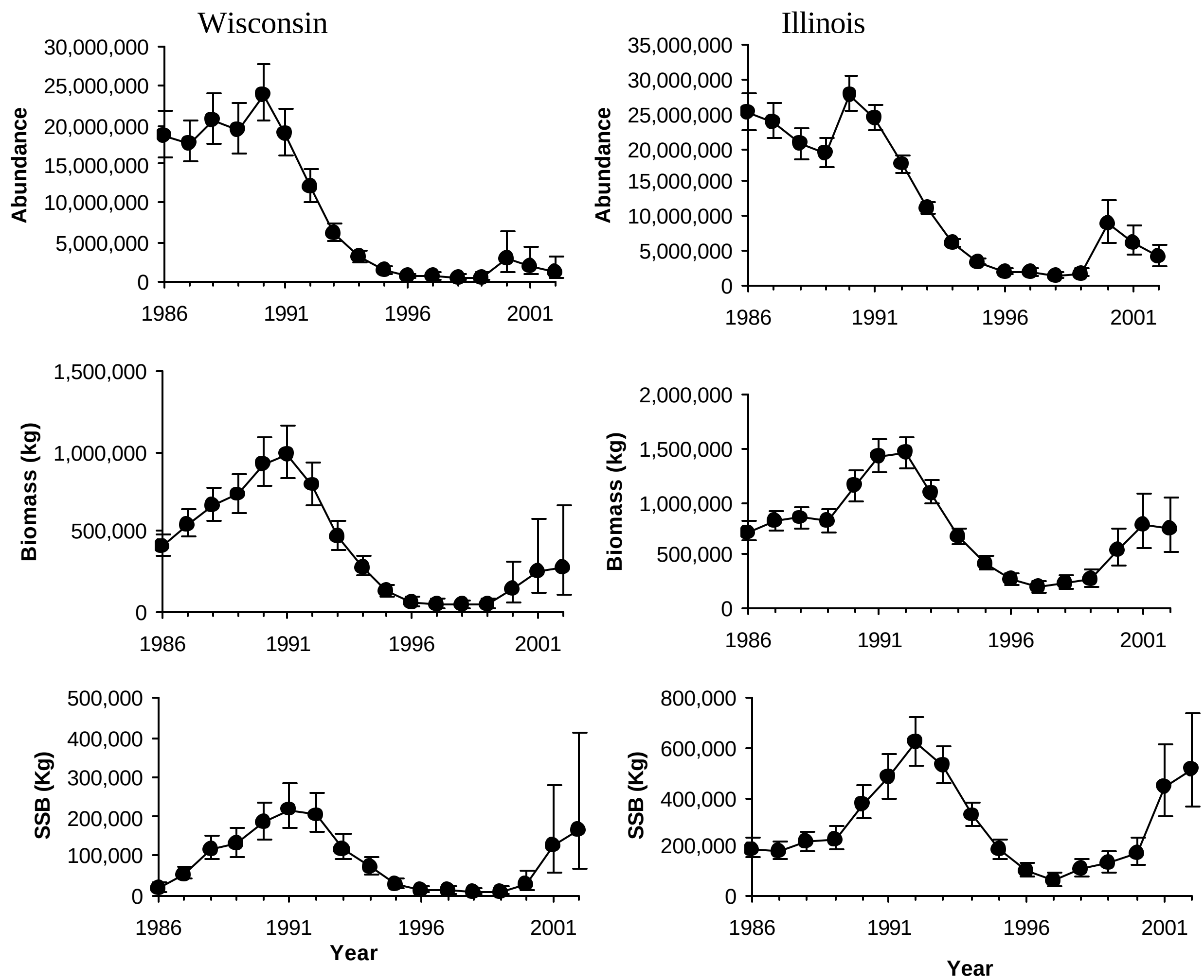


Figure 18. Estimated abundance, biomass, and spawning stock biomass (SSB) of yellow perch in Wisconsin and Illinois waters of southern Lake Michigan during 1986-2002. The error bars indicate approximate 95% confidence intervals.

biomass in 1986 in Wisconsin and 103% in Illinois. Spawning stock biomass (SSB) has shown a large increase in recent years and is now at its highest levels since the early 1990s. We believe that this is due to the relatively good recruitment of the 1998 year-class, low mortality rates, and rapid growth of females. We estimated that spawning stock biomass per recruit (SSB/R) is approximately 0.44 kg in Wisconsin and 0.47 kg in Illinois. We compared these SSB/R values to scenarios without fishing mortality, and found that SSB/R was 80% in Wisconsin and 85% in Illinois of the unexploited scenario. This indicates that recent fishing mortality rates have not substantially reduced the biomass of mature females and hampered efforts to recover yellow perch stocks in southern Lake Michigan.

Wisconsin and Illinois showed different patterns of exploitation. In Wisconsin, the commercial fishery was the predominant source of mortality and in Illinois the recreational fishery was the predominant source of mortality (Figure 18). Females had higher mortality rates than males, due to the selectivity patterns of the fisheries (Figure 19) and the higher growth rates of females. Estimated instantaneous mortality rates for females exceeded 1.0 in all modeled years prior to 1996 for perch in Wisconsin waters, and in some years the rate exceeded 2.0 (Figure 18). In Illinois waters, fishing mortality rates were not quite as high, but total mortality rates were about 1.0 for adult females in most years between 1986 and 1996. Until severe restrictions were placed on commercial and recreational fisheries (1996-1997), fishing was the predominant source of mortality for female yellow perch age 4 and older in both Wisconsin and Illinois.

Our results likely underestimate the amount of variability in recruitment because of the effect of aging error in the survey data, as aging error tends to blend strong and weak year classes together. Also, our mortality rate estimates are likely biased low because we have not accounted for the aging error. Younger fish tended to be aged as older when aged by their scales (Robillard and Mardsen 1996; Baker and McComish 1998; Wisconsin Department of Natural Resources, unpublished data). The overrepresentation of older fish in the data is most likely interpreted by the model as an indication that older fish were more abundant and thus that mortality rates were lower than they actually were.

The model was not very sensitive to changes in the assumed CVs and effective sample sizes for the different objective function components. In general, changes in the CVs of 25% resulted in only very minor changes to mortality rates and numbers-at-age. However, the Wisconsin model was very sensitive to the different levels of commercial harvest during 1989 through 1992 (see "Sensitivity Analyses"). Changes of the commercial yield for those years by up to three fold produced approximately proportional changes in the estimates of abundance and biomass. However, the estimated fishing mortality rates were much less sensitive to these changes in assumed commercial yield during 1989 through 1992.

We have presented the results of this work at the annual meeting of the International Association of Great Lakes Research and at the Lake Michigan Yellow Perch Task Group meeting. Our results have been used to advise the Lake Michigan Committee about the need for potential regulation changes. We are currently in the process of turning these models over to the respective agencies and training their personnel in the use and maintenance of these models. A manuscript detailing this project is in preparation.

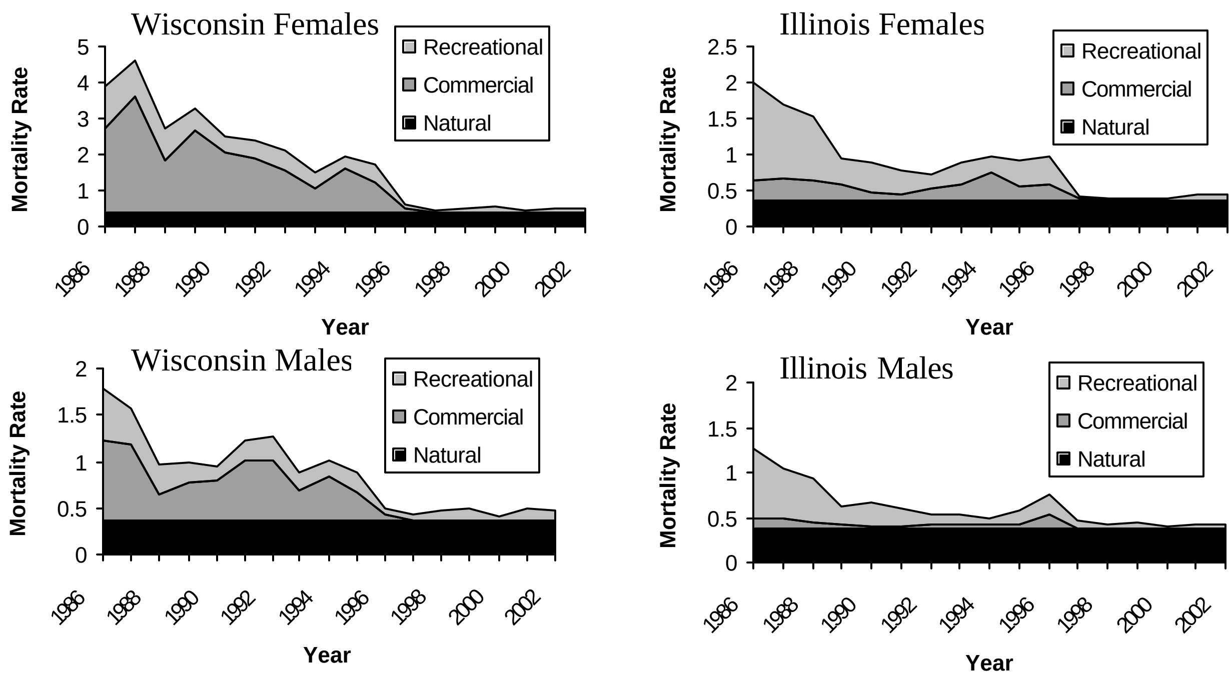
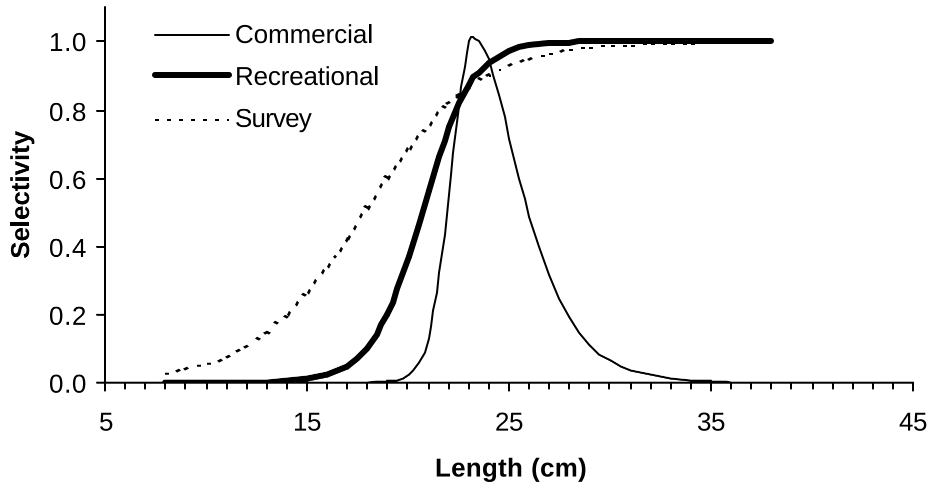


Figure 19. Estimated instantaneous rates of commercial and recreational fishing mortality, and their contribution to total mortality of age-6 yellow perch in Wisconsin and Illinois waters of southern Lake Michigan during 1986-2002.

Wisconsin



Illinois

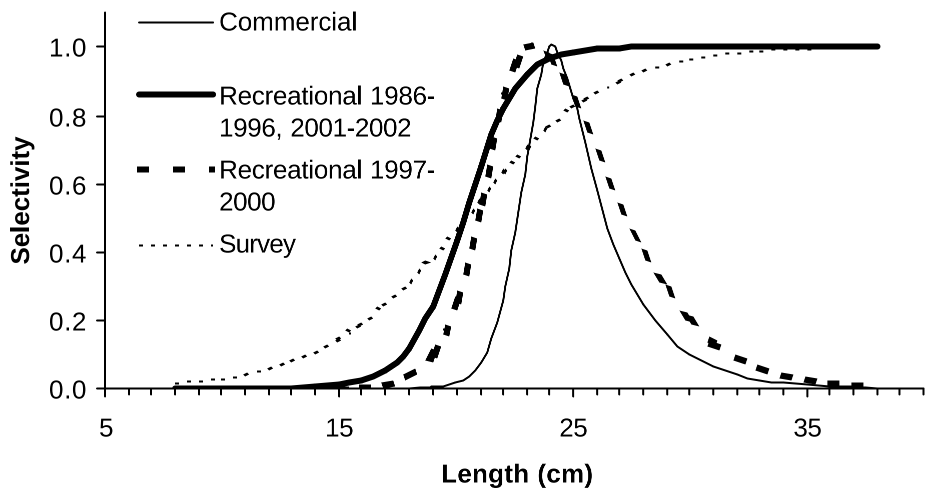


Figure 20. Selectivity at length for commercial, recreational, and survey yellow perch fisheries in Wisconsin and Illinois waters of southern Lake Michigan.

Charge #5: Complete a review of assessment data collected during 2003 and advise the LMC about potential risks to Lake Michigan yellow perch populations if current harvest regulations are maintained.

The following is a memo sent to the LMC on October 1, 2003 addressing charge #5:

During the 2003 Lake Michigan Committee meeting, concerns were expressed by members of your committee about the current status of the Lake Michigan yellow perch population. From the 2002 assessments, done by the agency members of the task group, recruitment for yellow perch into the fishery remained very low and the population consisted primarily of a single dominant 1998 year class. Wisconsin representatives expressed serious concern about the abundance of yellow perch based on winter assessments which showed a significant reduction of the 1998 year class from 2002 to 2003. Furthermore, sex ratios of yellow perch improved to 30% female in Illinois waters and were approximately 60% female in Indiana, Michigan, and Wisconsin waters. The females of the 1998 year class comprised the majority of the spawning stock abundance of the lake-wide population. The dominance of females and the fact they grow faster and larger than their male counterparts would likely result in sport anglers targeting those larger reproducing females, which could result in a further reduction in spawning stock. Specific concerns were expressed about current harvest regulations not adequately protecting the remaining spawning stock and that emergency measures would be needed in 2004. Thus, the Lake Michigan Committee provided the LMYPTG with the following charge to be completed by October 1, 2003:

a) complete a review of assessment data collected during 2003

b) advise the LMC about potential risks to Lake Michigan yellow perch populations if current harvest regulations are maintained.

2003 Annual Assessment

On September 22, 2003 agency members of the LMYPTG met in Michigan City, IN to address the aforementioned charge given by the LMC. In addition to the members who perform annual assessments of Lake Michigan yellow perch, Mike Wilberg, Michigan State University, was present to aid in addressing part b of the charge with the use of the statistical catch-at-age models he developed under the recommendation of the LMC.
Our current understanding of the yellow perch population is derived from data collected during the 2003 sampling season.

The lakewide adult (age 1 and older) yellow perch population abundance remained low in 2003. Illinois and Indiana (BSU) reported that catches of yellow perch increased slightly from 2002 to 2003, while Wisconsin, Michigan and Green Bay reported decreases. Gill net assessments from Illinois, Wisconsin, and Indiana reported the catch was predominately age 5, the 1998 year class. Trawl assessments from Indiana suggest the presence of two year classes, 1998 (age 5) and 2002 (age 1). From Illinois seining assessments, approximately 900 age 1 yellow perch were caught from just two seine pulls but were then caught in limited numbers during additional effort.

Proportions of females in the gill net catch were 42, 50, and 92% for Illinois, Wisconsin, and Indiana, respectively. Trawl assessments from Indiana showed females comprised approximately 60% of the catch.

The 2003 young-of-the-year (YOY) yellow perch were caught in the highest numbers since 1986 in Green Bay, while Indiana, for the second consecutive year, recorded an increase in the catch of YOY for the first time since 1991 and 1992. Michigan recorded the third highest catch for the period 1996 to 2003, but 2003 YOY abundance was still significantly lower than that recorded in 1998 and 2002. Wisconsin and Illinois noted YOY catches were extremely low. ILNHS reported a 35% reduction in their 2003 egg skein abundance, compared with the 2002 sampling results. Reproductive potential (egg/h) of mature females in Indiana waters showed an increase in 2003 based on data from trawl and gill net collections. Reproductive potential from trawl data increased 160% to its highest level since 1993, while an increase of 99% was observed in the gill net catch from 2002.

Modeling Effort

Statistical catch-at-age models were developed for each region (Wisconsin, Illinois, and Indiana-Michigan) of the Lake Michigan yellow perch fishery. Indiana and Michigan were combined due to a limited long-term data set from Michigan and insufficient commercial fishery data from Indiana. Each model used data for male and female yellow perch separately from age 2 to 9 for the years 1986 through 2002. The instantaneous rate of natural mortality, M, was assumed to be 0.37 and fishing mortality was sex, year, and age specific. Selectivity of each fishery was modeled as a function of length, while growth was modeled to track changes in mean length at age over time for both sexes. Recruitment is estimated by the model, but not predicted by a functional relationship, thus forecasting beyond 2002 is not possible.

Due to poor fitting of data to the Indiana-Michigan model, results were unable to be provided at this time for these jurisdictions. However, both the Wisconsin and Illinois models provided useful information which is applicable to Indiana and Michigan based on our current understanding of the yellow perch population from those regions.

Modeled population abundance decreased slightly from 2001 to 2002 for both Wisconsin and Illinois. However, spawning stock biomass (SSB) increased for both regions to mean values similar to the early 1990s when they were modeled to be at their highest levels. The use of fishing mortality that will produce a certain SSB per recruit is often used as a reference point to assess the impact of harvest on the available spawning stock on a per recruit basis. It has been suggested that the fishing mortality rate that reduces SSB/recruit to a value ranging from 0.35 to 0.45 ($F_{35\%}$ and $F_{45\%}$) be used as a maximum value for target harvest levels (Quinn and Deriso 1999). For this reference point a value of 1.0 indicates that there is no effect of fishing on SSB and a value of 0.0 indicates that the fishery is removing all of the fish before they become mature. Values of SSB/R below the range of 0.35 to 0.45 suggest that harvest is decreasing the SSB to unacceptably low levels, while values above this range should maintain adequate spawning stock for the population to continue to reproduce. Model estimates of the current SSB/recruit are 0.87 and 0.79 for Illinois and Wisconsin, respectively, which are both well above even the conservative policy of $F_{45\%}$.

Our ability to continue the use of the models, as developed, will require that data be obtained from fishery independent and dependent surveys. Fishery-independent surveys should be performed on an annual basis using standardized sampling protocols with the collection of age, length, and sex information. Fishery-dependent surveys should provide a good mix of samples for different times of the year with estimates of total removal, effort, size and age distributions and the inclusion of sex specific data when possible. Aging accuracy is important and the incorporation of aging error may produce less biased results.

Recommendations from the LMYPTG

Given the best and most current data available describing the status of the Lake Michigan yellow perch fishery, the member agencies of the LMYPTG unanimously recommend a continuation of the current harvest regulations in each jurisdiction (Appendix 1). Our decision was derived from knowledge obtained through the 2003 annual assessments and catch-at age modeling. We continue to be concerned by the dominance of the 1998 year class and that there has been no indication of a succeeding year class observed in Wisconsin. However, indications from Indiana, Illinois, and Green Bay suggest additional year classes may be forthcoming. Both assessment and modeling analysis have suggested that reproductive potential and spawner stock biomass is increasing. These increases may help to provide the needed conditions for a successful lake-wide recruitment of yellow perch to the fishery. Modeling efforts have also shown that sport harvest of yellow perch in Illinois and Wisconsin is low enough to maintain the current spawning stock, thus allowing for the potential for continued reproduction. For these reasons we recommend retaining the current harvest regulations.

Future directions of the LMYPTG

We discussed future meetings of the LMYPTG and how and who would be in attendance. Agency members were in agreement to continue to have two meetings a year, with one meeting held to discuss management recommendations, similar to the September 22, 2003 meeting and the second to include the research aspect of the LMYPTG. The management meeting will be in the fall or winter and address annual assessments, modeling efforts, and other areas of importance as deemed by the LMC. The spring meeting will likely coincide with the LMC annual meeting and will include the ongoing research updates related to Lake Michigan yellow perch and charged by the LMC. To help facilitate our transition we will seek input and ideas from the Lake Erie Yellow Perch Task Group (LEYPTG). This will require funding to have a representative from the LEYPTG to attend at least two of our task group meetings to advise us on our transition from primarily focusing on research questions (recruitment failures) to implementing a lake-wide management strategy for the Lake Michigan yellow perch fishery utilizing annual assessments and modeling efforts.

The logical next step in our modeling efforts is to begin development of decision analysis / risk assessment models. These efforts will help to establish key reference points that signal needed changes in harvest regulation and will provide a much-needed protocol for management decisions regarding the Lake Michigan yellow perch fishery. To accomplish this, the LMYPTG would need to identify additional funding for 1) support for travel to risk analysis workshops (along with other task groups around the basin), and 2) for grad student support to incorporate decision analysis. A best-guess timetable is that decision analysis would not be incorporated into the existing model for another 3 to 5 years. In the meantime, we must identify potential population parameters from annual assessments and outputs from current models on a lake-wide basis that can be used as reference points to determine if harvest regulations need to be changed. Some of those discussed at our September 22 meeting include population size, number of year classes, spawning stock biomass, and SSB/R. Establishing these reference points will provide to the agency members the opportunity to apply them specifically to their own assessment data, thus establishing their own trigger levels based on historical data for that jurisdiction. In addition, management reference points could be incorporated into Lake Michigan Fish Community Objectives for yellow perch. The original yellow perch objectives are likely too ambitious, given our current (improved) understanding of these populations.

Task Group Meetings

The spring 2003 meeting of the YPTG was held on March 18th at the Great Lakes Water Institute in Milwaukee, Wisconsin. Arrangements were made by Pradeep Hirethota and John Janssen.

The winter 2003 of the YPTG meeting was held on September 22 in Michigan City, IN. Arrangements were made by Brian Breidert.

The spring 2004 meeting of the YPTG was held on March 22 – 23rd and coincided with GLFC meeting in Ypsilanti, Michigan.

References

Allen, P. J., T. E. Lauer, and T. S McComish. 2003. Year three progress report: dynamics and models of the yellow perch in Indiana waters of Lake Michigan and near-shore fish community characteristics. Report of Ball State University to Indiana Department of Natural Resources, Division of Fish and Wildlife, Indianapolis.

Baker, E. A., and T. S. McComish. 1998. Precision of ages determined from scales and opercules for yellow perch *Perca flavescens*. Journal of Great Lake Research 24:658-665.

Quinn, T. J., III, and R. B. Deriso. 1999. Quantitative fish dynamics. Oxford University Press. New York.

Robillard, S. R., and J. E. Mardsen. 1996. Comparison of otolith and scale ages for yellow perch from Lake Michigan. Journal of Great Lakes Research 22:429-435.

Wilberg, M., J. Bence, and D. F. Clapp. 2003. Development of an age-structured yellow perch population model for Lake Michigan. Annual progress report to the Great Lakes Fish and Wildlife Restoration Act.

Appendix 1. Lake Michigan statistical districts.