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

Brian Flood (far right), recently-retired crew member on the MDNR research vessel S/V *Steelhead*, sorting yellow perch from a trawl sample near South Haven, Michigan, August 19, 2003.

REPORT TO THE LAKE MICHIGAN COMMITTEE
Niagara Falls, Ontario
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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 structure data available for different parts of the lake. The final section consists of estimates (or indices) of juvenile yellow perch recruitment: most of these data come 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 were collected with either gill nets or bottom trawls (Figures 1 to 8). 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, 2, 6, 7). Increases in catch-per-unit-effort resulting from recruitment of the 1998 and 2002 year classes are particularly apparent in some data series (Figures 2, 3, 4, 7). Data from common gear types (graded-mesh gill net) fished in all jurisdictions are presented in Figure 8; these index data show that 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 in most areas of the lake. Percent females in Illinois, Indiana, and Michigan waters of Lake Michigan has ranged from 55 to 80% over the past five years (Figures 1, 2, 4, 5). The percentage of females in Wisconsin waters has been more variable, increasing from approximately 5% in 1996 to 65% in 2000, then ranging from >60% to <40% since that time (Figure 6).

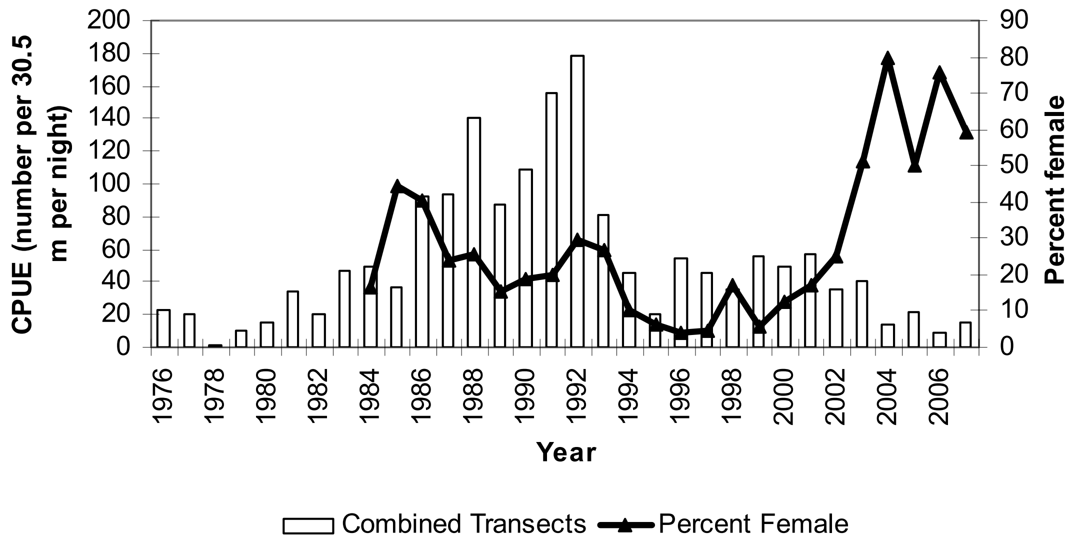

Figure 1. Adult yellow perch relative abundance and percent female in the Illinois waters of Lake Michigan. (ILDNR; data from spring gill net assessment, Chicago and Lake Bluff, IL, 1976 – 2007.)

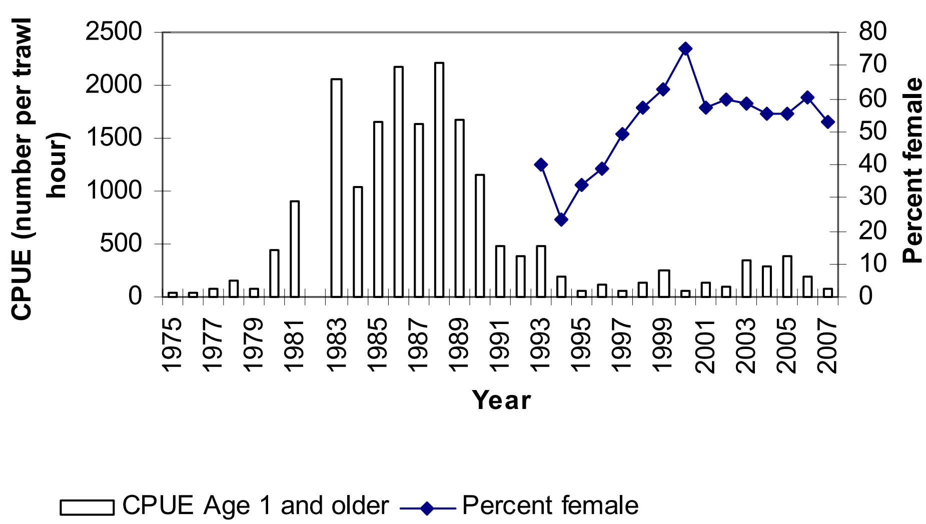

Figure 2. Adult yellow perch trawl CPUE and percent female in Indiana waters of Lake Michigan. (Ball State University; data from summer trawl survey at sites M and K in 1975 – 2007.)

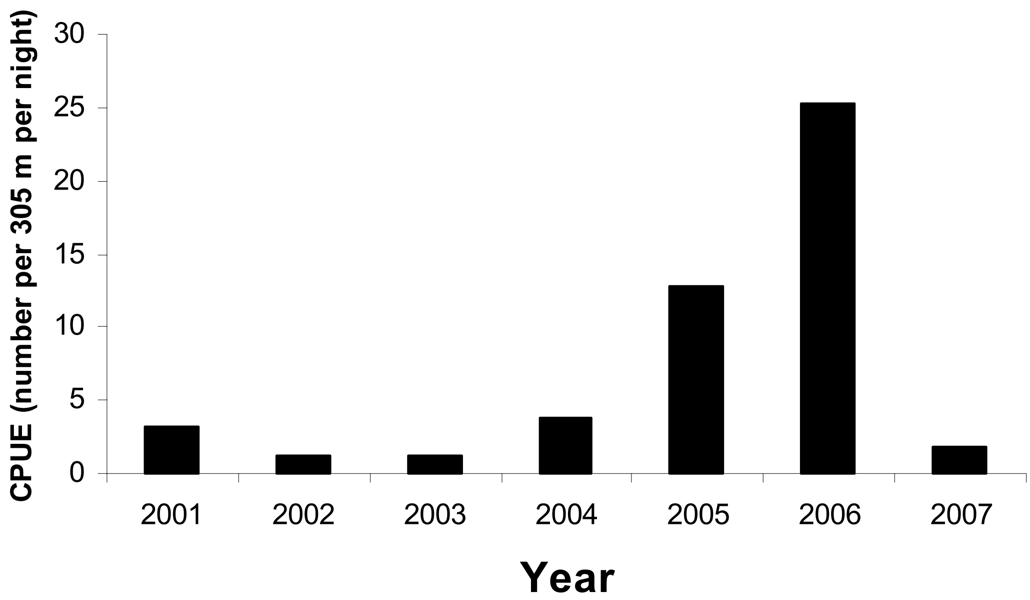

Figure 3. Adult yellow perch gill net catch-per-unit-effort in Little Traverse Bay. (LTBB; data from spring LWAP survey at Petoskey, 50-100' strata; CPUE adjusted for gear selectivity.)

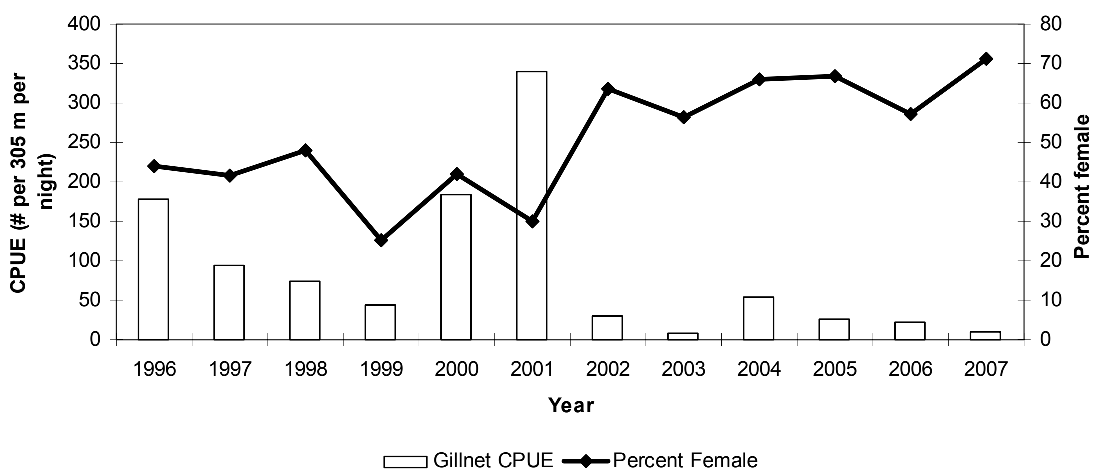

Figure 4. Adult yellow perch gill net catch-per-unit-effort and percent female in the catch at four southern Lake Michigan ports (Grand Haven, Saugatuck, South Haven, and St. Joseph, MI). (MDNR; data from April-June, 1996 – 2007.)

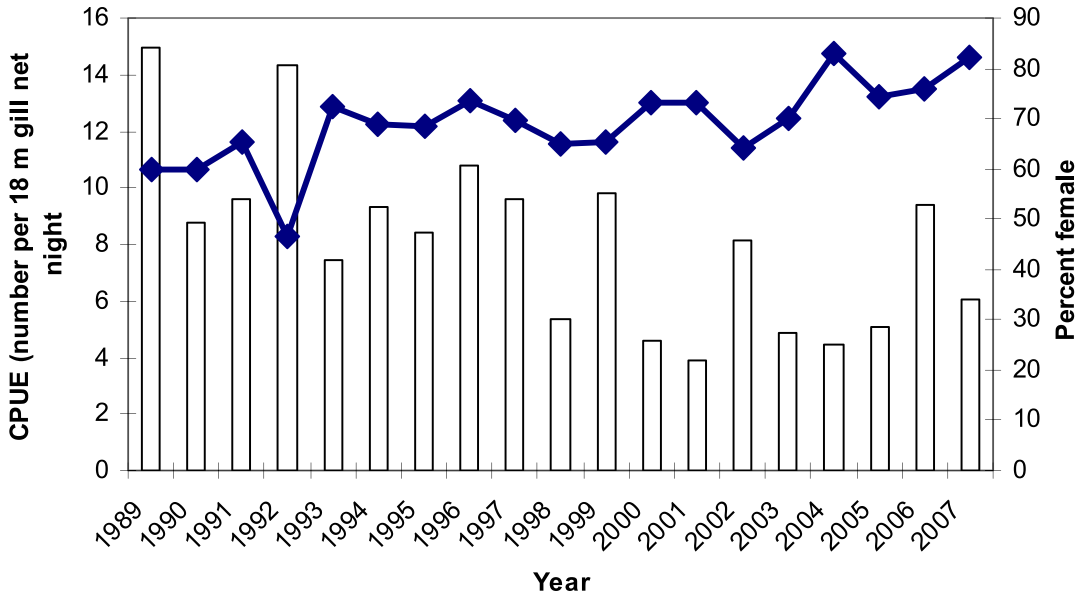

Figure 5. Adult yellow perch gill net catch-per-unit-effort and percent female in the catch in Bays de Noc. (MDNR; data from June to September, 1989 – 2007.)

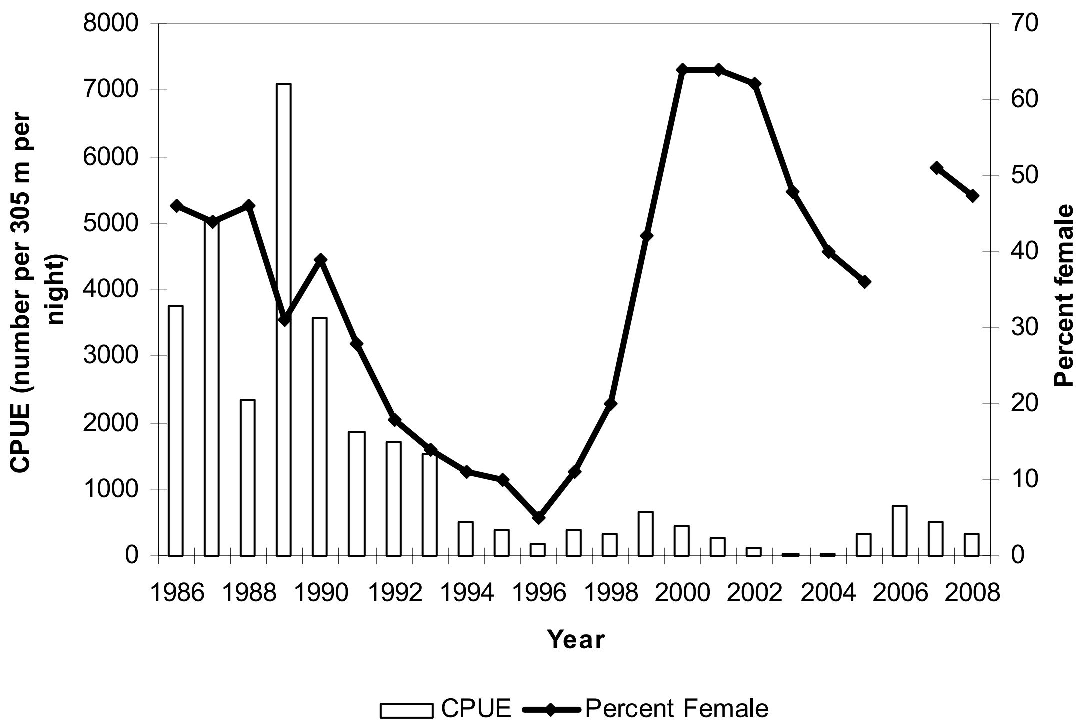

Figure 6. Adult yellow perch relative abundance and percent female in the Wisconsin waters of Lake Michigan. (WDNR; data from winter gill net assessment, Milwaukee, WI, 1986 – 2008.)

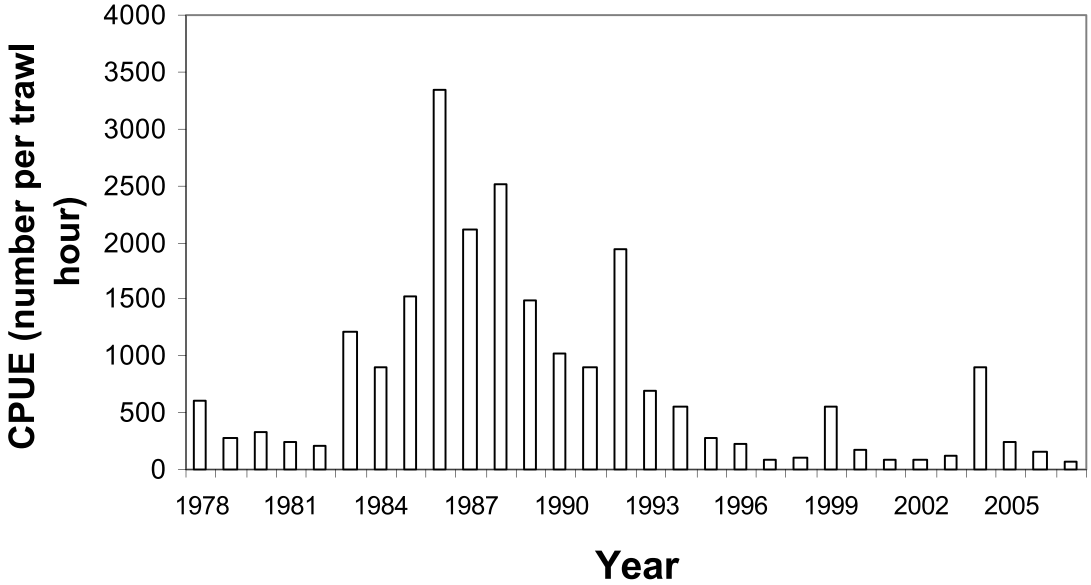

Figure 7. Adult yellow perch relative abundance in the Wisconsin waters of Green Bay. (WDNR; data from summer trawl assessment, Green Bay, WI, 1978 – 2007.)

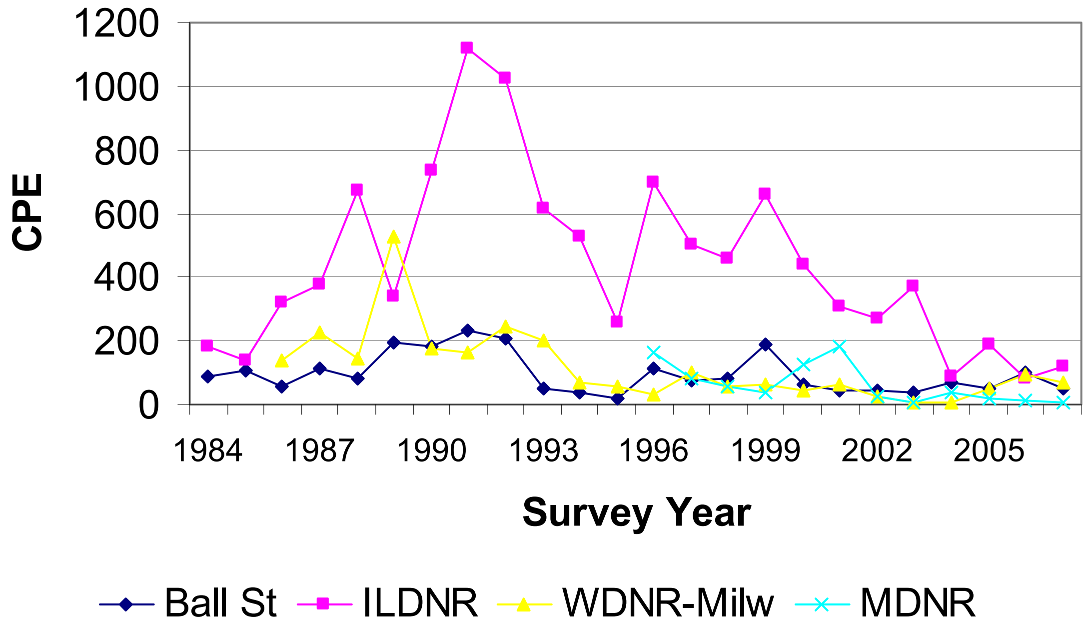

Figure 8. Yellow perch CPE (number of fish per 305 m) in graded mesh gill net consisting of equal length panels of 51-mm, 64-mm, and 76-mm stretched mesh, 1984-2007. (Data from BSU, ILDNR, WDNR, and MDNR; 1997-2000 & 2002-2007 MDNR values calculated from 1996 and 2001 selectivity evaluations.)

Population Age Structure

The yellow perch adult population age structure was determined by evaluating scales, otoliths, opercles, or spines. Although differences in aging techniques and collection methods and times occur between agencies, assessments continued to show increasing recruitment and contribution to the adult population from the 2002-2003 year classes. Successful recruitment of the 2002 year class was particularly apparent in gill net catches from Illinois (Figure 9), Michigan (Figure 13), and Wisconsin (Figure 15) waters. These data are indicative of successful reproduction by the relatively strong 1998 year class, and continued survival of the 1998 year class (age 9) is particularly apparent in data collected in Illinois (Figures 9, 10), Michigan (Figure 13), and Wisconsin (Figure 15) waters of Lake Michigan. These figures also indicate relatively strong recruitment from the 2005 year class.

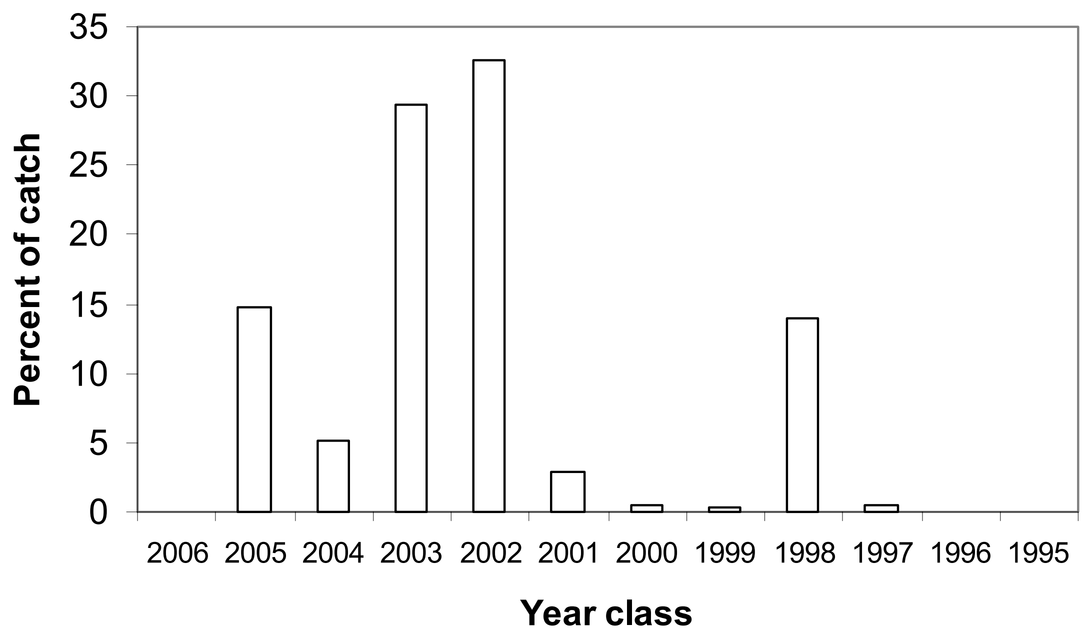

Figure 9. Yellow perch age structure from the Illinois waters of Lake Michigan. (ILDNR; data from spring gill net assessment, Chicago and Lake Bluff, IL, 2007. Ages determined using otoliths.)

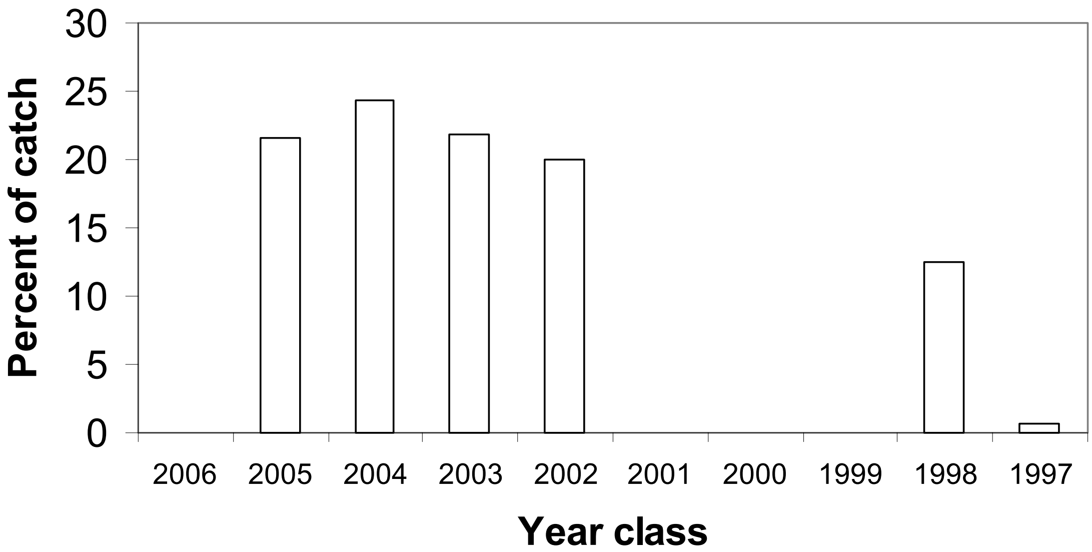

Figure 10. Yellow perch age structure from the Illinois waters of Lake Michigan. (INHS; data from spring fyke net sampling, Waukegan and Lake Bluff, IL, 2007. Ages determined using otoliths.)

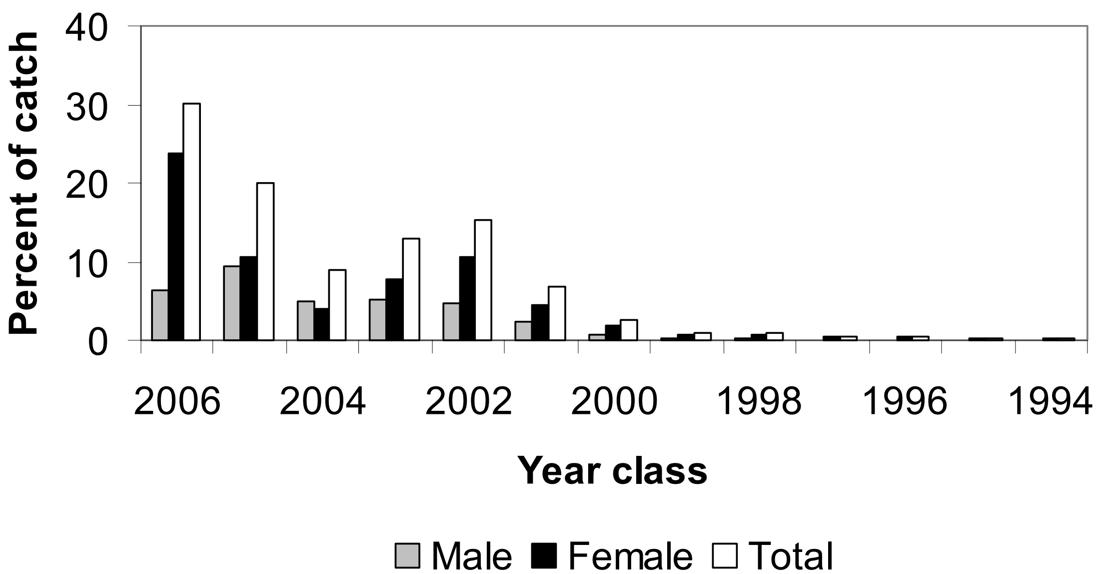

Figure 11. Yellow perch age structure from the Indiana waters of Lake Michigan. (Ball State University; data from summer trawl survey at sites M and K, Indiana, 2007. Ages determined using opercles.)

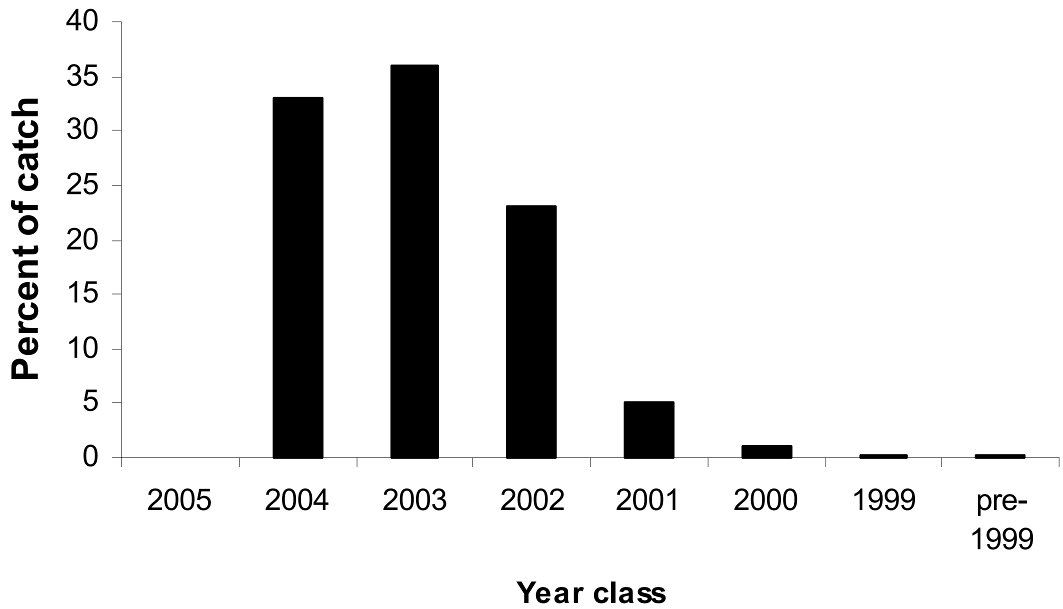

Figure 12. Yellow perch age structure from northern Lake Michigan. (LTBB data from spring gill net assessment, 2006. Age determined using spines.)

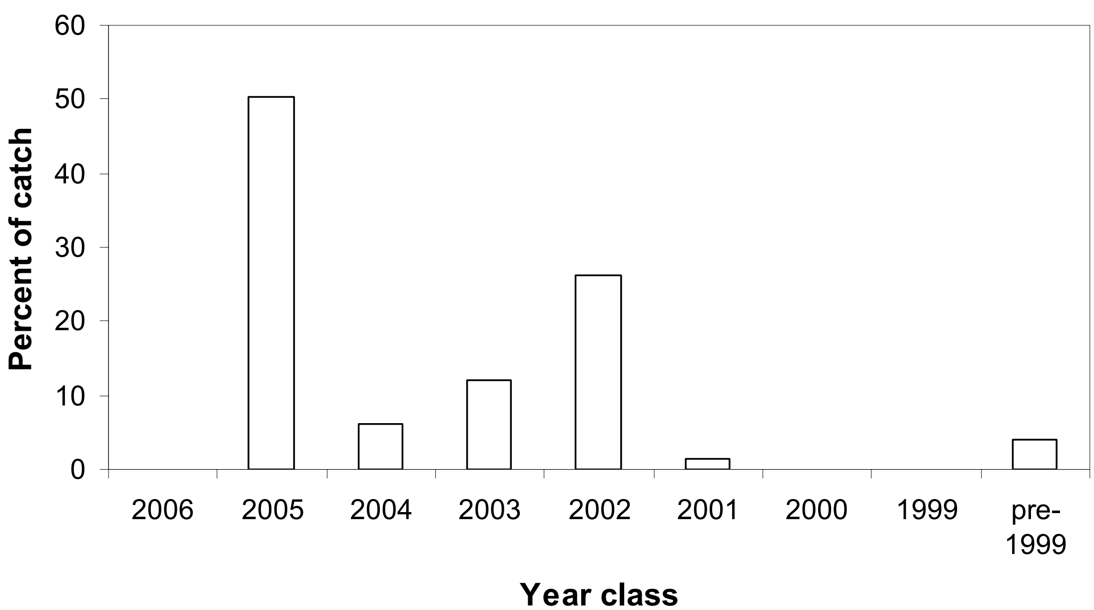

Figure 13. Yellow perch age structure from the Michigan waters of Lake Michigan. (MDNR data from spring gill net assessment, combined four southern Lake Michigan ports – Grand Haven, Saugatuck, South Haven, and St. Joseph, MI – 2007. Age determined using spines.)

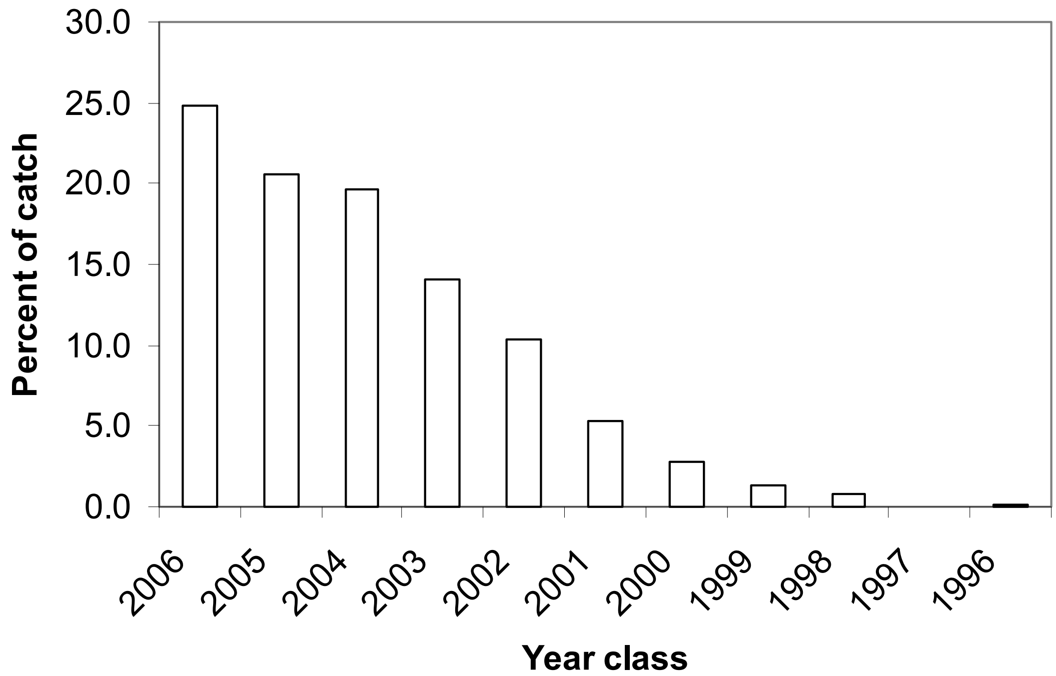

Figure 14. Yellow perch age structure from the Michigan waters of Bays de Noc, Lake Michigan. (MDNR data from June to September gill net assessment, 2007. Age determined using scales.)

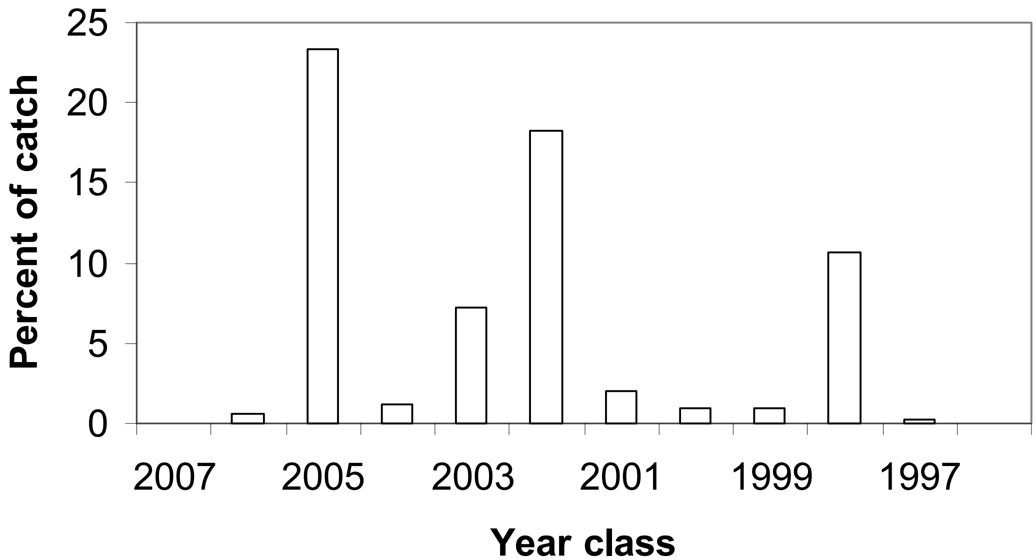

Figure 15. Yellow perch age structure from the Wisconsin waters of Lake Michigan. (WDNR; data from winter gill net assessment, Milwaukee, WI, 2008. Ages determined using spines.)

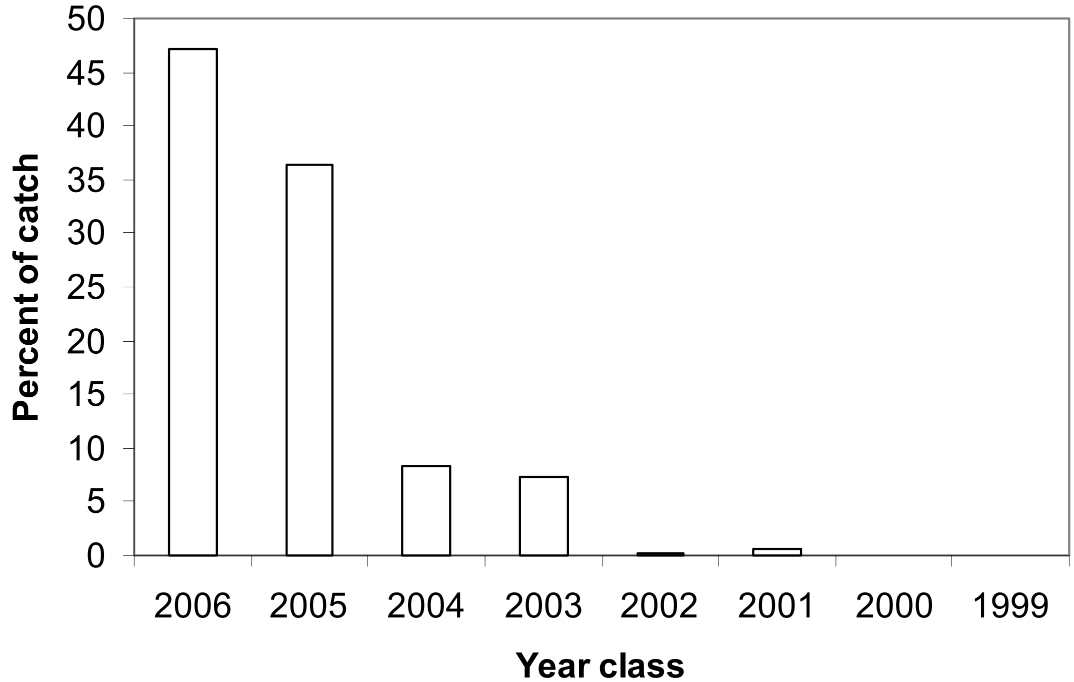

Figure 16. Yellow perch age structure from the Wisconsin waters of Green Bay. (WDNR; data from summer trawl assessment, Green Bay, WI, 2007. Ages determined using spines.)

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 yellow perch recruitment have traditionally been collected using bottom trawls or beach seines. Recruitment of young-of-the-year (YOY, age-0) yellow perch in 2007 was relatively low (weak) in most areas of the lake. Catch of age-0 yellow perch was greater than that observed in 2006 only in Wisconsin waters of Lake Michigan (Figure 22) and in Green Bay / Bays de Noc (Figures 23 and 21, respectively). Recruitment in all areas of the lake was less than that observed in 2005, when young-of-year production was the highest observed in at least 16 years for all areas of the lake.

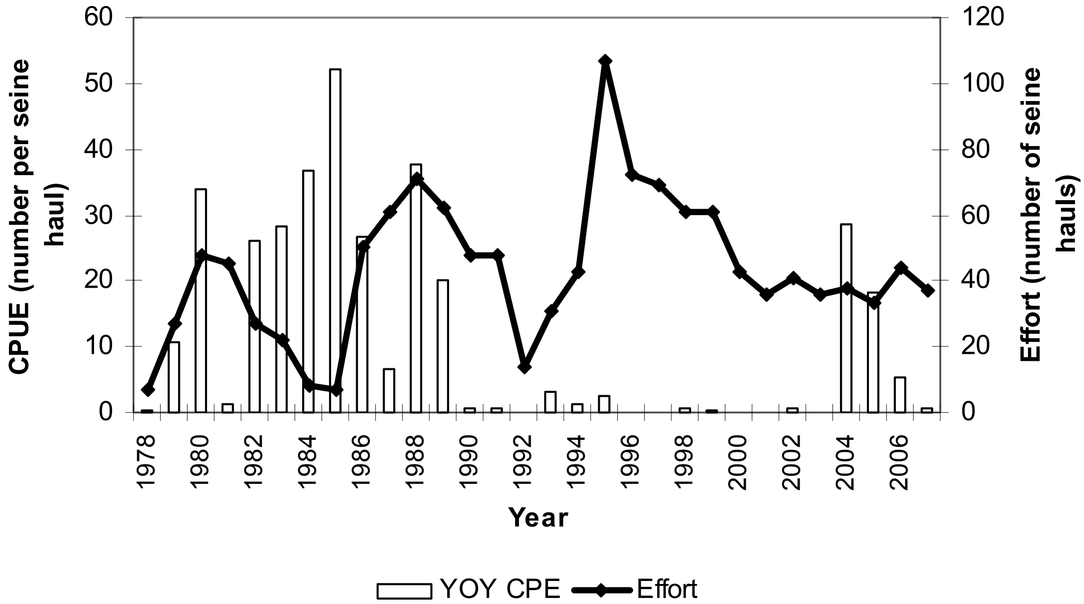

Figure 17. CPUE of YOY yellow perch from the Illinois waters of Lake Michigan. (ILDNR; data from summer beach seining along the Illinois shoreline, 1978 – 2007.)

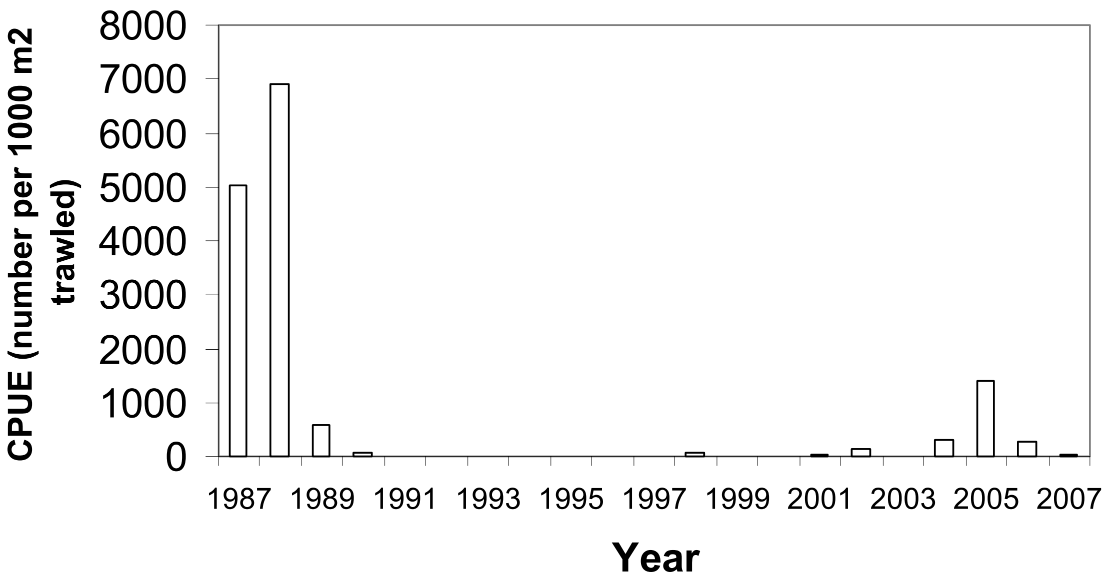

Figure 18. CPUE of age-0 yellow perch in the Illinois waters of Lake Michigan. (INHS; data from summer and fall bottom trawls off Waukegan, IL, 1987 – 2007.)

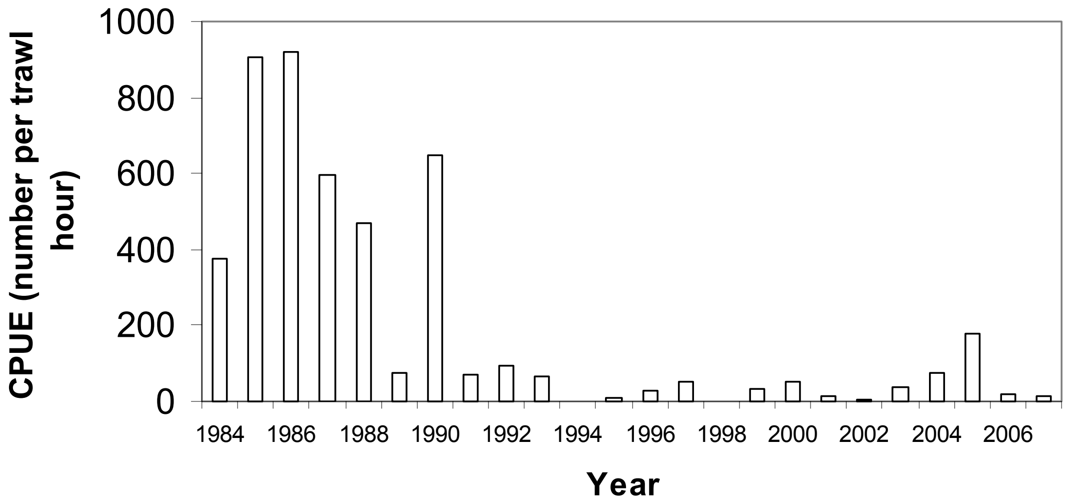

Figure 19. CPUE of age-2 yellow perch from the Indiana waters of Lake Michigan. (Ball State University; data from summer bottom trawl assessments, 1984 – 2007).

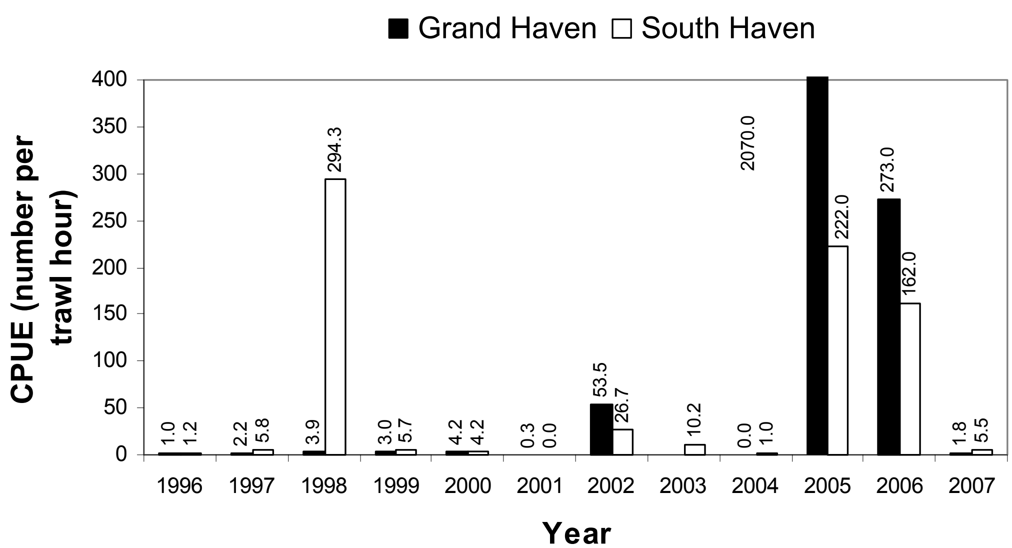

Figure 20. CPUE of age-0 yellow perch in the Michigan waters of Lake Michigan. (MDNR; late summer bottom trawl data from Grand Haven and South Haven 1996 - 2007. Grand Haven was not sampled in 2003.)

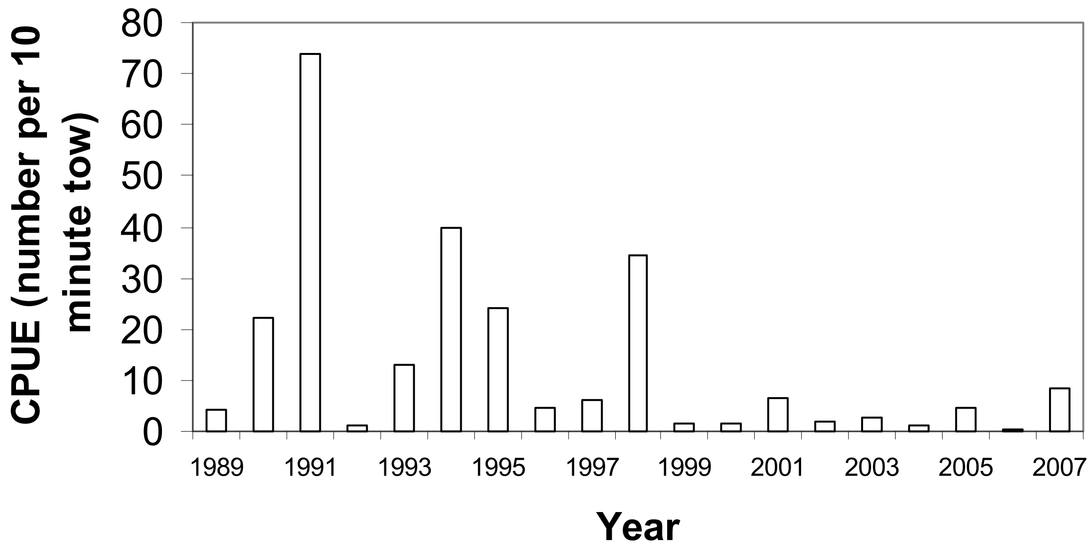

Figure 21. CPUE of age-0 yellow perch in Bays de Noc, Lake Michigan. (MDNR; summer bottom trawl data, 1989 - 2007.)

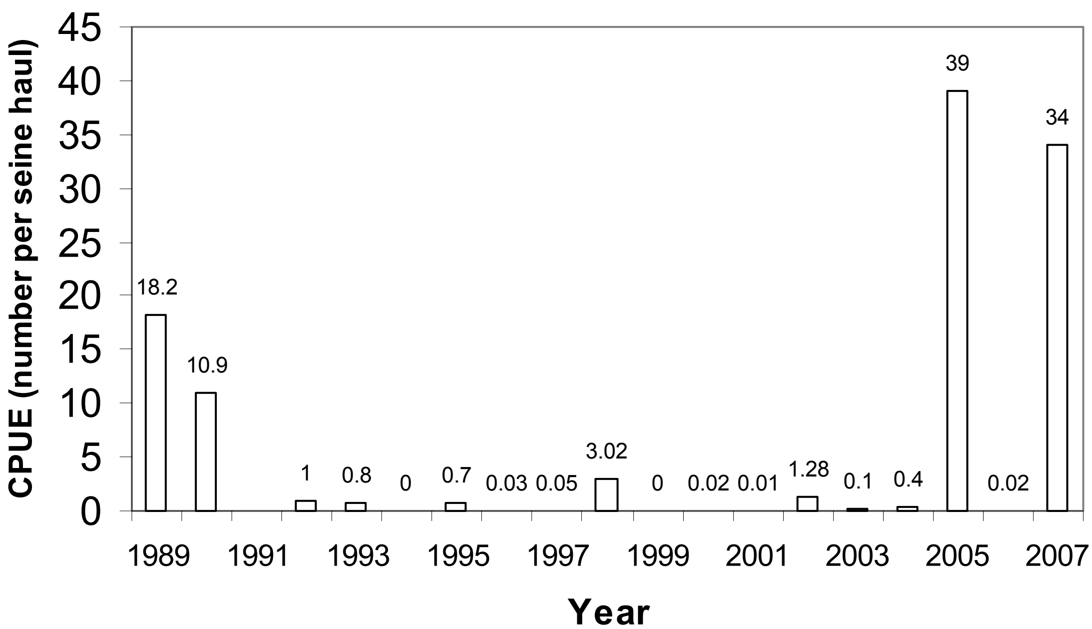

Figure 22. CPUE of age-0 yellow perch from the Wisconsin waters of Lake Michigan. (WDNR; data from summer beach seine assessments along the southern Wisconsin shoreline, 1989 – 2007.)

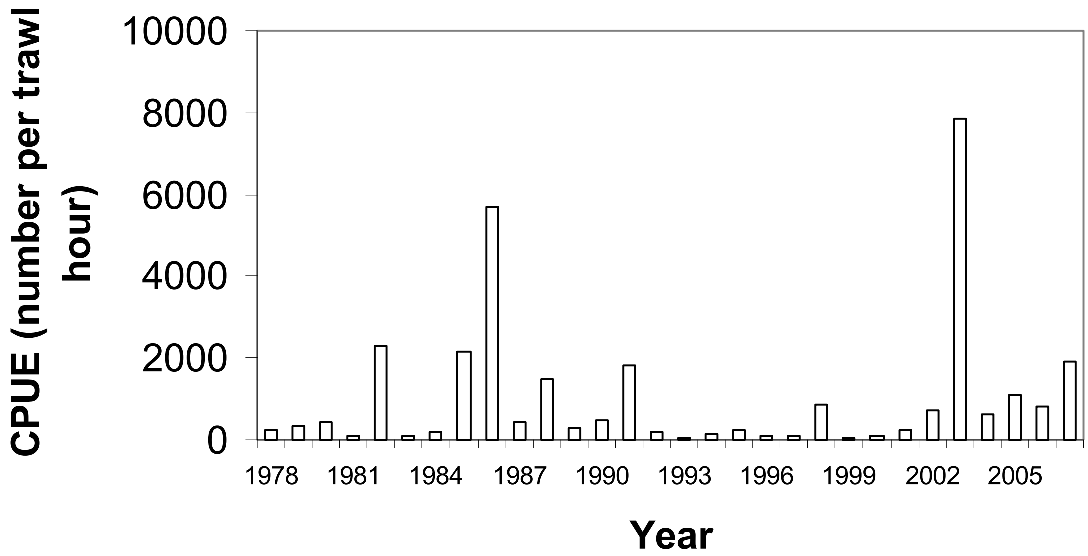

Figure 23. CPUE of age-0 yellow perch from the Wisconsin waters of Green Bay. (WDNR; data from summer trawl assessments, 1978 – 2007.)

2008 Yellow Perch Harvest Restrictions

<u>Sportfishing regulations:</u>

- Illinois
  - July closed to sportfishing for yellow perch (exception: under 16 years of age – 10 fish bag limit)
  - 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) / 50 fish (north of 45^{th} parallel and Grand Traverse Bays)
- 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 19; closed to sportfishing for yellow perch
  - Daily bag limit 15 fish

<u>Commercial regulations:</u>

- 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 for 2008 is 100,000 pounds)

Yellow Perch Task Group Progress Report

The Yellow Perch Task Group (YPTG) was formally given 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;

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. 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.

Charge #2 has been completed, as described in the 2006 Yellow Perch Task Group annual report (Makauskas and Clapp 2006). The following section of this report provides a brief summary of the progress made towards the completion of charges 1 and 3-5 during 2007-08.

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. Work to address this charge is ongoing; this report addresses, in part, the charge to “achieve compatibility of information”.

During the winter 2006 YPTG meeting, member agencies agreed to implement standardized spring adult yellow perch assessments (beginning in spring 2007), to coincide with other LMTC spring lakewide assessments (for lake trout and burbot). The results of this standardized spring adult yellow perch sampling are presented in the first section of this report (Figure 8, including *post hoc* standardized data from years prior to 2007). In addition, the YPTG agreed to implement a lakewide summer “micromesh” gill net assessment (beginning in summer 2007) to standardize assessment of young-of-year yellow perch production, especially in areas where standard trawl and seine surveys cannot be implemented. Some preliminary sampling with micromesh nets had been conducted prior to 2007 (Jude and Janssen 2008; Janssen and Luebke

2004), but agencies were able to implement this new survey lakewide in summer 2007 (Table 1). Catches were highest in Indiana and Wisconsin waters, and peak catches came in 12.5 and 16.0 mm (stretched) mesh nets. Additional, expanded sampling is planned for summer 2008, but early indications are that this will be a valuable assessment for providing a comparable measure of young-of-year yellow perch abundance across all nearshore habitats in Lake Michigan.

Table 1. Summary of micromesh gill net surveys by YPTG member agencies in Lake Michigan, July-September 2007.

State	Agency	Number of survey events	Mesh sizes (stretched, mm)	# of YOY yellow perch captured	Comments
Indiana	Ball State University	8	12.5, 16.0, 20.0, 25.0	302	
Illinois	Illinois Natural History Survey	6	12.5, 16.0, 20.0, 25.0	108	
Michigan	Michigan DNR	6	16.0	1	Additional sampling by Jude and Janssen (2008)
Wisconsin	Wisconsin DNR	2	12.5, 16.0	45	Additional sampling by Janssen and Luebke (2004)

Charge #3: Identify any additional work to address yellow perch recruitment failure. 2007 marked the eleventh 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, as well as to provide increased understanding of the factors influencing Lake Michigan yellow perch population dynamics. The Lake Michigan Yellow Perch Task Group has addressed several hypotheses that may be limiting the survival of yellow perch (see Clapp and Dettmers 2004 for a list of hypotheses and description of the work conducted to address these hypotheses). Additional work to address questions related to recruitment of Great Lakes yellow perch is ongoing (see, for example; Beletsky et al. 2007, Glover et al. 2008).

Charge #4: Develop and implement a lakewide yellow perch population model. During 2007-08, population modeling work has continued as part of an effort to develop decision analysis tools, and to apply these tools to evaluate harvest policies for yellow perch in the southern portion of the main basin of Lake Michigan. Statistical catch-at-age models were developed for each region (Wisconsin, Illinois, and Indiana-Michigan) of the Lake Michigan yellow perch fishery (Wilberg et al. 2005). Initially, Indiana and Michigan were combined due to a limited long-term data set from Michigan and insufficient commercial fishery data from Indiana. During 2007-08, researchers at the Chesapeake Biological Laboratory and Michigan State University continued work to incorporate new data and develop separate population models for Michigan and Indiana waters. Currently, a stochastic simulation model that projects the age, sex, size, and spatial dynamics of the yellow perch population is being used to evaluate the performance of alternative harvest policies. In addition, USFWS personnel have provide assistance to WDNR biologists in continued development and refinement of a yellow perch population model for Green Bay waters (J. Netto, USFWS, personnel communication).

Preliminary results of the Lake Michigan yellow perch decision analysis study were presented at the American Fisheries Society meeting in San Francisco, CA in September 2007 (Irwin et al. 2007). In addition, two manuscripts (Irwin et al. *in review*, Wilberg et al. *in review*) connected to this work are in review for a special issue on harvest policies in *Fisheries Research*. An abstract reflecting these two manuscripts is included here (highlighted passages are particularly relevant to Charge #5, below).

We used decision analysis and projections from a stochastic simulation model to aid managers in formulating a harvest policy for yellow perch (Perca flavescens) in southern Lake Michigan. In workshops with management agency personnel, we identified potential harvest policies (constant or state-dependent fishing morality) and associated performance variables (e.g., recreational fishery harvest, spawning stock biomass, and length of harvested fish), as well as critical uncertainties relevant to the population (e.g., alternatives for future stock-recruitment relationships and mixing of recruits among management jurisdictions). Our simulation model acknowledged uncertainty in the stock-recruitment relationship, parameter uncertainty given such a relationship, stochastic process variation, and uncertainty associated with assessment and implementation errors. First, we used the model to project age-, sex-, size-, and spatial-dynamics of the yellow perch population, and thus predicted likely distributions of outcomes for different harvest policies. These distributions were summarized by both time averages and the proportion of years when undesirable conditions existed. These summary performance statistics included average spawning stock biomass, proportion of years with low spawning stock biomass, average recreational harvest, proportion of years with low recreational harvest, and average total length of harvested individuals. ***For most performance statistics, our results indicate that constant-F policies for yellow perch perform poorly relative to state-dependent policies at all but the lowest levels of fishing mortality. State-dependent harvest policies provided benefits (e.g., higher levels of spawning stock biomass remained) with little detriments (e.g., harvests often were approximately equal to or greater than those of constant-F policies).*** *Second, we also evaluated how sensitive the results of the base model were to the assumptions of how different areas contributed to recruitment in other areas. To accomplish this, we considered the extreme alternatives, where all recruitment was produced by only one management area, considering each of the four areas to be the sole source in turn, and compared results from these* *variants of the model with results of the base model where all areas produced recruits. Performance of harvest policies differed predictably depending on which management area was the source because relative productivity of stock-recruitment relationships and growth patterns differed among source areas.* ***However, state-dependent harvest policies seem to be less sensitive to source-sink population dynamics than constant fishing mortality rate policies.***

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. Work to address Charge #5 was described in the 2004 report of the Yellow Perch Task Group to the Lake Michigan Committee (Makauskas and Allen 2004). At that time, the Yellow Perch Task Group recommended retaining the current harvest regulations, pending additional analyses of available and subsequently-collected data. Agency members were in agreement to continue to have two meetings a year, focusing jointly on recruitment questions and implementation of a lake-wide management strategy for the Lake Michigan yellow perch fishery, utilizing annual assessments and modeling efforts. Recently developed decision analysis tools (see Charge 4, above) will help to establish key reference points that signal needed changes in harvest regulation and will aid in providing a much-needed protocol for management decisions regarding the Lake Michigan yellow perch fishery. Semi-annual YPTG meetings will result in regular status reports to LMC members, as well as management recommendations, as appropriate.

Task Group Meetings

A winter 2008 meeting of the YPTG was held on January 22, 2008, at the Indiana DNR office in Michigan City. Agenda items at this meeting included regulation criteria and potential regulation changes, standard assessment protocols (including added lakewide assessments), spawning and egg deposition information, aging updates, and preparation of the annual report to the Lake Michigan Committee.

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Appendix 1. Lake Michigan statistical districts.