

**Preliminary Results of 2007 Ball State University  
Yellow Perch Research in Indiana Waters  
of Lake Michigan**

Jason C. Doll and Thomas E. Lauer  
jcdoll@bsu.edu and tlauer@bsu.edu

Aquatic Biology and Fisheries Center  
Department of Biology  
Ball State University  
Muncie, IN 47306-0440  
765-285-8825

Submitted to:  
Indiana Department of Natural Resources  
Division of Fish and Wildlife  
402 West Washington Street, Room W273  
Indianapolis, Indiana 46204-2267

October, 2007

## **Foreword**

This is a brief update on yellow perch population dynamics in Indiana waters of Lake Michigan and near-shore fish community characteristics based on results of 2007 sampling by the Aquatic Biology and Fisheries Center at Ball State University. Data should be considered provisional, as revisions may be made before publication of our progress report due June 30, 2008. The progress report will be more extensive, including data on age and growth, mortality, etc. for 2007. We hope this update, though brief, will be an interesting and useful source of preliminary information to the Indiana Department of Natural Resources and others.

Nighttime June to August bottom trawl sampling was conducted along the 5 m contour at three index sites in Indiana waters of Lake Michigan in 2007 (Appendix 1). Additionally, gill net sampling was performed at the 10 m and 15 m depth contours due north from the midpoint of the trawl zone at each site. Sampling methods are described in detail by Lauer and Doll (2007). Sixteen species were sampled in 2007 (Appendix 2).

Additional sampling was conducted in the spring and fall as part of a Lake Michigan Yellow Perch Task Group experimental lake-wide assessment. Adult yellow perch sampling was conducted on May 14 and 15 using experimental mesh gill nets of the same configuration as the historical index sampling. Gill net sampling was performed at the 10 m and 15 m depth contours at sites M and K. Total effort for spawning assessment was 4 net nights. On September 12 and 13, micromesh gill-nets were used to assess young-of-the-year abundance. Each net was 40 m long and 1.5 m deep, consisting of 4 panels of monofilament webbing 10 m each with stretch mesh sizes 12.5, 16.0, 20.0, and 25.0 mm in that order. Four hour sets were fished at sites M and K at both the 3 m and 5 m depth contours during the day and night with total effort of 8 gill-net lifts. These sampling sites provided two contrasting substrate types, clay ridges (site K) and sand (site M).

Preliminary results of 2007 trawl sampling are listed in Table 1. Yellow perch and alewives age  $\geq 1$  were separated from age-0 fish based on length-frequency distributions. Trawl catches of yellow perch were highest in June and tailed off to below 100/hr in July and August. Age-0 yellow perch were only collected during the month of August. Alewife catches were highly variable throughout 2007 with at least one catch above 200/hr each month.

The 2007 trawl CPUE of yellow perch age  $\geq 1$  continued a significant downward trend in trawl catch the past seven years (ANOVA:  $F= 2.69$ ;  $df = 6,119$ ;  $P = 0.018$ ) (Figure 1). Tukey's pairwise comparisons showed catch in 2007 was significantly lower when compared to the catch in 2005, while other comparisons were not significantly different. Age-2 (2005 year-class) and age-3 (2004 year-class) fish appeared to compose a majority of the 2007 age  $\geq 1$  catch based on length frequency distributions (Figure 2). The 2007 female length frequency ranged from 67 mm to 355 mm and had three major modal points at 80 to 89 mm, 110 to 119 mm, and

Table 1. Preliminary 2007 trawl catches of yellow perch (YEP) and alewives (ALE) at three 5 m contour sites in Indiana waters of Lake Michigan.

Date	Site	YEP age $\geq 1$	YEP age 0	ALE age $\geq 1$
6/6/2007	G	37	0	248
6/11/2007	M	381	0	104
6/12/2007	K	154	0	62
6/19/2007	K	215	0	89
6/20/2007	G	40	0	232
6/21/2007	M	292	0	20
7/5/2007	G	12	0	75
7/9/2007	K	23	0	236
7/10/2007	M	13	0	96
7/16/2007	K	92	0	55
7/17/2007	G	37	0	44
7/23/2007	M	2	0	58
8/1/2007	G	15	304	214
8/2/2007	M	23	1	6
8/6/2007	K	27	34	67
8/17/2007	M	14	26	6
8/18/2007	G	22	226	41
8/19/2007	K	37	20	9
Total		1436	611	1662
Minimum		2	0	6
Maximum		381	304	248
Mean		80	34	92
SD		109	86	83
2SE		52	40	39
Median		32	0	65
25th percentile		17	0	42
75th percentile		79	15	102

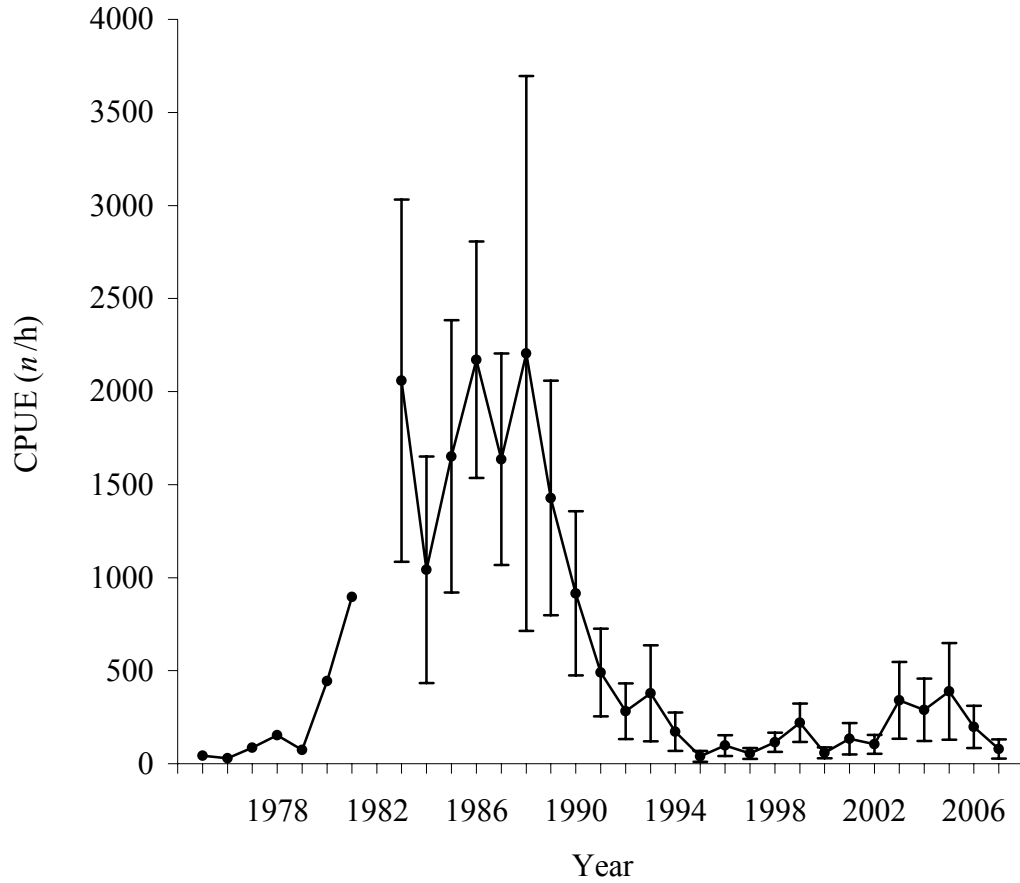


Figure 1. Mean annual trawl CPUE of yellow perch age  $\geq 1$  from pooled sites in Indiana waters of Lake Michigan from 1975 to 2007. Only site K was sampled from 1975 to 1983; 1984 to 1988 data represent pooled sites M and K; and 1989 to 2007 data represent pooled sites M, K, and G. No trawling was conducted in 1982. Error bars for 1983 to 2007 are  $\pm 2$  SE.

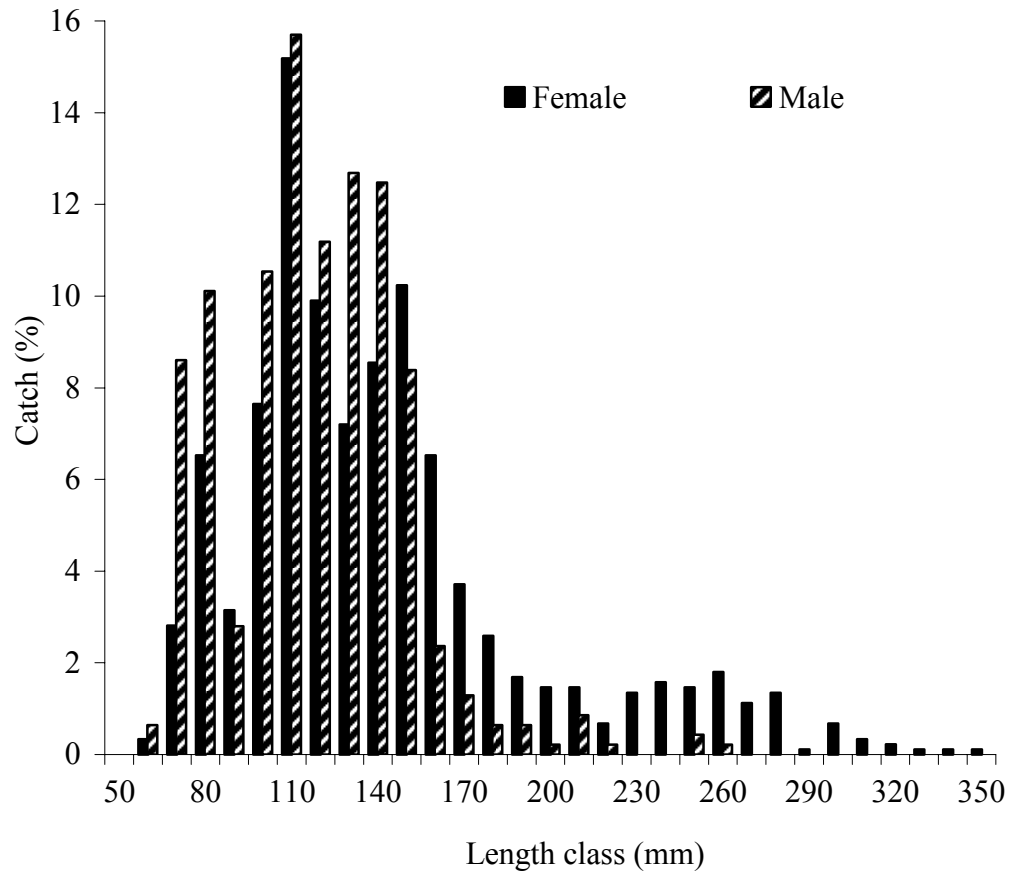


Figure 2. Length frequency distribution of female and male yellow perch age  $\geq 1$  from June to August trawl catches in Indiana waters of Lake Michigan, 2007.

150 to 159 mm. Male lengths ranged from 65 to 267 mm and also exhibited three major modal points at 80 to 89 mm, 110 to 119, and 130 to 139 mm. The mean length of females was 147 mm with 50% of females ranging from 113 to 164 mm (Table 2). Mean length of males was 122 mm with 50% of males ranging from 103 to 142 mm.

The CPUE of age-0 yellow perch in 2007 slightly decreased from the observed abundance in 2006 (Figure 3). This is the lowest observed catch rate since 2001. However, our age-0 trawl CPUE is not a reliable index of recruitment to the stock due to annual variation in catchability. For example, when mean CPUE values were  $> 10/h$ , only four years (1991, 1998, 2004, and 2005) were significantly greater than zero.

Total gill-net catch of yellow perch in 2007 decreased approximately 50% from the near record catch of 100/net-night observed in 2006 (Figure 4). The size range of gill-net caught yellow perch was from 178 mm to 361 mm in 2007 (Figure 5). The length frequency distribution shows over 50% of the gill-net catch was  $\geq 260$  mm. Females continued to dominate the gill net catch composing 93% of the total in 2007. The reproductive potential exhibited by the gill-net catch expressed as eggs/net/night using a length-fecundity relationship developed by Lauer et al. (2005) shows an upward trend beginning in 1993 to nearly 2.0 million eggs per hour during 2007 (Figure 6). Although the catch has not yet been aged, based on the 2006 gill-net age-length frequency (Lauer and Doll 2007) it is likely the 2000 and 2001 year classes will be a major part of the gill-net catch.

Alewife trawl CPUE increased slightly from 2006 (Figure 7). Based on length-frequency distributions, the 1998 year class (age 9) is no longer a significant portion of the population (Figure 8). A continued decline in abundance in the alewife population could provide the yellow perch population an opportunity to produce large year classes as discussed by Shroyer and McComish (2000). For the yellow perch to produce similar sized year classes as those observed in the 1980s, alewife abundance would likely have to be suppressed even further than the declines observed over the last three years based on the Shroyer and McComish (2000) model.

The spring adult yellow perch sampling yielded a gill-net CPUE of 16/net-night, with quality size ( $\geq 200$  mm) CPUE of 15/net-night. Lengths of female perch ranged from 190 to 300 mm and males ranged from 190 to 310 mm (Figure 9). Sex

Table 2. Length statistics from female and male yellow perch age  $\geq 1$  from June to August trawl catches in Indiana waters of Lake Michigan, 2007.  $n$  is number of fish measured, Mean is average length, Median is median length, Q1 is first quartile, and Q3 is third quartile.

Sex	$n$	Mean (mm)	Median (mm)	Q1	Q3
Female	889	147	136	113	164
Male	465	122	121	103	142

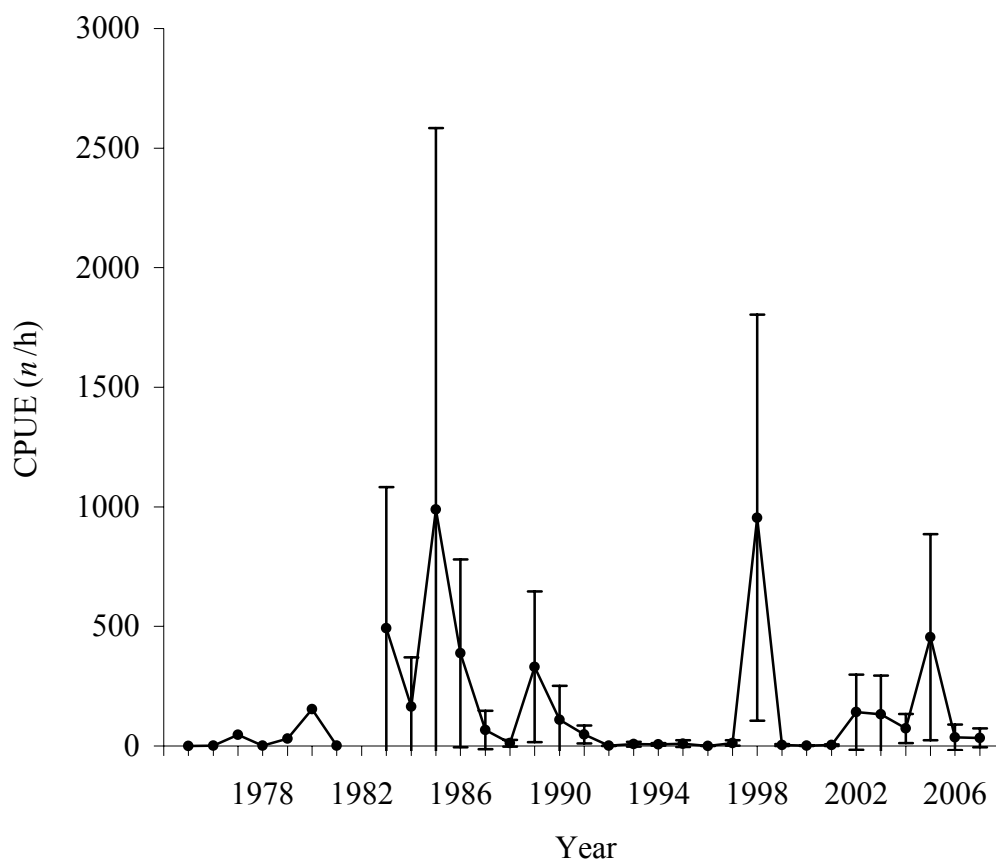


Figure 3. Mean annual trawl CPUE of age-0 yellow perch from pooled sites in Indiana waters of Lake Michigan from 1975 to 2007. Only site K was sampled from 1975 to 1983; 1984 to 1988 data represent pooled sites M and K; and 1989 to 2007 data represent pooled sites M, K, and G. No trawling was conducted in 1982. Error bars for 1983 to 2007 are  $\pm 2$  SE.



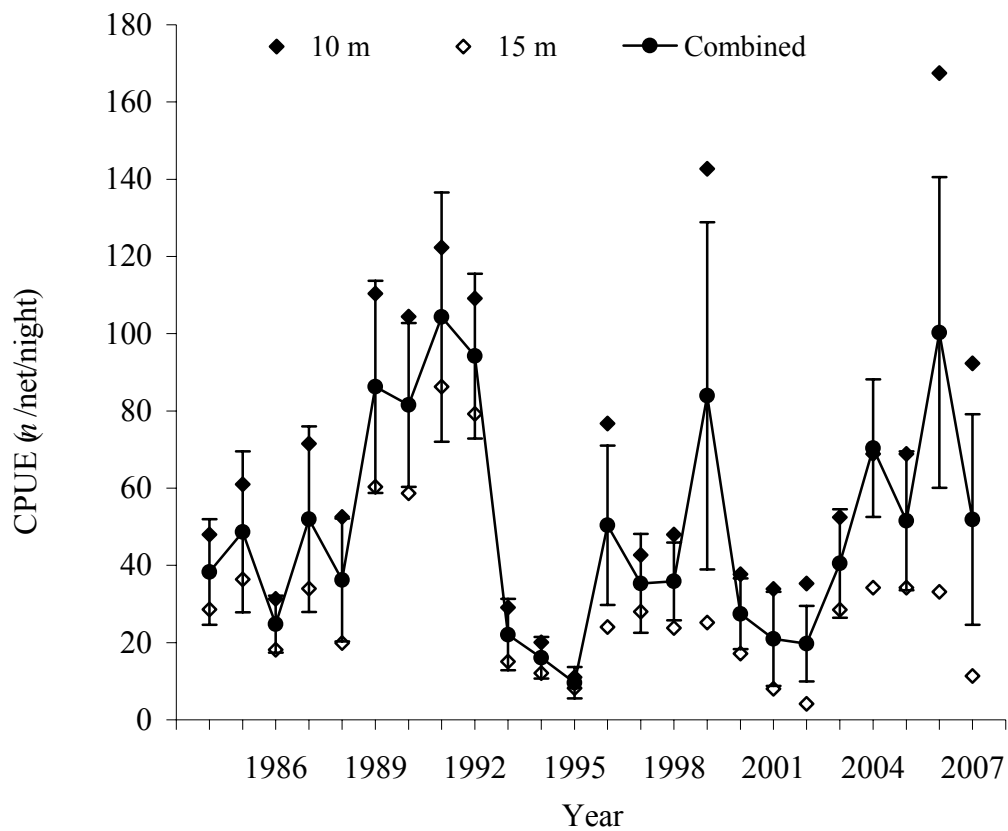


Figure 4. Mean annual gill net CPUE of yellow perch at 10 m, 15 m, and combined depths from pooled sites in Indiana waters of Lake Michigan from 1984 to 2007. Error bars for 1984 to 2007 are  $\pm 2$  SE.

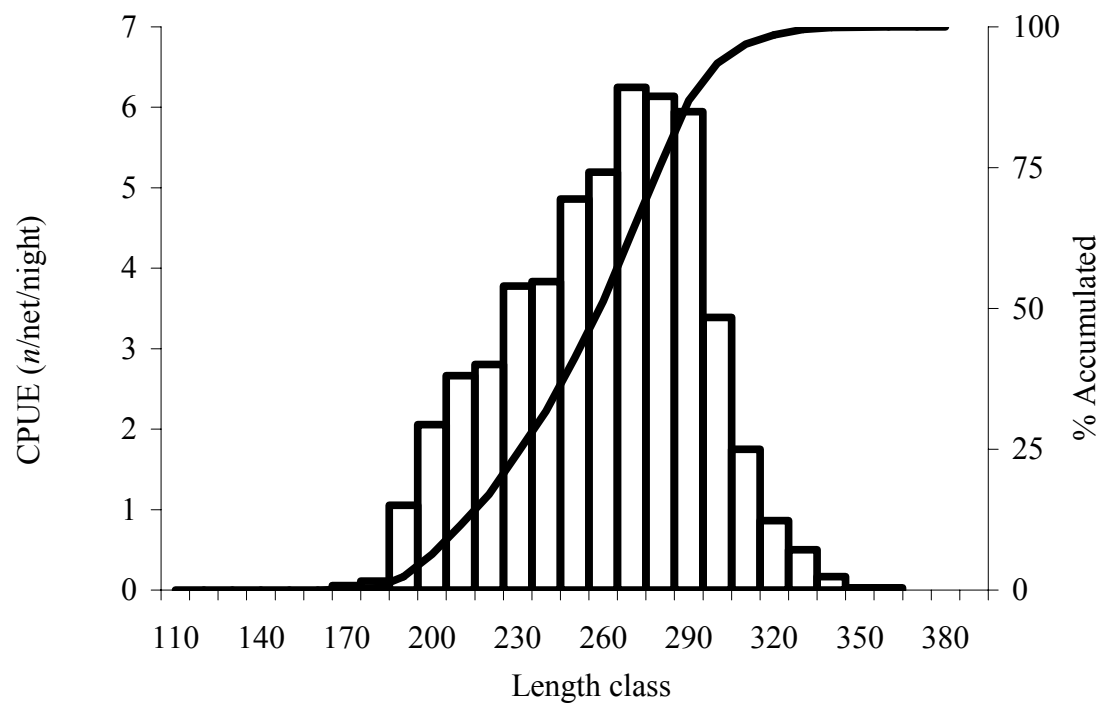


Figure 5. Length frequency and percent accumulated yellow perch from June to August gill-net catches in Indiana waters of Lake Michigan, 2007.

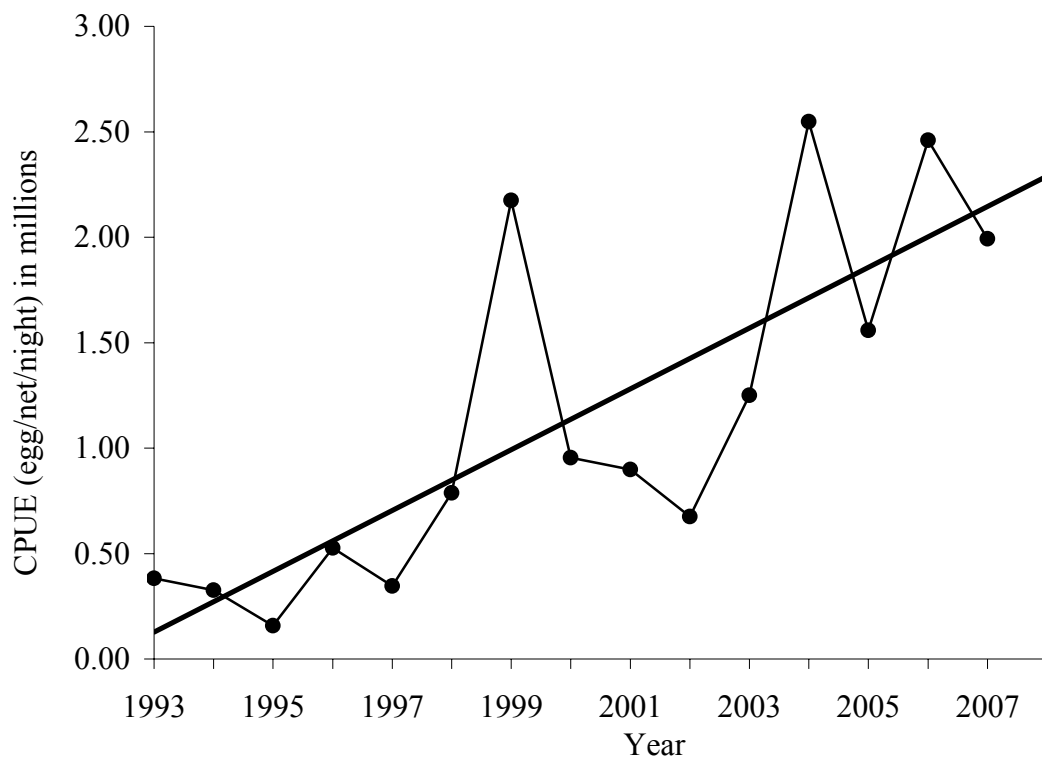


Figure 6. Yellow perch reproductive potential from gill-net catches in Indiana waters of Lake Michigan, 1993 to 2007. Trend line is best fit.

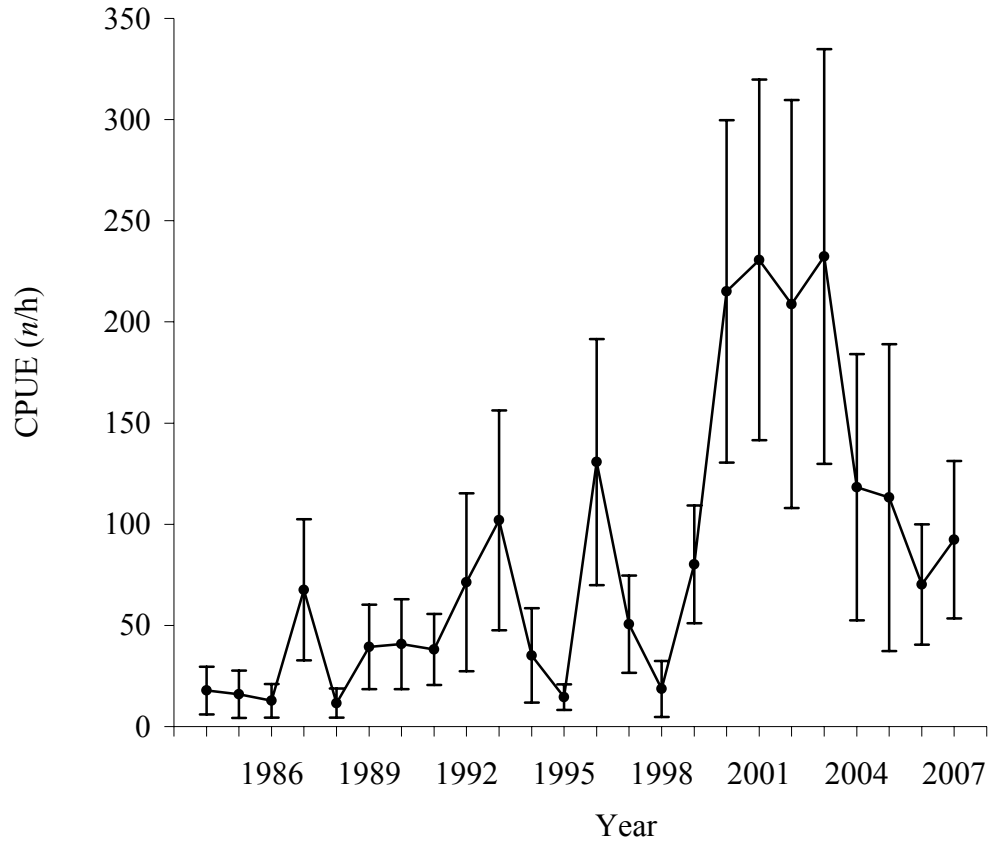


Figure 7. Mean annual trawl CPUE of alewives age  $\geq 1$  from pooled sites in Indiana waters of Lake Michigan from 1984 to 2007. The 1984 to 1988 data represent pooled sites M and K; the 1989 to 2007 data represent pooled sites M, K, and G. Error bars are  $\pm 2$  SE.

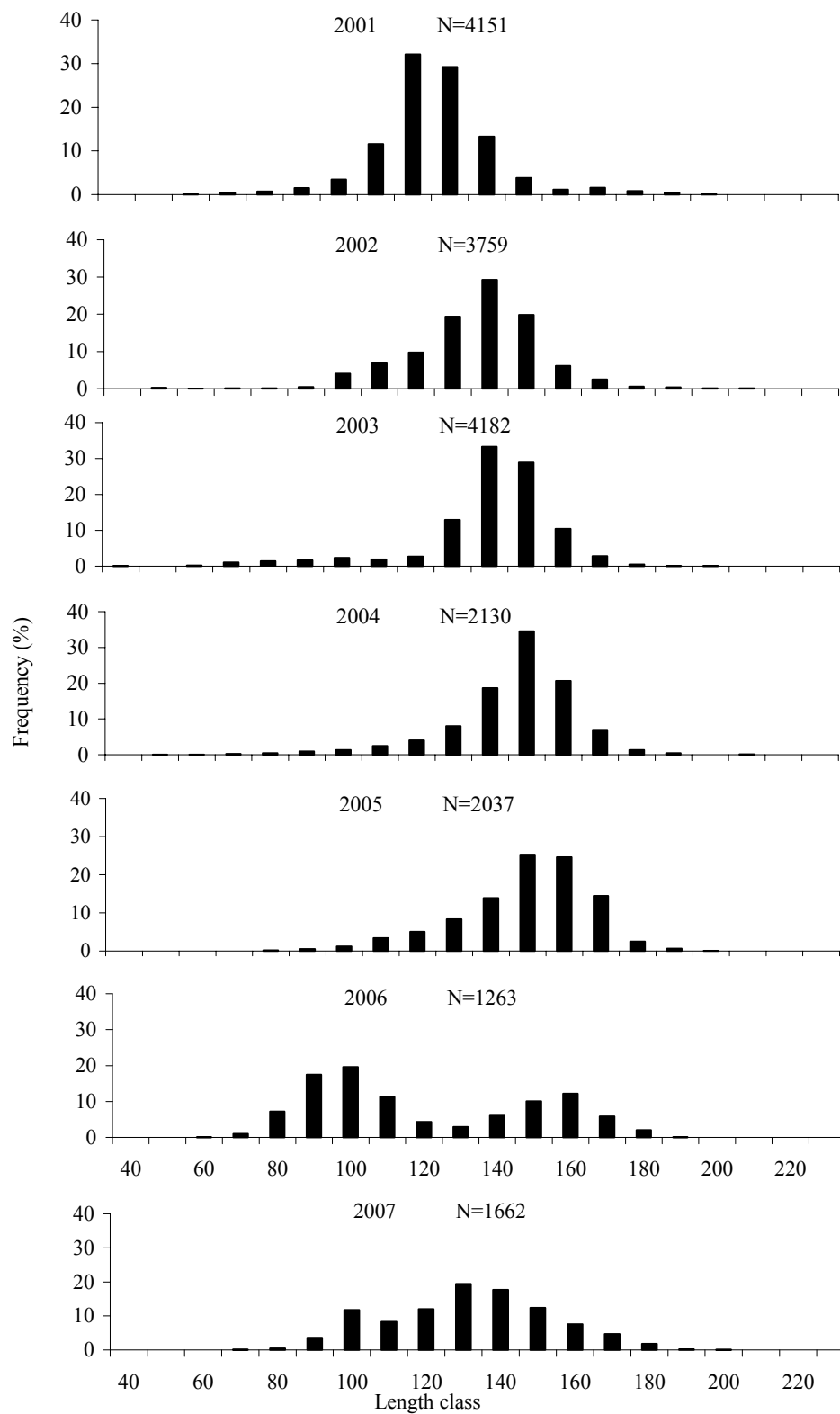


Figure 8. Length frequency distribution of alewives from June to August trawl catches in Indiana waters of Lake Michigan, 2001 to 2007.

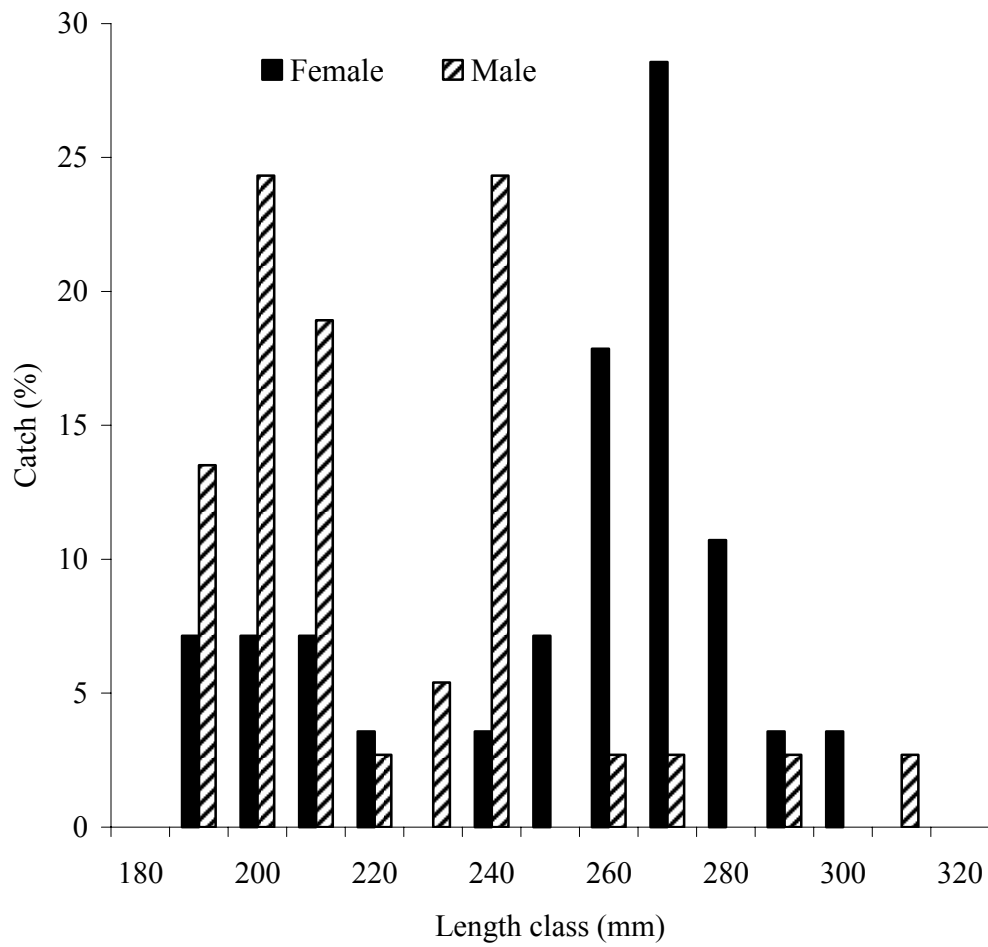


Figure 9. Length frequency distribution of female and male yellow perch age $\geq$ 1 from May gill-net catches in Indiana waters of Lake Michigan, 2007.

ratio of females to males was nearly 50:50. Female yellow perch ranged from age 4 to 10 and males ranged from age 2 to 10 (Figure 10).

The fall young-of-the-year sampling produced 302 age-0 yellow perch weighing 558 g (Table 3). Overall catch rate was 38/net-lift. The majority of the age-0 yellow perch were collected on the sand substrate (90.0%), during the day (98.7%) and at the 3 m depth contour (95.0%). However, it is important to note that nearly all (253) were collected in one net lift. No age-0 yellow perch were collected in the 20.0 and 25.0 mm stretch mesh.

### **Conclusions**

Results of 2007 sampling in Indiana waters of Lake Michigan provided some evidence the yellow perch stock is trying to rebuild. Gill-net CPUE of stock sized yellow perch continues to be high. Furthermore, the reproductive potential of mature female yellow perch remains well above levels observed in the early 1990s as defined by eggs/net/night from gill-net catches. We continue to observe large yellow perch in the gill-net catches with dominance by females. These observations along with a continued reduction in alewife catch rates may allow for the building of the yellow perch population in the Indiana waters of Lake Michigan in the coming years.

The experimental sampling of adult and age-0 yellow perch was successful. While it will be a few years before we can begin drawing inferences and constructing useful models, we can make some general conclusions for future sampling. Adult yellow perch sampling yielded relatively low catch rates, however they were predominantly quality size fish. At the time of sampling, the thermocline was deeper than 15 m and outside our sampling area. From this, we believe higher catch rates with increased sampling would not have occurred, as temperature does influence movement and behavior. The micromesh gill-net sampling could be improved. The larger stretch mesh (>16 mm) did not catch any age-0 yellow perch. It is recommended that the use of micromesh gill nets in the future only consists of 12 and 16 mm stretch mesh if sampling is done at this time of year (mid-September). It is also recommended that nets are set and ran during the day. With the exception of the catch in one daytime set during the day at site M, 88.9% of the remaining age-0 yellow perch were sampled during daytime sets. A more detailed analysis will be conducted after collaboration with the yellow perch task group.

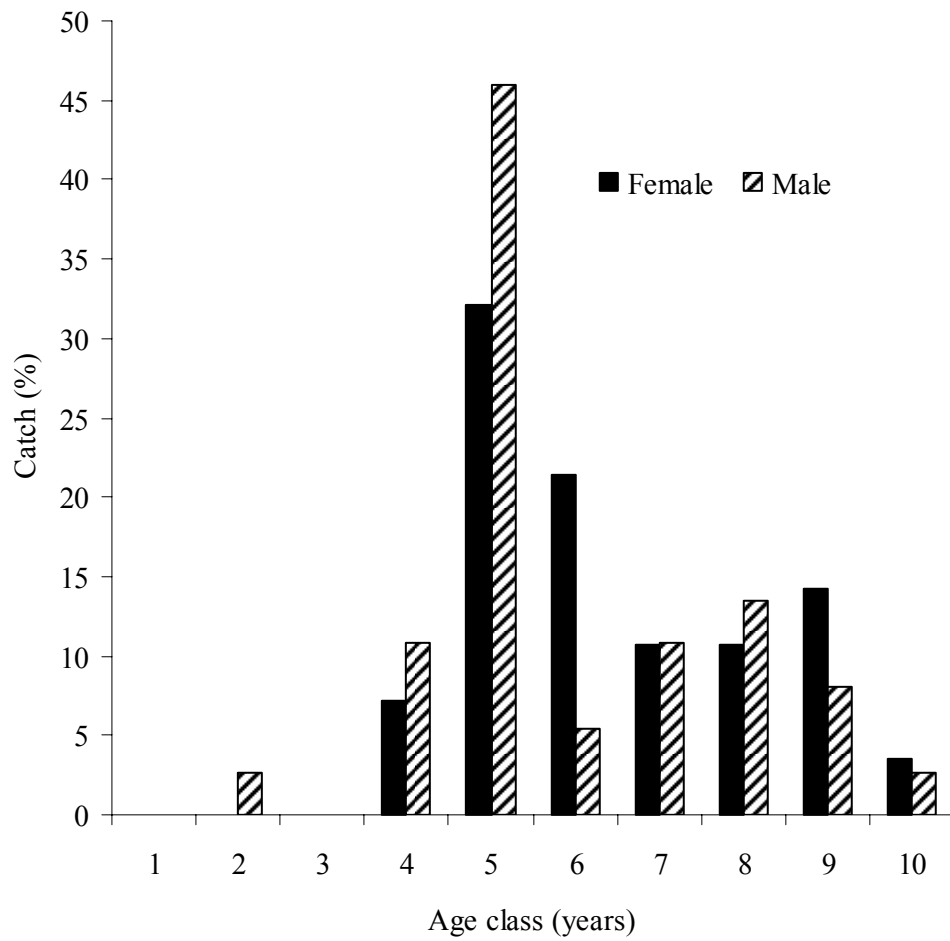


Figure 10. Age frequency distribution of female and male yellow perch from May gill-net catches in Indiana waters of Lake Michigan, 2007.



Table 3. Micromesh gill-net catches of age-0 yellow perch in Indiana waters of Lake Michigan in 2007. *n* is the total number sampled in the individual sampling event.

Site	Period	Depth	Mesh Size (mm)	N	Wt. (g)
K	Day	3	12	24	42
K	Day	3	16	2	4
K	Day	5	12	3	6
K	Night	5	12	2	4
M	Day	3	12	253	460
M	Day	3	16	8	25
M	Night	5	12	2	3
M	Day	5	12	8	14
Total				302	558

## References

- Lauer, T.E., and J.C. Doll. 2007. Final 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 Division of Fish and Wildlife, Indiana Department of Natural Resources, Indianapolis.
- Lauer, T. E., S. M Shroyer, J. M. Kilpatrick, T. S. McComish, and P. J. Allen. 2005. Yellow perch length-fecundity and length-egg size relationships in Indiana waters of Lake Michigan. *North American Journal of Fisheries Management* 25:791-796.
- Shroyer, S. M., and T. S. McComish. 2000. Relationship between alewife abundance and yellow perch recruitment in southern Lake Michigan. *North American Journal of Fisheries Management* 20:208-213.

## Appendices

Appendix 1. Coordinates of the trawl zone at sites M, K, and G in Indiana waters of Lake Michigan during 2007.

Site	North	East End	West End
M	N 41° 44' 17.1"	W 86° 52' 39.6"	W 86° 44' 06.0"
K	N 41° 42' 37.6"	W 86° 56' 01.1"	W 86° 56' 56.4"
G	N 41° 37' 28.6"	W 87° 14' 36.6"	W 87° 15' 31.8"

Appendix 2. Annual mean CPUE values by gear type for species caught in Indiana waters of Lake Michigan during 2007.

Species	Trawl ( <i>n/h</i> )	Gill Net ( <i>n/net/night</i> )
Spottail shiner	153.2	
Alewife	92.3	0.1
Yellow perch	79.8	51.9
Round goby	71.9	0.2
Rainbow smelt	0.6	
White sucker	0.4	0.9
Longnose sucker	0.4	0.3
Lake whitefish	0.1	1.3
Gizzard shad	0.1	0.9
Channel catfish	0.1	0.1
White perch	0.1	< 0.1
Chinook salmon	0.1	< 0.1
Brown trout		0.1
Lake trout		0.1
Freshwater drum		< 0.1
Steelhead trout		< 0.1