Illinois Department of Natural Resources

Division of Fisheries

Yellow Perch Monitoring in Lake Michigan: 2019 Adult and Young-of-Year Assessments

Daniel Makauskas and Rebecca A. Redman
Illinois Department of Natural Resources
Lake Michigan Program
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EXECUTIVE SUMMARY

During 2019, graded mesh gill nets were used to assess the relative abundance and age structure of Yellow Perch along two transects in Illinois waters of Lake Michigan. Additionally, beach seining was conducted at five shoreline locations to estimate relative abundance of young-of-year perch as an early life stage index of year-class strength. Catch-per-unit-effort of Yellow Perch was higher than that observed during 2018 at Lake Bluff (4.0 fish/30.5 m of net) and Foster Ave, Chicago (10 fish/30.5 m of net), but continued to be lower than levels observed during the early 2000's. Age 3 (2016 year-class) and age 4 (2015 year-class) Yellow Perch dominated the catch; each of these year-classes made up 46% of the total. In 2019, males outnumbered females at both assessment sites, which was a reversal from that observed during 2018. Poor recruitment strength continued with < 1 young-of-year Yellow Perch caught per seine haul in 2019.

INTRODUCTION

Yellow Perch (*Perca flavescens*) are an essential native component of Lake Michigan's nearshore-shore fish community that once supported substantial commercial fishing while remaining a popular catch among sport anglers around the lake. The abundance of Yellow Perch in Lake Michigan has fluctuated greatly over time including years of booming abundance followed by sharp declines. These population fluctuations are largely driven by variations in the recruitment of perch to the adult stock. A series of very strong year-classes in the 1980s resulted in a period of high Yellow Perch abundance supporting over 2 million pounds of commercial and recreational harvest annually for the period 1985 – 1993 (Makauskas and Clapp 2018). However, this was followed by a drastic decline in adult abundance and few to no young-of-year (YOY) Yellow Perch collected in lakewide sampling efforts during 1994 – 1997. Since that time, perch abundance in assessment catches has continued an uneven decline and only a few strong year-classes have been produced (i.e., 1998, 2005, 2010 and 2015). Lack of steady, measureable recruitment over a prolonged period resulted in a fishery sustained by only a few moderate year-classes and by 2014 the fishery was largely supported by a single year-class (2010).

As Yellow Perch abundance and sport harvest declined in the early 1990s and assessment catches showed an aging population, harvest restrictions were instituted on the sport and commercial fisheries in Illinois. The first restrictions on the sport fishery went into effect in 1995 when a 25 fish daily harvest limit and a closed season during the month of June were instituted. During this time, the Illinois commercial quota was also reduced from 343,000 to 120,000 lbs. and similar regulations on sport and commercial harvest were enacted in other states bordering the southern basin. However, by 1997 intense fishing pressure on larger female perch had resulted in a population where males comprised 97% of the adult stock. In response to this, a slot limit was introduced to protect faster growing females while focusing harvest on 8 to 10-inch male perch. Additionally, the sport harvest limit was reduced to 15 fish daily and the commercial quota was reduced to zero pounds, effectively closing the commercial perch fishery in Illinois. The states of Indiana and Wisconsin also instituted stricter regulations on their fisheries at this time. By 2001 the population structure had changed again. The slot limit was no longer protecting females and allowing males to be targeted, so this regulation was removed and the seasonal closure was changed from June to July. On average from 1997-2001, the highest proportion of total annual Yellow Perch harvest in Illinois occurred during the month of July. The July seasonal closure was a way to reduce overall harvest, afford more protection for Yellow Perch of all sizes and still allow perch fishing and regulated harvest for most of the year. The 15 fish daily limit and July closure remained in effect through 2013, although an additional rule that allowed anglers under the age of 16 to harvest 10 perch daily during July was in place from 2006 - 2013. Then, in 2013 the July closure was terminated and the closed season was changed to 1 May - 15 June for all anglers effective from April 1, 2014 through the present. The harvest limit remains unchanged at 15 perch per day.

While harvest pressure contributed to the rate at which Yellow Perch abundance decreased during the 1990's, other major changes in the lake, such as the introduction and establishment of several exotic species, exacerbated the speed and magnitude of the population decline. The expansion of Zebra Mussels followed by Quagga Mussels not only led to a re-engineered lake bottom, where adult Yellow Perch feed and spawn, but also an increase in water clarity and an altered food web. Offshore zooplankton, the obligate food of larval perch, has declined since the arrival of Dreissenid mussels and a shift away from zooplankton species that prefer warmer, surface waters (Vanderploeg et al. 2012), where young yellow perch typically feed, has also occurred. Such major ecosystem and food web changes in a relatively short time-frame likely make it difficult for young perch to find enough food to grow sufficiently and survive to adulthood.

The objectives of this ongoing study are to: 1) monitor changes in the relative abundance of Yellow Perch across years; 2) monitor growth and the population sex ratio for Yellow Perch; 3) collect age-composition data to determine year-class strength; 4) evaluate anticipated recruitment through standardized sampling and estimates of YOY abundance.

METHODS

Adult Assessment

Yellow Perch were sampled with graded-mesh gill nets on 21-31 May 2019 (Table 1) along sampling transects at Lake Bluff and Foster Avenue, Chicago (Chicago hereafter, Figure 1). Gill nets consisted of six panels of differing length and mesh sizes: one 15 m panel each of 25 and 38 mm mesh, a 30.5 m panel of 51 mm mesh, one 91.5 m panel each of 64, 76, and 89 mm mesh. The total length of each gill net was 335 m and nets were fished on the bottom for approximately 24 hours. Five depth stations were sampled off both Lake Bluff and Chicago (7, 11, 12, 18 and 22 m) and an additional deep water station (26 m) was sampled only at Lake Bluff. A total of 10 nets were fished in 2019. Captured fish were sorted by mesh size, identified and counted. A subsample of Yellow Perch (25 fish per mesh) was measured, weighed, examined for gender and maturity, and kept for otolith extraction. Otoliths were processed following methods of Robillard and Marsden (1996). Catch-per-unit-effort (CPUE) of Yellow Perch was calculated for each mesh size (25 – 89 mm) as the average number of Yellow Perch caught per 30.5 m of gill net at all depth stations along a transect.

Young-of-Year Assessment

Beach seining was conducted weekly from July through early September 2019 (Table 2) at five shoreline sites from North Point Marina in the north to Jackson Park Outer Harbor in the south (Figure 1). A 9.1 by 1.8 m bag seine with 6 mm mesh netting was pulled perpendicular to shore over a distance of approximately 15 m. A total of 43 seine hauls were conducted in 2019. Sampled fish were identified to species and Yellow Perch and sensitive species (e.g., Banded Killifish) were placed in a bucket of lake water prior to processing. A subsample of up to 25 individuals of each species was measured (nearest 5 mm total length) from each seine haul. Remaining fish were counted and all sampled fish returned to the water. CPUE of YOY Yellow Perch was calculated as the number of fish per seine haul.

RESULTS

Relative Abundance

Compared to 2018, average CPUE in 2019 increased from 1.8 to 4.0 Yellow Perch per 30.5m of net at Lake Bluff (Table 3, Figure 2) and from less than one Yellow Perch to 10 perch per 30.5 m of net at Chicago (Table 4, Figure 2). Catches in 25-mm mesh decreased in 2019 compared to 2018 at the Lake Bluff and Chicago sampling transects, but catches in 38 – 76 mm mesh increased at both locations in 2019. Overall, these results show continuing low abundance of adult Yellow Perch in Illinois waters of Lake Michigan in recent years compared to abundance observed in past decades.

2019 Year-Class

Relative year-class strength can be assessed by using standardized beach seining techniques to capture YOY Yellow Perch and comparing catches among sample years. Forty-three seine hauls were conducted during 2019, during which a total of eight YOY Yellow Perch were collected (Figure 3). Low abundance of the 2019 year-class suggests that it is unlikely to make a measurable contribution to the adult stock in future years. The seining information must continue to be evaluated in order to determine if the accuracy and usefulness of this assessment are changing given observed changes in the lake (e.g., increased water clarity). Strong YOY catches in recent years (2010 and 2015) have not resulted in proportionate recruitment to the adult stock, suggesting that factors affecting Yellow Perch at older ages have become more important in determining year-class recruitment to the fishery.

Catch at Age

A total of 189 Yellow Perch were aged from the 2019 assessment, ages ranged from 2 to 9 years old. Age 3 (2016 year-class) and age 4 (2015 year-class) fish were most common; each of these year-classes comprised 46% of the total catch in 2019 (92% of the total; Table 5, Figure 4). Age 5 (2014) and age 2 (2017) also contributed minimally to the catch.

Length at Age

The inconsistent recruitment of Yellow Perch to the adult stock has resulted in a population comprised of only a few year-classes. Low numbers of Yellow Perch captured outside of ages 3 and 4 make it difficult to determine any trends in mean length at age for the Yellow Perch population in Illinois. In 2019, age 3 females showed a small increase in size relative to 2018 (Figure 5), length for age 3 males increased slightly from 2018 to 2019, as well (Figure 6). Low catches in 2018 and the few year-classes represented in both 2018 and 2019 limit any additional comparisons.

Sex Ratios

At the Lake Bluff transect, the sex ratio favored males 6.1:1 over females, differing from the 13.3 :1 of females to males observed in 2018. The sex ratio at Chicago was 3:1 males over females, also a change from 2018 when females outnumbered males 4.5:1. The percentage of female Yellow Perch caught in 64 mm mesh across both sampling transects (Lake Bluff and Chicago catch combined) decreased from 93% in 2018 to 53% in 2019. Sex ratios changed greatly in some cases from 2018 to 2019; however, low overall catches in 2018 should be considered when evaluating this sex ratio information.

MANAGEMENT RECOMMENDATIONS

1. Continue to monitor Yellow Perch populations in the Illinois waters of Lake Michigan.
2. Evaluate the current regulations to ensure that the Yellow Perch population is adequately protected and robust enough to withstand future environmental disruptions.

ACKNOWLEDGEMENTS

This study was conducted using Federal Aid in Sport Fish Restoration funds through grant F-65-R.

LITERATURE CITED

Makauskas, D., and D. F. Clapp. 2018. Status of yellow perch in Lake Michigan 2016-2017. Report to the Lake Michigan Committee. Sault Ste Marie, Ontario, March 2018.

Robillard, S. R., and J. E. Marsden. 1996. Comparison of otolith and scale ages for yellow perch from Lake Michigan. Journal of Great Lakes Research 22(2):429-435.

Vanderploeg. H. A., S. A. Pothoven, G. L. Fahnenstiel, J. F. Cavaletto, J. R. Liebig, C. A. Stow, T. F. Nalepa, C. P. Madenjian, D. B. Bunnell. 2012. Seasonal zooplankton dynamics in Lake Michigan: disentangling impacts of resource limitation, ecosystem engineering, and predation during a critical ecosystem transition. Journal of Great Lakes Research, doi10.106/j/jglr.2012.02.005

Table 1. Adult Yellow Perch gill net sampling dates and water temperatures during 2019.

Gill netting	Location	
Depth Station	Foster Avenue, Chicago	Lake Bluff
7m	21 May / 50F	29 May / 52F
11m	21 May / 50F	30 May / 50F
12m	24 May / 48F	29 May / 50F
18m	24 May / 45F	30 May / 49F
22m	No Sample	31 May / 47F
26m	na	31 May / 44F

Table 2. Young-of-year Yellow Perch beach seining dates and water temperatures (◦F) during 2019.

Beach Seining	Location				
Sample Date	North Point Marina Beach, Winthrop Harbor	Waukegan Municipal Beach	Tower Road, Winnetka	Farwell Avenue, Chicago	Jackson Park-Outer Harbor, Chicago
1 July	60	65	64	62	72
12 July	70	70	71	69	73
15 July	70	No Sample	70	74	76
24 July	70	70	No Sample	68	70
2 August	72	71	No Sample	69	71
6 August	69	73	72	72	76
16 August	No Sample	No Sample	73	72	76
21 August	72	No Sample	82	74	76
28 August	58	60	68	58	66
6 September	54	64	58	No Sample	66

Table 3. Catch-per-unit-effort (No. fish /30.5 m of net) of Yellow Perch caught in gill nets during 2000-2019 at the Lake Bluff sampling transect.

Year	25 mm Mesh	38 mm Mesh	51 mm Mesh	64 mm Mesh	76 mm Mesh	89 mm Mesh	Overall Average (38-76 mm)
2000	39	71	48	48	51	5	54
2001	1	142	69	43	22	4	69
2002	0	58	68	17	9	1	37
2003	3	30	89	38	27	8	46
2004	9	4	13	17	19	9	13
2005	7	28	25	17	14	16	21
2006	8	13.5	16	12	8	8	12
2007	16	30	12	11	6	4	15
2008	9	14	4	2	2	1	6
2009	3	47	24	8	3	3	20
2010	19	34	8	3	1	1	12
2011	15	11	7	4	3	1	6
2012	49	1	0	<1	<1	<1	<1
2013	2	4	4	2	<1	1	3
2014	1	0	1	<1	<1	<1	<1
2015	0	1	1	<1	<1	<1	<1
2016	0	0	1	<1	<1	<1	<1
2017	327	3	1	<1	0	<1	<1
2018	44	6	1	<1	0	0	2
2019	0	9	2	1	<1	0	4

Table 4. Catch-per-unit-effort (No. fish /30.5 m of net) of Yellow Perch caught in gill nets during 2000-2019 at the Foster Avenue, Chicago sampling transect.

Year	25 mm Mesh	38 mm Mesh	51 mm Mesh	64 mm Mesh	76 mm Mesh	89 mm Mesh	Overall Average (38-76 mm)
2000	100	58	63	31	24	5	44
2001	2	126	30	15	5	2	44
2002	0	73	40	21	8	2	35
2003	2	58	42	24	13	7	34
2004	38	22	11	14	9	3	14
2005	96	37	27	19	10	5	23
2006	6	10	6	4	4	1	6
2007	24	20	14	18	11	4	16
2008	5	10	7	8	8	3	8
2009	7	17	6	5	3	3	8
2010	15	54	20	6	2	2	20
2011	5	10	1	2	1	1	3
2012	94	10	2	6	3	2	5
2013	29	38	5	3	2	<1	12
2014	0	0	0	<1	<1	<1	<1
2015	0	2	3	<1	<1	<1	1
2016	1	1	2	<1	<1	<1	<1
2017	161	3	<1	<1	<1	<1	<1
2018	5	2	<1	<1	<1	<1	<1
2019	<1	17	19	4	1	<1	10

Table 5. Catch-per-unit-effort (No. fish /30.5 m of net) of each age group of Yellow Perch caught during 2000-2019. Data from both sampling transects were combined for mesh sizes 38 - 76 mm.

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	> Age 10
2000	27.1	6.1	0.3	5.0	0.7	0.4	0.1	0.4	0.9	7.8
2001	0	48.9	2.6	0.2	1.9	0.3	0.2	0	0.1	2.3
2002	0	0.2	33.5	0.7	0.2	0.7	0.02	0.06	0	0.7
2003	0.3	0.1	0.2	38.6	0.2	0.1	0.2	0	0	0.4
2004	2.2	1.2	0.1	<0.1	9.7	<0.1	<0.1	<0.1	0	<0.1
2005	<0.1	8.7	2.5	<0.1	0.2	9.8	0.1	<0.1	0.2	<0.1
2006	0.1	1.3	5.0	0.5	0.1	<0.1	2.0	0	<0.1	<0.1
2007	2.2	0.8	4.5	4.9	0.4	0.1	<0.1	2.1	<0.1	0
2008	<0.1	2.1	1.1	1.5	1.4	0.2	<0.1	<0.1	0.4	<0.1
2009	0.3	2.8	4.3	2.2	1.8	1.8	0.3	<0.1	<0.1	0.3
2010	0.5	3.9	2.9	4.6	1.4	1.3	1.3	<0.1	<0.1	<0.1
2011	<0.1	0.6	1.3	1.0	0.9	0.3	0.3	0.2	0	<0.1
2012	0	0.4	0.6	0.6	0.3	0.5	<0.1	0.1	0.1	<0.1
2013	<0.1	4.2	1.9	0.4	0.3	0.1	0.1	<0.1	0.1	<0.1
2014	0	0	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	0	<0.1
2015	<0.1	0.5	0	0.3	<0.1	0	0	<0.1	<0.1	0
2016	0	0.1	0.3	0	0.1	0	0	0	0	<0.1
2017	38.3	1.2	0	<0.1	<0.1	<0.1	0	0	0	0
2018	5.8	2.5	<0.1	0	<0.1	0	0	<0.1	0	0
2019	<0.1	3.2	3.2	0.4	<0.1	<0.1	0	<0.1	0	0

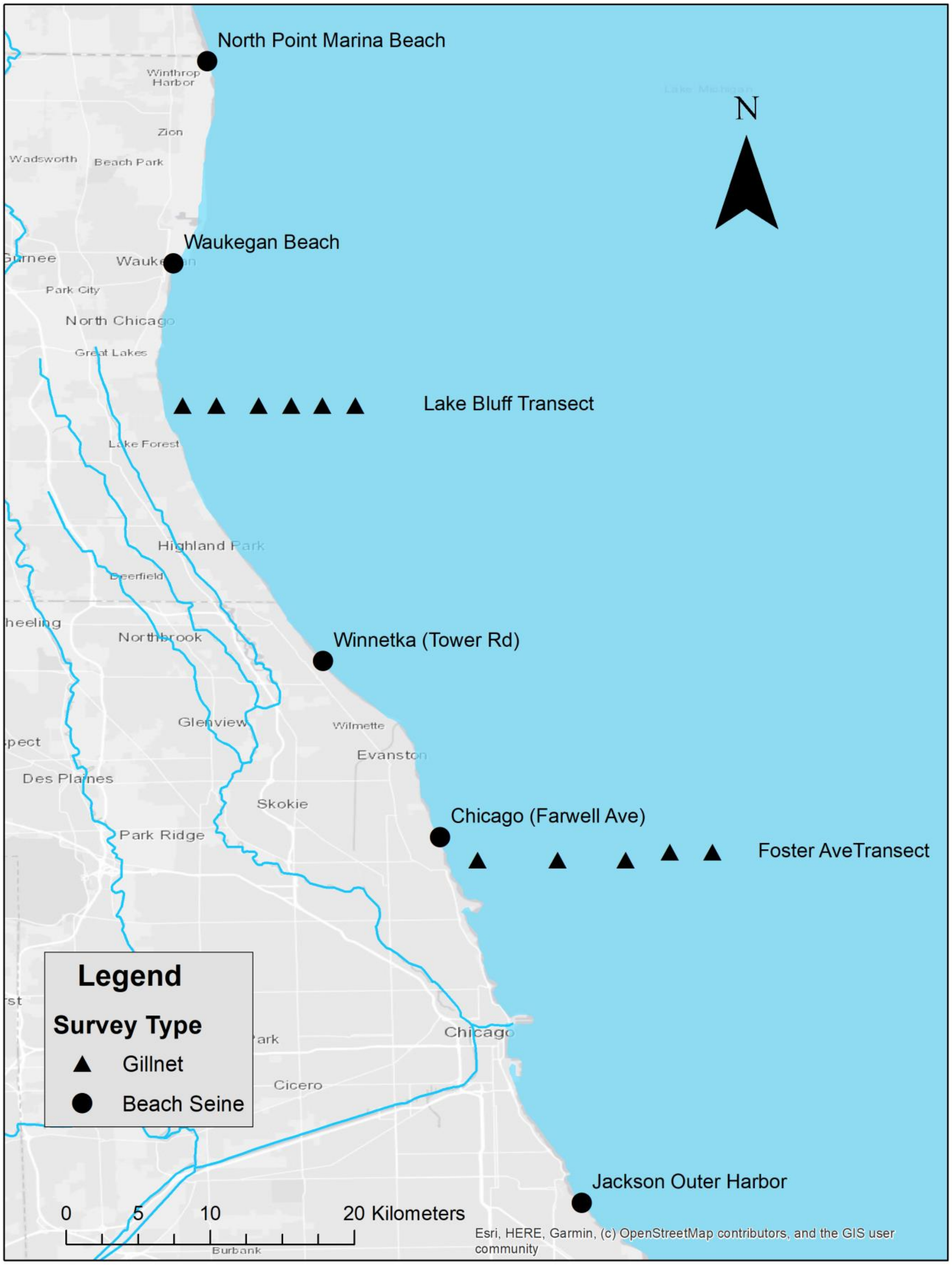

Figure 1. Location of adult Yellow Perch gill net sites (triangles) and young-of-year Yellow Perch beach seine sites (circles) in Illinois waters of Lake Michigan.

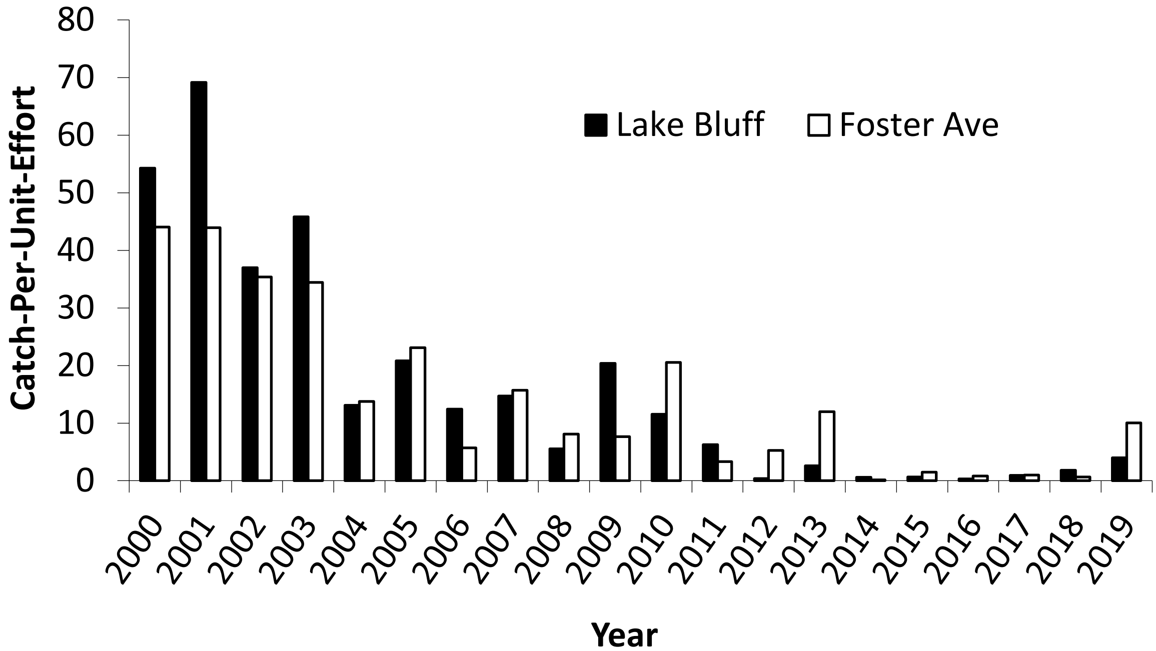

Figure 2. Adult Yellow Perch catch-per-unit-effort (No. fish/30.5 m of net) at annual assessment locations, Lake Bluff and Foster Avenue, Chicago during 2000-2019. Data from mesh sizes 38 – 76 mm were combined.

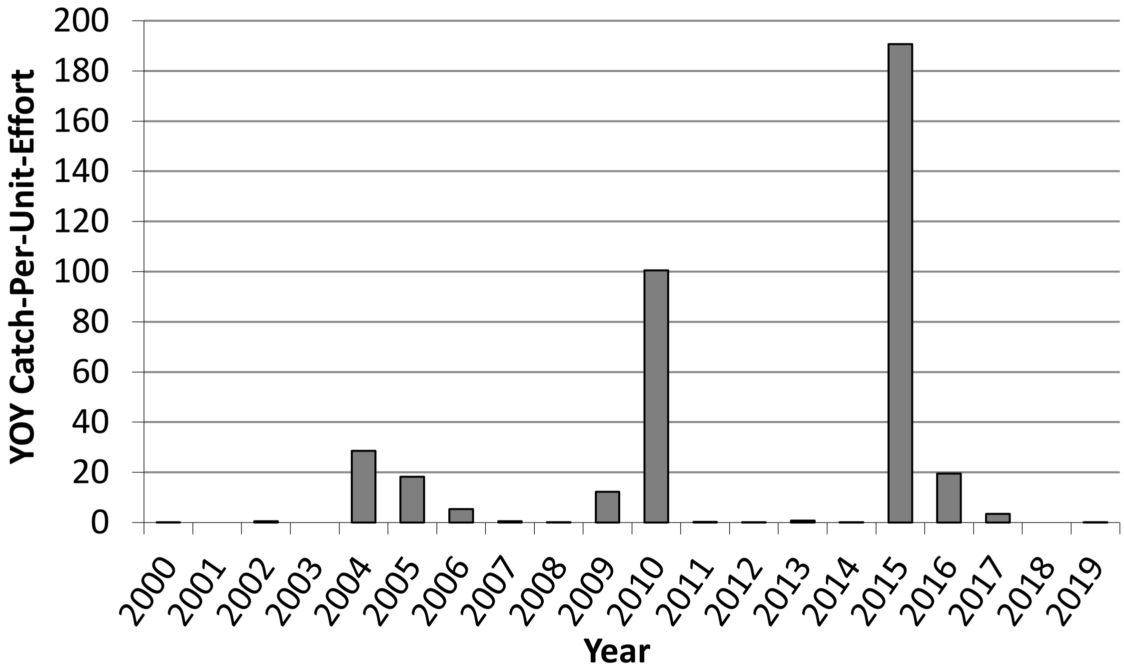

Figure 3. Catch-per-unit-effort (No. fish/seine haul) of young-of-year Yellow Perch sampled at five locations along the Illinois shoreline of Lake Michigan from North Point Marina south to Jackson Park Outer Harbor in Chicago, 2000-2019.

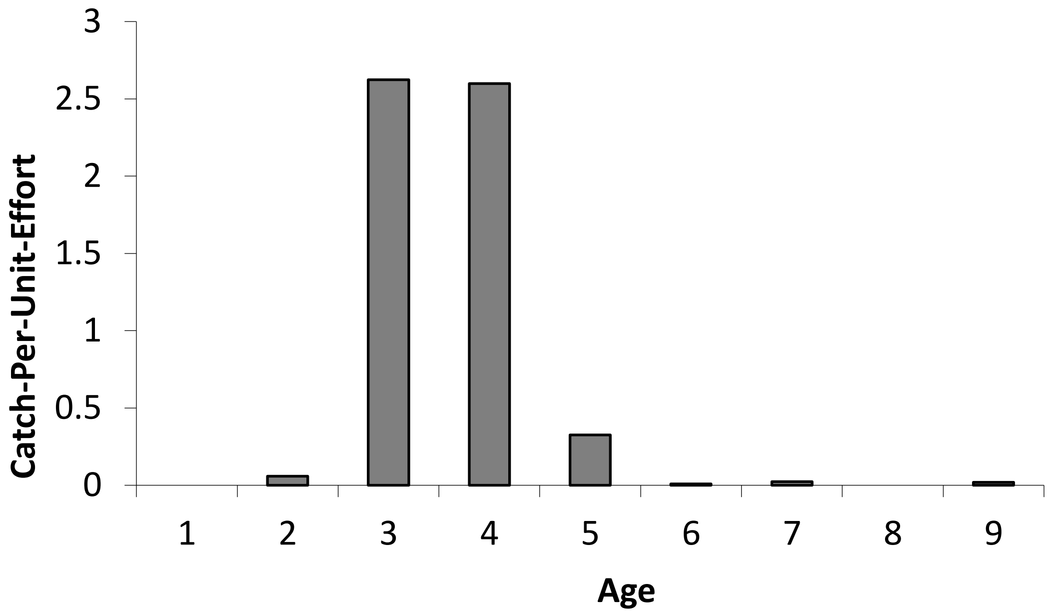

Figure 4. Catch-per-unit effort (No. fish/30.5 m of net) of Yellow Perch age classes collected in 38-76 mm mesh during 2019.

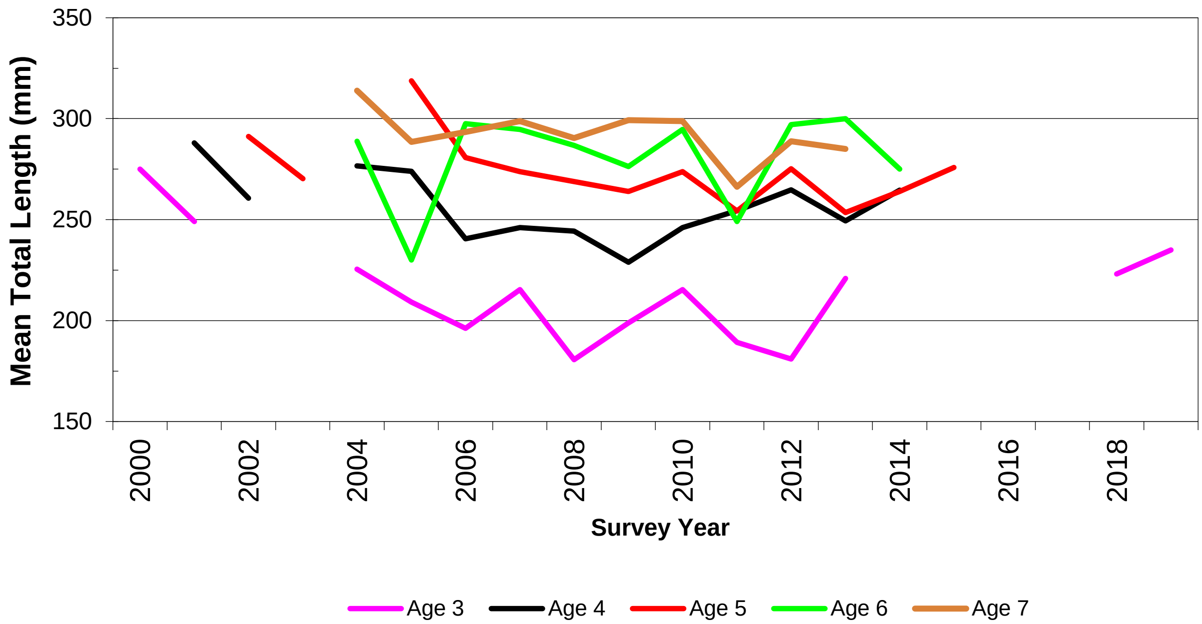

Figure 5. Mean total length of each age class of female Yellow Perch collected in gill nets during 2000-2019. Data from Lake Bluff and Foster Avenue, Chicago sampling transects were combined.

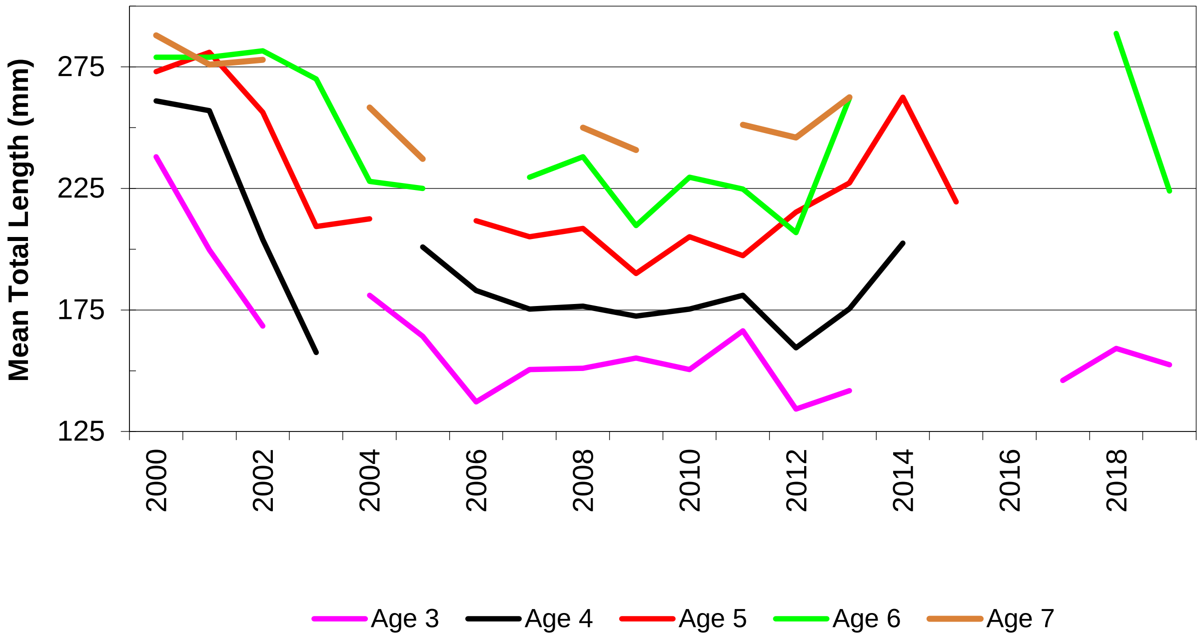

Figure 6. Mean total length of each age class of male Yellow Perch collected in gill nets during 2000-2019. Data from Lake Bluff and Foster Avenue, Chicago sampling transects were combined.