

Illinois Department of Natural Resources

Division of Fisheries

Nearshore Fish Community of Lake Michigan: 2022 Summer Harbor Assessment

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Lake Michigan Program
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Executive Summary

Pulsed DC electrofishing was used to assess the nearshore fish community in two Illinois harbors and the shoreline inside Calumet Harbor from May – mid-August 2022. Sampling could not be conducted at Jackson Inner Harbor during 2022 due to lack of launch ramp access during the Jackson Park Transportation Improvement and Obama Presidential Center construction projects. Species richness was highest in North Point Marina with a total of 23 fish species detected. We detected 20 species in Waukegan South Harbor and 11 species along the shoreline in Calumet Harbor. Rock Bass, Pumpkinseed, Smallmouth Bass, Largemouth Bass, and Bluegill were the most abundant targeted, sportfish encountered. In 2022, a total of 128 Smallmouth Bass were collected; of these 106 were Stock size (≥ 180 mm), 79 were Quality size (≥ 280 mm), 50 were Preferred size (≥ 350 mm), 11 were Memorable size (≥ 430 mm), and one trophy size (≥ 510 mm). Sixty-four Largemouth Bass were sampled in 2022 and 26 of these were Stock size (≥ 200 mm). A total of 13 Largemouth Bass were Quality size (≥ 300 mm) and 2 were Preferred size (≥ 380 mm). No Memorable (≥ 510 mm) or Trophy size (≥ 630 mm) Largemouth Bass were sampled. Overall, relative weight of Stock size Smallmouth Bass and Largemouth Bass was equivalent to or higher than the species-specific standard weight. A total of 234 Rock Bass were collected in 2022 and 197 of these were Stock size (≥ 100 mm). A total of 70 were Quality size (≥ 180 mm), and 9 were Preferred size (≥ 230 mm). No Memorable size (≥ 280 mm) or Trophy size (≥ 330 mm) Rock Bass were sampled. The relative weight of Stock size Rock Bass tended to be higher than standard weight.

Introduction

Several sport and non-sport fish species inhabit Illinois harbors and nearshore areas of Lake Michigan during summer. Common sport fish found in these areas include Smallmouth Bass (*Micropterus dolomieu*), Largemouth Bass (*Micropterus salmoides*), Yellow Perch (*Perca flavescens*), Northern Pike (*Esox lucius*), Black Bullhead (*Ameiurus melas*), Rock Bass (*Ambloplites rupestris*), and several other Centrarchids (sunfish family). There has been an increasing demand for sport fishing opportunities in nearshore areas and an increased interest in the nearshore sport fishery since 1998, especially for Largemouth and Smallmouth Bass. Increases in the abundances of these warm- and cool-water fish species and angler effort for non-perch and non-salmonid fish species in the Illinois waters of Lake Michigan are evident from sport angler creel data. Prior to 1996 no estimate of Smallmouth Bass harvest could be calculated from creel data because few were found in the possession of anglers. However, by 2000 anglers reported catching an estimated 4,892 Smallmouth Bass (Brofka and Dettmers 2006) and since 2015 annual catch has ranged from approximately 3,840 to a peak of 12,951 Smallmouth Bass (previous segments of F196).

Historical stocking of juvenile Smallmouth Bass in Illinois harbors may or may not have contributed to the establishment of sustainable populations. For example, no stocking records exist for Largemouth Bass and yet they are also observed in the nearshore fish community. Regardless, stocking events for Smallmouth Bass were small scale, sporadic and last occurred in 1985. Since that time, young-of-year (YOY) Smallmouth Bass have been captured at multiple sites that were never stocked and have been collected in areas where no Smallmouth Bass were collected in the past (e.g., Farwell Avenue Pier since 2000). Both these observations suggest that natural reproduction and immigration have allowed Smallmouth Bass to expand its range along the Illinois shoreline. Regarding Largemouth Bass, there are several potential sources for brood fish to have entered Lake Michigan in the past, such as the Lake Calumet complex, Wolf Lake, the Japanese Gardens ponds at 59th Street Harbor, Lincoln Park Zoo ponds, the diversion structure at the North Branch of the Chicago River (Wilmette), and Prairie Cove Harbor on the Illinois/Wisconsin state line. Remnant populations of brood fish may have existed in these locations until recent changes in the lake favored their dispersal. Over the past 10 years, monitoring data suggest stable abundance of Smallmouth Bass, a downward trend in the abundance of Largemouth Bass, and quality sizes of both species within Illinois waters of Lake Michigan. In fact, during 2019 a pedestrian angler landed the new Illinois state record Smallmouth Bass (22.5 inch, 7lb 3oz) along the shoreline at Monroe Harbor.

Although management of fish species inhabiting nearshore areas has been incorporated into the Illinois Strategic Plan for Lake Michigan fisheries since the early 1980s, personnel and funding deficiencies did not allow their investigation until 1995. This assessment program was developed to monitor the relative abundance and

distribution of nearshore sport fish species and to determine whether those species were susceptible to overexploitation by tracking changes in relative abundances over time. Species composition, abundance, and length distribution data were previously obtained through incidental catches of non-salmonid fish species during fall electrofishing for returning salmonids and through a sport angler creel survey. During creel surveys sport anglers were interviewed, fish in their possession were measured and weighed, and estimated sport harvest was used as an index of the relative abundance of these fish species. Abundance and species composition data obtained through a creel survey, however, may be biased because anglers target specific species, effort is not equivalent at all locations, and harvest (rather than total catch) is usually reported. In addition to biological information (e.g., length and weight), an understanding of seasonal dispersal patterns of the sport fish associated with the nearshore fish community is required to effectively manage these species. If sport fish dispersal patterns for Lake Michigan are like the patterns observed in Lake Ontario, then some of these fish species will inhabit protected areas early in the year and later move into open lake areas once water temperatures reach 15° C (Danehy 1984).

The objectives of this ongoing study are to: 1) determine the fish species composition of select Illinois harbors and nearshore areas of Lake Michigan; 2) monitor changes in the relative abundances of Smallmouth and Largemouth Bass and other sport fish through time; 3) evaluate intra- and inter-annual fidelity of Smallmouth and Largemouth Bass to harbors; 4) monitor size structure and growth indices for sport fish inhabiting these harbors; and 5) collect age-composition data during select years which may eventually be used to determine recruitment rates of the most abundant fish species.

Methods

Fish were sampled using a boat electrofishing pulsed-DC control box (Smith-Root Inc.) capable of delivering 5kw from the GPP 5.0 generator to the electrodes. Pulse frequency was set to 60 Hz and duty-cycle was internally controlled. Total sampling time was based on harbor size, weather conditions, and the amount and type of fish collected. Selection of sampling sites (Figure 1) was based on harbor configurations that were conducive to electrofishing (i.e., availability of shallow water areas <3 m in depth), availability of a launch ramp, and sport-angler creel survey data. Two Illinois harbors and the shoreline inside Calumet Harbor were sampled in 2022 (Table 1). Sampling at North Point Marina was limited to the inner entrance of the north harbor, the channel connecting the north and south harbors, and the south harbor. At Waukegan, the south harbor was sampled. The Calumet Harbor site consisted of the rip-rap shoreline between the Calumet River and the north slip within Calumet Harbor. In addition, the north face of the confined disposal facility and the south face of the Calumet breakwall were sampled when weather and waves permitted.

Sport fish species were the target of electrofishing sampling effort. We attempted to capture all Largemouth and Smallmouth Bass that were encountered except for bass fry whose presence was only noted. Other targeted species (e.g., Rock Bass, Crappie, Yellow Perch) were subsampled to obtain a representative distribution of sizes. The presence of non-target, incidental species (e.g., Alewife, Gizzard Shad, White Sucker, and Common Carp) was usually only noted, but when possible established aquatic nuisance species (e.g., Goldfish, Koi) were captured and removed from the water. All other sampled fish were dip-netted and held onboard in a 100-gallon tank filled with a 0.5% solution of NaCl and lake water. An oxygen cylinder with an air stone was used to increase retention time and keep the fish alive while biological data were obtained. Fish were measured to the nearest 5 mm (maximum total length) and weighed to the nearest 10 grams. No pit-tagged Smallmouth or Largemouth Bass were collected during 2022.

Catch-per-unit-effort (CPUE) for targeted species was calculated as the number of fish per hour of electrofishing effort. Relative Stock Density (RSD) for Quality, Preferred, and Memorable length fish were calculated for Smallmouth Bass, Largemouth Bass, and Rock Bass (Table 2; Gabelhouse 1984 as reported in Anderson and Neumann 1996). Relative Weight (Wr ; a measure of a fish's body condition or plumpness) of Smallmouth Bass, Largemouth Bass, and Rock Bass was compared to species-specific Standard Weight (Ws) equations taken from Anderson and Neumann (1996). Only Smallmouth and Largemouth Bass collected after 15 June and Rock Bass collected after 31 May were included in this analysis because pre-spawn fish tend to have inflated Wr values.

Results and Discussion

Species Composition

Overall, we collected 12 targeted, sportfish species, 1 hybridized form of Centrarchid, and encountered 15 non-targeted (incidental) species by electrofishing in 2022. The highest number of species was detected in North Point Marina (23 species), followed Waukegan South Harbor (20 species), and then Calumet Harbor (11 species). Rock Bass, Pumpkinseed, Smallmouth Bass, Largemouth Bass, and Bluegill were the most abundant targeted, sportfish encountered. The presence and abundance of sportfish differed among harbors. For example, abundance of Rock Bass and Pumpkinseed was much higher in North Point Marina than at Waukegan Harbor and along the shoreline in Calumet Harbor (Table 3). Similar to previous years, CPUE (No. fish/hr) of Smallmouth Bass was highest at Calumet, while few other Centrarchid species were collected at this location. This is likely due to the Calumet site being an open-lake area more exposed to wave action, slower warm up during the spring, and rapid changes in water temperatures during the summer. All these factors may reduce the establishment of aquatic vegetation and Centrarchids. Typically, the highest catch rate of Largemouth Bass, Black Bullhead and Bluegill occurs at Jackson Inner Harbor, but sampling did not occur at this location in 2022.

The types of sport fish species we encountered in the two protected harbors (North Point Marina, Waukegan Harbor) were similar to those typically found in warm-water inland lakes with similar habitats. It is likely that increased aquatic vegetation in the protected areas of these harbors have produced favorable conditions for a number of these cool- and warm-water fish species (Jude et al. 2002). One major difference between these harbors and inland lakes is the abbreviated growing season caused by influxes of cool water from the main lake, which suppresses water temperatures in the spring and can intermittently decrease temperatures during summer upwellings. A second difference is the relatively restricted fishing access; much of the area within these harbors is dedicated to moored vessels and closed to fishing. Thus, Illinois harbors likely act as refuges on Lake Michigan where populations of warm-water fish may grow in a near natural state with limited fishing mortality.

Smallmouth Bass

A total of 128 Smallmouth Bass that ranged in length from 80-525 mm were sampled in 2022. Eighty-three percent of these fish were Stock size (N=106, ≥ 180 mm), the majority of which were collected at Calumet Harbor (N=80; Figure 2). The length distribution of Stock size fish was superb with 75% Quality size (N=79), 47% Preferred size (N=50), 10% Memorable size (N=11) and 1 Trophy size fish (≥ 510 mm). The presence of smaller, juvenile fish (80- 175 mm) at the three sampled sites indicates that natural reproduction continues to occur throughout Illinois waters of Lake Michigan.

In 2022, Catch-per-unit-effort (CPUE) of Stock size Smallmouth Bass at North Point Marina remained low and nearly unchanged from that reported at this site since 2019. CPUE increased at Waukegan Harbor compared to 2021 and was the highest catch rate reported in 15 years along the shoreline in Calumet Harbor (Table 4). The average relative weight (Wr) of Smallmouth Bass sampled in 2022 was 107 which indicates these fish were at a healthy weight for their length. More specifically, measured weights of Smallmouth Bass ≤ 250 mm in length were similar to standard weights and higher than standard weights for fish > 300 mm, suggesting no food limitation for these fish (Ws ; Figure 3).

Largemouth Bass

Only 64 Largemouth Bass were sampled in 2022 and 26 of these fish were Stock size (≥ 200 mm). Over the last several years the majority of Largemouth Bass have been collected at Jackson Inner Harbor, so lack of sampling at this site in 2022 greatly reduced the number we encountered and measured this season. CPUE of Stock size Largemouth Bass increased slightly at Waukegan South Harbor and North Point Marina compared to 2021; however, relative abundances at North Point Marina remain far below the levels detected prior to 2015. No Largemouth Bass were caught along the shoreline in Calumet Harbor (Table 5).

Largemouth Bass collected in 2022 ranged from 85-460 mm in total length (Figure 4). Thirteen fish were Quality size and 2 were Preferred size. No memorable (≥ 510 mm) or trophy size (≥ 630 mm) Largemouth Bass were sampled. Almost 60% of all the Largemouth Bass sampled during 2022 were juvenile fish (≤ 195 mm) caught at North Point Marina, indicating reproduction is occurring in this region. Most of these fish were 105-125 mm in length and were likely age-1 based on past age analysis. The average relative weight (Wr) of Stock size Largemouth Bass was 105 in 2022 which indicates good body condition. Measured weights of these fish were similar to or slightly higher than standard weights for fish < 230 mm and generally higher than standard weights for fish > 240 mm (Ws ; Figure 5).

Rock Bass

Rock Bass were more abundant than Smallmouth or Largemouth Bass in our samples during 2022 and the highest catches occurred in North Point Marina. CPUE of Stock size Rock Bass declined at North Point Marina and Waukegan Harbor and was similar to that reported at Calumet in 2021 (Table 6). We sampled a total of 234 Rock Bass in 2022 of which 197 were Stock size (≥ 100 mm). Several Rock Bass were Quality size ($N = 70$) and fewer were Preferred size ($N = 9$). No memorable (≥ 280 mm) or trophy size (≥ 330 mm) Rock Bass were collected. Rock Bass ranged in length from 50-260 mm with 55% of the fish between 130-200 mm (5-7 inches; Figure 6). The average relative weight (Wr) of Rock Bass was 111 in 2022; the weight of fish measured in the field tended to be higher than standard weights for this species (Ws ; Figure 7).

Recommendations

1. Monitor angler effort directed at Smallmouth and Largemouth Bass and potential population expansions using shoreline creel surveys.
2. Collect a representative sample of abundant sport fish species during select years to determine ages.

Acknowledgements

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Table 1. Amount of electrofishing effort (hrs:min) and water temperature at two Illinois harbors and along the shoreline in Calumet Harbor during 2022.

<i>Sampling Date</i>	<i>Location</i>		
	<i>North Point Marina</i>	<i>Waukegan South Harbor</i>	<i>Calumet Harbor</i>
<i>11, 12 May</i>	<i>1:00 / 58F</i>	<i>0:20 / 57F</i>	<i>0:30 / 60F</i>
<i>20, 31 May</i>	<i>0:53 / 61F</i>	-	<i>0:22 / 56F</i>
<i>9, 10 June</i>	<i>1:02 / 62F</i>	<i>0:31 / 59F</i>	<i>0:48 / 62F</i>
<i>22, 23 June</i>	<i>0:55 / 70F</i>	<i>0:25 / 67F</i>	<i>0:37 / 70F</i>
<i>5, 6 July</i>	<i>1:02 / 62F</i>	<i>0:22 / 64F</i>	-
<i>15, 22 July</i>	<i>1:03 / 74F</i>	<i>0:29 / 70F</i>	<i>0:47 / 73F</i>
<i>10 August</i>	<i>1:02 / 68F</i>	<i>0:37 / 66F</i>	-

Table 2. Proposed minimum lengths (millimeters) for Smallmouth Bass, Largemouth Bass and Rock Bass of various length categories (taken from Gabelhouse 1984).

<i>Species</i>	<i>Size designation</i>				
	<i>Stock</i>	<i>Quality</i>	<i>Preferred</i>	<i>Memorable</i>	<i>Trophy</i>
<i>Smallmouth Bass</i>	<i>180</i>	<i>280</i>	<i>350</i>	<i>430</i>	<i>510</i>
<i>Largemouth Bass</i>	<i>200</i>	<i>300</i>	<i>380</i>	<i>510</i>	<i>630</i>
<i>Rock Bass</i>	<i>100</i>	<i>180</i>	<i>230</i>	<i>280</i>	<i>330</i>

Table 3. Fish species sampled during summer 2022 by electrofishing in two Illinois harbors and along the shoreline in Calumet Harbor. Catch-per-unit-effort (No. fish / hr. electrofishing) is shown for targeted species and the presence of incidental species is denoted with the letter P.

	Location		
	North Point Marina	Waukegan South Harbor	Calumet Harbor
<i>Target Species</i>			
Black Bullhead	0.14	0.37	
Bluegill	4.89	1.83	
Green Sunfish	3.02	0.37	
Largemouth Bass	8.20	2.56	
Northern Pike	1.30		
Pumpkinseed	29.21	0.73	0.33
Sunfish (hybrid)	1.30	0.37	
Rock Bass	27.63	14.27	0.98
Smallmouth Bass	2.16	7.32	30.3
Walleye			0.33
Warmouth	0.14	0.37	
Yellow Bullhead	1.01		
Yellow Perch	2.59	0.73	
<i>Incidental Species</i>			
Alewife	P	P	P
Bowfin	P		
Brook Silverside	P	P	
Brown Trout	P	P	P
Common Carp	P	P	P
Freshwater Drum	P		P
Gar spp.		P	
Gizzard Shad	P	P	P
Goldfish	P		
Redhorse spp.	P		
Rainbow Trout	P	P	
Round Goby	P	P	P
Sand Shiner		P	
Spottail Shiner		P	
White Sucker	P	P	P

Table 4. Catch-per-unit-effort (CPUE; No. fish / hr electrofishing) of Stock size (≥ 180 mm) Smallmouth Bass in three Illinois harbors and along the shoreline in Calumet Harbor, 2002-2022. *Caution should be used comparing 2020 CPUE among years due to reduced sampling effort during Covid-19 restrictions.

Year	Location			
	North Point Marina	Waukegan South Harbor	Jackson Inner Harbor	Calumet Harbor
2002	22.34	6.91	12.67	42.67
2003	10.19	3.69	5.65	12.57
2004	13.21	2.00	7.95	34.07
2005	15.35	3.98	1.09	15.71
2006	11.34	10.36	1.41	28.93
2007	4.17	2.62	0	30.79
2008	9.19	8.67	2.75	26.38
2009	7.67	2.14	2.11	20.70
2010	4.49	0.56	2.80	21.51
2011	12.57	5.79	2.41	14.52
2012	5.59	7.12	1.47	20.16
2013	5.43	3.60	0.54	17.42
2014	3.58	5.92	3.91	18.75
2015	2.49	3.82	1.23	22.67
2016	1.17	3.90	0	16.03
2017	5.17	3.86	1.89	16.24
2018	3.78	2.14	4.12	16.30
2019	1.67	1.38	4.56	15.66
2020*	1.38	7.07	1.25	6.15
2021	1.79	2.19	4.26	19.06
2022	1.15	6.57	NS	28.01

Table 5. Catch-per-unit-effort (No. fish / hr electrofishing) of Stock size (≥ 200 mm) Largemouth Bass in three Illinois harbors and along the shoreline in Calumet Harbor, 2002-2022. *Caution should be used comparing 2020 CPUE among years due to reduced sampling effort during Covid-19 restrictions.

Year	Location			
	North Point Marina	Waukegan South Harbor	Jackson Inner Harbor	Calumet Harbor
2002	26.98	24.73	42.67	0.67
2003	22.27	14.29	31.85	0.58
2004	54.40	35.00	74.43	1.47
2005	64.82	42.61	115.22	1.19
2006	36.51	31.53	56.34	1.02
2007	33.82	31.46	20.97	0
2008	51.59	14.67	48.62	0.43
2009	33.92	16.43	24.47	0
2010	19.16	10.61	30.84	0
2011	15.50	4.96	39.76	0
2012	10.66	7.12	19.06	0
2013	15.13	15.2	18.80	0
2014	19.32	9.17	16.29	0
2015	8.19	3.82	16.31	0
2016	3.51	1.46	13.66	0.42
2017	7.68	2.97	19.73	0
2018	5.26	4.50	16.25	0
2019	2.65	1.38	8.46	0
2020*	4.83	0.51	1.92	0
2021	1.46	0	19.55	0.25
2022	3.31	1.09	NS	0

Table 6. Catch-per-unit-effort (No. fish / hr electrofishing) of Stock size (≥ 100 mm) Rock Bass in two Illinois harbors and along the shoreline in Calumet Harbor, 2002-2022. *Caution should be used comparing 2020 CPUE among years due to reduced sampling effort during Covid-19 restrictions.

Year	Location			
	North Point Marina	Waukegan South Harbor	Jackson Inner Harbor	Calumet Harbor
2002	17.17	24.36	2.67	7.33
2003	12.09	31.34	2.42	3.51
2004	10.88	28.00	1.14	0.49
2005	19.83	21.02	4.35	0
2006	14.74	10.81	0	5.08
2007	16.18	14.98	0	5.30
2008	45.94	30.67	0	7.23
2009	47.49	5.71	1.27	4.85
2010	19.46	10.06	0.47	4.66
2011	31.58	21.49	4.22	0
2012	50.00	22.37	1.17	3.46
2013	50.66	22.40	3.27	2.44
2014	32.92	16.57	5.54	2.50
2015	29.54	10.88	5.85	1.00
2016	33.33	20.49	4.92	0.84
2017	37.22	21.36	3.24	1.86
2018	50.88	17.13	5.03	0.92
2019	33.01	22.93	2.82	1.96
2020*	36.55	8.08	1.28	0
2021	30.84	13.6	1.25	0.99
2022	23.20	12.04	NS	0.98

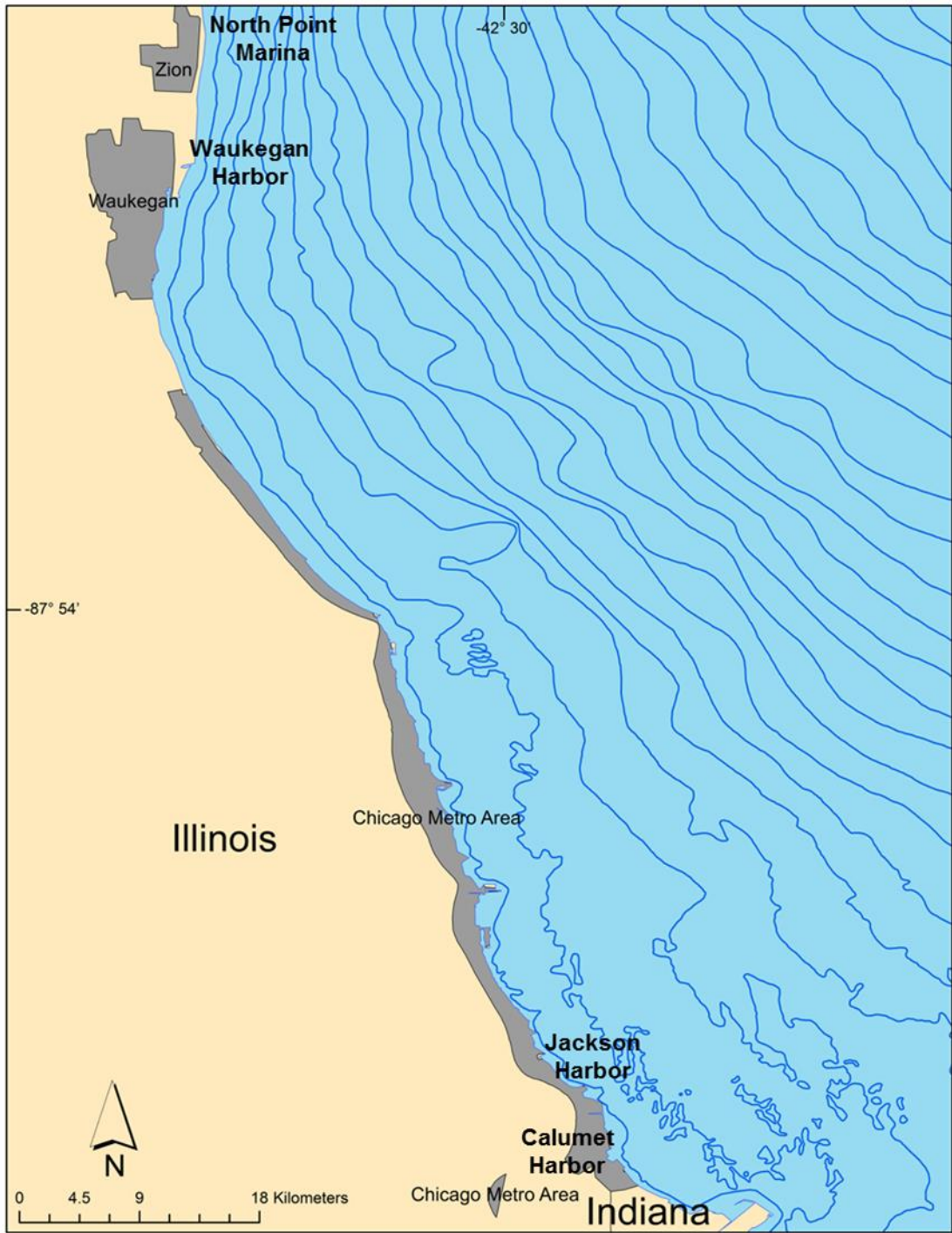


Figure 1. Location of Lake Michigan harbors sampled.

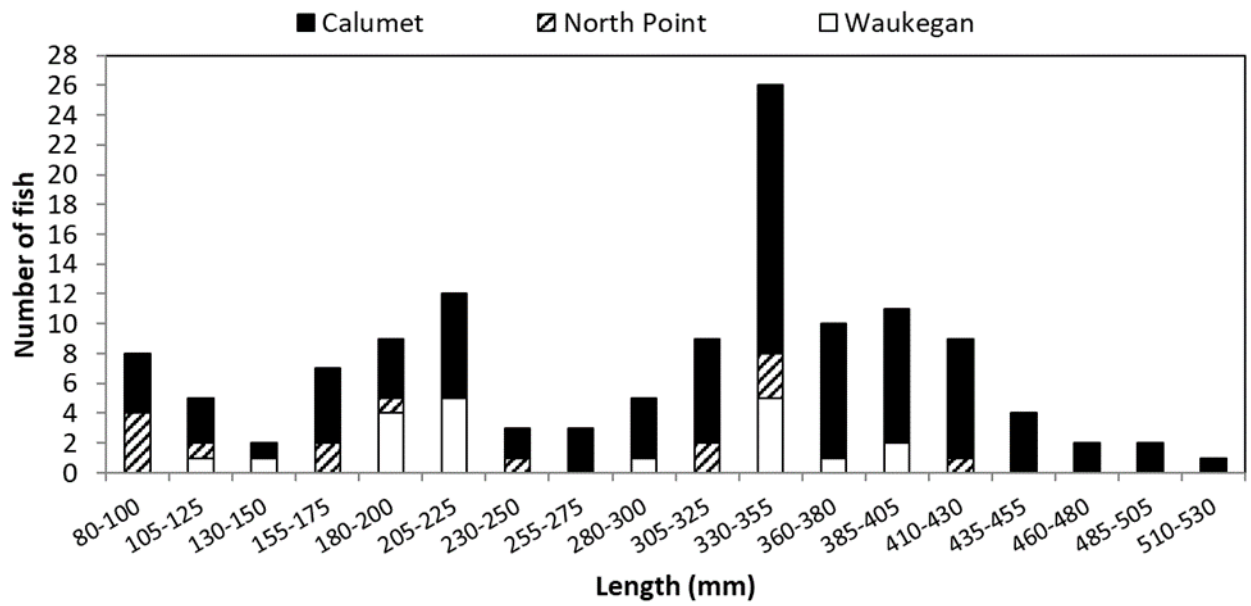


Figure 2. Length distribution of Smallmouth Bass sampled at two Illinois harbors and along the shoreline in Calumet Harbor during 2022.

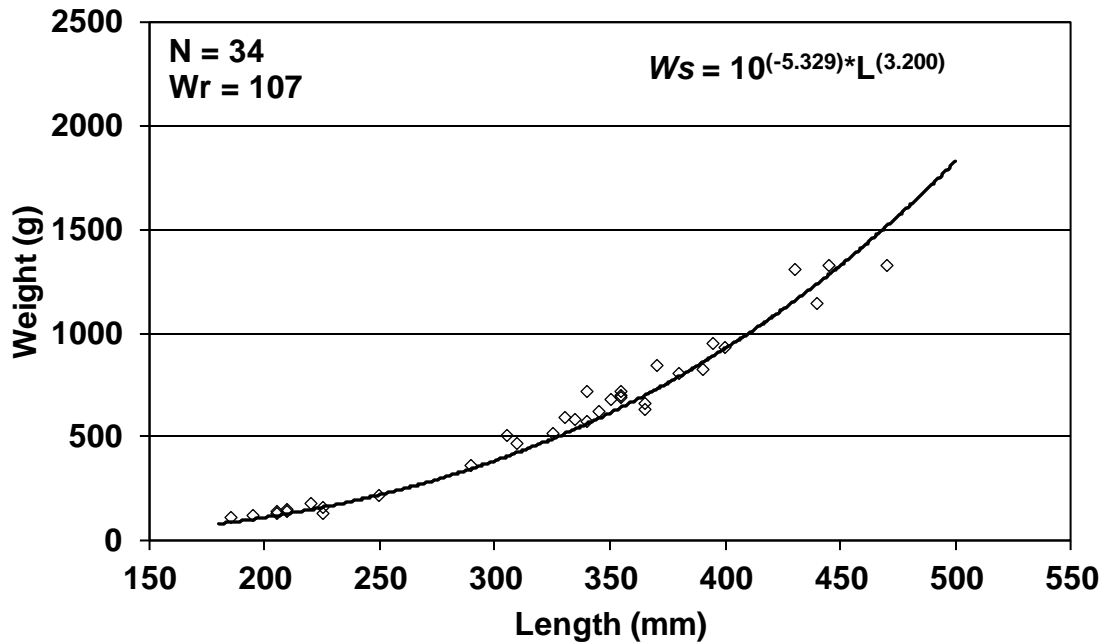


Figure 3. Observed weight-length relationship (white diamonds) and standard weight equation (W_s ; black line) of Stock size (≥ 180 mm) Smallmouth Bass sampled at two Illinois harbors and along the shoreline in Calumet Harbor during 2022.

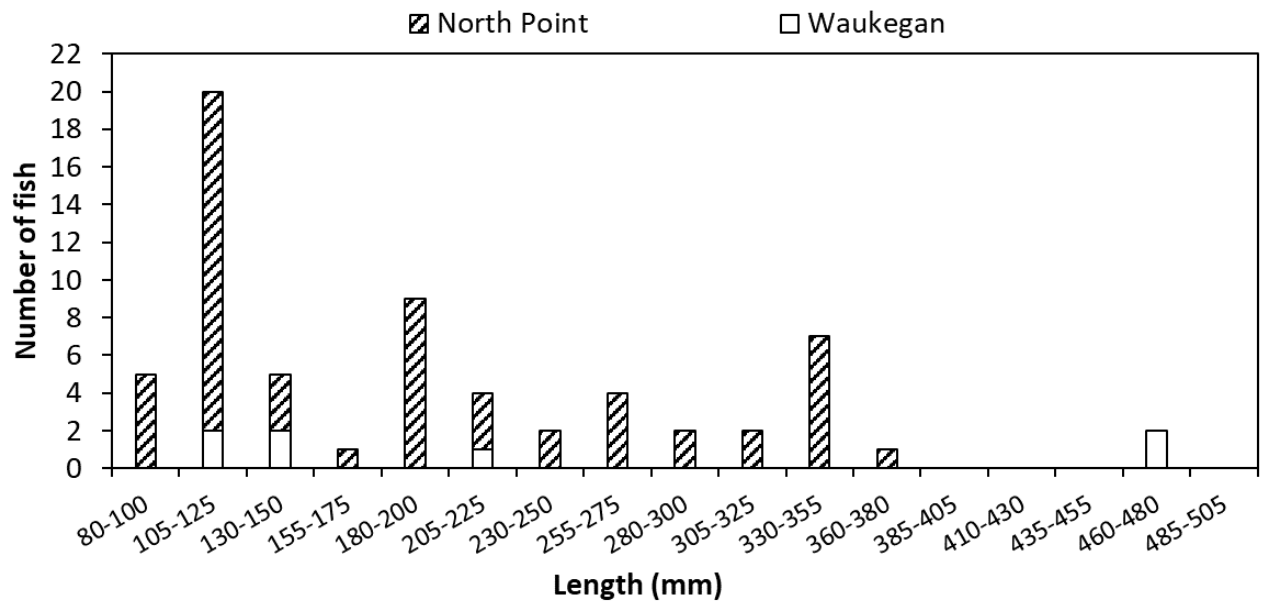


Figure 4. Length distribution of Largemouth Bass sampled at two Illinois harbors during 2022. No Largemouth Bass were sampled along the shoreline in Calumet Harbor.

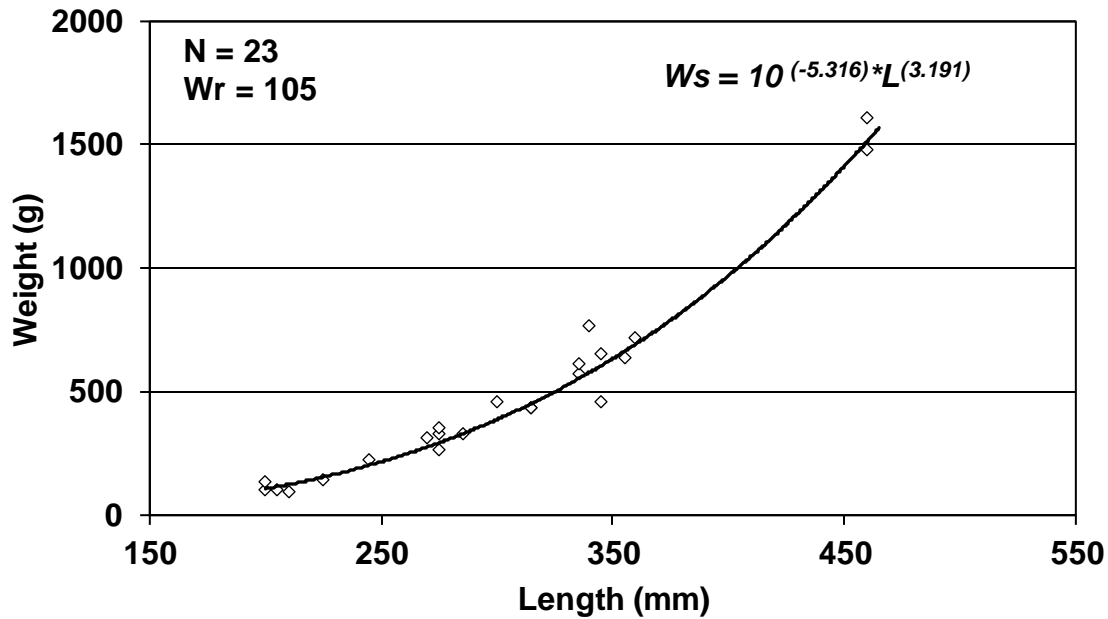


Figure 5. Observed weight-length relationship (white diamonds) and standard weight equation (W_s ; black line) of Stock size (≥ 200 mm) Largemouth Bass sampled at two Illinois harbors and along the shoreline in Calumet Harbor during 2022.

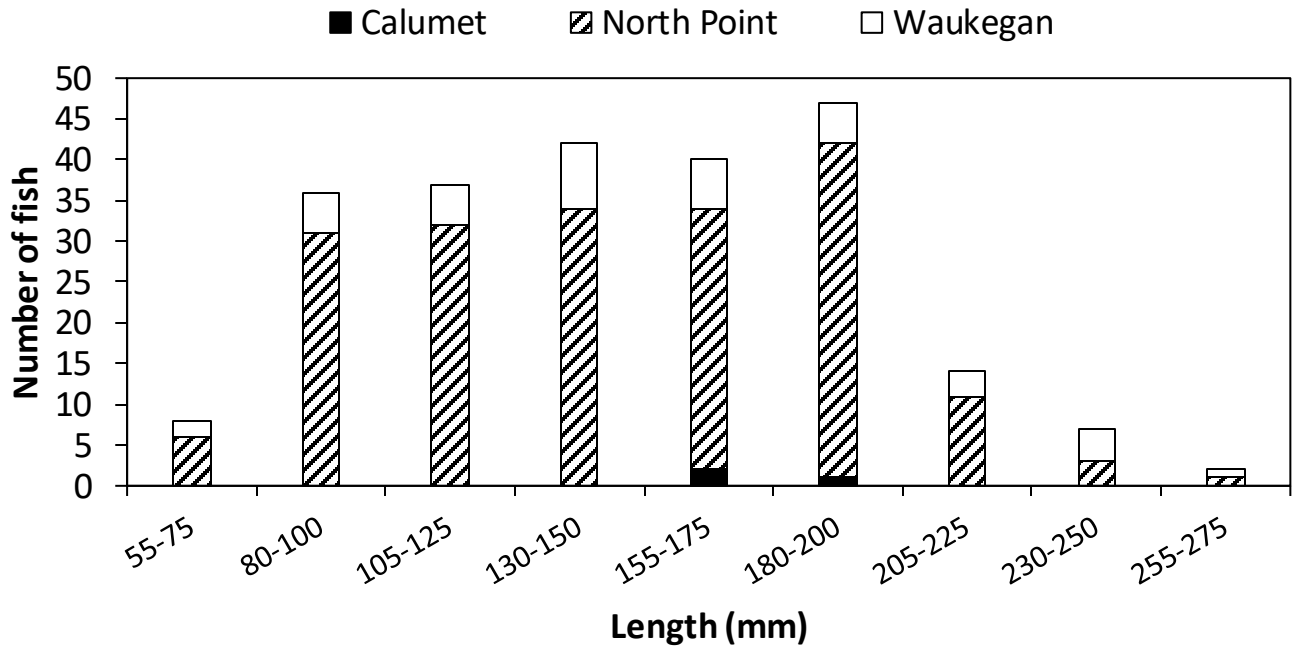


Figure 6. Length distribution of Rock Bass sampled at two Illinois harbors and along the shoreline in Calumet Harbor during 2022.

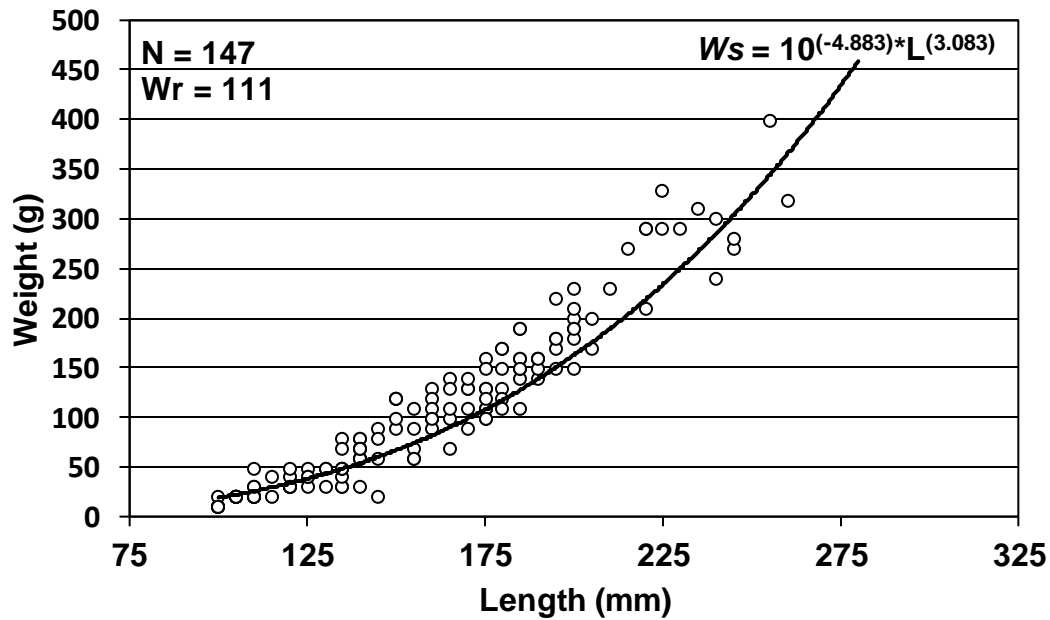


Figure 7. Observed weight-length relationship (white circles) and standard weight equation (W_s ; black line) of Stock size (≥ 100 mm) Rock Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2022.