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Division of Fisheries

Nearshore Fish Community of Lake Michigan: 2024 Summer Harbor Assessment

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Executive Summary

Pulsed DC electrofishing was used to assess the nearshore fish community in three Illinois harbors and the shoreline inside Calumet Harbor from May through July 2024. Species richness was highest in Jackson Inner Harbor with a total of 26 fish species detected. We detected 20 species in North Point Marina, 19 in Waukegan South Harbor and 15 species along the shoreline in Calumet Harbor. Smallmouth Bass, Pumpkinseed, Rock Bass, Largemouth Bass, and Black Bullhead were the most abundant targeted, sportfish encountered. In 2024, a total of 305 Smallmouth Bass ranging from 60 to 535 mm (2-21 in) were collected with 84% of fish Stock size or larger (≥ 180 mm, 7 in). The length distribution of Stock size fish was excellent with 31% Quality size (280-345 mm), 24% Preferred size (350-425 mm), 9% Memorable size (430-505 mm), and one Trophy size fish (≥ 510 mm, 20 in). One hundred and forty Largemouth Bass ranging from 25 to 515 mm (1-20 in) were sampled in 2024 and 52% of fish were at least Stock size (≥ 200 mm, 8 in). Thirty-seven percent of Largemouth Bass were Quality size (300-375 mm), 40% were Preferred size (380-505 mm), and one fish was Memorable size (510-625 mm). Overall, relative weight of Stock size Smallmouth Bass and Largemouth Bass continued to be equivalent to or higher than the species-specific standard weight. A total of 171 Rock Bass were collected in 2024 with 96% of fish Stock size or larger (≥ 100 mm, 4 in). A total of 34% of these were Quality size (180-225 mm) and 5% were Preferred size (230-275 mm). Similar to previous years, 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*), Bluegill (*Lepomis macrochirus*) 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, but by 2000 anglers reported catching an estimated 4,892 Smallmouth Bass (Brofka and Dettmers 2006). Since 2015, the number of Smallmouth Bass caught and released has ranged from approximately 3,840 to a peak of 16,604 in 2022 (Roswell and Czesny 2023) and in 2023 an estimated 9,870 Smallmouth Bass and 3,490 Largemouth Bass were caught and released in Illinois waters of Lake Michigan (Roswell and Czesny 2024).

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, Chicago River through the Chicago Lock, 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 four years, monitoring data suggests increasing abundance of Smallmouth Bass particularly along the shoreline in Calumet Harbor and Waukegan South Harbor. Whereas mixed trends were observed for Largemouth Bass with modest increases at North Point Marina and downward trends at Waukegan South and Jackson Inner harbors since 2021. Quality sizes and good body condition have also been observed for both species within Illinois waters of Lake Michigan.

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 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. Three Illinois harbors and the shoreline inside Calumet Harbor were sampled on 6-7 occasions from May through July 2024 (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 and the inner harbor was sampled at Jackson Harbor. 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 break wall were sampled when weather and waves permitted. Sampling efforts at North Point Marina on May

15, 2024 were ineffective due to poor weather conditions and equipment issues and thus biodata from this event were excluded from the report.

Sport fish species were the target of electrofishing 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, Bluegill, 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.

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 target, sportfish species, 2 hybrid forms of Centrarchid, and encountered 24 non-target (incidental) species during the 2024 electrofishing survey. The highest number of species was detected in Jackson Inner Harbor (26), followed by North Point Marina (20 species), Waukegan South Harbor (19 species), and Calumet Harbor (15 species). Smallmouth Bass, Pumpkinseed, Rock Bass, Largemouth Bass, and Black Bullhead were the most abundant target, sportfish encountered. The presence and abundance of sportfish differed among harbors. For example, Pumpkinseed, Rock Bass, and Yellow Perch abundance was much higher in North Point Marina than any other harbor sampled, while the majority of Black Bullhead (76%) were collected in Jackson Harbor (Table 3). Similar to previous years, CPUE (No. fish/hr) of Smallmouth Bass was highest at Calumet and 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 the potential for rapid changes in water temperatures during the summer.

The types of sport fish species 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 typically 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 with limited fishing opportunities. Thus, Illinois harbors likely continue to act as refuges on Lake Michigan where populations of warm-water fish may grow in a near natural state with low fishing mortality.

Smallmouth Bass

A total of 305 Smallmouth Bass that ranged in length from 60-535 mm (2-21 inches) were sampled in 2024 (Figure 2). Eighty-four percent of these fish were Stock size or larger (≥ 180 mm, 7 in), the majority of which were collected along the shoreline in Calumet Harbor (N=202; Figure 2). The length distribution of Stock size fish was excellent with 31% Quality size fish (280-345 mm), 24% Preferred (350-425 mm), 9% Memorable (430-505 mm), and one Trophy size fish (≥ 510 mm, 20 in). The presence of smaller, juvenile fish (60-175 mm) at all four sampled sites indicates that natural reproduction continues to occur throughout Illinois waters of Lake Michigan.

Annual catch-per-unit-effort (CPUE) of Stock size Smallmouth Bass increased significantly along the shoreline in Calumet Harbor and was the highest observed since 2000 (Table 4). Annual CPUE at Waukegan South Harbor and Jackson Inner Harbor was similar to that observed in 2023 and declined at North Point Marina.

The average relative weight (W_r) of Smallmouth Bass sampled in 2024 was 107 which indicates these fish were at a healthy weight for their length. As in the recent past, the relative weight of most Stock size Smallmouth Bass was equivalent to or higher than the species-specific standard weight (W_s) suggesting no food limitation for these fish (Figure 3).

Largemouth Bass

In 2024, a total of 140 Largemouth Bass were sampled and 52% of these fish were Stock size or larger (≥ 200 mm, 8 in). Most Largemouth Bass were collected at North Point Marina and Jackson Inner Harbor (N=66 and 64, respectively). Annual CPUE of Stock size Largemouth Bass increased at North Point Marina compared to 2023 and declined at Jackson Harbor in 2024 (Table 4). Six Stock size Largemouth Bass were sampled in Calumet Harbor and none were collected at Waukegan South Harbor.

Largemouth Bass collected in 2024 ranged from 25-515 mm (1-20 in) in total length (Figure 4). Thirty-seven percent of Largemouth Bass were Quality size (300-375 mm), 40% were Preferred (380-505 mm) and one

fish was Memorable (510-625 mm). The average relative weight (*Wr*) of Stock size Largemouth Bass was 113 in 2024 which indicates good body condition. Measured weights of these fish tended to be higher than standard weight at most lengths (*Ws*; Figure 5). The presence of smaller, juvenile fish (25-195 mm) at all four sampled sites indicates that natural reproduction continues to occur throughout Illinois waters of Lake Michigan.

Rock Bass

A total of 171 Rock Bass were sampled in 2024 of which 96% were at least Stock size (≥ 100 mm, 4 in). Several Rock Bass were Quality size (34%, 180-225 mm) and 5% were Preferred size (230-275 mm). Rock Bass ranged in length from 55-260 mm (2-10 in) with approximately 60% of fish longer than 155 mm (>6 in, Figure 6). The average relative weight (*Wr*) of Rock Bass was 120 in 2024; the weight of fish measured in the field tended to be higher than standard weights for this species across all lengths observed (*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 three Illinois harbors and along the shoreline in Calumet Harbor during 2024.

Sampling Date	Location			
	North Point Marina	Waukegan South Harbor	Jackson Harbor	Calumet Harbor
6, 8 May	0:42 / 62F	0:22 / 56F	0:42 / 68F	0:54 / 59F
13, 15 May	0:39* / 57F	0:26 / 62F	-	-
4, 5 June	0:59 / 71F	0:18 / 66F	0:27 / 74F	0:52 / 67F
17, 20 June	0:57 / 72F	0:32 / 69F	0:41 / 77F	0:23 / 69F
3, 9 July	0:55 / 71F	0:25 / 71F	0:40 / 79F	0:46 / 72F
15, 16 July	0:50 / 77F	0:25 / 74F	0:39 / 80F	0:30 / 74F
30, 31 July	0:48 / 77F	0:21 / 78F	0:32 / 82F	0:43 / 77F

*Biodata from this sampling event were excluded from the report because poor weather conditions and equipment issues resulted in ineffective sampling.

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

Species	Size Designation				
	Stock	Quality	Preferred	Memorable	Trophy
Smallmouth Bass	180 (7)	280 (11)	350 (14)	430 (17)	510 (20)
Largemouth Bass	200 (8)	300 (12)	380 (15)	510 (20)	630 (25)
Rock Bass	100 (4)	180 (7)	230 (9)	280 (11)	330 (13)

Table 3. Fish species sampled by electrofishing in three Illinois harbors and along the shoreline in Calumet Harbor during May - July 2024. Catch-per-unit-effort (No. fish / hr. electrofishing) is shown for targeted species (no minimum length) and the presence of incidental species is denoted with the letter P.

	Location			
	North Point Marina	Waukegan South Harbor	Jackson Harbor	Calumet Harbor
<i>Target Species</i>				
Black Bullhead	2.7	5.0	26.1	
Black Crappie			0.54	
Bluegill	9.4	2.1	2.4	
Green Sunfish	5.1	0.4	0.5	
Largemouth Bass	11.3	0.7	17.4	1.9
Northern Pike	0.51			
Pumpkinseed	36.7	2.1	4.9	0.7
Sunfish (hybrid)	0.2	0.7		
Rock Bass	18.3	16.7	1.9	2.4
Smallmouth Bass	1.4	13.1	5.7	57.8
Warmouth		0.4		
Yellow Bullhead	1.0	0.4	0.5	
Yellow Perch	10.5	0.7		0.2
<i>Incidental Species</i>				
Alewife	P	P	P	
Banded Killifish			P	
Black Buffalo			P	P
Blackstripe Topminnow		P		
Bluntnose Minnow			P	
Bowfin	P		P	
Brown Trout	P		P	
Carp x Goldfish hybrid			P	
Chinook Salmon			P	
Common Carp	P	P	P	P
Emerald Shiner			P	
Fathead Minnow			P	
Freshwater Drum	P	P	P	P
Gizzard Shad	P	P	P	P
Golden Shiner	P			
Goldfish	P		P	
Koi			P	
Rainbow Trout		P	P	P
Round Goby	P	P	P	P
Silver Redhorse				P
Spottail Shiner				P
Threespine Stickleback		P		
White Bass				P
White Sucker	P	P		P

Table 4. Annual catch-per-unit-effort (CPUE; No. fish / hr electrofishing) of **Stock size** Smallmouth Bass (≥ 180 mm) and Largemouth Bass (≥ 200 mm) in three Illinois harbors and along the shoreline in Calumet Harbor, 2015-2024.

Year	North Point Marina		Waukegan South Harbor		Jackson Harbor		Calumet Harbor	
	SMB	LMB	SMB	LMB	SMB	LMB	SMB	LMB
2015	2.5	8.2	3.8	3.8	1.2	16.3	22.7	0
2016	1.2	3.5	3.9	1.5	0	13.7	16.0	0.4
2017	5.2	7.7	3.9	3.0	1.9	19.7	16.2	0
2018	3.8	5.3	2.1	4.5	4.1	16.3	16.3	0
2019	1.7	2.7	1.4	1.4	4.6	8.5	15.7	0
2020*	1.4	4.8	7.1	0.5	1.3	1.9	6.2	0
2021	1.8	1.5	2.2	0	4.3	19.6	19.1	0.2
2022	1.1	3.3	6.6	1.1	NS	NS	28.0	0
2023	4.0	5.7	10.2	0	4.5	14.9	23.2	1.2
2024	1.0	6.8	11.0	0	4.4	9.0	48.8	1.2

*Caution should be used comparing 2020 CPUE among years due to reduced sampling effort during Covid-19 restriction

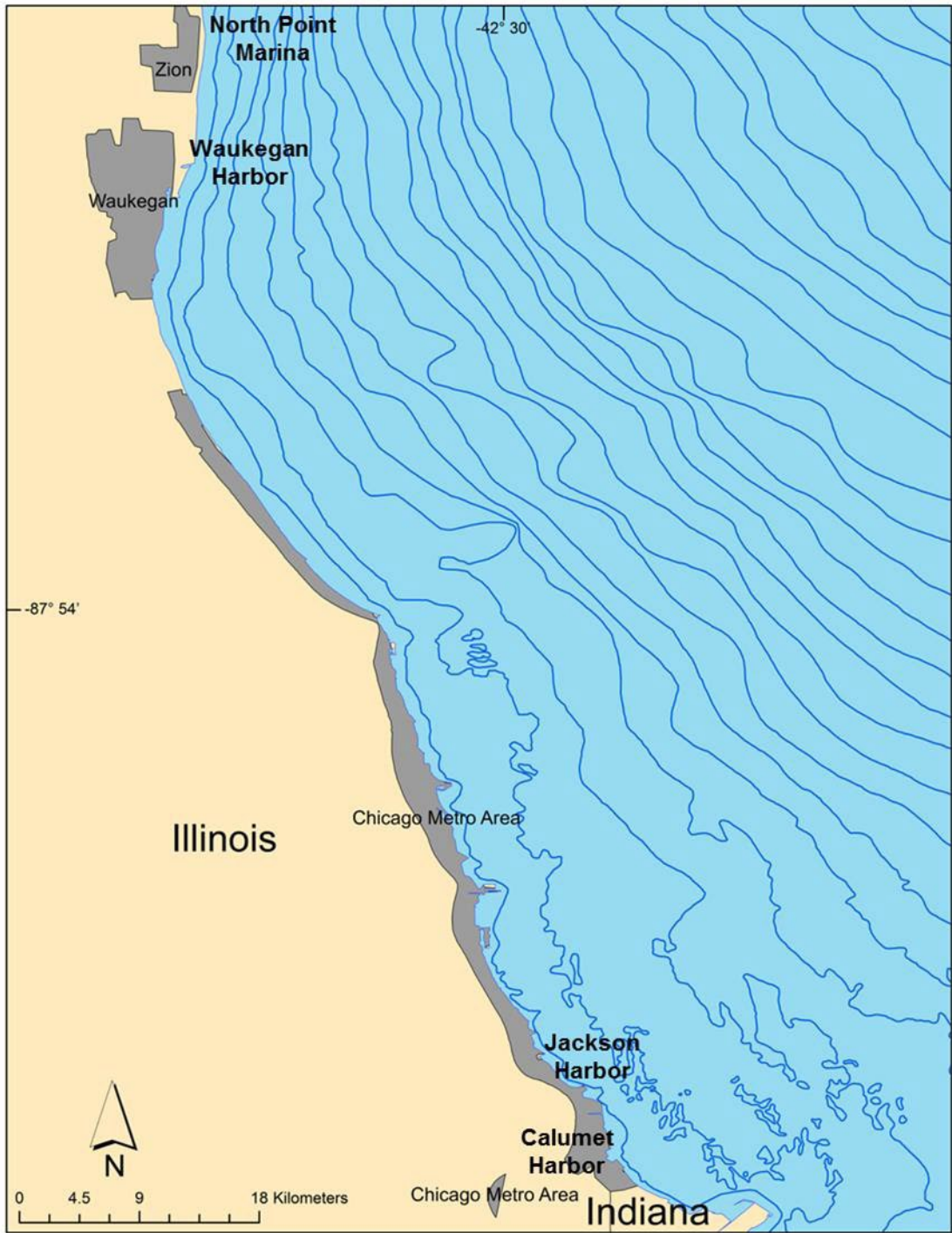


Figure 1. Location of Lake Michigan harbors sampled.

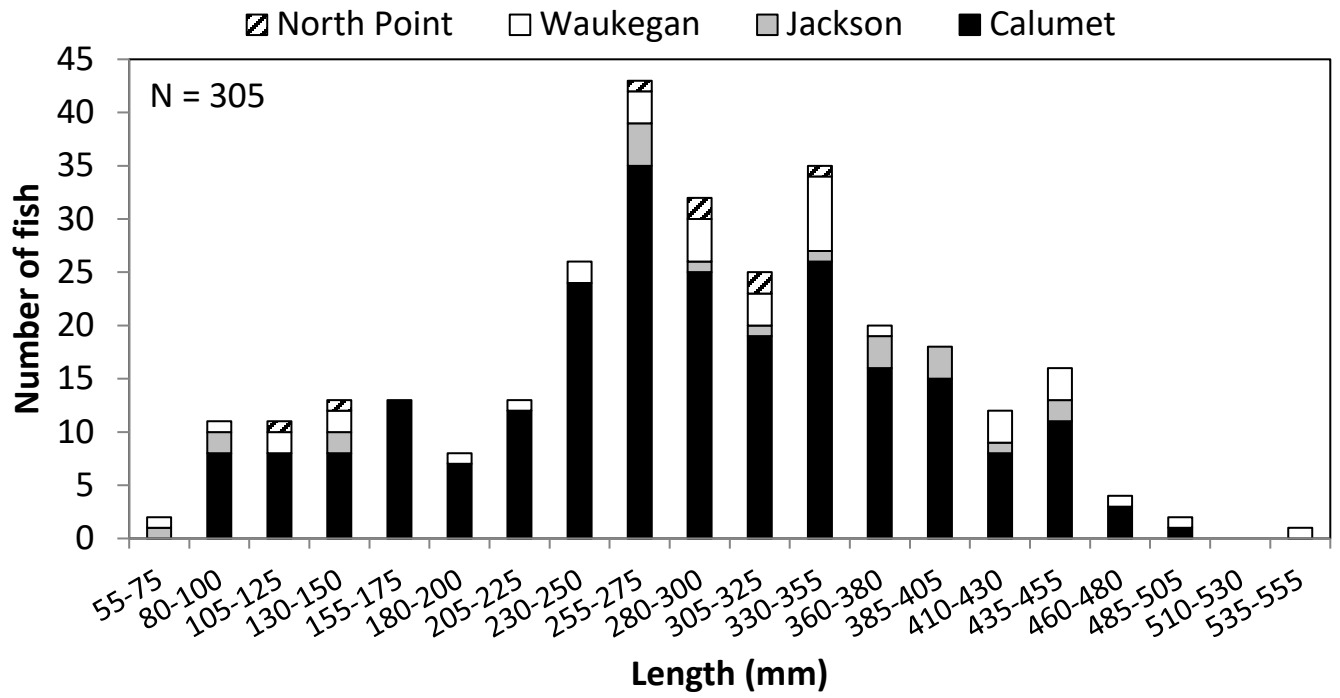


Figure 2. Length distribution of Smallmouth Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2024.

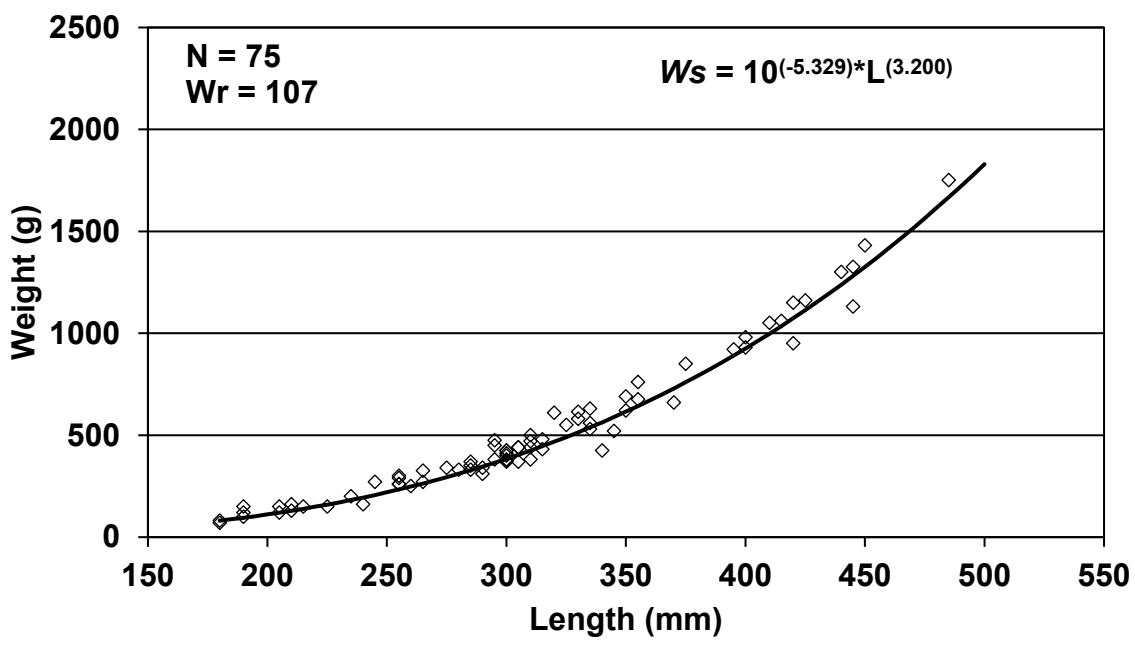


Figure 3. Observed weight-length relationship (white diamonds) and standard weight equation (W_s ; black line) of Stock size (≥ 180 mm) Smallmouth Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2024.

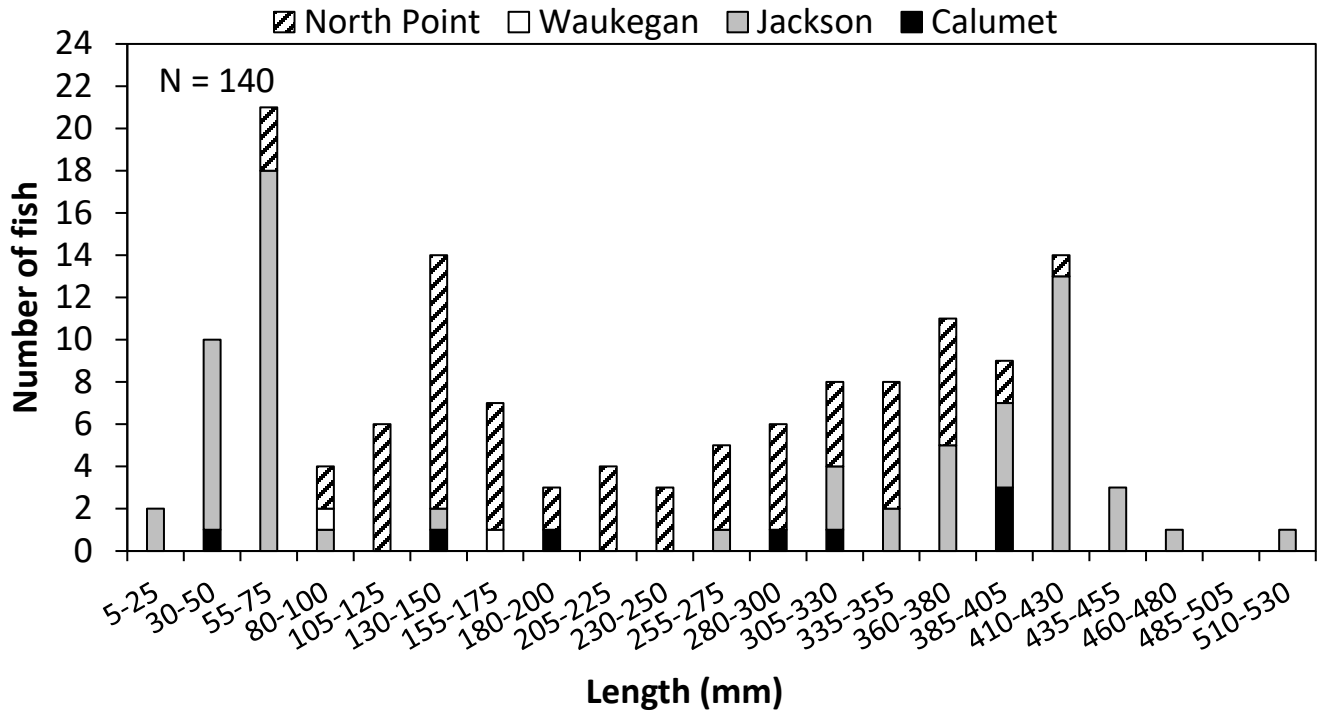


Figure 4. Length distribution of Largemouth Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2024.

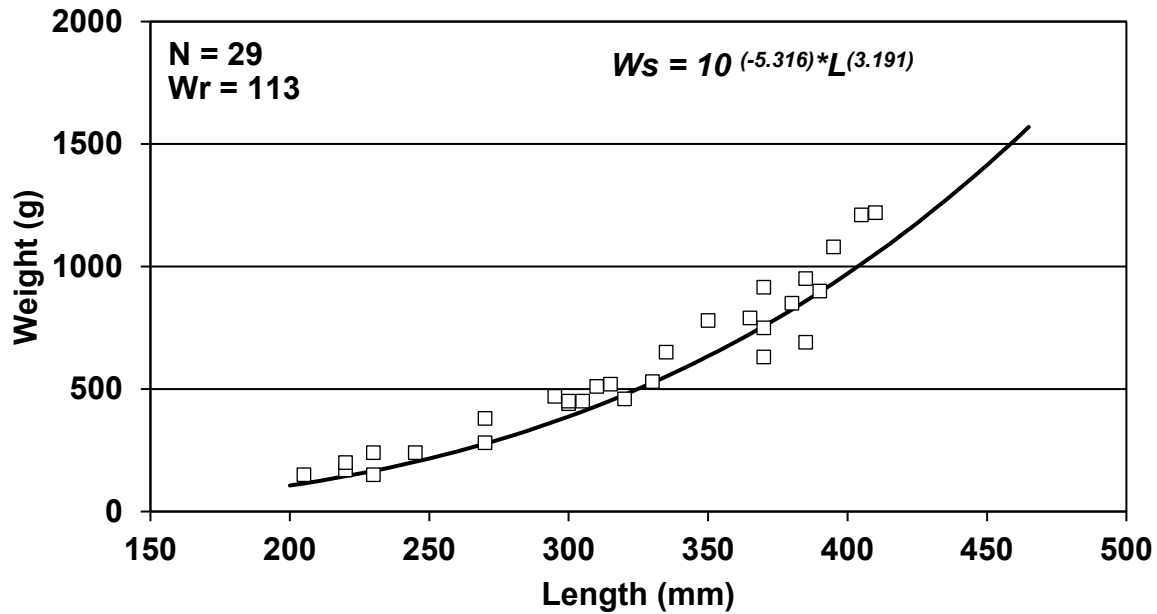


Figure 5. Observed weight-length relationship (white squares) and standard weight equation (W_s ; black line) of Stock size (≥ 200 mm) Largemouth Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2024.

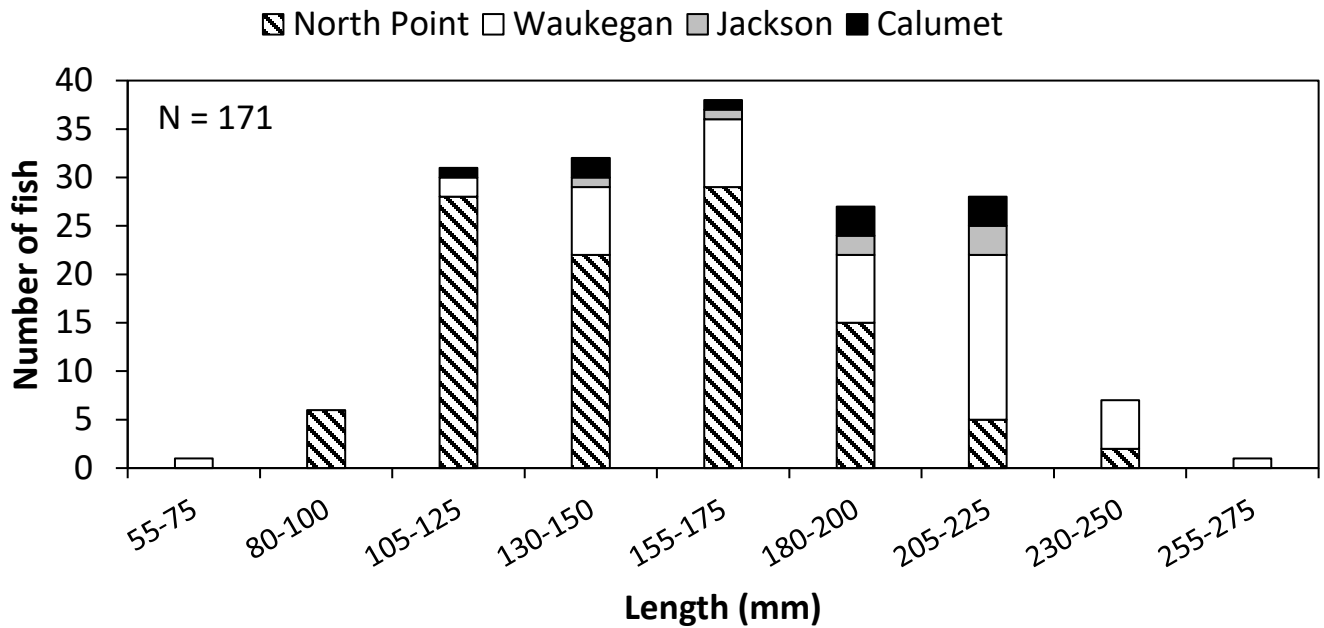


Figure 6. Length distribution of Rock Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2024.

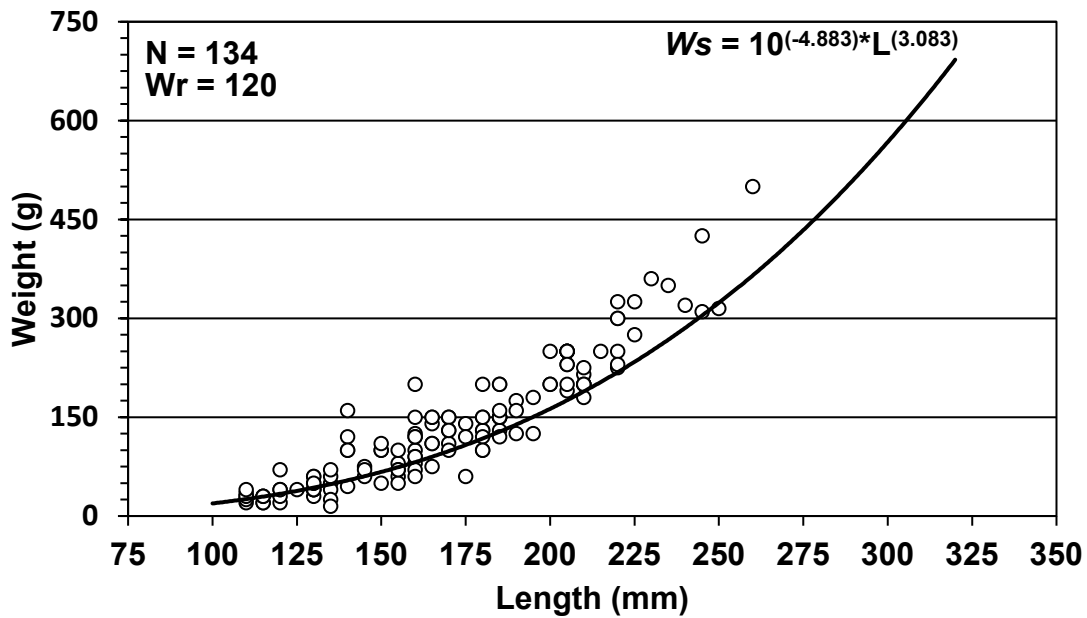


Figure 7. Observed weight-length relationship (white circles) and standard weight equation (W_s ; black line) of Stock size (≥ 100 mm) Rock Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2024.