

Illinois Department of Natural Resources

Division of Fisheries

Nearshore Fish Community of Lake Michigan: 2023 Summer Harbor Assessment

Rebecca A. Redman
Illinois Department of Natural Resources
Lake Michigan Program
February 20, 2024

This work was funded by Federal Aid in Sport Fish Restoration Funds (F-65-R)

The Illinois Department of Natural Resources receives Federal financial assistance from the U.S. Fish and Wildlife Service. Under Title VI of the 1964 Civil Rights Act, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments Act of 1972, and the U.S. Department of the Interior prohibits discrimination on the basis of race, color, national origin, age, sex, or disability.

If you believe that you have been discriminated against in any program, activity, or facility, or if you need more information, please write to:

*Chief, Public Civil Rights
Office of Civil Rights
U.S. Department of the Interior
1849 C Street, NW
Washington, D.C. 20240*

*This information may be provided in an alternative format if required. Contact the DNR Clearinghouse at 217/782-7498 for assistance.
Printed by the authority of the State of Illinois*

Table of Contents

| | |
|------------------------------|-------|
| Executive Summary..... | 1 |
| Introduction..... | 2 |
| Methods | 3 |
| Results and Discussion | 4 |
| Recommendations..... | 6 |
| Acknowledgements | 6 |
| Literature Cited | 7 |
| Tables | 8-12 |
| Figures | 13-16 |

List of Tables

- Table 1. Amount of electrofishing effort (hrs:min) and water temperature at three Illinois harbors and along the shoreline in Calumet Harbor during 2023.
- Table 2. Proposed minimum lengths (mm) for Smallmouth Bass, Largemouth Bass and Rock Bass of various length categories (taken from Gabelhouse 1984).
- Table 3. Fish species sampled by electrofishing in three Illinois harbors and along the shoreline in Calumet Harbor during May – August 2023. 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.
- 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, 2003-2023. *Caution should be used comparing 2020 CPUE among years due to reduced sampling effort during Covid-19 restrictions.
- Table 5. Catch-per-unit-effort (CPUE; No. fish / hr electrofishing) of Stock size (≥ 200 mm) Largemouth Bass in three Illinois harbors and along the shoreline in Calumet Harbor, 2003-2023. *Caution should be used comparing 2020 CPUE among years due to reduced sampling effort during Covid-19 restrictions.
- Table 6. Catch-per-unit-effort (CPUE; No. fish / hr electrofishing) of Stock size (≥ 100 mm) Rock Bass in three Illinois harbors and along the shoreline in Calumet Harbor, 2003-2023. *Caution should be used comparing 2020 CPUE among years due to reduced sampling effort during Covid-19 restrictions.

List of Figures

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 2023.

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 2023.

Figure 4. Length distribution of Largemouth Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2023.

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 three Illinois harbors and along the shoreline in Calumet Harbor during 2023.

Figure 6. Length distribution of Rock Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2023.

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 2023.

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 to early August 2023. Species richness was highest in North Point Marina with a total of 24 fish species detected. We detected 21 species in Jackson Inner Harbor, 18 in Waukegan South Harbor and 10 species along the shoreline in Calumet Harbor. Pumpkinseed, Rock Bass, Smallmouth Bass, Largemouth Bass, Black Bullhead, and Bluegill were the most abundant targeted, sportfish encountered. In 2023, a total of 232 Smallmouth Bass were collected; of these 169 were Stock size (≥ 180 mm), 103 were Quality size (≥ 280 mm), 62 were Preferred size (≥ 350 mm), 16 were Memorable size (≥ 430 mm), and one trophy size (≥ 510 mm). One hundred and fifty-seven Largemouth Bass were sampled in 2023 and 102 of these were Stock size (≥ 200 mm). A total of 84 Largemouth Bass were Quality size (≥ 300 mm) and 44 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 continued to be equivalent to or higher than the species-specific standard weight. A total of 365 Rock Bass were collected in 2023 and 329 of these were Stock size (≥ 100 mm). A total of 83 were Quality size (≥ 180 mm), 11 were Preferred size (≥ 230 mm), and 3 were Memorable size (≥ 280 mm). No 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*), 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 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. Three Illinois harbors and the shoreline inside Calumet Harbor were sampled in 2023 (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 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, 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. No pit-tagged Smallmouth or Largemouth Bass were collected during 2023.

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 (W_r ; 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 (W_s) 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 W_r values.

Results and Discussion

Species Composition

Overall, we collected 11 targeted, sportfish species, 1 hybridized form of Centrarchid, and encountered 21 non-targeted (incidental) species by electrofishing in 2023. The highest number of species was detected in North Point Marina (24 species), followed by Jackson Inner Harbor (21 species), Waukegan South Harbor (18 species), and Calumet Harbor (10 species). Pumpkinseed, Rock Bass, Smallmouth Bass, Largemouth Bass, Black Bullhead, and Bluegill were the most abundant targeted, sportfish encountered. The presence and abundance of sportfish differed among harbors. For example, Rock Bass and Pumpkinseed abundance was much higher in North Point Marina than any other harbor sampled, and the majority (95%) of Black Bullhead were collected in Jackson 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.

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 232 Smallmouth Bass that ranged in length from 40-520 mm were sampled in 2023. Seventy-three percent of these fish were Stock size (N=169, ≥ 180 mm), the majority of which were collected at Calumet Harbor (N=96; Figure 2). The length distribution of Stock size fish was excellent with 61% Quality size (N=103), 37% Preferred size (N=62), 9% Memorable size (N=16) and 1 Trophy size fish (≥ 510 mm). The presence of smaller, juvenile fish (40- 175 mm) at all four sampled sites indicates that natural reproduction continues to occur throughout Illinois waters of Lake Michigan.

Catch-per-unit-effort (CPUE) of Stock size Smallmouth Bass decreased slightly along the shoreline in Calumet Harbor compared to 2022 but was the second highest CPUE observed in 15 years (Table 4). After not being able to sample at Jackson Harbor in 2022, CPUE was stable and similar to that in 2021. Catch rates at Waukegan South Harbor increased and were the highest recorded since 2006. Likewise CPUE at North Point Marina was the highest relative abundance observed since 2017. The average relative weight (W_r) of Smallmouth Bass sampled in 2023 was 101 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 most fish > 275 mm, suggesting no food limitation for these fish (W_s ; Figure 3).

Largemouth Bass

In 2023, a total of 157 Largemouth Bass were sampled and 102 of these fish were Stock size (≥ 200 mm). Most Largemouth Bass were collected at Jackson Inner Harbor (N=99), followed by North Point Marina (N=46). CPUE of Stock size Largemouth Bass increased at North Point Marina compared to 2021; however, relative abundance at North Point Marina remains far below levels detected prior to 2015 (Table 5). Relative abundance

at Jackson Harbor declined 23% from that reported in 2021. Six Stock size Largemouth Bass were sampled in Calumet Harbor and none were collected at Waukegan South Harbor.

Largemouth Bass collected in 2023 ranged from 40-485 mm in total length (Figure 4). Eighty-four fish (82%) were Quality size and 44 (43%) were Preferred size. No memorable (≥ 510 mm) or trophy size (≥ 630 mm) Largemouth Bass were sampled. The presence of smaller, juvenile fish (40-195 mm) at all four sampled sites indicates that natural reproduction continues to occur throughout Illinois waters of Lake Michigan (Figure 4). The average relative weight (Wr) of Stock size Largemouth Bass was 104 in 2023 which indicates good body condition. Measured weights of these fish tended to be similar to or slightly higher than standard weight (Ws ; Figure 5).

Rock Bass

Similar to last year, Rock Bass were more abundant than Smallmouth or Largemouth Bass in our samples and the highest catches occurred in North Point Marina. CPUE of Stock size Rock Bass increased at all harbors in 2023 and was nearly two-fold higher at North Point Marina and Waukegan Harbor compared to 2022 (Table 6). We sampled a total of 365 Rock Bass in 2023 of which 329 were Stock size (≥ 100 mm). Several Rock Bass were Quality size ($N= 83$), 11 were Preferred size ($N = 9$) and 3 Memorable size (≥ 280 mm) fish were caught. No trophy size (≥ 330 mm) Rock Bass were collected. Rock Bass ranged in length from 65-290 mm with 78% of the fish between 105-200 mm (4-7 inches; Figure 6). The average relative weight (Wr) of Rock Bass was 110 in 2023; 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

This study was conducted using Federal Aid in Sport Fish Restoration funds (grant number F-65-R). We thank P. Bevell for administrative support and W. Stacy-Duffy for assistance with sample collection.

Literature Cited

- Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447–482 in Murphy, B. R., and D. W. Willis (eds.) *Fisheries Techniques* (2nd ed.). American Fisheries Society, Bethesda, Maryland.
- Brofka, W. A., and J. M. Dettmers. 2006. A survey of sport fishing in the Illinois portion of Lake Michigan. Aquatic Ecology Technical Report 06/04. Illinois Natural History Survey. 66 pp.
- Danehy, R. J. 1984. Comparative ecology of fishes associated with natural cobble shoals and sand substrates in Mexico Bay, Lake Ontario. MS Thesis. State University of New York, Syracuse. 84 pp.
- Gabelhouse, D.W. 1984. A length categorization system to assess fish stocks. *North American Journal of Fisheries Management* 4:273-285.
- Jude, D., Stoermer, E., Johengen, T., and A. N. Perakis. 2002. Non-indigenous species in the Great Lakes: ecology, interactions, impacts, and future research directions. White paper prepared for the University of Michigan's Great Lakes Initiative. 39 pp.
- Roswell, C. R., and S. J. Czesny. 2023. A Survey of sport fishing in the Illinois portion of Lake Michigan. INHS Technical Report 2023 (46). 47 pp.

Table 1. Amount of electrofishing effort (hrs:min) and water temperature at three Illinois harbors and along the shoreline in Calumet Harbor during 2023.

| <i>Sampling Date</i> | <i>Location</i> | | | |
|----------------------|---------------------------|------------------------------|-----------------------|-----------------------|
| | <i>North Point Marina</i> | <i>Waukegan South Harbor</i> | <i>Jackson Harbor</i> | <i>Calumet Harbor</i> |
| <i>9, 10 May</i> | <i>0:54 / 57F</i> | <i>0:22 / 53F</i> | <i>0:33 / 60F</i> | <i>0:57 / 56F</i> |
| <i>15, 30 May</i> | <i>0:57 / 65F</i> | <i>0:24 / 57F</i> | - | - |
| <i>6, 9 June</i> | <i>1:00 / 68F</i> | <i>0:24 / 67F</i> | <i>0:47 / 73F</i> | <i>0:29 / 66F</i> |
| <i>21, 22 June</i> | <i>1:01 / 71F</i> | <i>0:30 / 67F</i> | <i>0:47 / 74F</i> | <i>0:51 / 69F</i> |
| <i>6, 7 July</i> | <i>0:50 / 74F</i> | <i>0:28 / 71F</i> | <i>0:40 / 77F</i> | <i>0:31 / 70F</i> |
| <i>17, 25 July</i> | <i>0:50 / 72F</i> | <i>0:25 / 69F</i> | <i>0:41 / 81F</i> | <i>0:36 / 76F</i> |
| <i>1,2 August</i> | <i>0:55 / 75F</i> | <i>0:23 / 76F</i> | <i>0:34 / 81F</i> | <i>0:44 / 75F</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 by electrofishing in three Illinois harbors and along the shoreline in Calumet Harbor during May - August 2023. 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 | Jackson Harbor | Calumet Harbor |
| <i>Target Species</i> | | | | |
| Black Bullhead | 0.16 | 1.71 | 39.67 | |
| Bluegill | 13.02 | 1.36 | 18.1 | |
| Green Sunfish | 6.36 | 0.34 | | |
| Largemouth Bass | 7.13 | 2.05 | 24.55 | 1.45 |
| Northern Pike | 1.86 | | | |
| Pumpkinseed | 50.70 | 7.16 | 13.14 | |
| Sunfish (hybrid) | 0.62 | | | |
| Rock Bass | 46.51 | 15.00 | 3.72 | 1.45 |
| Smallmouth Bass | 11.00 | 11.25 | 5.70 | 25.40 |
| Warmouth | 0.16 | | | |
| Yellow Bullhead | 2.79 | 0.68 | 0.25 | |
| Yellow Perch | 4.65 | 0.34 | | |
| <i>Incidental Species</i> | | | | |
| Alewife | P | P | P | P |
| Banded Killifish | | P | P | |
| Black Buffalo | | | P | P |
| Bluntnose Minnow | | | P | |
| Bowfin | P | P | | |
| Brown Trout | P | | | |
| Central Mudminnow | P | | | |
| Coho Salmon | | | P | |
| Common Carp | P | P | P | P |
| Freshwater Drum | P | P | P | P |
| Gizzard Shad | P | P | P | P |
| Golden Shiner | P | | | |
| Goldfish | P | | P | |
| Koi | | | P | |
| Quillback Carp | | | P | |
| Rainbow Trout | P | | P | |
| Round Goby | P | P | P | P |
| Sand Shiner | | P | | |
| Shorthead Redhorse | | | | P |
| Spottail Shiner | P | | 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, 2003-2023. *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 |
| 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 |
| 2023 | 4.03 | 10.20 | 4.47 | 23.24 |

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, 2003-2023. *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 |
| 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 |
| 2023 | 5.74 | 0 | 14.89 | 1.21 |

Table 6. Catch-per-unit-effort (No. fish / hr electrofishing) of Stock size (≥ 100 mm) Rock Bass in three Illinois harbors and along the shoreline in Calumet Harbor, 2003-2023. *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 |
| 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 |
| 2023 | 41.24 | 21.09 | 3.47 | 1.45 |

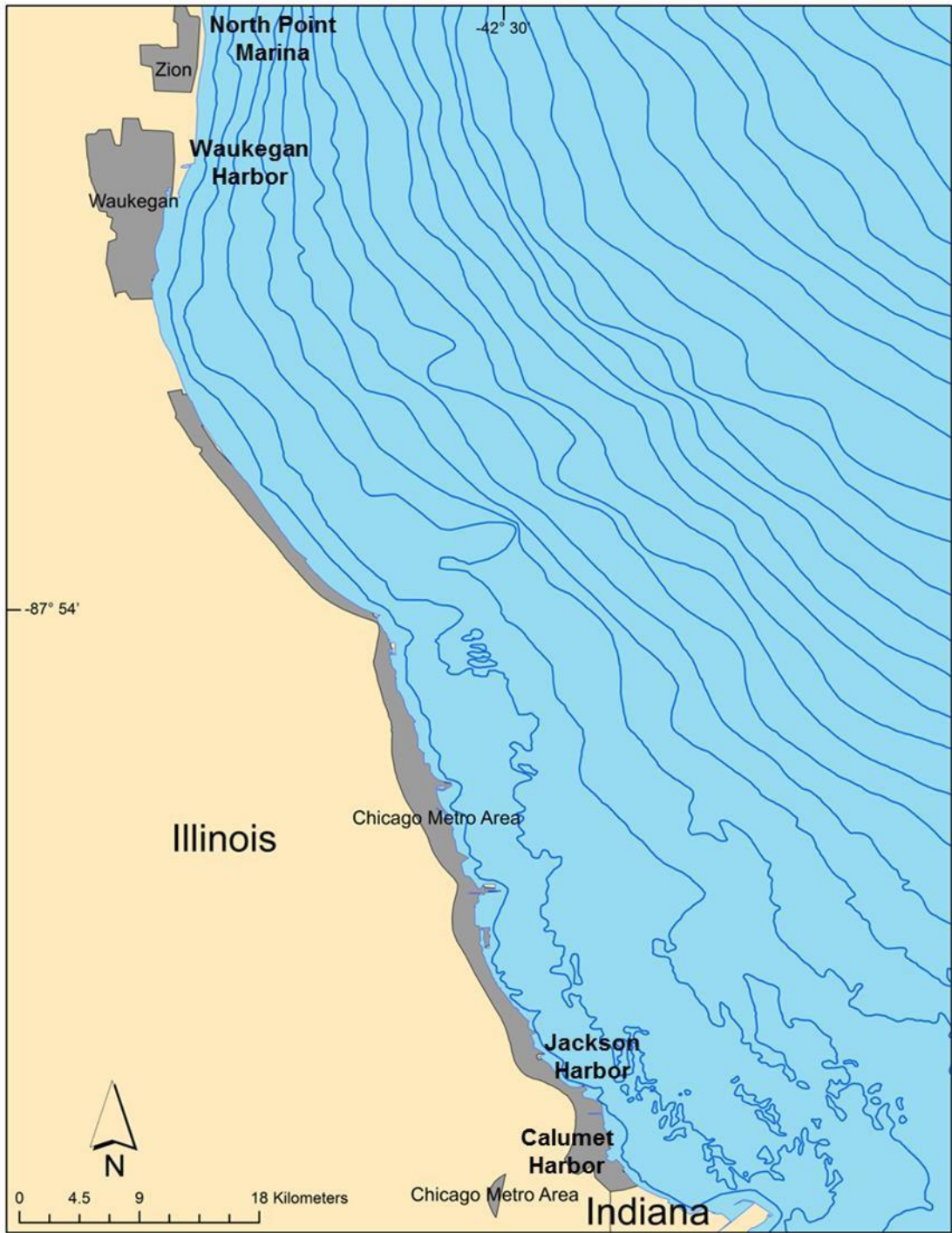


Figure 1. Location of Lake Michigan harbors sampled.

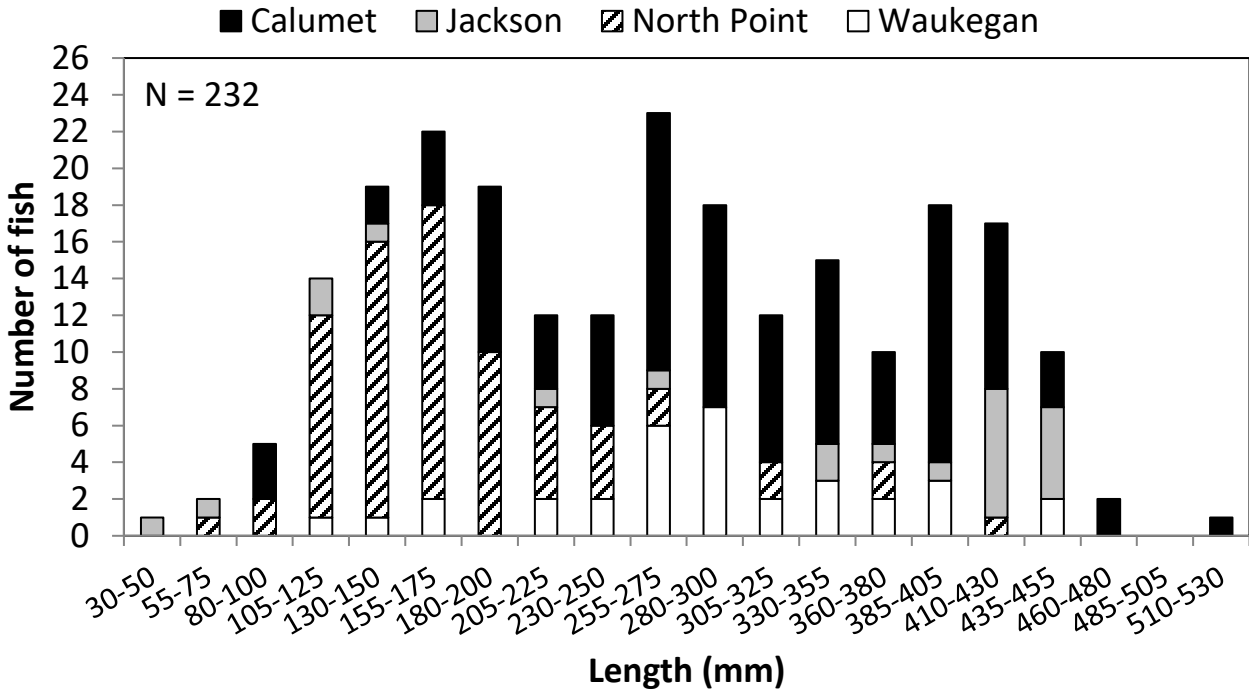


Figure 2. Length distribution of Smallmouth Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2023.

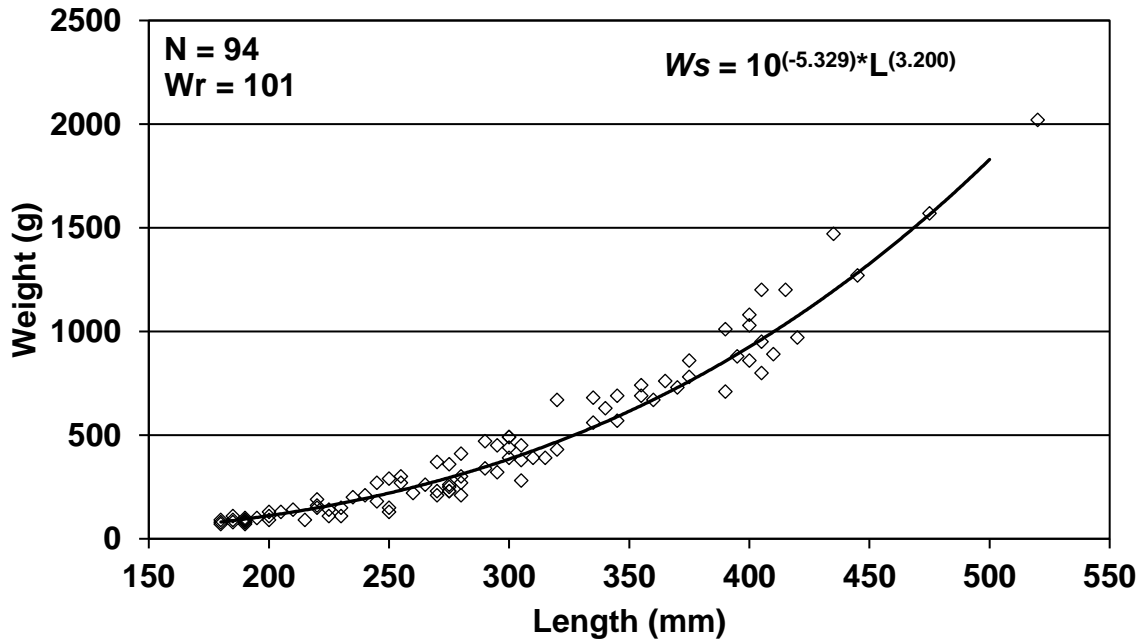


Figure 3. Observed weight-length relationship (white diamonds) and standard weight equation (W_s ; black line) of Stock size (≥ 180 mm) Smallmouth Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2023.

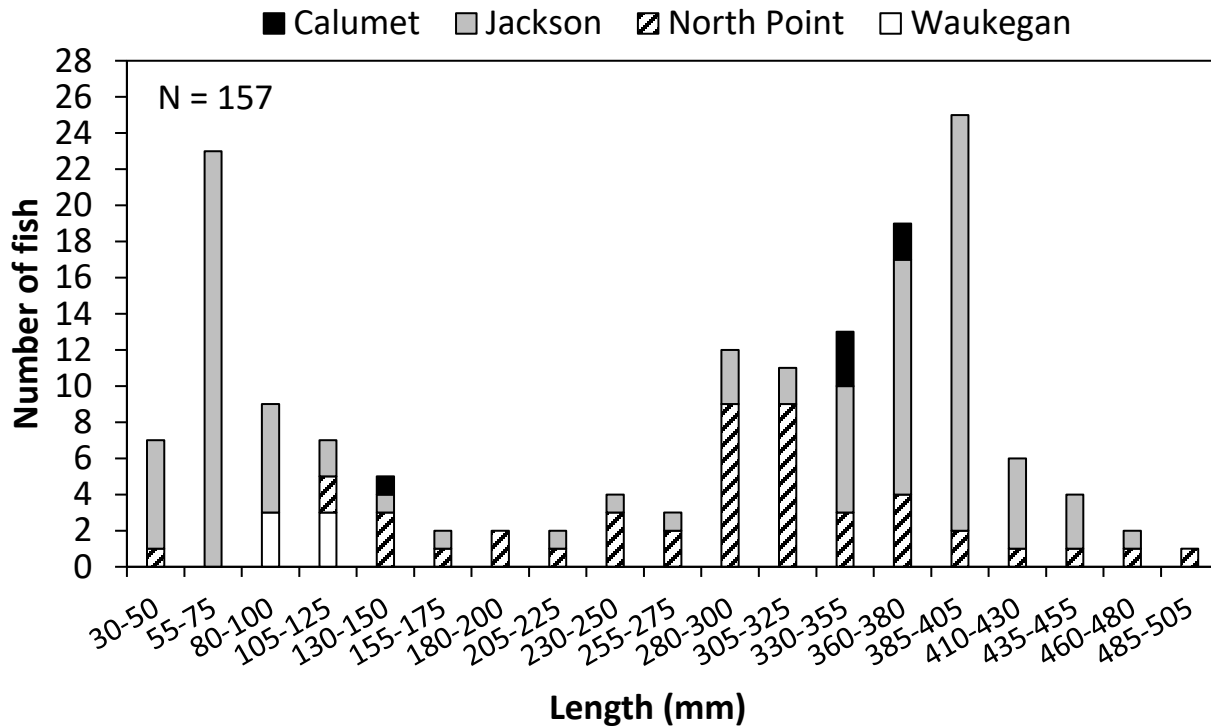


Figure 4. Length distribution of Largemouth Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2023.

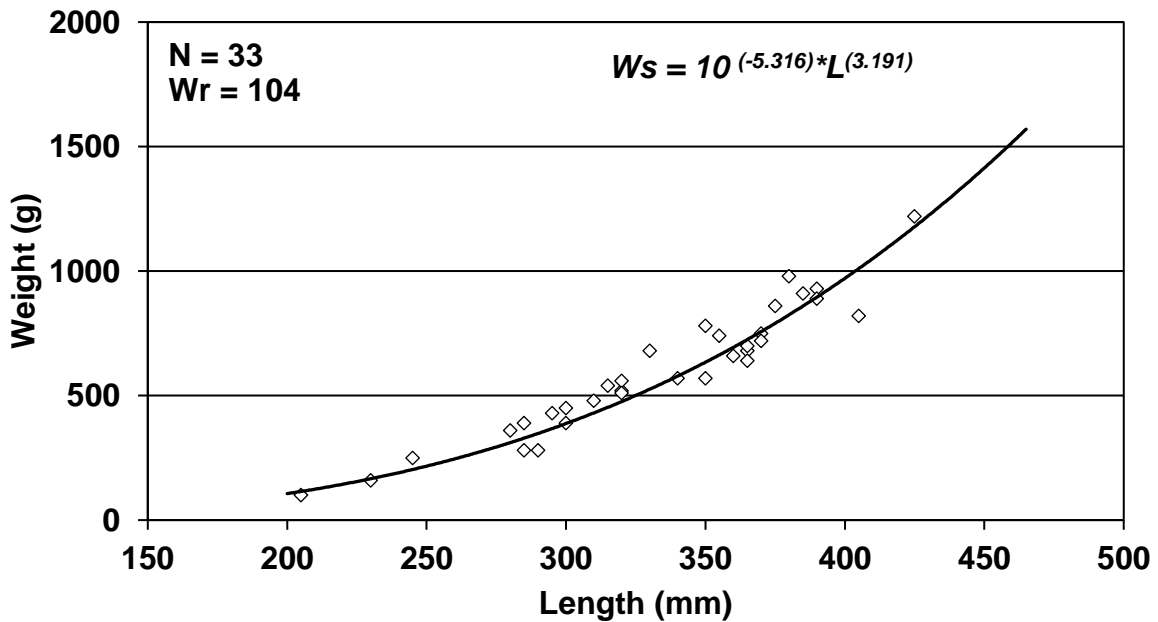


Figure 5. Observed weight-length relationship (white diamonds) and standard weight equation (W_s ; black line) of Stock size (≥ 200 mm) Largemouth Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2023.

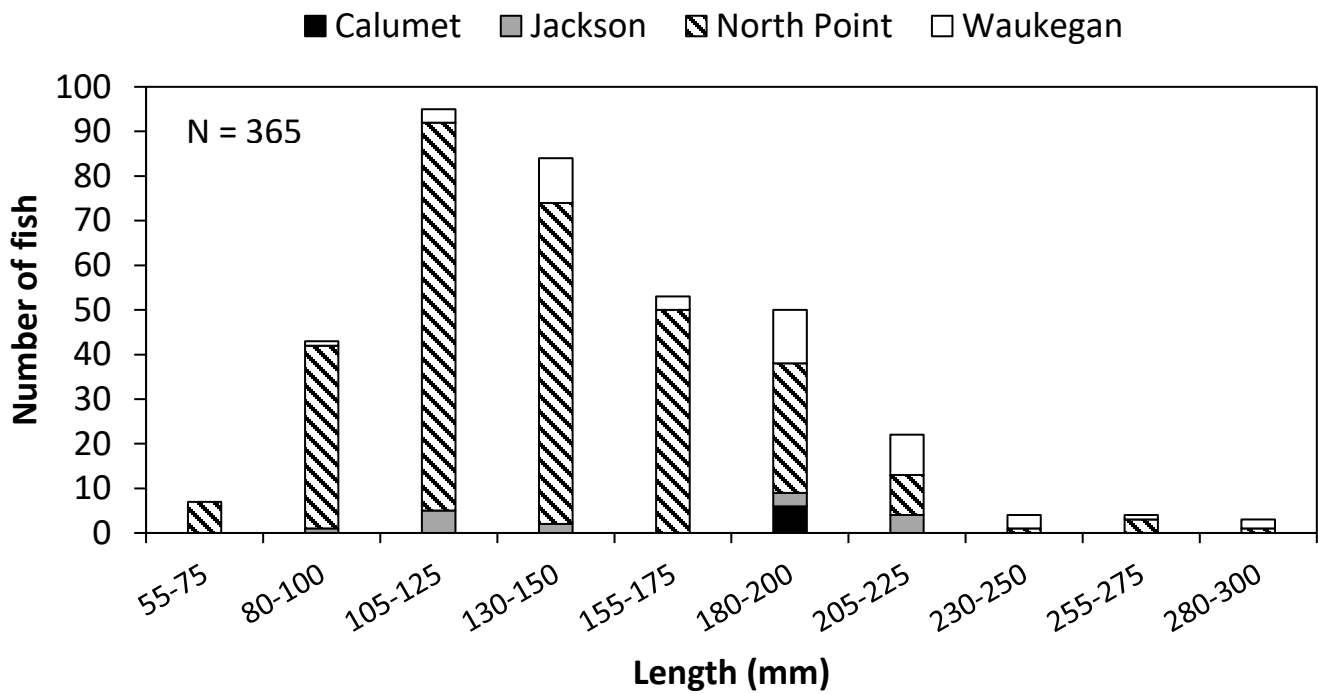


Figure 6. Length distribution of Rock Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2023.

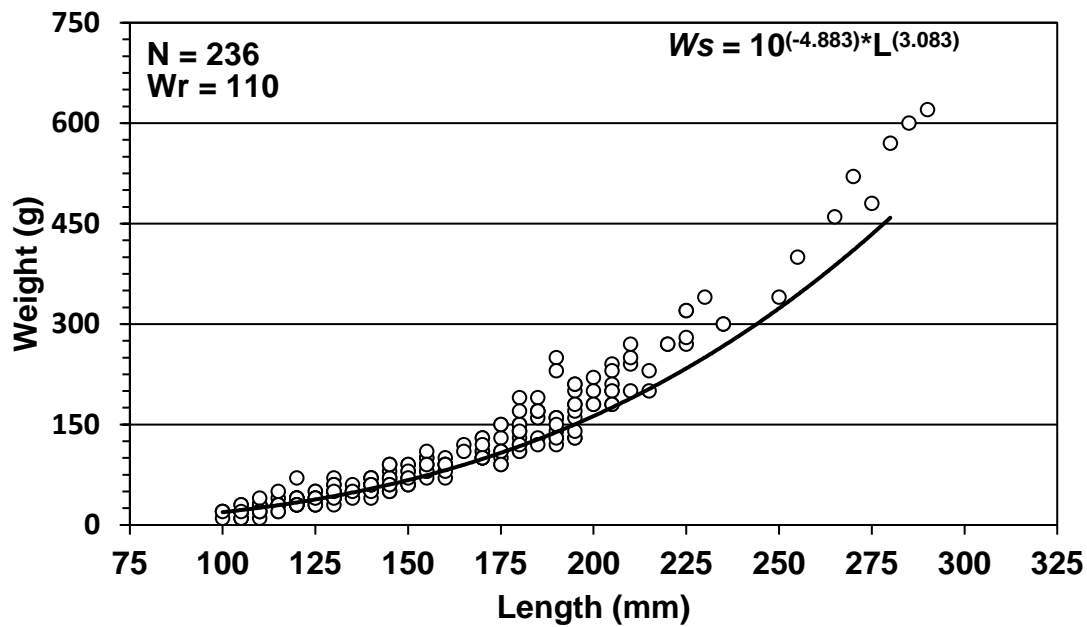


Figure 7. Observed weight-length relationship (white circles) and standard weight equation (Ws; black line) of Stock size (≥ 100 mm) Rock Bass sampled at three Illinois harbors and along the shoreline in Calumet Harbor during 2023.