

**Smallmouth bass distribution and abundance in selected harbors of
Southeastern Wisconsin Lake Michigan, 2003-2005**



**Pradeep Hirethota
and
Tom Burzynski**

February 2006

PUB-FH-512-2006

**Wisconsin Department of Natural Resources
Southern Lake Michigan Fisheries Work Unit
600 E. Greenfield Ave., Milwaukee, WI 53204**



|

Smallmouth bass distribution and abundance in selected harbors of Southeastern Wisconsin Lake Michigan, 2003-2005

Introduction

In recent years, interests in the smallmouth bass fishery in the nearshore waters of Lake Michigan have increased. The smallmouth bass population has substantially increased due to improvements in the habitat quality of Lake Michigan tributary streams, especially in the lower reaches, and facilitated, in some cases, by dam removals (Hirethota et al. 2005). The stone rip-rap along the shoreline, break wall construction in the harbor area and quiet water bays have also contributed to enhance habitat availability for smallmouth bass spawning, nursery and forage areas. Although there are many anecdotal reports and some creel data available on the angler catch of smallmouth bass in the harbors of Wisconsin waters of Lake Michigan, we do not have systematic survey information on the smallmouth population in these harbors. Therefore, we developed a two-year survey plan with the following objectives:

1. To survey and document the occurrence and abundance of adult smallmouth bass in Kenosha, Racine, Port Washington and Sheboygan harbors.
2. To survey and document their natural reproduction.
3. To describe size and age structure in the population.
4. To assess the smallmouth bass fishery and its potential in the area.

A detailed account of smallmouth bass data in the Lower Milwaukee River and harbor is provided in a different publication (Hirethota et al. 2005).

Methods

We used both passive and active gear at all the sampling sites. Active gear included a standard WDNR pulsed-DC electroshocking boat with two dippers, and the passive gear used were standard double-ended fyke nets (4ft X 4ft metal frame mouth with 0.5 inch stretch mesh netting) set overnight. The first round of boomshocking was done in all four harbors (Figure 1) in August 2003. At each site we targeted smallmouth bass and largemouth bass. At times we collected other game species and panfish species. We sampled at Kenosha and Racine harbors in May 2004 and at Port Washington and Sheboygan in May 2005, using double-ended fyke nets lifted on multiple days. All species of fish captured in fyke nets were counted and recorded. Total length (mm) and weight (g) (using spring scale) of smallmouth bass were recorded. Scale samples of a subsample of smallmouth bass were taken for age determination. We repeated the boomshocking effort at the Kenosha and Racine harbors in August-September 2004 and at the Sheboygan and Port Washington harbors in June 2005.

The following table summarizes the sampling effort in the four harbors:

Table 1. Fish sampling dates in the four harbor locations in the Southeast Region of Wisconsin, 2003-2005.

Fyke netting dates at different harbors:			
Kenosha	Racine	Port Washington	Sheboygan
May 5, 2004	May 5, 2004	May 17, 2005	May 17, 2005
May 6, 2004	May 6, 2004	May 18, 2005	May 18, 2005
May 19, 2004	May 18, 2004	May 19, 2005	May 19, 2005
May 20, 2004	May 19, 2004	May 24, 2005	May 24, 2005
	May 20, 2004	May 25, 2005	May 25, 2005
Boom shocking dates at different harbors:			
Aug 4, 2003	Aug 5, 2003	Aug 12, 2003	Aug 11, 2003
Aug 11, 2004	Sep 22, 2004	June 28, 2005	June 27, 2005

Results and Discussion

Kenosha Harbor

Boomshocking was conducted from the Kemper Center south of downtown Kenosha along the shoreline into Southport Marina, along the outer breakwall and into the Kenosha Harbor. Fyke netting was done by deploying two double-ended fyke nets in the Southport Marina harbor and fishing overnight. The nets were set at the same location throughout the week and checked on successive days (Table 1).

During boomshocking, we focused on collecting only gamefish. In 2003, the catch was dominated by largemouth bass, followed by rock bass. Very few smallmouth bass were captured. Although the location, effort and timing were similar, the 2004 boomshocking survey produced very few fish compared to the 2003 survey (Table 2). We used fyke nets in the 2004 sampling, which also did not catch any bass. The harbor appears to have a diverse fish community with fifteen species recorded in the fyke net sample. Alewife dominated the catch followed by spottail shiner. Panfish such as rock bass, bluegill, and pumpkinseed also were well represented. The fyke net effort was extended over four lifts on consecutive days, while boomshocking was limited to one night of effort. With the large area of rock walls and rip rap we expected to find a lot more smallmouth bass than we encountered. However, the warmer water temperature and the wide spread submerged vegetation are probably more conducive for panfish and largemouth bass to flourish in the area.

Rock bass are widely distributed in the Lake Michigan drainage basin but are not considered an important sport fish in Wisconsin (Becker 1983). Rock bass occurred in sizeable numbers in the Kenosha Harbor. Although the majority of rock bass were in the 161-200mm size-class, the wide size range (47 mm-270 mm) in the sample indicated the strong presence of multiple year-classes (Table 3). The majority of largemouth bass captured (89%) ranged from 101 mm to 200 mm (Table 3). Becker (1983) reported largemouth bass attain greater growth in length during their first two years of life. Based on the published size at age data (Becker 1983), largemouth

bass ranging from 101-200 mm in Kenosha may be 1, 2 and 3 years old. We captured very few bass over 201 mm total length. It is possible that larger individuals are being harvested since the largest bass measured 364 mm in total length. Largemouth bass in Kenosha and Walworth county lakes reach an average total length of 101 mm at age 1, 152 mm at age 2 and 203 mm at age 3 (Doug Welch, WDNR, Personal communication).

Table 2. Number of fish captured by species in Kenosha Harbor during electrofishing and fyke net surveys, 2003-2004.

Species caught	2003		2004	
	Boomshocker		Boomshocker	Fyke net ¹
Alewife				3,155
Rainbow trout				1
Northern Pike	1			
Goldfish				5
Golden shiner				3
Spottail shiner				532
Bluntnose minnow				1
White sucker				95
Black bullhead				21
Trout-perch				2
3-spine stickleback				3
Rock bass	38	1		316
Green sunfish				1
Pumpkinseed				77
Bluegill				154
Smallmouth bass	3			
Largemouth bass	94	4		
Yellow perch	1			14

¹ includes four fyke net lifts

Table 3. Size frequency distribution of rock bass and largemouth bass in Kenosha Harbor captured by electrofishing, 2003.

Rock bass		Largemouth bass	
Size class (mm)	# of rock bass	Size class (mm)	# of largemouth bass
41 – 80	1	51-100	3
81 – 120	6	101-150	26
121 – 160	2	151-200	57
161 – 200	18	201-250	1
201 – 240	8	251-300	4
241 - 280	3	301-350	1
		351-400	1

Racine Harbor

We used a boomshocker to sample in Meyers Park along the shoreline and breakwall, the shoreline of the Pershing Park small boat harbor, Reef Point marina, Racine Yacht Club and the Root River upstream to Cedar Bend Park. Fyke net sampling was conducted using two double-ended fyke nets fished overnight in the Racine Harbor.

Boomshocking produced similar species composition in 2003 as well as 2004 (Table 4). However, smallmouth bass numbers increased in the 2004 sampling. The majority of them measured 251-300 mm total length, and were probably 3 year old bass (Table 5, Figure 6). We did not capture any smallmouth bass less than 150 mm. This may not be a factor of capture efficiency of the electroshocking as we were able to collect many bass less than 150 mm at other locations. The largest smallmouth bass captured was 461 mm in total length.

We did not capture any smallmouth bass in fyke nets. However, fyke netting was effective and produced 24 species in five lifts (Table 4). Alewife dominated the catch by number followed by white sucker, black bullhead, spottail shiner and rock bass.

Table 4. Numbers of fish captured by species in Racine Harbor during electrofishing and fyke net surveys, 2003-2004.

Species caught	2003		2004	
	Boomshocker		Boomshocker	Fyke net ²
Alewife				9,367
Gizzard shad				1
Coho salmon				1
Rainbow trout				2
Brown trout				4
Northern Pike	1		5	
Goldfish				5
Carp				3
Golden shiner				1
Spottail shiner				99
Bluntnose minnow				3
White sucker				190
Black bullhead				172
Yellow bullhead				7
Channel catfish				1
Trout-perch				35
9-spine stickleback				1
3-spine stickleback				1
White perch				2
Rock bass	1		8	79
Pumpkinseed	1		2	2
Bluegill	2		4	18

Table 4 (Continued). Number of fish captured by species in Racine Harbor during electrofishing and fyke net surveys, 2003-2004.

Species caught	2003		2004	
	Boomshocker		Boomshocker	Fyke net ²
Black crappie				20
Smallmouth bass	2		28	
Largemouth bass	4		8	
Yellow perch			1	10
Sculpin				1

²includes five fyke net lifts

Table 5. Size frequency distribution of smallmouth bass in Racine Harbor captured during the 2004 electrofishing survey.

Size class (mm)	# of smallmouth bass	%
51-100	0	0
101-150	0	0
151-200	5	17.8
201-250	5	17.8
251-300	11	39.3
301-350	5	17.8
351-400	1	3.6
401-450	0	0
451-500	1	3.6

Port Washington Harbor

Boomshocking was conducted inside the harbor along all of the breakwalls, and along the rock wall of the power plant water intake channel. Two double-ended fyke nets were set inside the harbor and fished overnight. Fyke netting was done in May 2005, and boomshocking was done once in August 2003 and again in June 2005. During boomshocking we focused on collecting only game species. Very few fish were captured. Five lifts of fyke netting produced a variety of fish species, including migratory salmonids (Table 6). Exotic round goby dominated the catch. Based on the few smallmouth bass that we aged, they appear to grow faster than the average state-wide smallmouth bass growth rate (Figure 7 and Table 7). A greater abundance of goby in the area may serve as a good prey base for smallmouth bass.

Table 6. Number of fish captured by species in Port Washington Harbor during the electrofishing and fyke net surveys, 2003 and 2005.

Species caught	2003		2005	
	Boomshocker	Boomshocker	Fyke net ³	
Alewife			142	
Chinook salmon			1	
Rainbow trout			1	
Brown trout			3	
Northern Pike	2			
Carp			1	
Spottail shiner			2	
White sucker			56	
Black bullhead			1	
9-spine stickleback			7	
Rock bass			116	
Pumpkinseed			19	
Bluegill			4	
Smallmouth bass	8	8	3	
Largemouth bass		1		
Black crappie			2	
Round goby			260	

³ includes five fyke net lifts

Table 7. Mean length (TL mm) and weight (g) at age of smallmouth bass captured in Port Washington Harbor in 2003.

Age	No. of smallmouth bass	Mean length (mm)	Mean weight (g)
2	1	297	445
3	3	353	647
4	3	338	608

Sheboygan Harbor

Boomshocking was conducted from the Kiwanis Park ramp on the Sheboygan River downstream to the harbor, including the entire inside of the marina break walls. For the first week of the survey, two double-ended fyke nets were set, one inside the break wall, and the other just downstream of the 14th Street Bridge on the Sheboygan River. Both fyke nets were set in the Sheboygan Harbor for the second week of the survey. The nets were lifted each morning to collect data. The Sheboygan River and Harbor sampling produced the greatest number of smallmouth bass when compared to the rest of the sites. Although we observed many northern pike during the electrofishing survey we captured only limited numbers and took measurements, since our focus was mainly to capture smallmouth bass. Using fyke nets and boomshocking we captured a total of 26 species which included four species of stocked salmonids (Table 8). Bass and northern pike were captured mainly by boomshocking, while alewife dominated the catch in the fyke net lifts. Compared to the Kenosha harbor, the Sheboygan Harbor had very limited largemouth bass and rock bass populations.

Age distribution data from the 2003 and 2005 surveys indicate strong year-classes exist in both years (Table 9-10). In 2003, age 2 smallmouth bass from the 2001 year-class dominated the catch at 36 fish, or 64% of the aged sample. These fish averaged 198 mm total length and 118 g. We also captured age 3 (10.7%) and age 4 (10.7 %) smallmouth bass during the electrofishing survey. In 2005, age 3 smallmouth bass dominated the catch with 11 fish comprising 44% of the aged sample. These age 3 smallmouth bass averaged 257 mm total length and 258 g. The 2001 year-class of smallmouth bass, represented in 2005 as age 4 fish, only comprised 24 % of the aged sample, indicating a fairly high mortality rate from 2003 to 2005. In both years smallmouth bass ranging from 151 mm to 250 mm dominated the catch (Table 11, Figure 8). We did not catch any in the 51 mm to 100 mm size class in 2005 sampling (Table 11) which is evident by the absence of ages 0-1 bass in 2005. Our sampling technique and timing remained consistent in both years.

The growth rate of smallmouth bass in the Sheboygan Harbor appears to be greater than the state-wide average for smallmouth bass (Figures 9-10). Becker (1983) reported that smallmouth bass in Lake Michigan and Green Bay reached an average size (total length in mm) of 79 mm at age 1, 160 mm at age 2, 234 mm at age 3 and 264 mm at age 4. More recently, Kroeff (1996) reported mean back-calculated lengths of smallmouth bass as 120 mm at age 1, 169 mm at age 2, 216 mm at age 3, and 268 mm at age 4 for fish captured in Sturgeon Bay. Average size at age for smallmouth bass from Sheboygan Harbor captured in this study (Table 9-10) was greater compared to the Sturgeon Bay population. Sturgeon Bay area has an abundant population of smallmouth bass with multiple year class. The average length at age for smallmouth bass from our previous survey in Milwaukee Harbor were 159 mm at age 2, 243 mm at age 3, and 314 mm at age 4 (Hirethota et al. 2005).

Table 8. Number of fish caught by species in Sheboygan River/Harbor during electrofishing and fyke net surveys, 2003-2004.

Species caught	2003		2005	
	Boomshocker		Boomshocker ⁴	Fyke net ⁵
Alewife				898
Coho salmon				1
Chinook salmon				4
Rainbow trout				2
Brown trout				2
Rainbow smelt				18
Northern Pike			10	2
Carp				2
Spottail shiner				54
Bluntnose minnow				1
White sucker				51
Greater redhorse				1
Black bullhead				72
Yellow bullhead				3
Brown bullhead				4
Channel catfish				1
Burbot				1
9-spine stickleback				77
Rock bass				9
Bluegill				9
Smallmouth bass	61		46	2
Largemouth bass			1	
Black crappie				15
Yellow perch				1
Walleye				1
Round goby				14

⁴ Targeted capturing smallmouth bass only; many northern pike were not captured

⁵ includes five fyke net lifts

Table 9. Mean length (TL mm) and weight (g) at age of smallmouth bass captured in Sheboygan Harbor by electrofishing in August 2003.

Age	No. of smallmouth bass	%	Mean length (mm)	Mean weight (g)
1	4	7	140	40
2	36	64	198	118
3	6	10.7	288	376
4	6	10.7	339	556
5	2	3.6	358	680
6	1	1.8	372	795
7	1	1.8	408	920

Table 10. Mean length (TL mm) and weight (g) at age of smallmouth bass captured in Sheboygan Harbor by electrofishing in June 2005.

Age	No. of smallmouth bass	%	Mean length (mm)	Mean weight (g)
2	2	8	237	203
3	11	44	257	258
4	6	24	327	495
5	1	4	349	490
6	4	16	389	755
8	1	4	445	1300

Table 11. Size frequency distribution of smallmouth bass in Sheboygan River and Harbor captured during electrofishing surveys in 2003 and 2005.

Size class (mm)	# of smallmouth bass in 2003	%	# of smallmouth bass in 2005	%
51-100	3	4.9	0	0
101-150	5	8.2	3	6.5
151-200	23	37.7	15	32.6
201-250	13	21.3	9	19.6
251-300	5	8.2	8	17.4
301-350	7	11.5	4	8.7
351-400	4	6.5	5	10.9
401-450	1	1.6	2	4.3

Summary

In this survey, we recorded 35 fish species from four harbors of which ten were common to all harbors (Table 12). Alewife was most abundant at all locations, which were probably moving in schools into the harbor area. Four species of migratory stocked salmonid species were captured in the harbors. Most of them might have entered the harbor as they were staging for spawning migration. We did not see any pattern in the distribution of species between the harbors north of Milwaukee and harbors south of Milwaukee, except that smallmouth bass were more abundant in Sheboygan Harbor, while largemouth bass were more abundant in Kenosha Harbor. The greater abundance of fish in Sheboygan is likely due to our sampling upstream of the harbor on the Sheboygan River, which supports an abundant population of smallmouth bass. Although we also sampled the Root River in Racine upstream of the harbor, we found far fewer smallmouth bass. Historically, the Root River has not supported an abundant smallmouth bass population; thus the lower abundance of fish is not unexpected. Rock bass, belonging to a wide size range, dominated the catch in Kenosha Harbor, especially in the fyke net catch. Although Racine harbor produced a wide size range of smallmouth bass, very few were less than 150 mm. A few 2 to 4-year old smallmouth bass were captured in Port Washington Harbor. In Sheboygan, 2001 year-class smallmouth bass occurred in greater numbers in 2003 samples, but not in 2005 samples suggesting higher fishing mortality. No age 0 or age 1 smallmouth bass were captured. It is not unusual to miss younger bass in both fyke net and Boomshocker. Most smallmouth bass captured belonged to 151 to 250 mm size class. Compared to the state-wide average growth rate, the smallmouth bass in the harbors of southeastern Wisconsin have a slightly higher growth rate. Fyke nets were not effective in capturing smallmouth bass in this survey although rock bass and sunfishes were effectively captured. However, fyke nets were effective in sampling smallmouth bass in Sturgeon Bay (Kroeff 1996). Poor number of smallmouth bass in the fyke nets in our survey may be a function of abundance of bass in the area. Several exotic fish species were also recorded in these harbors. Round goby were more common northward to Sheboygan and Port Washington harbors than in the south. Other exotic species recorded in the survey included common carp, gold fish, smelt, white perch and 3-spine stickleback.

Table 12. Occurrence and relative abundance of various species in the four harbors in Southeastern Wisconsin, 2003-2005.

Species caught	Kenosha	Racine	Port Washington	Sheboygan
Alewife	Abundant	Abundant	Abundant	Abundant
Gizzard shad		Present		
Coho salmon		Present		Present
Chinook salmon			Present	Present
Rainbow trout	Present	Present	Present	Present
Brown trout		Present	Present	Present
Rainbow smelt				Common
Northern Pike	Present	Present	Present	Common
Carp			Present	Present
Goldfish	Present	Present		
Golden shiner	Present	Present		

Table 12 (Continued). Occurrence and relative abundance of various species in four harbors in Southeastern Wisconsin, 2003-2005.

Species caught	Kenosha	Racine	Port Washington	Sheboygan
Spottail shiner	Abundant	Common	Present	Common
Bluntnose minnow	Present	Present		Present
White sucker	Common	Abundant	Common	Common
Greater redhorse				Present
Black bullhead	Common	Abundant	Present	Common
Yellow bullhead		Present		Present
Brown bullhead				Present
Channel catfish		Present		Present
Burbot				Present
Trout-perch	Present	Common		
3-spine stickleback	Present	Present		
9-spine stickleback		Present	Present	Common
White perch		Present		
Rock bass	Abundant	Common	Abundant	Present
Green sunfish	Present			
Pumpkinseed	Common	Present	Common	
Bluegill	Abundant	Common	Present	Present
Smallmouth bass	Present	Common	Common	Abundant
Largemouth bass	Common	Present	Present	Present
Black crappie		Common	Present	Common
Yellow perch	Common	Present		Present
Walleye				Present
Sculpin		Present		
Round goby			Abundant	Common

Smallmouth Bass Survey Sampling Locations



Figure 1. Smallmouth bass survey sampling locations in southeastern Wisconsin harbors from 2003-2005.

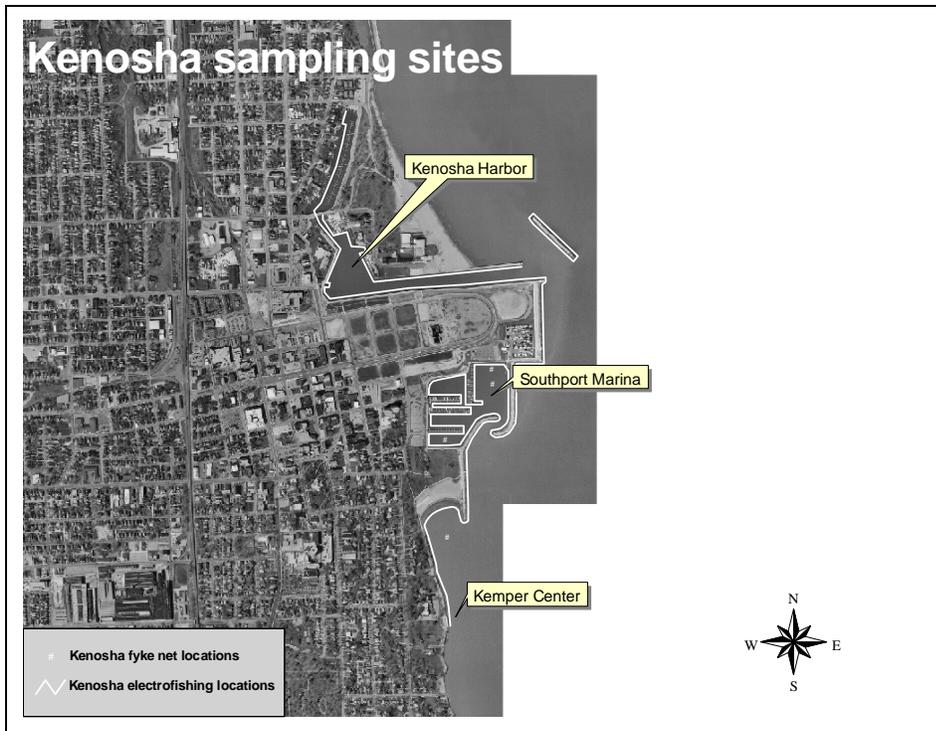


Figure 2. Kenosha sampling sites.

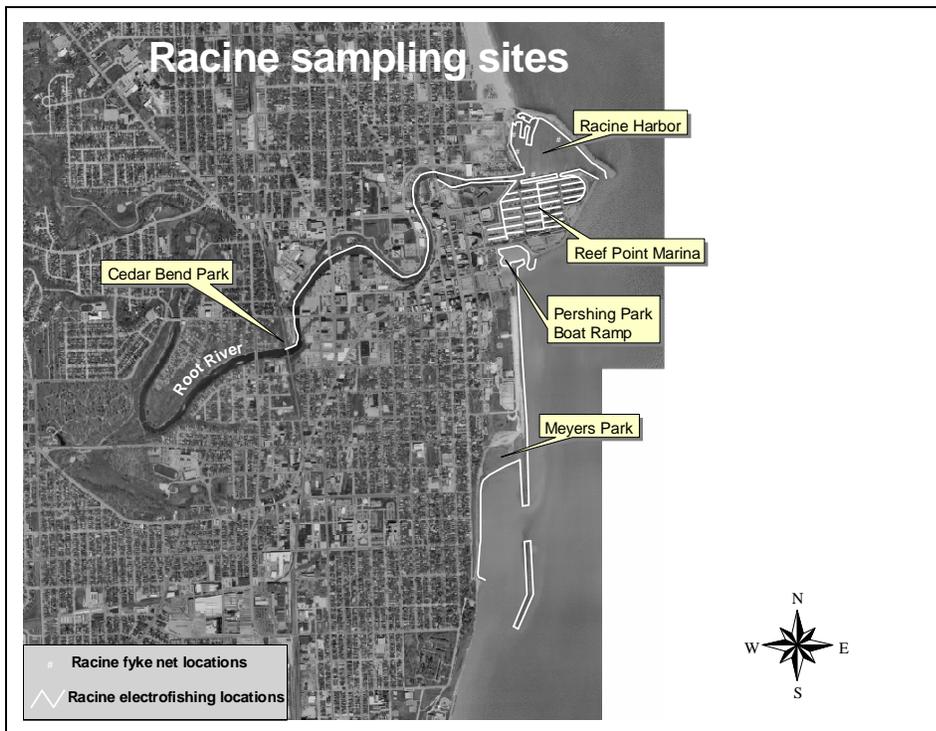


Figure 3. Racine sampling sites.



Figure 4. Port Washington sampling sites.



Figure 5. Sheboygan sampling sites.

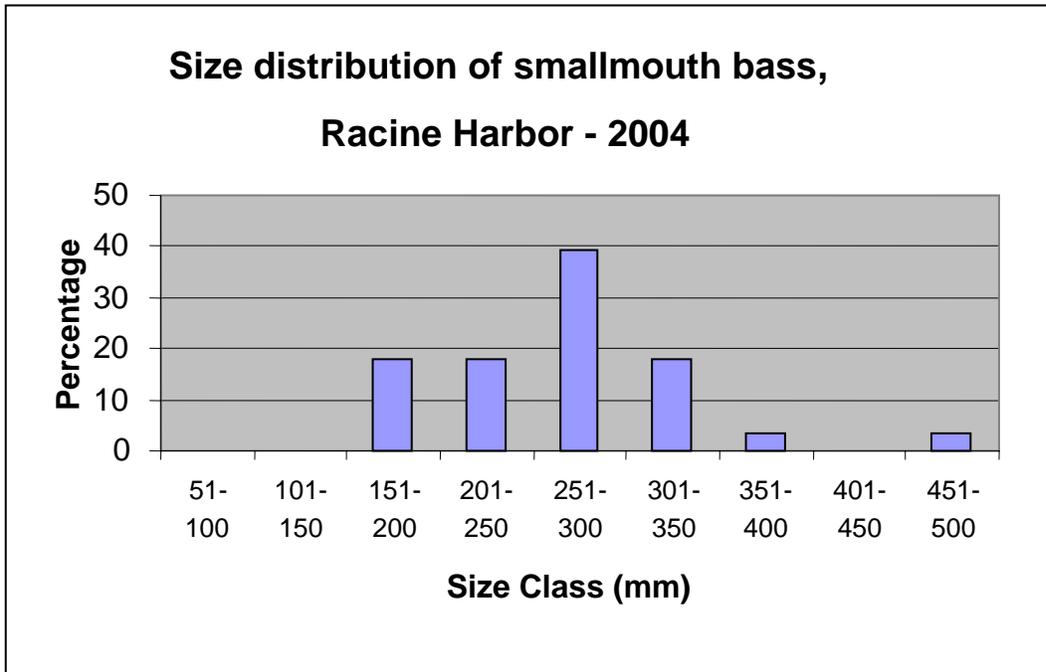


Figure 6. Length frequency distribution of smallmouth bass captured in Racine Harbor using electrofishing.

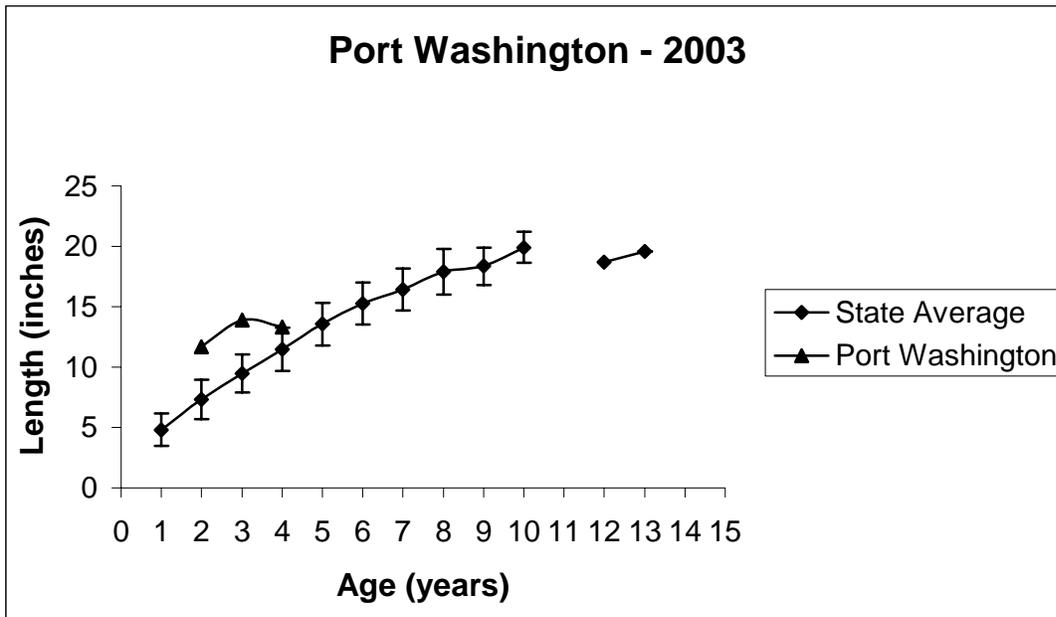


Figure 7. Comparison of mean length at age of smallmouth bass captured in Port Washington Harbor plotted against state average.

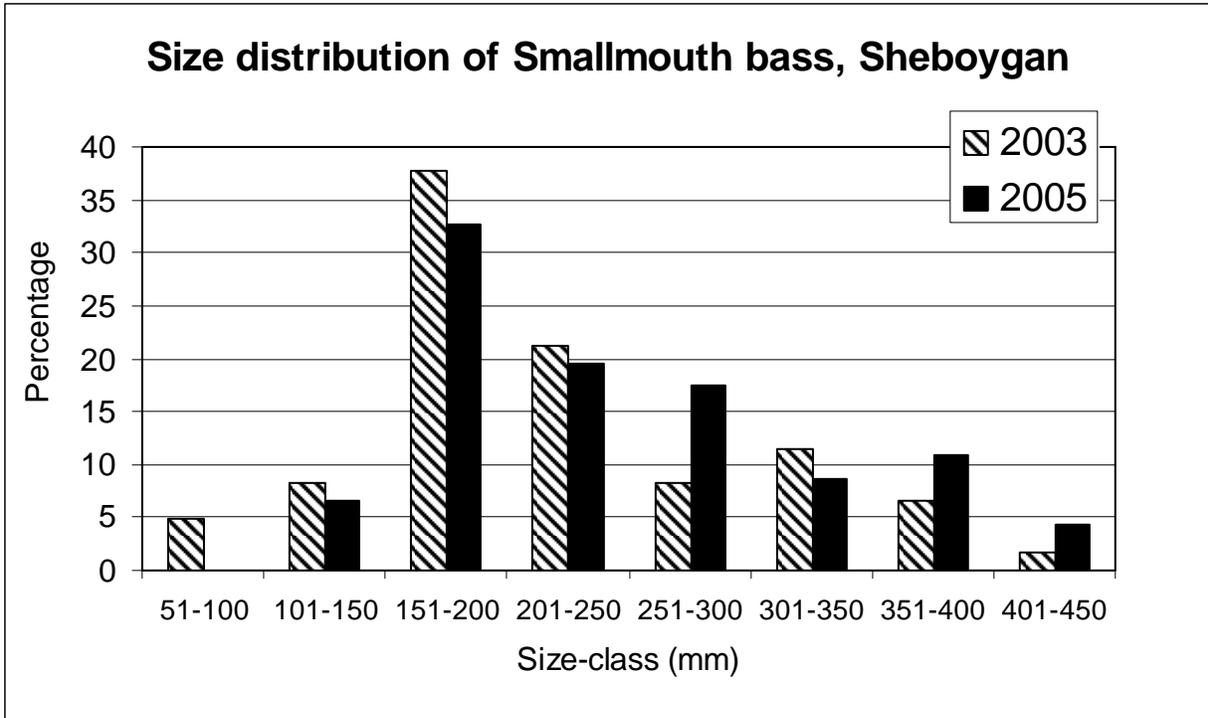


Figure 8. Length frequency distribution of smallmouth bass captured in Sheboygan Harbor using electrofishing in 2003 and 2005.

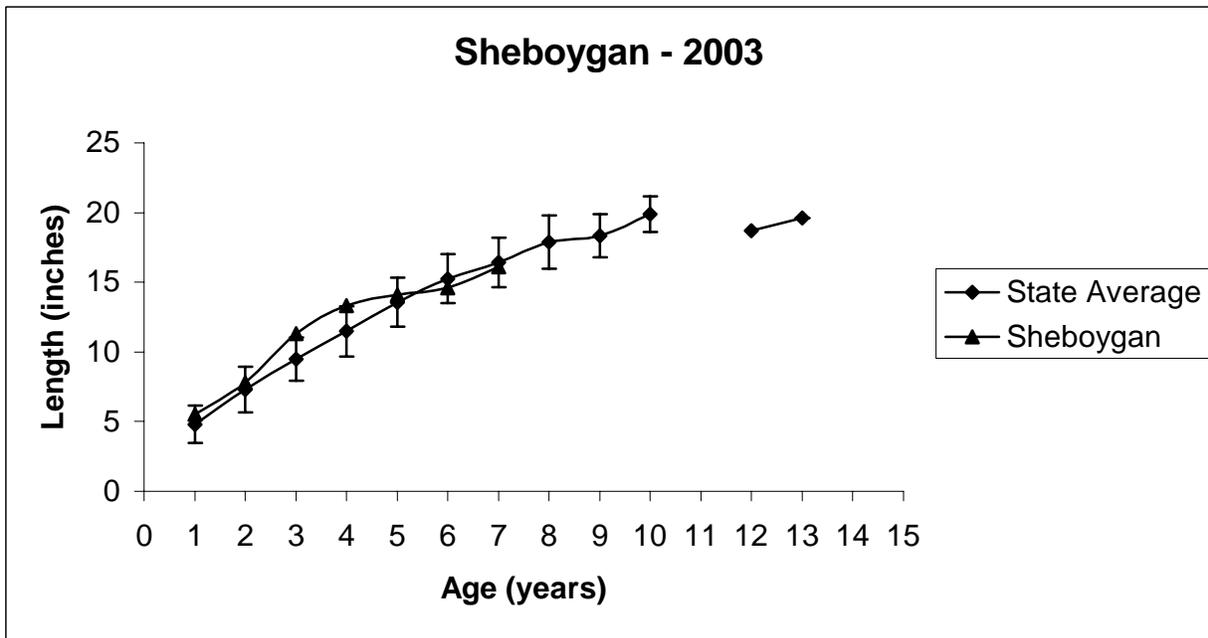


Figure 9. Comparison of mean length at age of smallmouth bass captured in Sheboygan River/harbor plotted against state average - 2003.

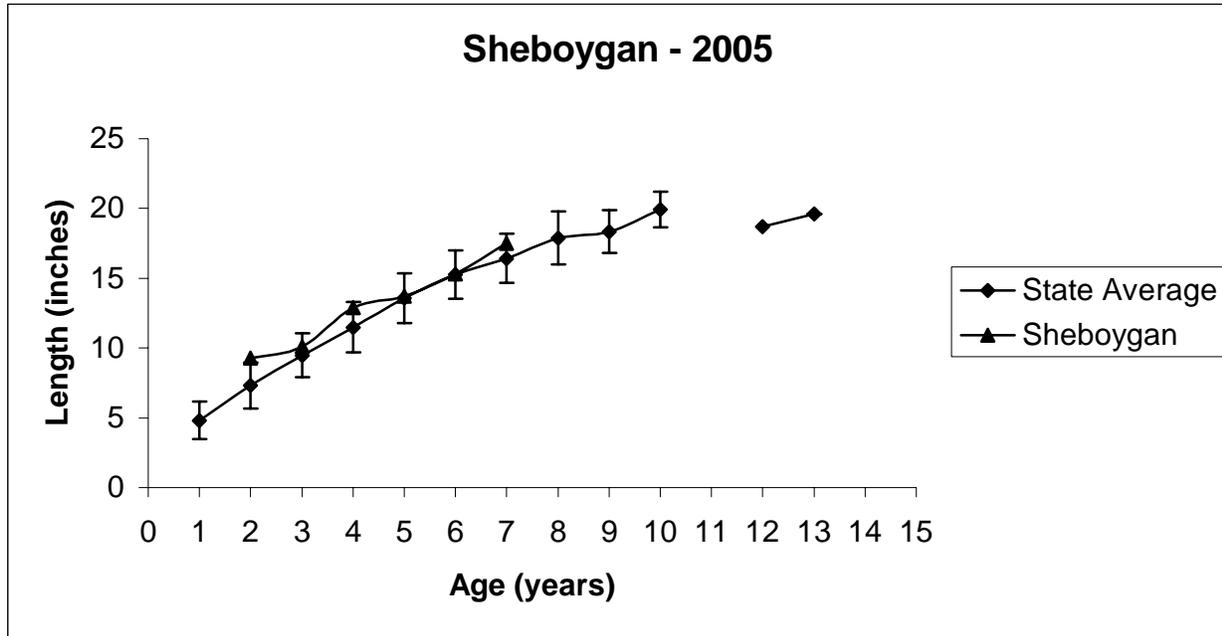


Figure 10. Comparison of mean length at age of smallmouth bass captured in Sheboygan River/Harbor plotted against state average - 2005.

Acknowledgements

We are thankful to the staff of the Southern Lake Michigan Fisheries Work Unit for their assistance in conducting sampling. Tim Kroeff from Sturgeon Bay office provided valuable input in the preparation of this report.

References

- Becker, G.C. 1983. Fishes of Wisconsin. University of Wisconsin Press, Madison.
- Hirethota, P.S., T.E. Burzynski and B.T. Eggold. 2005. Changing Habitat and Biodiversity of the Lower Milwaukee River and Estuary. 49p.
- Kroeff, T. 1996. Assessment of spawning populations of smallmouth bass at Little Sturgeon and the Mink River/Rowley Bay area and young-of-the-year survey along the Door county shoreline in 1996. Wisconsin Department of Natural Resources, Sturgeon Bay, WI. 15p.
- Welch, D. 2005. Wisconsin Department of Natural Resources, Personal communication.