Big Lake Fisheries Assessment
(WBIC 345100)
Shawano County, Wisconsin, 2010

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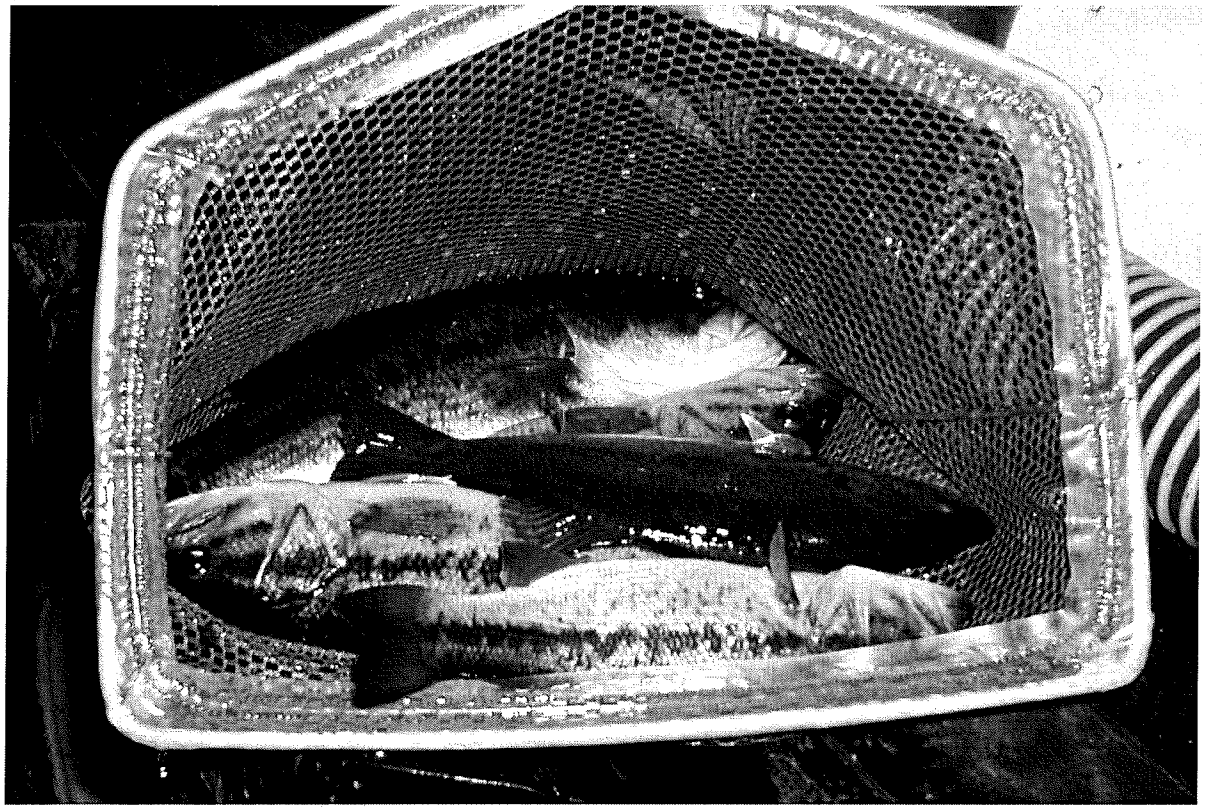

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Report Approval Signatures

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Executive Summary

In cooperation with the Stockbridge Munsee Tribe and Big Lake Association a fisheries assessment was conducted in Big Lake (MWBC 345100) on October 5, 2010. The fish survey focused on collection of fish samples for tribal VHS testing and baseline quantitative fish community data. A well balanced and high quality fishery was sampled in Big Lake. Largemouth bass dominated the predator fish community catch. Relative abundance was high with an electrofishing catch per effort (CPE) of 30.4 bass per hour. Largemouth bass size structure indexes were high with an overall PSD_{12} of 88%, RSD_{14} of 47%, and RSD_{18} of 9%. Mean length at age was average with bass attaining legal size (≥14.0 inches) after 6 summers of growth. Bass relative weight (Wr) was 94 (range: 83 to 117) and remained constant with age and size. Bluegill dominated panfish/prey catch followed by black crappie, yellow perch, pumpkinseed and rock bass. Bluegill relative abundance was high with an electrofishing CPE of 398 bluegill per hour. Size structure indexes were above average with PSD_6 of 41%, RDS_7 of 25%, and RSD_8 of 8%. Bluegill Wr was slightly low with an average value of 90 (range: 75 to 114) and did not change across age or size classes. Bluegill mean length at age was above average with most fish reaching harvestable size (≥ 6.0 inches) after 4 summers of growth. Total annual mortality estimates for bluegill (43%) and largemouth bass (46%) were low. Primary management recommendations include: continue managing Big Lake for largemouth bass and northern pike as primary predators and bluegill and black crappie as the main prey species; assessment of aquatic plant community with particular emphasis on Eurasian watermilfoil abundance and management; continue working with lake association and Stockbridge Munsee Tribe on future fish population monitoring.

Introduction

Big Lake is a 57 acre hardwater spring lake located near Gresham, Wisconsin, in northern Shawano County. It has a maximum depth of 40 feet with an average of 9 feet. The littoral bottom area consists primarily of sand with lesser amounts of gravel and muck. The water is slightly alkaline with moderate transparency. Volland Creek, an outlet stream on the east side of the lake drains into Mud Lake and eventually the west branch of the Wolf River. Submergent and emergent macrophytes are located throughout the entire lake. There are roughly 50 dwellings located on the shoreline of the lake. There is no public access on the lake.

Big Lake supports a diverse fishery consisting of northern pike *Esox lucius*, largemouth bass, *Micropterus salmoides*, bluegill *Lepomis macrochirus*, black crappie *Pomoxis nigromaculatus*, rock bass *Ambloplites rupestris*, pumpkinseed *Lepomis gibbosus* and various nongame species.

Historic management of Big Lake has included fishery surveys, fish stocking, and various length and bag limit regulations. The Wisconsin Conservation Department stocked Big Lake up until 1962 when public access was no longer allowed into the lake (Table 2). Fishery surveys have been conducted by the State of Wisconsin in 1952, 1957, 1967 and 2010. Active management of Big Lake by the DNR is limited since there is no public access. However, the DNR conducted the most recent survey to assist the Stockbridge Munsee Tribe (SMT) with collection of fish specimens for Viral Hemorrhagic Septicemia (VHS) testing as well as gathering basic fish population information.

The objective of the 2010 survey was to assist SMT with collection of VHS samples and determine the status of fish communities in Big Lake. Fish surveys collected basic fish population data related to size structure, condition, growth and mean length at age for dominant predator and prey species.

Methods

Electrofishing - A fall night-time electrofishing survey was conducted on October 5, 2010. A standard WDNR electrofishing boat was used; set at 200 volts and 13 amps (peak) DC, with a 25% duty cycle and 45 pulses per second. Two people netted fish; thus, catch per effort (CPE) data are catch/two netter hour or mile. Shocking was divided into transects at different intervals 0.2 miles – 0.5 miles (Figure 1). Time and distance were recorded for each shocking run in order to calculate CPE (Tables 3 and 4).

Data collected from gamefish and non-predator fish catch included, total length and weight. Scales were collected from stratified samples (5 per size group) of largemouth bass and bluegills for age estimation. A smaller subsample of bluegill otoliths were collected from anglers.

Data Analysis - Total catch, and catch per hour/mile of shoreline electrofished were calculated for all species. Proportional stock densities (PSD) and relative stock densities (RSD) were calculated for all major gamefish and panfish species according to quality and stock sizes defined by Anderson and Gutreuter (1983). Mean length at age and age frequency distributions were calculated for largemouth bass and bluegill. Mortality rates were calculated from the descending limb of catch curves (Ricker, 1975). Fish condition was assessed by analysis of relative weight (Wr) for largemouth bass and bluegill (Wege and (Anderson, 1978). Differences in Wr were analyzed among different length-classes.

Data collected during the 2010 survey were compared to previous surveys. In addition, gamefish and panfish size structure, relative abundance (boomshocker CPEs), and growth data were compared with regional indexes utilizing the WDNR Fisheries and Habitat database. Regional size structure and relative abundance indexes were summarized using interquartile ranges.

Results

Fish Community – Ten species of fish were captured during the Big Lake electrofishing survey (Table 1). Many species encountered comprise a fish community typical of spring lakes in Central Wisconsin. Largemouth bass dominated the predator catch. Bluegill, white sucker and black crappie comprised a majority of prey species. Species composition was similar to the last electrofishing survey conducted in 1966.

Gamefish/Predators – Relative abundance from electrofishing indicated largemouth bass (96%) was the dominant predator followed by northern pike (4%).

Largemouth Bass – A total of 169 (30.4 bass/hour) were captured by electrofishing. Largemouth bass relative abundance was moderate when compared to regional CPE quartiles (Figure 10). Bass average length was 13.8 inches (range 4.6 to 20.6 inches); with modes of 10 and 13 inches (Figure 2). Average weight was 1.6 pounds with a range of 0.04 – 4.9 pounds. Size structure was above average, with an overall PSD_{12} value of 88% and was well above the northeast region 75th percentile (Figure 11). Legal size (RSD_{14}) and trophy size (RSD_{18}) bass comprised 47% and 9% of the stock size bass sampled, respectively. Mean lengths at age were comparable to statewide averages. Bass reached a mean length of 14.5 inches after 6 summers of growth and 16.7 inches after 7 summers of growth (Figure 4). Total annual mortality

for age 5-9 was determined to be 46%. Wr values averaged 94 (range: 83 to 117) and remained constant with age and size (Figure 5).

Northern Pike – Only two northern pike were captured in this survey. Electrofishing is typically not the most effective method for sampling northern pike. Based on habitat, prior surveys, and angler reports it is likely northern pike are an important top end predator in Big Lake. Future sampling should utilize spring ice-out fyke netting to target spawning northern pike and collect basic population information.

Prey – Relative abundance indices were used to characterize all prey population densities. Based on electrofishing catch, bluegill (80%) dominated prey species community follow by white sucker (11%), yellow perch (3%), black crappie (2%), and other fish species.

Bluegill – A total of 272 (398 per/hour) bluegill were captured by electrofishing. Relative abundance was well above the 75th percentile when compared to other regional lakes (Figure 10). Bluegill average length from electrofishing was 5.5 inches; ranging from 1.9 to 9.6 inches; with modes of 4.5 and 6 inches (Figure 6). Average weight was 0.11 pounds with a range of 0.002 to 0.67 pounds. Size structure was above average with PSD_6 value of 41% and RSD_7 25%. Exceptional sized ($RSD_{8)}$ bluegill had a value of 8%. Size structure indexes are similar to indexes collected during the 1966 survey and above the 75th percentile when compared to other northeast region lakes (Figure 12). Bluegills reached harvestable size ($\geq$ 6 inches) after 4 summers of growth and were comparable to statewide averages (Figure 8). Condition was slightly low with an average Wr value of 90 and ranges from 44 to 114 (Figure 9). Total annual mortality for ages 3-9 was 43% which is relatively low when compared to other area lakes.

Other Prey Species sampled during our survey include: black crappie, yellow perch, pumpkinseed rock bass, white sucker, and common shiner. Most species had low-moderate abundance. Of notable interest was the high abundance of white sucker with a CPE of 55.6 fish per hour and a mean length of 7.9 inches. Generally, lakes with high sucker populations have the highest potential to support high quality northern pike fisheries.

Summary and Management Recommendations

1) Continue managing Big Lake for largemouth bass and northern pike as primary predators and bluegill and black crappie as the main prey species. Big Lake possesses a very high quality bluegill and largemouth bass population and appears to have a well balanced fish community. Size structure and abundance indexes are higher than what is found in most area lakes. Furthermore, mortality rates were relatively low and may be likely due to low pressure and exploitation.

2) Of concern was the presence of Eurasian watermilfoil (EWM). EWM is an exotic invasive aquatic plant that can displace native aquatic macrophytes. In high abundance it can also affect predator/prey interactions which could lead to poor growth and size of bluegills and other prey/panfish species. We recommend a plant survey to identify extent of EWM distribution and initiation of a management program to eradicate and/or minimize its spread.

3) Discuss and share survey results with local user groups. Assist groups with future management.

4) Protect and/or restore natural aquatic habitat. Preserving existing habitat will be far more beneficial in maintaining the fishery than relying on stocking and artificial habitat enhancements (e.g. rock spawning reef). Natural habitat may be restored or augmented through addition of large coarse wood in the littoral areas.

5) Conduct a spring ice-out fyke net survey to target spawning northern pike. We were unable to effectively sample northern pike populations with electrofishing and it is likely this species is an important top predator in the fish community. As part of the survey, we also recommend conducting a mark and recapture population estimate.

6) Continue monitoring of fish populations on a 6-8 year rotation. Although Big Lake does not have a public access it serves as an important reference lake for regional fish community comparisons. Future surveys and access should be coordinated through Big Lake Association and/or Stockbridge Munsee Tribe.

Acknowledgements

Special thanks to all the volunteers who assisted with data collection including: Stockbridge Tribal Biologists, Luke Hennigan and Bob Frank; members of Stockbridge Munsee Tribe; Ray Heinritz, Kim Kafura and other volunteers from the Big Lake Association.

Literature Cited

Anderson, R.O. and S. J. Gutreuter. 1983. Length, weight and associated structural indices. Pages 283-300 in L. Nielson and D. Johnson, editors. Fisheries Techniques. American Fisheries Society, Bethesda, Maryland.

Andrews, L.M. and C.W. Threinen. 1968. Surface water resources of Shawano County. Wisconsin Department of Natural Resources, Madison, Wisconsin. 147 pages.

Ricker, W. E. 1975 Computation and interpretation of biological statistics of fish populations. Bulletin 191, Dept. Env. Fish. Mar. Sci., Ottawa.

Ryan, Danny. 1967. Investigation Report – Big Lake, Shawano County. Wisconsin DNR Memo.

Simonson, T., A. Fayram, J. Hennessy, and T. Treska. 2008. Lakes Assessment Protocol. Unpublished Guidance Document, Wisconsin Department of Natural Resources, Madison.

Table 1. Common and scientific names and abbreviations for species mentioned in this report, and sampled in Big Lake during 2010.

Common name	Scientific name	Species Code
Predators		
Largemouth Bass	*Micropterus salmoides*	W12
Northern Pike	*Esox lucius*	L02
Non-predators		
Black Bullhead	*Ictalurus melas*	O05
Black Crappie	*Pomoxis nigromaculatus*	W14
Bluegill	*Lepomis macrochirus*	W09
Common Shiner	*Notropis cornutus*	M28
Pumpkinseed	*Lepomis gibbosus*	W06
Rock Bass	*Ambloplites rupestris*	W04
White Sucker	*Catostomus commersoni*	N09
Yellow Perch	*Perca falvescens*	X15

Table 2. Stocking history for Big Lake from 1938 to1962.

Year	Species	Age Class	Number
1962	Walleye	Fingerling	6100
1960	Walleye	-	4415
1959	Walleye	-	6100
1958	Walleye	-	6100
1955	Walleye	-	3000
1953	Walleye	-	3000
1952	Walleye	Fingerling	1500
1950	Walleye	Fingerling	825
1950	Walleye	Fry	99000
1949	Walleye	Fingerling	375
1947	Walleye	Fry	250000
1947	Largemouth Bass	Fingerling	700
1946	Largemouth Bass	Fingerling	450
1945	Largemouth Bass	Fingerling	3200
1945	Walleye	Yearling	412
1944	Largemouth Bass	Fingerling	250
1944	Walleye	Fingerling	1500
1943	Largemouth Bass	Fingerling	1400
1943	Walleye	Fingerling	1100
1943	Walleye	Fry	100000
1942	Largemouth Bass	Fingerling	600
1942	Walleye	Fry	96000
1941	Black Crappie	Adult	1225
1941	Yellow Perch	Fingerling	3000
1941	Rock Bass	Adult	76
1941	Smallmouth Bass	Fingerling	1200
1941	Walleye	Fry	500000
1940	Bluegill	Adult	25
1940	Brown Trout	Two year	135
1940	Black Crappie	Adult	850
1940	Rock Bass	Adult	25
1940	Walleye	Fry	500000
1939	Bluegill	Adult	250
1939	Bullhead	Fingerling	500
1939	Bullhead	Yearling	200
1939	Black Crappie	Adult	900
1939	Largemouth Bass	Fingerling	4000
1939	Yellow Perch	Adult	500
1939	Yellow Perch	Fingerling	5000
1939	Yellow Perch	Yearling	2000
1939	Sunfish	Adult	300
1939	Sunfish	Fingerling	4000
1938	Bluegill	Fingerling	18000
1938	Bullhead	Fingerling	5000
1938	Yellow Perch	Adult	1000
1938	Yellow Perch	Fingerling	3000
1938	Smallmouth Bass	Adult	50

Table 3. Summary of fall electrofishing catch for Big Lake, Shawano County, October 5, 2010. Electrofishing distance and time for **gamefish** was 1.94 miles and 1.12 hours, respectively. All other fish distance and time were 1.14 miles and 0.68 hours, respectively. Gamefish were only targeted in stations E and F.

Species	A	B	C	D	E	F	Total	CPE no/mile	CPE no/hour
Northern Pike	-	-	-	1	-	1	2	1	1.8
Common Shiner	-	-	-	1	-	-	1	0.9	1.5
White Sucker	-	22	-	16	-	-	38	33.3	55.6
Black Bullhead	-	-	2	2	-	-	4	3.5	5.9
Rockbass	-	1	-	3	-	-	4	3.5	5.9
Pumpkinseed	-	-	-	2	-	-	2	1.8	2.9
Bluegill	58	62	55	97	-	-	272	238.6	398
Largemouth Bass	2	10	3	8	8	3	34	17.5	30.4
Black Crappie	1	4	2	1	-	-	8	7	11.7
Yellow Perch	1	6	1	2	-	-	10	8.8	14.6

Table 4. Electrofishing transects shocked during October, 2010, on Big Lake. Transects correspond to those pictured in Figure 1.

Date	Station	Generator Time (min)	Distance (miles)	Volts	Amps	Water Temp (°F)
10/05/2010	A	8	0.2	200	10	59.9
10/05/2010	B	12	0.34	200	10	59.5
10/05/2010	C	8	0.2	200	10	59.5
10/05/2010	D	14	0.4	200	10	59.2
10/05/2010	E	15	0.5	200	10	59.2
10/05/2010	F	10	0.3	212	10	59.2

Table 5. Minimum, maximum, and mean lengths (inches) of all fish species captured during fall electrofishing on Big Lake, 2010

Species	Count	Minimum	Maximum	Mean
Northern Pike	2	20.7	24.3	22.5
Common Shiner	1	4.4	4.4	4.4
White Sucker	38	3.1	12.3	7.9
Black Bullhead	4	6.8	11.6	8.3
Rockbass	4	4.3	8.0	6.7
Pumpkinseed	2	7.2	7.2	7.2
Bluegill	272	1.9	9.6	5.5
Largemouth Bass	34	4.6	20.7	13.8
Black Crappie	8	4.4	9.6	6.6
Yellow Perch	10	2.9	8.5	5.5

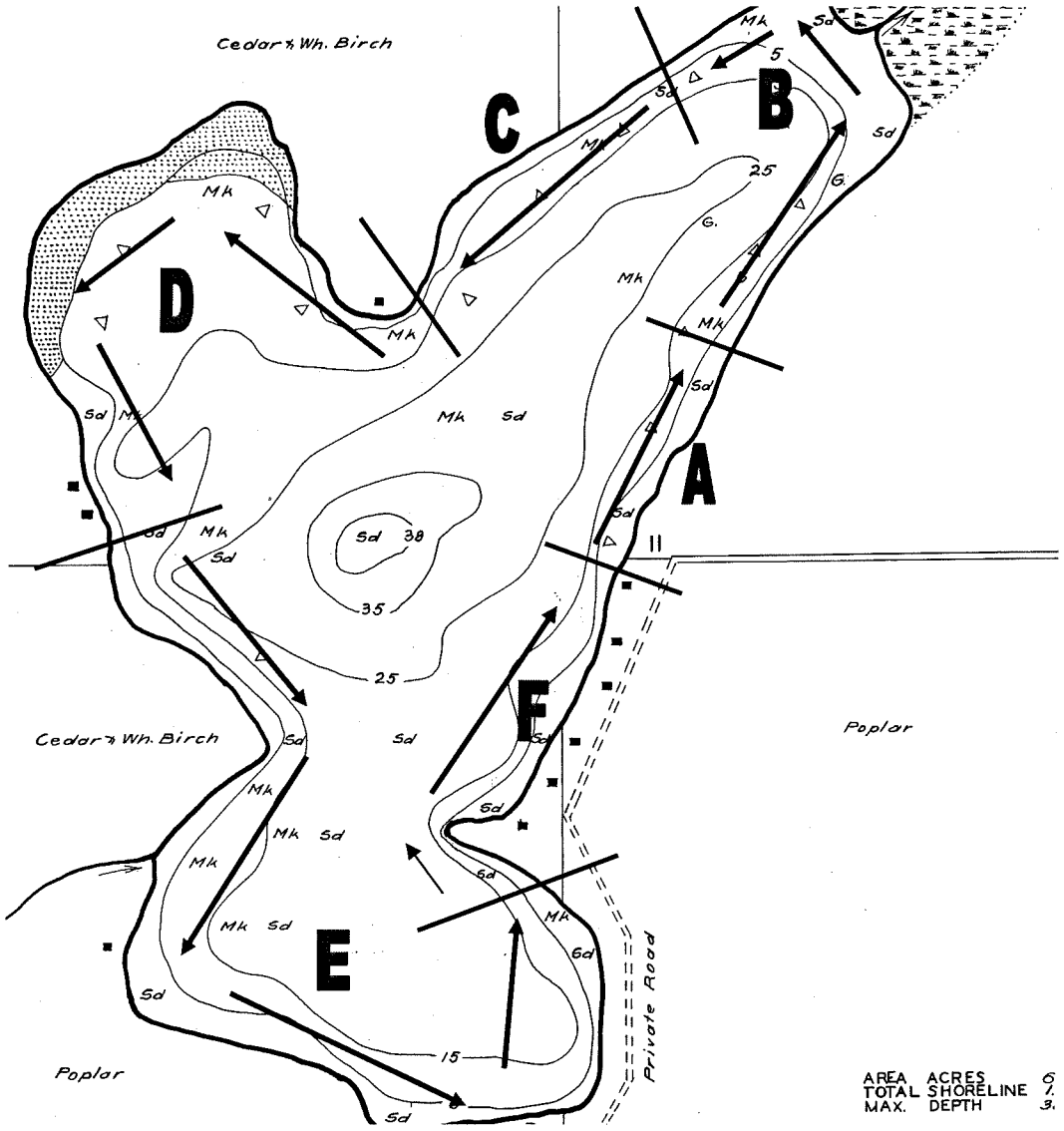

Figure 1. Locations of timed electrofishing transects on Big Lake, October 5, 2010.

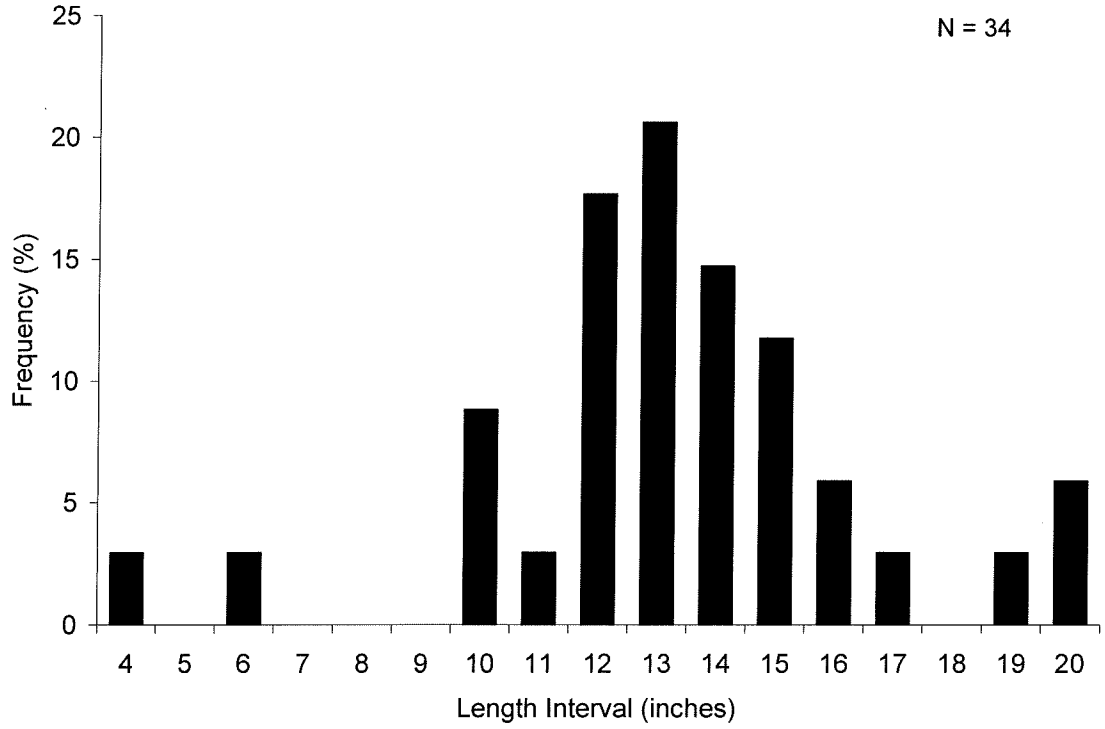

Figure 2. Largemouth bass length frequency distribution taken from fall electrofishing catch, Big Lake, October 5, 2010.

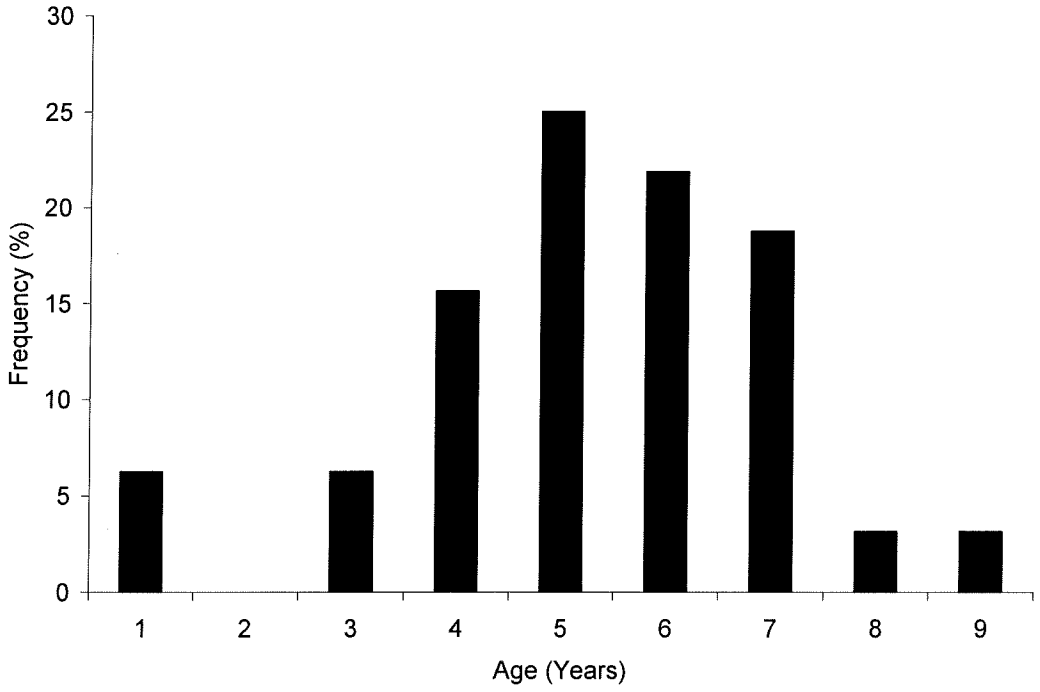

Figure 3. Largemouth bass age composition taken from fall electrofishing catch, Big Lake, October 5, 2010.

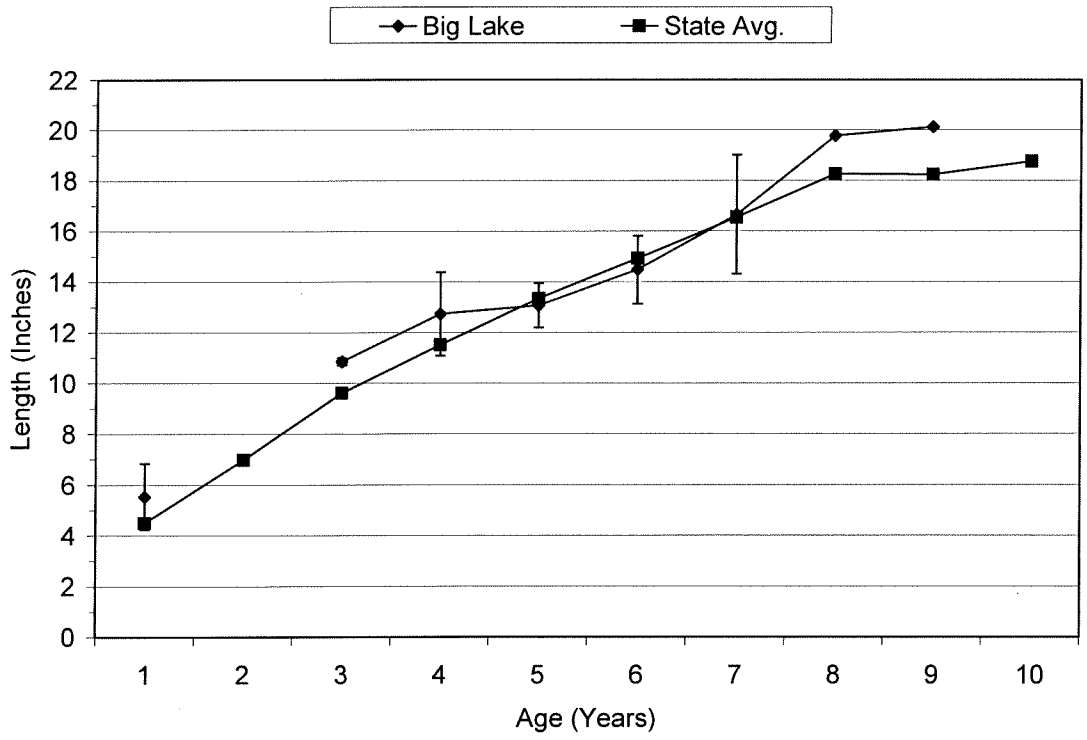

Figure 4. Largemouth bass mean length at age estimate from scales collected from fall electrofishing catch, Big Lake, October 5, 2010.

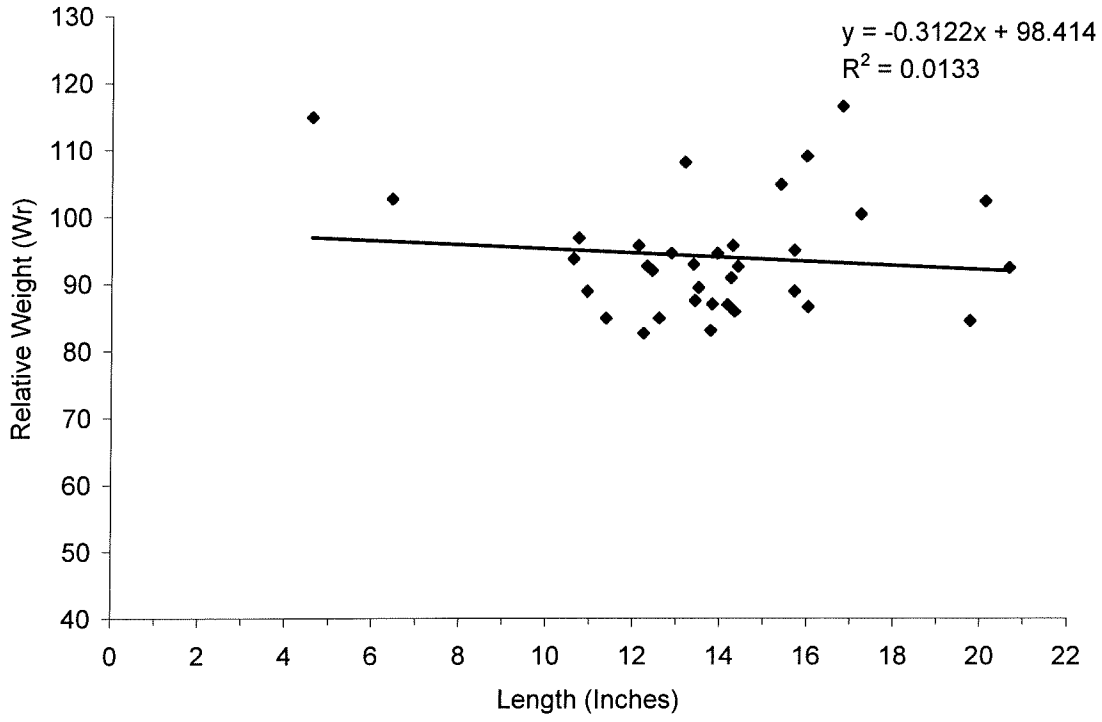

Figure 5. Largemouth bass relative weight (Wr) taken from fall electrofishing catch, Big Lake, October 5, 2010.

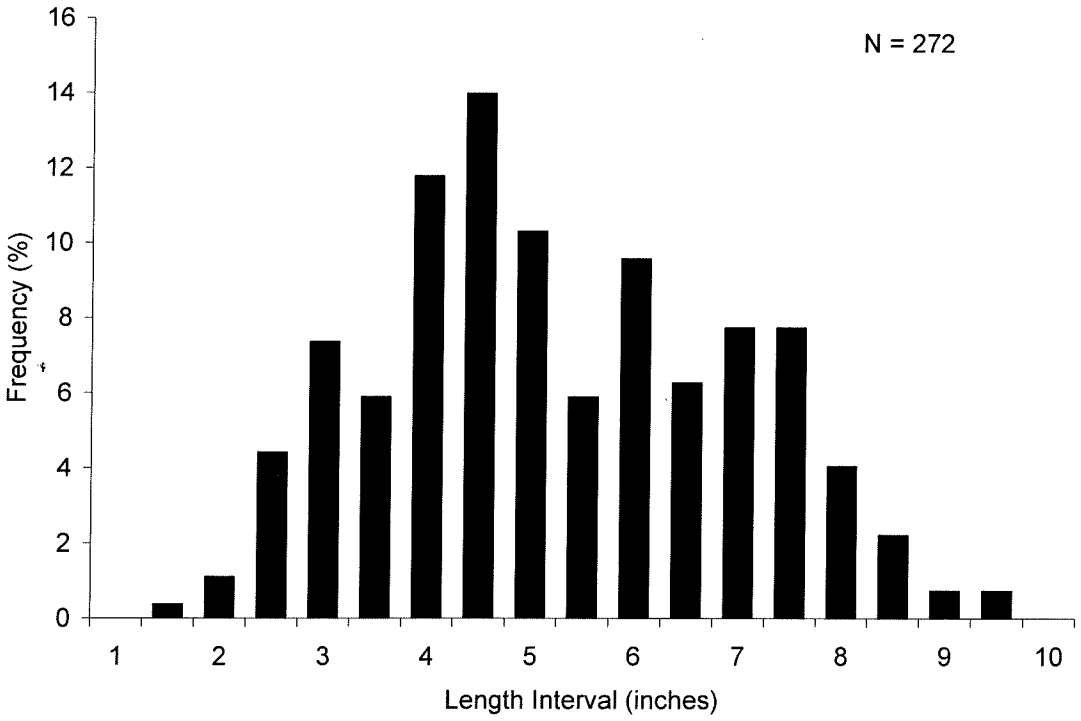

Figure 6. Bluegill length frequency distribution taken from fall electrofishing catch, Big Lake, October 5, 2010.

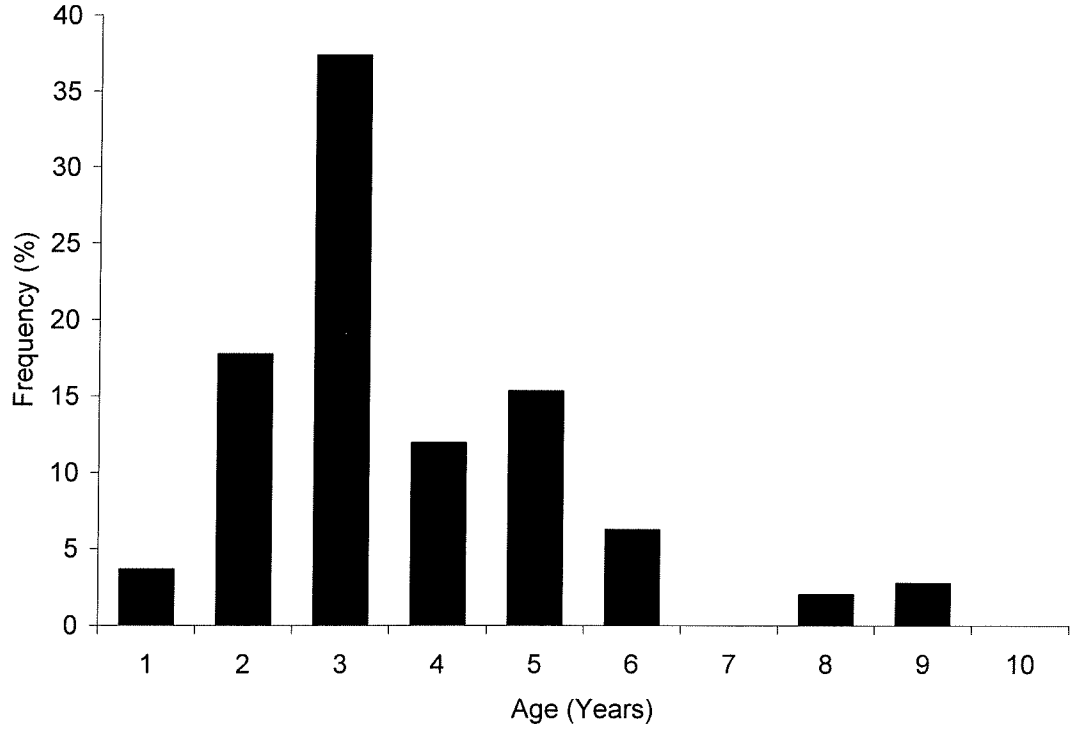

Figure 7. Bluegill age composition taken distribution taken from fall electrofishing catch, Big Lake, October 5, 2010.

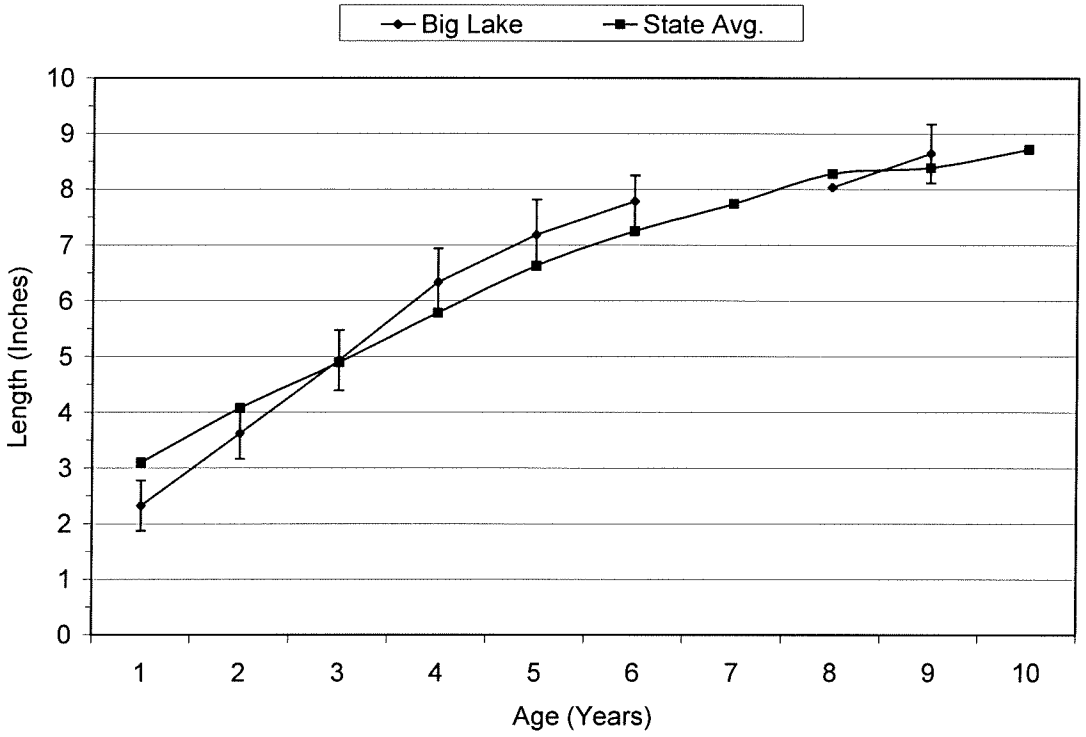

Figure 8. Bluegill mean length at age estimated from scale and otolihs collected from fall electrofishing catch, Big Lake, October 5, 2010.

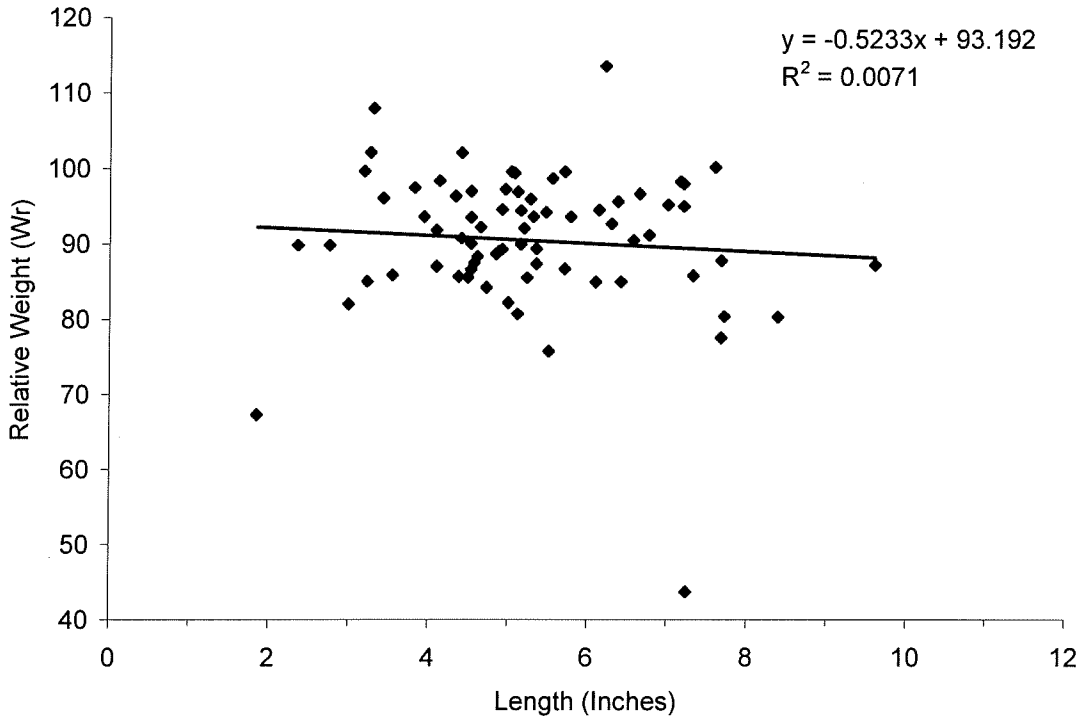

Figure 9. Bluegill relative weight (Wr) taken from fall electrofishing catch, Big Lake, October 2, 2010.

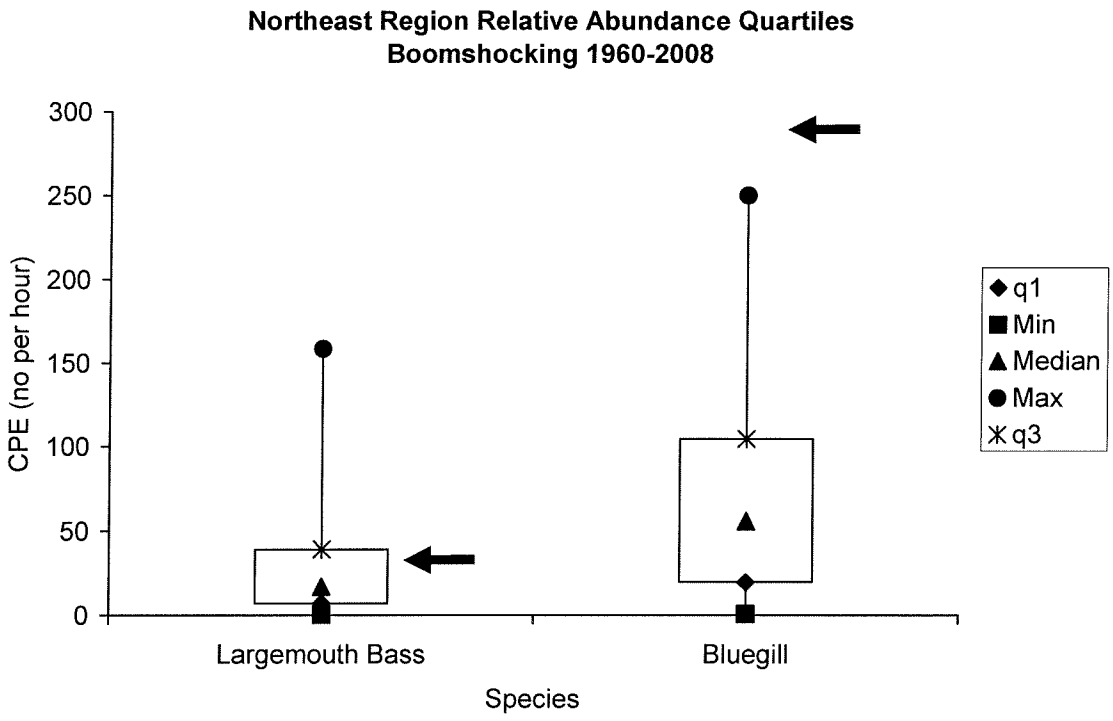

Figure 10. Northeast Region relative abundance quartiles for largemouth bass and bluegill taken from electrofishing surveys during 1960-2008. Arrows indicate values for Big Lake.

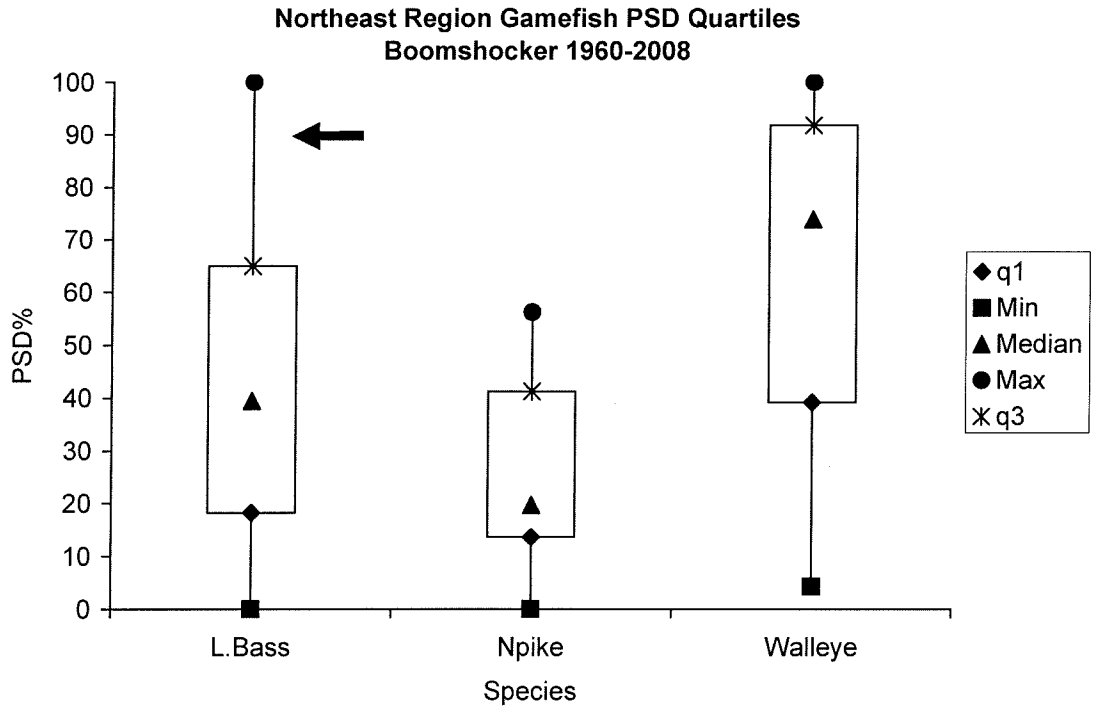

Figure 11. Northeast Region PSD quartiles for gamefish taken from electrofishing surveys during 1960-2008. Arrow indicates bluegill PSD value for Big Lake from 2010 survey. Sample size from 2010 survey was not large enough to quantify for other species.

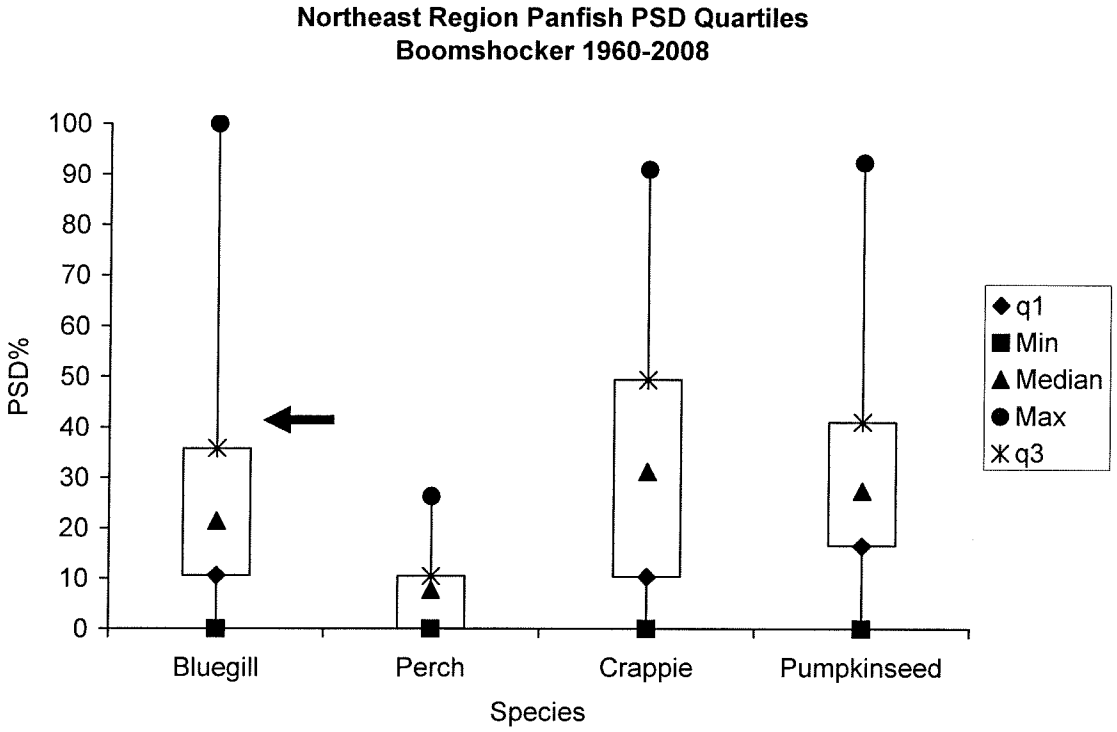

Figure 12. Northeast Region PSD quartiles for panfish taken from electrofishing surveys during 1960-2008. Arrow indicates bluegill PSD value for Big Lake from 2010 survey. Sample size from 2010 survey was not large enough to quantify for other species.