Big Sand Lake Fishery Survey, Burnett County, Wisconsin

2008-2010

MWBIC 2676800

Jamison Wendel

Senior Fisheries Biologist

Wisconsin Department of Natural Resources

Northern Region – Spooner

June, 2012

Executive Summary

Big Sand Lake (Burnett County) was surveyed during 2008, 2009 and 2010 following the protocol established by the Wisconsin Department of Natural Resources Treaty Fisheries Assessment Unit. The primary objective of this survey was to assess the status of walleye, and other game and panfish populations. Also, a creel survey assessed angler effort, catch, and harvest of all fish species on Big Sand Lake.

The 2009 adult walleye population estimate on Big Sand Lake (0.03 fish/acre) was much lower than both Burnett County and Northwest Wisconsin averages. Growth rates for both male and female walleyes exceeded regional averages. Largemouth bass were found at moderate densities with below average growth rates. Northern pike were at low densities, with 27 total fish captured during spring surveys. Bluegill catch rates were high and size structure was average.

Total angler effort on Big Sand Lake (12.6 hours/acre) was below both Burnett County and ceded territory averages. Over 80% of angling effort on Big Sand Lake was directed at centrarchids, primarily bluegill (26%), largemouth bass (20%), black crappie (18%), and pumpkinseed (17%). Angler catch rates for largemouth bass far exceeded regional averages. Panfish species comprised most of the sport angler harvest on Big Sand Lake.

Management recommendations include: 1) Focus management efforts on a centrarchid dominated fishery, 2) Monitor changes to the largemouth bass population after removal of the 14 in minimum size limit initiated in 2012, 3) Continue panfish management strategies, 4) Discontinue walleye stocking by the Wisconsin DNR, 5) Protect and enhance critical fish habitat, 6) Continue efforts to maintain and enhance habitat diversity whenever possible, and 7) Continue exotic species monitoring and control programs.

Introduction

Big Sand Lake is a 1,400 acre soft water seepage lake in south central Burnett County. The lake's shoreline is primarily privately owned and highly developed. Maximum depth on Big Sand Lake is 55 feet. However, much of the lake is shallow and mean depth is 9 feet.

Big Sand Lake is a clear water, mesotrophic lake. TSI is an index for evaluating trophic state or nutrient condition of lakes (Carlson 1977; Lillie et. al. 1993). TSI values can be computed for water clarity (secchi disk measurements), chlorophyll-a, and total phosphorus values. TSI values represent a continuum ranging from very clear, nutrient poor water (low TSIs) to extremely productive, nutrient rich water (high TSIs). The data on Big Sand Lake (WDNR (online) 2010) indicate the nutrient conditions were mesotrophic (moderate productivity) when considering secchi disk, total phosphorus and chlorophyll-a TSI indices. Between 2004 and 2011, the mean secchi TSI value was 43.6 (S.D. = 0.79) from samples taken near the deep hole of Big Sand Lake.

Gamefish species present in Big Sand Lake include walleye Sander vitreus, largemouth bass Micropterus salmoides, and northern pike Esox lucius. Panfish species include bluegill Lepomis macrochirus, black crappie Pomoxis nigromaculatus, pumpkinseed L. gibbosus, yellow perch Perca flavescens, green sunfish L. cyanellus, and rock bass Ambloplites rubestris. Other species common in Big Sand Lake include bowfin Amia calva, yellow bullhead Ameiurus natalis, and white sucker Catostomus commersoni.

Numerous surveys primarily targeting walleyes have been conducted by Wisconsin DNR and Great Lakes Indian Fish and Wildlife Commission in recent years. Since 1997, walleye has been the only fish species stocked into Big Sand Lake (Appendix Table 1). During this survey, all of the standard statewide fishing regulations

applied to Big Sand Lake, except for a 40 in minimum size limit on muskellunge (Appendix Table 2).

The primary objective of this study was to assess the status of the walleye population, as well as sport and tribal exploitation of walleye on Big Sand Lake. Secondary objectives were to assess largemouth bass, northern pike, and panfish populations.

Methods

Big Sand Lake was surveyed in 2008-2010 following the Wisconsin Department of Natural Resources treaty assessment protocol (Cichosz 2010). The first phase of this survey consisted of spring electrofishing in 2008 to estimate largemouth bass and panfish abundance, growth, and size structure. Soon after ice out in 2009, fyke nets were set targeting adult walleye and northern pike. Beginning with the gamefishing opener in May 2009, a creel survey (both open water and ice) was conducted. Fall electrofishing targeting young-of-the-year (YOY) walleye was conducted in 2008 and 2009.

Sampling targeting largemouth bass and panfish was conducted on 03 June 2008. Largemouth bass were sampled over two, two-mile index stations. A 1/2 mile index station was embedded in each station where panfish were collected in addition to bass.

Fyke nets (4 x 5 ft frame) were set on 10 April 2009. Nets were checked daily and set at areas expected to contain high concentrations of spawning walleye. Nets were removed on 14 April, with a total effort of 24 net nights on Big Sand Lake. After removal of nets, the entire shoreline of Big Sand Lake was sampled with an electrofishing boat on 14 April for the recapture run.

All walleyes, northern pike, and largemouth bass captured during the spring portion of the survey were measured to the nearest 0.5 in and given the appropriate fin

clip (Appendix Table 3). Sex was determined for walleyes and northern pike by the presence of gametes.

Spring survey data were used to estimate the adult walleye population for Big Sand Lake. Fish captured during netting were included in the marked sample and fish captured during the electrofishing run were included in the recapture sample. Adult walleye population estimates were calculated using the Chapman modification of the Petersen Estimator as outlined in Cichosz (2010).

For age analysis, scale samples were removed from walleyes and largemouth bass less than 12 in, while dorsal spines were removed from larger fish. Scale samples were used exclusively to determine bluegill age. Age interpretations on northern pike were not conducted due to the unreliability and difficulty of determining annuli. Casselman (1990) found this to be due to irregular growth and resorption or erosion on the midlateral region.

Mean length-at-age comparisons for walleye and largemouth bass were made to regional (18 county Northern Region) and statewide data using the WDNR Fish and Habitat statewide database. Mean length at age was used to assess growth for largemouth bass using the following von Bertalanffy equation:

$$l_t = L_\infty(1-e^{-K(t+t_o)})$$

Where l_t is length at time t, L_∞ is asymptotic length, K is a growth parameter, t is age in years, and t_0 is the age at which l_t is zero (Van den Avyle and Hayward 1999). L_∞ predicts the average ultimate length attained for fish in that population.

Size structure quality of species sampled was determined using the indices proportional (PSD) and relative (RSD) stock densities (Anderson and Gutreuter 1983). The PSD and RSD value for a species is the number of fish of a specified length and

longer divided by the number of fish of stock length or longer, the result multiplied by 100 (Appendix Table 4).

Catch per Unit Effort (CPE) was calculated as the number of fish captured above stock, preferred, and quality sizes divided by the appropriate unit of sampling effort for that species. That value is then compared to surveys of similar waterbodies throughout Wisconsin using the Fisheries Assessment Classification Tool (FACT) to determine how that value compares to other fisheries.

Creel survey data were collected on Big Sand Lake beginning 02 May 2009 and continuing through 07 March 2010 (the open season for gamefish angling in Wisconsin). No creel survey data were collected during November because thin ice created dangerous fishing conditions. Creel survey methods followed a stratified random design as described by Rasmussen et al. (1998) and Cichosz (2010). Walleye exploitation rates were calculated using the proportion of fin clipped walleye (from spring population estimates) observed and measured during the creel survey.

Results

Walleye. The 2009 adult walleye population on Big Sand Lake was estimated at 37 fish (CV = 0.31). This estimated density (0.03 fish/acre) was lower than both the Burnett County and Northwest Wisconsin averages of 2.5 and 2.7 fish/acre, respectively (WDNR unpublished data). This density was also below the average density of other ceded territory walleye lakes where stocking was the primary source of recruitment (1.9 fish/acre).

Adult walleyes captured in the spring 2009 survey ranged from 15.0 to 28.4 in (Figure 1). Mean lengths of male and female walleyes were 18.9 (S.D. = 2.3) and 25.0 in (S.D. = 1.8), respectively. All walleyes captured in the 2009 survey were longer than the 15 in minimum size limit. The proportional stock density (PSD) and relative stock

density of preferred size (RSDP) walleyes captured during spring fyke netting was 100 and 50.0, respectively. Compared to similar Wisconsin waterbodies (FACT), these values exceeded 100% of surveys for PSD and 88% of surveys for RSDP. Growth rates for both male and female walleyes on Big Sand Lake exceeded regional averages (Figures 2 and 3).

The average catch rate of Young of Year (YOY) walleye in surveys conducted by both Great Lakes Indian Fish and Wildlife Commission and Wisconsin DNR crews between 1991 and 2010 was 0.38 fish/mile (S.D. = 0.78, N = 11). Catch rates of walleye less than 10 in averaged 0.1 fish/mile from 2000-2010, greater than 13% of similar surveys statewide (FACT).

Largemouth bass. The mean length of largemouth bass captured during the spring 2008 survey on Big Sand Lake was 11.1 in (S.D. = 1.7), with a range of 5.0-17.4 in (Figure 4). A total of 217 largemouth bass $\geq$ 8.0 in (36.2/mile) were collected during that survey, which was greater than 79% of surveys in Wisconsin (FACT). PSD value was 28 (C.I. = 5.87), greater than 6% of surveys from similar Wisconsin lakes. The proportion of fish greater than the 14 in minimum size limit (RSD-14) was 3.2 (C.I. = 2.31), greater than 5% of statewide surveys.

Largemouth bass growth rates were below both statewide averages and results from the 1983 survey of Big Sand Lake (Figure 5). Mean ultimate length from the von Bertalanffy growth equation was 19.4 in (Figure 6).

Northern Pike. A total of 27 northern pike, ranging in length from 8-19 in were captured during spring surveys (Figure 7). No northern pike greater than 21 in (quality size) were captured during the 2009 survey.

Panfish. A total of 176 bluegills $\geq$ 3.0 in (mean length = 5.6, S.D. = 1.8) were captured during the 2008 sampling on Big Sand Lake (Figure 8). This catch rate of 176 bluegill/mile was greater than 75% of similar surveys of Wisconsin waterbodies. The

2008 survey had a higher proportion of bluegills ≥ 7 in than the 1983 survey (Figure 9). Bluegill growth rates were below statewide averages and results from the 1983 survey of Big Sand Lake (Figure 10).

Angler Survey. Total projected angling effort on Big Sand Lake during the 2009-2010 season was estimated at 17,645 hours (12.6 hours/acre). This was much lower than mean angling effort in both the ceded territory (32.4 hours/acre) and Burnett County (24.2 hours/acre). Open water anglers accounted for 80% of the total effort on Big Sand Lake in 2009-2010. The majority of angling effort on Big Sand Lake was directed at bluegill (26%), largemouth bass (20%), black crappie (18%), and pumpkinseed (17%).

Bluegill had the highest estimated sport angler harvest of any species on Big Sand Lake (Table 1). Estimated angler effort and catch for largemouth bass on Big Sand Lake exceeded ceded territory averages.

Discussion

This survey of Big Sand Lake found a sport fishery dominated by centrarchid species. Fyke netting and electrofishing surveys found high density largemouth bass and panfish populations. These species were also the primary target of sport anglers. A 1983 survey also found a fish community dominated by largemouth bass and bluegill (Johannes 1984).

While the high density largemouth bass population provided very high catch rates for anglers, the size structure of the population was poor. Largemouth bass growth rates were much poorer in 2008 than in 1983, particularly for fish greater than four years of age. In May 2012, the 14 in minimum size limit of largemouth bass was replaced with a no minimum size limit. Liberalizing this regulation will allow increased harvest opportunities for the abundant 10-14 in fish and may improve growth rates of largemouth bass.

The majority of angler effort on Big Sand Lake was directed towards panfish, particularly bluegill, pumpkinseed, and black crappie. Bluegill catch rates far exceeded statewide averages for similar waterbodies. Though comparable creel statistics were not available for panfish, catch and harvest rates were similar to other area lakes with recent creel surveys such as Lipsett Lake, Burnett County (Damman 2008) and Wapogasset Lake, Polk County (Benike 2009).

Anglers directed little effort towards the extremely low density walleye population. Fall electrofishing surveys found little to no survival of stocked walleyes. Anecdotal evidence suggested a fishable walleye population existed in Big Sand Lake in the late 1950s and early 1960s. However, after stocking was discontinued in 1957, the population was unable to support itself through natural reproduction. During the 1983 survey of Big Sand Lake, a total of two adult walleye were captured (Johannes 1984).

Good to excellent natural reproduction supports all fish communities in Big Sand Lake except walleye. Catch rates of YOY walleye have been low in both non-stocked years and stocked years. Walleye stocking efforts by the Wisconsin DNR should be discontinued. Private groups interested in stocking walleye on Big Sand Lake should be encouraged to stock large fingerling walleye, which may have greater survival than small fingerlings (Kampa and Hatzenbeler 2009).

Northern pike size structure on Big Sand Lake was very poor in both the spring survey and creel survey. Due to a buildup of ice near the boat landing, spring fyke netting may not have provided an adequate sample of the spawning population. During the creel survey, northern pike were the most harvested gamefish. However, 64% of the northern pike measured by creel clerks were below 18 in. Jacobson (1992) suggested ontogenetic differences in optimal thermal temperatures may inhibit growth of large northern pike in shallow lakes lacking deep water thermal refuge. Margenau et al.

(1998) attributed poor growth rates of larger northern pike to lack of larger prey in vegetated areas of shallow lakes.

Though common carp Cyprinus carpio are present in most lakes with connections to the Yellow River, no common carp were observed during this survey of Big Sand Lake. High density bluegill populations can be effective larval predators of common carp (Bajer and Sorensen 2009). With infertile water and a high density bluegill population on Big Sand Lake, it is unlikely that common carp numbers will increase to densities that would have significant impacts on aquatic resources.

Conclusions and Management Recommendations

1. The Big Sand Lake fishery is dominated by centrarchid species. Future management efforts should focus on these self-sustaining fisheries.
2. Liberalized largemouth bass regulations should provide increased harvest opportunities for anglers and may improve growth rates.
3. Bluegill, pumpkinseed, and black crappie provide above average fisheries. No panfish management changes are warranted at this time.
4. The walleye population on Big Sand Lake was extremely low density. Walleye stocking by the Wisconsin DNR should be discontinued. If there is interest from private groups to maintain a low density walleye fishery through stocking, large fingerlings should be considered.
5. Critical fish habitat in Big Sand Lake needs to be protected and enhanced where possible. Efforts should be made to work with the Big Sand Lake shoreowners and local angler groups stressing the importance of protecting critical habitat and water quality.
6. Efforts to increase habitat complexity in Big Sand Lake should be strongly encouraged. Input of coarse woody debris, protection of aquatic vegetation, and

maintenance or restoration of 35 foot vegetative buffers are some examples of work that can increase habitat complexity.

7. Exotic species monitoring and control programs should continue. Efforts to keep aquatic invasive species out of a waterbody are much more effective than controlling these species once they are established.

Acknowledgements

I would like to thank Kent Bass, Larry Damman, Misty Rood and the other biologists and technicians of the Wisconsin Department of Natural Resources who conducted the field work, aged fish, and entered data during this study. The WDNR treaty assessment unit, particularly Todd Brecka, Mike Keniry, Scott Plaster, Jill Sunderland, and Abby Medis for data collection and entry of both field and creel survey information. Terry Margenau provided a critical review of the manuscript.

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.

Bajer, P.G., G. Sullivan, and P.W. Sorensen. 2009. Effects of rapidly increasing population of common carp on vegetative cover and waterfowl in a recently restored Midwestern shallow lake. Hydrobiologia. doi:10.1007/s10750-009-9844-3.

Benike, H.M. 2009. Wapogasset and Bear Trap Lakes, Treaty Assessment survey, Polk County, Wisconsin 2007-2008 (MWBIC: 2618000; 2618100). Wisconsin Department of Natural Resources, Internal Fisheries Management Report. Barron Field Office.

Carlson, R. 1977. A trophic state index for lakes. Limonology and Oceanography 22(2):361-369.

Casselman, J.M. 1990. Growth and relative size of calcified structures of fish. Transactions of the American Fisheries Society 119:673-688.

Cichosz, T.A. 2010. 2007-2008 Ceded territory fishery assessment report. Wisconsin Department of Natural Resources. Administrative Report 65, Madison.

Damman, L. 2008. Summary of fisheries surveys, Lipsett Lake, Burnett County, 1990-2007, WBIC Code (Lipsett Lake – 2678100). Wisconsin Department of Natural Resources, Internal Fisheries Management Report. Spooner Field Office.

Jacobson, P.C. 1992. Analysis of factors affecting growth of northern pike in Minnesota. Minnesota Department of Natural Resources, Section of Fisheries, Investigational Report 424.

Johannes, S.J. 1984. Walleye stocking evaluation-survey, Big Sand Lake, Burnett County. Wisconsin Department of Natural Resources, Internal Fisheries Management Report, Spooner Field Office.

Kampa, J.M., and G.R. Hatzenbeler. 2009. Survival and growth of walleye fingerlings stocked at two sizes in 24 Wisconsin lakes. North American Journal of Fisheries Management 29:996-1000.

Lillie, R.A., S. Graham, and P. Rasmussen. 1993. Trophic state index equations and regional predictive equations for Wisconsin lakes. Bureau of Research – Wisconsin Department of Natural Resources, Research Management Findings, Number 35.

Margenau, T.L., P.W. Rasmussen, and J.M. Kampa. 1998. Factors affecting growth of northern pike in small Northern Wisconsin lakes. North American Journal of Fisheries Management 18:625-639.

Rasmussen, P. W., M. D. Staggs, T. D. Beard, Jr., and S. P. Newman. 1998. Bias and confidence interval coverage of creel survey estimators evaluated by simulation. Transactions of the American Fisheries Society 127:469-480.

Van den Avyle, M.J. and R.S. Hayward. 1999. Dynamics of exploited fish populations. Pages 127-166 *in* C.C. Kohler and W.A. Hubert, editors. Inland fisheries management in North America, 2nd edition. American Fisheries Society, Bethesda, Maryland.

WDNR (online) 2010. Citizen monitoring lake water quality database. Available from: http://dnr.wi.gov/lakes/CLMN/about.html.

Table 1. Summary of effort, catch, harvest, and mean length statistics for Big Sand Lake, Burnett County, Wisconsin. Ceded territory averages are in parentheses, where available.

	Walleye	Largemouth Bass	Bluegill	Black Crappie	Northern Pike
Directed Effort (hrs)	1,535	6,965	8,906	6,176	3,890
Directed Effort/Acre	1.10 (7.54)	4.98 (3.86)	6.4 (NA)	4.41 (NA)	2.78 (4.23)
Projected Catch (# of fish)	20	12,381	28,154	5,139	7,190
Catch/Acre	0.01 (1.19)	8.84 (2.85)	20.1 (NA)	3.67 (NA)	5.14 (2.22)
Specific Catch Rate (Fish/Hour)	0.01 (0.12)	1.3 (0.28)	3.03 (NA)	0.73 (NA)	0.93 (0.20)
Projected Harvest (# of fish)	8	200	9,960	2,098	286
Harvest/Acre	0.01 (0.27)	0.14 (0.15)	7.11 (NA)	1.50 (NA)	0.20 (0.35)
Specific Harvest Rate (Fish/Hour)	0.01 (0.03)	0.03 (0.02)	1.10 (NA)	0.31 (NA)	0.06 (0.05)
Mean Length (in)	27.1	14.5	7.4	9.4	19.2

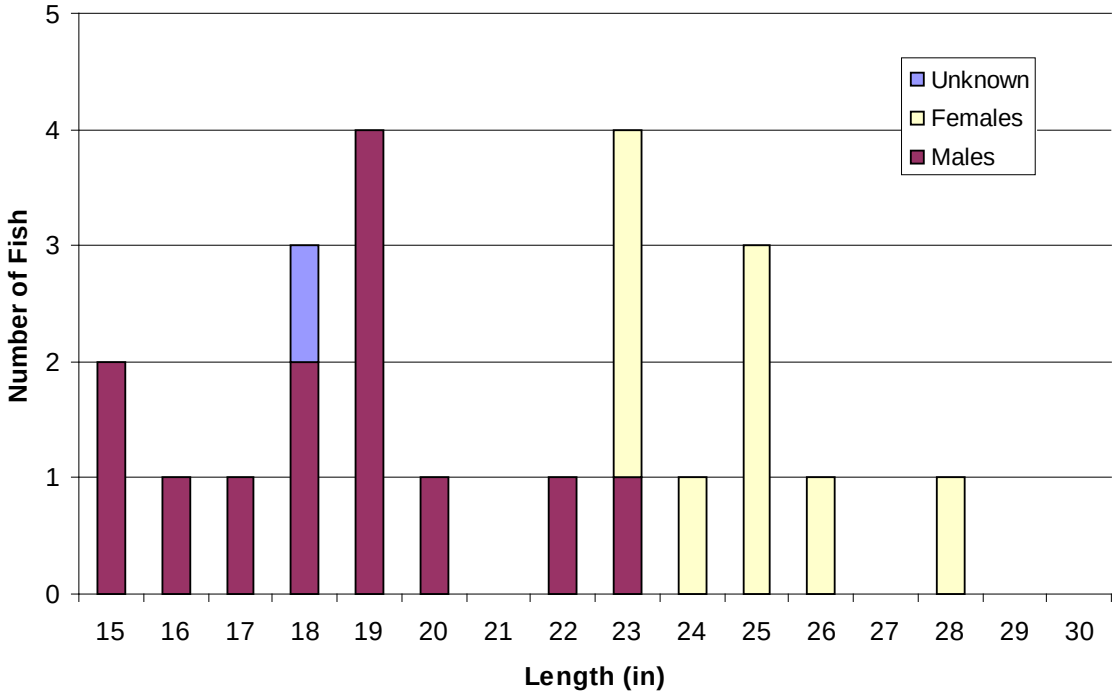

Figure 1. Length frequencies of adult walleyes captured during spring 2009 sampling on Big Sand Lake, Burnett County, Wisconsin (N=23).

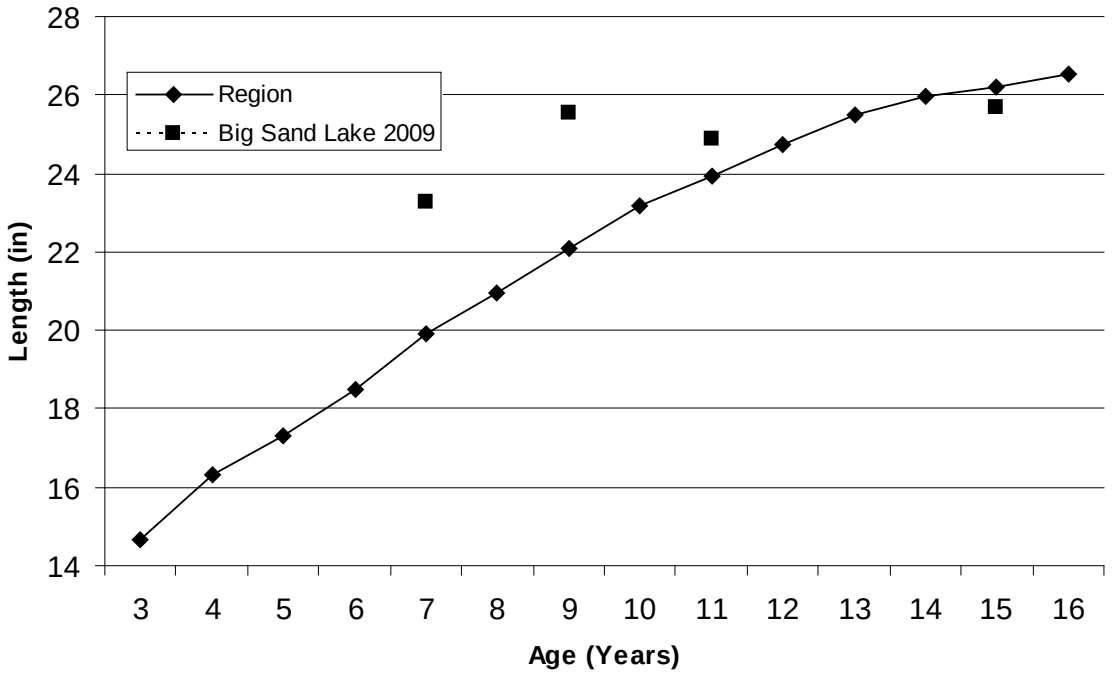

Figure 2. Mean lengths at age for female walleyes captured during 2009 spring survey on Big Sand Lake, Burnett County, Wisconsin. Regional averages are displayed for comparison.

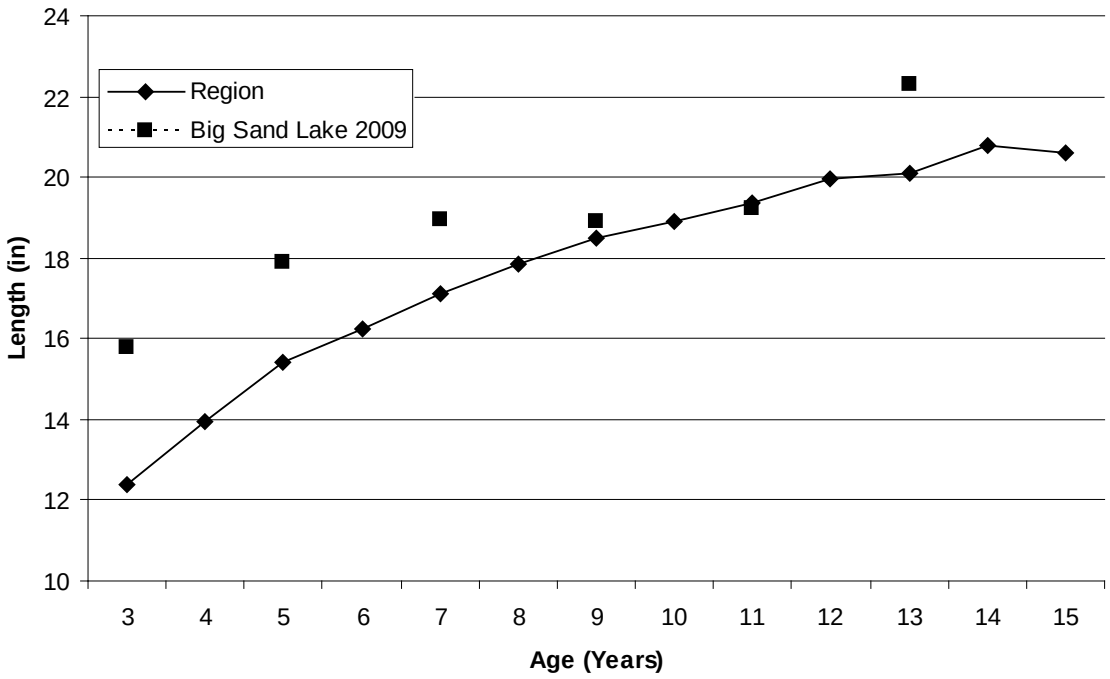

Figure 3. Mean lengths at age for male walleyes captured during 2009 spring survey on Big Sand Lake, Burnett County, Wisconsin. Regional averages are displayed for comparison.

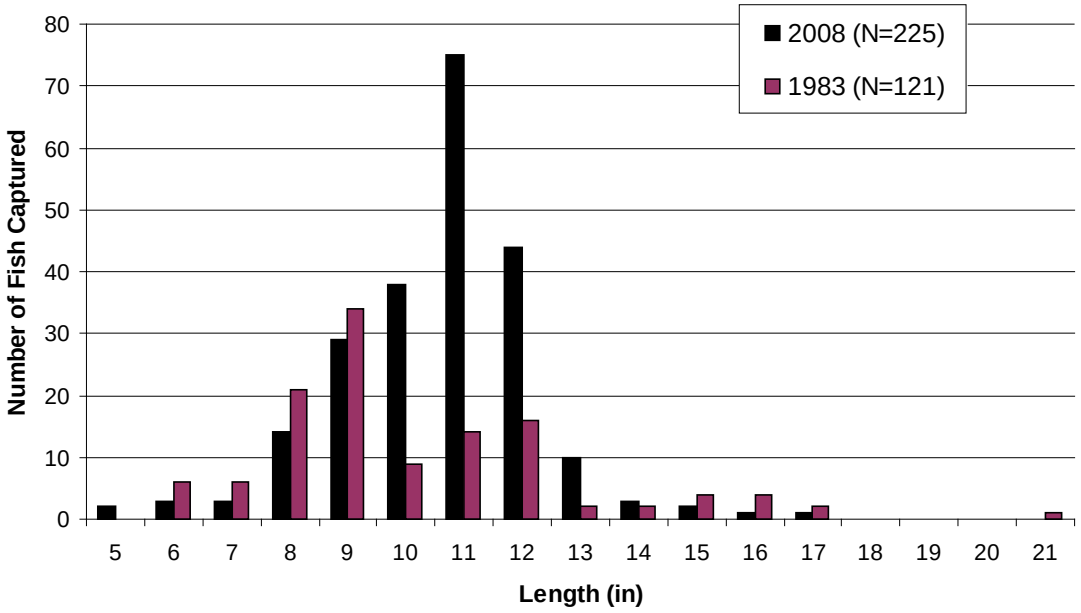

Figure 4. Length frequency of largemouth bass captured in Big Sand Lake, Burnett County, Wisconsin, in spring 2008 and 1983 surveys.

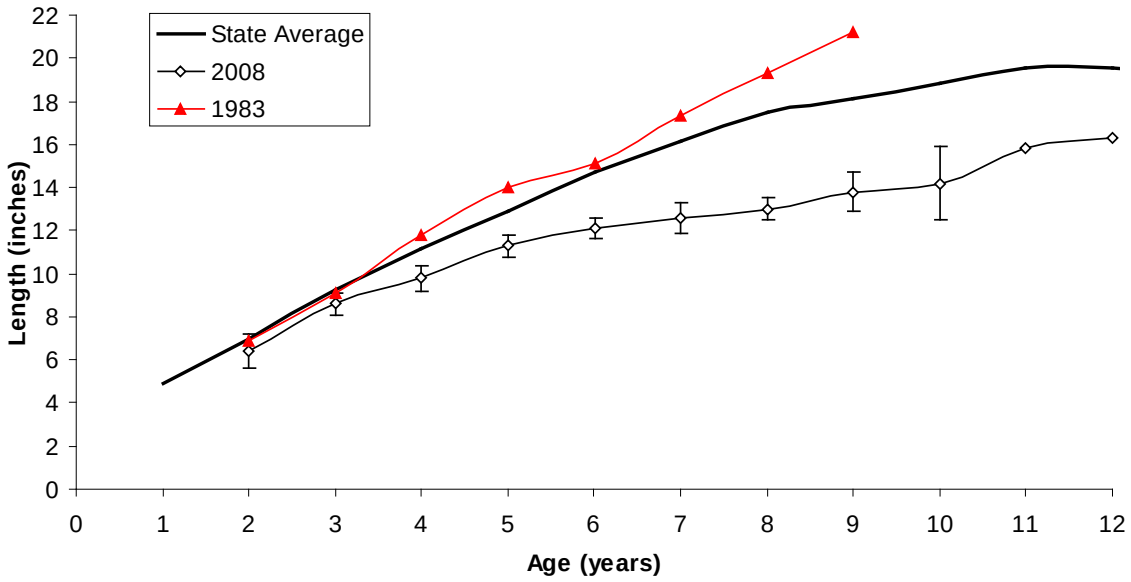

Figure 5. Mean lengths at age (± one standard deviation) for largemouth bass captured during spring surveys on Big Sand Lake, Burnett County, Wisconsin in 2008 and 1983. Statewide averages are displayed for comparison.

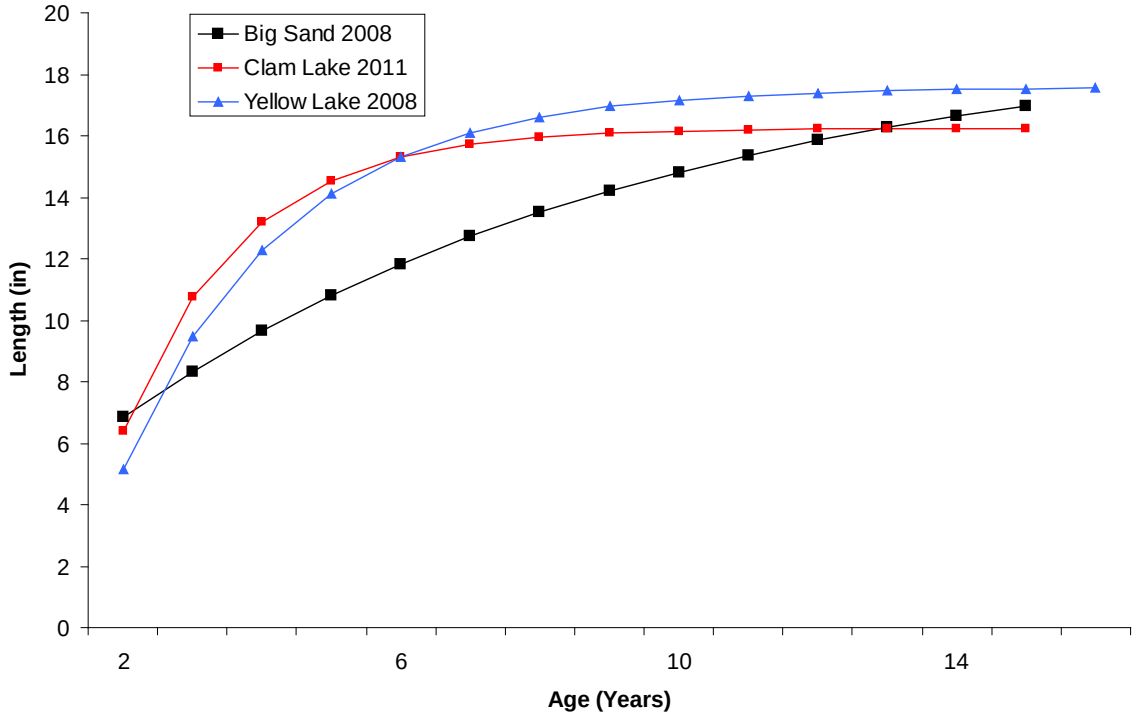

Figure 6. von Bertalanffy growth curves for largemouth bass captured during spring 2008 surveys on Big Sand Lake, Burnett County, Wisconsin. Other Burnett County lakes are displayed for comparison.

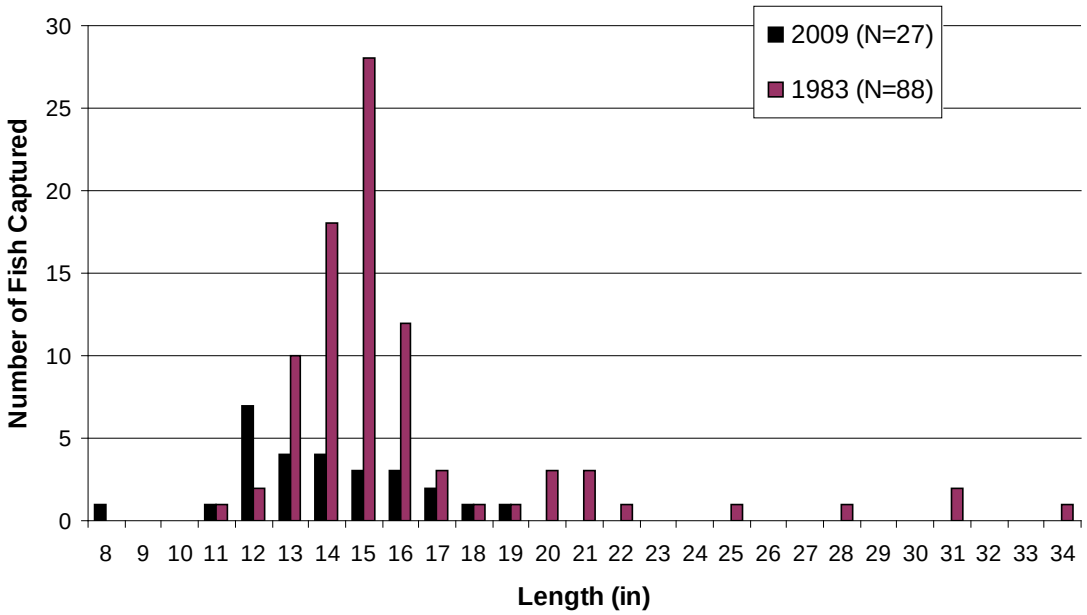

Figure 7. Length frequency of northern pike captured in Big Sand Lake, Burnett County, Wisconsin, in spring 2009 and 1983 surveys.

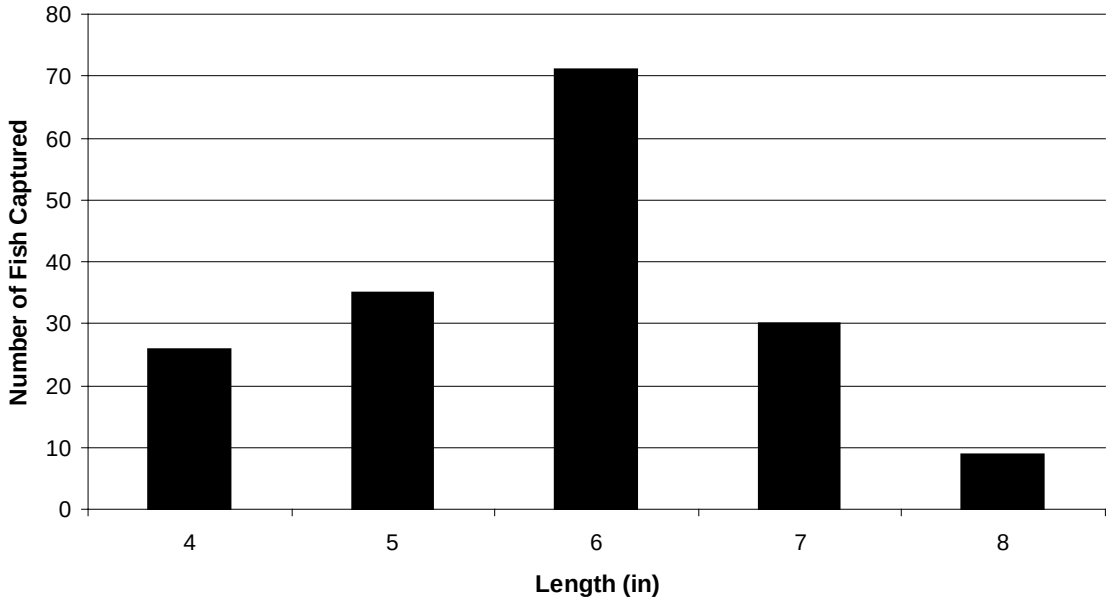

Figure 8. Length frequency of bluegill captured in Big Sand Lake, Burnett County, Wisconsin, in spring 2008 survey (N=176).

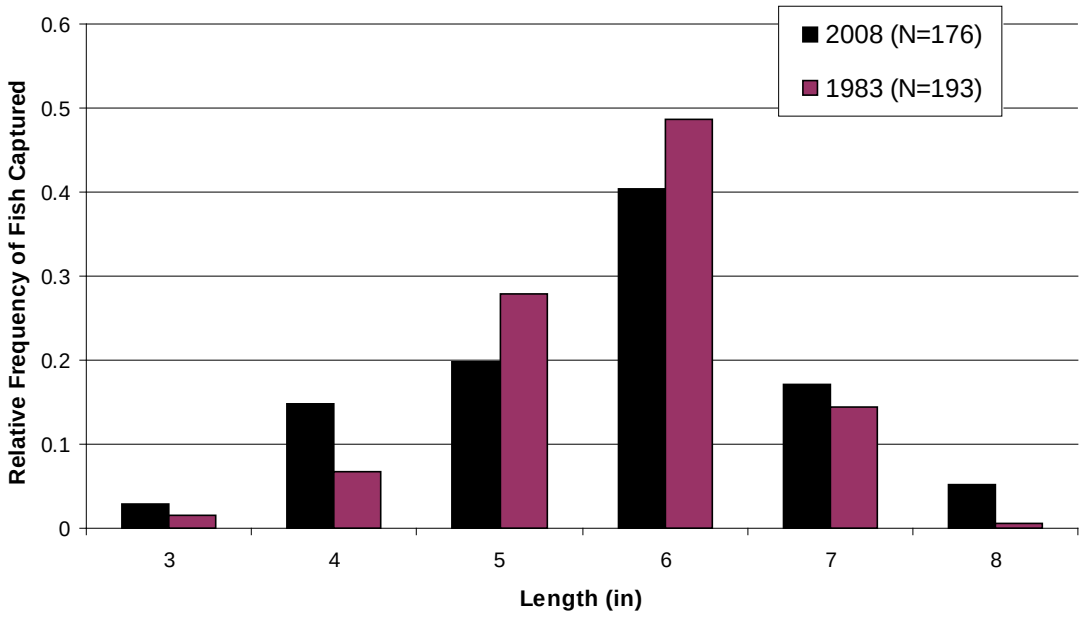

Figure 9. Relative frequency of bluegill captured in Big Sand Lake, Burnett County, Wisconsin, in spring 2008 and 1983 surveys.

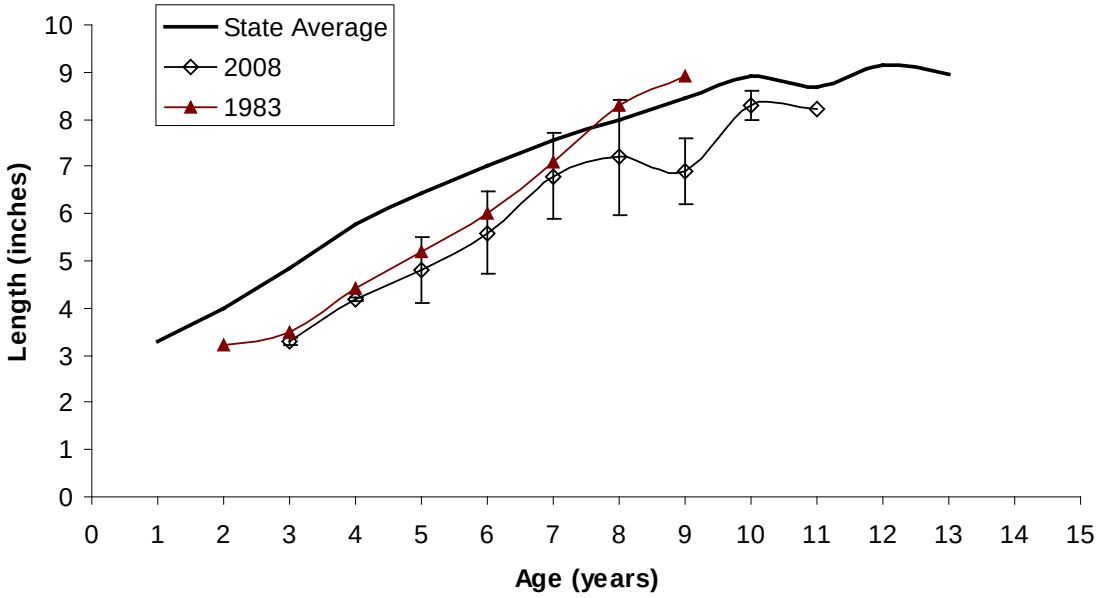

Figure 10. Mean lengths at age (± one standard deviation) for bluegill captured during spring surveys on Big Sand Lake, Burnett County, Wisconsin in 2008 and 1983. Statewide averages are displayed for comparison.

Appendix Table 1. Fish stocking records for Big Sand Lake, Burnett County, Wisconsin, from 1998 through 2011.

Year	Species	Number of Small Fingerlings Stocked	Number of Large Fingerlings Stocked
1998	Walleye	70,000	1,941
1999	Walleye		3,708
2000	Walleye	110,950	932
2002	Walleye	71,424	179
2003	Walleye	3,162	1,575
2004	Walleye	70,973	
2005	Walleye	2,335	
2006	Walleye	58,712	
2008	Walleye	49,076	
2011	Walleye		485

Appendix Table 2. General Fishing Regulations for Big Sand Lake, Burnett County, Wisconsin, in 2009.

Fish Species	Open Season	Daily Limit	Minimum Length
Walleye	May 02-March 07	5	15”
Largemouth and Smallmouth Bass	May 02-March 07	5	14”
Muskellunge	May 23-November 30	1	40”
Northern Pike	May 02-March 07	5	NONE
Panfish	Open Season Year Round	25	NONE

Appendix Table 3. Size cutoffs used to determine whether primary or secondary fin clips should be applied to gamefish when gender could not be determined.

Fish Species	Primary Fin Clip	Secondary Fin Clip
Walleye	≥15 in	≥ 7" < 15" (TC Clip*)
Bass	≥8 in	< 8” (TC Clip)
Northern Pike	≥12 in	< 12" (TC Clip)

* Top caudal fin clip

Appendix Table 4. Values used in proportional and relative stock density calculations.

Fish Species	Stock Size (in)	Quality Size (in)	Preferred Size (in)
Largemouth Bass	8	12	15
Northern Pike	14	21	28
Smallmouth Bass	7	11	14
Walleye	10	15	20