Stone Lake Fishery Survey, Washburn County, Wisconsin

2010-2011

MWBIC 1884100

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Northern Region – Spooner

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Executive Summary

Stone Lake (Washburn County) was surveyed during 2010 and 2011 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 in Stone Lake.

The 2010 adult walleye population estimate on Stone Lake (0.9 fish/acre) was lower than both Washburn County and Northwest Wisconsin averages. Growth rates for both male and female walleyes exceeded regional averages. Catch curve analysis estimated adult walleye mortality at 67%. Smallmouth bass densities were very high, though the size structure of fish captured during spring sampling was below statewide averages. Largemouth bass were found at moderate densities with near average growth rates. Northern pike were at low densities, with 49 total fish captured during spring surveys. Bluegill catch rates were very high and size structure was poor.

Total angler effort on Stone Lake (11.7 hours/acre) was below both Washburn County and ceded territory averages. The majority of angling effort on Stone Lake was directed at smallmouth bass (30%), walleye (28%), and largemouth bass (19%). Smallmouth bass catch and harvest rates exceeded regional averages. Adult walleye exploitation including both sport angler and tribal harvest on Stone Lake was high, at 34.3%.

Management recommendations include: 1) Maintain the existing high quality smallmouth bass fishery and monitor the impacts of liberalized harvest regulations initiated in 2012, 2) Focus walleye stocking efforts on large fingerlings and consider an 18 in minimum length limit for walleye, 3) Allow greater angler harvest opportunity for largemouth bass through liberalized regulations, 4) Maintain high density bluegill populations as potential larval predators of common carp, 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

Stone Lake is a soft water seepage lake in east central Washburn County. The lake's shoreline is primarily privately owned and well developed. Stone Lake is 523 acres with a maximum depth of 49 feet and mean depth of 33 feet. A wide channel connects Little Stone Lake to Stone Lake allowing fish movement between the lakes. Due to low water levels, Little Stone Lake was not included in this survey.

Stone Lake is a clear water, oligotrophic 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 Stone Lake (WDNR (online) 2010) indicate the nutrient conditions were oligotrophic (low productivity) when considering secchi disk, total phosphorus and chlorophyll-a TSI indices. Between 1987 and 2011, the mean secchi TSI value was 33.75 (S.D. = 1.6) from samples taken near the deep hole of Stone Lake.

Gamefish species present in Stone Lake include smallmouth bass Micropterus dolomieui, walleye Sander vitreus, largemouth bass M. salmoides, and northern pike Esox lucius. Panfish species include bluegill Lepomis macrochirus, black crappie Pomoxis nigromaculatus, pumpkinseed L. gibbosus, yellow perch Perca flavescens, and rock bass Ambloplites rubestris. Other species common in Stone Lake include bowfin Amia calva, common carp Cyprinus carpio, 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 Stone Lake (Appendix Table 1). During this survey, all of the standard statewide fishing regulations applied to Stone 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 Stone Lake. Secondary objectives were to assess largemouth bass, smallmouth bass, and northern pike populations.

Methods

Stone Lake was surveyed in 2010-2011 following the Wisconsin Department of Natural Resources treaty assessment protocol (Cichosz 2010). The first phase of this survey consisted of spring fyke netting and electrofishing to estimate gamefish abundance, growth, and size structure. Beginning with the gamefishing opener in May 2010, a creel survey (both open water and ice) was conducted. Fall electrofishing targeting young-of-the-year (YOY) walleye was conducted in 2010.

The first portion of the survey started soon after ice out with fyke nets (4 x 5 ft frame) set on 31 March. Nets were checked daily and set at areas expected to contain high concentrations of spawning walleye. Nets were removed on 09 April, with a total effort of 72 net nights on Stone Lake. After removal of nets, the entire shoreline of Stone Lake was sampled with an electrofishing boat on 09 April for the recapture run.

Sampling targeting largemouth bass, smallmouth bass, and panfish was conducted on 02 June. Both bass species 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.

The final component of the on-the-water sampling consisted of a fall electrofishing run on 16 September. During this survey, all gamefish were targeted and collected over the entire shoreline.

All walleyes, northern pike, largemouth bass, and smallmouth 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 populations for Stone 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, smallmouth bass, and largemouth bass less than 12 in, while dorsal spines were removed from larger fish. 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, smallmouth bass, 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 walleye, smallmouth bass, and 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. Assuming dimorphic separation of length at age, growth equations were calculated separately for male and female walleye.

The descending limb of a catch curve regression was used to estimate total annual mortality for walleye (Ricker 1975). As aging materials were not taken for all fish, an age-length key was used to assign a sample age distribution.

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 Stone Lake beginning 01 May and continuing through 06 March of the following year (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 2010 adult walleye population on Stone Lake was estimated at 458 fish (CV = 0.16). This estimated density (0.9 fish/acre) was lower than both the Washburn 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 2010 survey ranged from 12.0 to 24.9 in (Figure 1). Mean lengths of male and female walleyes were 15.2 (S.D. = 1.6) and 20.2 in (S.D. = 2.7), respectively. All female walleyes captured in the 2010 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 50.5 and 5.9, respectively. Compared to similar Wisconsin waterbodies (FACT), these values exceeded 34% of surveys for PSD and 16% of surveys for RSDP.

Growth rates for both male and female walleyes on Stone Lake exceeded regional averages (Figures 2 and 3). The von Bertalanffy growth curve for female and male walleyes in the 2010 Stone Lake survey were very similar to other area populations (Figures 4 and 5). Catch curve analysis estimated annual mortality of Stone Lake adult walleye at 66.7% (Figure 6).

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 1995 and 2010 was 3.8 fish/mile (S.D. = 4.4, N = 13; (Figure 7)). Catch rates of walleye less than 10 in averaged 6.1 fish/mile from 2000-2010, greater than 62% of similar surveys statewide (FACT). YOY catch rates in years with no walleye stocking averaged 1.7 fish/mile (S.D. = 0.41, N = 5) compared to 5.1 fish/mile (S.D. = 5.26, N = 8) in years where small fingerling walleyes were stocked.

Smallmouth bass. A total of 87 smallmouth bass $\geq$ 7.0 in (mean length = 11.7, S.D. = 2.4 in) were captured during all spring 2010 sampling on Stone Lake (Figure 8). During the 02 June survey, a total of 82 smallmouth bass (20.5/mile) were captured, greater than 93% of surveys from similar Wisconsin lakes (FACT). PSD value was 62 (C.I. 10.2), greater than 39% of Wisconsin surveys. The proportion of fish greater than the 14

in minimum size limit (RSD-14) was 17.1 (C.I. = 7.91), greater than 13% of statewide surveys.

Smallmouth bass growth rates from the 2010 survey were below statewide averages for all age classes (Figure 9). Growth rates in the 2010 survey were very similar to previous Stone Lake surveys in 2005 and 1983 (Figure 9). Mean ultimate length calculated from the von Bertalanffy growth equation was 20.7 in (Figure 10).

Largemouth bass. The mean length of largemouth bass ≥ 8.0 in collected during all phases of the spring 2010 survey on Stone Lake was 13.0 in (S.D. = 1.6), with a range of 8.0-16.4 in (Figure 11). To allow comparisons to statewide averages, only largemouth bass collected during 02 June sampling were included in CPE, PSD, and RSD analyses. A total of 30 largemouth bass ≥ 8.0 in (7.5/mile) were collected during that survey, which was greater than 58% of surveys in Wisconsin (FACT). PSD value was 77 (C.I. = 14.4), greater than 78% of surveys from similar Wisconsin lakes. The proportion of fish greater than the 14 in minimum size limit (RSD-14) was 27 (C.I. = 15.1), greater than 49% of statewide surveys.

Largemouth bass growth rates were similar to statewide averages up to six years (Figure 12). Older aged largemouth bass had growth rates below statewide averages. Mean ultimate length from the von Bertalanffy growth equation was 16.9 in (Figure 13).

Northern Pike. A total of 49 northern pike, ranging in length from 10-33 in were captured during spring surveys (Figure 14). PSD and RSDP for northern pike were 62.5 and 16.7, respectively.

Panfish. A total of 326 bluegills ≥ 3.0 in (mean length = 4.5, S.D. = 1.0) were captured during the 02 June sampling on Stone Lake. This catch rate of 326 bluegill/mile was greater than 94% of similar surveys of Wisconsin waterbodies. The PSD value of 9 was greater than less than one percent of statewide surveys.

Angler Survey. Total projected angling effort on Stone Lake during the 2010-2011 season was estimated at 6,120 hours (11.7 hours/acre). This was much lower than mean angling effort in both the ceded territory (32.4 hours/acre) and Washburn County (28.3 hours/acre). Open water anglers accounted for 85% of the total effort on Stone Lake in 2010-2011. The majority of angling effort on Stone Lake was directed at smallmouth bass (30%), walleye (28%), and largemouth bass (19%).

Smallmouth bass had the highest estimated sport angler harvest of any species on Stone Lake (Table 1). Estimated angler effort, catch, and harvest for smallmouth bass on Stone Lake all exceeded ceded territory averages.

Adult walleye exploitation was estimated at 9.8% by sport anglers and 24.5% by tribal harvest (Krueger and Brost 2011) for a total exploitation rate of 34.3%. The mean length of walleyes harvested by tribal spearers in 2010 was 16.5 in, compared to 17.4 in for sport anglers.

Discussion

While this survey of Stone Lake found a relatively diverse fishery, some slight shifts in species abundance appear to have occurred since the last intensive survey of Stone Lake in 1983. While walleye were once considered the dominant sport fish (Johannes 1984), that title has likely shifted to smallmouth bass followed by walleye. Largemouth bass numbers appear to have increased since that survey also. Shifts in species abundance towards increasing centrarchid abundance and stable or decreasing percid abundance have been observed on many other regional lakes (Toshner 2009).

With excellent smallmouth bass spawning and nursery habitat, Stone Lake provides a high quality, self-sustaining population of smallmouth bass. Maintaining this quality fishery should be a primary goal of future management plans.

Beginning in May 2012, the 14 in minimum length limit on largemouth and smallmouth bass will be replaced with a no minimum length limit. Impacts of this

regulation change on Stone Lake's fisheries need to be monitored closely. Smallmouth bass were the most harvested species in the 2010-2011 angler survey, even under the more restrictive 14 in minimum size limit regulation. Liberalizing this regulation may increase angler harvest to levels that would impact densities.

To protect the high quality smallmouth bass fishery on Stone Lake, separate management plans may be needed for the two black bass species. This option would allow liberal harvest opportunities for largemouth bass and a more conservative harvest regulation on smallmouth bass to protect that quality fishery. With a mean ultimate length of 20.7 in predicted from the von Bertalanffy growth equation, smallmouth bass should be able to grow to lengths beyond even an 18 in minimum size limit.

Good to excellent natural reproduction supports all fish communities in Stone Lake except walleye. Catch rates of YOY walleye have been low in both non-stocked years and years when small fingerlings were stocked. Natural reproduction of walleye has been consistent but at very low levels. Years where small fingerling walleyes were stocked had higher catch rates for YOY walleye but still at relatively low levels. The Shoreowners of Stone Lake Association has been purchasing approximately 2,000 large fingerling walleyes to stock on an alternate year basis since 2007. Stocking of these large fingerling walleye may have greater survival than small fingerlings (Kampa and Hatzenbeler 2009).

In addition to poor recruitment, high exploitation may be impacting walleye densities. Total walleye exploitation in 2010-2011 (34%) was very close to the 35% maximum level recommended for Wisconsin waters (Staggs et al. 1990). The total mortality rate of adult walleye (67%) was also very high. Additionally, PSD and RSD values were low compared to statewide averages even though growth rates exceeded statewide averages. Various minimum length limits on walleye have been found to reduce adult exploitation (Fayram et al. 2001) and increase PSD values (Stone and Lott

2002). However, minimum length limits were not found to improve walleye abundance, size structure, or age structure in two Minnesota lakes, likely due to high variation in walleye recruitment (Isermann 2007). With walleye recruitment on Stone Lake at low but consistent levels, an increase in the minimum size limit for walleye to 18 in should be considered with goals of reducing adult exploitation and improving size structure. Many regional walleye fisheries meet these characteristics so any potential walleye regulation change on Stone Lake should be included in a broad, regional evaluation.

With habitat conditions on Stone Lake more favorable to smallmouth bass, largemouth bass on Stone Lake are at a moderate density. Removal of the 14 in minimum length limit on largemouth bass will provide greater consumptive opportunity for anglers. Also, Fayram et al. (2005) found survival of stocked walleyes was negatively correlated to largemouth bass densities. Liberalized harvest regulations may reduce largemouth bass densities and allow greater survival of stocked walleyes.

Stone Lake supports a low density northern pike population with above average size structure. Northern pike were first observed on Stone Lake during a 1969 fish survey. By 1983, a total of seven northern pike were captured during a spring survey and Johannes (1984) described the pike population as slowly expanding. During this survey, a total of 48 northern pike greater than 14 inches were captured. However, 17% of these fish were greater than the preferred length of anglers (28 in). Ice anglers have shown an interest in this fishery, as 33% of the ice fishing effort was directed at northern pike.

Panfish effort was relatively light on Stone Lake. The high density, slow growing bluegill population on Stone Lake was likely an undesirable fishery for anglers. However, high density bluegill populations can be effective larval predators of common carp (Bajer and Sorensen 2009).

With no common carp captured during spring fyke netting, densities appear to be at relatively low levels on Stone Lake. With infertile water and a high density bluegill population on Stone 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. Smallmouth bass provide a high quality sport fishery on Stone Lake. Management efforts should focus on maintaining and enhancing this fishery. Fishing regulation changes should be closely monitored for impacts to the fishery. If decreases in smallmouth bass density or size structure are detected, more restrictive harvest regulations should be considered.
2. The walleye population on Stone Lake is low density with above average growth rates. Efforts to stock large fingerling walleyes on an alternate year basis should be encouraged. Also, an 18 in minimum size limit on walleyes should be considered to reduce adult exploitation.
3. Largemouth bass densities have increased since the previous survey. Liberalized regulations will allow greater angler harvest opportunity of largemouth bass in Stone Lake.
4. The size structure of the northern pike population is relatively high quality and anglers are directing more effort towards this species, particularly in winter. No changes in northern pike management are recommended.
5. The high density of small bluegills on Stone Lake does not provide a desirable fishery for anglers. However, this population may be important ecologically on Stone Lake as larval predators of common carp. No changes in panfish management are recommended.

6. Critical fish habitat in Stone Lake needs to be protected and enhanced where possible. Efforts should be made to work with the Shoreowners of Stone Lake Association and local angler groups stressing the importance of protecting critical habitat and water quality.
7. Efforts to increase habitat complexity in Stone 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.
8. 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.

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

	Smallmouth Bass	Walleye	Largemouth Bass	Bluegill	Black Crappie	Northern Pike
Directed Effort	3,667	3,384	2,377	1,013	965	779
Directed Effort/Acre	7.01	6.47	4.54	1.94	1.85	1.49
	(2.89)	(7.54)	(3.86)	(NA)	(NA)	(4.23)
Projected Catch (# of fish)	1,888	202	238	1,598	294	225
Catch/Acre	3.61	0.39	0.46	3.06	0.56	0.43
	(1.61)	(1.19)	(2.85)	(NA)	(NA)	(2.22)
Specific Catch Rate (Fish/Hour)	0.47	0.06	0.09	1.37	0.25	0.04
	(0.29)	(0.12)	(0.28)	(NA)	(NA)	(0.20)
Projected Harvest (# of fish)	434	140	61	343	199	89
Harvest/Acre	0.83	0.27	0.12	0.66	0.38	0.17
	(0.09)	(0.27)	(0.15)	(NA)	(NA)	(0.35)
Specific Harvest Rate (Fish/Hour)	0.12	0.04	0.03	0.33	0.16	0.02
	(0.03)	(0.03)	(0.02)	(NA)	(NA)	(0.05)
Mean Length (in)	16.3	17.4	15.9	6.6	12.5	23.2

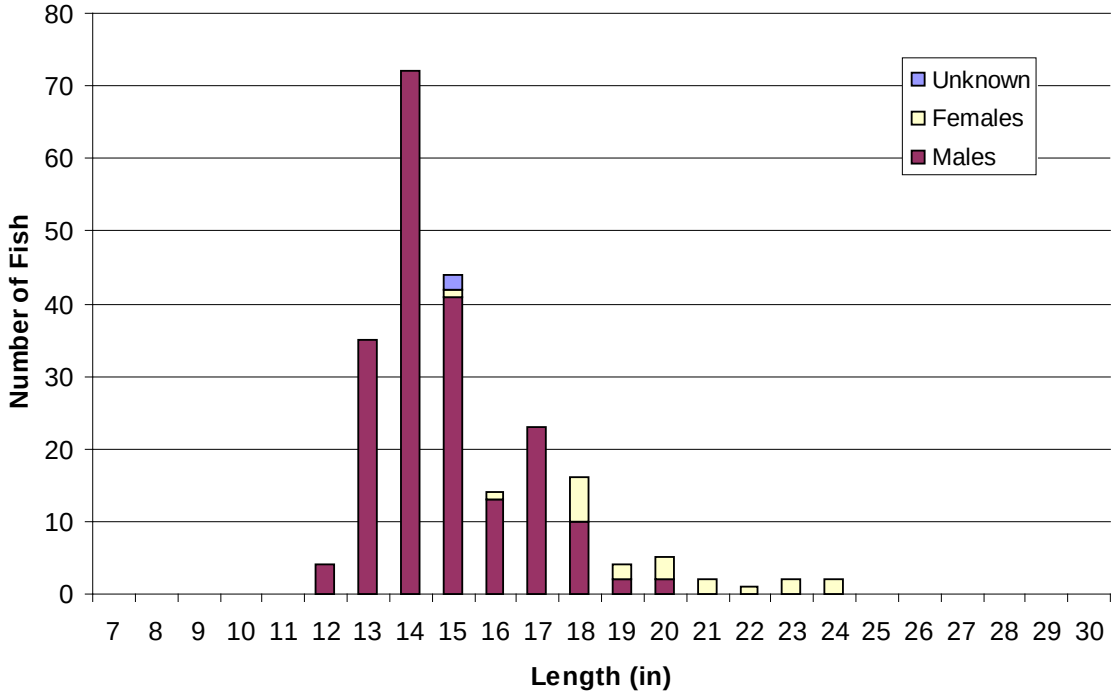

Figure 1. Length frequencies of adult walleyes captured during spring 2010 sampling on Stone Lake, Washburn County, Wisconsin (N=224).

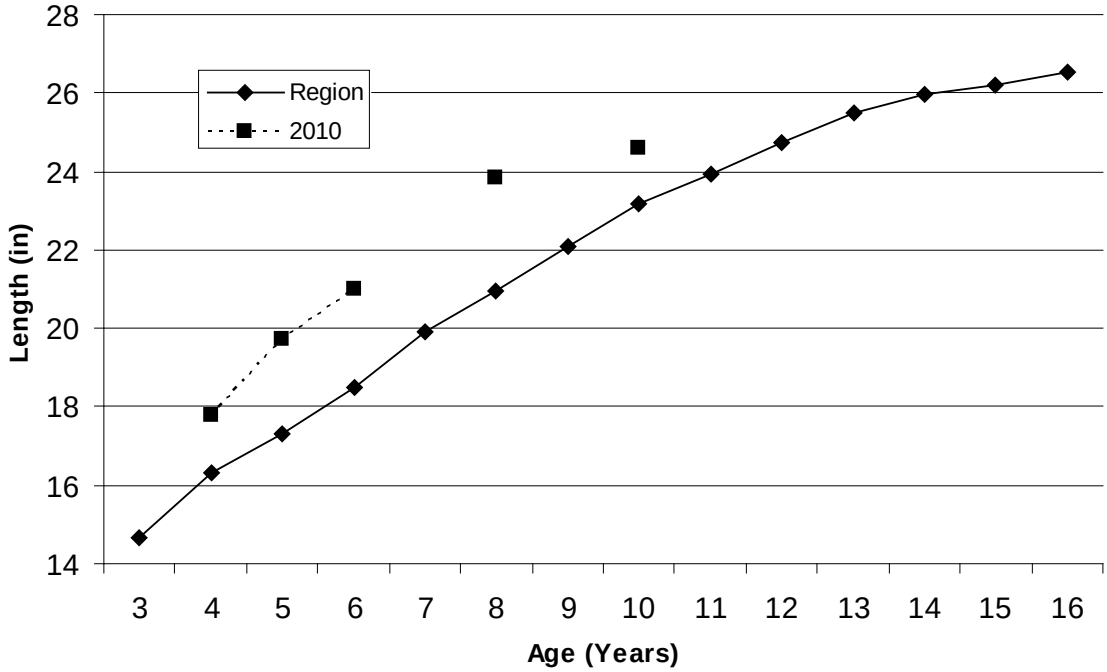

Figure 2. Mean lengths at age for female walleyes captured during 2010 spring survey on Stone Lake, Washburn County, Wisconsin. Regional averages are displayed for comparison.

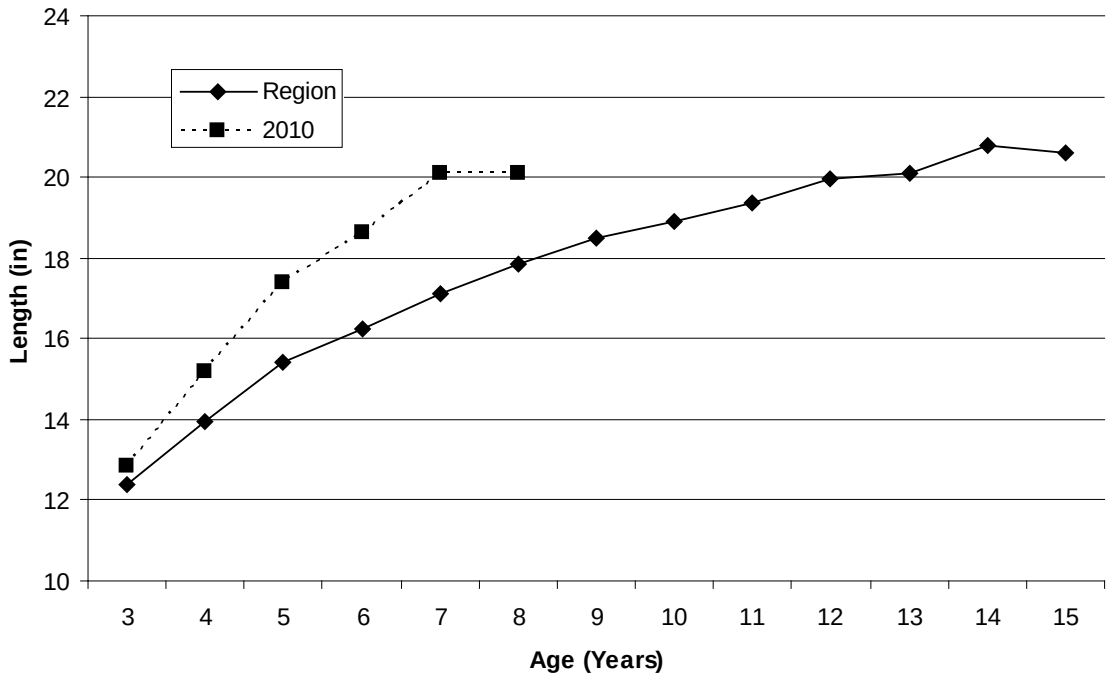

Figure 3. Mean lengths at age for male walleyes captured during 2010 spring survey on Stone Lake, Washburn County, Wisconsin. Regional averages are displayed for comparison.

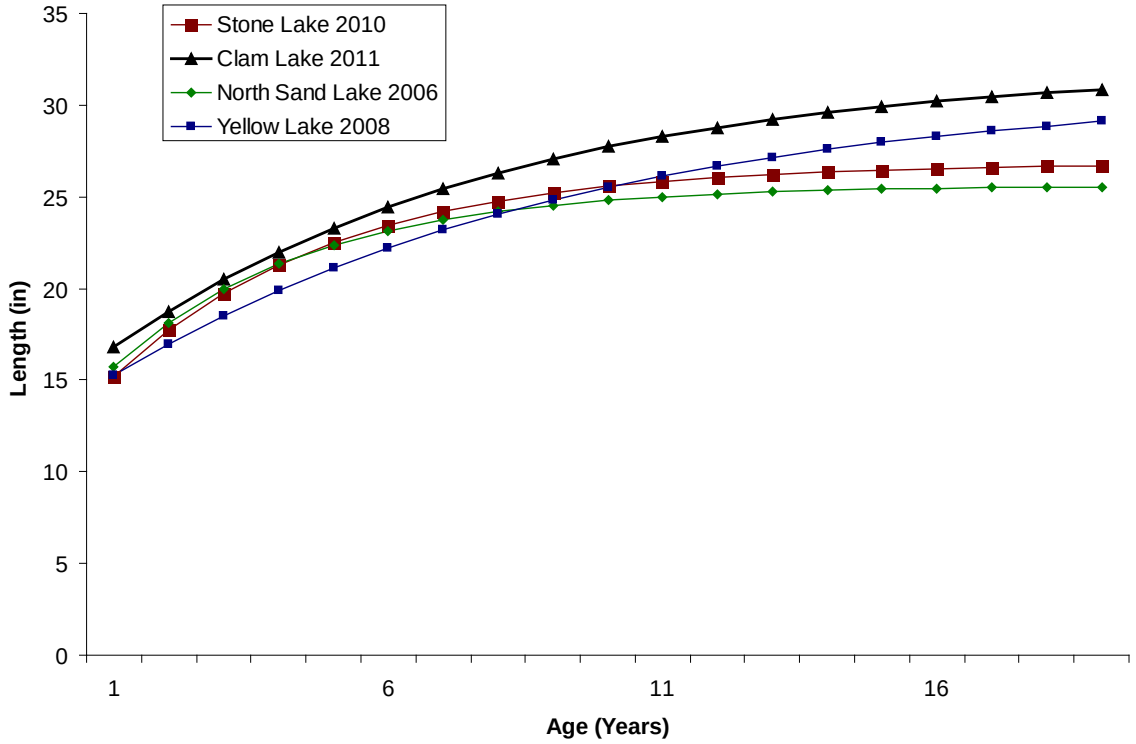

Figure 4. von Bertalanffy growth curves for female walleyes captured during 2010 spring survey on Stone Lake, Washburn County, Wisconsin. Other area populations are shown for comparison.

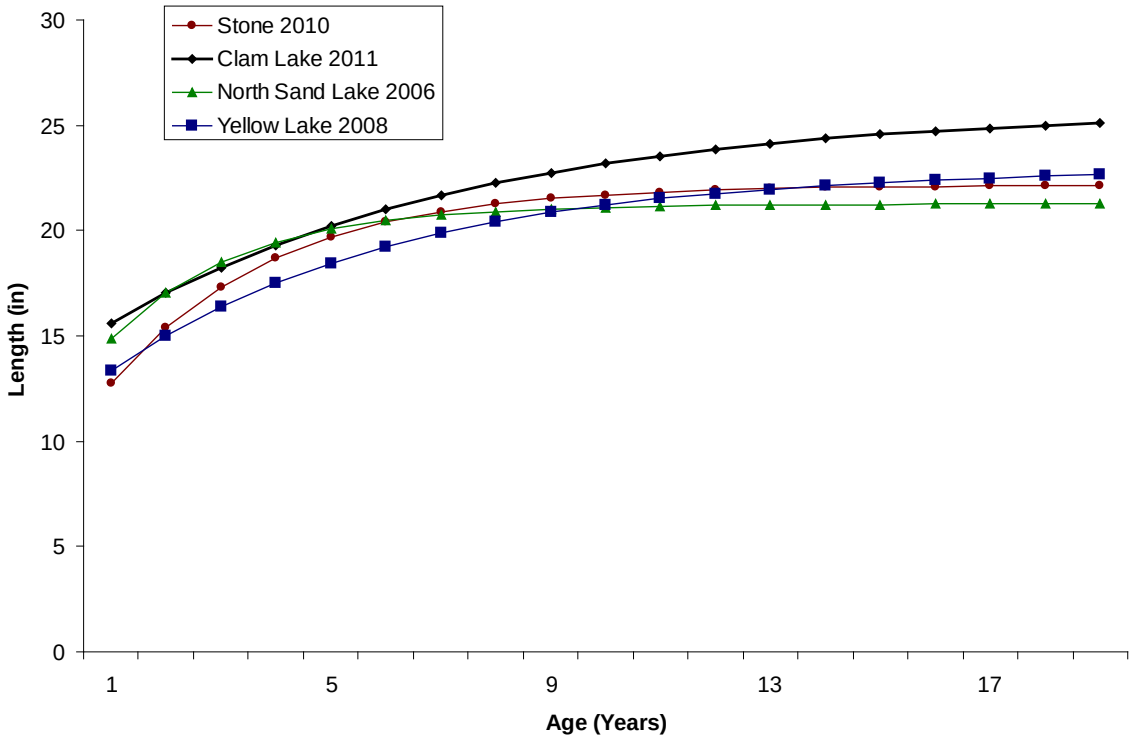

Figure 5. von Bertalanffy growth curves for male walleyes captured during 2010 spring survey on Stone Lake, Washburn County, Wisconsin. Other area populations are shown for comparison.

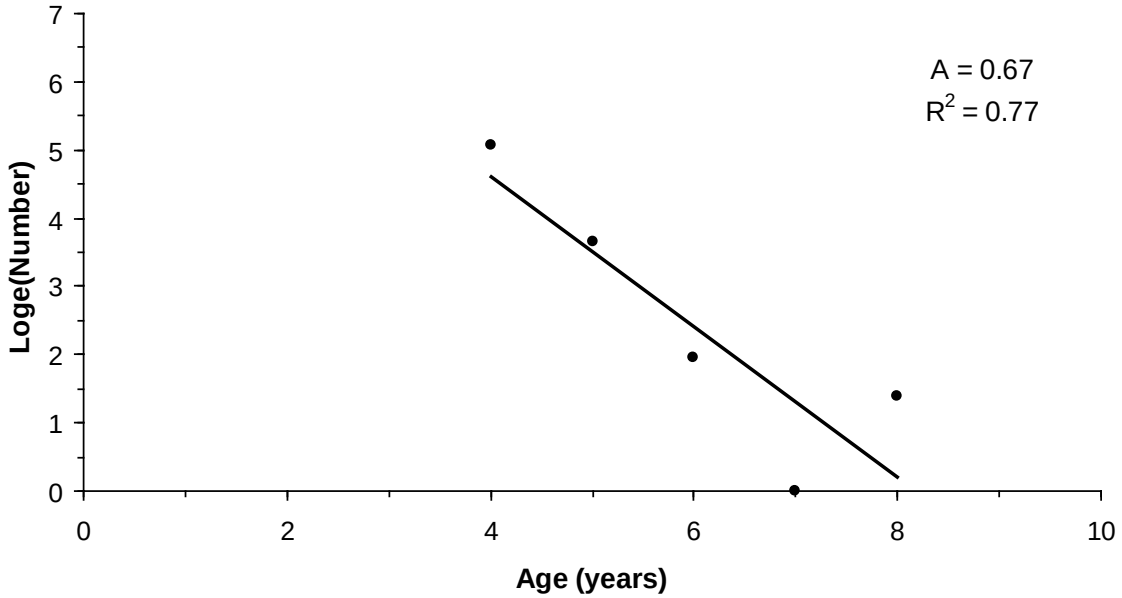

Figure 6. Catch curve for adult walleye sampled in Stone Lake, Washburn County, Wisconsin, in spring 2010.

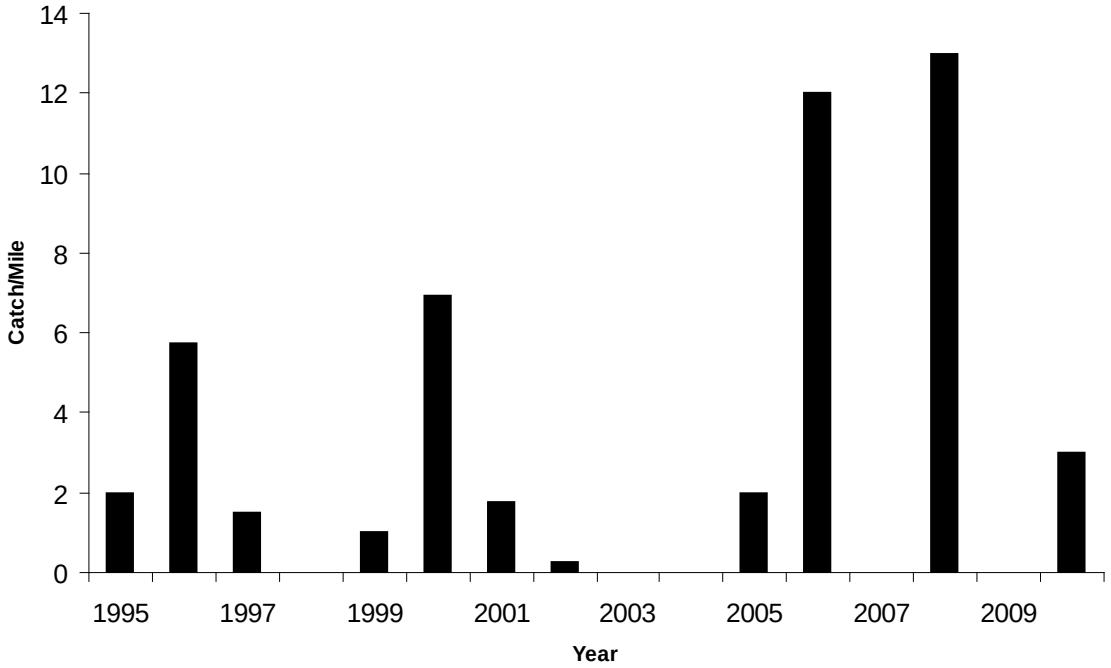

Figure 7. Young of year (YOY) walleye relative abundance determined by fall electrofishing surveys on Stone Lake, Washburn County, Wisconsin. Fall surveys were not conducted on Stone Lake in 2003, 2007, and 2009.

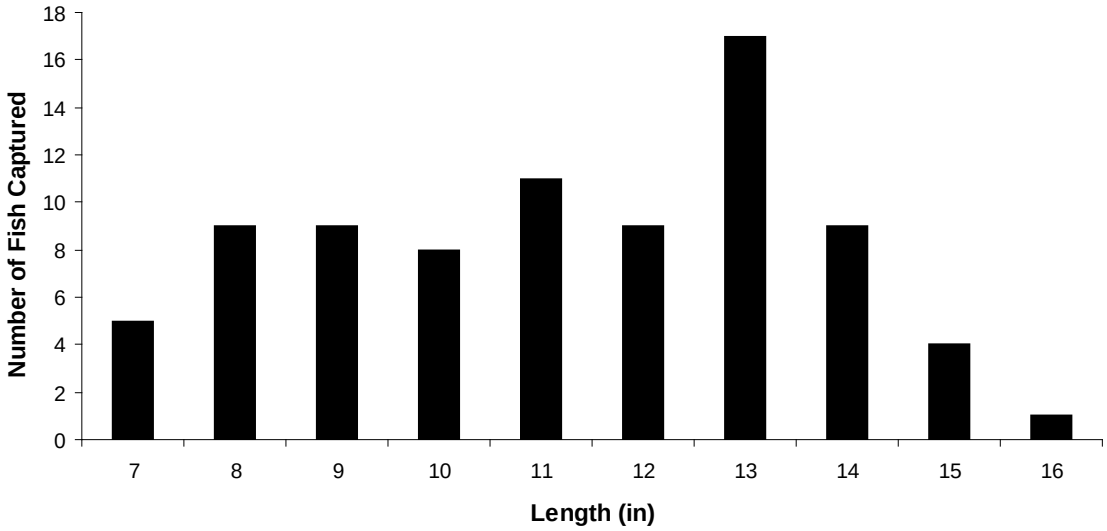

Figure 8. Length frequency of smallmouth bass captured in Stone Lake, Washburn County, Wisconsin, in spring 2010 surveys (N=87).

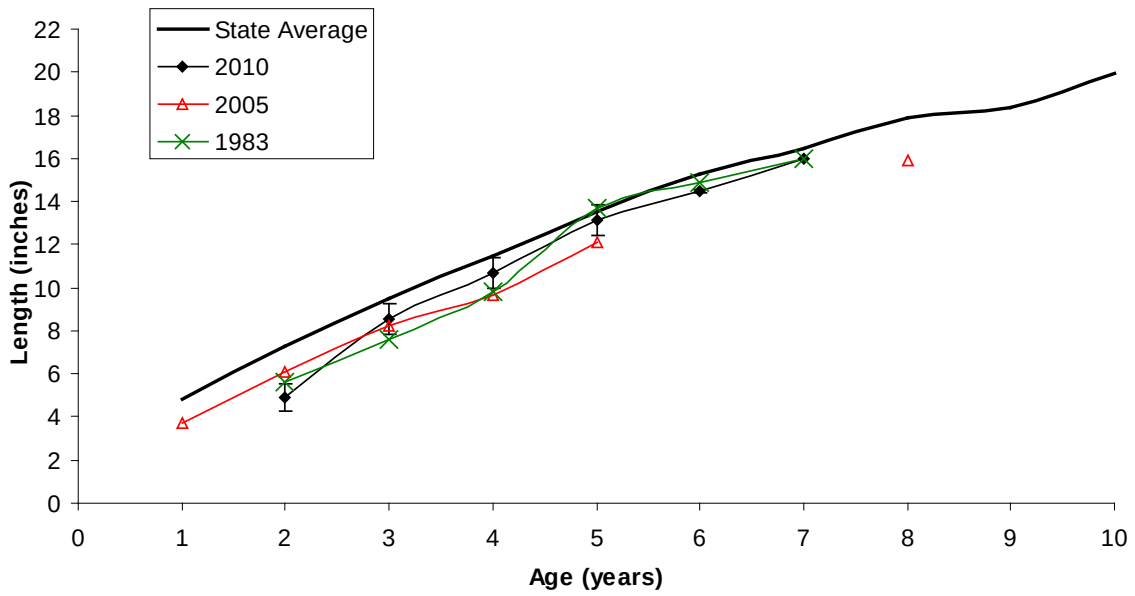

Figure 9. Mean lengths at age (± one standard deviation for 2010 data) for smallmouth bass captured during spring surveys on Stone Lake, Washburn County, Wisconsin. Statewide averages are displayed for comparison.

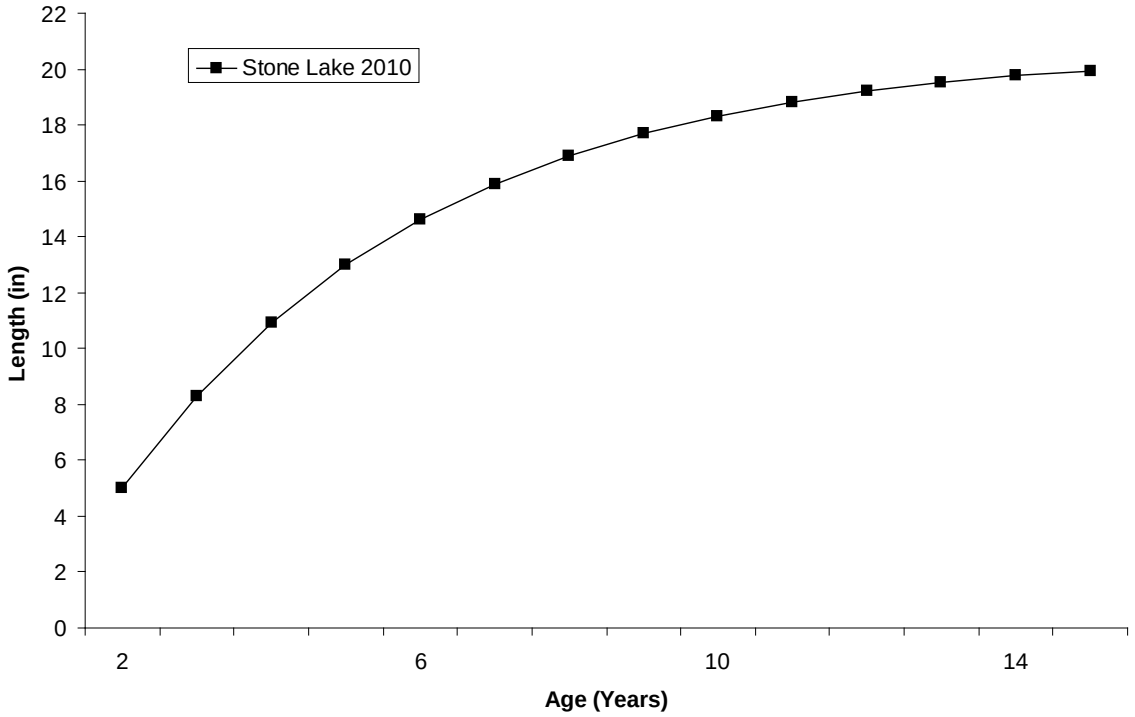

Figure 10. von Bertalanffy growth curves for smallmouth bass captured during spring 2010 surveys on Stone Lake, Washburn County, Wisconsin.

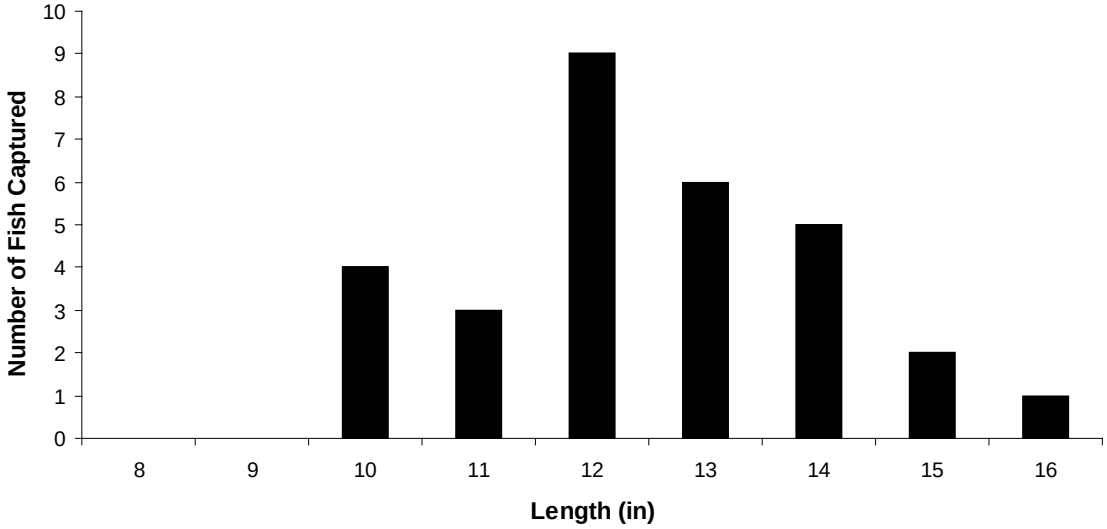

Figure 11. Length frequency of largemouth bass captured in Stone Lake, Washburn County, Wisconsin, in spring 2010 surveys (N=30).

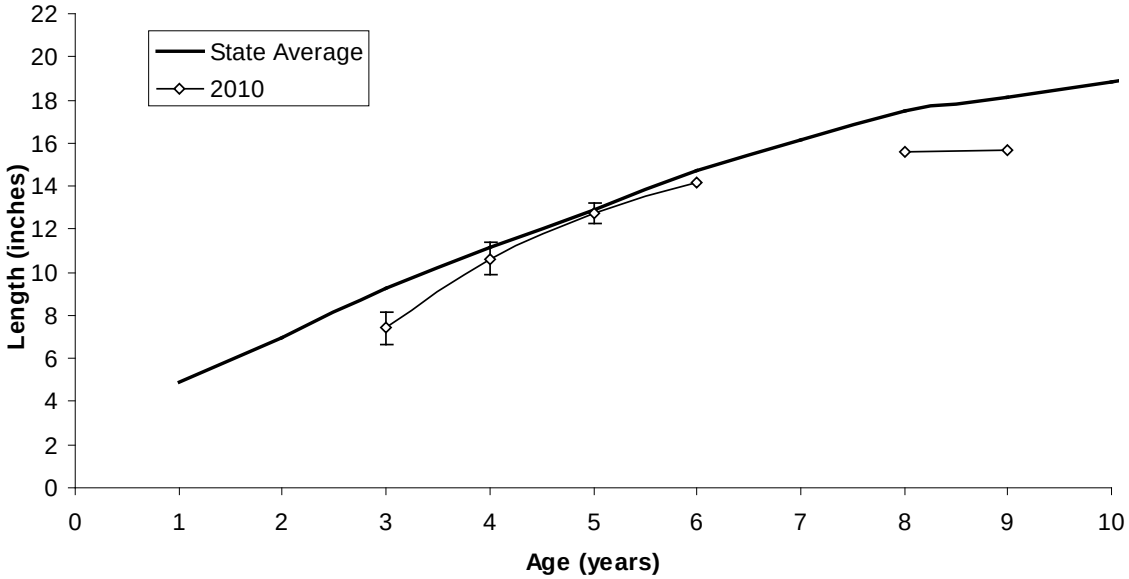

Figure 12. Mean lengths at age (± one standard deviation) for largemouth bass captured during spring surveys on Stone Lake, Washburn County, Wisconsin. Statewide averages are displayed for comparison.

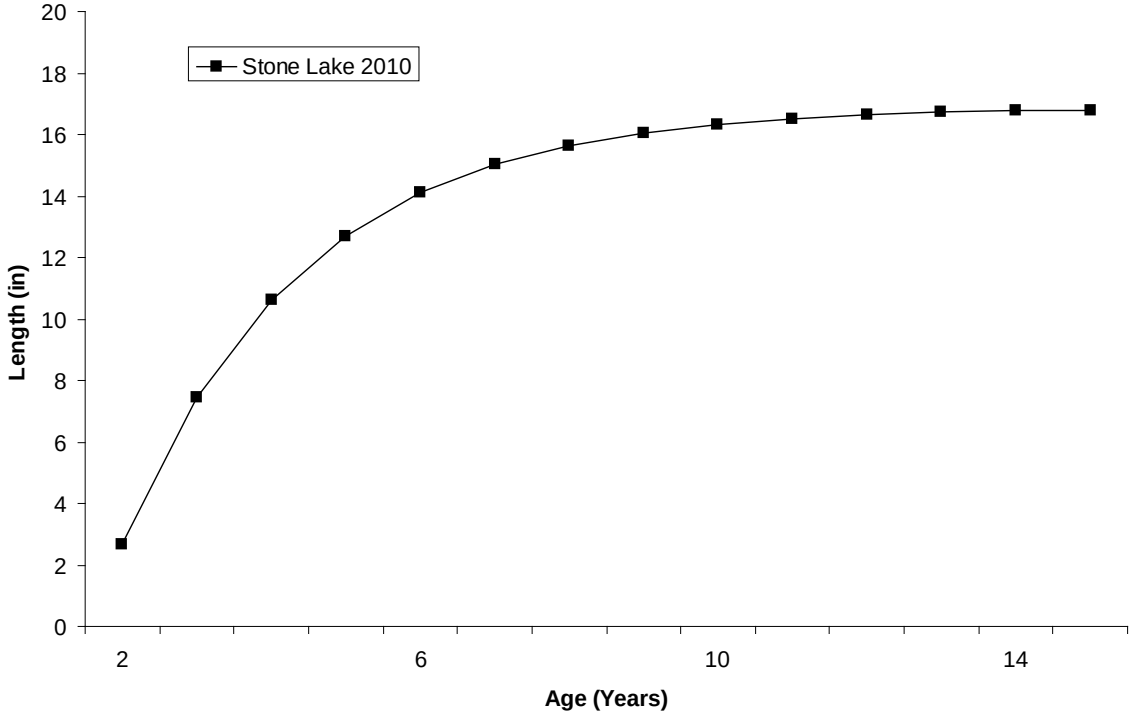

Figure 13. von Bertalanffy growth curve for largemouth bass captured during spring 2010 surveys on Stone Lake, Washburn County, Wisconsin.

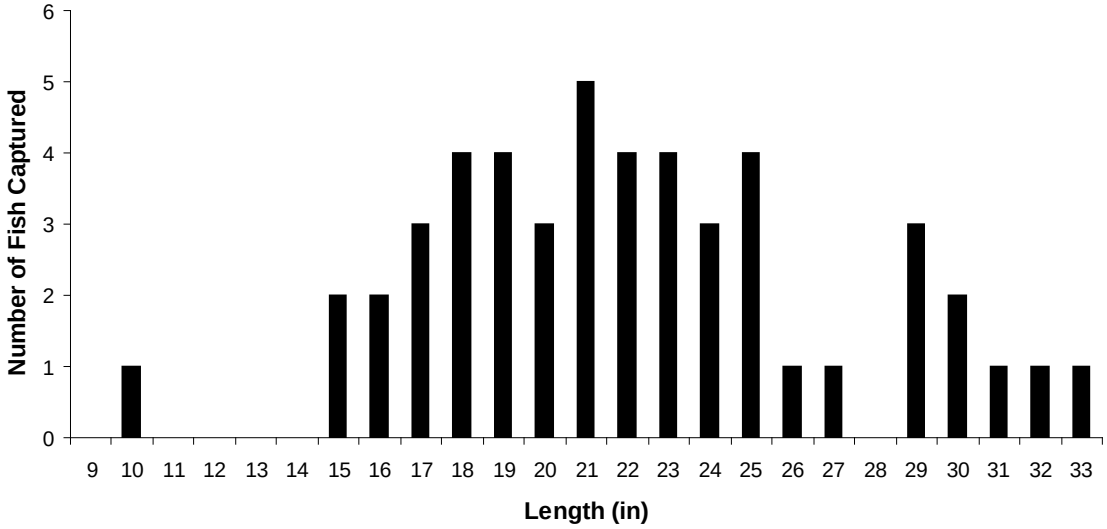

Figure 14. Length frequency of northern pike captured in Stone Lake, Washburn County, Wisconsin, in spring 2010 surveys (N=49).

Appendix Table 1. Fish stocking records for Stone Lake, Washburn County, Wisconsin, since 1976.

Year	Species	Number Fish Stocked	Mean Fish Length (in)
1976	Walleye	25,014	4
1978	Walleye	19,107	3
1979	Walleye	20,882	3
1982	Walleye	25,063	3
1983	Walleye	128,000	1
1984	Walleye	25,110	3
1986	Walleye	26,826	3
1989	Walleye	26,215	3
1991	Walleye	2,448	2
1992	Walleye	26,150	2
1994	Walleye	26,412	2
1996	Walleye	15,743	3
1998	Walleye	26,150	2
2000	Walleye	26,150	2
2002	Walleye	26,135	2
2004	Walleye	26,130	2
2006	Walleye	18,280	2
2007	Walleye	1,956	7
2008	Walleye	18,584	2
2009	Walleye	2,000	7
2010	Walleye	18,305	2
2011	Walleye	1,999	7

Appendix Table 2. General Fishing Regulations for Stone Lake, Washburn County, Wisconsin, in 2010.

Fish Species	Open Season	Daily Limit	Minimum Length
Walleye	May 01-March 06	3	15”
Largemouth and Smallmouth Bass	May 01-March 06	5	14”
Muskellunge	May 29-November 30	1	40”
Northern Pike	May 01-March 06	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)

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