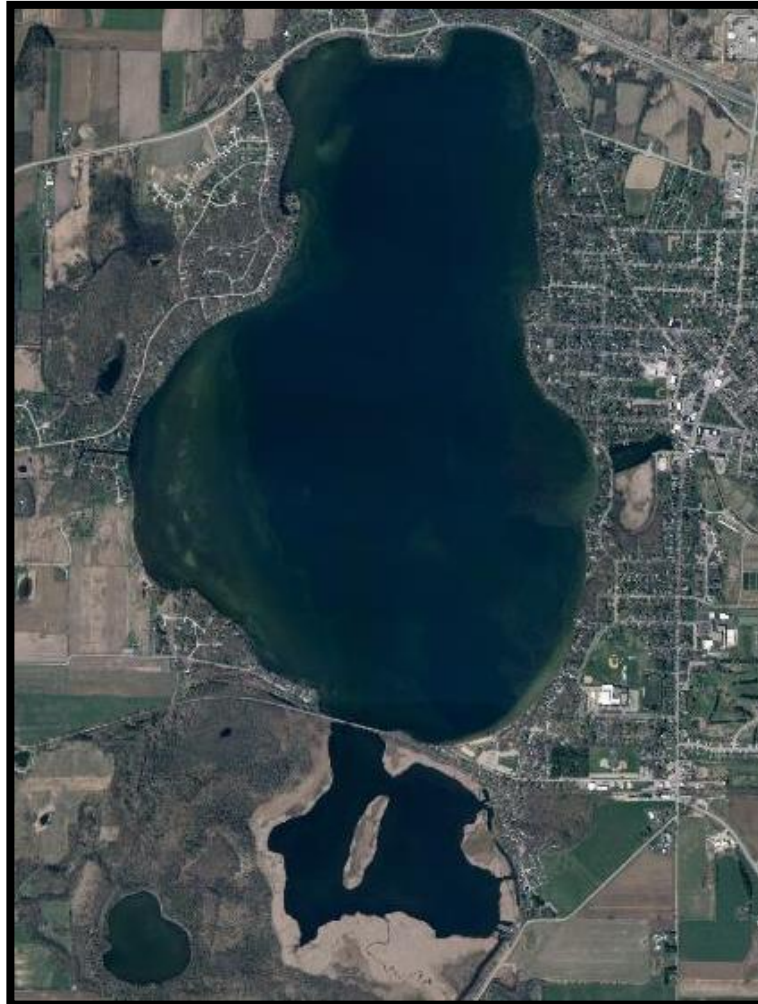


**Wisconsin Department of Natural Resources  
Comprehensive Fisheries Survey Report**

**Rock Lake, Jefferson County  
2014**

**Waterbody Identification Code: 830700**



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## **BACKGROUND**

Rock Lake is a 1,371-acre (including the southern lobe known as Marsh Lake), mesotrophic lake located in Jefferson County. Rock Lake is a natural glacial lake formed as a large compound depression in the ground moraine. The lake is classified as a natural drainage lake fed by streams, groundwater, precipitation and runoff and drained by an outlet stream, Rock Creek. Rock Lake drains to Rock Creek which flows into the Crawfish River which connects to the Rock River in the City of Jefferson. A mill dam was built in 1865 for the purposes of hydraulic power production but ceased operation in 1933 and the mill property was sold to the City of Lake Mills in 1935. In 1940, the location of the dam was moved to the outlet of the millpond.

The east shore of Rock Lake is within the City of Lake Mills, while the remainder of the shoreline is in the Town of Lake Mills. Rock Lake's 15.1 square mile watershed is home to four lakes (Rock Lake (including Marsh Lake), Mud Lake, Bean Lake, and Perch Lake). Rock Lake has 5.8 miles of shoreline and a maximum depth of 59-feet. Public access is provided via several boat launches including: Elm Point Road on the southwest shore, Sandy Beach at the south shore, Mill Pond on the east shore, North End at Rock Lake Park on the north shore and Ferry Park on the northwest shore. Most of the shoreline has been developed into residential and recreational housing, although portions of the southwest shoreline have been designated as county park (Korth County Park).

Rock Lake supports a diverse fishery including northern pike, walleye, largemouth bass and smallmouth bass. The panfish fishery includes bluegill, yellow perch, pumpkinseed, green sunfish, rock bass, and black crappie. The lake also supports a diverse non-game fish community including: bowfin, grass pickerel, white sucker, brook silverside, golden shiner, emerald shiner, blacknose shiner, mimic shiner, bluntnose minnow, fathead minnow, longnose gar, black bullhead, yellow bullhead, central mudminnow, blackstripe topminnow, Johnny darter, Iowa darter and common carp. In addition, three Special Concern (SC) fish species (lake chubsucker, banded killifish and least darter), and one Threatened (T) species (pugnose shiner) inhabit Rock Lake.

The purpose of this report is to summarize the results of the comprehensive fishery survey conducted on Rock Lake in 2014 with comparisons to the comprehensive fishery survey

conducted in 2008. Management recommendations are included based on the findings of the 2014 survey.

## **METHODS**

This comprehensive fishery survey utilized a variety of sampling methods throughout the open water period in attempt to sample the major components of the fishery.

Northern pike were sampled from April 9 through April 22, 2014, using 3-foot x 4-foot framed fyke nets set perpendicular to shore during the spring spawning season (SN1). A total of six net locations were established in Marsh Lake (Figure 1). Nets were set to fish for 24-hours, then lifted, emptied and reset each day. Total fyke net effort targeting northern pike was 36 net nights.

Walleye were sampled from April 12 through April 23, 2014, using 3-foot x 4-foot framed fyke nets set perpendicular to shore during the spring spawning season (SN1). A total of six net locations were established located primarily on the east shore of Rock Lake. (Figure 2). Nets were set to fish for 24-hours, then lifted, emptied and reset each day. Total fyke net effort targeting walleye was 53 net nights.

All northern pike and walleye sampled during spring fyke netting were measured to the nearest 0.1 inch and a subsample was weighed to the nearest ounce. Sex was determined by the extrusion of milt or eggs. Scales and dorsal spines were taken from a subset of the fish sampled for ageing analysis. All northern pike and walleye sampled received differential fin clips as a mark (right pectoral for females, left pectoral for males and top caudal for unknown sex) and largemouth bass received top caudal fin clips to facilitate the calculation of a population estimate and to prevent recording multiple captures of individual fish. Other species sampled were measured to the nearest 0.1 inch and all fish were returned to the lake. Northern pike and walleye population size was estimated using the Schumacher-Eschmeyer formula using daily fyke net (SN1) catch and recapture data during the spring spawning period and the Schnabel method using fish marked during SN1 and recaptured during SE1 sampling. The following formulas were used:

Schnabel method: 
$$N = \frac{\sum(CtMt)}{R+1}$$

Where  $N$  is the population size,  $Ct$  is the number captured on day  $t$ ,  $Mt$  is the number marked on day  $t$ , and  $R$  is the total number of recaptures from the survey (Ricker 1975).

Schumacher-Eschmeyer method: 
$$N = \frac{\sum(CtMt^2)}{\sum(MtRt)}$$

Where  $N$ ,  $Ct$ , and  $Mt$  represent the same variables as in the Schnabel method, and  $Rt$  is the number recaptured on day  $t$  (Ricker 1975).

Fyke net total catch and catch per unit effort (CPUE,) expressed as number per net night were calculated for northern pike and walleye. Electrofishing total catch and CPUE (#/hour, #/mile) was calculated for walleye, largemouth bass, smallmouth bass, bluegill, pumpkinseed, yellow perch, rock bass and other panfish and other species. Lengths were used to calculate length frequency histograms for northern pike, walleye, largemouth bass, smallmouth bass and bluegill to assess size structure. Relative weight, the ratio of a fish's weight to the weight of a standard fish of the same length based on a scale of 100 was used to assess body condition. Mean relative weight ( $W_r$ ) was calculated by length group as an index of northern pike and walleye condition using a standard length-at-weight equation (Willis, 1998). Average relative weight was calculated for each species and for each sex separately when sex data were available. Relative weight values between 75 and 100 indicate normal weight for a given length. A relative weight value greater than 100 indicates that a fish is in excellent condition. A relative weight value less than 75 indicates that a fish is in poor condition.

Spring electrofishing (SE1) using a Wisconsin Department of Natural Resources (WDNR) standard direct current (DC) boom shocker boat was conducted at night on May 21 and May 22, 2014 to count and measure adult walleye and northern pike and record marks for adult walleye and northern pike marked with fin clips during spring fyke netting for use in estimating their abundance in the form of a population estimate. Largemouth bass received top caudal fin clips as marks to facilitate the calculation of a population estimate using SE1 as the marking sampling. SE1 sampling encompassed nearly all the lake's shoreline (11.56 miles) and included 5.4 hours of sampling effort.

Spring electrofishing (SE2) using a WDNR standard DC boom shocker boat was conducted at night on June 9 and June 10, 2014 and included four gamefish stations, each 1.5 miles long (6 miles and 3 hours of effort) where only largemouth and smallmouth bass were collected and measured to the nearest 0.1 inch. Four additional stations, each .5 miles long (2 miles and 1.03 hours of effort) were sampled where all panfish species were collected, and a subsample measured to the nearest 0.1 inch. Largemouth bass were examined for top caudal fin clip marks to facilitate the calculation of a population estimate using SE2 as the recapture sampling. A count of common carp was also conducted.

Fall electrofishing (FE) using a WDNR standard DC boom shocker boat was conducted at night on October 8 and October 9, 2014 to assess adult and young-of-the-year (YOY) largemouth bass and walleye abundance, gamefish and panfish relative abundance, gamefish population size-structure and gamefish recruitment. Fall electrofishing was conducted at four gamefish stations, each 1.5 miles long (6 miles and 3.12 hours of effort) where only gamefish were collected and measured to the nearest 0.1 inch. Four additional stations, each .5 miles long (2 miles and 1.12 hours of effort) were sampled where all fish species were collected, and a subsample measured to the nearest 0.1 inch. A total of 8 miles of shoreline was sampled with 4.24 hours of effort.

Growth information from largemouth bass, smallmouth bass, bluegill, yellow perch and pumpkinseed was obtained from scale samples collected throughout the survey. Growth data from Rock Lake was compared to statewide and regional mean growth rates utilized in the WDNR Fisheries Management Database.

Proportional stock density (PSD) and relative stock density of preferred length fish (RSD-P) indices were calculated for northern pike, largemouth bass, smallmouth bass and bluegill to evaluate size structure. PSD represents the percent of fish greater than or equal to the stock length (14 inches for northern pike, 8 inches for largemouth bass and 3 inches for bluegill) that are greater than the quality length (21 inches for northern pike, 12 inches for largemouth bass and 6 inches for bluegill). RSD-P is the proportion of fish of a preferred length group in a population. RSD-P values were set at 28 inches for northern pike, 15 inches for largemouth bass, 20 inches for walleye, 14 inches for smallmouth bass and 8 inches for bluegill (Anderson and Neumann 1996).

## **RESULTS AND DISCUSSION**

### **Northern Pike**

A total of 363 northern pike (including 22 recaptured fish) were sampled during 2014 spring fyke netting (SN1) specifically targeting the species for a catch rate of 10.1 per net night. Lengths were taken on 341 northern pike captured in fyke nets (total excluding recaptures). The mean length was 19.1 inches and the maximum length was 30.9 inches. The largest northern pike sampled was a 30.9-inch female weighing 7.5 pounds. Catch rate for 2014 spring electrofishing (SE1) specifically targeting northern pike to look for fish marked during spring fyke netting was 3.9 per hour (21 fish total, 1.82 per mile), with a mean length of 21.9 inches and maximum length of 35 inches. A total of 27 northern pike were sampled in 2014 fall electrofishing (FE) for a catch rate of 6.4 per hour (3.4 per mile). In 2014, 3% of the northern pike sampled during spring fyke netting were greater than 26 inches in length (legal harvestable size), compared to 12% in 2008. The adult northern pike population size in 2014 was estimated at 3,555 or 2.6 fish per acre (95% C.I. 2,118-11,065) compared to 1,645 or 1.2 fish per acre (95% C.I. 1,263-2,358) in 2008 using the Schuman Echmeyer formula. Using the Schnabel formula, the 2014 population estimate was 2,871 fish or 2.1 fish per acre (95% C.I. 2,000-5,085) compared to 1,778 or 1.3 fish per acre (95% C.I. 1,442-2,318) in 2008. 2014 and 2008 spring electrofishing (SE1) did not yield an adequate number of northern pike to confidently estimate population size using single census formulas.

In 2008, a total of 560 northern pike (including 66 recaptured fish) were sampled in SN1 sampling (63 net nights effort) specifically targeting the species for a catch rate of 8.5 per net night. Lengths were taken on 494 northern pike captured in fyke nets (total caught excluding recaptures). The mean length was 21.5 inches and the maximum length was 42 inches. The largest northern pike was a 42-inch female weighing 17.75 pounds. Catch rate for 2008 SE1 specifically targeting northern pike to inspect for fish marked with a fin clip during SN1 was 3.3 per hour (12 fish total, 1.9 per mile), with a mean length of 21.4 inches and maximum length of 29.9 inches. One northern pike marked with a fin clip was recaptured in SE1 sampling. A total of 3 northern pike were sampled in 2008 FE for a catch rate of 1.1 per hour (0.61 per mile) with a mean length of 20.9 inches and maximum length of 34.2 inches.

Mean length of northern pike sampled in SN1 decreased from 21.2 inches in 2008 to 19.1 inches in 2014. Abundance of northern pike greater than 26 inches (legal harvestable size) decreased from 2008 (N=86) to 2014 (N=11). Relative stock density of northern pike greater than 26 inches ( $RSD_{26}$ ) decreased from 12 in 2008 to 4 in 2014, indicating a decrease in the number of legal harvestable fish.

Northern pike body condition as suggested by relative weight ( $W_r$ ) values was good and did not vary greatly between years.  $W_r$  values ranged from 83-106 with a mean  $W_r$  of 96 (N = 416) for 2014 length groups and from 77-105 with a mean  $W_r$  of 97 (N=443) for 2008 length groups. Sex specific relative weight for females was excellent and ranged from 83-112 with a mean  $W_r$  of 101 in 2014 and 77-101 with a mean  $W_r$  of 111 in 2008. Male sex specific relative weight was good but lower than females and ranged from 78-99 with a mean  $W_r$  of 89 in 2014 and 87-100 with a mean  $W_r$  of 93 in 2008.

The overall size distribution of northern pike sampled in 2014 SN1 indicates the presence of nine-year classes (Figure 3). Most fish collected during 2014 spring fyke netting were 3-years old, representing fish produced in 2011. PSD was 24 in 2014 SN1 compared to 47 in 2008 indicating a decline in quality-size northern pike. Relative stock density of northern pike greater than the preferred length of 28 inches ( $RSD-P$ ) was 2 in 2014 compared to 8 in 2008 indicating few preferred-size northern pike in Rock Lake.

In 2014, the growth rate of female northern pike was fairly consistent with the growth rate in 2008, the statewide average and the South Central Region (SCR) average until age 5, after which growth rate falls below the three averages (Figure 4). As expected, female northern pike in Rock Lake grow faster and larger than males. In 2014, growth rate of male northern pike was slightly lower than 2008. While males in both survey years showed growth above the statewide average, they were considerably below the South Central Region average. A few males become sexually mature in 1 year, with the majority maturing at 2 years. A few females mature in 2 years, with the majority maturing in 3 years. Female northern pike reach legal harvestable size (26-inches) in 6 years and males in 7 years.

The northern pike population in Rock Lake is naturally reproducing and stocking has not occurred since 1999 when 100,000 fry were stocked from the Lake Mills State Fish Hatchery (Table 1).

### **Walleye**

A total of 587 walleye (including 190 recaptured fish) were sampled in SN1 sampling (53 net nights effort) specifically targeting the species for a catch rate of 11.1 per net night. Lengths were taken on 397 walleye captured in fyke nets (total caught excluding recaptures). The mean length was 18.6 inches and the maximum length was 26.6 inches. The largest female walleye sampled was 26.6 inches in length and weighed 7.7 pounds. Catch rate for 2014 SE1 specifically targeting walleye to look for fish marked with fin clips during SN1 was 2.96 per hour (16 fish total, 1.4 per mile), with a mean length of 13.3 inches and maximum length of 21.9 inches. Of the 16 walleye sampled in SE1, three male walleye marked with a fin clip were recaptured. A total of 22 walleye were sampled in 2014 FE for a catch rate of 5.2 per hour (2.8 per mile).

In 2008, a total of 839 walleye (including 398 recaptured fish) were sampled in SN1 sampling (114 net nights effort) specifically targeting the species for a catch rate of 7.4 per net night. Lengths were taken on 398 walleye captured in fyke nets (total excluding recaptures). The mean length was 19.7 inches and maximum length was 26.8 inches. The largest female walleye sampled was 26.8 inches in length and weighed 7.9 pounds. Catch rate for 2008 SE1 specifically targeting walleye to inspect for fish marked with fin clips during SN1 was 15 per hour (55 fish total, 8.7 per mile), with a mean length of 17.8 inches and maximum length of 24 inches. Of the 55 walleye sampled in SE1, forty-two walleye marked with a fin clip were recaptured. Three young-of-the-year (YOY) walleye were sampled during SE2. A total of 7 walleye were sampled in 2008 FE for a catch rate of 2.5 per hour (1.4 per mile) with a mean length of 18.2 inches and maximum length of 24 inches. In both survey years, the size distribution did not indicate overharvest as 96% of the walleye sampled during 2014 spring fyke netting were greater than 15 inches in length (legal harvestable size), and 99% in 2008 (Figure 5).

The adult walleye population size (including sexually mature fish and fish over 15-inches) in 2014 was estimated at 276 or 0.2 fish per acre (95% C.I. 203-432) compared to 850 or 0.6 fish per acre (95% C.I. 780-919) in 2008 using the Schumacher-Eschmeyer formula. Using the Schnabel formula, the 2014 population estimate was 305 fish (95% C.I. 263-362) or 0.2 per acre compared



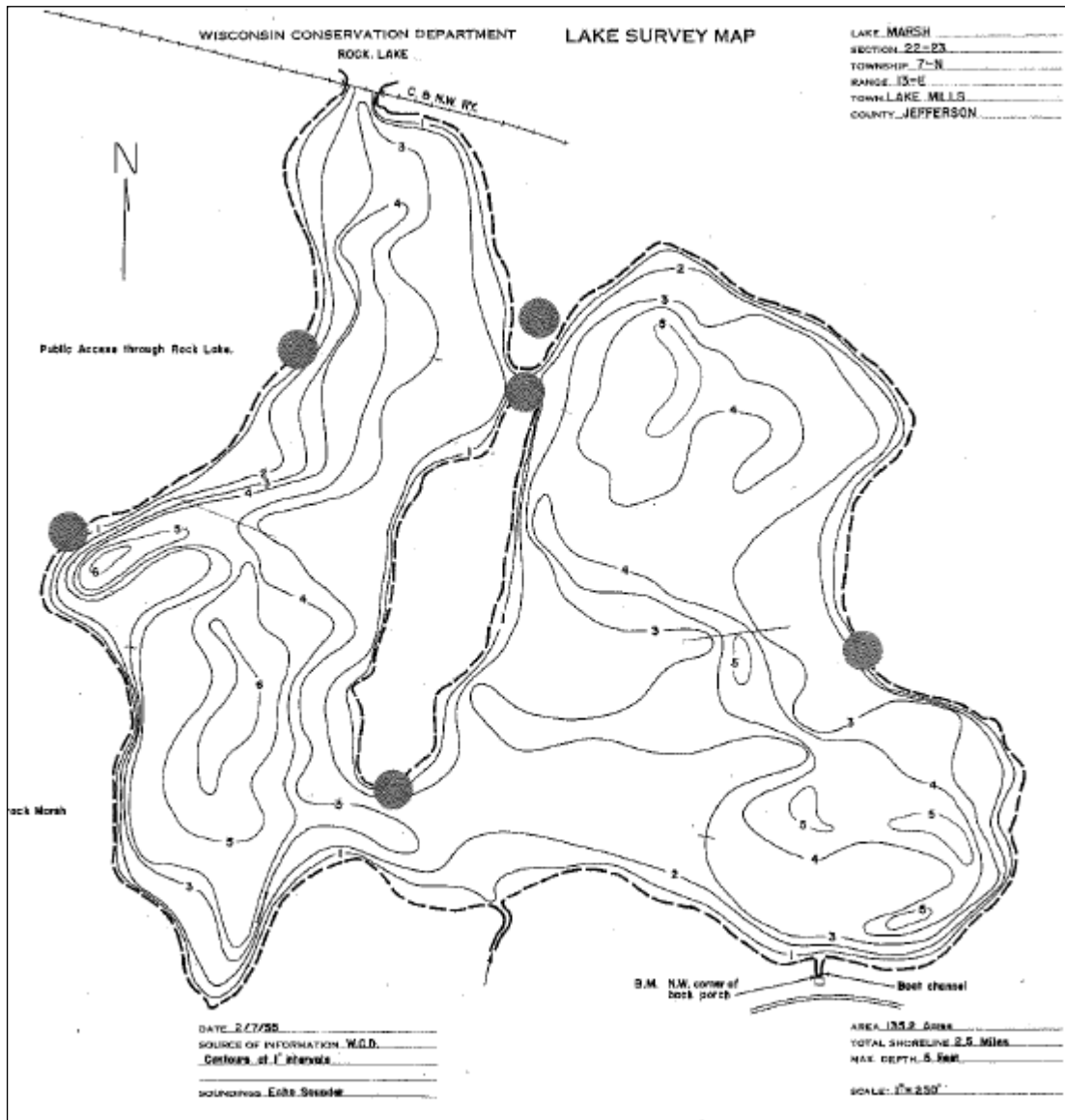


Figure 1. Lake survey map of Marsh Lake in Jefferson County indicating northern pike fyke net locations for 2014 spring netting survey.

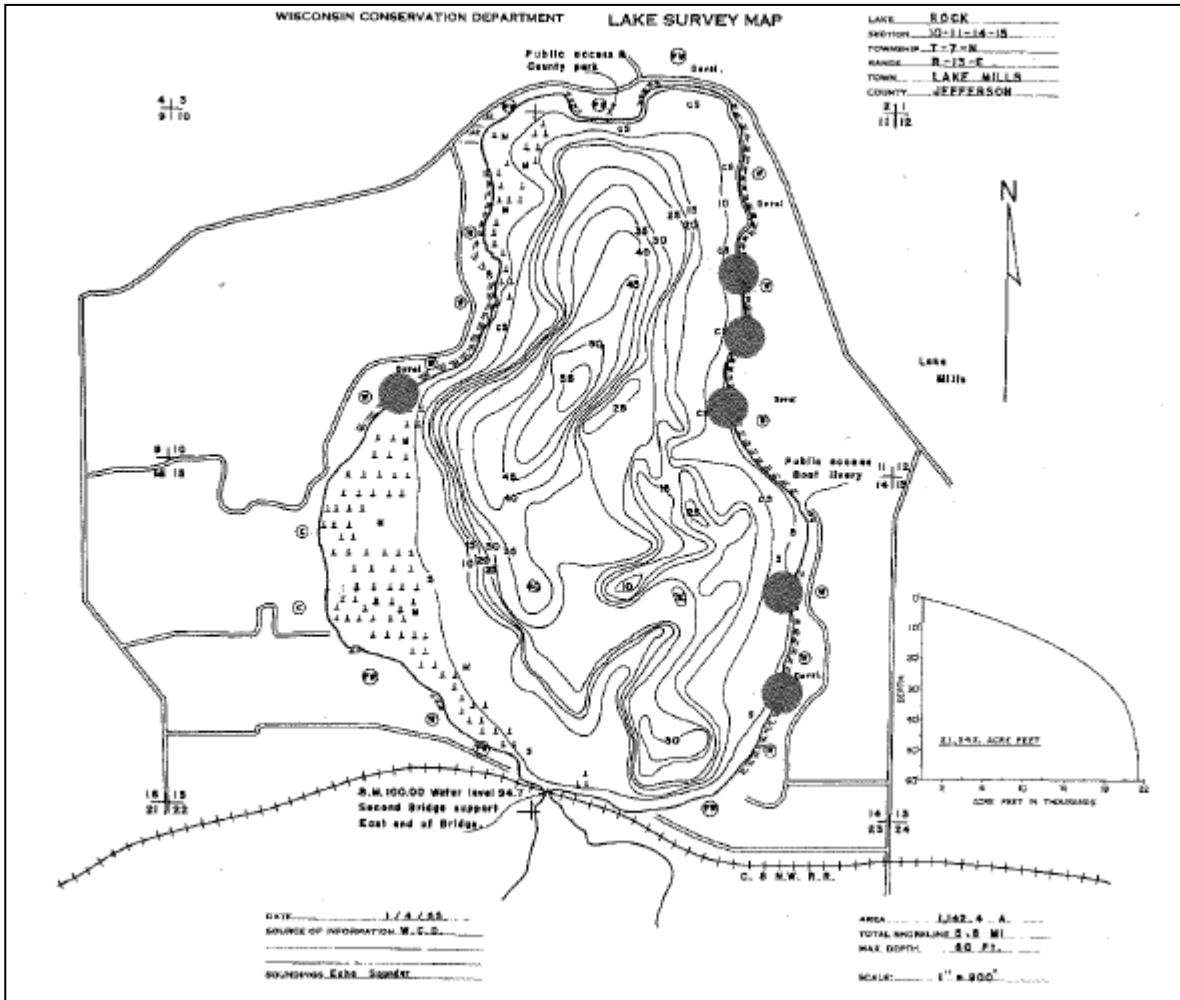


Figure 2. Lake survey map of Rock Lake in Jefferson County indicating walleye fyke net locations for 2014 spring netting survey.

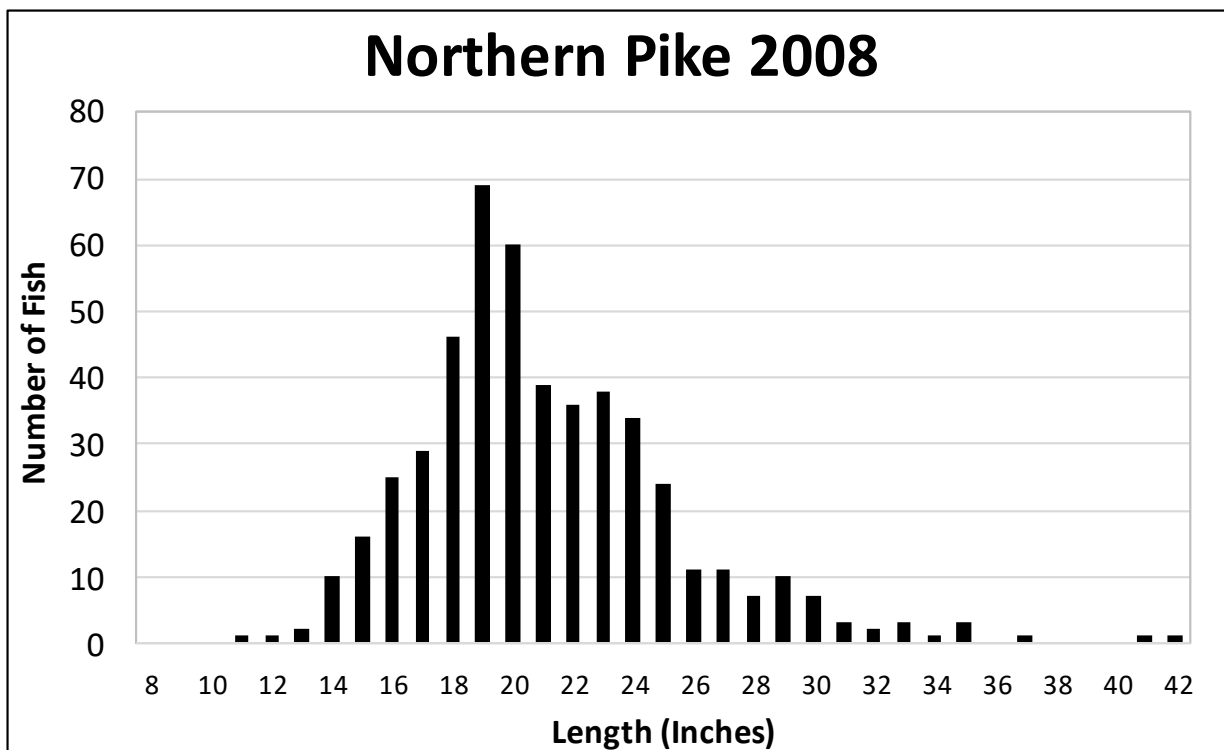
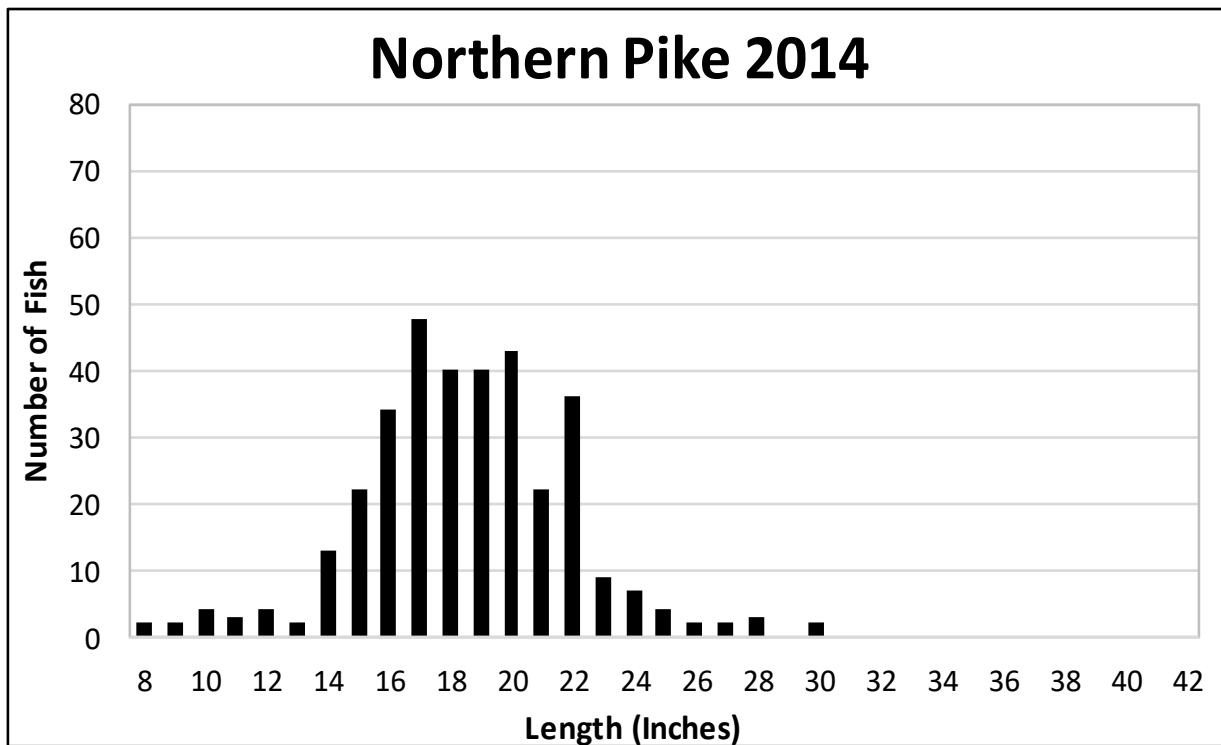


Figure 3. Length-frequency histogram indicating fyke net (SN1) catch of northern pike from 2014 and 2008 at Rock Lake, Jefferson County.

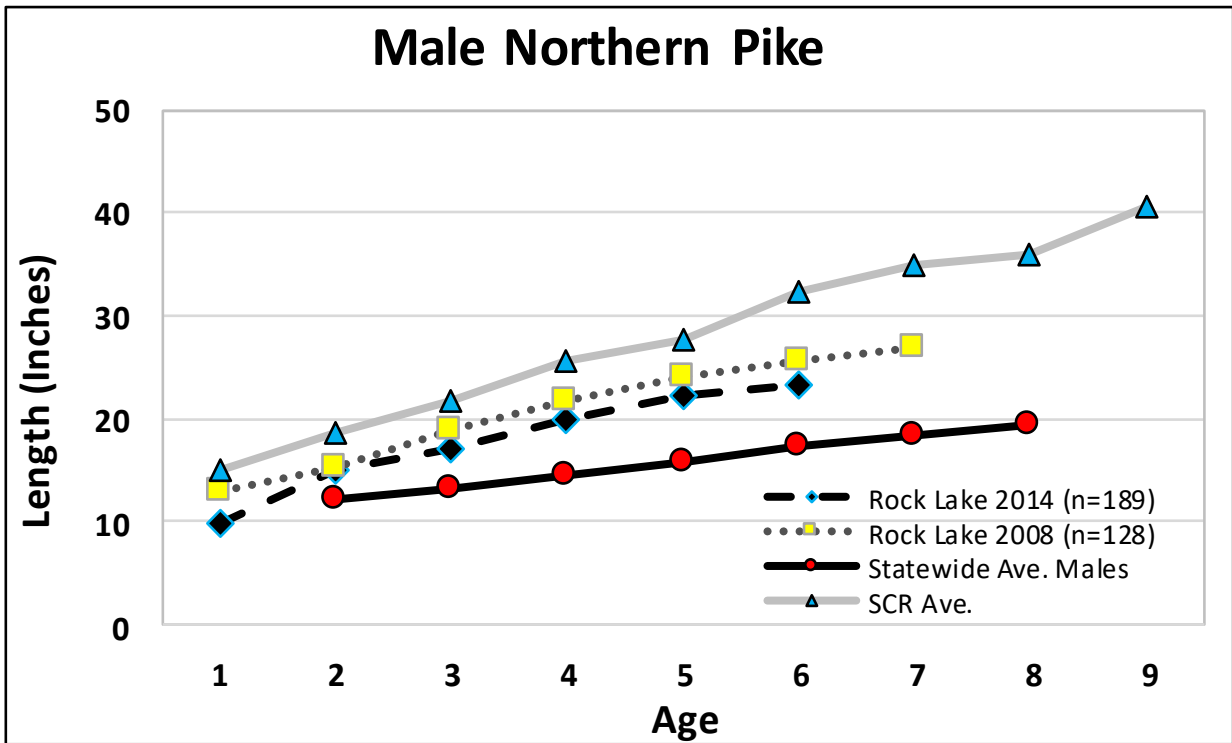
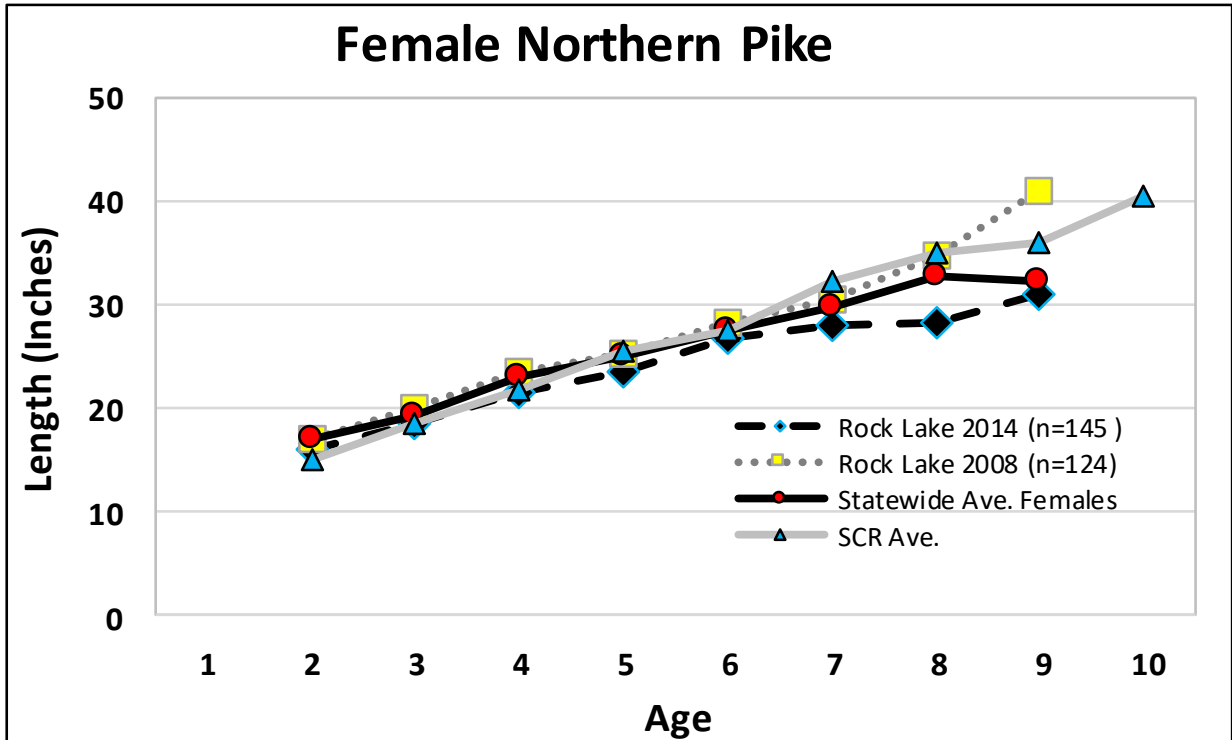


Figure 4. Northern pike mean length at age determined using scales collected from Rock Lake in 2014 and 2008 compared to statewide and South Central Region (SCR) mean length at age data.

to 806 fish (733-895) in 2008. 2014 SE1 sampling did not yield adequate numbers of marked, recaptured fish (3 marked, recaptured fish out of 16 fish collected) to estimate population size using single census population estimate methods. In 2008 the population size was estimated at 814-819 (718-992) using single census population estimate methods.

Walleye body condition as suggested by relative weight ( $W_r$ ) values was good and did not vary greatly between years.  $W_r$  values ranged from 87-111 with a mean  $W_r$  of 99 ( $N = 388$ ) for 2014 length groups and from 86-106 with a mean  $W_r$  of 97 ( $N=92$ ) for 2008 length groups. Sex specific relative weight for females was excellent and ranged from 94-111 with a mean  $W_r$  of 102 in 2014 and 90-110 with a mean  $W_r$  of 103 in 2008. Male sex specific relative weight was good and ranged from 87-98 with a mean  $W_r$  of 92 in 2014 and 86-104 with a mean  $W_r$  of 93 in 2008. Relative weight for male northern pike was generally lower than females given the females' spawning condition and presence of eggs at the time of capture.

Growth rate of female walleye in 2014 was below the statewide average (Figure 6). Male walleye growth rate was consistent with the statewide average but below the South Central Region average, most noticeably after age 8. On average, female and male walleye in Rock Lake reach 15-inches (legal harvestable size) in 5 years. PSD was 97 in 2014 SN1 compared to 99 in 2008 indicating many quality-size walleye. Relative stock density of walleye greater than the preferred length of 20 inches (RSD-P) was 26 in 2014 compared to 31 in 2008.

Interestingly, walleye were the dominant predator species in Rock Lake in the 1970's. At that time the walleye population was naturally reproducing and was thought to produce strong year classes each year (WDNR, 1977). Management of the population consisted of stocking small fingerlings at 50 per acre in June of alternate years. Annual fall electrofishing surveys did not indicate stronger year classes being established from stocking. However, both young-of-year (YOY) and adults were abundant. By 1985 the walleye population was reproducing each year but produced modest year classes (WDNR<sub>1</sub>, 1985). Both YOY and adults were present in decent numbers. By 1992 very few (7) adult walleye were present in fall electrofishing with no YOY

walleye sampled, despite stocking 250,000 fry that year (WDNR<sub>2</sub>, 1992). More recent fall electrofishing (1998-2014) indicates that despite the stocking of fry, small fingerling and large fingerling, (Table 5) walleye year classes are low to non-existent each year (Figure 7).

### **Largemouth Bass**

A total of 134 largemouth bass were sampled in SN1 for a catch rate of 1.5 per net night. The mean length was 9 inches and the maximum length was 17.5 inches. Catch rate for 2014 SE1 was 49/hour (264 fish total, 22.8 per mile), with a mean length of 12.5 inches and maximum length of 19.6 inches. Catch rate for 2014 SE2 was lower than fall electrofishing at 27 per hour (81 fish total, 13.5 per mile), with a mean length of 10.9 inches and maximum length of 17 inches. A total of 157 largemouth bass were sampled in 2014 FE for a catch rate of 37 per hour (19.6 per mile), with a mean length of 10.4 inches and maximum length of 18 inches.

In 2008, 79 largemouth bass were sampled in SN1 for a catch rate of 0.45 per net night. A total of 102 largemouth bass were sampled in 2008 SE2 for a catch rate of 44.9 per hour (25.3 per mile) with a mean length of 9.8 inches and maximum length of 16.9 inches. A total of 84 largemouth bass were sampled in 2008 FE for a catch rate of 30.5 per hour (17.1 per mile) with a mean length of 9.6 inches and maximum length of 16.5 inches.

A balanced largemouth bass population typically displays PSD values between 40-60. Rock Lake largemouth bass PSD values from fall electrofishing have historically been between 33 and 69 for the last ten years and specifically within the 40-60 range for six of the last ten years (Figure 9). This indicates a balanced population with recruitment of small fish into the population and a desirable amount of quality-size bass (12-inch) present. PSD values from the 2014 survey were 72 in SN1, 45 in SE2 and 22 in fall electrofishing. Relative stock density of largemouth bass greater than a preferred length of 15 inches (RSD-P) was 13 in 2014 compared to 7 in 2008.

Largemouth bass body condition as suggested by relative weight ( $W_r$ ) values was excellent and ranged from 89-112 with a mean  $W_r$  of 105 ( $N = 94$ ) for 2014 length groups. Insufficient sample size did not allow for relative weight values to be calculated for largemouth bass in 2008.

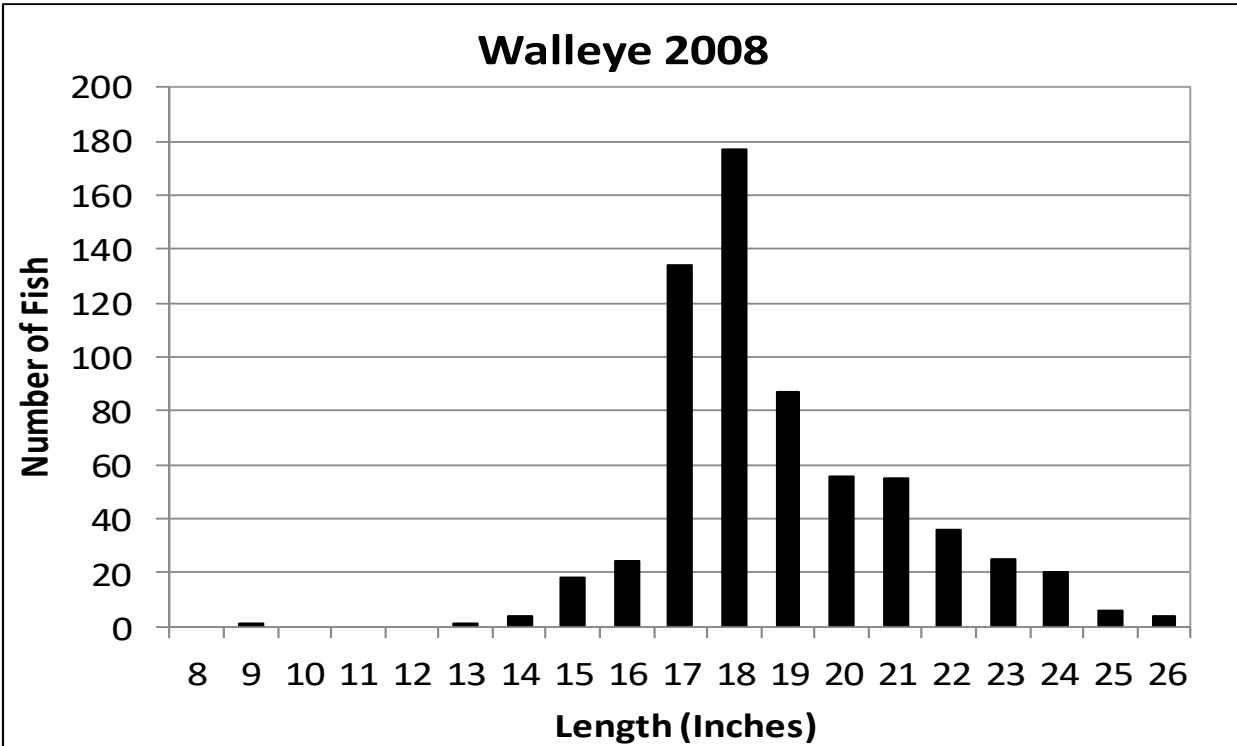
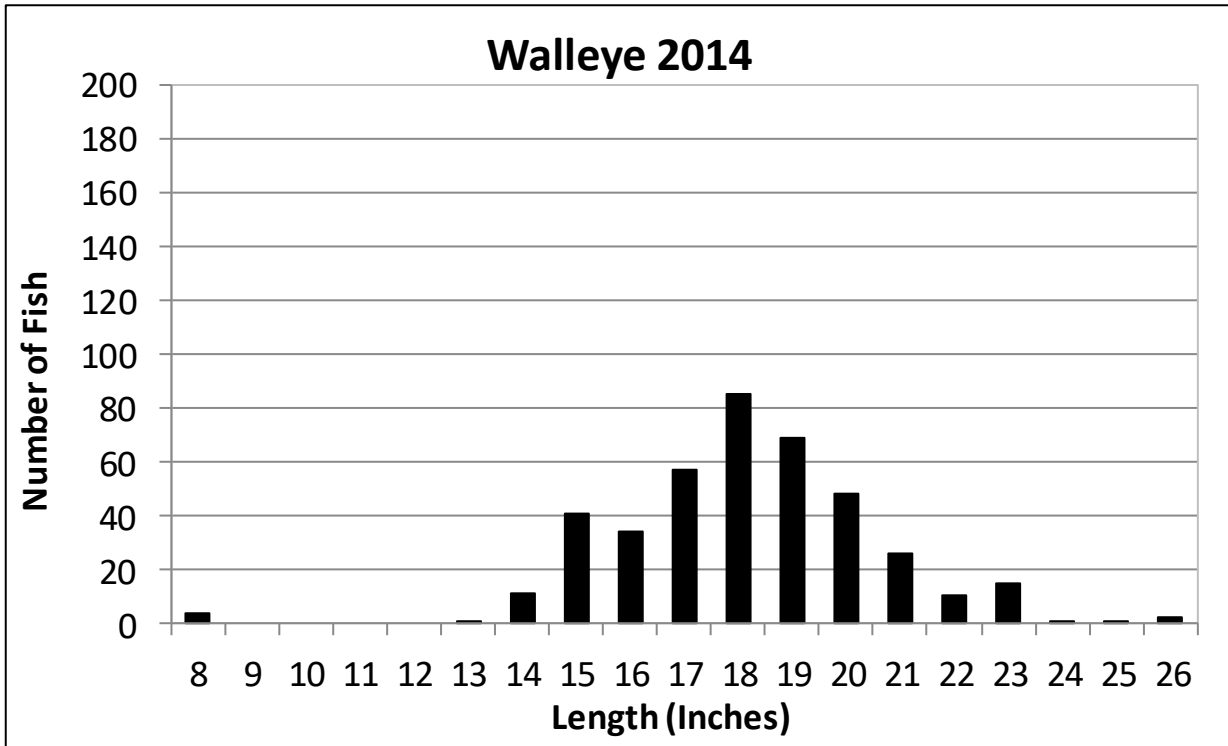


Figure 5. Length-frequency histogram indicating fyke net (SN1) catch of walleye from 2014 and 2008 at Rock Lake, Jefferson County.

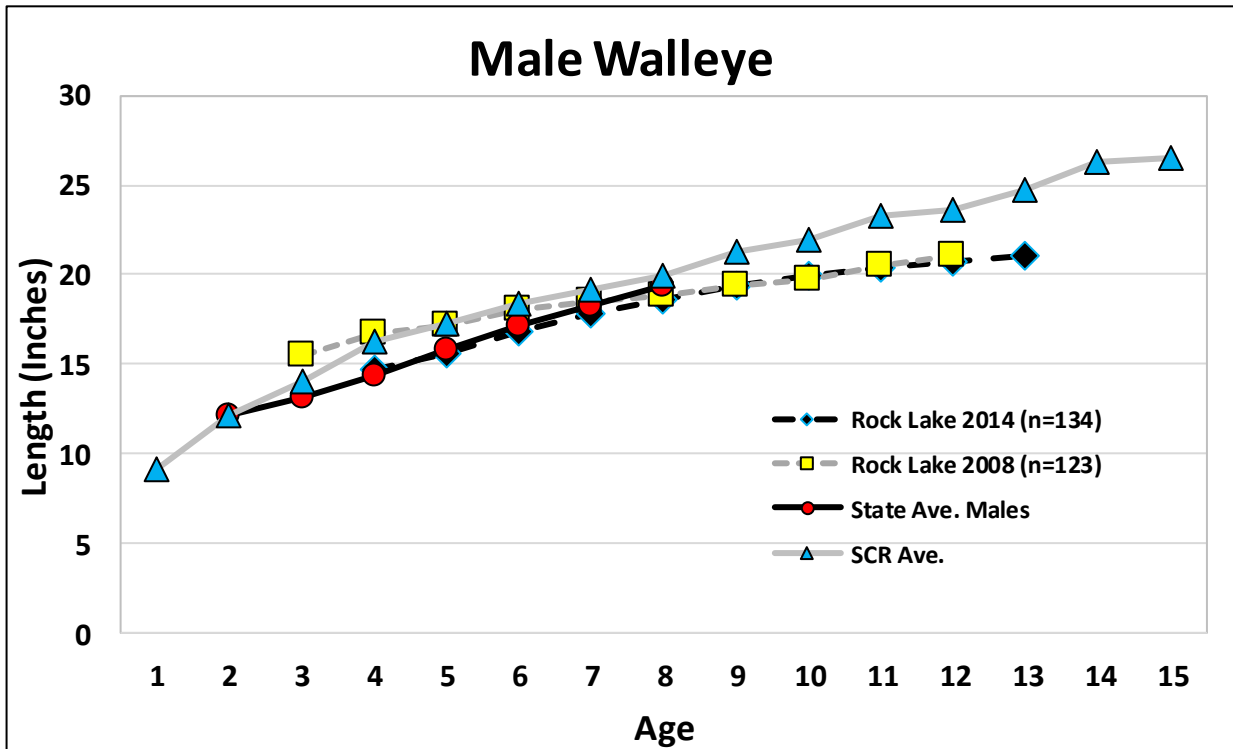
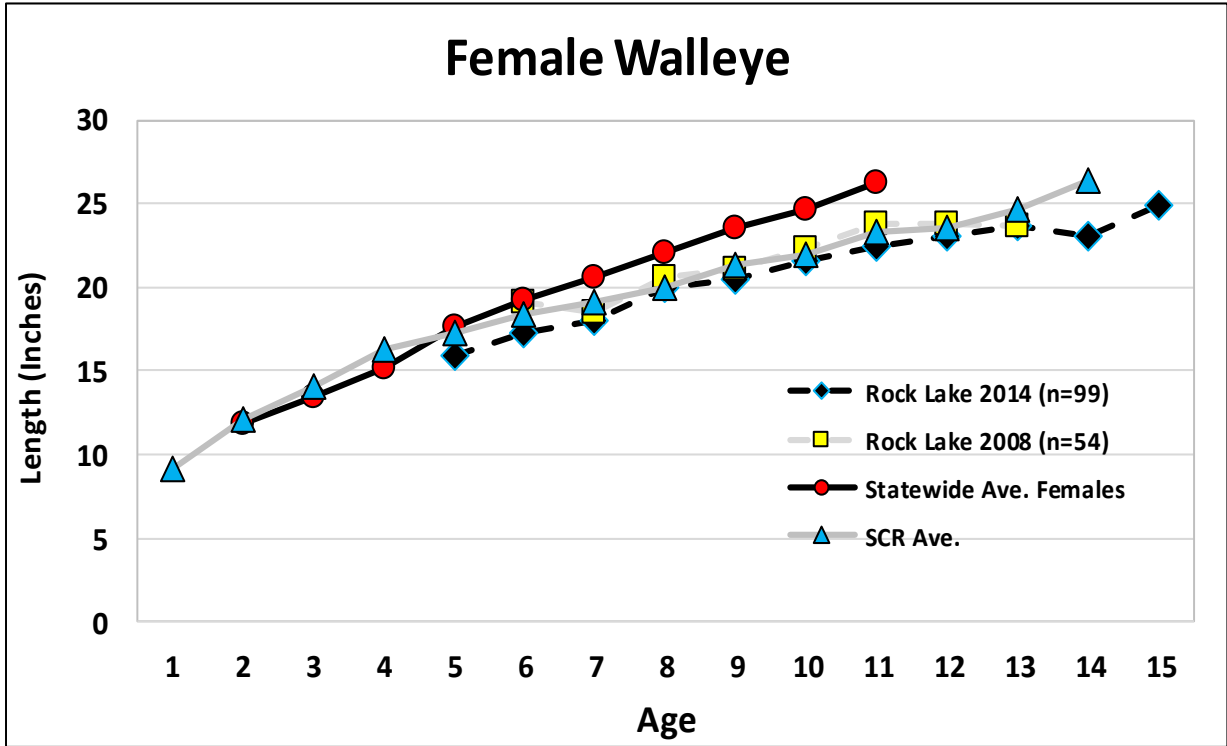


Figure 6. Walleye mean length at age determined using dorsal spines collected from Rock Lake in 2014 and 2008 compared to statewide and South Central Region mean length at age data.



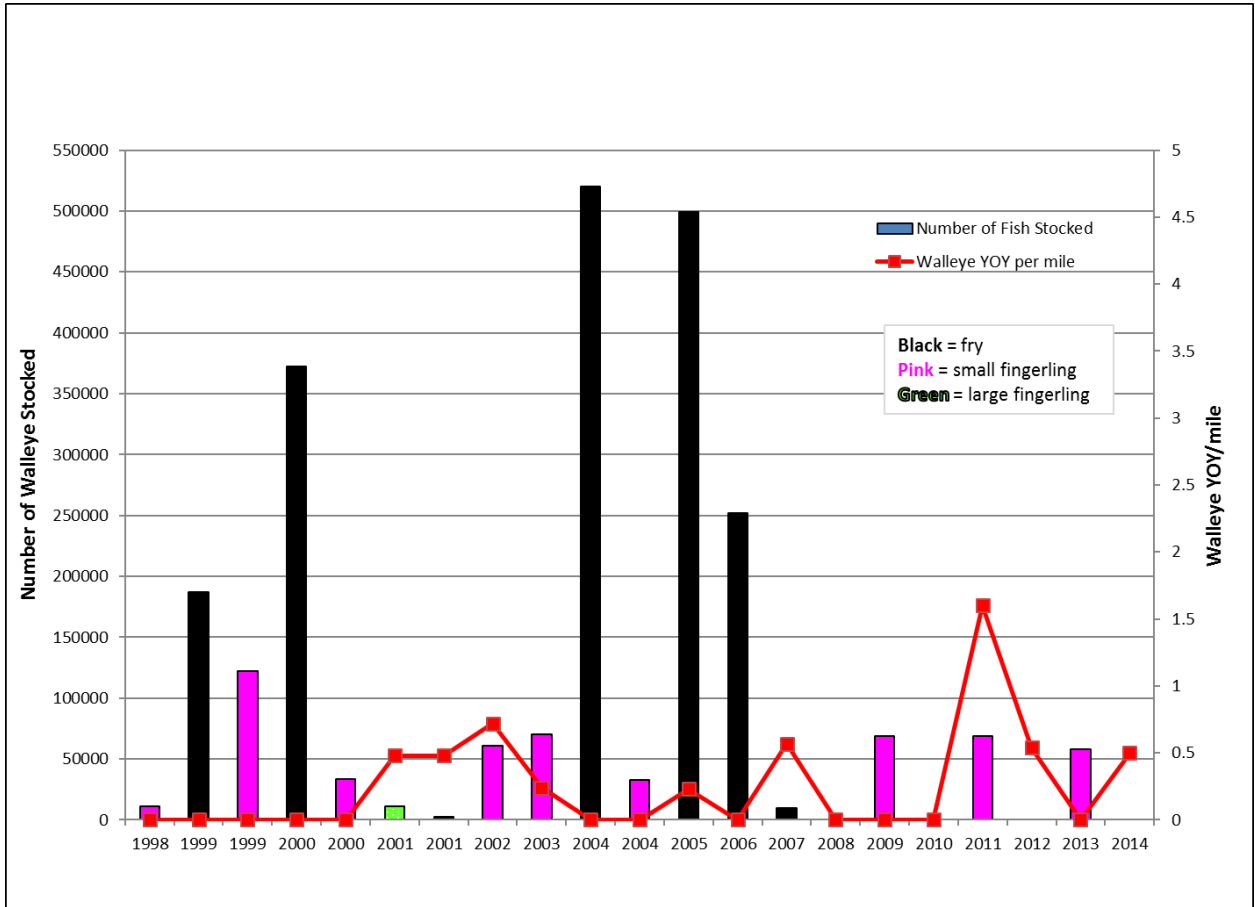


Figure 7. Number of walleye stocked in Rock Lake by year and corresponding walleye young-of-the-year (YOY) CPUE during fall electrofishing (FE).

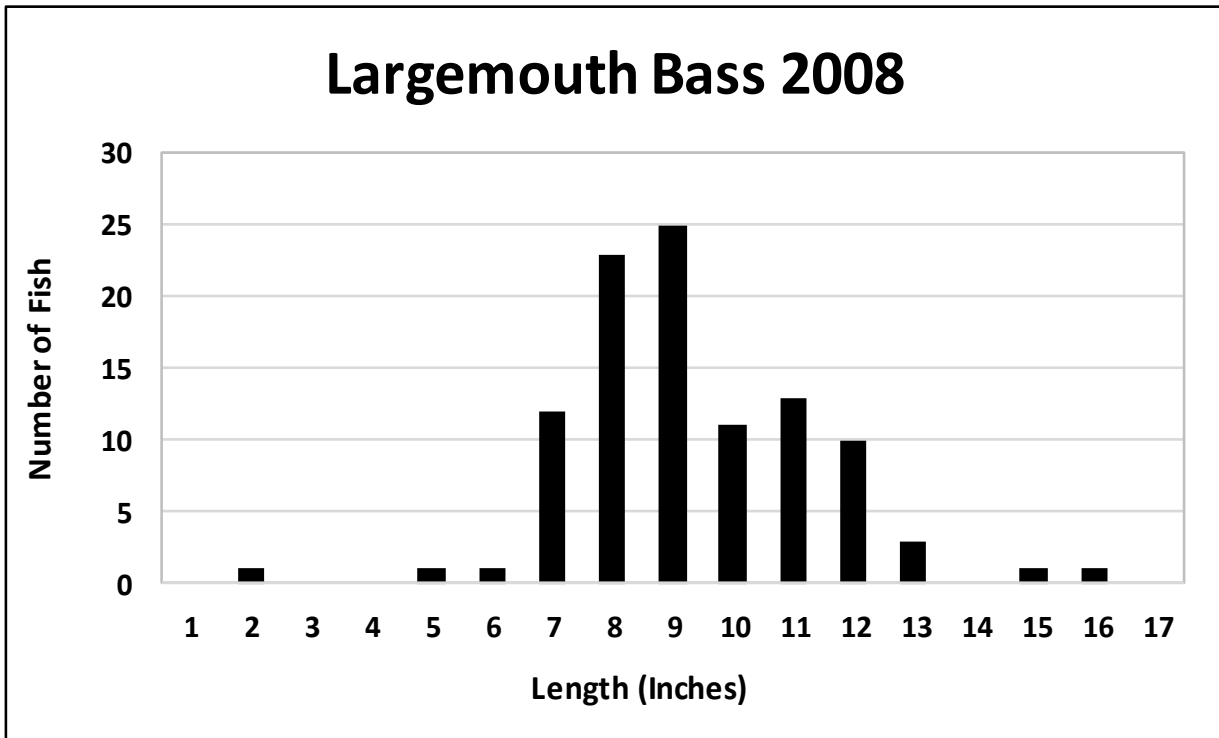
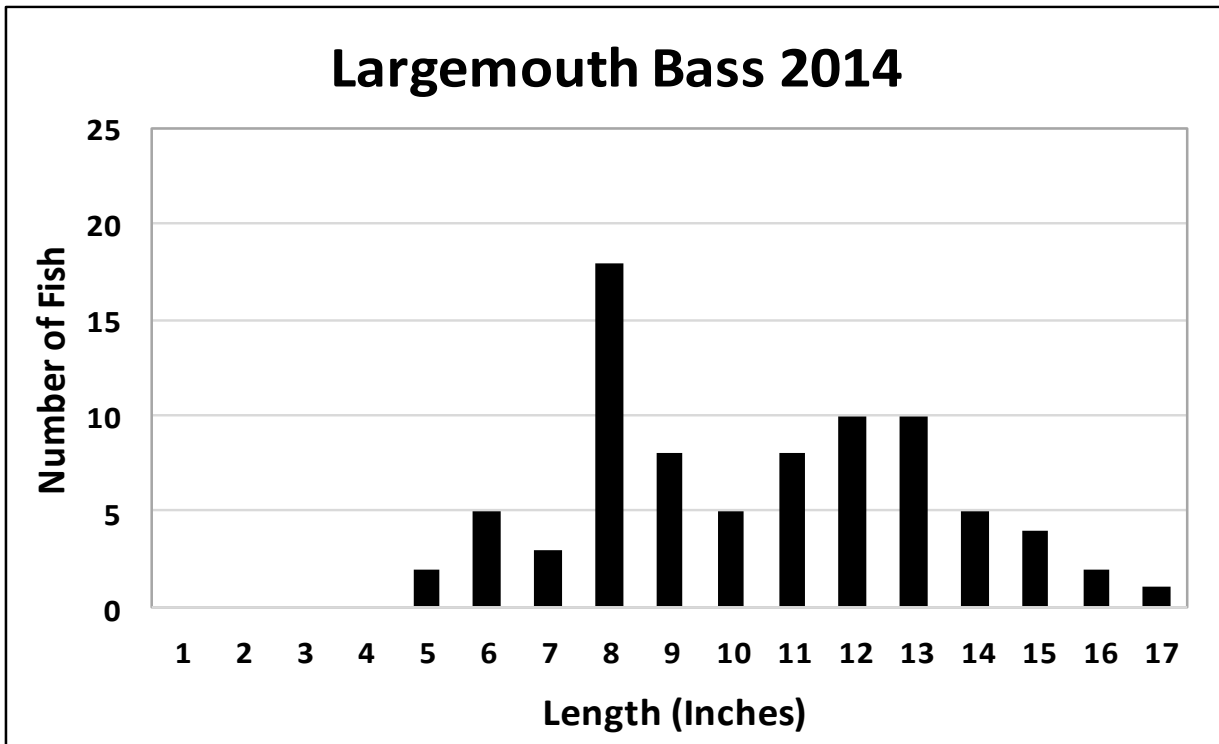


Figure 8. Length-frequency histogram indicating spring electrofishing (SE2) catch of largemouth bass in 2014 and 2008 at Rock Lake, Jefferson County.

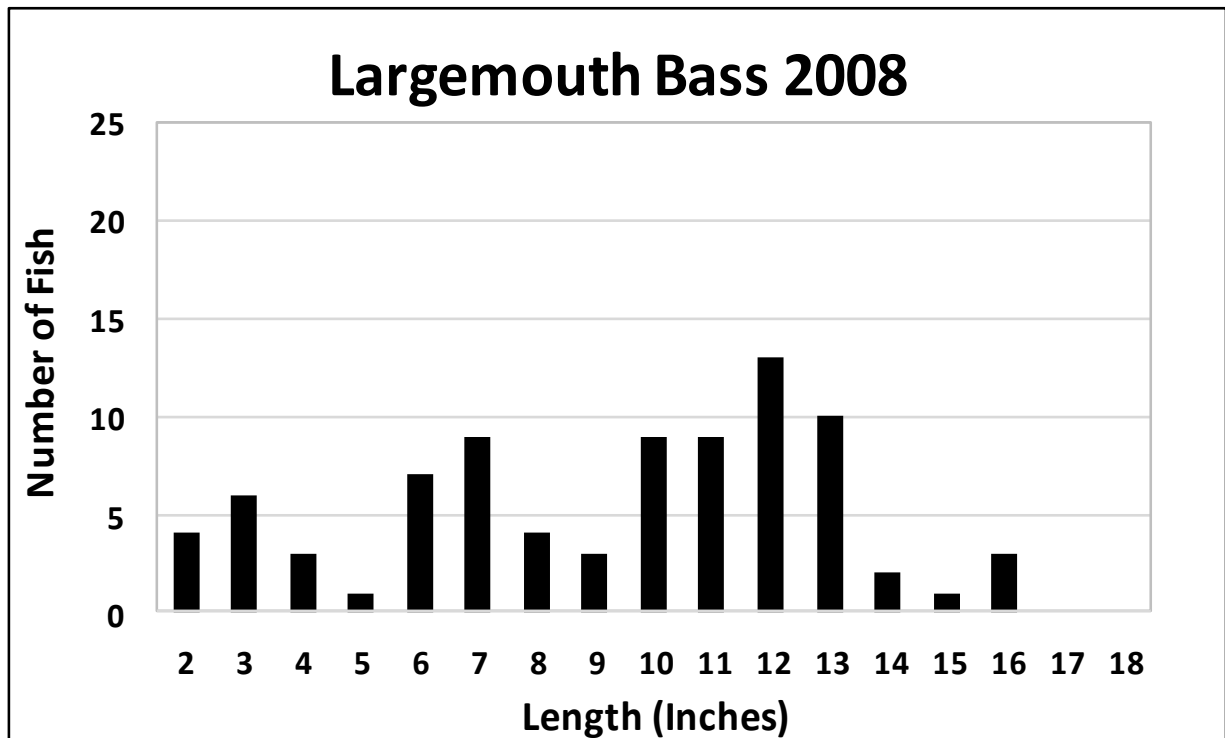
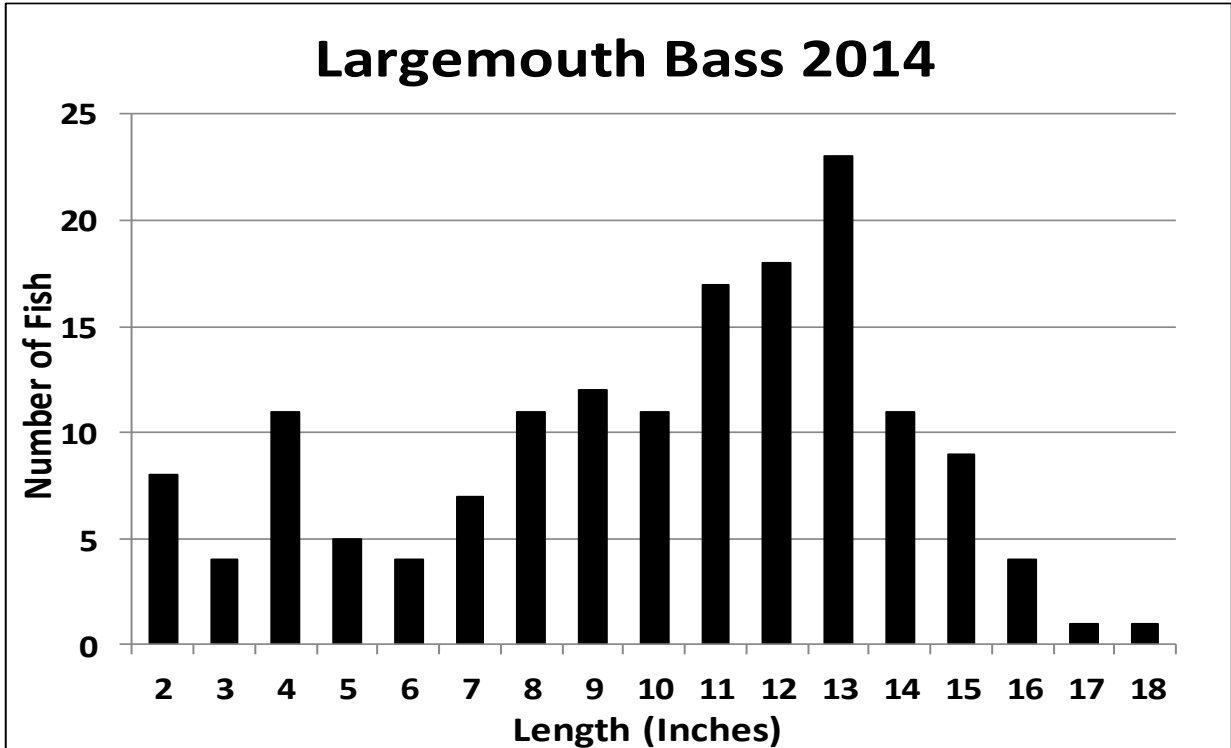


Figure 9. Length-frequency histogram indicating fall electrofishing (FE) catch of largemouth bass in 2014 and 2008 at Rock Lake, Jefferson County.

Table 1. Catch-per-unit-effort (CPUE), percent legal harvestable, proportional stock density (PSD) and relative stock density of preferred length (RSD-P) of largemouth bass during fall electrofishing in Rock Lake, Jefferson County.

Year	Total CPUE	% $\geq 14$ inches	PSD = $\frac{\# > 8''}{\# > 12''}$	RSD = $\frac{\# > 8''}{\# > 15''}$
2005	66/hr	3	40	5
2006	38/hr	4	33	4
2007	51/hr	11	38	5
2008	31/hr	7	54	7
2009	15/hr	9	64	5
2010	51/hr	14	69	10
2011	50/hr	11	54	4
2012	31/hr	11	60	4
2013	41/hr	9	50	8
2014	37/hr	17	57	13

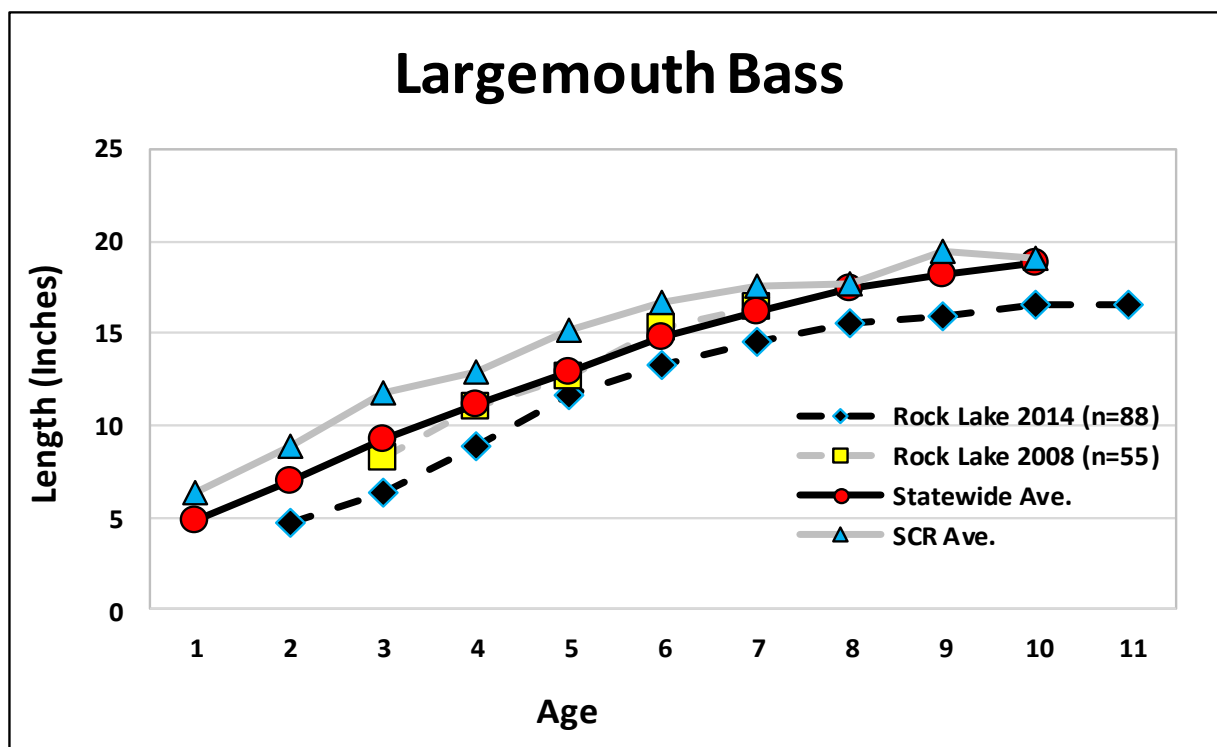


Figure 10. Largemouth bass mean length at age determined using scales collected from Rock Lake in 2014 and 2008 compared to statewide mean and South Central Region (SCR) mean length.

Growth rate of largemouth bass in Rock Lake in 2014 was below the 2008 average and both survey years were below the statewide average for the species. Growth rate was also considerably below the South Central Region (SCR) average. Largemouth bass in Rock Lake reach legal harvestable size of 14 inches in 6 to 7 years. (Figure 10). Largemouth bass growth rates should continue to be monitored to track improvements or changes over time.

Largemouth bass were the dominant predator species in Rock Lake before 1970. However, as vegetation in the lake decreased, by 1977 the largemouth bass population was relatively small (WDNR, 1977). During this period the lake favored walleye as the dominant predator species.

The largemouth bass population in Rock Lake is naturally reproducing and stocking has not occurred since 1987 when 1,170 fry were stocked from the Lake Mills State Fish Hatchery (Table 6).

### **Smallmouth Bass**

A total of 20 smallmouth bass were sampled in SN1 for a catch rate of 0.22 per net night. The mean length was 13 inches and the maximum length was 16.9 inches. Catch rate for 2014 SE1 was 14 per hour (76 fish total, 14.1 per mile), with a mean length of 11.7 inches and maximum length of 17.5 inches. Catch rate for 2014 SE2 was lower than fall electrofishing at 9.7 per hour (29 fish total, 4.8 per mile), with a mean length of 9.7 inches and maximum length of 15.1 inches. A total of 64 smallmouth bass were sampled in 2014 FE for a catch rate of 15.1 per hour (8 per mile) with a mean length of 10.8 inches and a maximum length of 16.2 inches.

In 2008, 57 smallmouth bass were sampled in SN1 for a catch rate of 0.32 per net night. The mean length was 12.2 inches and maximum length was 15.9 inches. Catch rate for 2008 SE1 was 31.8 per hour (115 fish total, 18 per mile), with a mean length of 10.8 inches and maximum length of 15.4 inches. Catch rate for 2008 SE2 was lower than fall electrofishing at 23 per hour (52 fish total, 13 per mile) with a mean length of 9 inches and maximum length of 14.2 inches. A total of 83 smallmouth bass were sampled in 2008 FE for a catch rate of 30.2 per hour (17 per mile) with a mean length of 9.8 inches and maximum length of 18 inches.

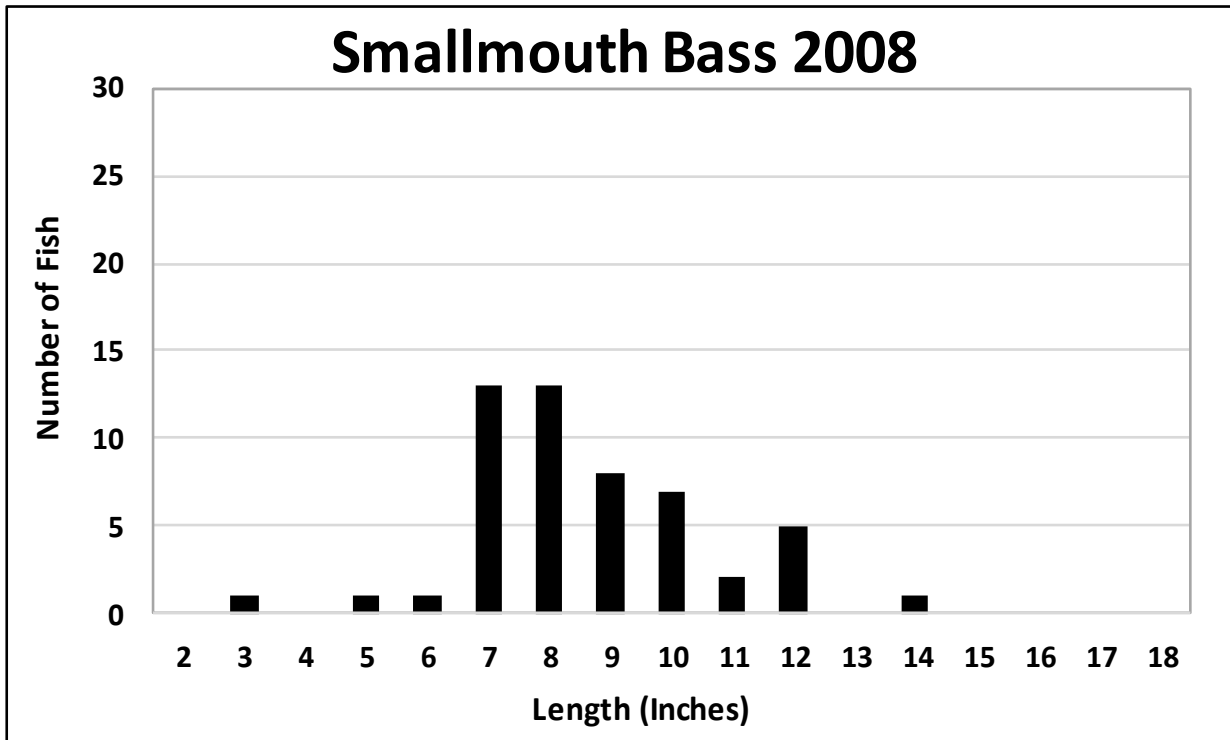
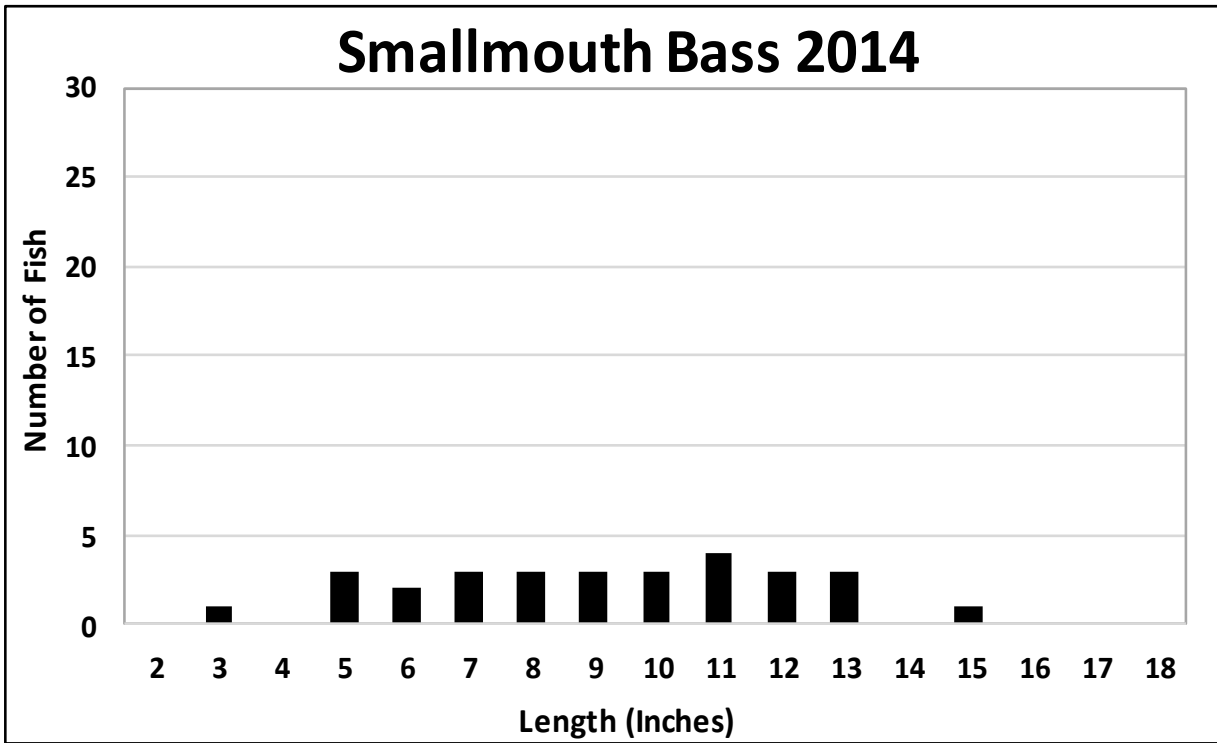


Figure 11. Length-frequency histogram indicating spring electrofishing (SE2) catch of smallmouth bass in 2014 and 2008 at Rock Lake, Jefferson County.

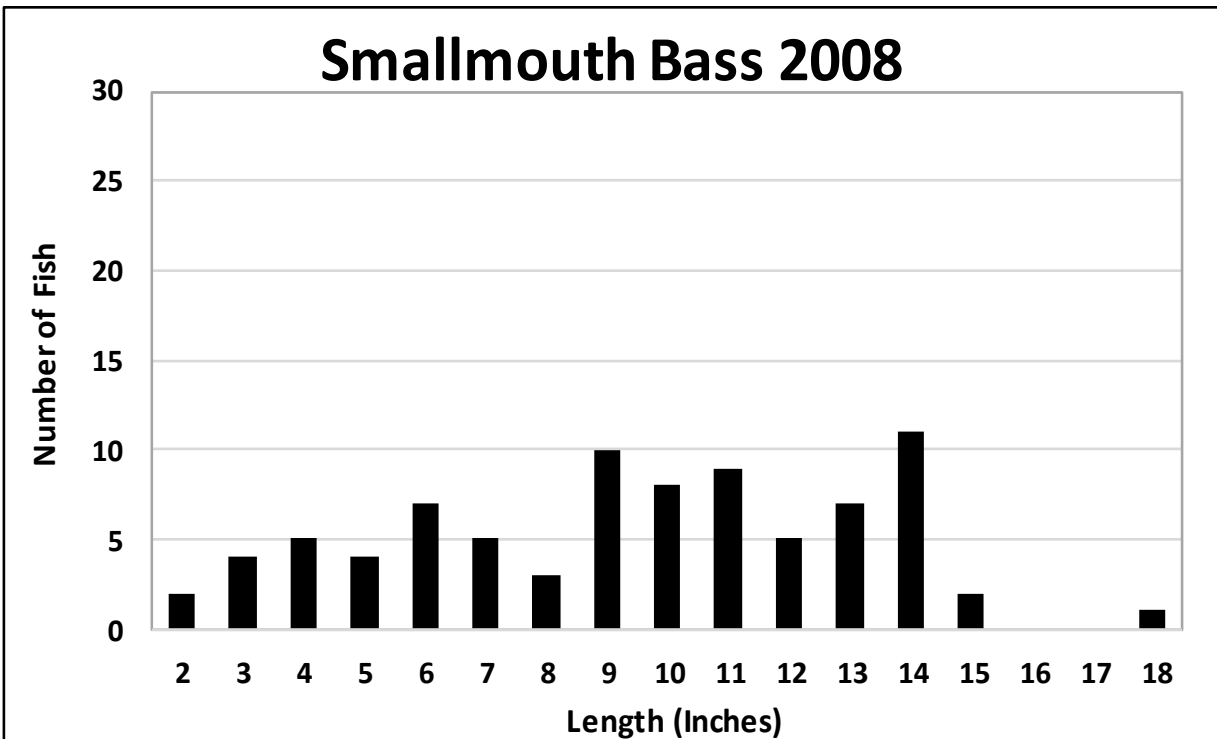
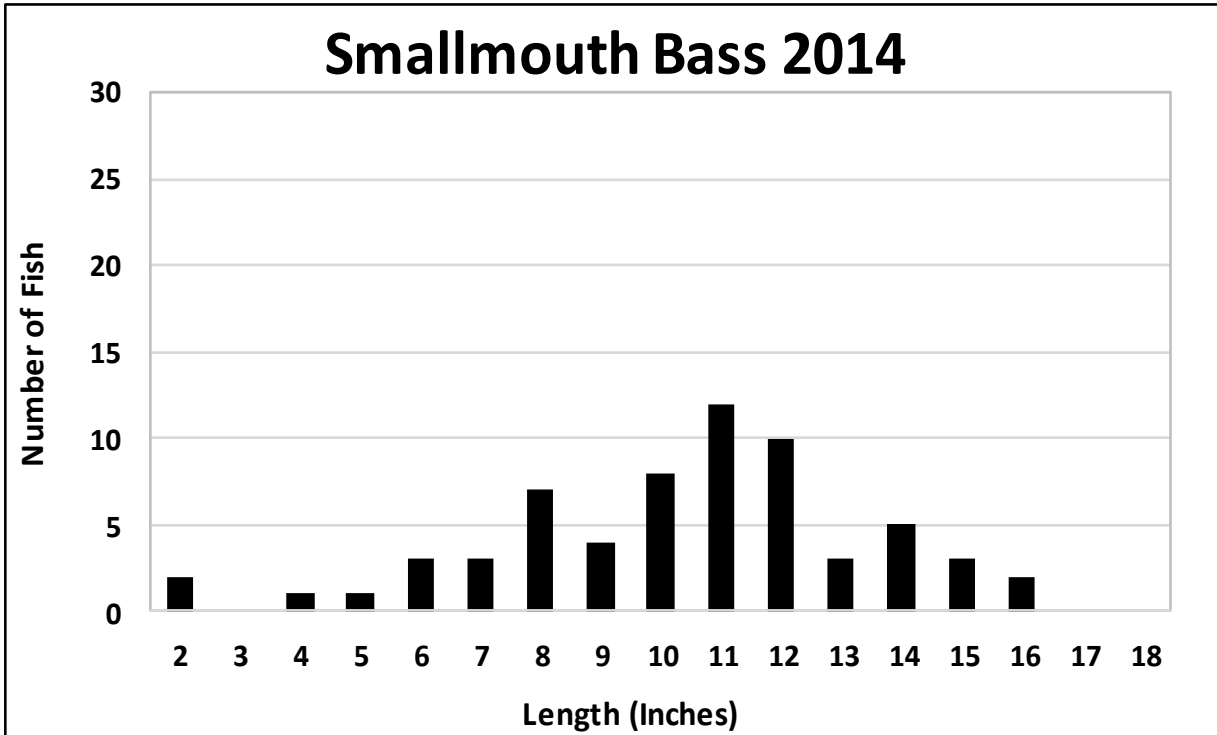


Figure 12. Length-frequency histogram indicating fall electrofishing (FE) catch of smallmouth bass in 2014 and 2008 at Rock Lake, Jefferson County

Table 2. Catch-per-unit-effort (CPUE), percent legal harvestable, proportional stock density (PSD) and relative stock density of preferred length (RSD-P) of smallmouth bass during fall electrofishing in Rock Lake, Jefferson County.

Year	Total CPUE	% $\geq$ 14-inches	PSD = $\frac{\#>7"}{\#>11"}$	RSD-P = $\frac{\#>7"}{\#>14"}$
2005	50/hr	4	30	4
2006	50/hr	7	32	8
2007	8/hr	14	35	18
2008	30/hr	17	57	23
2009	32/hr	18	64	27
2010	24/hr	7	33	10
2011	55/hr	3	39	10
2012	21/hr	4	65	5
2013	32/hr	4	49	6
2014	15/hr	16	61	18

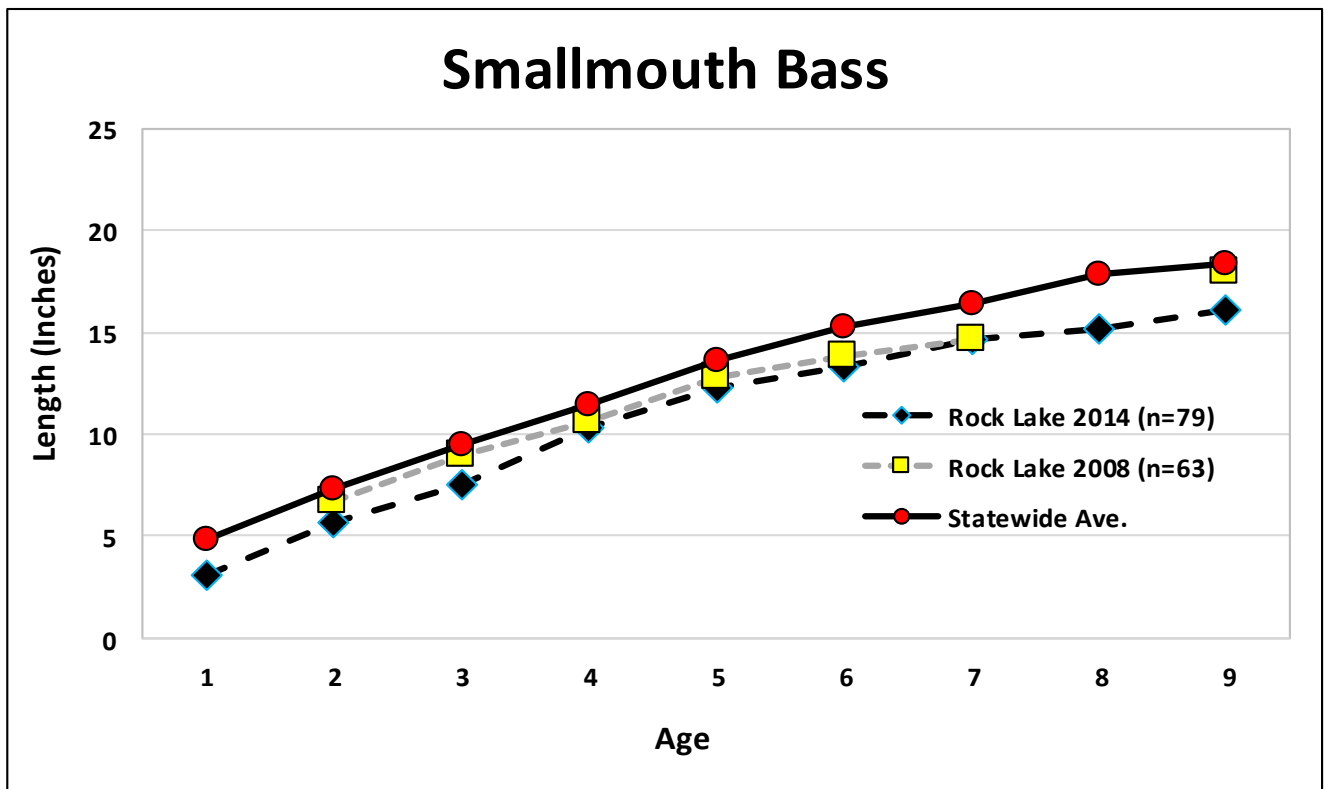


Figure 13. Smallmouth bass mean length at age determined using scales collected from Rock Lake in 2014 and 2008 compared to statewide mean and South Central Region (SCR) mean length at age data.



The size distribution of smallmouth bass sampled during SE2 indicates that 3% of the smallmouth bass sampled were greater than 14 inches (current legal harvestable size) compared to 2% in 2008 (Figure 11). The size distribution of smallmouth bass sampled during FE indicates that 16% of the smallmouth bass sampled were greater than 14 inches in length (legal harvestable size), compared to 17% in 2008 (Figure 12).

Growth rate of smallmouth bass in Rock Lake in 2014 was below the 2008 average and both survey years were below the statewide average for the species.

A balanced bass population typically displays PSD values between 40-60. Rock Lake smallmouth bass PSD values from fall electrofishing have historically been below 40 in five out of the last ten years and specifically within the target range of 40-60 for two of the last ten years, 2008 (57) and 2013 (49) (Figure 12). This indicates a population with recruitment of small fish into the population and a moderate amount of quality size bass (11-inch) present. PSD values from the 2014 survey were 58 in SN1, 48 in SE2 and 61 in fall electrofishing. Relative stock density of smallmouth bass greater than the preferred length of 14 inches (RSD-P) was 18 in 2014 compared to 23 in 2008.

The smallmouth bass population in Rock Lake is naturally reproducing and stocking has occurred once in 1990 when 3,100 fingerlings were stocked from a private hatchery source (Table 7).

### **Bluegill**

A total of 2,777 bluegill were sampled in SN1 for a catch rate of 31.2 per net night. The mean length was 4.5 inches and the maximum length was 8.8 inches. Catch rate for 2014 SE2 was lower than FE at 368 per hour (379 fish total, 189.5 per mile), with a mean length of 4.3 inches and maximum length of 8.7 inches. A total of 592 bluegill were sampled in 2014 FE for a catch rate of 528.6 per hour (296 per mile).

In 2008, 933 bluegill were sampled in SN1 for a catch rate of 5.3 per net night. The mean length was 5.7 inches and maximum length was 9.6 inches. Catch rate for 2008 SE2 was lower than fall

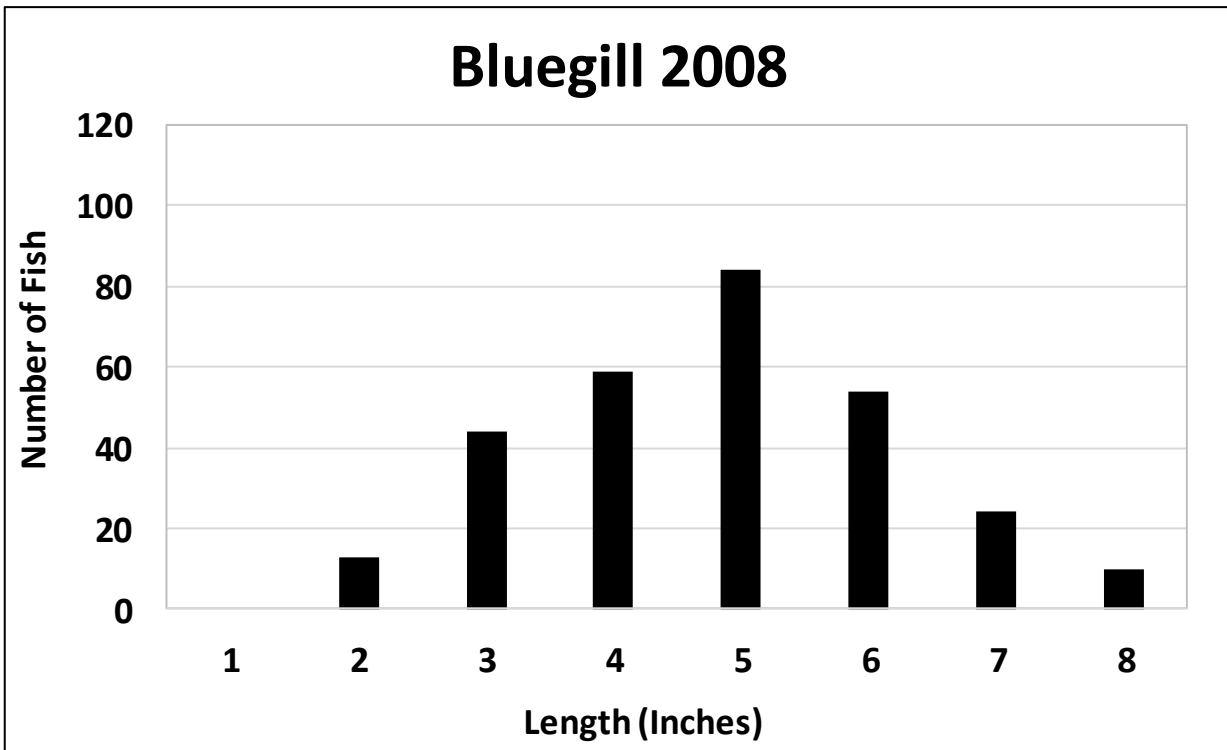
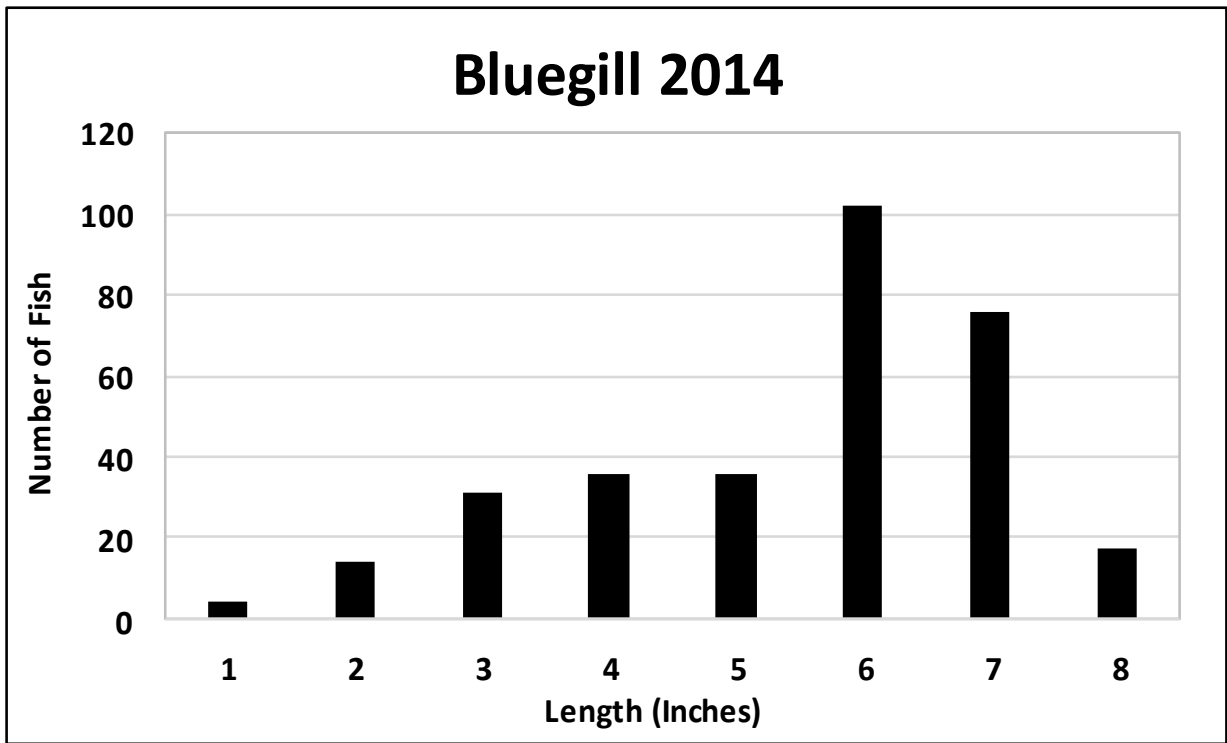


Figure 14. Length-frequency histogram indicating spring electrofishing (SE2) catch of bluegill in 2014 and 2008 at Rock Lake, Jefferson County.

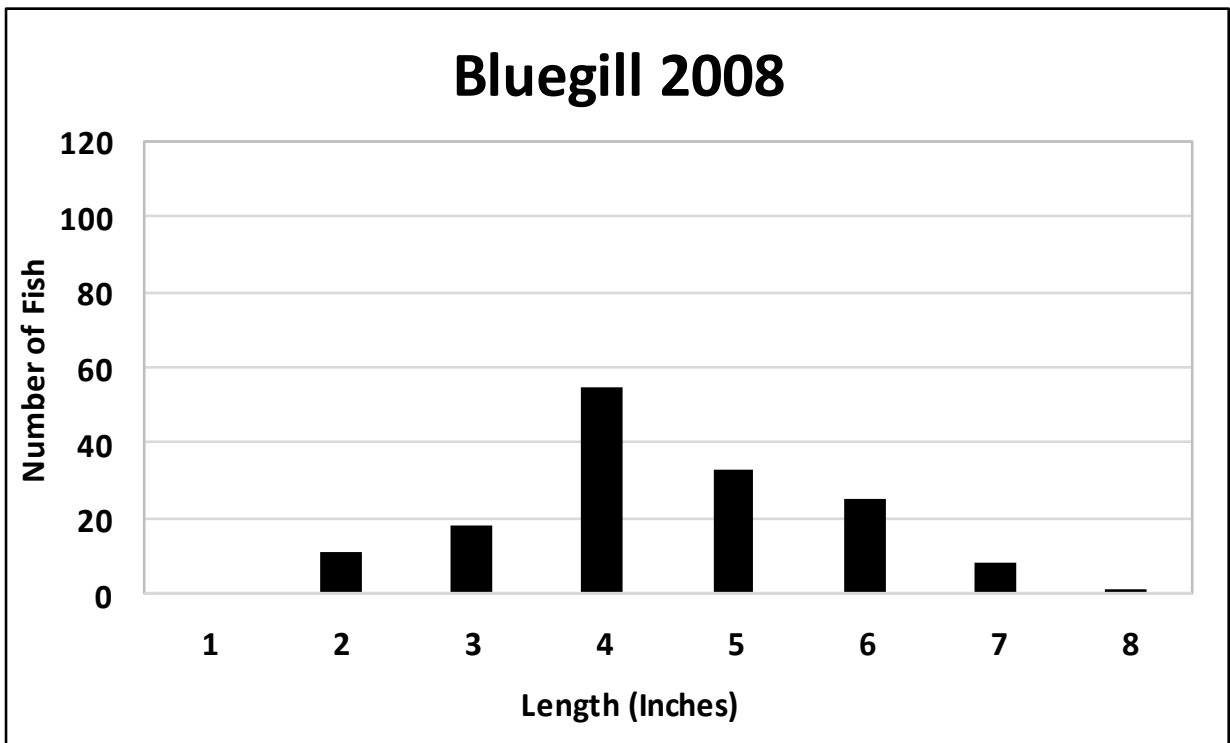
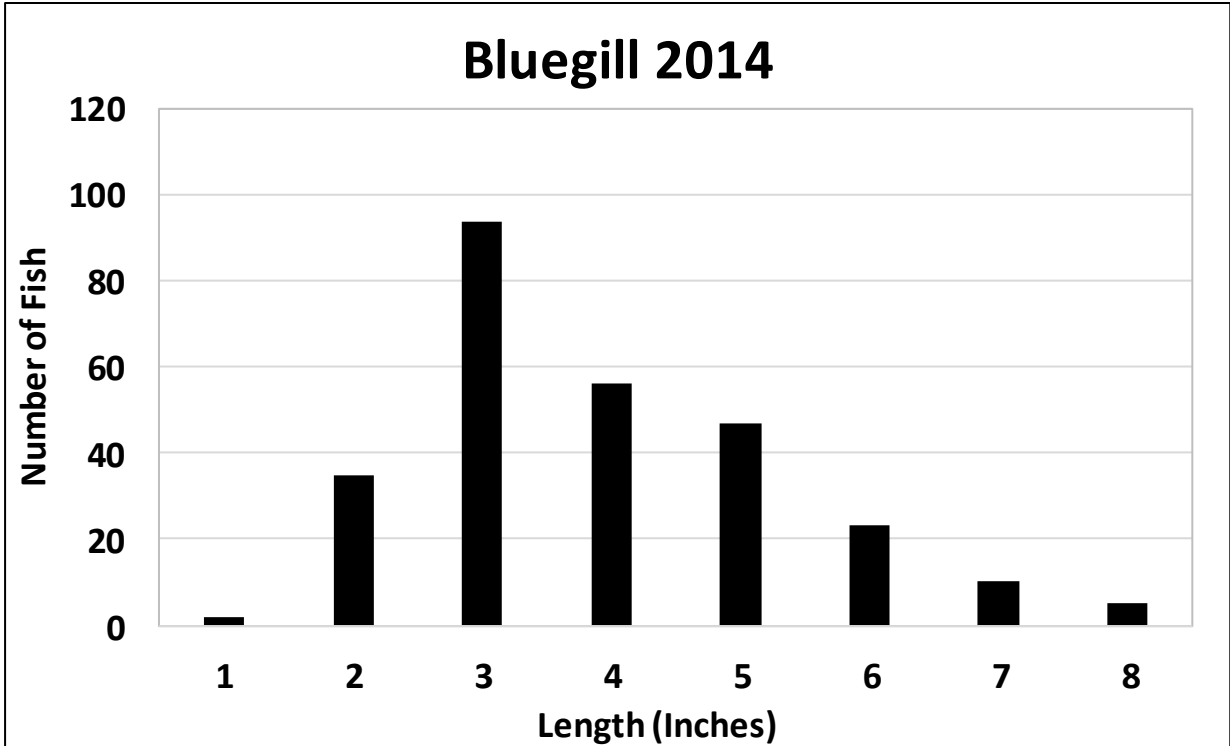


Figure 15. Length-frequency histogram indicating fall electrofishing (FE) catch of bluegill in 2014 and 2008 at Rock Lake, Jefferson County.

Table 3. Catch-per-unit-effort (CPUE), percent over stock length, proportional stock density (PSD) and relative stock density of preferred length (RSD-P) of bluegill during fall electrofishing in Rock Lake, Jefferson County.

Year	Total CPUE	% $\geq 6''$	PSD= $\frac{\# > 6''}{\# > 3''}$	RSD-P= $\frac{\# > 8''}{\# > 3''}$
2005	376/hr	25	26	2
2006	230/hr	34	51	8
2007	172/hr	34	35	3
2008	320/hr	31	32	4
2009	165/hr	40	46	4
2010	457/hr	33	36	2
2011	664/hr	6	7	0
2012	468/hr	16	18	0
2013	597/hr	18	21	2
2014	529/hr	62	65	6

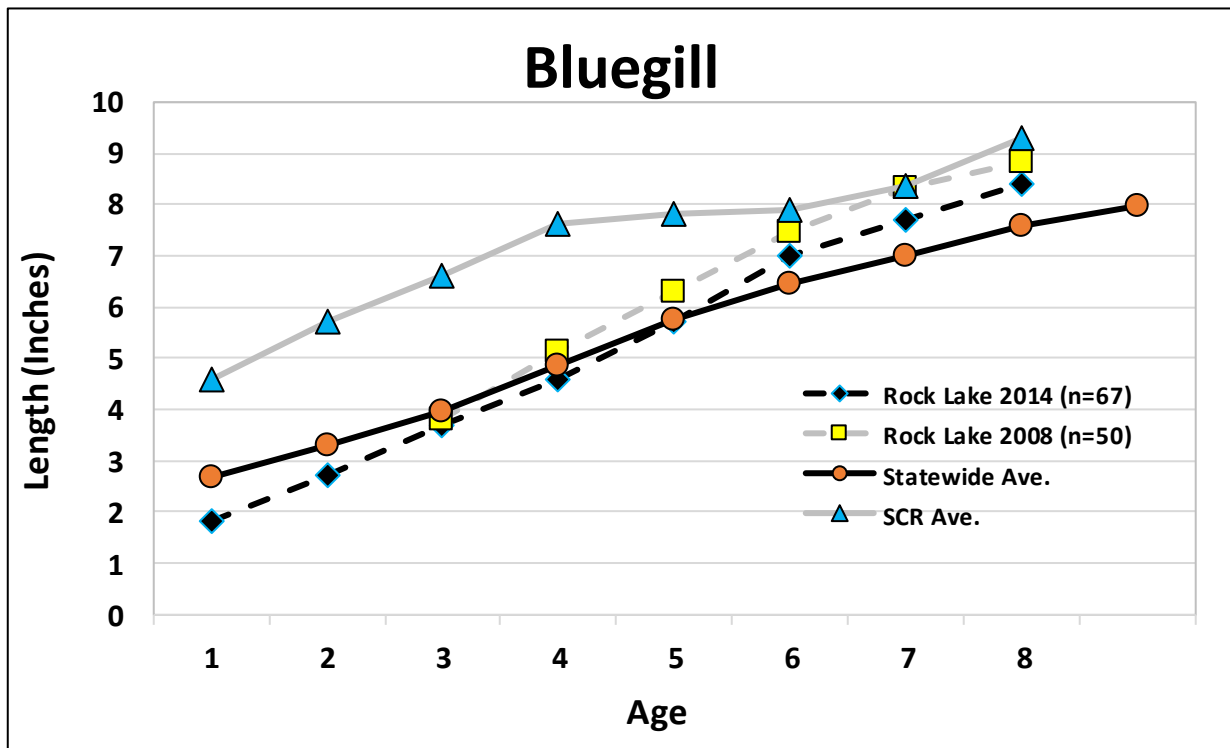


Figure 16. Bluegill mean length at age determined using scales collected from Rock Lake in 2014 and 2008 compared to statewide mean and South Central Region (SCR) mean length at age data.

electrofishing at 260 per hour (151 fish total, 150 per mile) with a mean length of 4.9 inches and maximum length of 8 inches. A total of 881 bluegill were sampled in 2008 FE for a catch rate of 320.4 per hour (179.8 per mile) with a mean length of 5.3 inches and maximum length of 8.9 inches. In 2014, 62% of the bluegill sampled during FE were greater than 6 inches in length, compared to 31% in 2008 (Figure 15).

The size distribution of bluegill sampled during SE2 indicates that 15% of the bluegill sampled were greater than 6 inches compared to 23% in 2008 (Figure 14). The size distribution of bluegill sampled during FE indicates that 62% of the bluegill sampled were greater than 6 inches in length.

Proportional stock density (PSD) of bluegill greater than 6 inches was 13 for SN1 (43 in 2008), 17 for SE2 (24 in 2008) and 65 for fall electrofishing (32 in 2008). Ideally a balanced bluegill population displays a PSD of quality-size fish (6 inches) of 40-60 and a RSD-P of preferred-size fish (8 inches) of a minimum of 5. Rock Lake bluegill PSD values from fall electrofishing have historically been below 40 in seven of the last ten years of fall electrofishing sampling. PSD values were above 40 and below 60 in only two of the last ten years, 2006 (51) and 2009 (46) (Table 3). The low PSD values indicate a lack of quality-size bluegill in Rock Lake. Relative stock density of bluegill greater than the preferred length of 8 inches (RSD-P) was 2 in SNI (9 in 2008), 2 in 2014 SE2 (1 in 2008) and 6 in FE (4 in 2008). The low RSD-P values indicate a lack of preferred-size bluegill in Rock Lake.

A balanced population is characterized by a proper ratio of predator (largemouth bass) and prey (bluegill). Both the predator and prey species in a balanced population would have satisfactory rates of recruitment, growth, and survival and intermediate length distributions. Recent PSDs from 2005-2014 for both species compared to a balanced population are shown in Figure 17.

The growth rate of bluegill in Rock Lake is below the statewide average for ages 1 to 4, equals the average at age 5 and is above the average at age 6 and up (Figure 16). Growth rate in 2014 was below the 2008 average and considerably below the South Central Region (SCR) average at all ages. Due to the relatively slow growth of young fish, the bluegill population may not be able to withstand high intensity of exploitation without significantly reducing the percentage of quality and preferred-size fish in the population, hence the low PSD and RSD-P. The bluegill (age 1

through 4) in Rock Lake may be food limited and, therefore, minimum length limit regulations would likely be unsuccessful in improving the number of quality-size bluegill. Imposition of a minimum length limit may further reduce growth rates among sublegal-size bluegill. Efforts should be made to evaluate alternative solutions to regulating exploitation.

### **Pumpkinseed**

A total of 418 pumpkinseed were sampled in SN1 for a catch rate of 4.7 per net night. The mean length was 5.7 inches and the maximum length was 8.1 inches. Catch rate for 2014 SE2 was lower than fall electrofishing at 26.2 per hour (27 fish total, 13.5 per mile), with a mean length of 5.6 inches and maximum length of 7.1 inches. A total of 48 pumpkinseed were sampled in 2014 FE for a catch rate of 42.9 per hour (24 per mile).

In 2008, 116 pumpkinseed were sampled in SN1 for a catch rate of 0.7 per net night. The mean length was 5.7 inches and maximum length was 8 inches. No pumpkinseed were sampled in 2008 SE2 sampling. A total of 13 pumpkinseed were sampled in 2008 FE for a catch rate of 4.7 per hour (2.7 per mile) with a mean length of 5.3 inches and maximum length of 7.3 inches.

The growth rate of pumpkinseed in Rock Lake is below the statewide average for ages 1 to 3, equals the average at age 4 and is above the average at age 6 and up (Figure 18). Growth rate in 2014 was below the 2008 average. Growth rate of pumpkinseed is similar to bluegill in Rock Lake, with younger fish appearing to be food limited. Except for pumpkinseed less than 2.8 inches, pumpkinseeds of all sizes consume more gastropods (snails and mollusks) than other sunfish species (Sadzikowski and Wallace, 1976) due to their pharyngeal, molarlike teeth used for grinding shells. This may help to minimize competition for food with other cohabitating sunfish (Becker, 1983). This is interesting given the invasive zebra mussel population that was first detected in Rock Lake in 2005.

### **Yellow Perch**

A total of 30 yellow perch were sampled in SN1 for a catch rate of 0.34 per net night. The mean length was 6.4 inches and the maximum length was 9.8 inches. Catch rate for 2014 SE2 was lower than fall electrofishing at 13.6 per hour (14 fish total, 7 per mile), with a mean length of 5.2

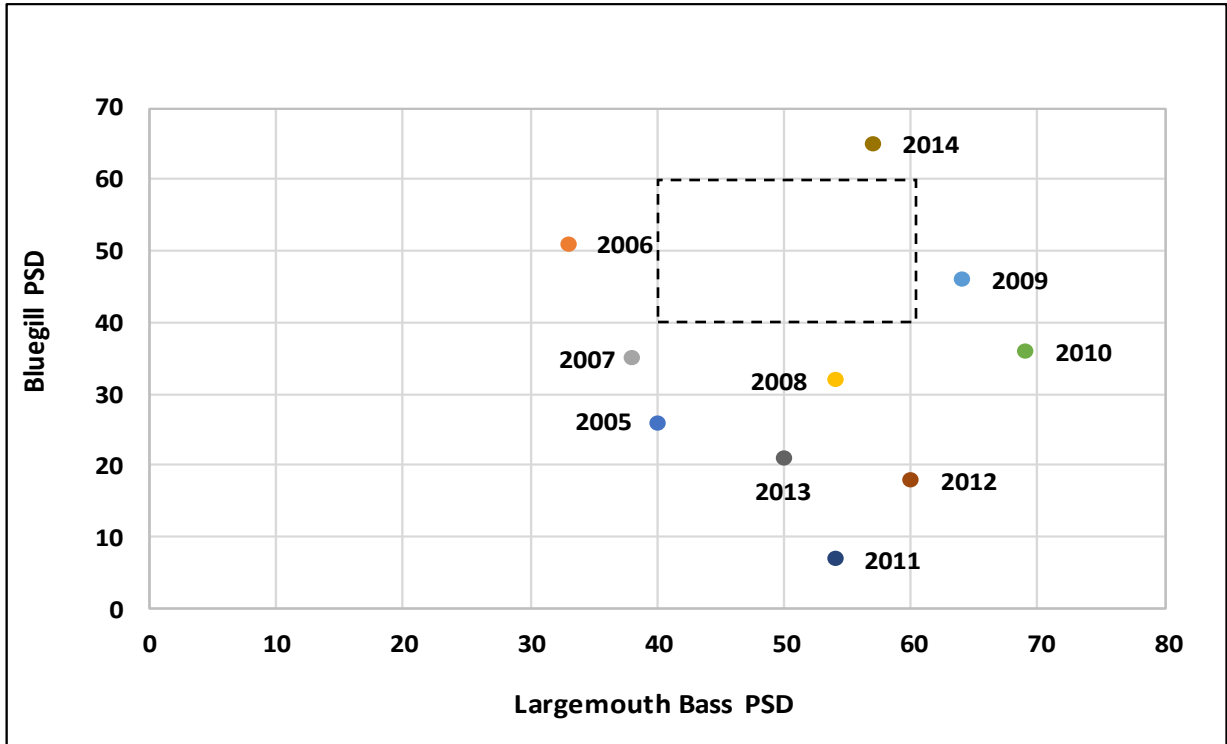


Figure 17. Plot of proportional size density (PSD) of largemouth bass and bluegill collected in Rock Lake fall electrofishing (FE) catch in 2005-2014. The rectangle formed by the dashed line represents where the PSDs should fall in a balanced predator/prey population.

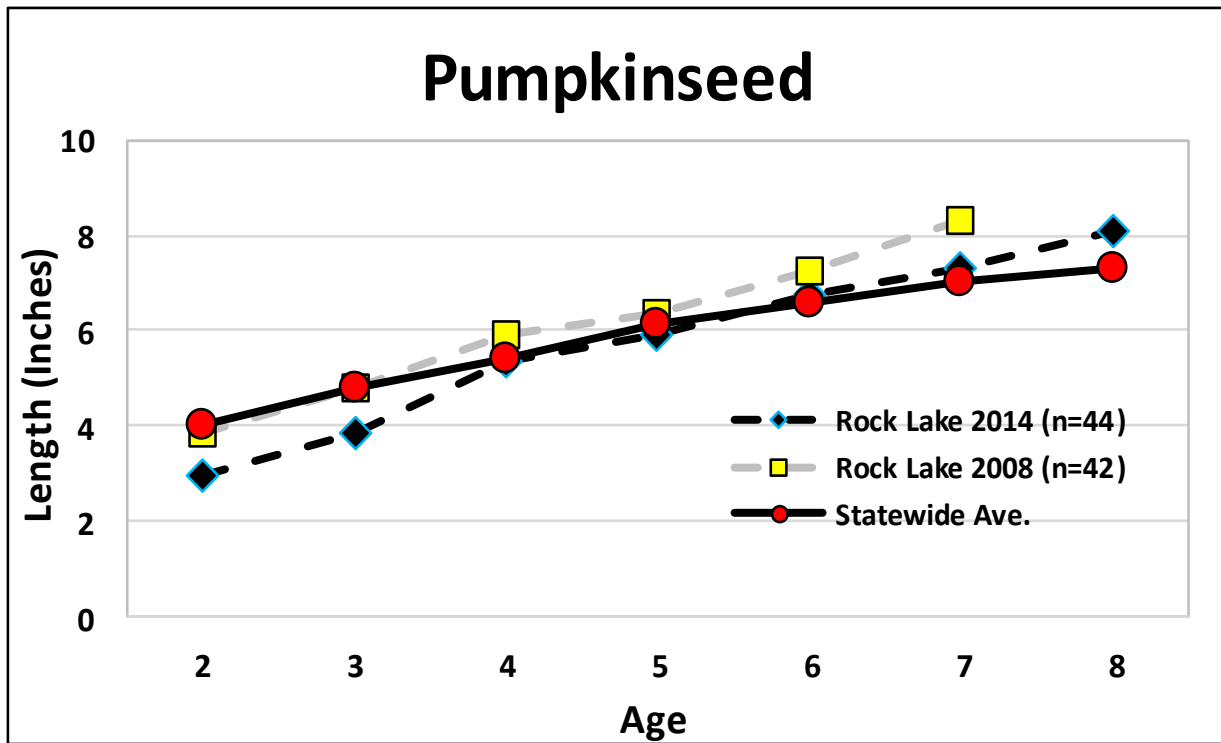


Figure 18. Pumpkinseed mean length at age determined using scales collected from Rock Lake in 2014 and 2008 compared to statewide mean length at age data.

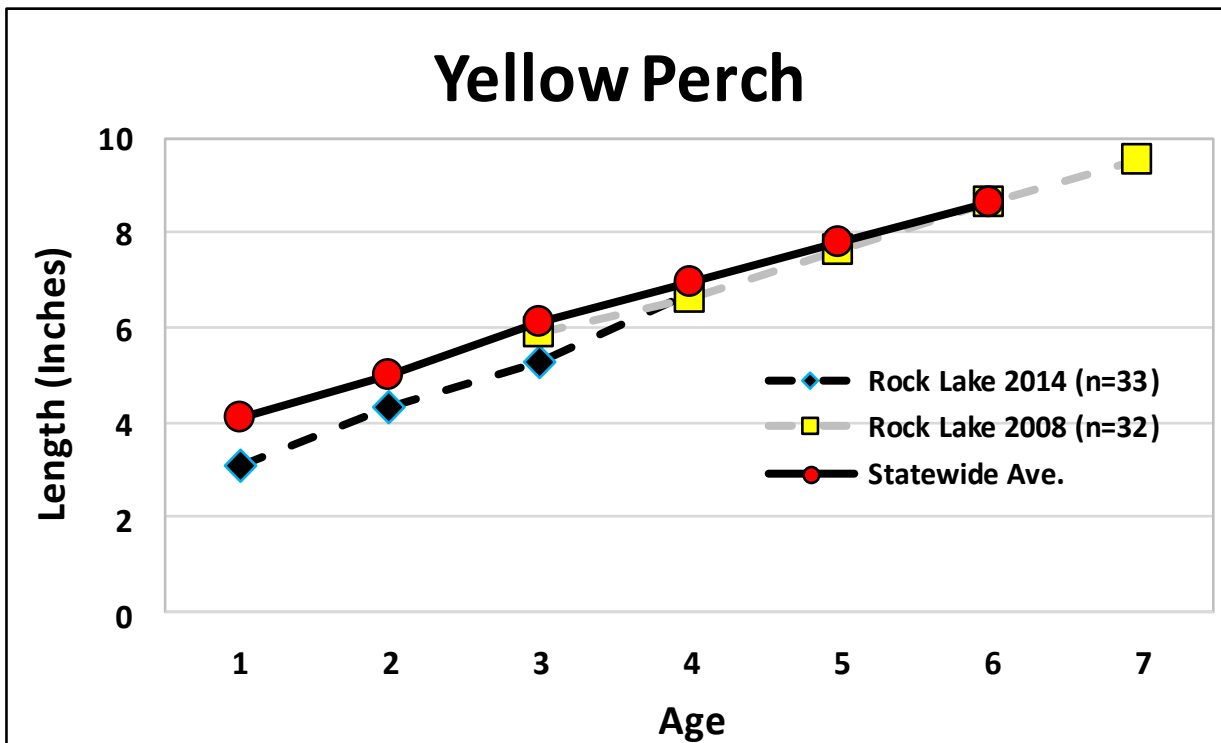


Figure 19. Yellow perch mean length at age determined using scales collected from Rock Lake in 2014 and 2008 compared to statewide mean length at age data.



inches and maximum length of 6.7 inches. A total of 78 yellow perch were sampled in 2014 FE for a catch rate of 70 per hour (39 per mile).

In 2008, 17 yellow perch were sampled in SN1 for a catch rate of 0.1 per net night. The mean length was 7.6 inches and maximum length was 8.8 inches. Catch rate for 2008 SE2 was lower than fall electrofishing at 58.6 per hour (17 fish total, 16.8/mile) with a mean length of 5.1 inches and maximum length of 8.6 inches. A total of 116 yellow perch were sampled in 2008 FE for a catch rate of 42 per hour (23.7 per mile) with a mean length of 4.5-inches and maximum length of 8.6-inches.

While sample size of aged fish was low in both survey years (n=33 in 2014 and n=32 in 2008), the growth rate of yellow perch in Rock Lake in 2014 was below the statewide average for ages 1 to 4 and equal to the average at age 5 and up (Figure 19).

Rock Lake supports a low-density yellow perch population. The yellow perch population in Rock Lake is naturally reproducing and stocking has only occurred twice, in 1996 (183 fish) and 1993 (1495 fish) with fish from the Lake Mills State Fish Hatchery (Table 8).

### **Rock Bass**

A total of 421 rock bass were sampled in SN1 for a catch rate of 4.7 per net night. The mean length was 6.9 inches and the maximum length was 10.8 inches. Catch rate for 2014 SE2 was lower than fall electrofishing at 24.3 per hour (25 fish total, 12.5 per mile), with a mean length of 6.8 inches and maximum length of 9.9 inches. A total of 36 rock bass were sampled in 2014 FE for a catch rate of 32 per hour (18 per mile).

In 2008, 408 rock bass were sampled in SN1 for a catch rate of 2.3 per net night. The mean length was 7.5 inches and maximum length was 10.9 inches. Catch rate for 2008 SE2 was lower than fall electrofishing at 43 per hour (25 fish total, 24.8 per mile) with a mean length of 6.6 inches and maximum length of 8.6 inches. A total of 137 rock bass were sampled in 2008 FE for a catch rate

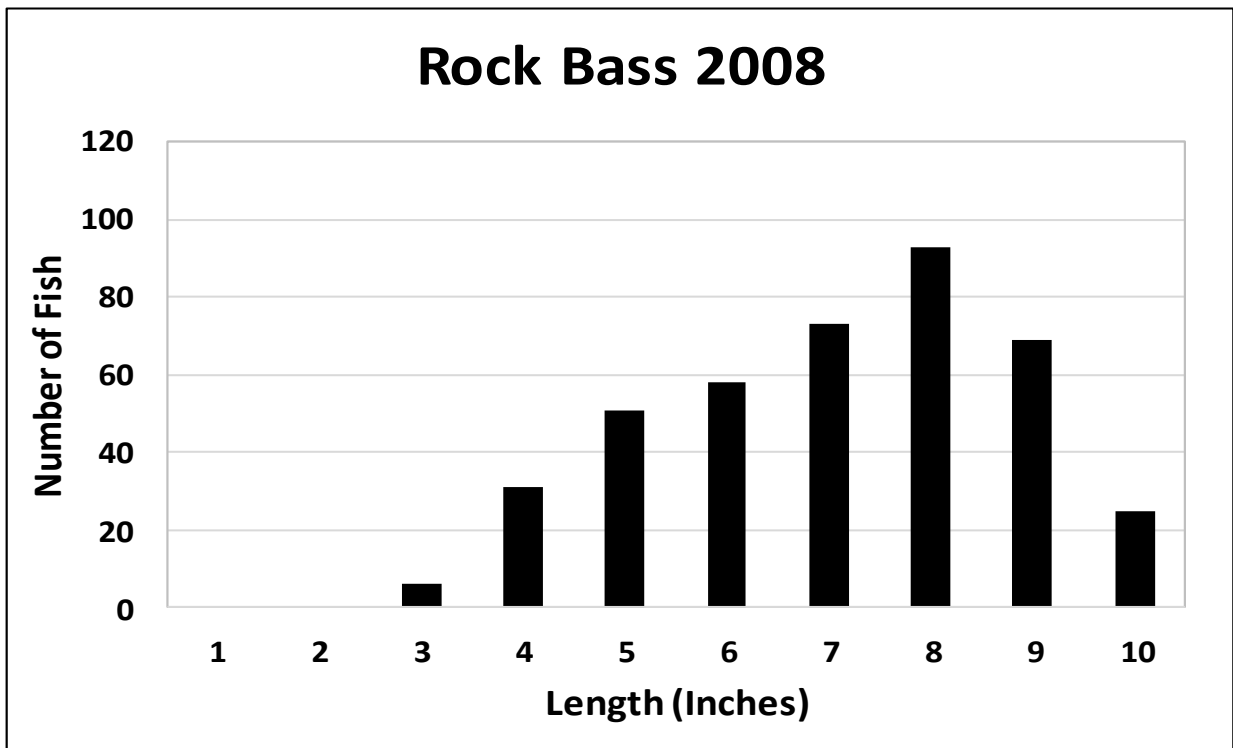
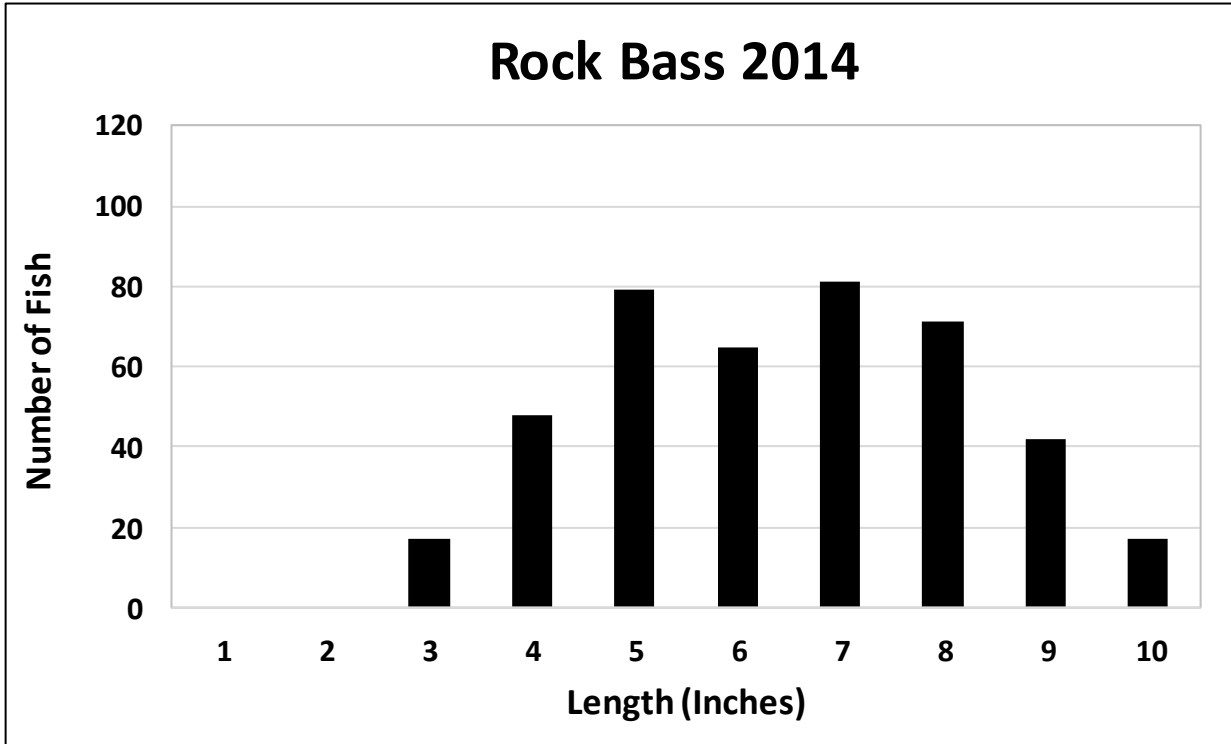


Figure 20. Length-frequency histogram indicating spring fyke net (SN1) catch of rock bass in 2014 and 2008 at Rock Lake, Jefferson County.

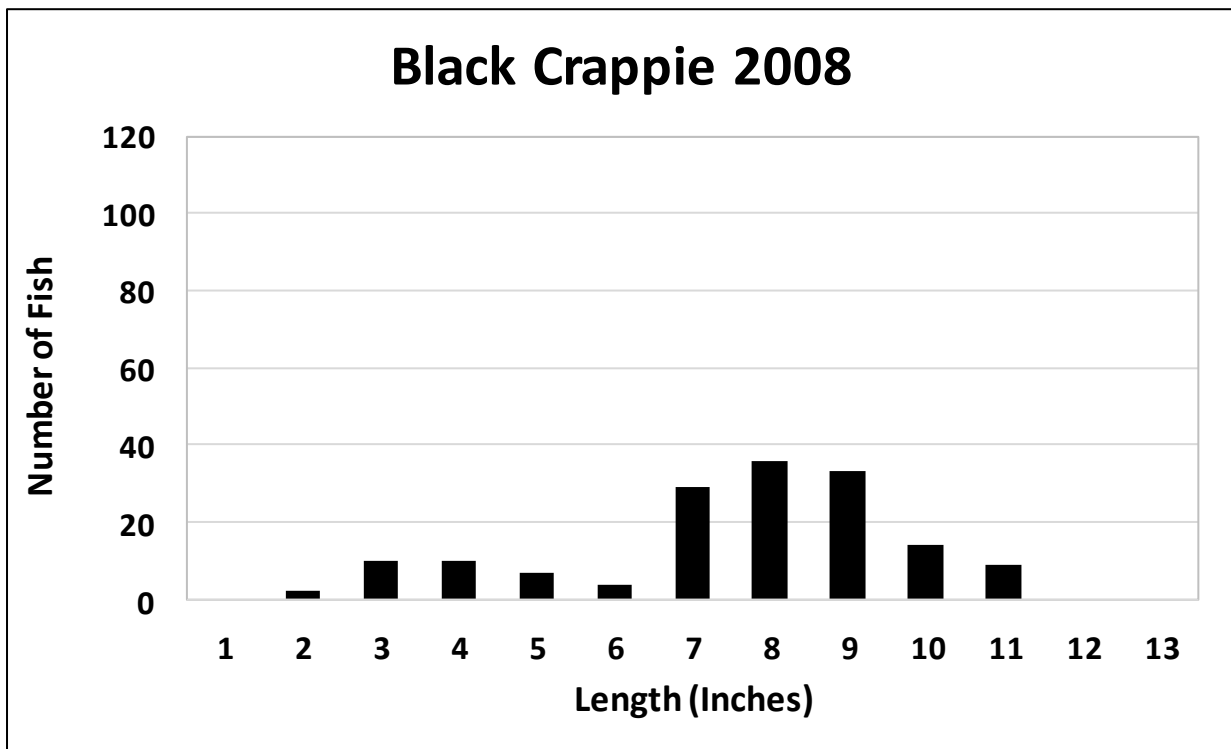
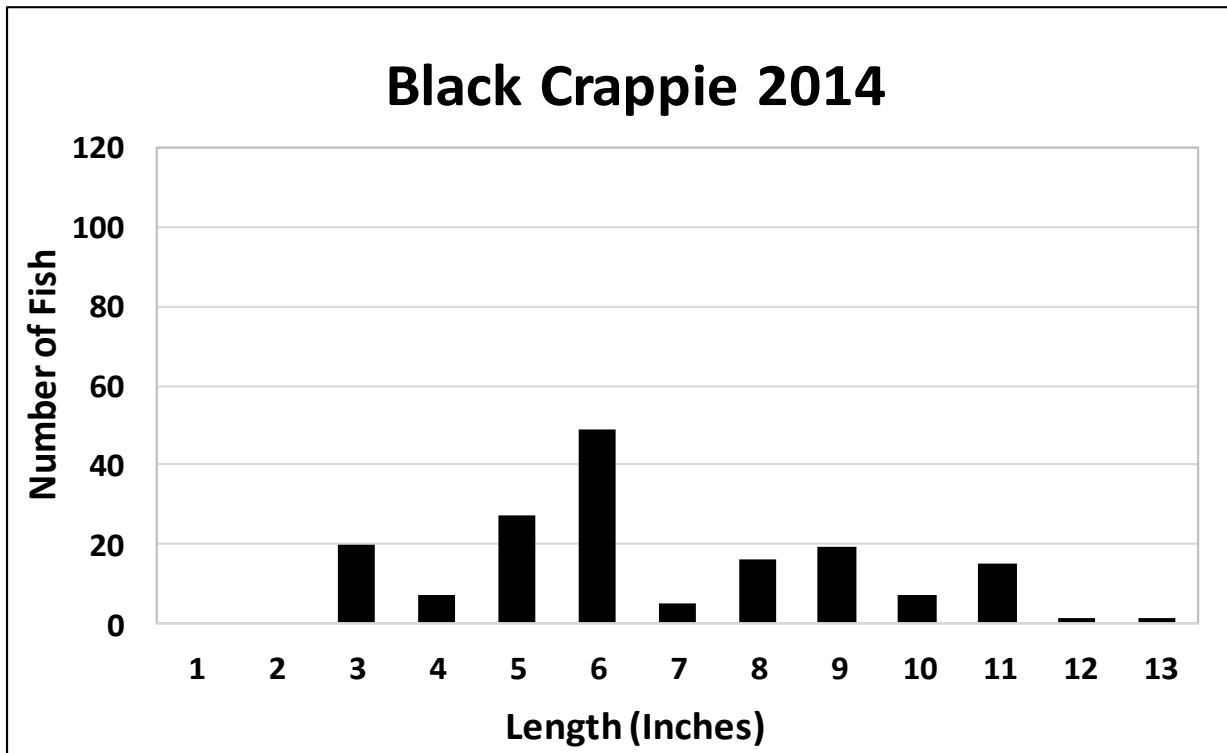


Figure 21. Length-frequency histogram indicating spring fyke net (SN1) catch of black crappie in 2014 and 2008 at Rock Lake, Jefferson County.

of 50 per hour (27.9 per mile) with a mean length of 6.7 inches and maximum length of 10.8 inches.

Rock Lake supports a robust rock bass population with fish up to 10.8 inches present (Figure 20). Past necropsy results from Viral Hemorrhagic Septicemia (VHS) monitoring indicate that the rock bass population in Rock Lake relies heavily on crayfish as a food source.

### **Black Crappie**

A total of 175 black crappie were sampled in SN1 for a catch rate of 2 per net night. The mean length was 7.1 inches and the maximum length was 13 inches. No black crappie were sampled in 2014 SE2 sampling. One black crappie was sampled in 2014 FE for a catch rate of 0.89 per hour (0.5 per mile).

In 2008, 145 black crappie were sampled in SN1 for a catch rate of 0.8 per net night. The mean length was 7.9 inches and maximum length was 11.8 inches. No black crappie were sampled in 2008 SE2 sampling. A total of 11 black crappie were sampled in 2008 FE for a catch rate of 4 per hour (2.2 per mile) with a mean length of 6.7 inches and maximum length of 10 inches (Figure 21).

### **Non-Game Species**

While the 2014 comprehensive fishery survey did not target non-game fish species, their presence was noted throughout the survey. Most notably, 11 lake chubsuckers (Special Concern), 1 pugnose shiner (Threatened) and 2 blackchin shiners were sampled during 2014 fall electrofishing. Bowfin, golden shiner, yellow bullhead, black bullhead, brown bullhead, white sucker, central mudminnow and brook silverside were also sampled during 2014 fall electrofishing. Rock Lake also supports a healthy population of mud puppies.

Common carp were present in the 2014 comprehensive fishery survey, but in small numbers (2 fish in SN1, 12 in SE2 and 0 in FE). Predation of common carp eggs by the abundant panfish

population helps keep the carp population in check. The lake's abundant submerged vegetation also indicates that the common carp population is not impacting water quality.

## **SUMMARY AND MANAGEMENT RECOMMENDATIONS**

1. The northern pike population in Rock Lake is self-sustained by natural reproduction and does not require supplemental stocking. Both male and female northern pike exhibit moderate growth rates, with females falling below the statewide and South Central Region average beginning at age 5. Northern pike growth rate for males in 2014 was below that of 2008. Female growth rate in 2014 was similar to 2008 but diverged from the 2008 average beginning at age 5. Effort should be directed at validating northern pike age estimates using progressive ageing methods such as anal fin rays to determine if the decline in growth rate is an error in ageing or an indication of reduced growth rate between sample years. Adult northern pike densities are estimated to be 2.6 fish per acre, consistent with a low-density northern pike fishery. The 26-inch minimum length appears to be sufficient in protecting enough males and females to facilitate natural reproduction. If northern pike growth rates are found to be declining, a more progressive regulation such as a slot limit should be considered. While Rock Lake produced northern pike over 40 inches, historically the lake has not had the sufficient growth rate needed to support a trophy northern pike fishery.
2. The largemouth bass population in Rock Lake is self-sustained by natural reproduction and does not require supplemental stocking. In 2008, largemouth bass growth rate was consistent with the statewide average but was below the South Central Region average. However, sample size in 2008 was small (n=55 fish). While sample size increased in 2014 (n=88), growth rate declined to below both Statewide and South Central Region averages. Additional effort should be directed at validating largemouth bass age estimates using progressive ageing methods to determine if the decline in growth rate is an artifact of small sample size, an error in ageing between survey years or an indication of truly reduced growth rate.

Overall, largemouth bass PSD values indicate a balanced population with recruitment of small fish into the population and a desirable amount of quality size bass (12-inch) present. However, PSD should continue to be monitored in comparison to bluegill PSD to ensure that largemouth bass population stocks do not become depleted resulting in low recruitment to stock size (8 inches) and the bluegill population does not trend towards sub-optimal PSD ranges. Changes in growth rate should continue to be monitored and if slow growth is documented, regulation options other than the current 14-inch minimum length, 5 fish daily bag limit should be explored. A slow growing population may not meet its potential under minimum length regulations as it may further reduce growth rates among sublegal-size largemouth bass.

3. Recent bluegill PSD values from fall electrofishing are lower than those established for balanced populations. A balanced bluegill population typically displays PSD values between 40-60. Rock Lake bluegill PSD values from fall electrofishing have historically been below 40 in seven of the last ten years of fall electrofishing sampling. PSD values were above 40 and below 60 in only two of the last ten years, 2006 (51) and 2009 (46) (Table 3). Relative stock density of bluegill greater than the preferred length of 8 inches (RSD-P) indicate that very few fish in the 2014 comprehensive survey were over 8 inches in length. RSD-P of bluegill greater than 8-inches was 2 in SNI (9 in 2008), 2 in 2014 SE2 (1 in 2008) and 6 in FE (4 in 2008). The low PSD and RSD-P values indicate a lack of quality-size and preferred-size bluegill in Rock Lake. PSD should continue to be monitored in comparison to largemouth bass PSD to ensure that the bluegill population does not trend towards lower PSD values.

Bluegill growth rates in Rock Lake are below the statewide and South Central Region averages. Effort should be directed at validating bluegill age estimates using progressive ageing methods such as otoliths to determine if growth rate is truly slow. Due to the relatively slow growth, the bluegill population may not be able to withstand high intensity of exploitation without significantly reducing the percentage of quality-size fish in the population, hence the low PSD. The bluegill (age 1 through 4) in Rock Lake may be food limited and, therefore, minimum length limit regulations would probably not improve size

structure. Rather imposition of a minimum-length limit would probably further reduce growth rates among sublegal bluegill. Efforts should be made to evaluate alternative solutions to regulating exploitation.

More information is needed to determine if the bluegill population size structure is indicative of the environmental conditions of the lake or the result of overharvest. A creel survey would help document exploitation, harvest and angler use. In addition, further study of the interaction between zebra mussel populations and food availability to small panfish is also warranted.

5. Rock Lake currently supports a low-density walleye population. Walleye were the dominant predator species in Rock Lake in the 1970's. At that time the walleye population was naturally reproducing and was thought to produce strong year classes each year (WDNR, 1977). Management of the population consisted of stocking small fingerlings at 50 per acre in June of alternate years. Annual fall electrofishing surveys did not indicate stronger year classes being established from stocking. However, both young-of-year (YOY) and adults were abundant at that time. By 1985 the walleye population was reproducing each year but producing modest year classes (WDNR<sub>1</sub>, 1985). Both YOY and adults were present in decent numbers. Population size using the Schumacher-Eschmeyer formula was estimated to be 2 fish per acre in 1980. By 1992 very few (7) adult walleye were present in fall electrofishing and no YOY walleye were sampled, despite stocking 250,000 fry that year (WDNR<sub>2</sub>, 1992). Population size using the Schumacher-Eschmeyer formula was estimated to be 0.7 fish per acre in 1994.

The Rock Lake walleye population is currently not meeting the established management goal for a stocked walleye fishery of 2 adults per acre. Population estimates conducted in 2014 and 2008 indicate a population size of 0.2 per acre and .06 per acre respectively. Consideration should be given to the costs associated with continued stocking of walleye in Rock Lake. Despite multiple stocking events over many years, Rock Lake may not achieve a management goal of 1 to 2 adult walleye per acre.

## ACKNOWLEDGMENTS

The field work, data collection, scale and spine ageing and data entry required for this survey was conducted by WDNR Fisheries Technicians Mark Baldock and Derek LaVigne.

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Table 4. Northern pike stocking events conducted in Rock Lake indicating year, age class, number stocked, average length and source hatchery (SFH = State Fish Hatchery).

Year	Age Class	Number Stocked	Ave. Length (Inches)	Source Hatchery
1991	FRY	1495	.6	LAKE MILLS SFH
1998	FRY	15000	.5	LAKE MILLS SFH
1999	FRY	100000	.4	LAKE MILLS SFH

Table 5. Walleye stocking events conducted in Rock Lake indicating year, age class, number stocked, average length and source hatchery (SFH = State Fish Hatchery).

Year	Age Class	Number Stocked	Ave. Length (Inches)	Source Hatchery
1974	FINGERLING	105000	3	-
1976	FINGERLING	137280	3	-
1977	FRY	3000000	-	-
1981	FINGERLING	4000	1	-
1982	FINGERLING	6440	1	-
1986	FRY	60000	1	-
1988	FRY	125000	1	-
1989	FINGERLING	7800	3	LAKE MILLS SFH
1989	FINGERLING	5061	3	-
1991	YEARLING	114	7	-
1991	FINGERLING	50032	3	-
1992	FRY	240100	0.4	LAKE MILLS SFH
1993	FINGERLING	231	6	LAKE MILLS SFH
1994	FINGERLING	76200	2	-
1995	FRY	176000	0.5	LAKE MILLS SFH
1996	FRY	100000	0.5	LAKE MILLS SFH
1996	FINGERLING	1757	3.7	LAKE MILLS SFH
1996	FINGERLING	1155	5.6	-
1997	LARGE FINGERLING	29588	1.6	WEST CENTRAL REGION PONDS
1997	SMALL FINGERLING	59176	1.6	WEST CENTRAL REGION PONDS
1998	SMALL FINGERLING	11340	2.33	LAKE MILLS SFH
1999	FRY	87400	0.4	LAKE MILLS SFH
1999	SMALL FINGERLING	122351	1.37	LAKE MILLS SFH
2000	FRY	372000	0.5	LAKE MILLS SFH
2000	SMALL FINGERLING	33217	2.23	LAKE MILLS SFH
2001	LARGE FINGERLING	11463	6.4	GOV THOMPSON SFH AND PONDS

2001	SMALL FINGERLING	2386	3	LAKE MILLS SFH
2002	SMALL FINGERLING	207	2.5	LAKE MILLS SFH
2002	SMALL FINGERLING	60343	1.4	GOV THOMPSON SFH AND PONDS
2003	SMALL FINGERLING	36630	2.2	SOUTH CENTRAL REGION PONDS
2003	SMALL FINGERLING	33732	1.5	LAKE MILLS SFH
2004	FRY	250000	0.5	LAKE MILLS SFH
2004	FRY	270000	0.5	LAKE MILLS SFH
2004	SMALL FINGERLING	32457	1.3	WEST CENTRAL REGION PONDS
2005	FRY	499200	0.5	LAKE MILLS SFH
2006	FRY	184100	0.5	LAKE MILLS SFH
2006	FRY	67500	0.5	LAKE MILLS SFH
2007	FRY	10000	0.2	LAKE MILLS SFH
2009	SMALL FINGERLING	68550	1.33	LAKE MILLS SFH
2011	SMALL FINGERLING	68550	1.39	LAKE MILLS SFH
2013	SMALL FINGERLING	57706	1.48	LAKE MILLS SFH

Table 6. Largemouth bass stocking events conducted in Rock Lake indicating year, age class, number stocked, average length and source hatchery (SFH = State Fish Hatchery).

Year	Age Class	Number Stocked	Ave. Length (Inches)	Source Hatchery
1981	FINGERLING	600	4	PRIVATE HATCHERY
1984	FINGERLING	1260	4	DNR COOP PONDS
1987	FRY	1170	5	LAKE MILLS SFH

Table 7. Smallmouth bass stocking events conducted in Rock Lake indicating year, age class, number stocked, average length and source hatchery (SFH = State Fish Hatchery).

Year	Age Class	Number Stocked	Ave. Length (Inches)	Source Hatchery
1990	FINGERLING	3100	3	PRIVATE HATCHERY

Table 8. Yellow perch stocking events conducted in Rock Lake indicating year, age class, number stocked, average length and source hatchery (SFH = State Fish Hatchery).

Year	Age Class	Number Stocked	Ave. Length (Inches)	Source Hatchery
1993	FINGERLING	1495	3	LAKE MILLS SFH
1996	FINGERLING	183	5.5	LAKE MILLS SFH

