Comprehensive Fishery Survey of Devils Lake
Sauk County, Wisconsin 2013

Waterbody Identification Code: 980900

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EXECUTIVE SUMMARY

A comprehensive fishery survey was conducted on Devils Lake during the spring of 2013, including early fyke netting for northern pike and walleyes (SNI), early electrofishing to recapture marked walleyes (SEI), and late spring electrofishing for bass and panfish (SEII). Largemouth bass was the most abundant of all non-trout sport fish species collected (panfish or gamefish) from Devils Lake, and largemouth bass are relatively abundant compared to other lakes in Wisconsin. Size structure and growth are poor. The SEII catch rate of largemouth bass ≥ 8 inches was 55.8 fish/mile, and the catch rate of fish ≥ 12 inches was 32.2 fish/mile. Largemouth bass PSD and RSD-P values were 62 and 1 based on the SEII catch. The average age of a 14.0-14.9 inch largemouth bass (MAL14) is 9.3 years in Devils Lake, ranking last in a comparison of 8 lakes (9 total surveys) in Columbia and Sauk counties surveyed between 2006 and 2013. Largemouth bass growth has declined since surveys in 1993 and 2001, which found similar values for mean length at age. Largemouth bass were in average to poor condition; relative weights averaged 83.0 and 18% of largemouth bass had relative weight values below 75.

Northern pike was the second most abundant sport fish species collected in the survey. Growth and condition of northern pike are very good. Northern pike reach the minimum harvest size of 32 inches as early as age 4, and average over 32 inches by age 7. Size structure has improved in Devils Lake since the 2002 survey based on several stock density indices. The only category which did not show improvement was RSD-40 which declined from 2 to 1. Based on the multiple census Schnabel method, the adult northern pike population declined from 1.3 adults/acre in 2002, to 0.5 adults/acre in 2013. This is a decrease of 62%. The Schnabel method may underestimate northern pike population size (Pierce 1997). However, if there truly has been a decline in northern pike abundance, spawning habitat may be a limiting factor.

Yellow perch in Devils Lake provide a low density, high quality fishery for anglers; PSD, RSD-P, and RSD-M values for the 2013 survey were 63, 37, and 10, respectively. Yellow perch grow relatively slowly but are long lived, averaging 8.5 inches by age 5, and 10.0 inches by age 8. The average age of females in the survey was 5.8 years, and males averaged 7.5 years.

Smallmouth bass are abundant in Devils Lake relative to other lakes in Wisconsin. Smallmouth bass size structure is poor, with only one individual larger than 14.0 inches collected. This is due to poor growth; smallmouth bass grow slower compared to other Wisconsin lakes on both a region and statewide scale, and the disparity increases with age. This indicates that larger smallmouth bass are not finding large enough prey to sustain body growth at a level comparable to other lakes. However, body condition was better for smallmouth bass than for largemouth bass.

Walleyes are present in Devils Lake, but at most only two year classes currently exist in the lake. Fish from the 2009 stocking of large fingerlings were age 4 fish at the time of the survey and represent 82% of the walleyes collected. The other age class was age 5, which composed the remaining 18% of the catch. The age 5 fish represent the only year class present in 2013 that would have come from a small fingerling stocking. The population estimate (PE) was 0.2 adults ≥ 15 inches per acre. Walleyes ranged in size from 16.3 to 20.6 inches, averaging 17.9 inches.

Rock bass provide a good supplementary panfish opportunity for anglers, averaging 8.2 inches with fish as large as 10.3 inches present in the survey. Bluegills and black crappies are present but very few individuals were collected in the survey. Survey methods traditionally used by WDNR to sample panfish have not been effective when used in Devils Lake both in 2013 and in

past surveys, primarily due to a relative lack of shallow littoral habitat where fyke nets and electrofishing boats are most effective.

Lake & location
Devils Lake, Sauk County
T11N, R6E Sections 13, 23-25

Physical/chemical attributes
Morphometry: 374 acres, maximum depth of 47.0 feet, average depth of 30.4 feet (Lillie and Mason 1986, Wisconsin Register of Waterbodies 2015). Area < 3 feet depth: 3%, area > 20 feet depth: 77% (Lillie and Mason 1986).
Watershed: 4.34 square miles with 2.65 square miles draining into the lake and the remainder (northeastern sub-basin) diverted to the Baraboo River (Lillie and Mason 1986).
Lake type: Drainage, seepage; one inlet (Messenger Creek) and no natural outlet. Hypolimnetic water is pumped out of the lake to the Baraboo River.
Water Clarity: Clear
Littoral substrate: 50% sand, 30% gravel, 20% muck
Trophic status: Mesotrophic
Aquatic vegetation: 2007 WDNR survey indicated 13 aquatic plant species present in the lake, with Robbins pondweed, common waterweed, and coontail the most prevalent species in terms of relative frequency. Eurasian watermilfoil was found at only one of 248 sample sites. Robbins pondweed has been the dominant species consistently since 1974.
Winterkill: Infrequent
Boat Landings: Three access points: Paved access ramp located on the southwest shore of the lake with parking for 6-10 vehicle-trailer units and 11-15 vehicle stalls, carry-in canoe landing (unpaved) also on the southwest side of the lake with 1-5 vehicle stalls, and one paved ramp on north end of the lake with parking for 11-15 vehicles. All boat access locations are within Devils Lake State Park and are managed by the DNR.
Other Features: Devils Lake has no natural outlet but hypolimnetic water has been pumped out of the lake and into the Baraboo River since 2002 in an attempt to reduce phosphorous levels in the lake. Use of gasoline engines is prohibited on Devils Lake. Hook and line fishing season dates, minimum harvest lengths, and bag limits can be found in Table 1.

Purpose of survey
Baseline lake survey Tier 1 assessment.

Dates of fieldwork
Fyke netting survey conducted April 16 through April 29, 2013 (SNI).
Electrofishing surveys conducted April 29, 2013 (SEI), and May 23, 2013 (SEII).

Fishery
Largemouth bass are abundant. Northern pike, smallmouth bass, and rock bass are common. Yellow perch, bluegills, and black crappies are present. Brown trout are stocked to provide a two-story fishery.

BACKGROUND

Devils Lake is a 374 acre seepage lake that also receives surface water inputs from a small stream (officially unnamed, unofficially known as Messenger Creek, WBIC 1632311) that drains a small forested watershed and enters the lake on the southwest shore. Devils Lake has no surface outlet, and much of the surrounding watershed is impervious rock, so surface runoff inputs during storms and snowmelt events are very flashy. Historically the lake level fluctuated 2.64 feet annually on average, and a range of fluctuation as high as 11 feet has been observed (1965 minimum, 1973 maximum) since record keeping began (House 1985). The lake was formerly part of the Wisconsin River, and was formed during the last ice age when glaciers deposited terminal moraines at the north and south ends of the lake. The Wisconsin River formed a new channel to the east, and the lake was left behind. The lake has steep rocky bluffs rising along the east, west, and south shores, and there are public beaches along the north and southeast shores. Martin (1916) provides a much more in-depth account of the geologic history and origin of Devils Lake.

Because it has a small watershed that is mostly forested with no agricultural inputs, Devils Lake historically had clear water and algal blooms were not an issue. However, beginning in the 1860s, Devils Lake became increasingly popular and as many as four resorts and 60 or more private cottages existed around the lake shore (Lathrop et al. 2004). It is assumed that the outhouses and primitive septic systems associated with these installments leached phosphorous into Devils Lake (Lathrop et al. 2004). A small amount of farm runoff coming from the southwest bluff likely contributed phosphorous as well (Lathrop et al. 2004). Expansion of Devils Lake State Park following its inception in 1911 has seen the disappearance of the resorts, and the number of private cottages along the shore is down to four, while agricultural runoff has been eliminated as well (Lathrop et al. 2004). A sewer main in Devils Lake State Park broke in the late 1970s and the resulting sewage leak contributed phosphorous to the lake until the sewer main was repaired in the early 1980s (Lathrop et al. 2004).

Thermal stratification occurs in Devils Lake; the depth of the epilimnion increases from 18 to 20 feet in early summer to 30 feet by late summer, and the temperature in the hypolimnion varies from 48 to 53°F (Lillie and Mason 1986). The thermocline begins to erode by late September and full mixing is established by late November (Lillie and Mason 1986). Water clarity has been

historically good to excellent when compared to other lakes in Wisconsin, though clarity generally declines from early to late summer (Lillie and Mason 1986). Dissolved oxygen in the hypolimnion declines through the early summer and becomes depleted by July (Lathrop et al. 2005). Once this occurs insoluble iron (Fe^{+3}) compounds in the sediments are reduced to a soluble form (Fe^{+2}), and the phosphorous bound to these compounds is released into the water (Lathrop et al. 2005). This phosphorous is contained in the hypolimnion until fall turnover, when it becomes mixed throughout the water column (Lathrop et al. 2005). This phosphorous enrichment led to increases in algal growth (phytoplankton, filamentous algae, periphyton), including noxious blue-green algal blooms (Lathrop et al. 2005). By the early 1990s, phytoplankton blooms became less severe, but dense mats of filamentous algae covered the bottom which smothered aquatic macrophytes (Lathrop et al. 2004).

With the problem of raw sewage entering Devils Lake corrected, removal of hypolimnetic water was recommended following a study of the lake in 1986-87 (WDNR 1988). Planning began in 2000 for the implementation of a system for removal of phosphorous from the lake via removal of phosphorous rich hypolimnetic water in late summer and early fall (Lathrop et al. 2005). A siphon system was implemented in 2002, which removes hypolimnetic water from near the lake bottom and discharges the water into a drainage channel (dry creek bed) that drains to the Baraboo River (Lathrop et al. 2005). The plan has been to run the siphon from late August until fall turnover to maximize the amount of phosphorous removed while minimizing the amount of water removed (Lathrop et al. 2005). At the time of the 2013 survey, phosphorous removal continued in this manner.

Significant observations of the aquatic plant community did not occur prior to a 1974 survey in an area along the southeast shore, where the plant community consisted of 7 species, and was dominated by *Potamogeton robbinsii* (Robbins pondweed) and *Elodea canadensis* (Common waterweed) (Baker 1975). Additional surveys from 1979 to 1983 found several additional species, and a 1984 survey found 16 species, dominated by Robbins pondweed, *Myriophyllum spicatum* (Eurasian watermilfoil), and common waterweed (Lillie and Mason 1986). Comparisons between the 1974 survey and those conducted in the 1980s suggested that Eurasian watermilfoil had expanded, elodea had declined, and Robbins pondweed remained unchanged (Lillie 1986, Lillie 1990). A WDNR survey conducted in 2007 indicated the presence of 13 species, and the three dominant species were Robbins pondweed, common waterweed, and

Ceratophyllum demersum (coontail). Eurasian watermilfoil had declined and was only found at one sampling spot out of 248 (WDNR unreported data).

Because of the geologic history of Devils Lake, the pre-settlement fish population likely originated from the Wisconsin River (Lillie and Mason 1986). The stocking of Devils Lake began as early as 1873, and salmonids (brook trout, lake trout, Atlantic salmon, and probably rainbow trout) were the first species reported to be stocked (Lillie and Mason 1986). Brook trout may have been present in the lake prior to stocking, and rainbow trout were first reported present in 1895, though were probably stocked earlier (Lillie and Mason 1986). The first comprehensive fish surveys were made in the early 1900s and were conducted by scientists from the University of Wisconsin (Lillie and Mason 1986). Several surveys have taken place since that time, primarily by the Wisconsin Conservation Department/Wisconsin Department of Natural Resources. White suckers are thought to have been original residents of Devils Lake have been captured during fish surveys throughout the years, while carp have been observed but never in great numbers (Lillie and Mason 1986). Many minnow and darter species have been documented, with mimic shiner, spotfin shiner, and bluntnose minnow most abundant in a 1984 survey.

Four fish population surveys made using seines from 1954 to 1984 indicated a shift in the fish composition of Devils Lake from a cool water fish assemblage dominated by yellow perch, walleyes, and smallmouth bass to one dominated by centrarchid panfish (primarily bluegills and pumpkinseeds) and largemouth bass (Lillie and Mason 1986). The shift began to occur between 1955 and 1967 when the percentage of the catch composed by bluegills and pumpkinseeds increased from 5.3% to 48.0% and the percentage composed by largemouth bass increased from 0% to 47.8% (Lillie and Mason 1986). By 1984, bluegills and pumpkinseeds made up an even larger percentage of the catch at 74.7%, while largemouth bass had declined to 16.3% (Lillie and Mason 1986). The 1984 survey indicated that 88% of the bluegills collected were between 3 and 6 inches, and these fish were of overlapping age groups; bluegill growth rate may have slowed between 1954 and 1984 (Lillie and Mason 1986).

For several decades, Devils Lake has supported a trout fishery, and currently the trout fishing season runs concurrent with the regular gamefish season (Table 1). Trout stockings primarily consisted of rainbow trout from the mid-1940s to the mid-1960s, and after 1953 yearling rainbow trout were the product of choice for stocking, typically at the rate of 30,000 to 50,000 per year

(Larson 1994). Managers began substituting brown trout for rainbow trout in the mid-1960s to achieve a higher rate of holdover fish (Larson 1994). After 1974, trout stocking rates were reduced in favor of walleye stockings, and following a study of Devils Lake in 1986-87, rainbow trout stockings were discontinued in favor of brown trout due to suspected overgrazing of *Daphnia* by rainbow trout (WDNR 1988, Larson 1994, Table 2). Rainbow trout were last stocked in Devils Lake in 1988 (Table 2). Since that time, stockings of yearling brown trout have occurred annually, but the number stocked each year has varied between approximately 3,000 and 23,000, often based on hatchery production levels (Table 2). Currently, WDNR stocking quota guidelines allow for 16,000 yearling brown trout to be stocked into Devils Lake but as of 2014 it appears that a more realistic number will be between 8,000 and 12,000 annually.

Stocked brown trout in Devils Lake have shown the ability to hold over and live for multiple years in the lake, providing a put-grow-and take fishery as opposed to a mere put-and-take opportunity. A 1993 study found that the yearling fish stocked in April at an average length of 8.2 inches had reached 9-10 inches by June (Larson 1994). Of the 57 brown trout that were examined, 10 were determined to be holdovers (18%) and these fish averaged 16.4 inches in June (Larson 1994). By winter, anglers were catching trout in two distinct groups that measured 12 to 14 inches and 18 to 22 inches, and these groups would have corresponded to fish stocked as yearlings the previous spring, and holdover fish stocked in previous years (Larson 1994). A fall gill net survey was conducted in October 2011 for the purpose of collecting various fish species for contaminant analysis. This survey captured 6 brown trout and ages were determined for 5 of these fish. Three fish were aged at 1+, and they averaged 13.4 inches, while 2 fish were aged at 2+ and they averaged 15.5 inches. Based on this small sample of aged fish, 40% of the brown trout were holdover fish. Local trout angler Ken Alvar was kind enough to share the lengths of the brown trout that he harvested from May through August 2013. Using the length at age data from the 2011 survey and the average length of fish stocked in April 2013 (9.2 inches), ages were estimated for Ken's sample, and 10 out of 25 of these fish were determined to be holdover fish (age 2+, 40%).

Stocking of walleyes into Devils Lake became standard practice in 1974, and since that time stockings almost exclusively consisted of small fingerling fish (≤ 3 inches) (Larson 1994, Table 2). One notable recent exception was 2009 when Gollon Bait and Fish Farm in Dodgeville, WI donated surplus large fingerling (LGF) walleyes to the WDNR and all Sauk County walleye lakes were stocked with 10 LGF walleyes/acre (Table 2). Northern pike have only been stocked once

since 1972; 2,500 small fingerlings (average length 1.9 inches) were stocked in 2005 (Table 2). Otherwise, the northern pike population has been sustained through natural reproduction.

METHODS

Data collection-spring netting and electrofishing

Following ice-out, two standard 3-foot hoop fyke nets with 0.7 inch bar, 1.4 inch stretch mesh were set near the mouth of Messenger Creek on April 16, 2013; these fyke nets targeted northern pike and walleye (SNI). The lake was 95% ice covered on April 16, and nets were added gradually as the lake opened up. A third net was set on April 17, two more on April 18, and the sixth net was set on April 19. Six nets were then run each day through April 29 with the exception of April 25 and 27. The nets were allowed to soak for 48 hours on these two occasions due to low catches. Nets were left in the lake for an extended period due to the slow warming of the lake and the anticipation of more walleyes moving into shallow water as the water temperature increased. When this did not occur by April 29, the fyke nets were pulled out, and total survey effort was 70 net nights. Fyke net locations (GPS coordinates) can be found in Table 3.

Gamefish and panfish were measured to the nearest 0.1 inch and a subsample of each species was weighed to the nearest 0.01 pound. Aging structures were taken from a subsample of bluegills, black crappies, largemouth bass, smallmouth bass, northern pike, walleyes, and yellow perch. The goal was to take structures from 5 fish per half-inch group for bluegills, black crappies, largemouth bass, and smallmouth bass, and 5 structures per half-inch group for each sex for northern pike, walleye, and yellow perch. Sex was recorded when evident for northern pike, walleye, and yellow perch. All walleyes captured during fyke netting were marked with a top caudal fin clip for the population estimate (PE). All unmarked walleyes captured during SEI were marked with a bottom caudal fin clip to avoid any double-counting in the event that they were captured twice during SEI. Northern pike captured during fyke netting were marked with a top caudal fin clip for the purpose of calculating a population estimate.

A WDNR standard direct current (DC) boom shocker boat was used to sample fish on Devils Lake during the spring of 2013. The first electrofishing survey occurred on the night of April 29 (SEI) to recapture walleyes that were marked during SNI, and also to mark largemouth bass for a population estimate. The entire shoreline was sampled and all gamefish were collected and

measured to the nearest 0.1 inch. Hard structures were removed and fish were weighed as needed to fill out length bins for age and growth analysis. Walleyes were examined for marks for calculation of the PE. Largemouth bass and smallmouth bass were marked with a top caudal fin clip; a PE was planned in the event that a sufficient number of recaptures were sampled during SEII.

The second electrofishing survey occurred on May 23, 2013 (SEII). A total of two electrofishing stations were chosen, which encompassed the entire shoreline of the lake. The first station began with a randomly chosen start point and was 2 miles of shoreline in length. Within the station, panfish and gamefish were collected during the first 0.5 mile, while gamefish only were collected for the remaining 1.5 miles. The second station continued from the end of the first, but the gamefish-only portion ended after 1.1 miles because the entire shoreline of the lake had been sampled. Rough fish and other non-game fish were observed and counted while sampling the 0.5 mile panfish stations, but were not dip netted. All gamefish and panfish were measured to the nearest 0.1 inch. Aging structures were taken and weights were recorded from gamefish and panfish where necessary to fill out length bins. Starting and ending GPS coordinates for electrofishing stations can be found in Table 4.

Data Analysis

The walleye PE (number of adult fish ≥ 15 inches) was calculated using the Chapman modification of the Petersen single-census method where fish are marked during multiple fyke netting events (SNI), followed by a single recapture event (SEI). The formula is noted here:

$$N = \frac{(M+1)(C+1)}{R+1} - 1$$

Where *N* is the estimated population size, *M* is the number of fish that were marked, *C* is the number of fish captured on the recapture run and examined for marks, and *R* represents the number of fish captured on the recapture run that had marks. Once the estimate was calculated, it was divided by the surface area of the lake to determine adult walleye density (number of fish ≥ 15 inches / acre). This density was then compared to average densities for stocked and naturally reproducing walleye fisheries in Wisconsin, and inferences were made about the success of walleye stocking in Devils Lake.

Multiple census mark-recapture population estimates for northern pike were calculated using the Schnabel method and the Schumacher-Eschmeyer methods. The formula for the Schnabel method is noted here:

$$N = \frac{\Sigma(C_t M_t)}{R+1}$$

Where *N* is the population size, C_t is the number captured on day *t*, M_t is the number marked on day *t*, and R is the total number of recaptures from the survey (Ricker 1975). The formula for the Schumacher-Eschmeyer method is noted here:

$$N = \frac{\Sigma(C_t M_t^2)}{\Sigma(M_t R_t)}$$

Where N, C_t, and M_t represent the same variables as in the Schnabel method, and R_t is the number recaptured on day *t* (Ricker 1975).

For SNI, SEI, and SEII total catch and catch per unit of effort (CPE) was calculated separately by gear type for all species. Length frequency distributions were generated for panfish and gamefish species of interest, including largemouth bass, smallmouth bass, northern pike, yellow perch, walleye, and rock bass. Length frequencies were not generated for bluegills or black crappies because too few individuals were collected to make it a worthwhile exercise. Length range, mean length, median length, and mode length were calculated for all species. Proportional stock density (PSD) and relative stock density of preferred length fish (RSD-P) were calculated for all panfish and gamefish species with more than 100 individuals collected (Anderson and Neumann 1996). Length designations for stock, quality, preferred, memorable, and trophy sizes of the panfish and gamefish species collected from Devils Lake can be found in Table 5; these values were used for calculation of stock density indices (Anderson and Neumann 1996). Aging structures (scales, dorsal spines, and anal fin rays/spines) were used to estimate ages of a subsample of each species, and age and size data of these fish were used to generate age-length keys to estimate the age frequency of the population as a whole based on the aged subsample. Age frequency distributions were then generated for each species except for bluegill and black crappie; the distributions were simple enough to describe without graphic representation. The mean age at 14.0-14.9 inches (MAL14) is a metric sometimes used to compare growth in largemouth bass populations in Wisconsin, and this metric was calculated for largemouth bass from Devils Lake and compared to the MAL14 values for several other lakes in Columbia and Sauk counties. Also, mean catch rates of different size categories, and stock density indices for largemouth bass from different time periods were compared using a two sample t-test with unequal variances.

Once age frequency distributions were completed for each species, inferences were made about year class strength and mortality when possible. Mean length at age was used to make inferences about growth of fish in Devils Lake by comparing the lake to regional and statewide averages. Mean length at age was calculated using methods outlined in Bettoli and Miranda (2001), with the formula listed here:

$$\overline{Li} = (\sum N_{ij}\bar{l}_{ij})/N_i$$

Where $\overline{L}_i$ represents the mean length of the *i*th age group, $N_{ij} = N_j(\frac{n_{ij}}{n_j})$, N_j is the number of fish in the *j*th length group, n_{ij} = number of fish of the *i*th age group subsampled in the *j*th length group, n_j is the number of fish subsampled in the *j*th length group, and $N_i = \sum N_{ij}$ over all *j* length groups. The inputs to this equation are derived from the length frequency distribution of the sample and the age-length key. The midpoints of each length group were used for the values of $\bar{l}_{ij}$. This is the "correct" method which extrapolates length at age data from the subsample of aged fish to the entire sample of fish collected (Bettoli and Miranda 2001). Simply reporting the mean length at age as the values calculated from the subsample of aged fish is "incorrect" because these values do not represent the entire sample since the subsampling is not in proportion to the frequency distribution of the sample as a whole (Bettoli and Miranda 2001).

A von Bertalanffy growth curve was not fitted to walleye length at age data for Devils Lake because only two age classes of walleyes were present in the lake. Mean length at age values were reported separately for males and females, and also for all walleyes combined, regardless of sex.

Relative weights were calculated to evaluate body condition of fish. Relative weight (W_r) is a measure that compares the length of the fish to an expected weight for that length. Standard weights were calculated for individuals of each species that had weights recorded and standard weights were only calculated for individuals larger than the minimum recommended length for each species. (Murphy et al. 1991, Anderson and Neumann 1996). Relative weights for each fish were calculated by dividing a fish's actual weight by the standard weight for a fish of that length. Average relative weight was then calculated for each species, and was done 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.

RESULTS AND DISCUSSION

General Fish Community

A total of 1,523 fish representing 14 different species from 7 families was sampled during spring netting and electrofishing on Devils Lake in 2013. Catch by gear type is shown for each species collected in Table 6. Two trout stocking events took place during fyke netting, on April 23 and April 25. A third stocking took place on May 1. Newly stocked brown trout were present in fyke nets in great numbers following their stocking, and also during SEI before occupying deeper habitat prior to SEII. Yearling brown trout were approximately 9.2 inches average length at time of stocking. Brown trout were not considered in the data analyses associated with this survey.

Largemouth Bass

In total, 393 largemouth bass were collected during the spring; overall catch rates were 0.2 per net night during fyke netting, 49.3 per mile of shoreline during SEI, and 55.8 per mile during SEII (Table 6). The catch rate of fish ≥ 8 inches (stock size) during SEII was 51.9 per mile, and this ranked in the 70th percentile in a comparison of four southern Wisconsin drainage basins (Table 7). The catch rate of fish ≥ 12 inches (quality size) during SEII was 32.2 per mile, and this ranked in the 51st percentile in a comparison of four southern Wisconsin drainage basins (Table 7). This indicates that based on SEII CPE8 and CPE12, largemouth bass abundance compares favorably to other systems in southern Wisconsin. Largemouth bass CPE8 in Devils Lake is higher than the desired 20-30 fish per mile. Although 175 largemouth bass were marked during SEI, too few individuals were recaptured during SEII for a valid population estimate.

It must be noted that largemouth bass in Devils Lake were not stunned well by the electrical field during electrofishing and presented a difficult target to dip net effectively. Also, the clarity of the water and the steep drop-off along the east and west shores allowed the dippers to see fish being stunned that were deeper than they could reach with their nets. It is estimated that for every fish successfully dipped, there were 2 to 3 individuals that escaped capture, and largemouth bass abundance may be three times higher than what is reported here. Largemouth bass was the most abundant sport fish species sampled during the survey.

For largemouth bass collected by electrofishing (N = 372, total excludes recaptures) lengths ranged from 5.0 to 19.9 inches, and the average, median, and mode lengths were 11.9 inches, 12.4, and 12.6 inches, respectively (Table 8). An additional 17 largemouth bass were captured with fyke nets, and they ranged from 6.5 to 14.3 inches in length, averaging 12.0 inches. The length frequency distribution based on the electrofishing catch is presented in Figure 1. Of the largemouth bass ≥ 8 inches in length (stock size), fish ≥ 12 inches were present in good numbers (PSD = 67), but fish 15 inches and larger were rare (RSD-P = 1). A comparison of largemouth bass size-specific catch rates between three electrofishing surveys in 2000 and 2001, and surveys in 2005 and 2013 indicates significant declines in CPE14, CPE15, RSD-14, and RSD-P (Table 7). Largemouth bass size structure is poor in Devils Lake and has declined since the early 2000s.

Altogether, 74 largemouth bass were included in the age analysis. Age 7 and age 9 were the most common age classes in the sample, with numbers declining steadily thereafter through age 15 except for age 12 which was almost entirely absent (Figure 2). It appears that recruitment has been variable, and may be on the decline. Two large year classes appear to have been produced in 2004 and 2006, and these compose over half of the largemouth bass population (51%). Largemouth bass growth in Devils Lake is slow; bass grow slower than the state and region averages throughout their life, and the disparity increases with age (Figure 3). Only five largemouth bass were captured that were ≥ 14 inches, and ages of these fish ranged from 7 to 15 years. Sub-legal largemouth bass were aged as old as 15 years, the oldest age in the distribution. The average age of fish that measured 14.0-14.9 inches (MAL14, n = 4) was 9.3 years; this is very poor growth compared to eight other lakes (9 total surveys) in Columbia and Sauk counties surveyed since 2006, and is well below the median value from these surveys (median MAL14 = 6.1, Table 9). This also represents a decline in largemouth bass growth compared to previous surveys. A 1993 survey indicated that largemouth bass in Devils Lake averaged 14.5 inches by age 6 (Larson 1994). A 2001 survey indicated similar growth, with largemouth bass averaging 14.6 inches by age 6 and 15.5 inches by age 7, and the MAL14 value was 6.0 years which was very close to the median MAL14 value of 6.1 for Columbia and Sauk County lakes (WDNR, unreported data, Table 9).

Condition of largemouth bass in Devils Lake was average to poor; relative weights averaged 83.0 (Table 8). Eighteen percent (N = 14) of weighed largemouth bass had relative weights below 75 indicating poor condition. Many fish had a slender appearance with the greatest depth of body

occurring at the head. Relative weights for largemouth bass in Devils Lake are represented in Figure 4.

Devils Lake has a high density bass population with poor growth and average to poor fish condition. Gizzard shad are not present; bluegills and other forage are the primary prey of largemouth bass in Devils Lake. Largemouth bass in Devils Lake grow much slower other lakes in Columbia and Sauk counties, regardless of the composition of the prey base, and an overabundance of fish coupled with a lack of appropriate forage, particularly for adult fish, is the likely cause. By and large, the largemouth bass in Devils Lake inhabit interstitial spaces among the boulders that line the steep bowl of the lake bottom. This environment presents a poor opportunity for largemouth bass to forage for prey, and large schools of fish have been observed feeding at the surface mid-lake, as well as cruising near the shoreline.

Northern Pike

In total, 172 northern pike were sampled during the spring including recaptures; the catch rates were 2.4 fish per net night (SNI), 0.8 fish per mile during SEI, and zero fish per mile during SEII (Table 6). All northern pike were collected early in the spring during spawning activities and by late spring the northern pike had moved off shore to occupy deeper habitats. Lengths of 117 northern pike captured in fyke nets (total excluding recaptures) were measured, and ranged from 13.4 to 40.0 inches, averaging 30.1 inches (Table 8). The median length was 31.1 inches, and the mode was 20.7 inches (Table 8). Two additional northern pike captured during SEI measured 35.4 and 38.2 inches, respectively. The length frequency distribution for northern pike collected during SNI is represented in Figure 5.

Northern pike ages ranged from 2 to 10 years, with ages 5 and 6 being the most common, as represented in Figure 6. All northern pike collected were mature; males mature as young as age 2 and females as young as age 3 based on the sample. Northern pike in Devils Lake show fast growth with mean length-at-age values between the state and region averages for ages 4 through 8 (Figure 7). After age 8, northern pike appear to grow faster than the state average through age 10. Northern pike in Devils Lake reach the legal harvest size of 32 inches as early as age 4, and average over 32 inches by age 7 (Figure 7). Northern pike were in good to excellent condition; 70% had relative weight values above 100 (39% of males, 87 % of females). Relative weights for northern pike were generally lower for males which averaged 97.3, while females averaged

118.0, and this is partly attributed to the females being full of eggs at the time of capture (Figure 8). No northern pike had relative weight values below 75. Northern pike relative weight was positively correlated with fish length (Figure 8). This correlation was not evident in any other species collected in the survey.

The Schnabel population estimate was 204 sexually mature northern pike, or 0.5 per acre (95% CI 156 – 265 total or 0.4 – 0.7 per acre). The Schumacher-Eschmeyer population estimate was 194 sexually mature fish, or 0.5 per acre (95% CI 152 – 269 or 0.4 – 0.7 per acre). These estimates are essentially the same in terms of the number of mature fish per acre with very small confidence intervals. This close similarity between the estimates derived from the two methods is consistent with a previous study of northern pike population estimate methods (Pierce 1997). The most recent northern pike for PE for Devils Lake prior to 2013 was conducted in 2002. At that time, The Schnabel population estimate was 478 sexually mature northern pike, or 1.3 per acre (95% CI 315 – 717 total or 0.8 – 1.9 per acre). The Schumacher-Eschmeyer population estimate was 503 sexually mature fish, or 1.3 per acre (95% CI 336 – 998 or 0.9 – 2.7 per acre). The 2002 Schnabel and Schumacher-Eschmeyer estimates were also very close in terms of the total number of mature fish and the lower limit of the 95% confidence interval. There appeared to be a wider difference in values for the upper limit of the 95% confidence interval. Results of the 2002 and 2013 northern pike PEs can be found in Table 10.

Based on the 2013 survey, northern pike population size structure has improved since 2002 based on multiple stock density indices with the exception of RSD-40 which declined from 2 to 1 (Table 11). However, the density of adult fish (number per acre) has declined by 62%, from 1.3 sexually mature adults/acre in 2002 to 0.5 adults/acre in 2013. This apparent decline may have been due partly to the fact that our sampling effort missed a large part of the northern pike spawning run and our survey underestimated the adult population. Ice-out occurred relatively late in 2013, and it was not possible to set nets until April 16. The catch rate on our first lift day (April 17) was 20.0/net night, many of the fish were ripe, and the sex ratio was 0.9:1.0 males to females. By the second lift, males were nearly absent from the catch and mostly ripe or spent females remained. The catch rate declined to 1.7/net night by the fourth lift, at which time the spawn was probably over. The catch rate did not recover, and on the final lift it was 0.3/net night (Figure 9). Also, the proportion of recaptures in the catch increased to 0.6 by the fourth lift, then fluctuated between 0.4 and 1.0 for the remainder of the netting survey (Figure 10). Conversely, in 2002 nets were set on March 31, the catch rate fluctuated between 1.0 and 3.0 fish/net night,

and the proportion of recaptures in the daily catch remained below 0.3 for the entire survey (Figure 9, Figure 10). Daily catch rates were never high, but overall the catch was steady and there was not a notable increase in the proportion of recaptures until late in the survey. This indicated that in 2002 the netting effort was more synchronous with the entire period of spawning activity; new fish appeared each day for the entire survey. Had we been able to sample earlier in 2013, we likely would have seen a pattern similar to 2002 and sampled a larger number of fish.

Another possible cause for the apparent decline in adult density is an actual decrease in northern pike recruitment. Since pumping of hypolimnetic water to remove phosphorous from the lake began in 2002, water levels in Devils Lake have been lowered and remain relatively static, while periodic pumping continues. The 2002 northern pike PE occurred immediately prior to the start of the pumping. Since that time, it is possible that the amount of spawning habitat available to northern pike in the marsh around the mouth of Messenger Creek has been reduced to levels that inhibit successful natural reproduction to some degree, and this negatively impacts recruitment of individuals to the fishery. Possible alterations to the pumping schedule may need to be considered to allow higher water levels at ice out to facilitate greater access to flooded emergent vegetation for spawning northern pike. If this is not feasible, a habitat project geared toward increasing the amount of flooded wetland area via excavation and removal of sediment may need to be considered. Monitoring of northern pike spawning success via trapping of YOY individuals in the creek to determine an index of reproductive success may be helpful in making decisions on alteration of pumping schedules.

Yellow Perch

In total, 106 yellow perch were collected and the catch rate was 1.5 per net night during SNI; zero yellow perch were collected during SEII (Table 6). Yellow perch was the third most abundant sport fish species collected by number during the survey. Lengths ranged from 5.4 to 13.5 inches, and the average, median, and mode lengths were 9.0, 9.1, and 6.3 inches, respectively (Table 8, Figure 11). Sex was known for 102 fish and the sex ratio of these fish was 0.7:1, males to females; the distribution was skewed toward females. Male yellow perch ranged from 5.4 to 12.1 inches and averaged 9.1 inches. Female yellow perch ranged from 5.7 to 13.5 inches and averaged 9.0 inches. Proportional stock density (PSD), RSD-P, and RSD-M values were 63, 37, and 10, respectively. Devils Lake has a low-density yellow perch population with good size structure and the potential for anglers to catch memorable fish ($\geq$ 12 inches).

In total, 84 yellow perch between 5.0 and 13.9 inches were included in the age analysis. Age 1 and age 2 fish were not present in the sample. The absence of age 1 fish is most likely due to them not being vulnerable to the sampling gear. All of the yellow perch collected were caught in fyke nets, and age 1 yellow perch are too small to be contained by the fyke net mesh used in the survey. The absence of age 2 fish indicates that either recruitment is very low, or that age 2 fish have not yet matured in Devils Lake and thus were not engaged in spawning activities near shore and were not vulnerable to the fyke nets. Age 7 was the most common age class present in the catch, with ages 4 through 9 present at similar abundance, with a decline in abundance from age 9 through age 11 which was the oldest age in the sample; mortality appears to be low prior to age 8 (Figure 12). In any case, yellow perch in Devils Lake provide a low density, high quality fishery for anglers.

Growth was slow to moderate, with fish reaching an average length of 6.3 inches by age 3, 7.0 inches by age 4, and 8.5 inches by age 5, which is probably an acceptable harvest size for anglers. Mean length at age is generally between the region and state averages, and the fact that these fish are long-lived allows them to reach large sizes during their life span (Figure 13). The oldest fish in the sample was a male that was aged at 11 years while the oldest female collected was aged at 10 years. Male yellow perch are generally thought to mature at younger ages, attain smaller size over their lifetime than females, and may dominate spring fyke net catches (Becker 1983, WDNR unreported data). However, the sample of yellow perch from Devils Lake was skewed toward females (0.7:1.0 male to female ratio), with males having a larger average size. Females matured as early as age 3 and the average age of females was 5.8 years, while males matured as early as age 4 and the average age was 7.5. Yellow perch condition was good in Devils Lake based on relative weight. Relative weights of yellow perch averaged 92.6 for males and 108.2 for females. Eleven percent (N = 11) of the individuals included in the analysis were in poor condition with relative weight values below 75. Many of the fish with low relative weight values were small in size, and their relative weight may have been impacted by the imprecision of the pan balance used to measure their weight (Figure 14). This may also be reflective of yellow perch life history whereby significant weight gains do not occur until after the first few years of life (Becker 1983). Although spawning habitat may be somewhat limiting, yellow perch in Devils Lake likely receive little predation pressure from walleyes which are at low abundance, and northern pike which have an abundant alternative food source (brown trout).

Rock Bass

In total, 102 rock bass were collected; catch rates were 1.3 per net night during SNI, and 8.0 per mile of electrofishing during SEII (Table 6). Rock bass was the fourth most abundant sport fish species collected by number during the survey. Lengths ranged from 4.8 to 10.3 inches, and the average, median, and mode lengths were 8.2, 8.3, and 8.1 inches, respectively (Table 8). The length frequency distribution for rock bass is represented in Figure 15. Proportional stock density (PSD) was 87, and RSD-P was 23; rock bass present an additional quality panfish angling opportunity in Devils Lake. However, because they are not a primary management species of interest, aging structures and weights were not collected from rock bass during this survey.

Smallmouth bass

In total, 70 smallmouth bass were collected during the spring and all were captured by electrofishing. Catch rates were 7.3 per mile of shoreline during SEI, and 12.2 per mile during SEII (Table 6). The catch rate of fish ≥ 7 inches (stock size) during SEII was 11.9 per mile, and this ranked in the 88th percentile statewide. The catch rate of fish ≥ 11 inches (quality size) during SEII was 3.6 per mile, and this ranked in the 76th percentile statewide. Smallmouth bass are abundant in Devils Lake relative to other lakes across the state. With the exception of a spring electrofishing survey in 2000, overall smallmouth bass catch rates in Devils Lake have ranged from 4.6 to 12.2 per mile, and catch rates show a weak positive correlation with water temperature (Table 12). The lowest catch rate in the time series occurred at a water temperature of 48°F, consistent with the idea that smallmouth bass become lethargic and inactive below 50°F (Becker 1983). Smallmouth bass appear to be less vulnerable to shoreline electrofishing at cold temperatures.

Smallmouth bass lengths ranged from 6.6 to 15.2 inches, and the average, median, and mode lengths were 11.4 inches, 11.7, and 12.4 inches, respectively (Table 8). The length frequency distribution is represented in Figure 16. Too few smallmouth bass were collected for meaningful calculations of stock density indices. However, the length frequency distribution truncates sharply beyond the 12.5 half-inch group, and only one individual larger than the 14 inch minimum harvest size was captured. Smallmouth bass size structure is poor in Devils Lake.

Altogether, 42 smallmouth bass were included in the age analysis. Age 6 was the most common age class in the sample with numbers declining sharply after age 9 except for a single age 13 fish (Figure 17). No individuals younger than age 4 were found in the survey. These three missing year classes may be indicative of poor recruitment, but may also indicate a preference of young smallmouth bass for deeper or more sheltered habitats where our electrofishing gear is not effective. Similar to largemouth bass, smallmouth bass mean length at age was lower than state and region averages, and the difference increased with age (Figure 18). Most of the fish sampled were between 9.0 and 12.5 inches in length and these fish were 4 to 9 years old. Only one fish larger than 14 inches was sampled. This was a 15.2 inch fish that was aged at 13 years. Smallmouth bass growth appears to be poor in Devils Lake.

Condition of smallmouth bass in Devils Lake was average; relative weights averaged 84.6. Only two percent (N = 1) of weighed largemouth bass had a relative weight below 75 indicating that smallmouth bass, although slow growing, are not experiencing nutritional stress to the same degree as largemouth bass (Figure 19). Smallmouth bass generally consume a diet that is more diverse and less reliant on fish compared to the diet of largemouth bass, and as a result may be less stressed in a system where prey fish are limited.

Walleye

In total, 68 walleyes were collected from Devils Lake during the spring (including recaptures); catch rates were 0.6 per net night during SNI, 7.6 per mile of shoreline during SEI, and zero per mile during SEII (Table 6). Walleye was the sixth most abundant sport fish species by number collected during the survey (Table 8). Seven walleyes collected during fyke netting were measured, kept, and sacrificed for contaminant analysis by the State Lab of Hygiene. For the population estimate, a total of 30 adult walleyes ≥ 15 inches were marked and released during fyke netting. Twenty-seven adult walleyes were captured during SEI, and marks were found on 11 of those fish. The Chapman population estimate was calculated at 71 adult walleyes ≥ 15 inches (95% CI 49 – 122), for a density of 0.2 adults ≥ 15 inches per surface acre (95% CI = 0.1 – 0.3 per acre).

In total, 53 walleyes were measured during spring sampling (total catch excluding recaptures) and lengths ranged from 16.3 to 20.6 inches (Table 8, Figure 20). The sex ratio of the sample was 2.1:1.0, males to females. The average length for males was 17.4 inches, the average length for

females was 18.9 inches, and the average length for all walleyes was 17.9 inches (Table 8). Ages were estimated for a total of 38 walleyes; 31 were estimated to be age 4 and seven were estimated to be age 5. Starting in 1982, small fingerlings were stocked exclusively into Devils Lake with the exception of 2009, when extended growth walleyes were stocked at the rate of 10 per acre in addition to small fingerlings at the rate of 18 per acre. While it is plausible that a few small fingerlings could have survived from the 2008 stocking to reach age 5 in 2013, it is very unlikely. If small fingerling walleyes were surviving in Devils Lake, we should have found small remnants of several year classes other than age 4 and age 5. The size range of walleyes collected from Devils Lake was almost exactly the same as for those collected from White Mound Lake in 2013 (16.6 to 20.6 inches). White Mound Lake was only stocked with walleyes once since 1989; 10 extended growth fingerlings per acre in 2009. The only age class present in White Mound Lake in 2013 was age 4, but a few of those were initially aged at 5 years using dorsal spine sections. Since this could not be possible, the age 5 fish were assumed to be age 4. It is likely that the same thing happened with Devils Lake, a small number of fish were aged at 5 years when they were really 4. However, because the possibility does exist that a small number of fish survived from the 2008 stocking, these fish were not corrected, and were considered age 5 (Figure 21). Mean length at age values for ages 4 and 5 were 18.1 and 17.3 inches, respectively. When comparing age 4 fish that were stocked in 2009, Devils Lake walleyes experienced similar growth to their counterparts stocked into White Mound Lake in 2009. Condition of walleyes in Devils Lake was good based on relative weights (Figure 22). Relative weights of males averaged 92.0 and females averaged 97.5.

The success of the single stocking of extended growth walleyes in 2009 into a high density bass fishery supports the idea that extended growth fingerlings are the preferred product to be stocked into fisheries with high centrarchid densities. The absence of walleye year classes that would have been produced in years of small fingerling stockings further supports this assertion. The good water clarity of Devils Lake, coupled with a lack of vegetative cover for small fingerling walleyes essentially gives them zero chance of survival in a large open bowl patrolled by numerous predators. Establishment of a population of adult walleyes at a density of 2 adults/acre $\geq$ 15 inches is not possible with small fingerlings; the only chance is through stocking of extended growth fingerlings.

Additionally, possible negative impacts to already low yellow perch recruitment from an increase in the adult walleye population warrant serious consideration where management decisions on walleyes are concerned.

Bluegill

In total, 19 bluegills were collected during the spring; the catch rates were 0.1 per net night during SNI and 12.0 per mile of shoreline during SEII (Table 6). The SEII catch rate ranked in the 13th percentile statewide; bluegills appear to be at low abundance in Devils Lake. However, the steep topography of much of the lake's bottom, and relative lack of vegetated littoral zone likely impacted bluegill catch rates. Because so few individuals were collected, the catch from each gear type was combined for calculation of a simple summary of fish lengths. Lengths ranged from 3.1 to 9.5 inches, and mean, median, and mode lengths were 5.8, 5.5, and 5.6 inches, respectively (Table 8).

Ages 3, 4, 6, and 8 were present in the catch. Based on a very small sample size, bluegill growth in Devils Lake appears to be below average for ages 3 and 4 (behind state and region averages) and above average for ages 6 and 8 (Figure 23). The sample size is too low to be of much value. Overall, bluegills larger than 3 inches were in very good condition (mean relative weight = 104.3). Only two individuals had relative weights below 75, indicating poor condition (Figure 24). Relative weight appears to be more variable for bluegills measuring three to five inches, but this is likely an artifact of the imprecision offered by the pan balance used when weighing small fish.

Bluegills provide a low density, high quality fishery in Devils Lake based on anecdotal evidence. However, actual survey data that support this assertion are lacking. Capturing bluegills using traditional WDNR survey methods on Devils Lake, particularly shoreline electrofishing, has often been difficult. As a result, an accurate assessment of the bluegill population has not been accomplished since a spring electrofishing survey in 2000. Good bluegill habitat, specifically aquatic macrophyte beds in areas shallow enough for electrofishing to be effective are rare in Devils Lake. The only shallow littoral habitat exists at the north and southeast ends of the lake, and these are beach areas that are heavily used by park visitors. Aquatic macrophytes become established in deeper areas further off shore but these areas are not conducive to electrofishing due to their depth. Setting fyke nets to capture panfish during the summer was done in August of

2002 and June of 2006 with limited success. Also, fyke netting during the season of heaviest use of the lake by park visitors is not desirable due to potential conflicts that arise with competing users.

Based on what little bluegill data we were able to collect, growth and condition are good and recruitment appears to be low. Good growth and condition can be attributed to predation pressure from largemouth bass and low recruitment keeping the population at a low level; competition for resources among bluegills is likely very low.

Black Crappie

In total, 17 black crappies were collected during the spring; the catch rates were 0.2 per net night during SNI and 1.0 per mile of shoreline during SEII (Table 6). Lengths ranged from 3.7 to 11.5 inches, and 82% (N = 14) of the fish were between 3.7 and 4.3 inches (Table 8).

Ages were estimated from scales for a subsample of 14 black crappies collected and 15 were weighed. The most common age class in the sample was age 1, with two individuals aged at three years and one at six years. This indicates that the single year class of note was produced in 2012. Age 1 black crappies averaged 4.0 inches, which was 1.6 inches shorter than the age 1 region average. Age 3 black crappies were between region and state averages, and the singe age 6 crappie was larger than region and state averages (Figure 25). However, the sample size was not sufficient to be of value. Black crappies larger than 4.0 inches were generally in good condition, with relative weights averaging 111.0; two individuals had relative weights below 75. Relative weights were highly variable, especially for smaller fish, and this may be a product of the imprecision of the pan balance used to weigh panfish.

Black crappies appear to be present at low abundance in Devils Lake, and a year class of indeterminate strength was produced in 2012. It is possible that black crappies are present in greater numbers and our sampling gear was simply ineffective at capturing them. Notes from a previous survey indicated that black crappies were not numerous, but based on the few individuals collected, growth was good (Larson 1994). Findings from the 2013 survey are consistent with what has been observed previously.

Other Desirable Fish Species

Stocked brown trout provide a highly desirable and well-utilized component of the fishery in Devils Lake. Several thousand legal-sized brown trout are stocked into Devils Lake each spring and sustain a fishery which is utilized during both open water and ice fishing until the end of the gamefish season the following March. Occasionally surplus brown trout hatchery brood fish are stocked as well. Indications from short-set gillnetting in 2011 as well as angler diaries are that the holdover rate of brown trout into the year following stocking may be as high as 40%. This fishery is put-grow-and-take as opposed to simply put-and-take. Alternate survey methods to those employed in this survey are necessary to learn more about the holdover portion of the brown trout population. These methods could include a voluntary creel census, expanded use of angler diaries, and also more short-set gillnetting in the fall. Marking of stocked brood fish (permanent fin clip) to differentiate them from holdover spring stockers would be recommended as well.

Detrimental Rough Fish

The only detrimental rough fish of note captured in Devils Lake in 2013 was common carp which were present at low abundance and only very large individuals were observed (none were measured). The lack of smaller carp indicates that recruitment in Devils Lake is at or near zero, likely as a result of the high number of predators in the lake, and ideal conditions for predators to hunt prey.

CONCLUSIONS AND RECOMMENDATIONS

Schnabel and Schumacher-Eschmeyer population estimate methods have the potential to significantly underestimate northern pike population size (Pierce 1997). These population estimates are derived from sampling a fish behavior pattern and the assumption of equal catchability during the movements associated with spawning activity is a very sensitive assumption due to possible behavioral alterations by northern pike due to trap (fyke net) shyness (Pierce 1997). Pierce (1997) suggested that a Petersen population estimate that used two gear types; one type to capture fish for marking, and a second type for the recapture effort be used instead. In his study, trap nets were used to capture and mark fish during the spawning period, and fish were recaptured using multimesh experimental gill nets in April and May following the spawn (Pierce 1997). The bias attributed to trap shyness was avoided by using the second gear

type in a different time period, in different habitat, after the fish were no longer engaged in spawning behavior.

Northern pike have sustained themselves through natural reproduction in Devils Lake. There is a small amount of suitable spawning habitat in the form of emergent vegetation located near the mouth of Messenger Creek which flows into Devils Lake on the southwest shore. There appears to be little in the way of traditional northern pike forage such as white suckers (mostly large individuals present) and golden shiners (none found) in Devils Lake. However, stocked brown trout are a fusiform soft-rayed fish that provides abundant energy-rich forage, and brown trout likely are a major component of northern pike diets in Devils Lake. It must be noted that the few northern pike captured during SEI were caught in the shallows among massive schools of newly-stocked brown trout. Northern pike may also forage for yellow perch, small bluegills, crappies, and largemouth and smallmouth bass to lesser degrees.

Based on population estimates in 2002 and 2013, the density of adult northern pike in Devils Lake has decreased from 1.3 to 0.5 sexually mature fish per acre. The management goal for northern pike is to provide a trophy fishery for anglers. The objective is to maintain an adult population of $\geq$ 1.0 adult fish per acre and an RSD-M (34 inches) value of 30 or greater. The size structure objective is currently being met (RSD-M = 40). A decline in recruitment following the initiation of hypolimnetic pumping is one hypothesis for the decline in adult density. Trapping of juvenile northern pike in lower Messenger Creek during their transition from the marsh to the lake is recommended to quantify an index of spawning success and determine if reduced access to good spawning habitat by adults is causing the decline. Juvenile northern pike transition from the spawning marsh to the lake some time 30-38 days post egg deposition (18-24 days post hatch) at around 20 millimeters in length (Becker 1983). Depending on the timing of ice out and the northern pike spawn, traps should be place between late April and mid to late May. If several successive years of low or zero spawning success occur and the next northern pike PE scheduled for 2023 remains below the goal, alteration to the pumping schedule to allow somewhat higher water levels in Devils Lake during the spring should be explored. This would facilitate increased access for adult northern pike to emergent marsh vegetation for spawning. If this is not possible, dredging the marsh to increase the flooded area is a more labor intensive and less preferred alternative.

Largemouth bass are abundant in Devils Lake but growth and condition are poor, growth has declined from previous levels, and stunting of largemouth bass is occurring in Devils Lake. There are currently more largemouth bass in Devils Lake than the forage base can support. The management goal is to reduce largemouth bass abundance and improve population size structure. The SEII catch rate for fish ≥ 8 inches was 51.9 per mile in 2013, but the objective for Devils Lake should be a CPE8 between 20 and 30 per mile with a CPE14 ≥ 5 per mile. The recommended action to achieve the objective is a change in the length and daily bag limit on Devils Lake from a 14 inch minimum and five fish daily bag to a 14 inch maximum length limit with one fish over 20 inches allowed, and a five fish daily bag limit. This will direct harvest toward those abundant fish that are between 10 and 13 inches to reduce competition and increase growth, while protecting and improving size structure. The opportunity to harvest a very large bass would be protected as well.

Smallmouth bass are abundant in Devils Lake, although not as abundant relative to other lakes in the state as largemouth bass. Growth is slow and population size structure is poor, but body condition is not nearly as poor as for largemouth bass. The management goal for smallmouth bass is to maintain smallmouth bass abundance at its current level. The objective is to maintain a SEII catch rate for smallmouth bass ≥ 7 inches at 10 to 20 fish per mile. The SEII catch rate in 2013 was 11.9 fish per mile ≥ 7 inches; the objective is currently being met and smallmouth bass are not overabundant. No regulation change is recommended at this time.

The density of adult walleyes in Devils Lake is very low. Small fingerling stockings have not succeeded in producing a fishery; the population estimate of 0.2 adults ≥ 15 inches per acre is well short of the goal of 2.0 adults per acre. Small fingerling walleyes should not be stocked into Devils Lake at any point in the future. The clear water, lack of vegetative cover, and abundance of centrarchid predators are all factors that negatively impact small fingerling survival. Large fingerlings stocked in 2009 survived to age 4 in 2013. However, in an effort to reduce pressure on the forage base, improve growth of other more abundant sportfish species, and protect the low density, high quality yellow perch population, it is recommended that walleye stockings be discontinued. If future fish surveys indicate that the lake can support adult walleyes in greater numbers, stocking may be resumed, but only large fingerlings should be stocked. If walleye stocking is resumed, Mississippi Headwaters is the genetic strain that should be used.

Yellow perch in Devils Lake provide a low density, high quality fishery for anglers. The management goal is to maintain a yellow perch fishery with good size structure. The objective is to maintain RSD-P ≥ 30 and RSD-M ≥ 10. The objective is currently being met, however the possibility of overfishing exists for this population, and a reduced bag limit may need to be considered if future surveys indicate a decline in abundance and size structure of yellow perch.

Bluegills and black crappies are present in Devils Lake. Notes from previous surveys indicate that black crappies were not numerous, but growth rates were good, and the limited amount of crappie data collected during this survey is consistent with previous findings (Larson 1994). Anecdotal evidence suggests that there is a low density, high quality bluegill population in the lake. Survey data do not support this, and data for this species was so lacking in the 2013 survey that very little can be said about the bluegill population. The management goal is to maintain a balanced bluegill population with good size structure. The objectives are a spring bluegill CPE ≥ 100 per mile with an RSD-P ≥ 10. Technically the objectives are not currently being met, but the data collected in 2013 are insufficient to form any concrete conclusions. The morphometry of Devils Lake, coupled with a lack of aquatic vegetation in shallow near shore areas and heavy public use of the lake during the spring and summer, presents a problem when trying to sample bluegills effectively with conventional methods. Electrofishing is unlikely to produce consistent high catches of bluegills. Setting fyke nets in shallow near shore areas in the summer is possible, but not desirable due to the possibility of conflicting with other lake users, and has shown only mixed results in past surveys. One method that has not been tried is deep fyke net sets with 4-foot frame nets during SNI as opposed to the 3-foot frame nets typically used. This type of set should be explored in the next survey to target bluegills that are holding off shore in deeper habitats. No regulation changes are proposed at this time for bluegills or crappies.

REFERENCES

Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B. R. Murphy and D.W. Willis editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Baker, F. C. 1975. The littoral macrophyte vegetation of southeastern Devils Lake. Trans. Wis. Acad. Sci., Arts and Lett. 63: 66-71.

Becker, G. C. 1983. Fishes of Wisconsin. The University of Wisconsin Press. Madison, Wisconsin.

Bettoli, P.W., and L.E. Miranda. 2001. Cautionary note about estimating mean length at age with subsampled data. North American Journal of Fisheries Management 21: 425-428.

House, L.B. 1985. Stage fluctuations of Wisconsin Lakes. Wis. Geol. And Nat. Hist. Surv., Information Circular No. 49.

Murphy, B. R., D. W. Willis, and T. A. Springer. 1991. The relative weight index in fisheries management: status and needs. Fisheries 16(2): 30-38.

Larson, Tim. 1994. Devils Lake Fishery Survey-1993. 17pp. Wisconsin Department of Natural Resources, Poynette, WI.

Lathrop, R.C., Astfalk, T. J., Panuska, J. C., and D. W. Marshall. 2004. Restoring Devils Lake from the bottom up. Wisconsin Natural Resources 28(3): 4-9.

Lathrop, R.C., Astfalk, T. J., Panuska, J. C., and D.W. Marshall. 2005. Restoration of a Wisconsin (USA) seepage lake by hypolimnetic withdrawal. Verh. Internat. Verein. Limnol. 29: 482-487.

Lillie, R. A., and J. W. Mason. 1986. Historical changes in water quality and biota of Devils Lake, Sauk County, 1866-1985. Trans. Wis. Acad. Sci., Arts, Lett. 74: 81-104.

Lillie, R.A. 1990. A quantitative survey of the submersed macrophytes in Devil's Lake, Sauk County, with a historical review of the invasion of Eurasian watermilfoil, *Myriophyllum spicatum*.

Martin, L. 1916. The physical geography of Wisconsin. Wis. Geol. and Nat. Hist. Surv., Bull. No. 36, Education Series No. 4, Madison, WI.

Pierce, R. B. 1997. Variable catchability and bias in population estimates for northern pike. Transactions of the American Fisheries Society 126: 658-664.

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Fisheries Research Board of Canada Bulletin 191.

Wisconsin Department of Natural Resources. 1988. A two-year study of Devil's Lake: results and management implications. Final Rep. for Bureau of Water Manage. By Bureau of Research. 97pp.

TABLES AND FIGURES

Table 1. Current fishing regulations and open season dates for Devils Lake, Sauk County, Wisconsin.

Species	Season Dates	2013 Length and Bag Limits
Catfish	Open All Year	No minimum length limit and the daily bag limit is 10.
Panfish (bluegill, pumpkinseed, sunfish, crappie, and yellow perch)	Open All Year	No minimum length limit and the daily bag limit is 25.
Largemouth bass and smallmouth bass	First Saturday in May through the first Sunday in March	The minimum length limit is 14" and the daily bag limit is 5.
Northern pike	First Saturday in May through the first Sunday in March	The minimum length limit is 32" and the daily bag limit is 1.
Walleye, sauger, and hybrids	First Saturday in May through the first Sunday in March	The minimum length limit is 15" and the daily bag limit is 5.
Bullheads	Open All Year	No minimum length limit and the daily bag limit is unlimited.
Rough fish	Open All Year	No minimum length limit and the daily bag limit is unlimited.
Trout	First Saturday in May through the first Sunday in March	The minimum length limit is 9" and the daily bag limit is 3.

Table 2. Stocking history for Devils Lake, Sauk County, Wisconsin, 1972-2013.

Year	Species	Strain (Stock)	Age Class	Number Stocked	Avg. Fish Length (inches)	Source
1972	BROWN TROUT	UNSPECIFIED	YEARLING	15,000	7.0	DNR HATCHERY
1972	RAINBOW TROUT	UNSPECIFIED	ADULT	207	13.0	OTHER STATE'S GVT. HATCHERY
1972	RAINBOW TROUT	UNSPECIFIED	ADULT	510	15.0	DNR HATCHERY
1972	RAINBOW TROUT	UNSPECIFIED	YEARLING	10,000	11.0	DNR COOP PONDS
1972	SMALLMOUTH BASS	UNSPECIFIED	ADULT	17	15.0	OTHER STATE'S GVT. HATCHERY
1973	BROWN TROUT	UNSPECIFIED	YEARLING	15,000	7.0	DNR HATCHERY
1973	RAINBOW TROUT	UNSPECIFIED	ADULT	830	15.0	DNR HATCHERY
1973	RAINBOW TROUT	UNSPECIFIED	YEARLING	10,000	9.0	DNR COOP PONDS
1974	BROWN TROUT	UNSPECIFIED	YEARLING	5,000	7.0	DNR HATCHERY
1974	RAINBOW TROUT	UNSPECIFIED	YEARLING	5,000	9.0	DNR COOP PONDS
1974	WALLEYE	UNSPECIFIED	FINGERLING	109,675	5.0	DNR COOP PONDS
1975	BROWN TROUT	UNSPECIFIED	YEARLING	5,000		DNR HATCHERY
1975	RAINBOW TROUT	UNSPECIFIED	YEARLING	5,000		DNR COOP PONDS
1975	WALLEYE	UNSPECIFIED	FINGERLING	43,600	4.3	DNR COOP PONDS
1976	BROWN TROUT	UNSPECIFIED	YEARLING	5,000		DNR HATCHERY
1976	RAINBOW TROUT	UNSPECIFIED	YEARLING	5,000		DNR HATCHERY
1976	WALLEYE	UNSPECIFIED	FINGERLING	35,280	3.0	DNR COOP PONDS
1977	RAINBOW TROUT	UNSPECIFIED	YEARLING	10,000		DNR HATCHERY
1977	WALLEYE	UNSPECIFIED	FINGERLING	8,000	5.0	DNR COOP PONDS
1978	RAINBOW TROUT	UNSPECIFIED	YEARLING	10,000		DNR HATCHERY
1978	WALLEYE	UNSPECIFIED	FINGERLING	38,160	2.0	DNR COOP PONDS
1979	RAINBOW TROUT	UNSPECIFIED	YEARLING	10,000		DNR HATCHERY
1979	WALLEYE	UNSPECIFIED	FINGERLING	7,155	7.0	DNR COOP PONDS
1980	RAINBOW TROUT	UNSPECIFIED	YEARLING	10,050		DNR HATCHERY
1981	RAINBOW TROUT	UNSPECIFIED	YEARLING	5,000		DNR HATCHERY
1982	RAINBOW TROUT	UNSPECIFIED	YEARLING	5,000		DNR HATCHERY
1982	WALLEYE	UNSPECIFIED	FINGERLING	23,100	2.0	DNR COOP PONDS

Year	Species	Strain (Stock)	Age Class	Number Stocked	Avg. Fish Length (inches)	Source
1983	RAINBOW TROUT	UNSPECIFIED	YEARLING	5,000	9.0	DNR HATCHERY
1984	RAINBOW TROUT	UNSPECIFIED	YEARLING	5,000	7.0	DNR HATCHERY
1984	WALLEYE	UNSPECIFIED	FINGERLING	18,000	3.0	DNR COOP PONDS
1985	RAINBOW TROUT	UNSPECIFIED	YEARLING	5,000	9.0	DNR HATCHERY
1985	WALLEYE	UNSPECIFIED	FINGERLING	18,055	2.0	DNR COOP PONDS
1986	RAINBOW TROUT	UNSPECIFIED	YEARLING	5,000	9.0	DNR HATCHERY
1987	RAINBOW TROUT	UNSPECIFIED	YEARLING	15,000	9.0	DNR COOP PONDS
1987	WALLEYE	UNSPECIFIED	FINGERLING	69,000	3.0	DNR COOP PONDS
1988	BROWN TROUT	UNSPECIFIED	FINGERLING	20,000	3.0	DNR HATCHERY
1988	RAINBOW TROUT	UNSPECIFIED	YEARLING	5,000	9.0	DNR COOP PONDS
1989	BROWN TROUT	UNSPECIFIED	FINGERLING	1,000	5.0	DNR HATCHERY
1989	WALLEYE	UNSPECIFIED	FINGERLING	20,000	2.0	DNR COOP PONDS
1990	BROWN TROUT	UNSPECIFIED	YEARLING	2,500	8.0	DNR HATCHERY
1991	BROWN TROUT	UNSPECIFIED	YEARLING	6,650	9.0	DNR HATCHERY
1991	WALLEYE	UNSPECIFIED	FINGERLING	17,550	2.0	DNR COOP PONDS
1992	WALLEYE	UNSPECIFIED	FINGERLING	10,062	3.0	DNR COOP PONDS
1993	BROWN TROUT	UNSPECIFIED	YEARLING	5,000	8.0	DNR HATCHERY
1994	BROWN TROUT	UNSPECIFIED	YEARLING	5,000	9.0	DNR HATCHERY
1995	BROWN TROUT	UNSPECIFIED	ADULT (BROODSTOCK)	45	29.0	DNR HATCHERY
1995	BROWN TROUT	UNSPECIFIED	YEARLING	5,000	9.3	DNR HATCHERY
1996	BROWN TROUT	UNSPECIFIED	YEARLING	8,000	9.7	DNR HATCHERY
1996	WALLEYE	UNSPECIFIED	FINGERLING	15,445	1.7	DNR HATCHERY
1997	BROWN TROUT	ST. CROIX	YEARLING	10,000	8.8	DNR HATCHERY
1998	BROWN TROUT	ST. CROIX	YEARLING	5,000	8.8	DNR HATCHERY
1998	WALLEYE	DELAVAN LAKE	SMALL FINGERLING	18,450	1.4	DNR HATCHERY
1999	BROWN TROUT	ST. CROIX	YEARLING	17,850	8.8	DNR HATCHERY
2000	BROWN TROUT	ST. CROIX	YEARLING	20,250	9.3	DNR HATCHERY

Year	Species	Strain (Stock)	Age Class	Number Stocked	Avg. Fish Length (inches)	Source
2000	WALLEYE	UNSPECIFIED	SMALL FINGERLING	27,456	1.5	DNR HATCHERY
2001	BROWN TROUT	ST. CROIX	ADULT (BROODSTOCK)	591	18.0	DNR HATCHERY
2001	BROWN TROUT	ST. CROIX	YEARLING	17,850	9.6	DNR HATCHERY
2002	BROWN TROUT	ST. CROIX	ADULT (BROODSTOCK)	275	18.2	DNR HATCHERY
2002	BROWN TROUT	ST. CROIX	YEARLING	17,907	9.4	DNR HATCHERY
2003	BROWN TROUT	ST. CROIX	ADULT (BROODSTOCK)	430	17.5	DNR HATCHERY
2003	BROWN TROUT	ST. CROIX	YEARLING	20,450	9.5	DNR HATCHERY
2003	WALLEYE	LAKE MICHIGAN	SMALL FINGERLING	9,828	2.1	DNR PONDS
2004	BROWN TROUT	ST. CROIX	ADULT (BROODSTOCK)	460	18.6	DNR HATCHERY
2004	BROWN TROUT	ST. CROIX	YEARLING	18,480	9.4	DNR HATCHERY
2005	BROWN TROUT	ST. CROIX	ADULT (BROODSTOCK)	364	19.5	DNR HATCHERY
2005	BROWN TROUT	ST. CROIX	YEARLING	21,733	10.8	DNR HATCHERY
2005	NORTHERN PIKE	UNSPECIFIED	SMALL FINGERLING	7,500	1.9	DNR HATCHERY
2005	WALLEYE	UNSPECIFIED	SMALL FINGERLING	9,850	1.8	DNR PONDS
2006	BROWN TROUT	ST. CROIX	ADULT (BROODSTOCK)	651	19.3	DNR HATCHERY
2006	BROWN TROUT	ST. CROIX	YEARLING	18,529	9.2	DNR HATCHERY
2006	WALLEYE	ROCK-FOX	SMALL FINGERLING	16,870	1.4	DNR HATCHERY
2007	BROWN TROUT	ST. CROIX	ADULT (BROODSTOCK)	360	18.2	DNR HATCHERY

Year	Species	Strain (Stock)	Age Class	Number Stocked	Avg. Fish Length (inches)	Source
2007	BROWN TROUT	ST. CROIX	LARGE FINGERLING	1,497	4.8	DNR HATCHERY
2007	BROWN TROUT	ST. CROIX	YEARLING	18,450	9.4	DNR HATCHERY
2008	BROWN TROUT	ST. CROIX	ADULT (BROODSTOCK)	600	18.5	DNR HATCHERY
2008	BROWN TROUT	ST. CROIX	YEARLING	18,487	8.9	DNR HATCHERY
2008	WALLEYE	ROCK-FOX	SMALL FINGERLING	6,714	1.3	DNR HATCHERY
2009	BROWN TROUT	ST. CROIX	ADULT (BROODSTOCK)	600	18.7	DNR HATCHERY
2009	BROWN TROUT	ST. CROIX	YEARLING	22,719	9.0	DNR HATCHERY
2009	WALLEYE	ROCK-FOX	SMALL FINGERLING	6,714	1.6	DNR HATCHERY
2009	WALLEYE	UNSPECIFIED	LARGE FINGERLING	3,730	7.0	PRIVATE HATCHERY
2010	BROWN TROUT	ST. CROIX	YEARLING	18,450	9.4	DNR HATCHERY
2010	WALLEYE	ROCK-FOX	SMALL FINGERLING	7,250	1.7	DNR HATCHERY
2011	BROWN TROUT	ST. CROIX	ADULT (BROODSTOCK)	300	19.9	DNR HATCHERY
2011	BROWN TROUT	ST. CROIX	YEARLING	3,213	9.0	DNR HATCHERY
2011	WALLEYE	ROCK-FOX	SMALL FINGERLING	6,546	1.5	DNR HATCHERY
2012	BROWN TROUT	ST. CROIX	YEARLING	8,876	8.9	DNR HATCHERY
2012	WALLEYE	ROCK-FOX	SMALL FINGERLING	6,600	1.7	DNR HATCHERY
2013	BROWN TROUT	ST. CROIX	YEARLING	8,005	9.2	DNR HATCHERY
2013	WALLEYE	ROCK-FOX	SMALL FINGERLING	6,642	1.7	DNR HATCHERY

Table 3. Locations of fyke nets (GPS coordinates) used during SNI on Devils Lake, Sauk County, Wisconsin in 2013.

Net Number	Date First Set	Date Last Lifted	Latitude	Longitude
1	04/16/2013	04/29/2013	43.41170	-89.73652
2	04/16/2013	04/29/2013	43.40834	-89.73073
3	04/16/2013	04/29/2013	43.41252	-89.72544
4	04/16/2013	04/29/2013	43.42650	-89.73486
5	04/17/2013	04/29/2013	43.41449	-89.73811
6	04/16/2013	04/26/2013	43.41365	-89.73822
7	04/26/2013	04/29/2013	43.41343	-89.72680

Table 4. Locations of electrofishing stations (GPS coordinates) sampled during SEII on Devils Lake, Sauk County, Wisconsin in 2013.

Date	Station	Distance	Start Lat	Start Long	End Lat	End Long
05/23/2013	PANFISH 1	0.5	43.41500	-89.73732	43.40973	-89.73476
05/23/2013	GAMEFISH 1	1.5	43.40973	-89.73732	43.42235	-89.72706
05/23/2013	PANFISH 2	0.5	43.42235	-89.72706	43.42709	-89.73156
05/23/2013	GAMEFISH 2	1.1	43.42709	-89.73156	43.41504	-89.73772

Table 5. Length categories (inches) that have been proposed for the sport fish species that were collected from Devils Lake in 2013 (Anderson and Neumann 1996).

Species	Stock	Quality	Preferred	Memorable	Trophy
Bluegill	3	6	8	10	12
Rock Bass	4	7	9	11	13
Black crappie	5	8	10	12	15
Yellow perch	5	8	10	12	15
Smallmouth bass	7	11	14	17	20
Largemouth bass	8	12	15	20	25
Walleye	10	15	20	25	30
Northern pike	14	21	28	34	44

Table 6. Summary of catch and catch per unit effort (CPE) by gear type for SNI, SEI, and SEII sampling on Devils Lake, Sauk County, Wisconsin in 2013.

	CATCH				CPE				
					Fish/net night	Fish/hour		Fish/mile	
Species	SNI	SEI	SEII	Total	SNI[1]	SEI[2]	SEII	SEI[3]	SEII
Brown Trout	204	323	16	543	2.9	161.5	8.4	91.0	4.4
Largemouth Bass	17	175	201	393	0.2	87.5	105.8	49.3	55.8
Northern Pike	169	3	0	172	2.4	1.5	0.0	0.8	0.0
Yellow Perch	106	0	0	106	1.5	0.0	0.0	0.0	0.0
Rock Bass	94	0	8	102	1.3	0.0	13.3	0.0	8.0
Smallmouth Bass	0	26	44	70	0.0	13.0	23.2	7.3	12.2
Walleye	41	27	0	68	0.6	13.5	0.0	7.6	0.0
Bluegill	7	0	12	19	0.1	0.0	20.0	0.0	12.0
Common Carp	0	10	8	18	0.0	5.0	13.3	2.8	2.2
Black Crappie	16	0	1	17	0.2	0.0	1.7	0.0	1.0
White Sucker	8	0	1	9	0.1	0.0	1.7	0.0	0.3
Brown Bullhead	2	0	2	4	0.0	0.0	3.3	0.0	2.0
Bluntnose Minnow	0	0	1	1	0.0	0.0	1.7	0.0	1.0
Golden Shiner	1	0	0	1	0.0	0.0	0.0	0.0	0.0
Totals	665	564	294	1,523					

[1]Total fyke netting effort during SNI was 70 net nights.
[2]Total electrofishing "on" time was 2 hours during SEI. During SEII, total "on" time was 1.9 hours for gamefish, and was 0.6 hours for panfish.
[3]Total electrofishing shoreline distance was 3.55 miles during SEI. During SEII, total shoreline distance was 3.6 miles for gamefish and 1.0 miles for panfish.

Table 7. Size-specific CPE, stock density indices, rank comparison, and pre and post pumping comparison of largemouth bass collected during 6 surveys in Devils Lake, Wisconsin from 2000 to 2013.

Year[1]	Month	CPE-ALL	CPE8	CPE12	CPE14	CPE15	PSD	RSD14	RSDP	Ranking CPE 8,12,15	CPE Compare[2]	PSD, RSD14	Stock Compare[3]
2000	May	124.2	101.1	41.2	6.1	1.1	41	6	1	94,98,9	B,S,B	17,13	S, A<794
2000	Oct.	39.4	34.8	16.5	3.2	0.8	47	9	2	54,79,7	B,S,B	25,16	S, A<794
2001	April	52.3	52.0	30.2	7.0	1.6	58	13	3	71,95,13	B,S,B	45,22	S, A<794
2005	Sept.	63.2	55.8	20.4	1.4	0.0	37	3	0	73,86,0	B,S,B	13,10	S, A<794
2013	April	49.3	48.7	36.1	0.6	0.0	74	1	0	68,98,0	B,S,B	74,8	S, A<794
2013	May	55.8	51.9	32.2	0.6	0.3	62	1	1	70,51,4	B,S,B	52,8	S, A<794
Averages													
2000-2001		72.0	62.6	29.3	5.4	1.2	49	9	2				
2005-2013		56.1	52.1	29.6	0.9	0.1	58	2	0				
p-value		0.306	0.326	0.489	0.030	0.012	0.254	0.035	0.044				
Change (I,N,D)		N	N	N	D	D	N	D	D				

[1]I = significant increase, N = no change, D= significant decrease.
[2]B = basin (4 drainage basins in southern WI), and S = statewide.
[3]S,A<794 indicates a statewide comparison among lakes with a surface area smaller than 794 acres.

Table 8. Summary of lengths (inches), stock density indices, and age of gamefish and panfish collected during the 2013 survey of Devils Lake, Sauk County, Wisconsin.

Species	N Collected	N Measured	Gear	Min. Length	Max. Length	Mean Length	Median Length	Mode Length	PSD	RSD-P	Mean Wr	Min. Age	Max. Age
Largemouth Bass	393	372	EF	5.0	19.9	11.9	12.4	12.6	67	1	83	2	15
Northern Pike	172	117	FYKE	13.4	40.0	30.1	31.1	20.7	87	65	111	2	10
Yellow Perch	106	105	FYKE	5.4	13.5	9.0	9.1	6.3	63	37	102	3	11
Rock Bass	102	102	EF+FYKE	4.8	10.3	8.2	8.3	8.1	87	23			
Smallmouth Bass	70	69	EF	6.6	15.2	11.4	11.7	12.4			85	4	13
Walleye	68	53	EF+FYKE	16.3	20.6	17.9	17.5	17.1			93	4	5
Bluegill	19	19	EF+FYKE	3.1	9.5	5.8	5.5	5.6			105	3	8
Black Crappie	17	17	EF+FYKE	3.7	11.5	4.9	4.1	4.2			111	1	6

Table 9. Mean age at 14.0-14.9 inches (MAL14) for largemouth bass populations in 8 Columbia and Sauk County lakes (9 surveys), 2006-2013.

Waterbody	County	Year	MAL14	LMB Density	Prey Base
Lake Wisconsin	Columbia	2012	4.8	Low	GZS, BLG
Park Lake	Columbia	2011	5.3	Low	GZS, BLG
Swan Lake	Columbia	2009	5.8	Moderate	GZS, BLG
Redstone Lake	Sauk	2010	6.0	Low	GZS, BLG
Seeley Lake	Sauk	2008	6.1	Moderate	BLG
White Mound Lake	Sauk	2013	6.5	High	BLG
Dutch Hollow Lake	Sauk	2006	6.9	High	BLG
White Mound Lake	Sauk	2006	7.2	High	BLG
Devils Lake	**Sauk**	**2013**	**9.3**	**High**	**BLG**
Average-All Lakes			6.4		
Median MAL14			6.1		

Table 10. Results of northern pike population estimate (PE) surveys in Devils Lake, Sauk County, Wisconsin, 2002-2013.

Year	Month	Gear	n with recaps	CPE-ALL (fish/net night)	n without recaps	Schumacher PE (mature/acre)	Schumacher PE Lower CI	Schumacher PE Upper CI	Schnabel PE (mature/acre)	Schnabel PE Lower CI	Schnabel PE Upper CI
2002	Mar-April	Fyke	160	1.5	143	503 (1.3)	336 (0.9)	998 (2.7)	478 (1.3)	315 (0.8)	717 (1.9)
2006	April	Fyke	73	2.0	73						
2013	April	Fyke	169	1.5	117	194 (0.5)	152 (0.4)	269 (0.7)	204 (0.5)	165 (0.4)	265 (0.7)

Table 11. Stock density indices from northern pike PE surveys of Devils Lake, Sauk County, Wisconsin during 2002 and 2013.

Index	2002	2013
PSD	51	87
RSDP	47	65
RSDL	34	47
RSDM	26	41
RSD36	8	26
RSD38	4	13
RSD40	2	1
RSDT	0	0

Table 12. Size-specific CPE, stock density indices, rank comparison, and pre and post pumping comparison of smallmouth bass collected during 6 surveys in Devils Lake, Wisconsin from 2000 to 2013.

Year	Month	Water Temp	CPE-ALL	CPE7	CPE12	CPE14	CPE15	PSD	RSD14	Rank CPE 7, 12, 15	Comparison	Rank PSD, RSD-P	Comparison[1]
2000	May	63	56.6	46.0	7.2	0.8	0.5	30	2	98,96,56	Statewide	4,4	state, A>304
2000	October	NA	12.2	10.9	5.6	0.5	0.0	NA	NA	87,91,NA	Statewide	NA	NA
2001	April	48	4.6	4.6	1.9	0.5	0.3	NA	NA	71,55,44	Statewide	NA	NA
2005	September	65	6.9	6.9	1.7	0.3	0.0	NA	NA	79,47,NA	Statewide	NA	NA
2013	April	52	7.3	7.3	4.5	0.3	0.3	NA	NA	80,84,44	Statewide	NA	NA
2013	May	61	12.2	11.9	3.6	0.0	0.0	NA	NA	88,76,NA	Statewide	NA	NA

[1]The RSD-P comparison for smallmouth bass was based on lakes with a surface area greater than 304 acres.

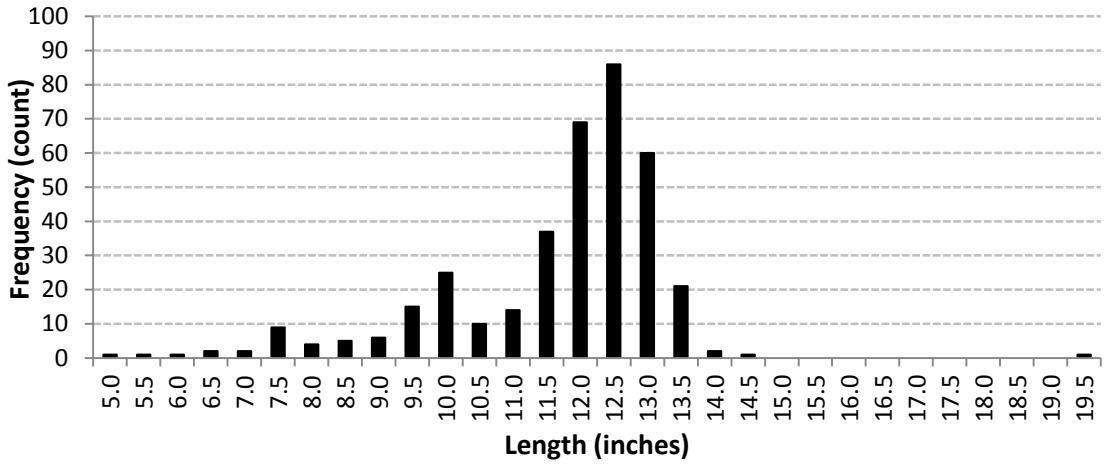

Figure 1. Length frequency distribution of largemouth bass collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

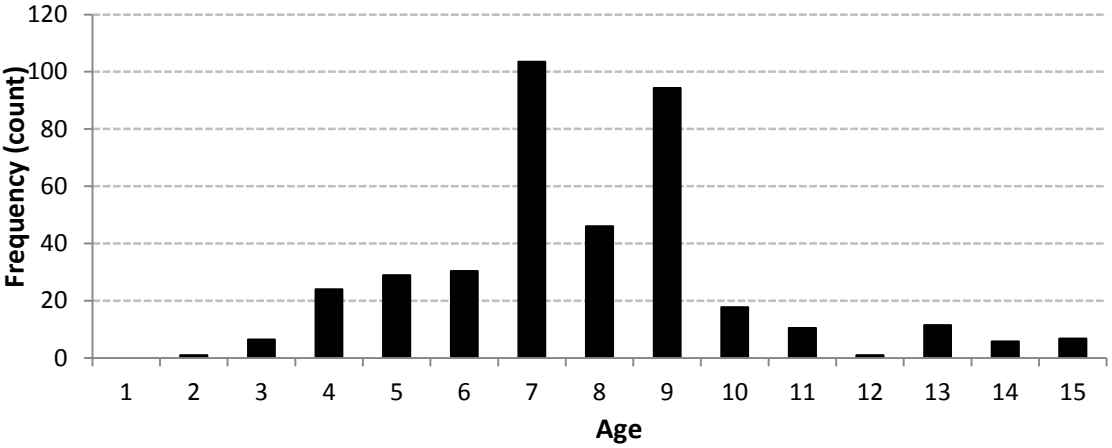

Figure 2. Age frequency distribution of largemouth bass collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

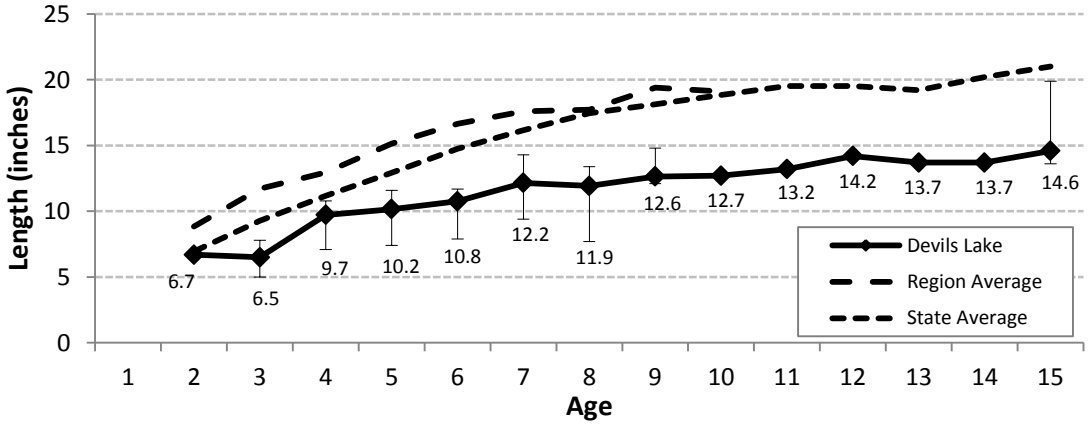

Figure 3. Mean length at age of largemouth bass collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin. Error bars represent minimum and maximum length values for a given age.

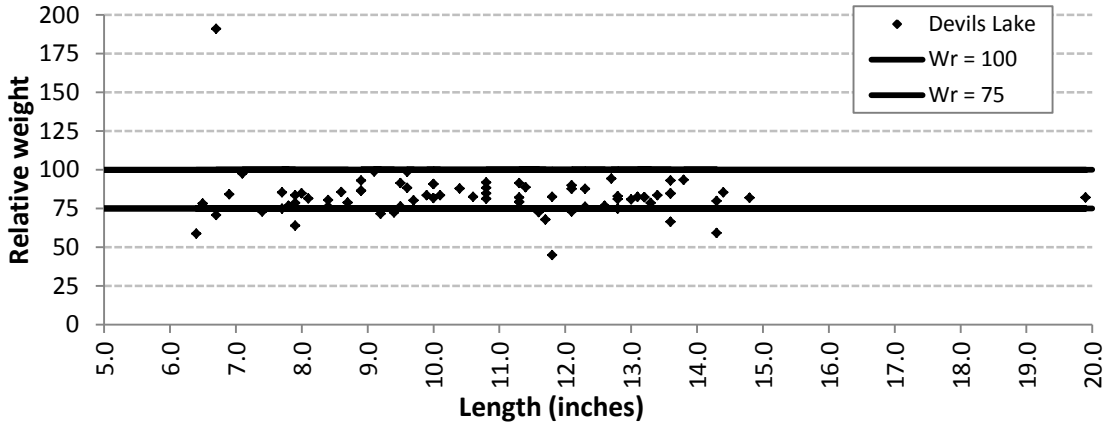

Figure 4. Relative weights of largemouth bass collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

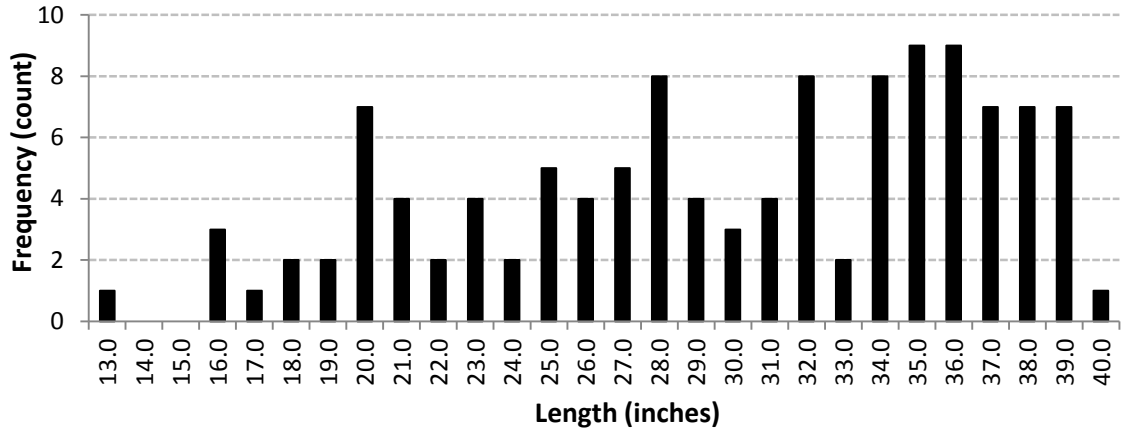

Figure 5. Length frequency distribution of northern pike collected using fyke nets (SNI) during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

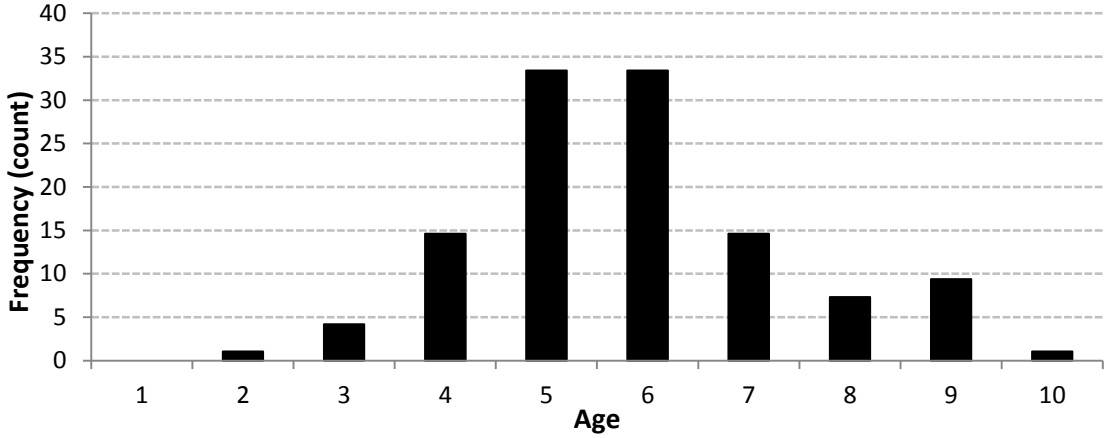

Figure 6. Age frequency distribution of northern pike collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

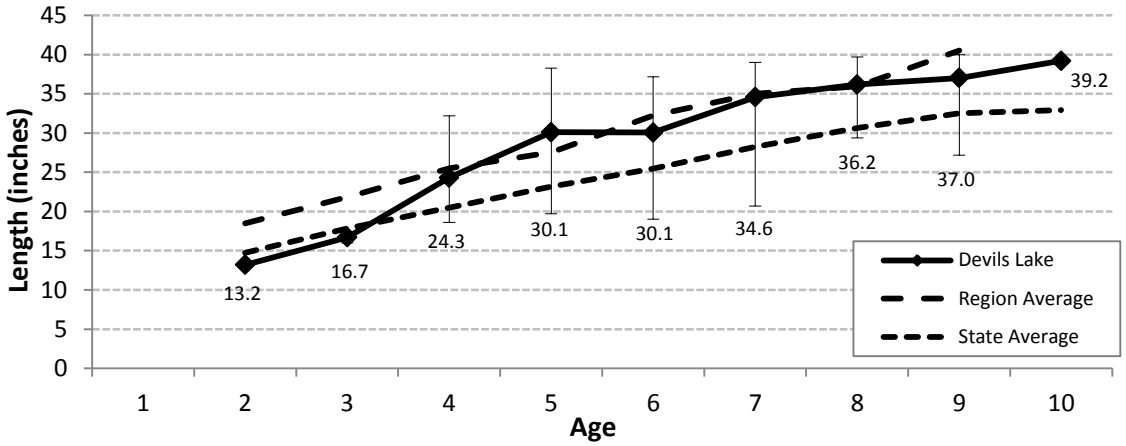

Figure 7. Mean length at age of northern pike collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin. Error bars represent minimum and maximum length values for a given age.

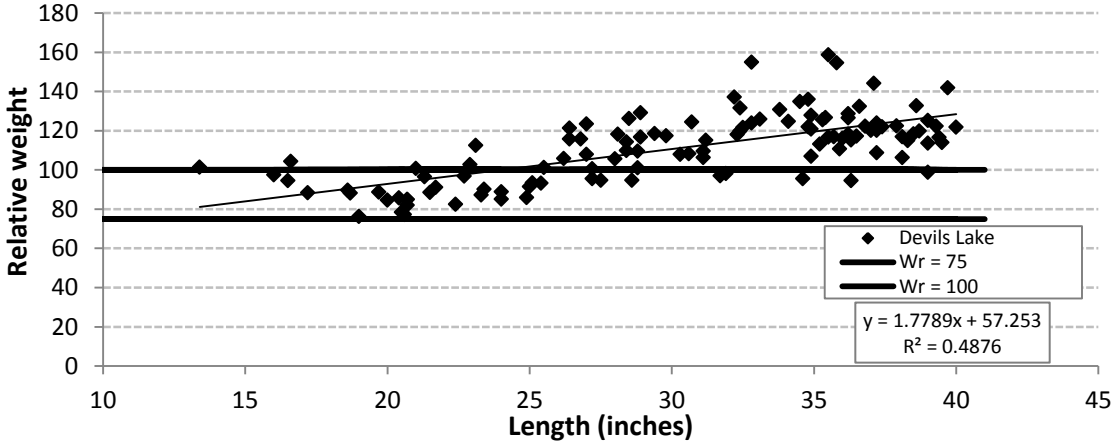

Figure 8. Relative weights of northern pike collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

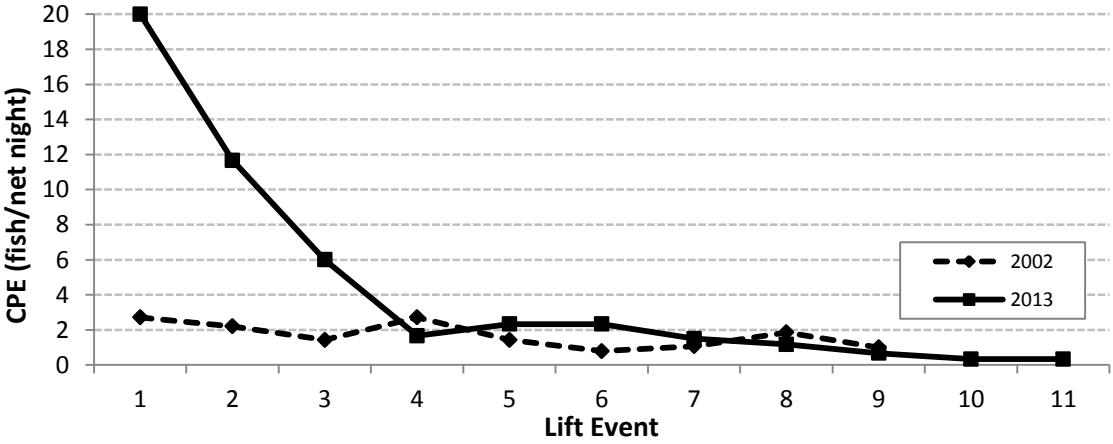

Figure 9. Catch per effort (CPE) of northern pike during fyke netting surveys conducted on Devils Lake, Sauk County, Wisconsin during 2002 and 2013.

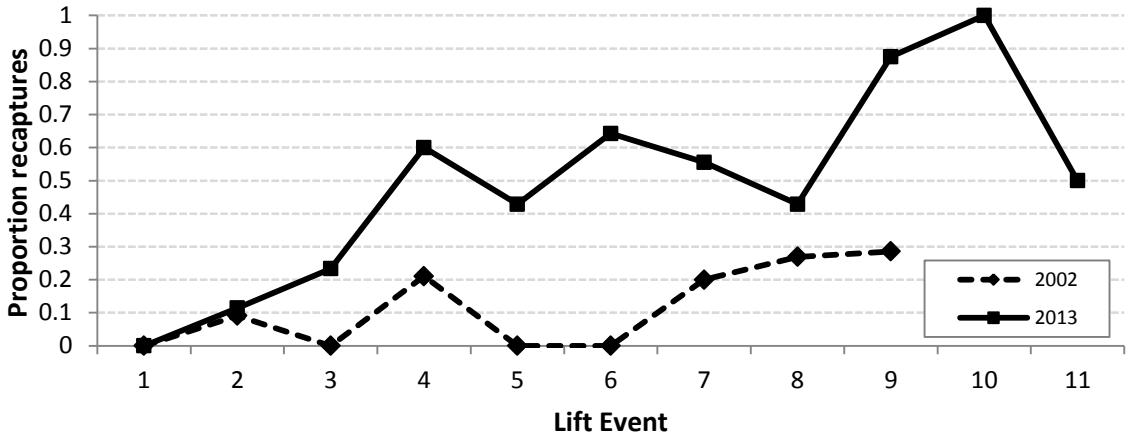

Figure 10. Proportion of recaptured fish in northern pike catch by lift event during fyke netting surveys conducted on Devils Lake, Sauk County, Wisconsin in 2002 and 2013.

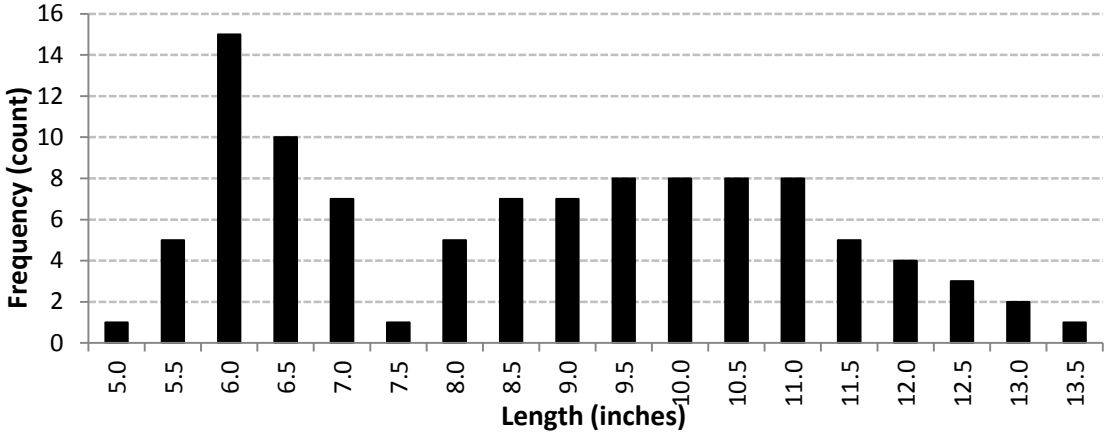

Figure 11. Length frequency distribution of yellow perch captured using fyke nets during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

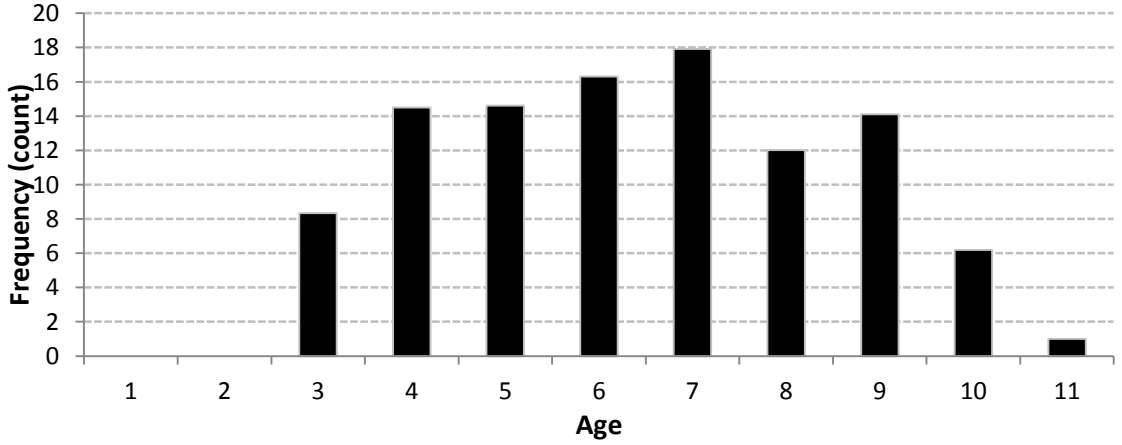

Figure 12. Age frequency distribution of yellow perch captured using fyke nets during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

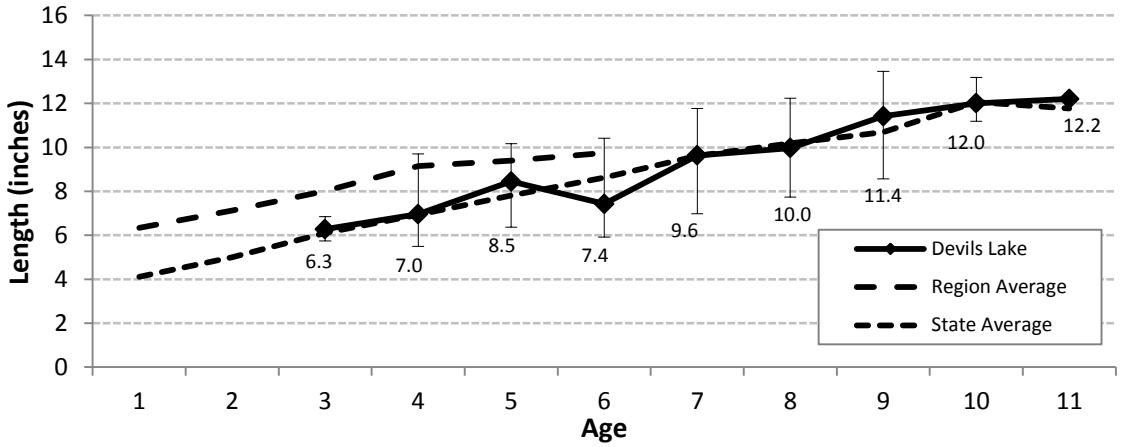

Figure 13. Mean length at age of yellow perch captured using fyke nets during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin. Error bars represent minimum and maximum length values for a given age.

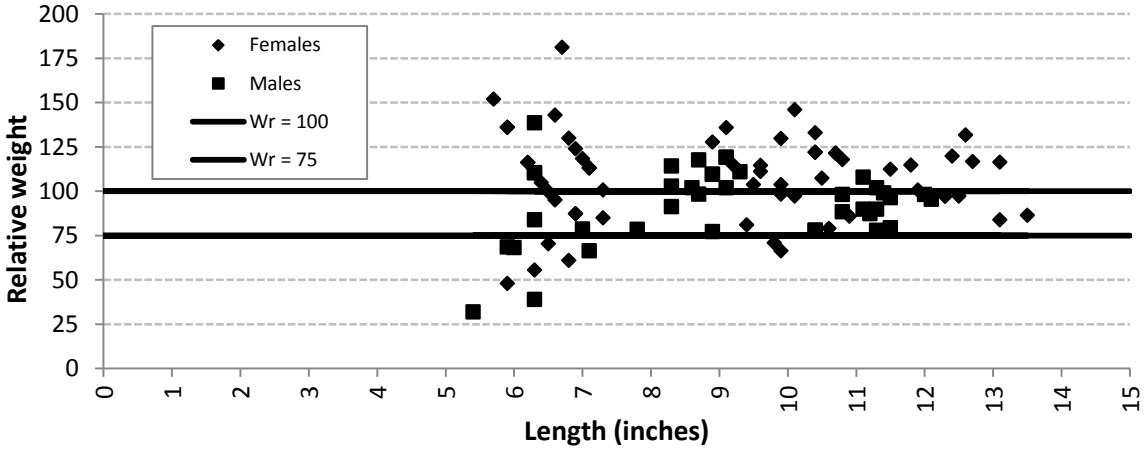

Figure 14. Relative weights of yellow perch captured using fyke nets during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

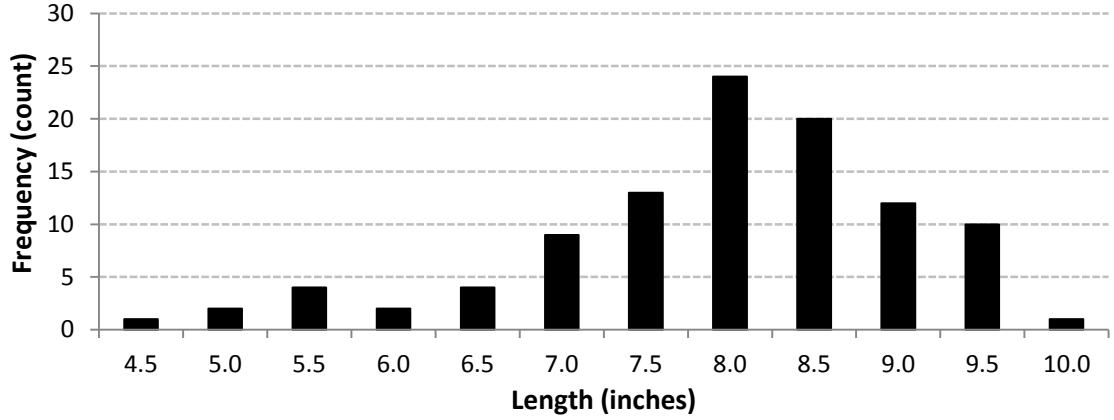

Figure 15. Length frequency distribution of rock bass collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

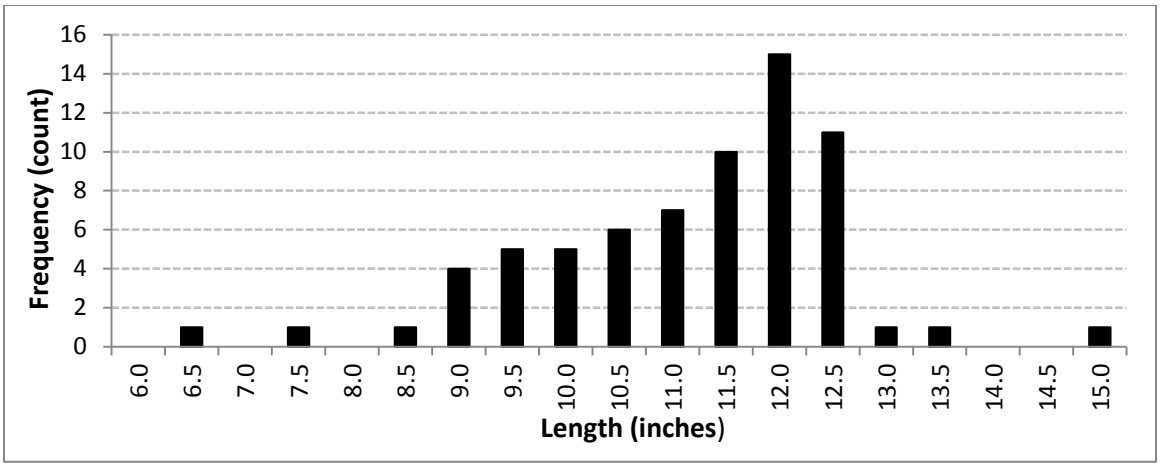

Figure 16. Length frequency distribution of smallmouth bass captured by electrofishing during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

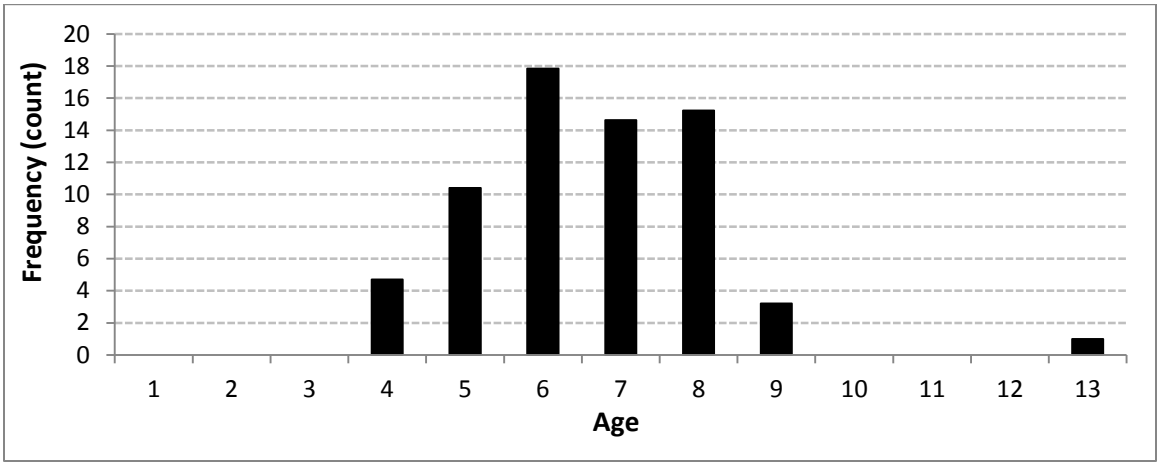

Figure 17. Age frequency distribution of smallmouth bass captured by electrofishing during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

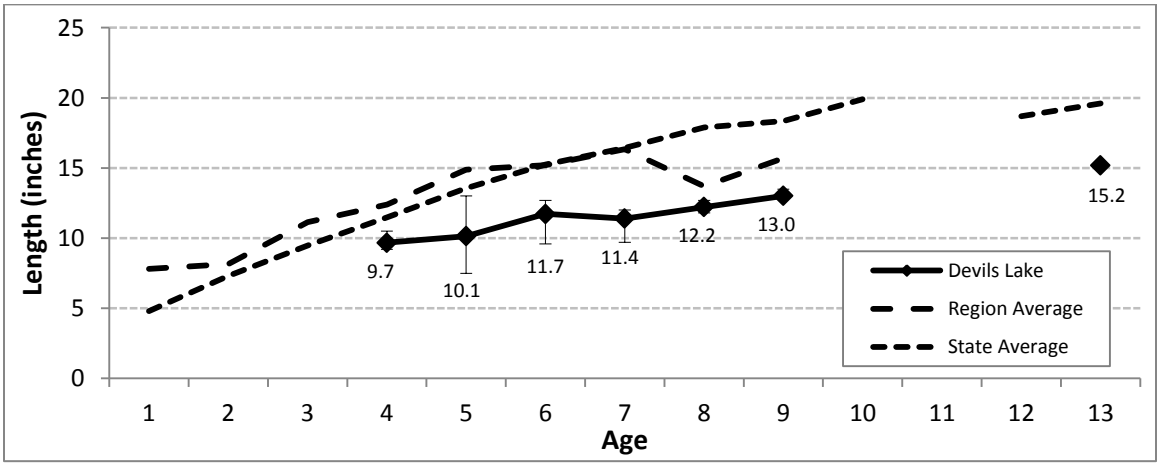

Figure 18. Mean length at age of smallmouth bass captured by electrofishing during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin. Error bars represent minimum and maximum length values for a given age.

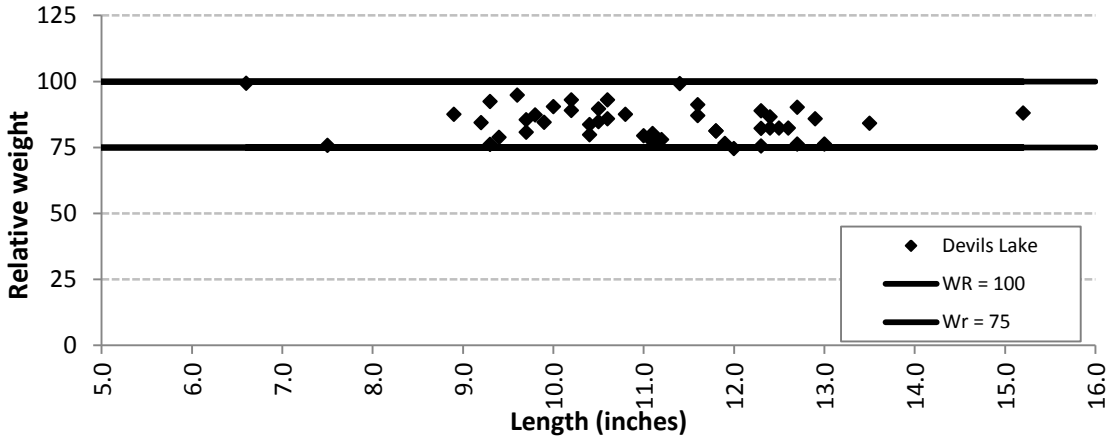

Figure 19. Relative weights of smallmouth bass captured by electrofishing during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

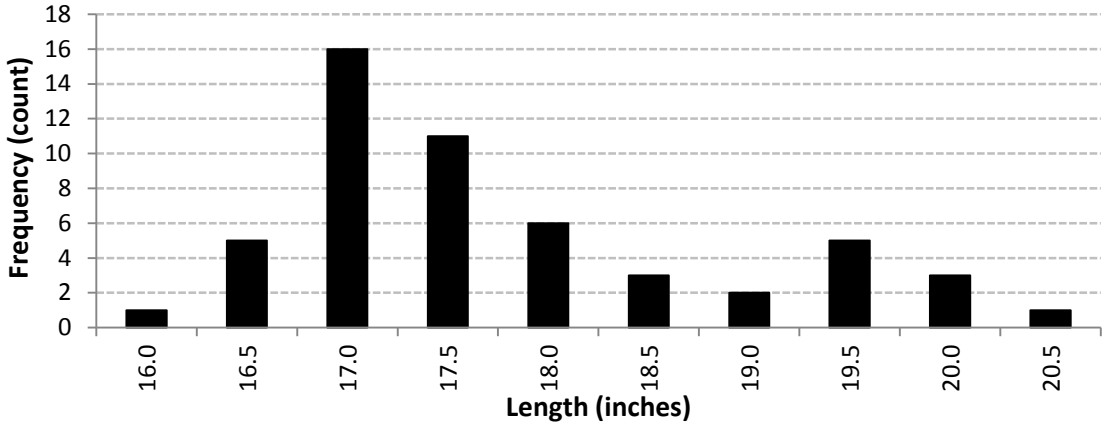

Figure 20. Length frequency distribution of walleyes collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

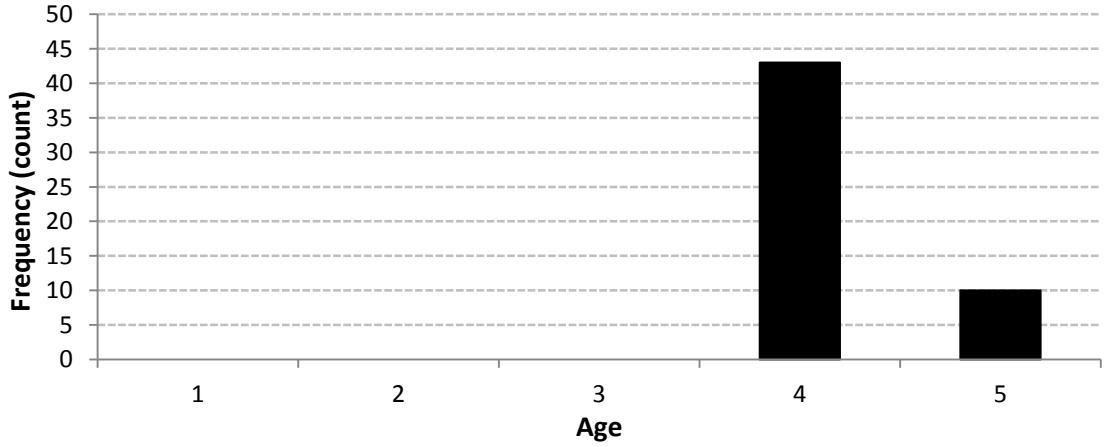

Figure 20. Age frequency distribution of walleyes collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

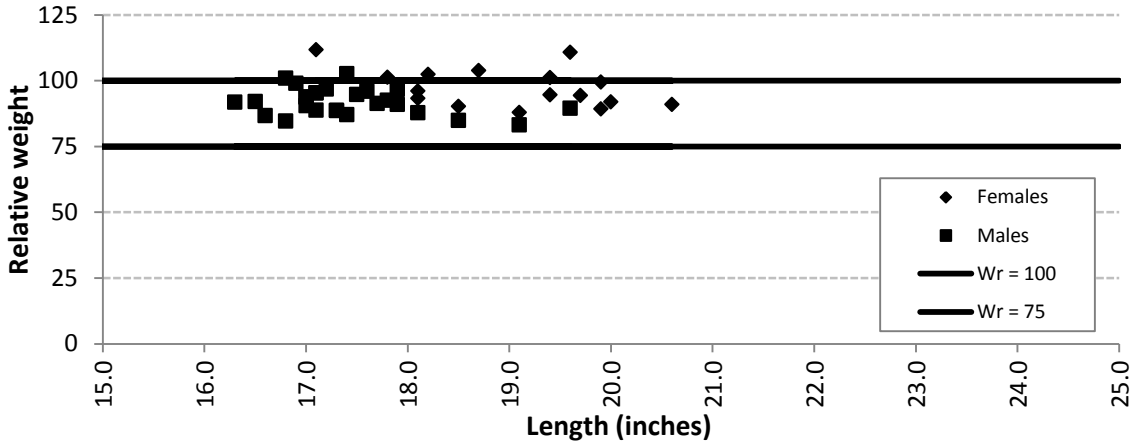

Figure 22. Relative weights of walleyes collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

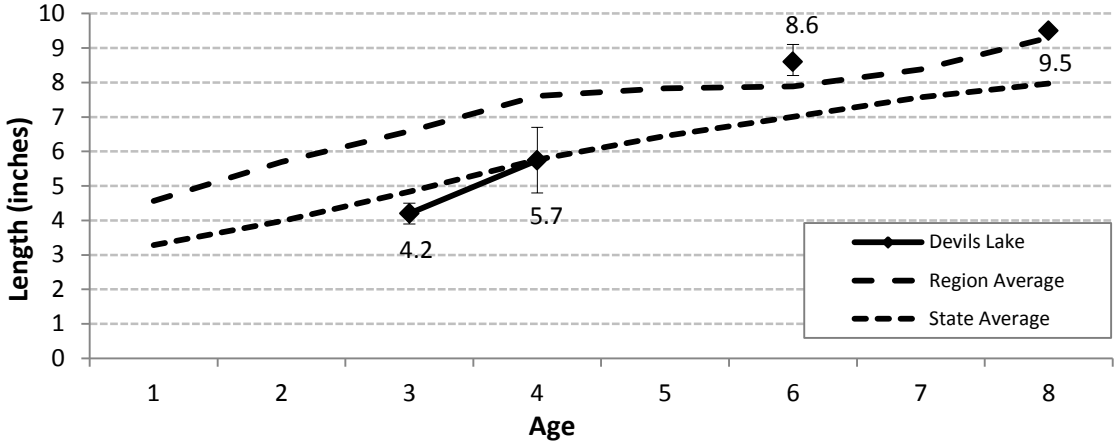

Figure 23. Mean length at age of bluegills collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

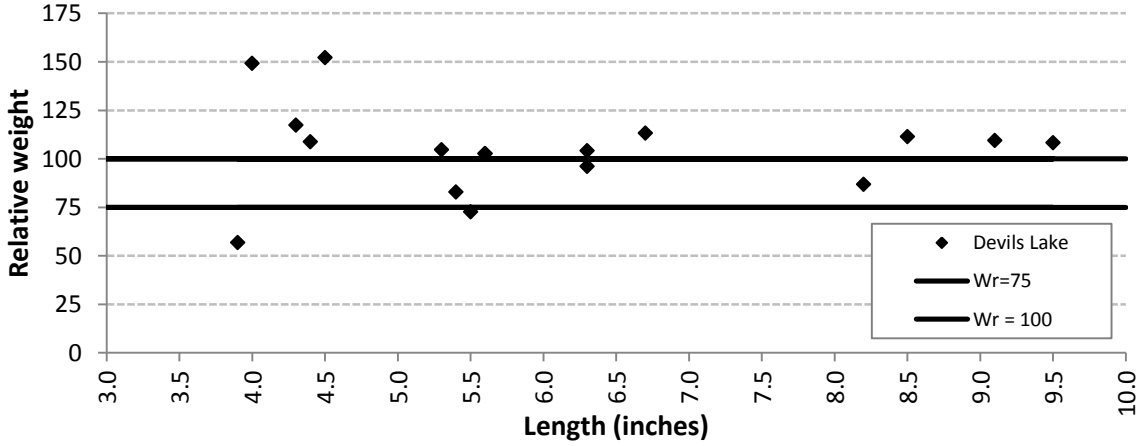

Figure 24. Relative weights of bluegills collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.

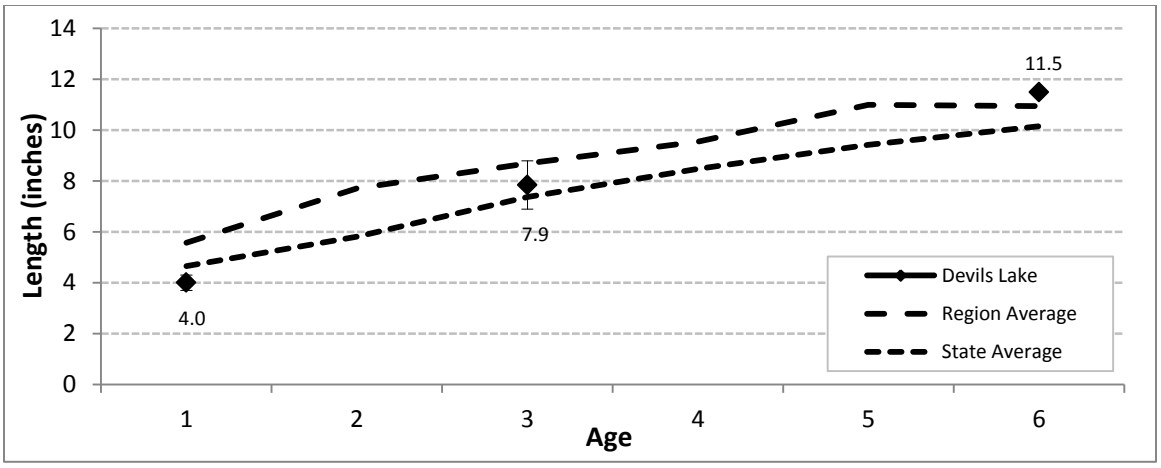

Figure 25. Mean length at age of black crappies collected during the spring 2013 survey of Devils Lake, Sauk County, Wisconsin.